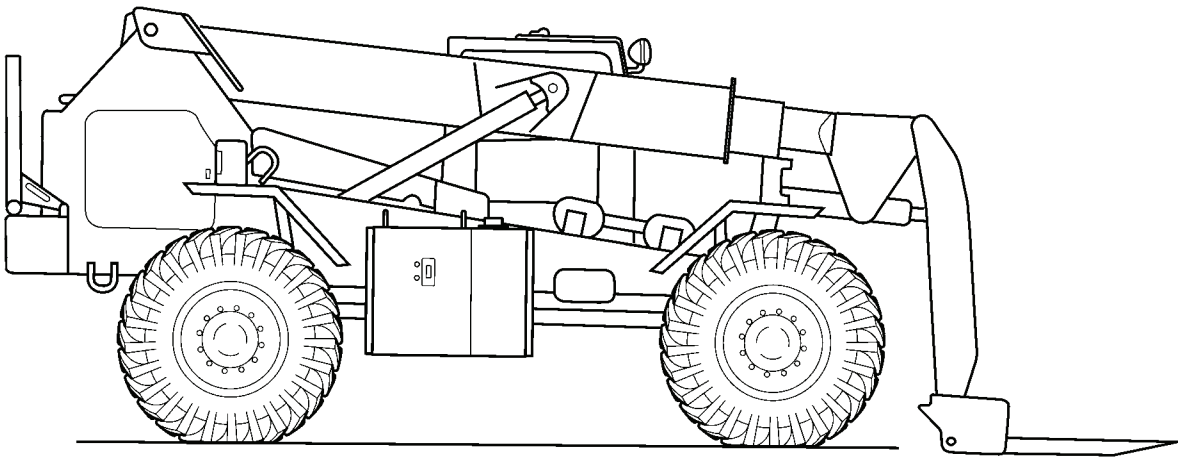
TM 10-3930-660-24-2

TECHNICAL MANUAL

Unit and Direct Support Maintenance

FOR

TRUCK, FORKLIFT; 6,000 LB.
VARIABLE REACH, ROUGH TERRAIN
(NSN 3930-01-158-0849)



SUPERSEDURE NOTICE - This manual supersedes TM 10-3930-660-20, dated 25 March 1993, and TM 10-3930-660-34, dated 30 March 1993.

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HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 2006

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 injury or death. 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.

HEAVY LIFTING - heavy object on human figure shows heavy parts back injury danger.

SLICK FLOOR - wavy line on floor with legs prone shows that slick floor presents a danger from falling.

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 roller is operated.

1. DO NOT operate roller engine in enclosed areas.
2. DO NOT idle roller engine without adequate ventilation.
3. DO NOT drive roller 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.
- 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 cause injury or death.

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

CLEANING COMPOUND, SOLVENT

- Cleaning compound, solvent 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

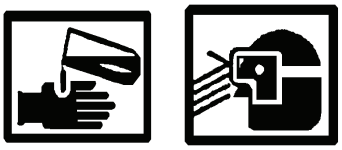
COMPRESSED AIR

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 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.

WARNING

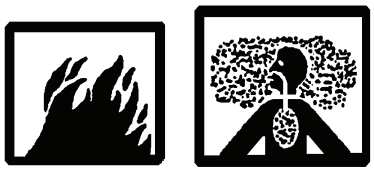
ELECTRICAL SYSTEM MAINTENANCE

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.



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 injury or death.

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 caution when disassembling them, to avoid injury.

WARNING

FUEL HANDLING

- DO NOT smoke or permit any open flame in area of vehicle while you are servicing diesel fuel system. Be sure hose nozzle is grounded against filler tube during refueling to prevent static electricity. Failure to follow this warning may cause 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 vehicle and injury or death to personnel.
- Operating personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.

WARNING

HAZARDOUS WASTE DISPOSAL

When servicing this vehicle, 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 vehicle or when working on vehicle while it is operating. Failure to wear hearing protection may cause 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 3000 psi (20,685 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 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

- Equipment used for lifting vehicle must be in good condition and of correct capacity. Failure to follow this warning may cause injury or death, or damage to equipment.
- Improper use of lifting equipment and improper attachment to vehicle can result in injury, or equipment damage. Observe all standard rules of safety.
- Use 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

VEHICLE OPERATION

This vehicle 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 injury from the improper operation of this vehicle. 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 (FM 21-40) 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 may cause serious burns.
- DO NOT remove 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

TIRE REPLACEMENT WARNINGS

- Always inflate tires mounted on rims with aligning rings or lock rings in an inflation safety cage. Failure to follow this warning may cause injury or death.
- Improperly seated aligning rings or lock rings could blow off during inflation. Never attempt to seat aligning rings or lock rings during or after inflation. Failure to follow this warning may cause injury or death.
- Never over-inflate tires to seat tire beads. Failure to follow this warning may cause injury or death.
- When inflating tires in a safety cage, always use an airhose and gauge for safety cage use. Failure to follow this warning may cause injury.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

Date of issue for original manual is:

Original 1 May 2006

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 40 AND TOTAL NUMBER OF WORK PACKAGES IS 117 CONSISTING OF THE FOLLOWING:

Page/WP No.	***Change No.**
Cover/(Back Blank)	0
a to h	0
A/(B Blank)	0
i to viii	0
WP 0209 00 to 0326 00	0
Index-1 to Index-7/(Index-8 Blank)	0

* Zero in this column indicates an original page or work package.

TECHNICAL MANUAL
TM 10-3930-660-24-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C. 1 May 2006

Unit and Direct Support Maintenance

FOR

TRUCK, FORKLIFT: 6,000 LB.
VARIABLE REACH, ROUGH TERRAIN
(NSN 3930-01-158-0849)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (*Recommended Changes to Equipment Technical Publications*), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is https://aeps.ria.army.mil/. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or e-mail your letter or DA Form 2028 direct to: AMSTA-LC-LPIT/TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is: TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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Table of Contents

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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. This manual is written in work package format and is designed to help you perform lubrication, troubleshooting and maintenance on the 6K Forklift.
2. This manual contains Unit (Field), Direct and General (Sustainment) Maintenance.
3. The 6K Forklift is normally equipped with the standard 152 horsepower engine; however, some vehicles may have been produced with or retrofitted with a 165 horsepower engine. Both engines are covered in this manual. Check the data plate on right-hand side of engine. The data plate will specify either 152 or 165 HP. Before performing engine-related maintenance tasks, be sure to check the title of the work package. It will tell you which of the two engines it covers.
4. 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.
5. Chapter 1, *Introductory Information with Theory of Information*, provides general information on the manual and the equipment.
6. 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.
7. Chapter 3 deals with Unit (Field) Maintenance Procedures: Major areas covered are Preventive Maintenance Checks and Services (PMCS), *Service Upon Receipt* and all maintenance procedures authorized by the MAC for this manual, organized in Functional Group Code (FGC) sequence. Refer to the *Table of Contents* for a complete listing of maintenance procedures.
8. Chapters divide the manual into major categories of information (e.g., *Introductory Information with Theory of Operation, Troubleshooting Procedures, Unit (Field) Maintenance, Direct and General Maintenance (Sustainment),* 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 5^{th} and 6^{th} 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.
9. Read through this manual to become familiar with its organization and contents before attempting to operate or maintain the equipment.

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.
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6. Chapter 4 covers Direct Support Maintenance information work packages. Before performing any maintenance procedure, read WP 0312 00, *General Maintenance Instructions*, and/or WP 0313 00, *Electrical General Maintenance Instructions*.
7. Chapter 5 covers General Support Maintenance instruction.
8. Chapter 6 covers General Maintenance Instructions.
9. Chapter 7 includes *Supporting Information: References; Maintenance Allocation Chart (MAC) Introduction; Maintenance Allocation Chart (MAC)*; *Expendable and Durable Items List; Tool Identification List;* and *Illustrated List of Manufactured Items.*

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 0012 00),” go to Work Package 0012 00 in this manual for instructions on replacing the filter.
4. Illustrations are placed after, and 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., 409-001; 409-002, etc.) are art control numbers and are used for tracking purposes. Disregard these numbers.
6. Dashed leader lines used in the Lubrication Chart (WP 0010 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.

CHAPTER 4
DIRECT SUPPORT MAINTENANCE

ENGINE ASSEMBLY REPLACEMENT (152 HP) 0209 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Engine stand, 2,000 lb capacity

Lifting chain, 2,000 lb capacity

Lifting device, 2,000 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Sealant, Loctite (Item 45, WP 0323 00)

Strap, tie down (Item 57, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Clamp (35, 37 and 41)

Cotter pin (26)

Locknut (39, 49, 64 and 68)

Lockwasher (4, 45, 47, 54, 57 and 60)

Rubber mount (57 and 58)

References

WP 0046 00

WP 0048 00

WP 0062 00

References - Continued

WP 0073 00

WP 0075 00

WP 0081 00

WP 0087 00

WP 0088 00

WP 0099 00

WP 0100 00

WP 0121 00

WP 0211 00

WP 0214 00

WP 0215 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Engine oil drained (WP 0012 00)

Battery cables disconnected (WP 0107 00)

Radiator removed (WP 0053 00)

Engine coolant fan removed (WP 0059 00)

Muffler removed (WP 0051 00)

Transmission cover removed (WP 0150 00)

REMOVAL

NOTE

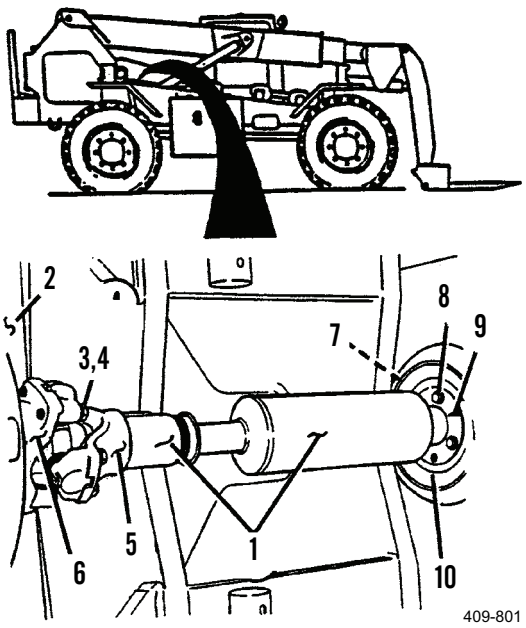
Note tie down strap locations, then cut and discard all tie down straps that secure electrical wiring, tubing and hoses to the engine.

1. To remove driveshaft assembly (1) from transmission (2), remove four capscrews (3) and four lockwashers (4) securing universal joint (5) of driveshaft assembly to input yoke (6) of transmission. Discard lockwashers.
2. To remove driveshaft assembly (1) from engine dampener (7), remove three capscrews (8) from engine coupling (9).
3. Temporarily install two of the capscrews (8) into two jacking holes (10) of engine coupling (9).

NOTE

If jacking screws only go partly in (less than half way up threads), then jacking screws and jacking hole threads needs to be cleared of dirt. Follow steps 4-5 to clean threads.

4. Clean threads of jacking screws using wire brush.
5. Spray solvent cleaning compound on screw thread and in jacking holes.
6. Repeat step 5 until jacking screws can be installed more than halfway up threads of jacking screws.
7. Tighten two capscrews (8) evenly until shaft assembly (1) and engine coupling (9) separate from engine dampener (7).
8. Remove coupling (9) and shaft assembly (1) from vehicle as an assembly.

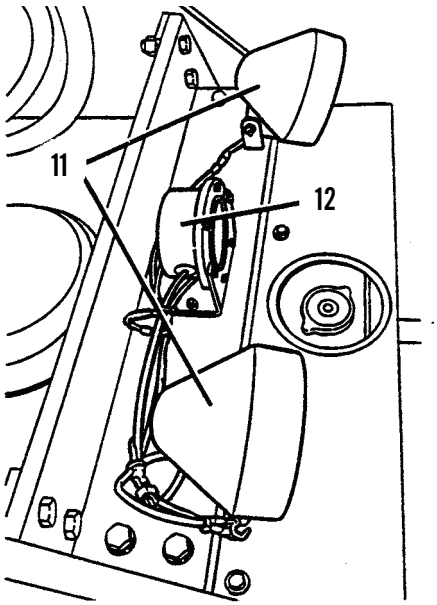


REMOVAL - CONTINUED

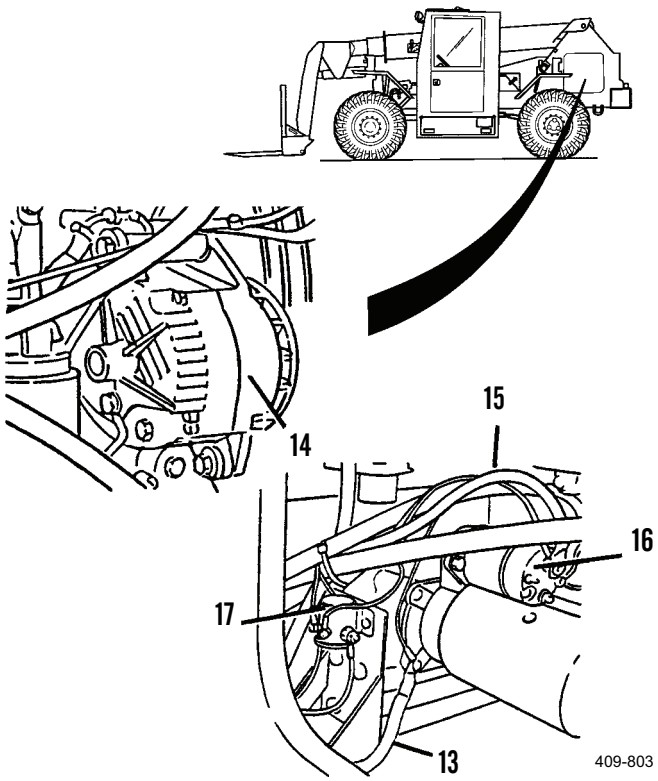
NOTE

Note routing of engine and STE/ICE-R wiring harnesses. Tag and disconnect.

9. Disconnect electric leads from rear flood light (11) and back-up alarm (12).

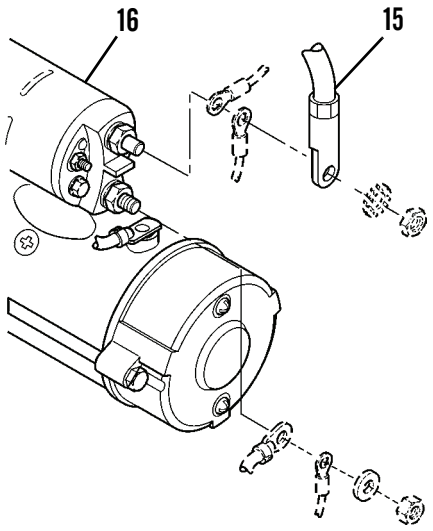


10. Remove battery ground cable (13) and wire no. M from starter mounting capscrew.
11. Remove electrical leads no. N and 60 from "BAT" terminal and electric lead no. P from "1" terminal of alternator (14).
12. Remove battery positive cable (15) and wire no. 39, T, and two wires no. 60 from starter solenoid (16) terminal "BAT".
13. Remove wiring harness leads no. S and 38 from starter solenoid (16) terminal "S".



REMOVAL - CONTINUED

14. Remove electrical leads from starter relay (17): lead no. 39 from large rear terminal, lead no. 38 from large front terminal, and lead no. 4A from rear small terminal.



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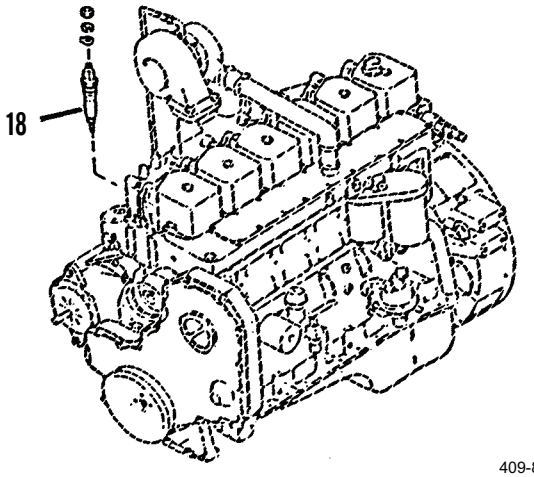
15. Remove electrical lead no. 15 from water temperature sender (18).



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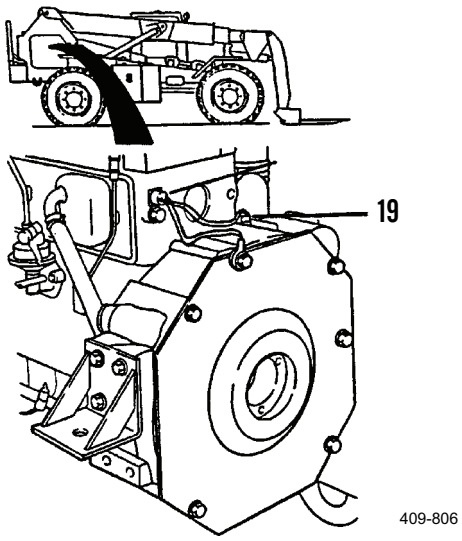
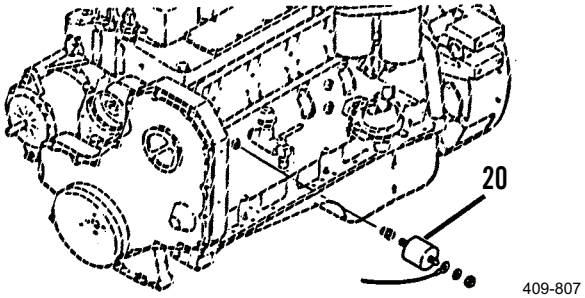
REMOVAL - CONTINUED

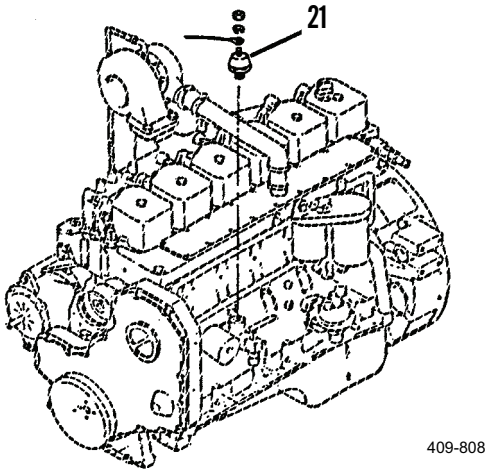
16. Disconnect ether start thermostat connector (19).



17. Disconnect electrical lead no. 17 from oil pressure sender (20).

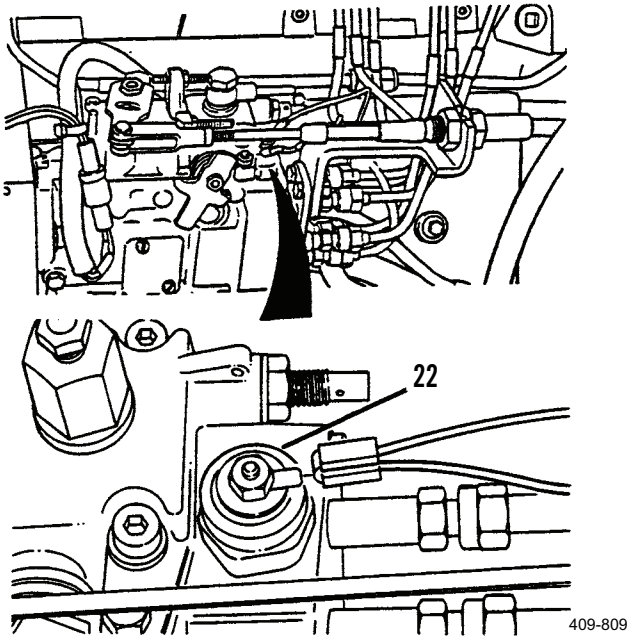


18. Disconnect electrical lead no. 16 from oil pressure switch (21).

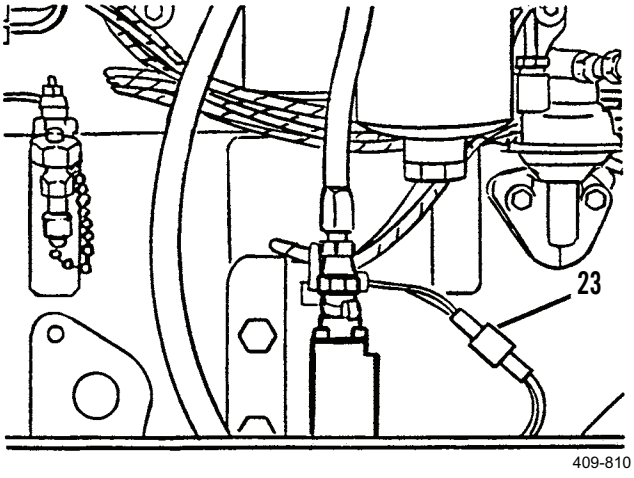


REMOVAL - CONTINUED

19. Disconnect electrical leads no. 07 and R from fuel solenoid (22).

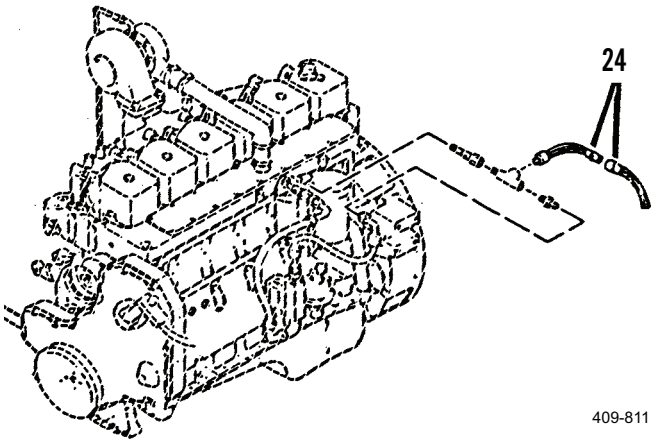


20. Disconnect pressure differential switch connector (23).



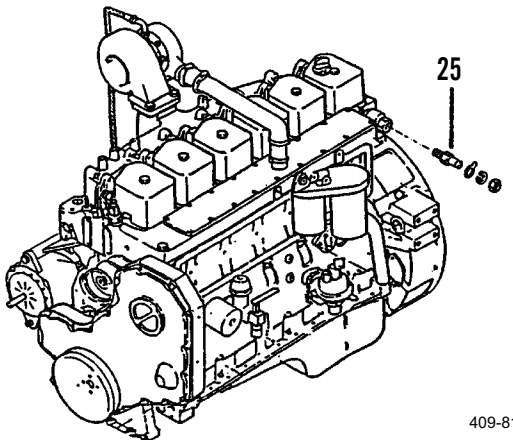
REMOVAL - CONTINUED

21. Disconnect pressure transducer connector (24).



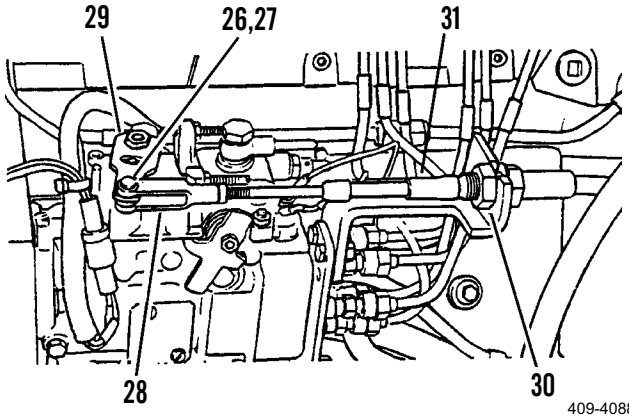
409-811

22. Disconnect electrical lead no. 14 from water temperature switch (25).



409-812

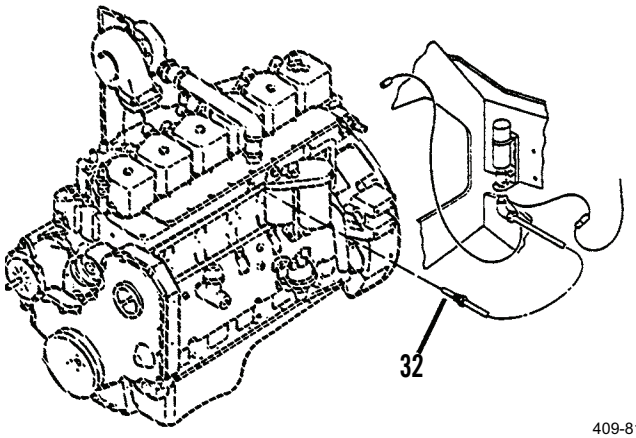
23. Remove cotter pin (26) and pin (27). Discard cotter pin.
24. Separate clevis (28) from the fuel injection pump control lever (29).
25. Loosen nut (30) and remove accelerator cable (31) from the engine.



409-4088

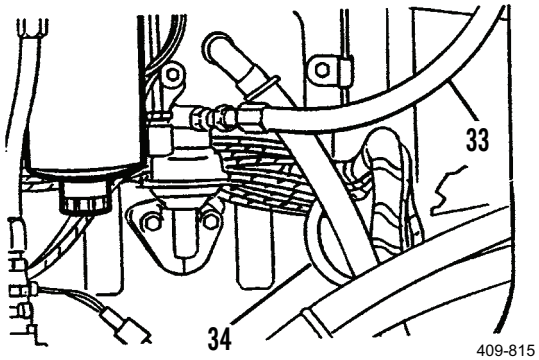
REMOVAL - CONTINUED

26. Disconnect ether starting aid tubing (32) from intake manifold.



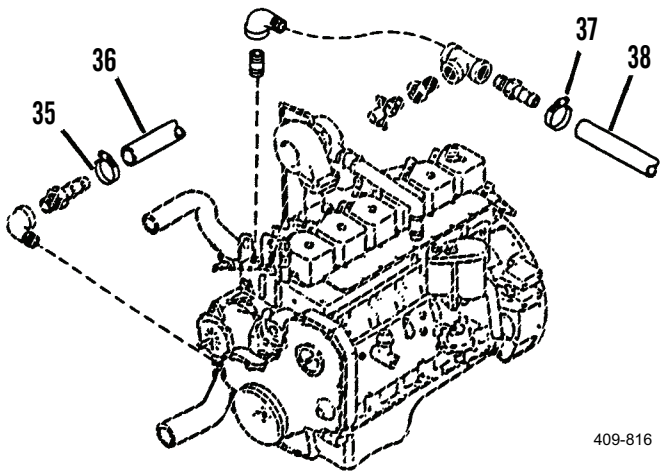
409-814

27. Tag and disconnect supply fuel hose (33) and return fuel hose (34).



409-815

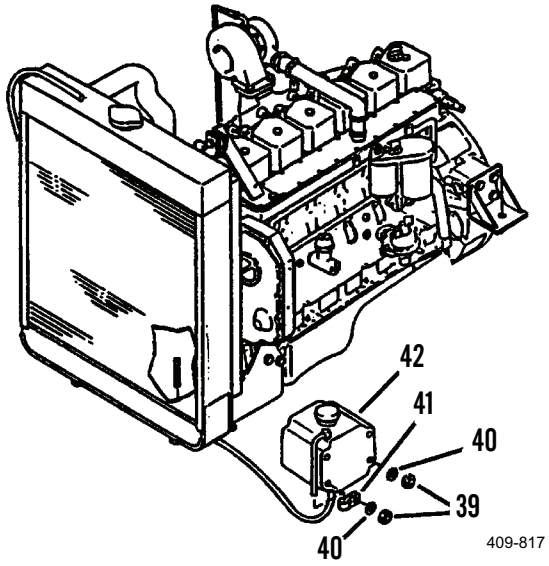
28. Loosen clamp (35) and disconnect heater hose (36). Discard clamp.
29. Loosen clamp (37) and disconnect heater hose (38). Discard clamp.



409-816

REMOVAL - CONTINUED

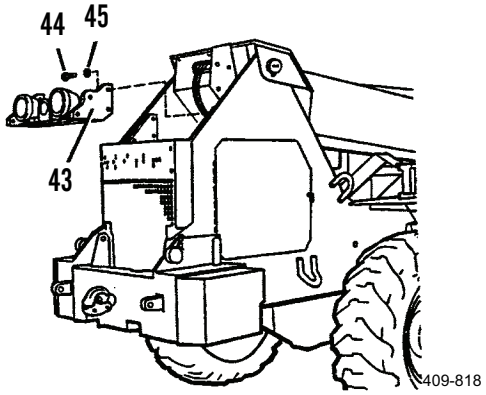
30. Remove four locknuts (39), four flatwashers (40), one clamp (41), and coolant overflow tank (42). Discard locknuts.



WARNING

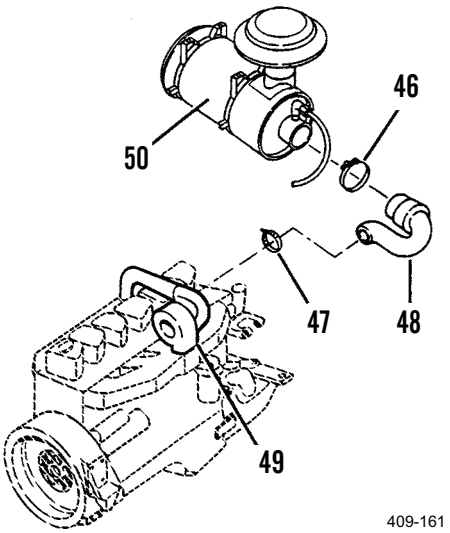
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

31. Attach a hoist and sling to cross member (43).
32. Remove six capscrews (44), lockwashers (45) and cross member (43). Discard lockwashers.

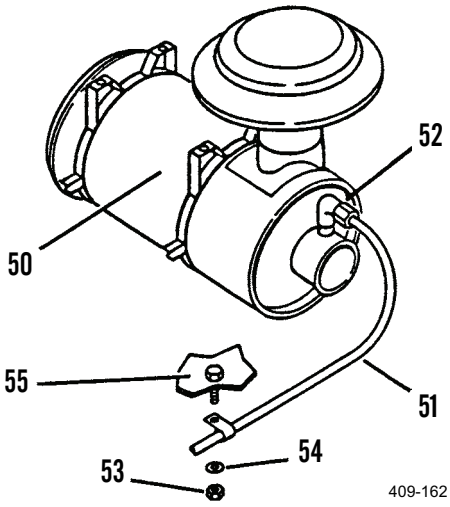


REMOVAL - CONTINUED

33. Loosen clamps (46 and 47) securing hose (48) to turbocharger (49).
34. Remove hose (48) from housing (50) and turbocharger (49).



35. Disconnect tube (51) from elbow assembly (52) at housing (50).
36. Remove two nuts (53) and two lockwashers (54) securing tube (51) to underside of front engine cover (55). Discard lockwashers.

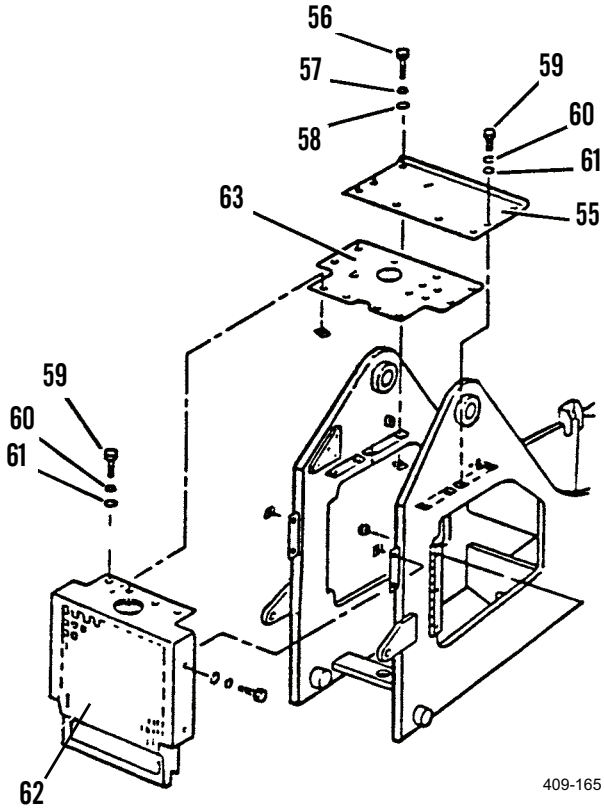


REMOVAL - CONTINUED

NOTE

Bolts (56) are longer than other bolts used to secure left-hand side of front engine cover. Note location of bolts for use during installation.

37. Remove bolts (56 and 59), lockwashers (57 and 60), and flatwashers (58 and 61) securing front and rear engine covers (55 and 63). Discard lockwashers.
38. Lift rear engine cover (63) with air cleaner assembly still attached up and over rear frame.
39. Remove front engine cover (55) up and over rear frame.

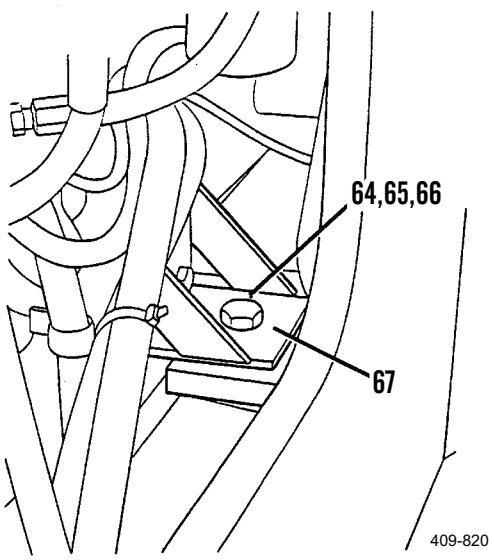


REMOVAL - CONTINUED

NOTE

There is one locknut, rebound washer, and capscrew attaching each front engine mount to the vehicle frame.

40. Remove locknut (64), rebound washer (65) and capscrew (66) from front left side and front right side of engine mounts (67). Discard locknut.



41. Remove fan (WP 0059 00).

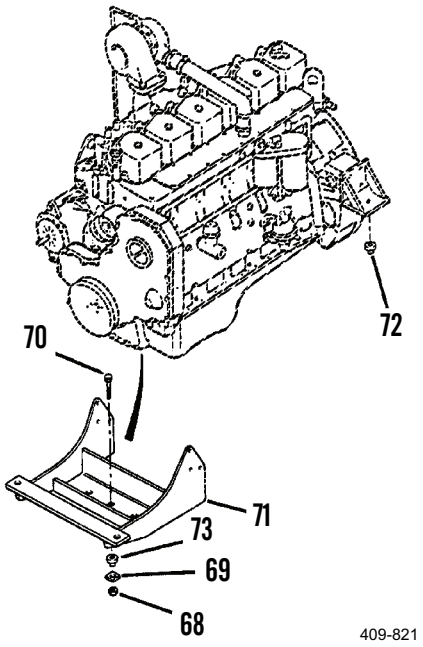
42. Remove locknut (68), rebound washer (69) and capscrew (70) from rear engine mount (71). Discard locknut.

WARNING

Use 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 1,075 lb (488 kg).



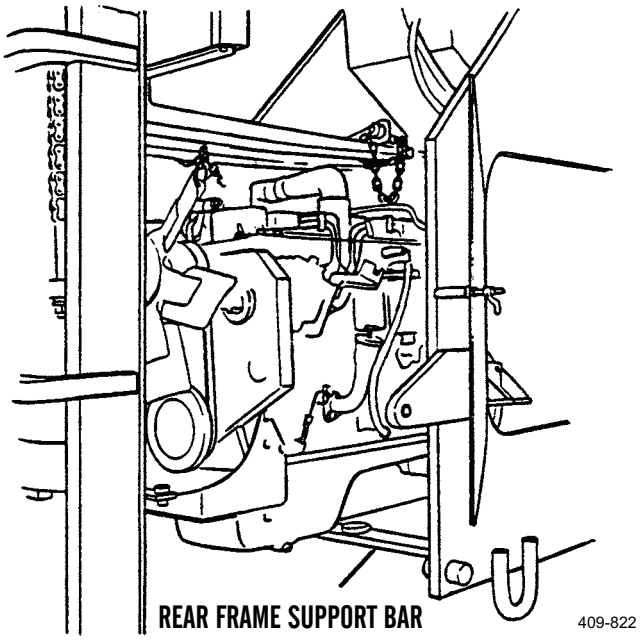
REMOVAL - CONTINUED

43. Attach lifting chains, with a lifting capacity of 2,000 lb (907 kg) to engine lifting brackets.
44. With assistance, raise engine high enough to clear rear frame support bar.
45. Slowly remove engine through the back of the engine compartment.
46. Place engine in a suitable engine stand.

NOTE

There are two front rubber mounts; one under each of the two front engine mounts.

47. Remove and discard two front rubber mounts (72) and rear rubber mount (73).



48. Remove alternator (WP 0062 00).
49. Remove STE/ICE-R fuel pressure sender (WP 0087 00) and STE/ICE-R fuel filter differential pressure switch (WP 0088 00).
50. Remove starter relay (WP 0081 00).
51. Remove transmission oil sampling valve and fittings (WP 0121 00).
52. Remove engine oil pressure and water temperature switches (WP 0073 00 and WP 0075 00).
53. Remove engine oil pressure and water temperature senders (WP 0099 00 and WP 0100 00).
54. Remove engine mounts (WP 0211 00).
55. Remove flywheel housing cover (WP 0215 00).
56. Remove coupling from flywheel (WP 0214 00).
57. Remove ether start thermostat (WP 0046 00).

INSTALLATION

1. Install engine mounts (WP 0211 00).
2. Install ether start thermostat (WP 0046 00).
3. Install water temperature and oil pressure senders (WP 0099 00 and WP 0100 00).
4. Install engine oil pressure and water temperature switches (WP 0073 00 and WP 0075 00).
5. Install oil sampling valve and fittings (WP 0121 00).
6. Install starter relay (WP 0081 00).

REMOVAL - CONTINUED

7. Install STE/ICE-R fuel pressure sender and STE/ICE-R fuel filter differential pressure switch (WP 0087 00 and WP 0088 00).
8. Install alternator (WP 0062 00).
9. Install coupling to flywheel (WP 0214 00).
10. Install flywheel housing cover (WP 0215 00).

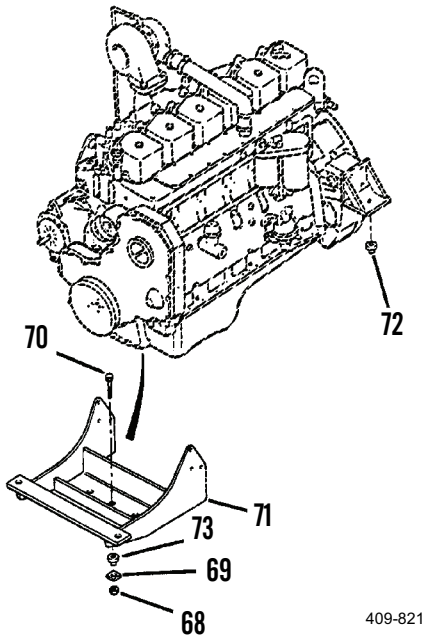
WARNING

Use 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

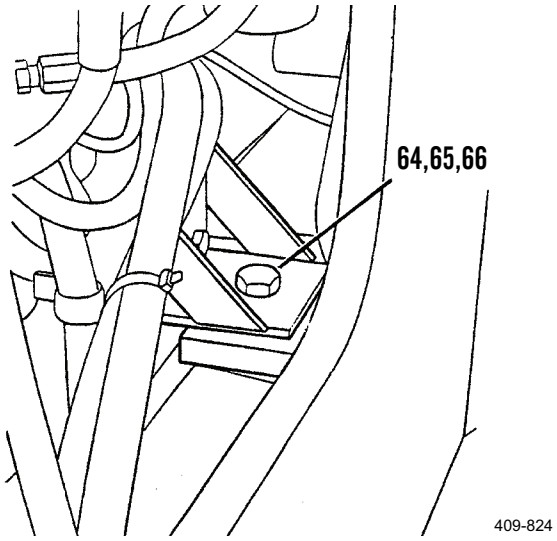
Weight of the engine assembly is approximately 1,075 lb (488 kg).

11. Install two new front rubber mounts (72) and rear rubber mount (73).
12. Attach lifting chains to front and rear engine lifting brackets.



INSTALLATION - CONTINUED

13. With assistance, attach lifting chains to lifting device. Slowly lift and install engine through the back of the engine compartment. Lift engine high enough to clear rear frame support bar.
14. Slowly lower engine into position over new rubber mounts. Install capscrews (66 and 70), rebound washers (65 and 60) and new locknuts (64 and 73), to rear engine mount (71). Torque locknuts to 307 lb-ft (139 kg).



NOTE

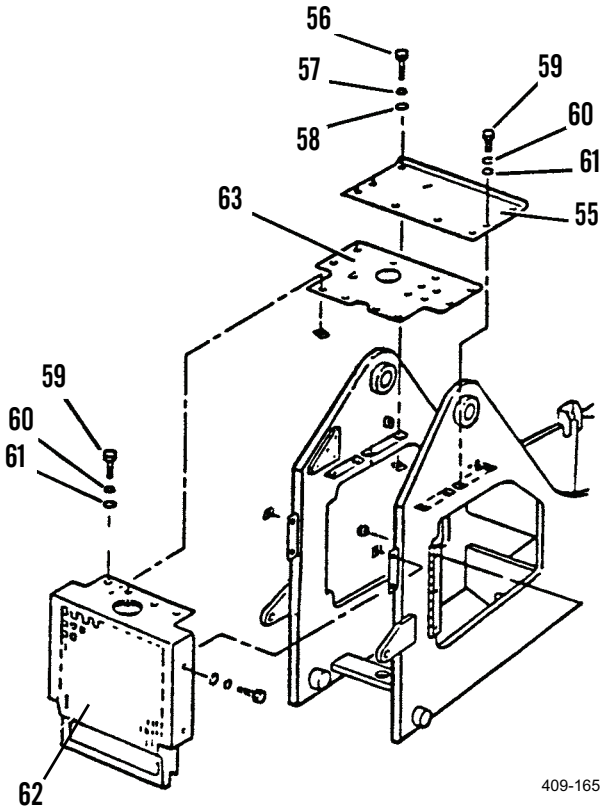
There are two locknuts, rebound washers, and capscrews attaching the front two engine mounts to the vehicle frame.

15. Remove lifting chains. Remove lifting device from the vehicle area.
16. Install fan (WP 0059 00).
17. Install front engine cover (55) by going up and over rear frame and setting in mounting position.
18. Install rear engine cover (63) with air cleaner assembly still attached by going up and over rear frame and under front engine cover.

NOTE

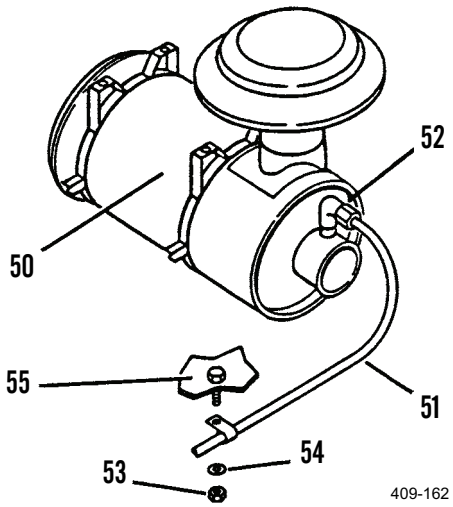
Bolts (56) are longer than other bolts used to secure left-hand side of front engine cover.

19. Secure front and rear engine covers (55 and 63) with bolts (56 and 59), lockwashers (57 and 60), and flat washers (58 and 61).
20. Install two nuts (53) and two lockwashers (54) securing tube (51) to underside of front engine cover (55).

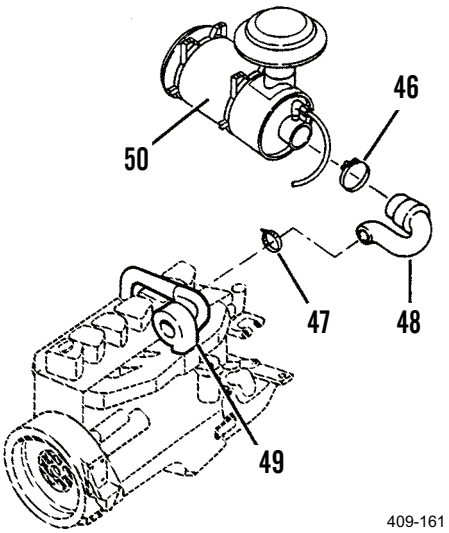


INSTALLATION - CONTINUED

21. Connect tube (51) to elbow assembly (52) at housing (50).



22. Install hose (48) to housing (50) and turbocharger (49).
23. Install clamps (46 and 47) securing hose (48) to turbocharger (49) and housing (50).

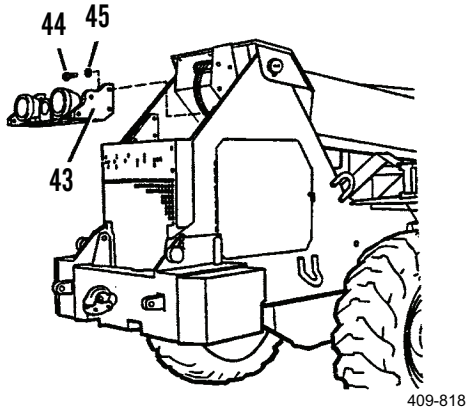


INSTALLATION - CONTINUED

WARNING

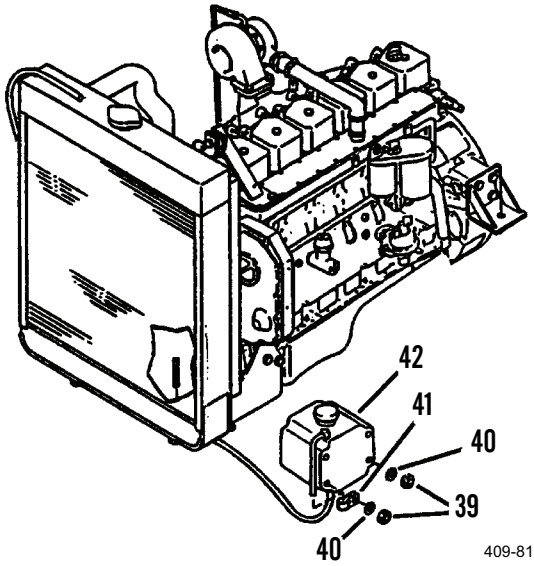
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

24. With assistance, put frame cross member (43) in position using a hoist and sling.
25. Apply loctite to threads of capscrews (44). Install new lockwashers (45) and capscrews. Torque capscrews to 210 lb-ft (95 kg).
26. Remove lifting device.



409-818

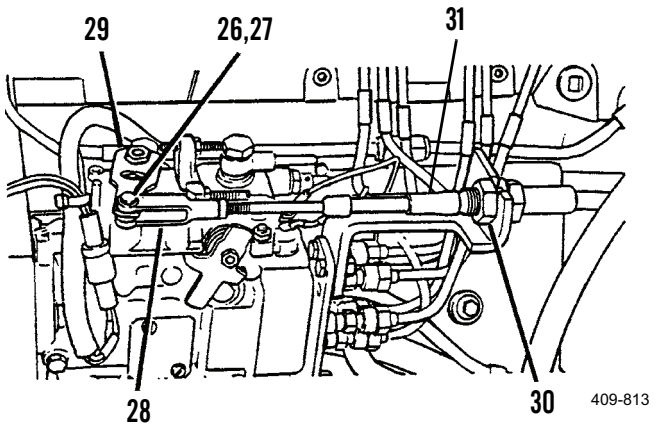
27. Install coolant overflow tank (42) and clamp (41) with two flatwashers (40) and two new locknuts (39).



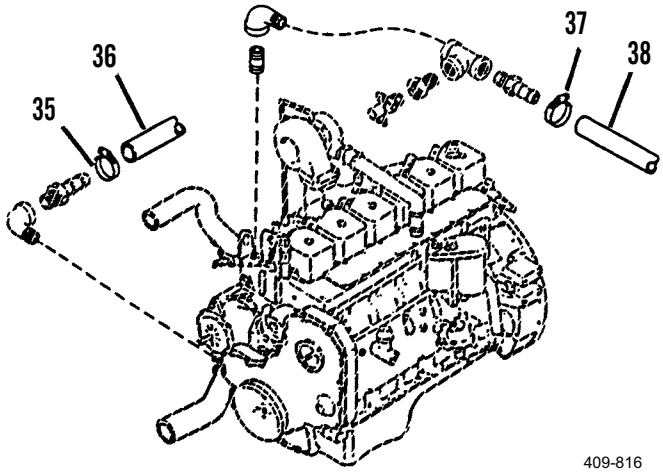
409-817

INSTALLATION - CONTINUED

28. Attach clevis (28) to fuel injection pump control lever (29) with pin (27) and new cotter pin (26).
29. Place accelerator cable (31) in throttle bracket and tighten nut (30).

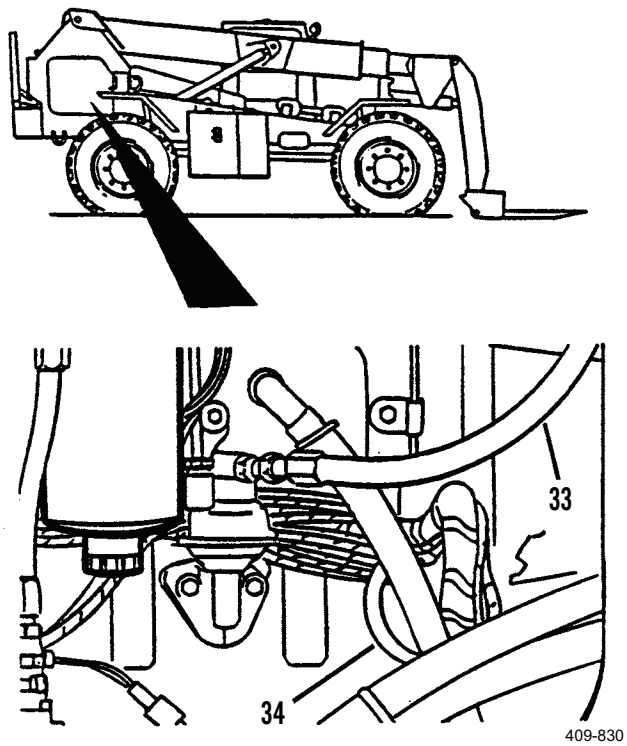


30. Connect heater hose (36) with new clamp (35).
31. Connect heater hose (38) with new clamp (37).



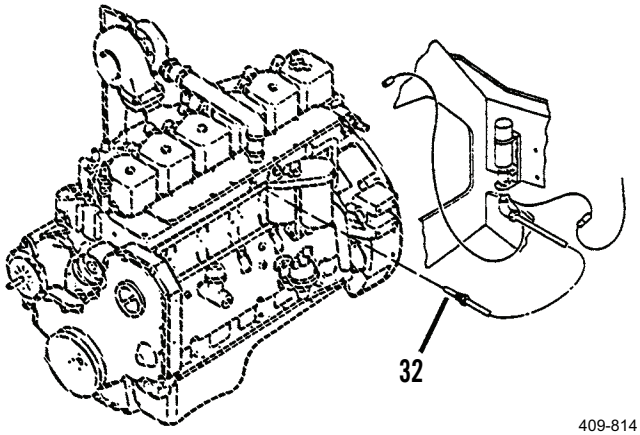
INSTALLATION - CONTINUED

32. Connect fuel hoses (33 and 34).



409-830

33. Connect ether starting aid tubing (32) to intake manifold.

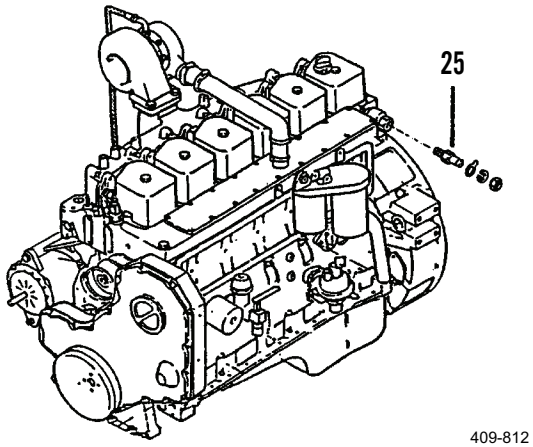


409-814

INSTALLATION - CONTINUED

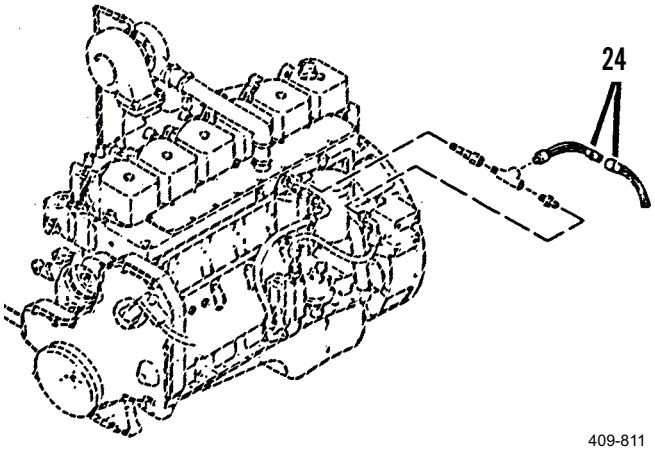
34. Route engine and STE/ICE-R wiring harnesses as noted at engine removal.

35. Connect electrical lead no. 14 to water temperature switch (25).



409-812

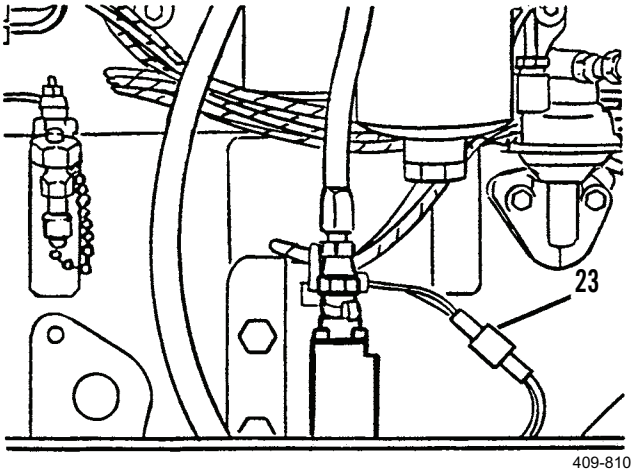
36. Connect pressure transducer connector (24).



409-811

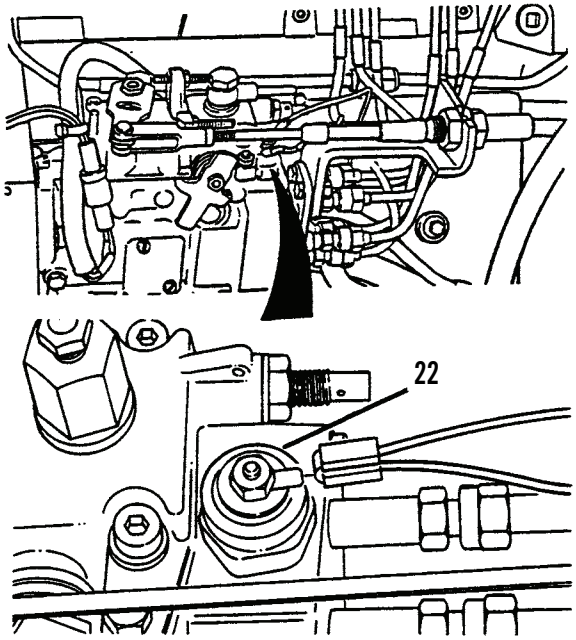
INSTALLATION - CONTINUED

37. Connect pressure differential switch connector (23).



409-810

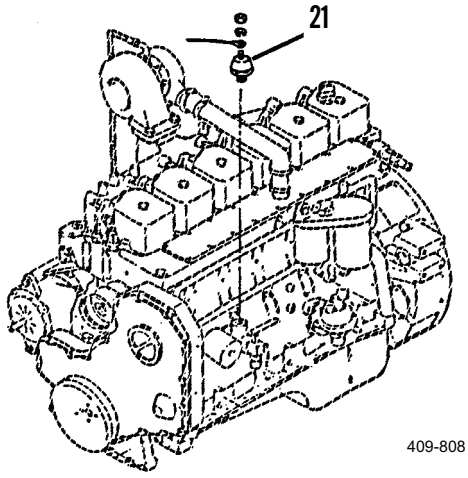
38. Connect electrical leads no. 07 and R to fuel solenoid (22).



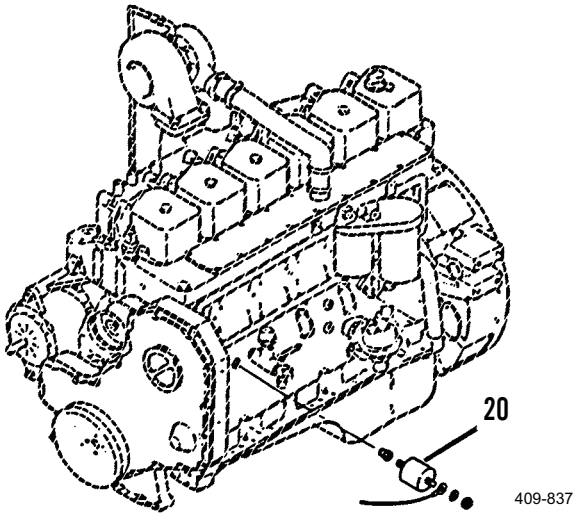
409-809

INSTALLATION - CONTINUED

39. Connect electrical lead no. 16 to oil pressure switch (21).

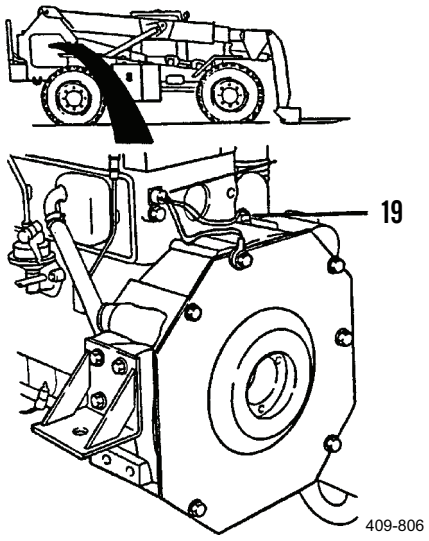


40. Connect electrical lead no. 17 to oil pressure sender (20).

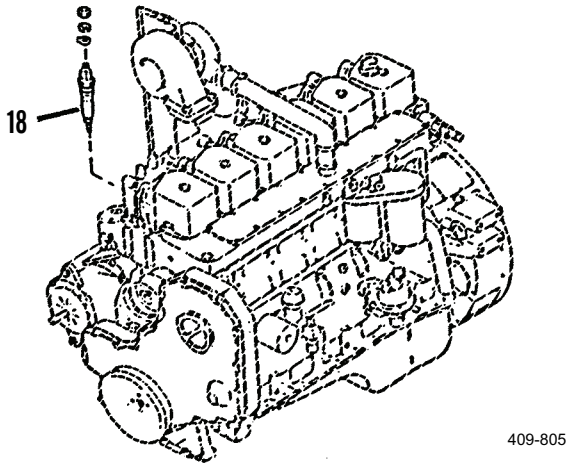


INSTALLATION - CONTINUED

41. Connect ether thermostat connector (19).

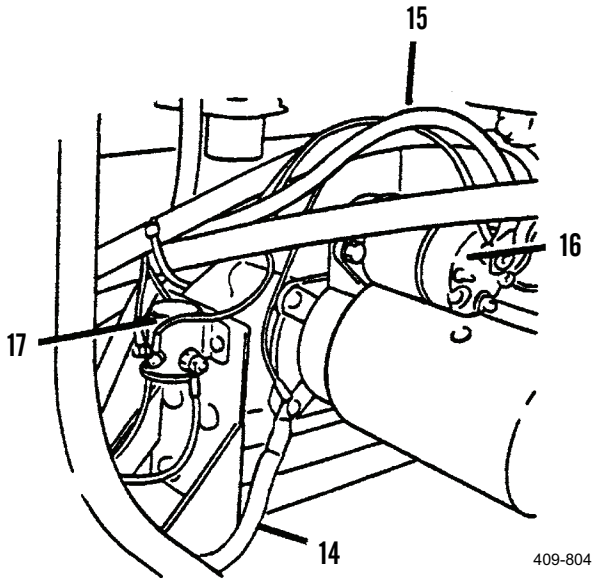


42. Connect electrical lead no. 15 to water temperature sender (18).

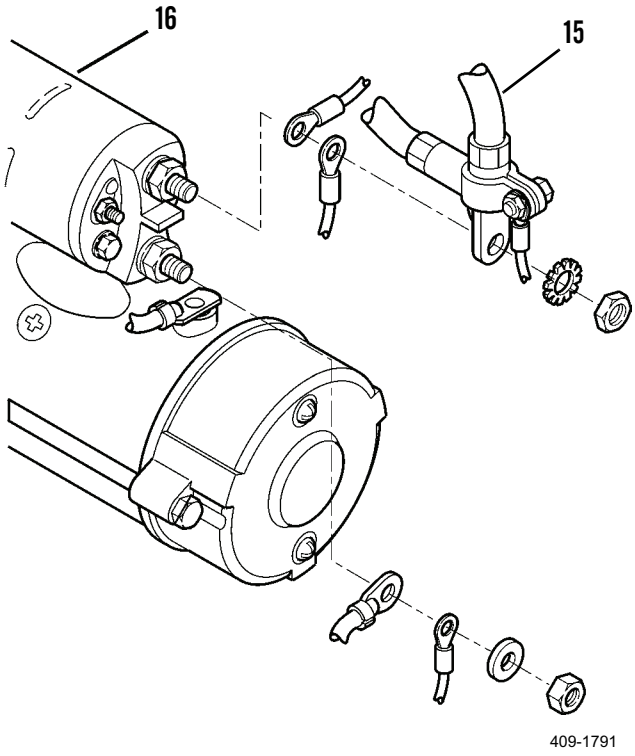


INSTALLATION - CONTINUED

43. Connect electrical leads to starter relay (17), lead no. 4A to rear small terminal, lead no. 38 to large front terminal, and lead no. 39 to large rear terminal.
44. Connect electrical leads no. 38 and S to starter solenoid (16) terminal “S”.
45. Connect battery positive cable (15) and wire no. 39, T and two wires no. 60 to starter solenoid (16) terminal “BAT”.

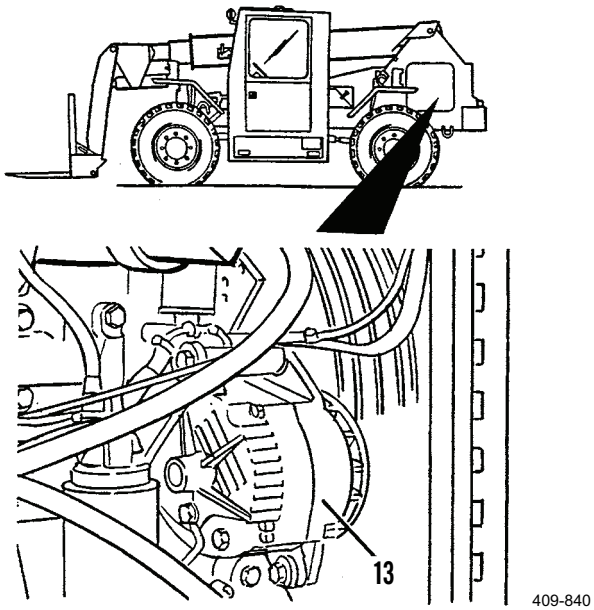


46. Connect battery ground cable (14) and wire no. M to starter mounting capscrew.

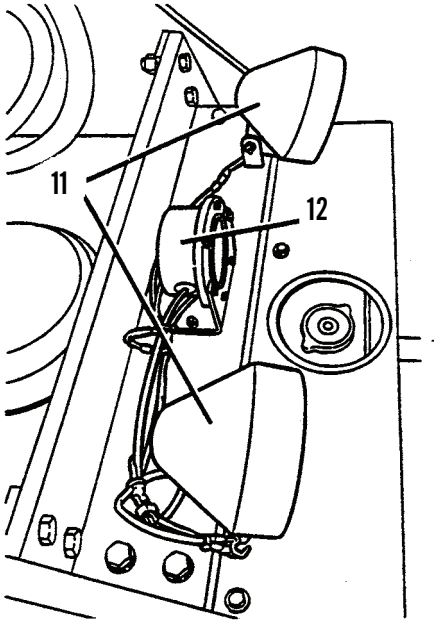


INSTALLATION - CONTINUED

47. Connect electrical leads no. 60 and N to “BAT” terminal and electrical lead no. P to “1” terminal of alternator (13).

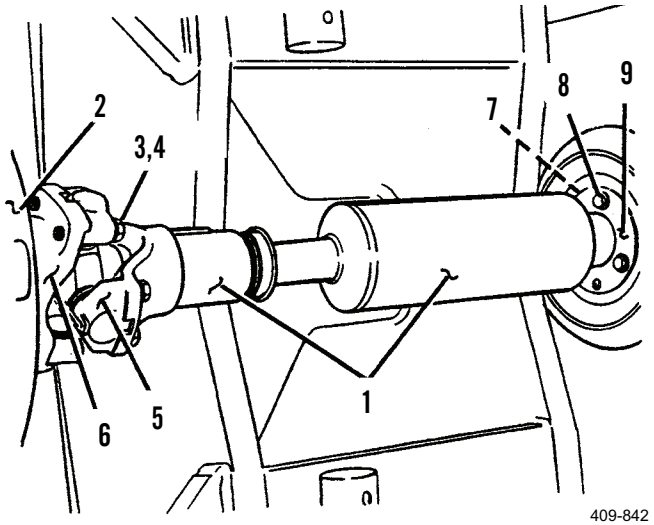


48. Connect electrical leads to back-up alarm (12) and rear floodlights (11).



INSTALLATION - CONTINUED

49. Install driveshaft assembly (1) to engine dampener (7).
50. Position engine coupling (9) with driveshaft assembly (1) into engine dampener (7).
51. Apply loctite to three capscrews (8) and install coupling (9) to engine with capscrews. Torque capscrews to 25 lb-ft (34 Nm).
52. Position drive assembly (1) to transmission (2).
53. Apply loctite to four capscrews (3). Install universal joint (5) of shaft assembly (1) to input yoke (6) of transmission (2) with four capscrews and four new lockwashers (4). Torque capscrews to 41 lb-ft (56 Nm).



409-842

54. Install tie down straps to lines and electrical wires at areas noted during engine removal, and as necessary to prevent damage to lines and wires.
55. Install muffler (WP 0051 00).
56. Install radiator (WP 0053 00).
57. Service cooling system with coolant (WP 0053 00).
58. Service engine with engine oil (WP 0012 00).
59. Connect battery cables (WP 0107 00).
60. Adjust accelerator cable (WP 0048 00).
61. Run engine, check for proper operation and leaks (TM 10-3930-660-10).
62. Install transmission cover (WP 0150 00).

END OF WORK PACKAGE

ENGINE ASSEMBLY REPLACEMENT (165 HP) 0210 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Engine stand, 2,000 lb capacity

Lifting chain, 2,000 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Compound, sealing (Item 14, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Strap, tie down (Item 56, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Locknut (105, 109, 133, 119 and 123)

Lockwasher (2, 22, 27, 45, 50, 55, 58, 64, 83, 100, 109, 112, 115 and 127)

Starwasher (33, 34, 40, 68, 69 and 100)

References

WP 0017 00

WP 0046 00

WP 0049 00

WP 0062 00

WP 0074 00

WP 0070 00

WP 0075 00

References - Continued

WP 0081 00

WP 0087 00

WP 0088 00

WP 0089 00

WP 0099 00

WP 0100 00

WP 0211 00

WP 0214 00

WP 0215 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Battery cables disconnected (WP 0107 00)

Engine oil drained (WP 0012 00)

Radiator removed (WP 0053 00)

Engine coolant fan removed (WP 0059 00)

Muffler removed (WP 0051 00)

Transmission cover removed (WP 0150 00)

REMOVAL

NOTE

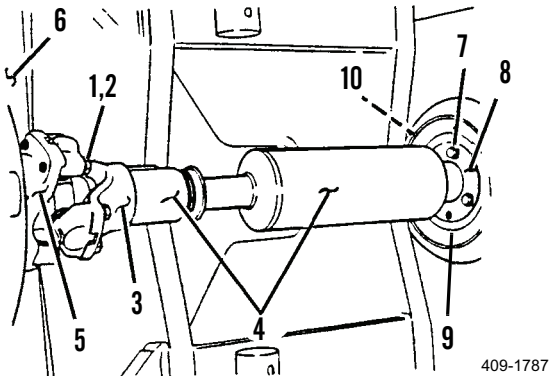
Note tie wrap locations, then remove and discard all tie wraps that secure electrical wiring, tubing and hoses to engine.

1. Remove four screws (1), lockwashers (2), universal joint (3) and driveshaft assembly (4) from input yoke (5) and transmission (6). Discard lockwashers.
2. Remove three screws (7) from engine coupling (8).
3. Temporarily install two screws (7) removed in step 2 above in two jacking holes (9) of engine coupling (8).

NOTE

If jacking screws only go partly in (less than half way up threads) then jacking screws and jacking hole threads needs to be cleared of dirt. Follow steps 4-5 to clean threads.

4. Clean threads of jacking screws using wire brush.
5. Spray solvent cleaning compound on screw thread and in jacking holes.
6. Repeat step 5 until jacking screws can be installed more than halfway up threads of jacking screws.
7. Tighten two screws (7) evenly until driveshaft assembly (4) and engine coupling (8) separates from engine dampener (10).
8. Remove coupling (8) and driveshaft assembly (4) from vehicle as an assembly.



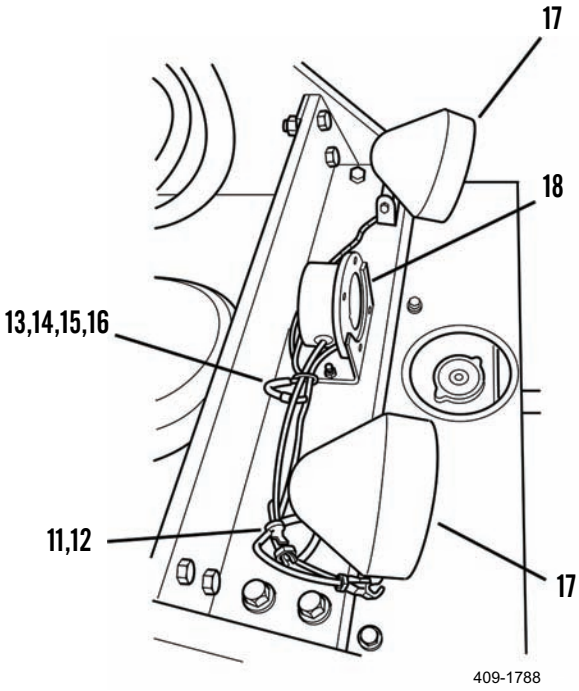
409-1787

REMOVAL - CONTINUED

NOTE

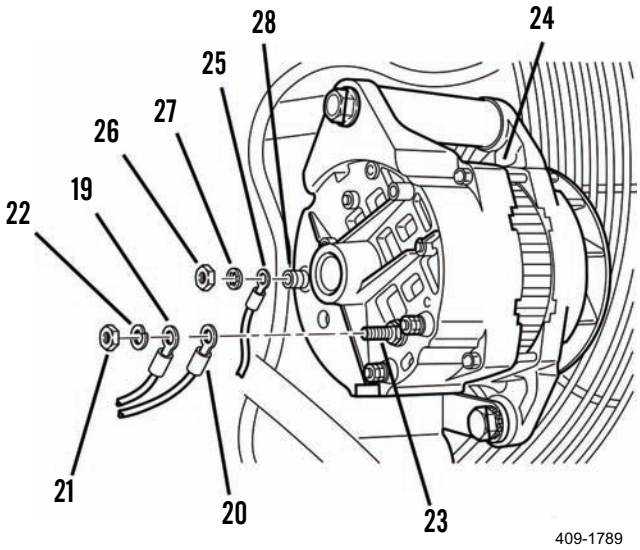
Note routing of engine and STE/ICE-R wiring harnesses before removal.

9. Tag, mark and disconnect electrical connections (11 thru 16) from rear flood lights (17) and back-up alarm (18).

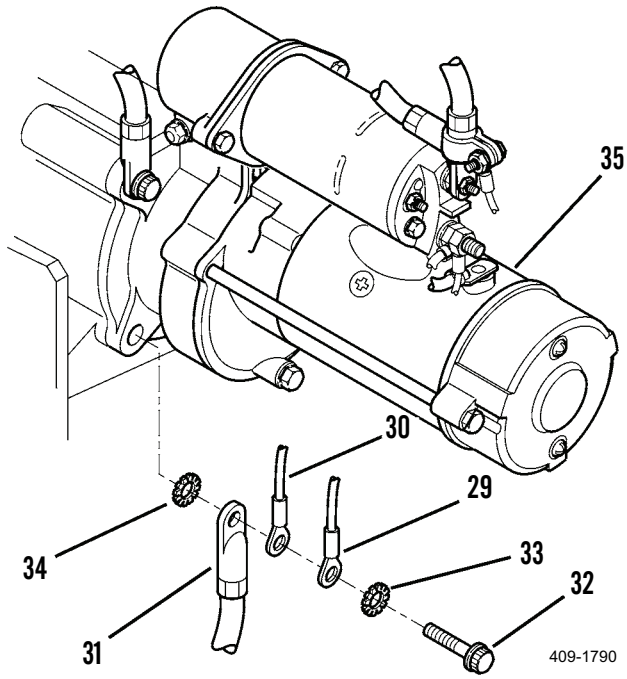


REMOVAL - CONTINUED

10. Tag and mark electrical wires no. N (19) and no. 60 (20). Remove nut (21), lockwasher (22), electrical wires no. N and no. 60 from "BAT" terminal (23) on alternator (24). Discard lockwasher.
11. Tag and mark electrical wire no. P (25). Remove nut (26), lockwasher (27) and electrical wire no. P from "GRD" terminal (28) on alternator (24). Discard lockwasher.

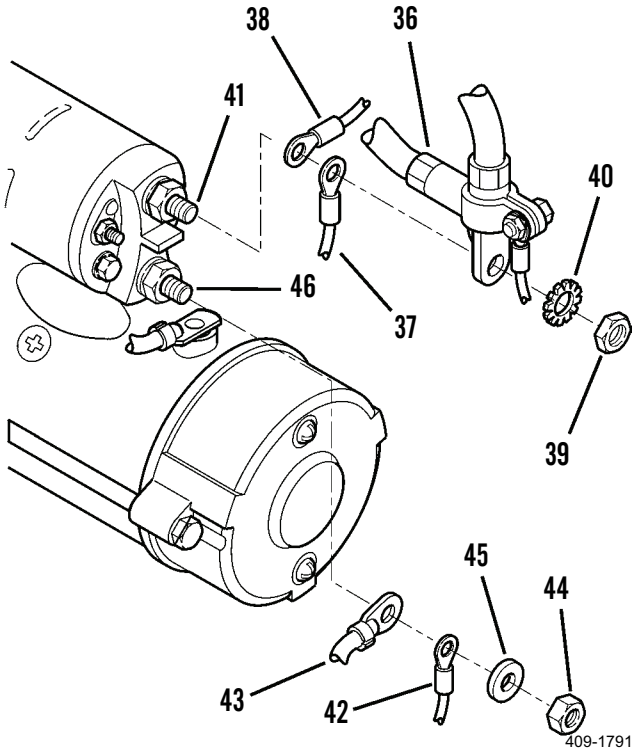


12. Tag and mark electrical wires (29) and no. M (30) and battery ground cable (31). Remove bolt (32), starwasher (33), electrical wire, electrical wire no. M, battery ground cable (31) and starwasher (34) from starter (35). Discard starwashers.

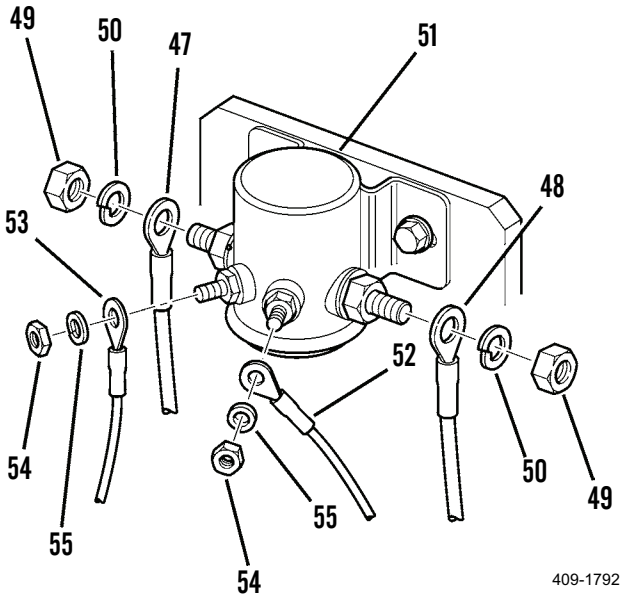


REMOVAL - CONTINUED

13. Tag and mark battery positive cable (36), electrical wire no. T (37) and connector (38). Remove nut (39), starwasher (40), battery positive cable, electrical wire no. T and connector from starter solenoid "BAT" terminal (41). Discard starwasher.
14. Tag and mark electrical wires no. S (42) and no. 38 (43). Remove nut (44), lockwasher (45), and electrical wires no. S and no. 38 from starter solenoid S terminal (46). Discard lockwasher.

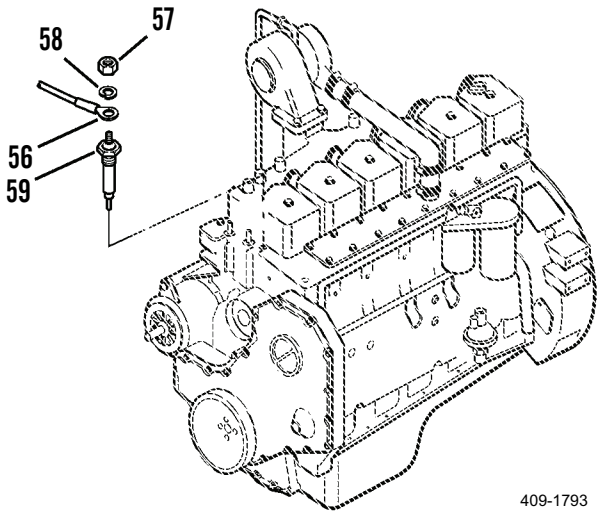


15. Tag and mark electrical wires no. 38 (47) and no. 39 (48). Remove two nuts (49), lockwashers (50) and electrical wires no. 38 and no. 39 from starter relay (51). Discard lockwashers.
16. Tag and mark electrical wires no. 4A (52) and no. 492 (53). Remove nuts (54), lockwashers (55), electrical wires no. 4A and no. 492 from starter relay (51). Discard lockwashers.

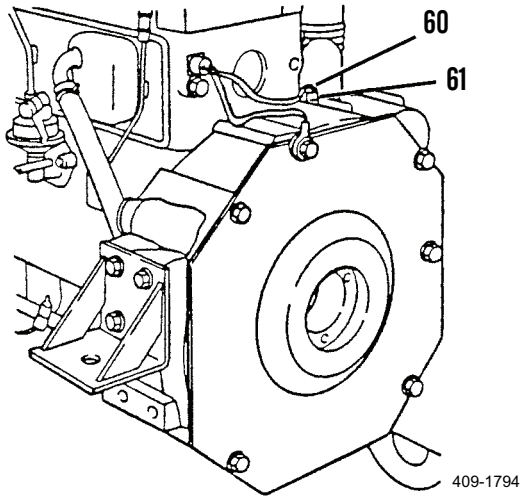


REMOVAL - CONTINUED

17. Tag and mark electrical wire no. 15 (56). Remove nut (57), lockwasher (58) and electrical wire no. 15 from water temperature sender (59). Discard lockwasher.

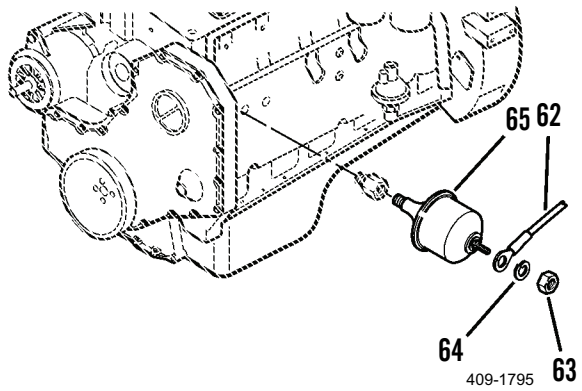


18. Tag, mark, and remove ether start thermostat connector (60) from engine wiring harness connector (61).

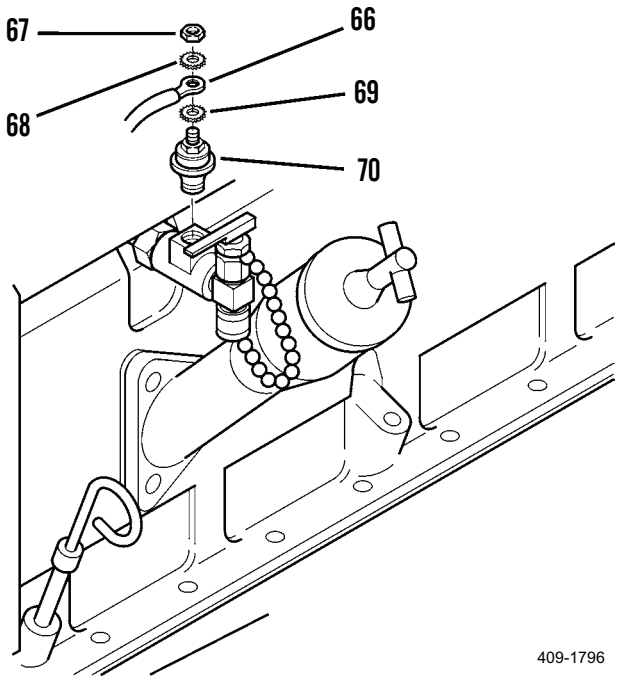


REMOVAL - CONTINUED

19. Tag and mark electrical wire no. 17 (62). Remove nut (63), lockwasher (64) and electrical wire no. 17 from oil pressure sender (65). Discard lockwasher.

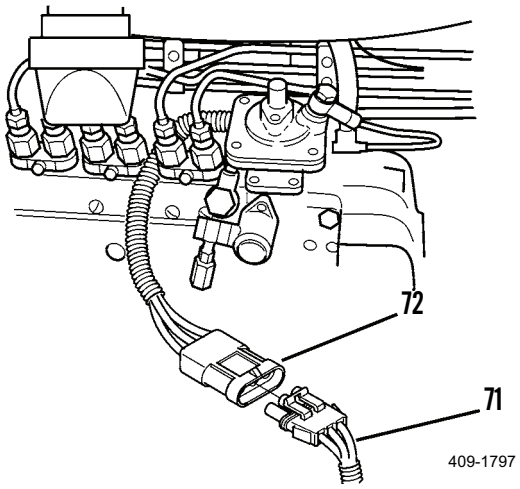


20. Tag and mark electrical wire no. 16 (66). Remove nut (67), starwasher (68), electrical wire no. 16 and starwasher (69) from oil pressure switch (70). Discard starwashers.

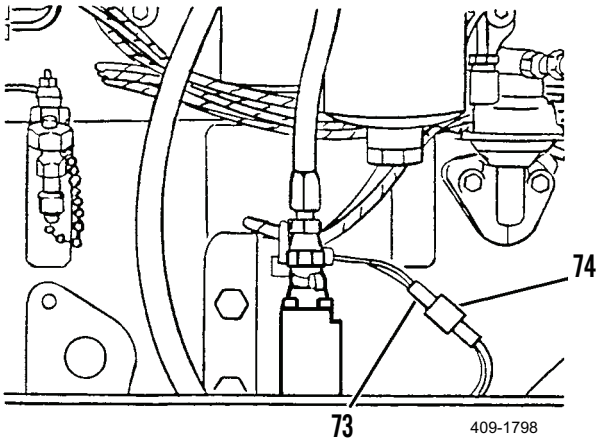


REMOVAL - CONTINUED

21. Tag, mark and remove electrical connector (71) from fuel solenoid (72).

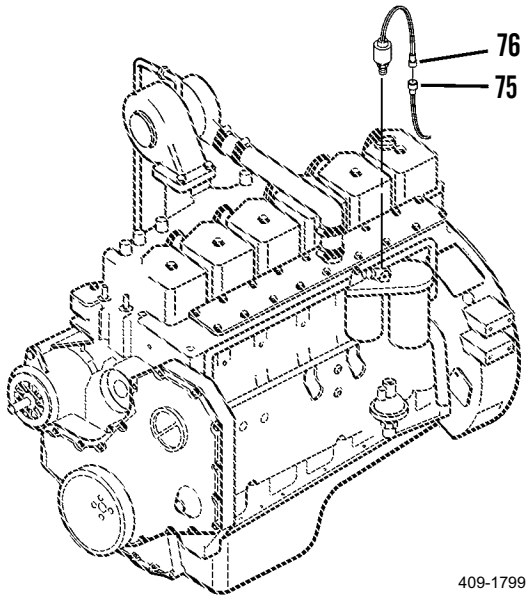


22. Tag, mark and remove electrical connector (73) from pressure differential switch connector (74).

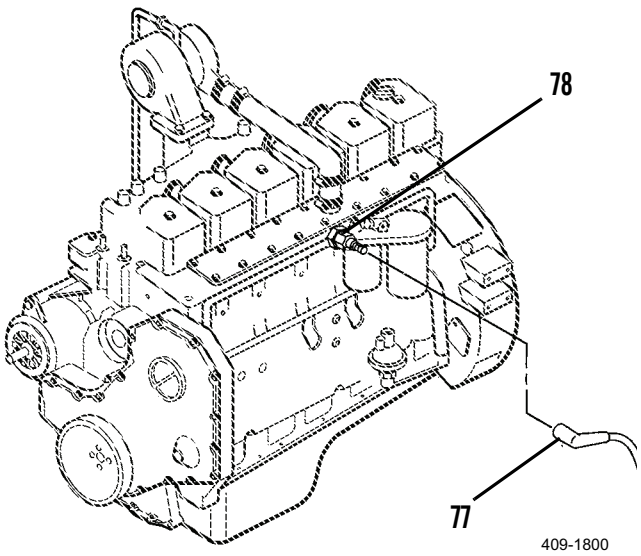


REMOVAL - CONTINUED

23. Tag, mark and remove electrical connector (75) from pressure transducer (76).

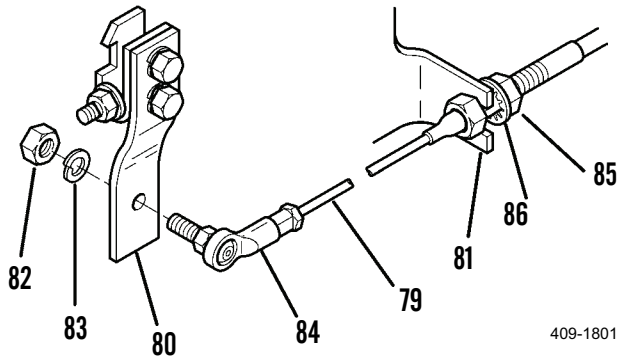


24. Tag, mark and remove electrical wire no. 14 (77) from water temperature switch (78).

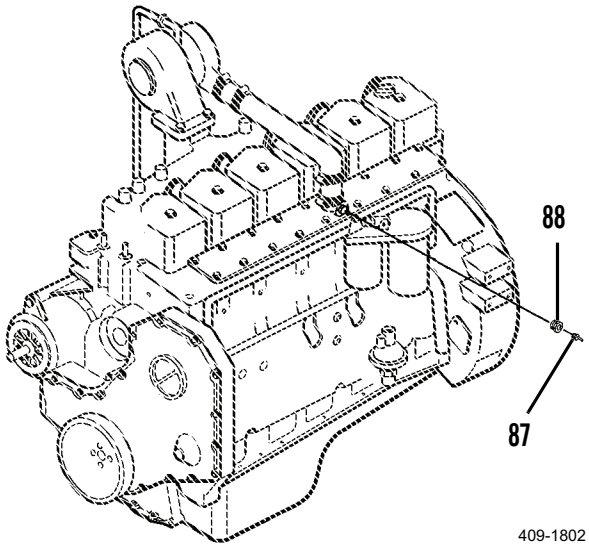


REMOVAL - CONTINUED

25. Remove nut (82), lockwasher (83) and rod end connector (84) from bracket (80). Discard lockwasher.
26. Loosen nut (85) and starwasher (86). Remove throttle cable (79) from bracket (81).



27. Tag, mark and remove ether starting aid tubing (87) from bushing (88).

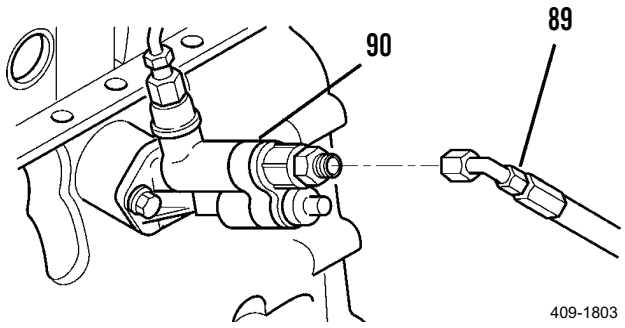


REMOVAL - CONTINUED

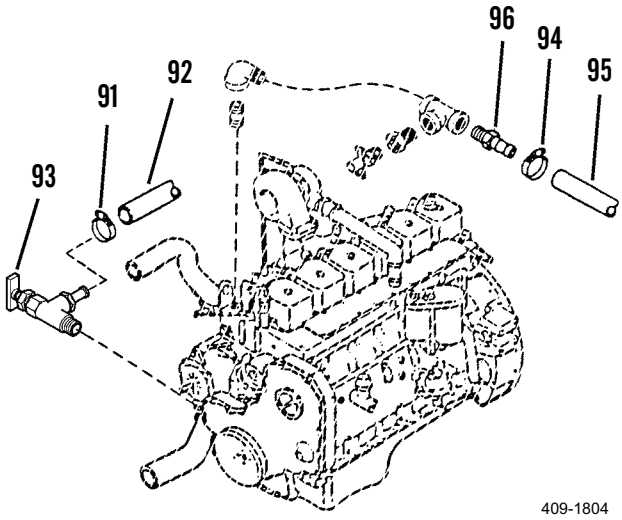
WARNING

- DO NOT smoke or permit any open flame in area of machine while you are servicing diesel fuel system. Failure to follow this warning may cause 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.
- Operating personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.

28. Tag, mark, and remove supply fuel hose (89) from fuel transfer pump (90).



29. Loosen clamp (91) and disconnect heater hose (92) from drain valve (93).
30. Loosen clamp (94) and disconnect heater hose (95) from adapter (96).

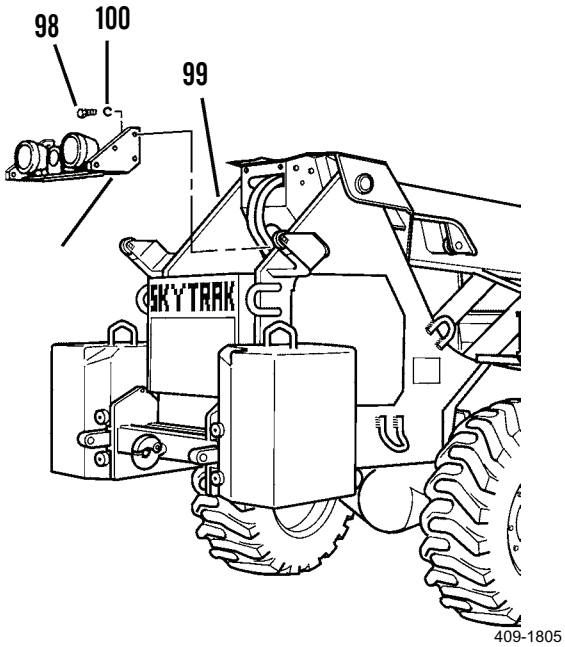


REMOVAL - CONTINUED

WARNING

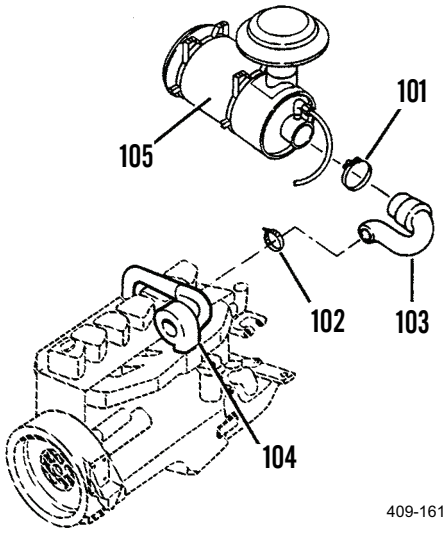
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

31. Attach lifting device to crossmember (97).
32. Remove six screws (98) and lockwashers (100) and crossmember (97) from frame (99). Discard lockwashers.



409-1805

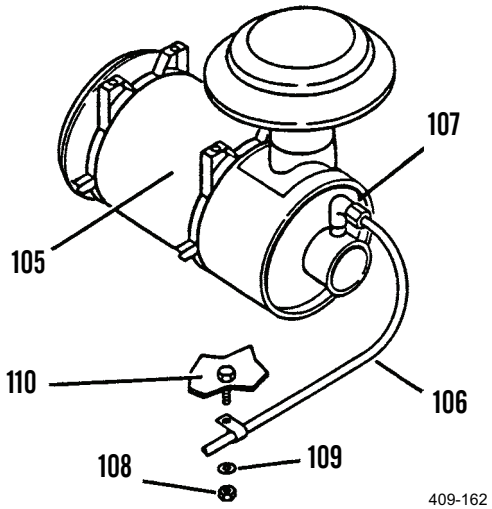
33. Loosen clamps (101 and 102) securing hose (103) to turbocharger (104).
34. Remove hose (103) from housing (105) and turbocharger (104).



409-161

REMOVAL - CONTINUED

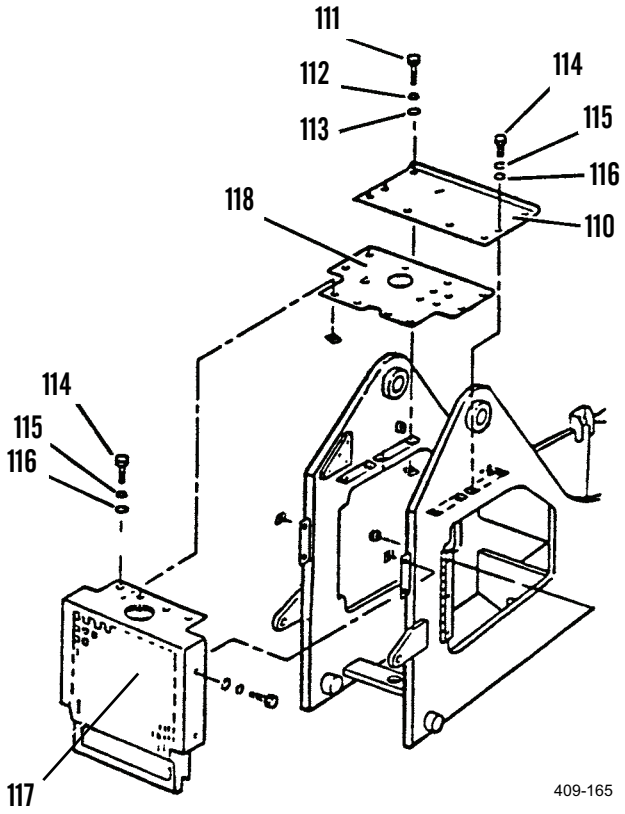
35. Disconnect tube (106) from elbow assembly (107) at housing (105).
36. Remove two nuts (108) and two lockwashers (109) securing tube (106) to underside of front engine cover (110). Discard lockwashers.



NOTE

Bolts (111) are longer than other bolts used to secure left-hand side of front engine cover. Note location of bolts for use during installation.

37. Remove bolts (111 and 114), lockwashers (112 and 115), and flatwashers (113 and 116) securing front and rear engine covers (110 and 118). Discard lockwashers.
38. Lift rear engine cover (118) with air cleaner assembly still attached up and over rear frame.
39. Remove front engine cover (110) up and over rear frame.



REMOVAL - CONTINUED

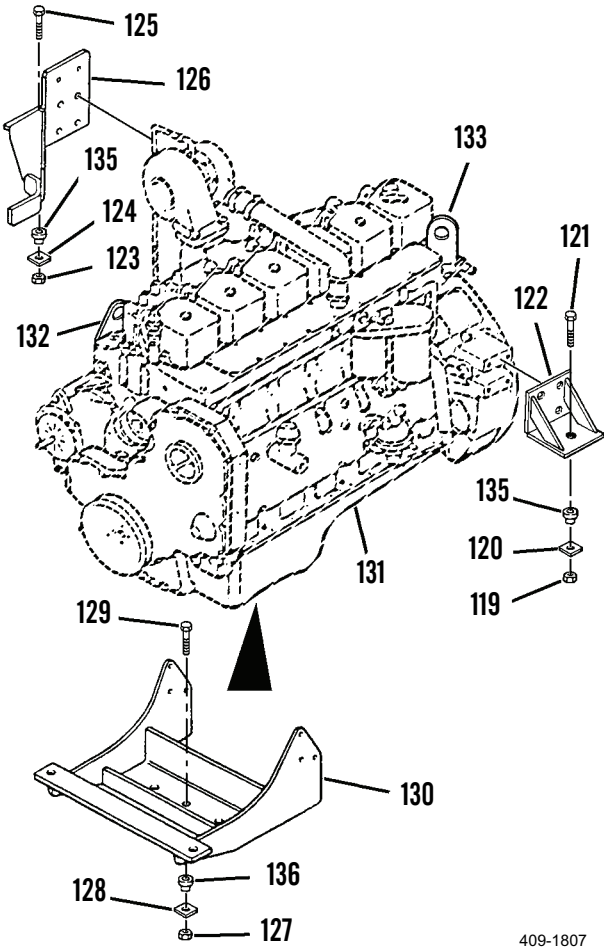
40. Remove locknut (119), rebound washer (120) and screw (121) from right front engine mount (122). Discard locknut.
41. Remove locknut (123), rebound washer (124), and screw (125) from left front engine mount (126). Discard locknut.
42. Remove locknut (127), rebound washer (128), and screw (129) from rear engine mount (130). Discard locknut.

Use 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.

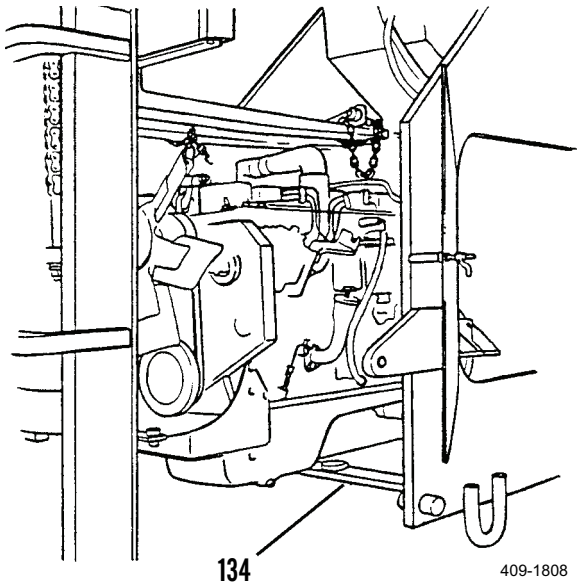
NOTE

Engine assembly weighs 1,075 lb (488 kg).

43. Attach lifting chains to engine lifting brackets (132 and 133).
44. Attach lifting chains to lifting device.
45. With assistance, raise engine (131) high enough to clear rear frame support bar (134).
46. Slowly remove engine (131) through back of engine compartment.
47. Place engine (131) in engine stand.
48. Remove front rubber mounts (135) and rear rubber mount (136) from right and left front engine mounts (122 and 126) and rear engine mount (130).



409-1807



409-1808

REMOVAL - CONTINUED

NOTE

If new engine is to be installed, remove engine components in steps below. Components removed will be installed on new engine.

49. Remove alternator (WP 0062 00).
50. Remove STE/ICE-R fuel pressure sender and STE/ICE-R fuel filter differential pressure switch (WP 0087 00 and WP 0088 00).
51. Remove starter relay (WP 0081 00).
52. Remove oil sampling valve and fittings (WP 0017 00).
53. Remove engine oil pressure and water temperature switches (WP 0074 00 and WP 0075 00).
54. Remove engine oil pressure and water temperature senders (WP 0099 00 and WP 0100 00).
55. Remove engine mounts (WP 0211 00).
56. Remove flywheel housing cover (WP 0215 00).
57. Remove coupling from flywheel (WP 0214 00).
58. Remove ether start thermostat (WP 0046 00).

INSTALLATION

1. Install engine mounts (WP 0211 00).
2. Install ether start thermostat (WP 0046 00).
3. Install water temperature and oil pressure senders (WP 0099 00 and WP 0100 00).
4. Install engine oil pressure and water temperature switches (WP 0074 00 and WP 0075 00).
5. Install oil sampling valve and fittings (WP 0017 00).
6. Install starter relay (WP 0081 00).
7. Install STE/ICE-R fuel pressure sender and STE/ICE-R fuel filter differential pressure switch (WP 0087 00 and WP 0088 00).
8. Install pulse tachometer (WP 0089 00).
9. Install alternator (WP 0062 00).
10. Install coupling to flywheel (WP 0214 00).
11. Install flywheel housing cover (WP 0215 00).

INSTALLATION - CONTINUED

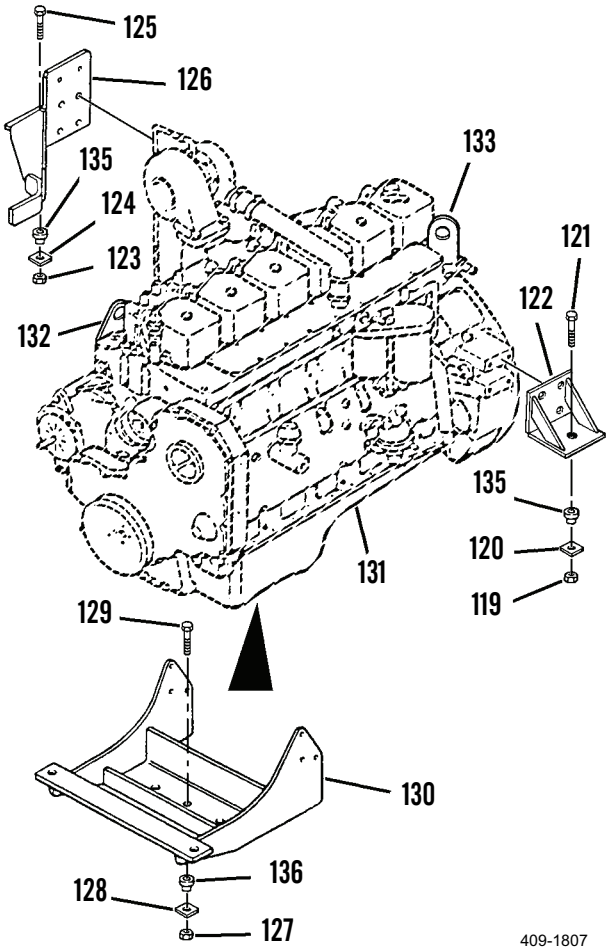
WARNING

Use 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.

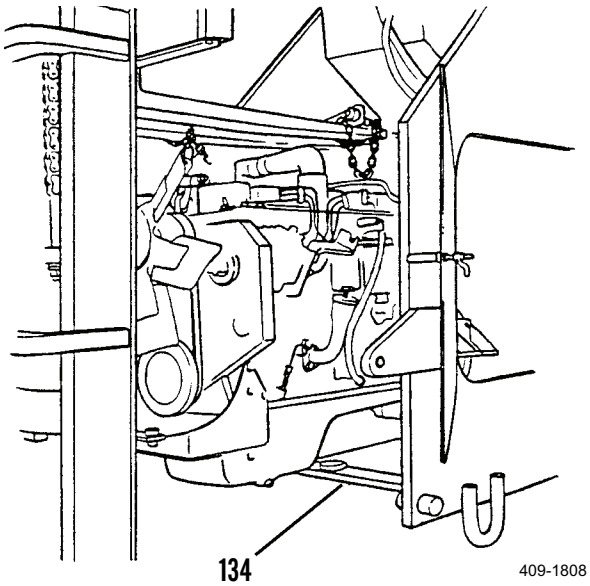
NOTE

Engine assembly weighs 1,075 lb (488 kg).

12. Install two front rubber mounts (135) and rear rubber mount (136) on right and left front engine mounts (122 and 126) and rear engine mount (130).
13. Attach lifting chains to front and rear engine lifting brackets (132 and 133).
14. Attach lifting chains to forklift truck forks or other suitable lifting device. Slowly lift and install engine through the back of the engine compartment. Lift engine high enough to clear rear frame support bar (134).
15. Lower engine into position over rubber mounts and install screw (129), rebound washer (128) and new locknut (127) on rear engine mount (130).
16. Install screw (125), rebound washer (124) and new locknut (123) on left front engine mount (126).
17. Install screw (121), rebound washer (120) and new locknut (119) on right front engine mount (122).
18. Remove lifting device and lifting chains from engine lifting brackets (132 and 133).
19. Torque locknuts (119, 123 and 127) to 307 lb-ft (416 Nm).



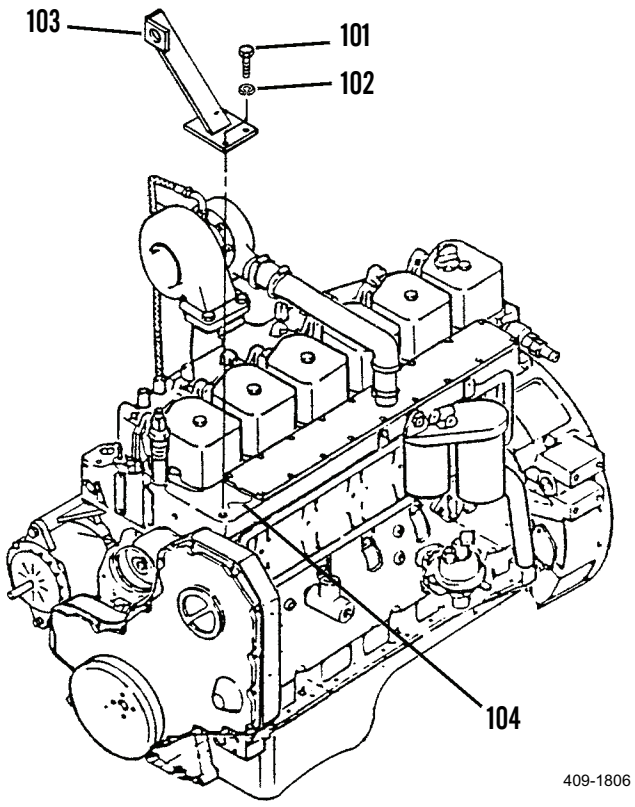
409-1807



409-1808

INSTALLATION - CONTINUED

20. Install radiator support (103), three new lockwashers (102), and screws (101) on cylinder head (104). Do not tighten screws.



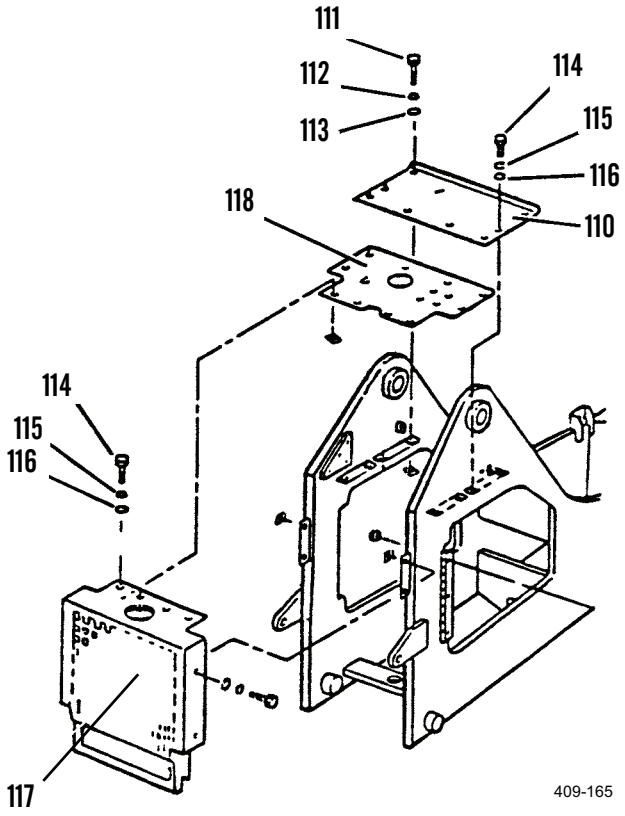
INSTALLATION - CONTINUED

21. Install front engine cover (110) by going up and over rear frame and setting in mounting position.
22. Install rear engine cover (118) with air cleaner asembly still attached by going up and over rear frame and under front engine cover.

NOTE

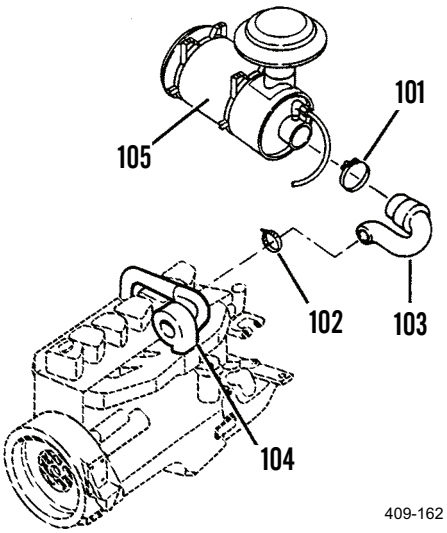
Bolts (111) are longer than other bolts used to secure left-hand side of front engine cover.

23. Secure front and rear engine covers (110 and 118) with bolts (111 and 114), lockwashers (112 and 115), and flat washers (113 and 116).
24. Install two nuts (108) and two lockwashers (109) securing tube (106) to underside of front engine cover (110).

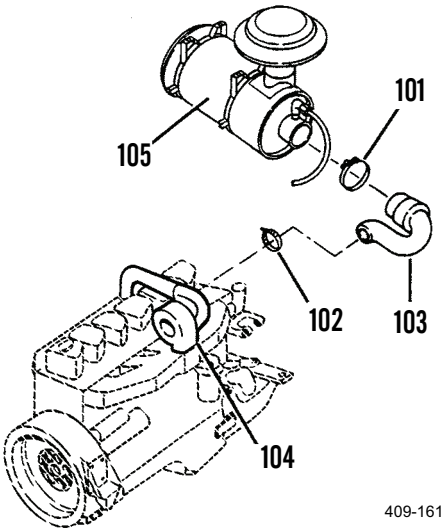


INSTALLATION - CONTINUED

25. Connect tube (106) to elbow assembly (107) at housing (105).



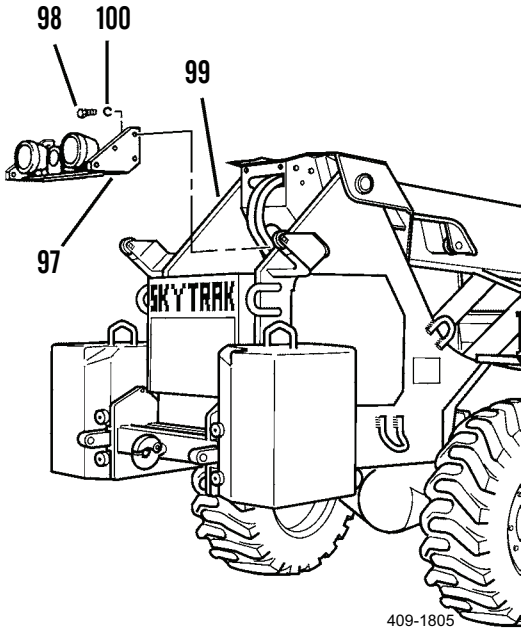
26. Install hose (103) to housing (105) and turbocharger (104).
27. Install clamps (101 and 102) securing hose (103) to turbochargers (104) and housing (105).



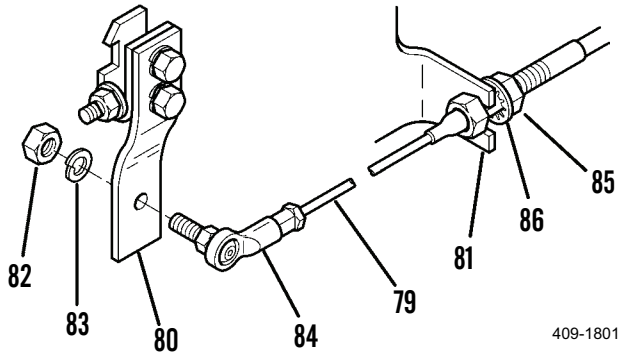
INSTALLATION - CONTINUED

Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in a well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

28. Apply sealing compound to threads of six screws (98).
29. Install six new lockwashers (100) and screws (98). Torque screws to 210 lb-ft (285 Nm).

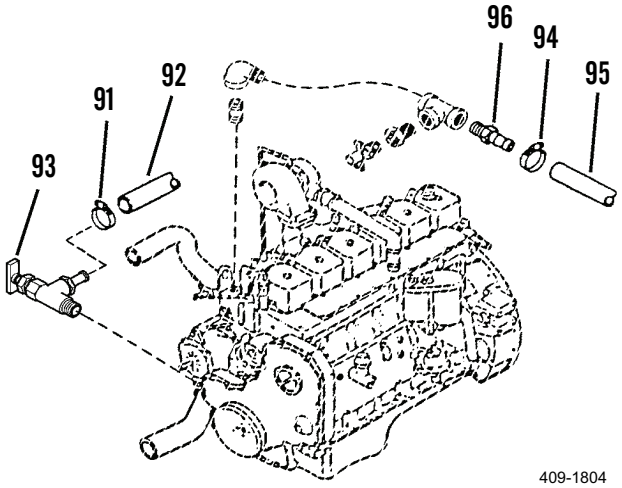


30. Position throttle cable (79) on bracket (81) and tighten nut (85) and starwasher (86).
31. Install rod end connector (84), new lockwasher (83) and nut (82) on bracket (80).



INSTALLATION - CONTINUED

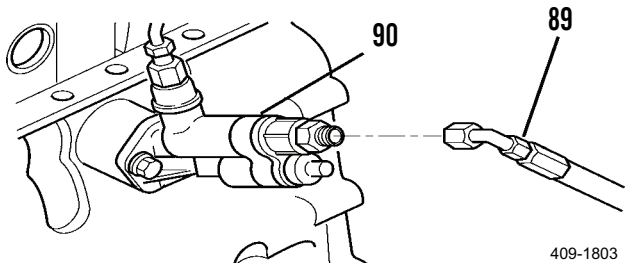
32. Connect heater hose (95) on adapter (96) with clamp (94).
33. Connect heater hose (92) on drain valve (93) with clamp (91).



WARNING

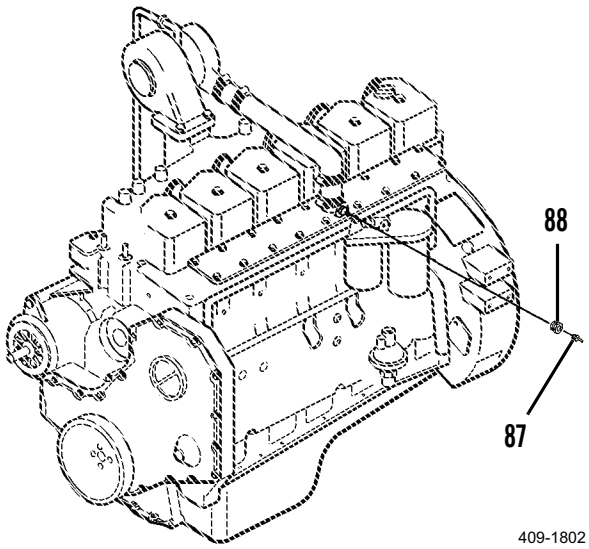
Fuel is very flammable and can explode easily. To avoid serious injury or death, keep fuel away from open fire and keep fire extinguisher within easy reach when working with fuel. Do not work on fuel system when engine is hot. Fuel can be ignited by hot engine. When working with fuel, post signs that read NO SMOKING WITHIN 50 FEET (15 m).

34. Connect fuel supply and return hose (89) on adapter (90).

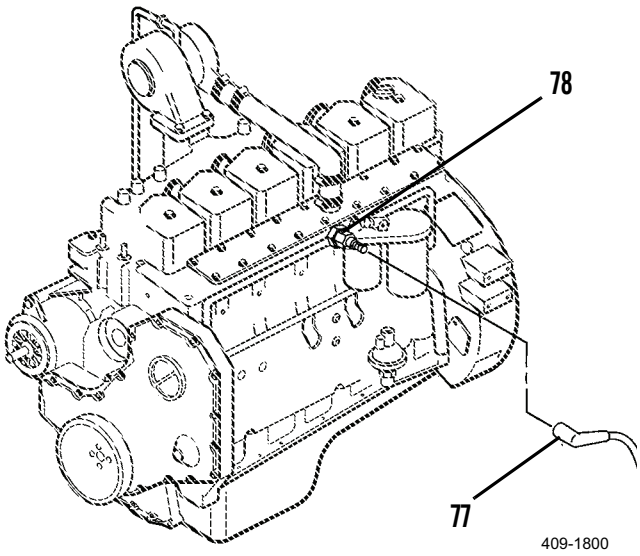


INSTALLATION - CONTINUED

35. Connect ether starting aid tubing (87) to bushing (88).

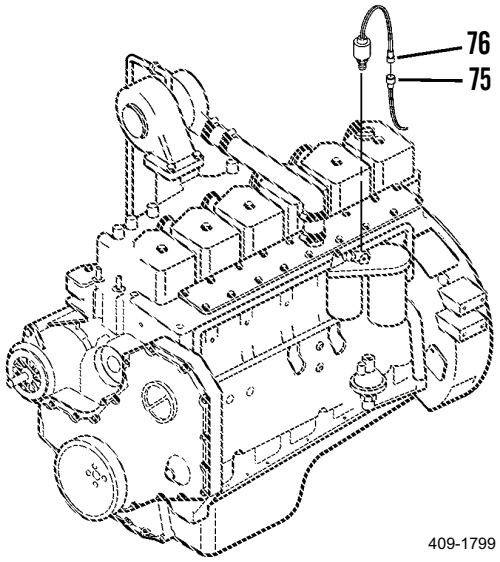


36. Connect electrical wire no. 14 (77) to water temperature switch (78).

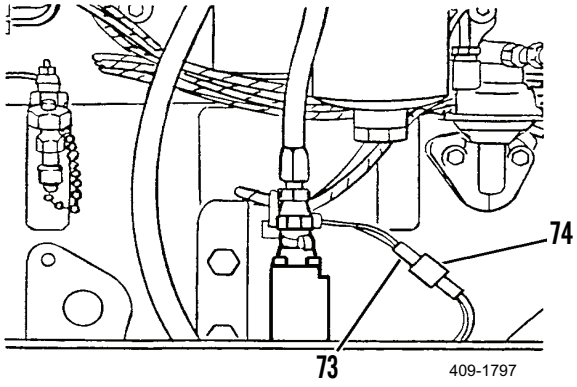


INSTALLATION - CONTINUED

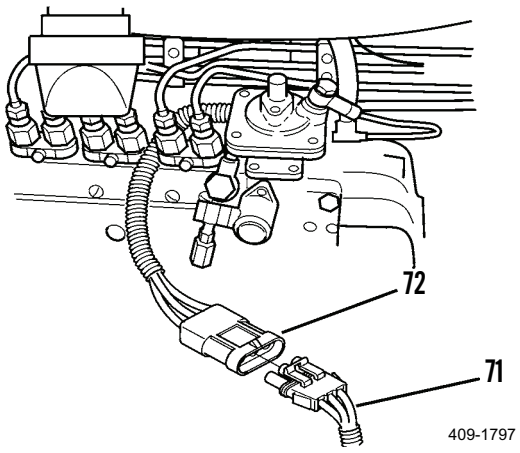
37. Connect pressure transducer (76) to electrical connector (75).



38. Connect pressure differential switch connector (74) to electrical connector (73).

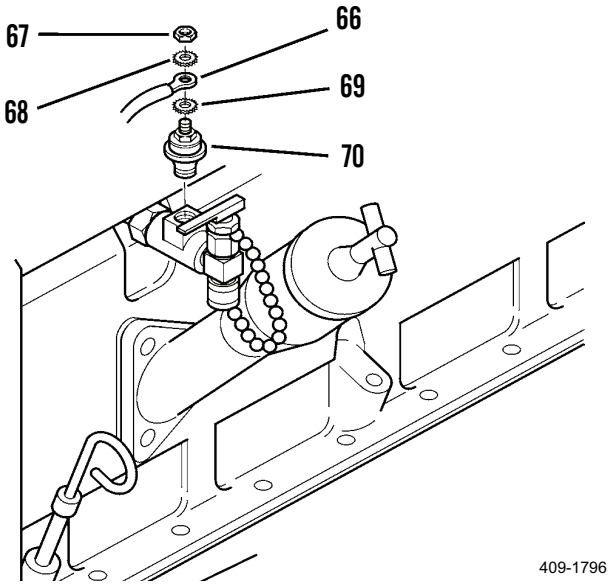


39. Connect electrical connector (71) to fuel solenoid (72).

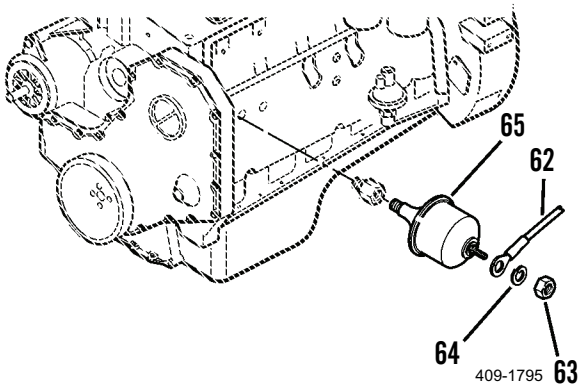


INSTALLATION - CONTINUED

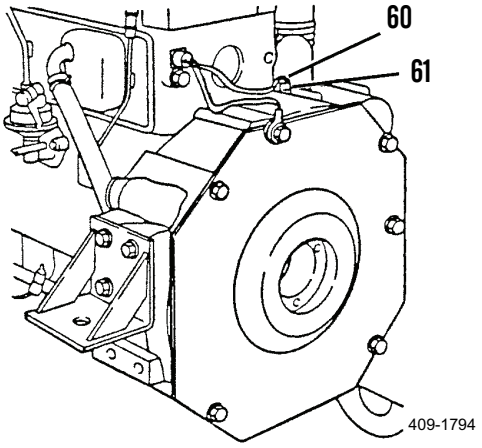
40. Connect electrical wire no. 16 (66) to oil pressure switch (70) and install new starwasher (68) and nut (67).



41. Connect electrical wire no. 17 (62) to oil pressure sender (65) and install new lockwasher (64) and nut (63).

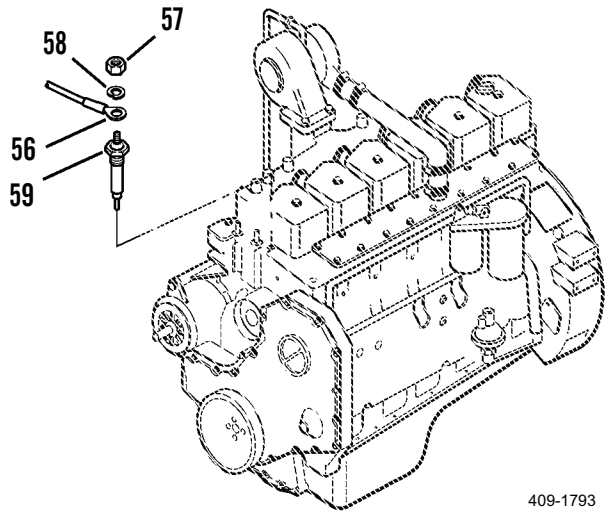


42. Connect ether thermostat connector (60) to engine wiring harness connector (61).

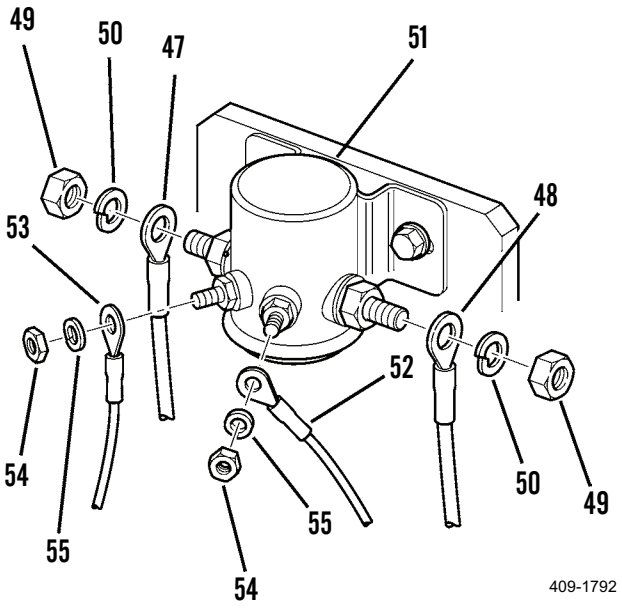


INSTALLATION - CONTINUED

43. Connect electrical wire no. 15 (56) to water temperature sender (59) and install new lockwasher (58) and nut (57).



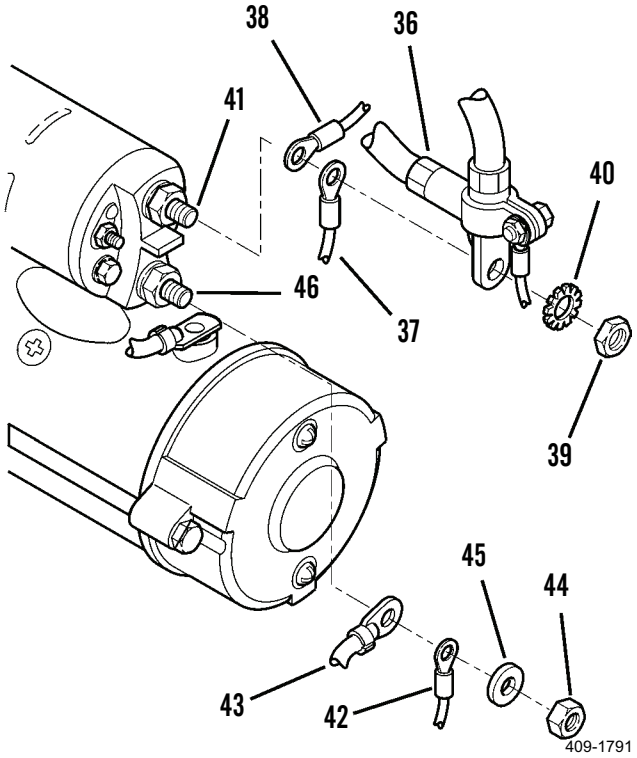
44. Connect electrical wire no. 492 (53), no. 4A (52), no. 39 (48), no. 38 (47), new lockwashers (50 and 55), and nuts (49 and 54) to starter relay (51).



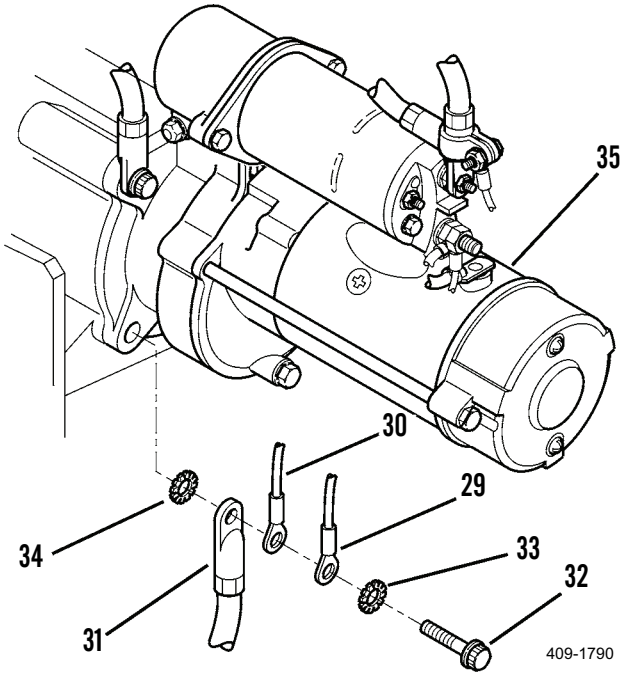
INSTALLATION - CONTINUED

45. Connect electrical wires no. 38 (43), no. S (42), new lockwasher (45) and nut (44) to starter solenoid "S" terminal (46).

46. Connect connector (38), electrical wire no. T (37), battery positive cable (36), new starwasher (40) and nut (39) to starter solenoid terminal "BAT" terminal (41).

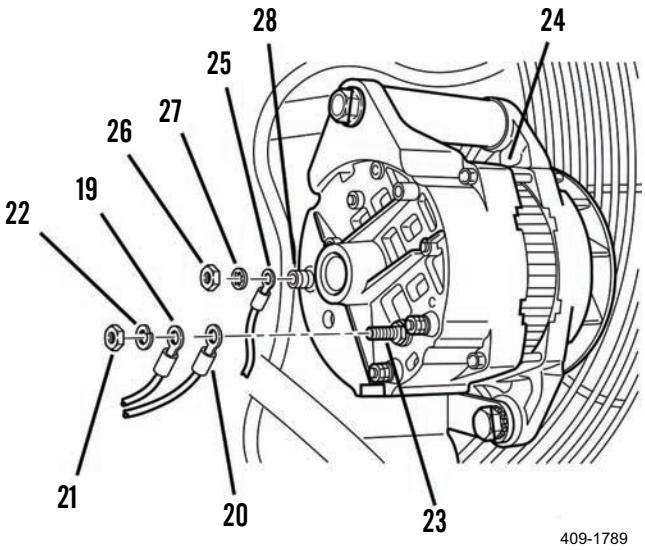


47. Install new starwasher (34) and connect electrical wire no. M (30), electrical wire (29), battery ground cable (31), new starwasher (33) and bolt (32) to starter (35).

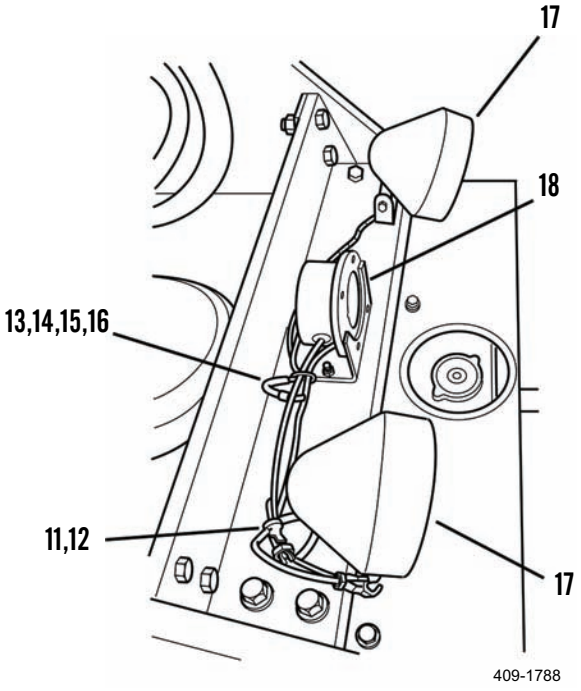


INSTALLATION - CONTINUED

48. Connect electrical wires no. 60 (20) and no. N (19) to "BAT" terminal (23) on alternator (24) and electrical wire no. P to "l" terminal of alternator (24).
49. Connect electrical wire no. P (25), new lockwasher (27), and nut (26) to "GRD" terminal (28) on alternator (27).

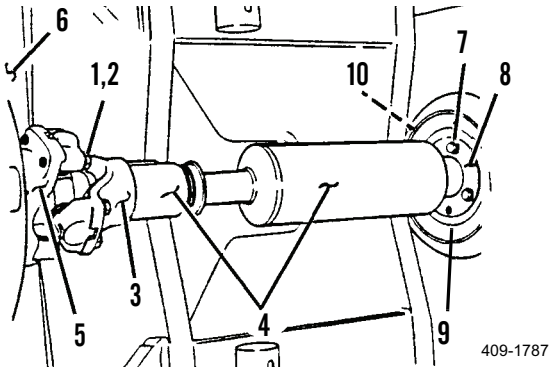


50. Connect electrical wires (11 thru 16) to back-up alarm (18) and rear floodlights (17).



INSTALLATION - CONTINUED

51. Position coupling (8) with shaft assembly (4) into engine dampener (10).



WARNING

Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. Use protective gloves and goggles. To avoid injury or death, keep away from open fire and use in a well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

52. Apply sealing compound to threads of three screws (7).
53. Install coupling (8) on engine with three screws (7). Torque screws to 25 lb-ft (34 Nm).
54. Apply sealing compound to threads of four screws (1).
55. Install universal joint (3) of shaft assembly (4) on input yoke (5) of transmission (6) with four new lockwashers (2) and screws (1). Torque screws to 41 lb-ft (56 Nm).
56. Install tie down straps to hoses and electrical wires as noted during engine removal and as necessary to prevent damage to hoses and wires.
57. Install muffler (WP 0051 00).

WARNING

Use 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.

58. Using lifting device hoist and sling, position frame cross member (97) on frame (99).
59. Install fan (WP 0059 00).
60. Install radiator and service cooling system (WP 0053 00).
61. Service engine with engine oil (WP 0012 00).
62. Connect battery cable (WP 0107 00).
63. Adjust accelerator cable (WP 0049 00).
64. Run engine, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

ENGINE MOUNTS REPLACEMENT 0211 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting chain, 2,000 lb capacity

Lifting device, 2,000 lb capacity

Materials/Parts

Sealant, Loctite (Item 45, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Lockwasher (5, 18 and 20)

Rebound washer (9 and 13)

Rubber mount (21)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Battery disconnected (WP 0107 00)

Air cleaner removed (WP 0024 00)

Engine covers removed (WP 0147 00)

Radiator removed (WP 0053 00)

Muffler removed (WP 0051 00)

Transmission input shaft disconnected, if required (WP 0119 00)

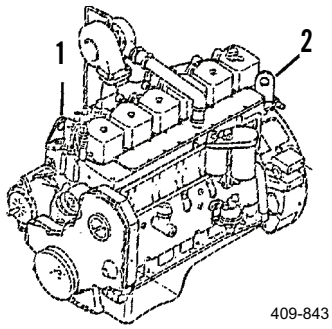
REMOVAL

WARNING

Lifting equipment used for lifting engine must be in good condition and of suitable load capacity. Failure to follow this warning may cause injury, or damage to equipment.

NOTE

"Front" and "rear" engine references used in this paragraph are relative to the front and rear of the vehicle, with engine mounted in the vehicle. The fan side of the engine is designated the rear of the engine, and the flywheel end of the engine is identified as the front of the engine.

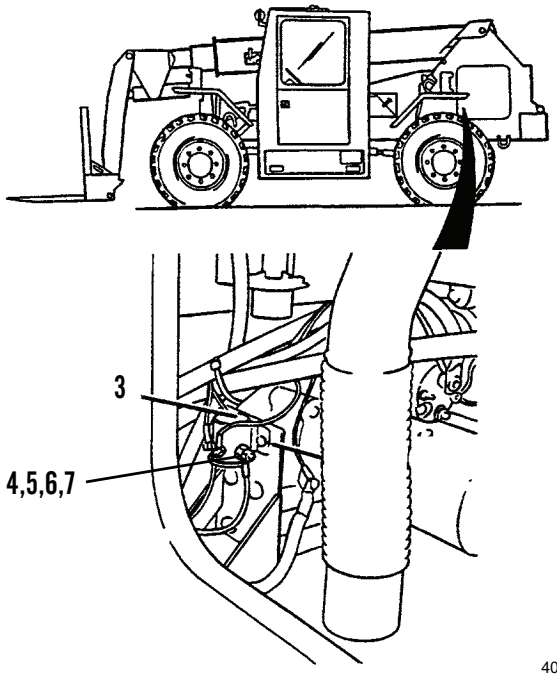


409-843

1. Attach lifting chains to engine lifting brackets (1 and 2).

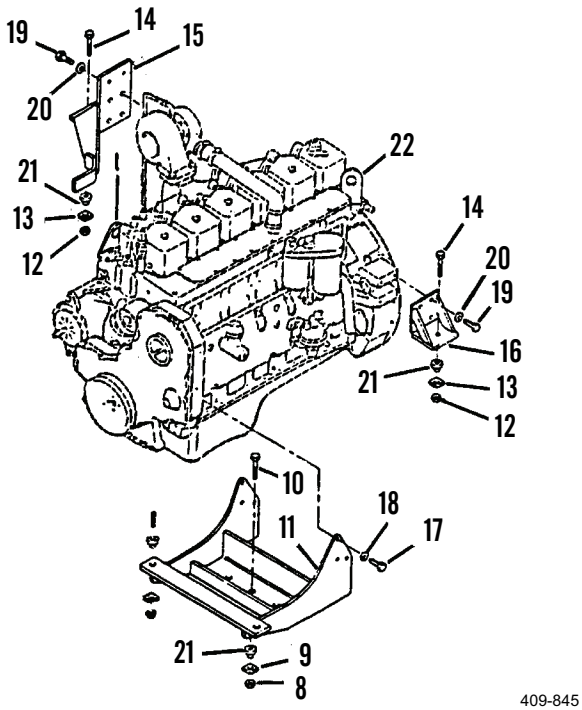
REMOVAL - CONTINUED

2. Attach lifting chains to lifting device and lift just enough to remove slack from lifting chains.
3. Tag and disconnect electrical leads from starter relay (3).
4. Remove two nuts (4), lockwashers (5), capscrews (6), washers (7) and starter relay (3). Discard lockwashers.



409-844

5. Remove nut (8), rebound washer (9) and capscrew (10) from rear engine mount (11). Discard rebound washer.
6. Remove nut (12), rebound washer (13) and capscrew (14) from front engine mounts (15 and 16). Discard rebound washer.
7. Remove three capscrews (17) and lockwashers (18) from each side of rear engine mount (11). Discard lockwashers.
8. Remove rear engine mount (11) from engine (22).
9. Remove four capscrews (19) and lockwashers (20) from left front engine mount (15) and right front engine mount (16). Discard lockwashers.
10. Remove engine mounts (15 and 16) from engine (22).
11. Remove and discard three rubber mounts (21) from vehicle frame.



409-845

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

1. Install three new rubber mounts (21) into vehicle frame.
2. Apply loctite to threads of capscrews (17 and 19).
3. Install right front engine mount (16), capscrews (19) and new lockwashers (20). Securely tighten capscrews.
4. Install left front engine mount (15), capscrews (19) and new lockwashers (20). Securely tighten capscrews.
5. Position rear engine mount (11) to engine. Install and securely tighten six capscrews (17) and new lockwashers (18). There are three capscrews (17) and new lockwashers (18) located on each side of the engine mount.
6. If engine was lifted for engine mounts removal, slowly lower engine onto rubber mounts (21) and align engine mounts (11, 15 and 16) to new rubber mounts (21).
7. Install two capscrews (14), new rebound washers (13) and nuts (12).
8. Install capscrew (10), new rebound washer (9) and nut (8).
9. Torque three nuts (8 and 12) to 307 lb-ft (416 Nm).
10. Remove lifting chains from engine.
11. Install starter relay onto left front engine mount (15) with two capscrews (6), washers (7), new lockwashers (5) and nuts (4). Connect relay ground lead under new lockwasher (5).
12. Correctly connect electrical leads to starter relay (3).
13. Connect transmission input shaft, if disconnected (WP 0119 00).
14. Install muffler (WP 0051 00).
15. Install radiator (WP 0053 00).
16. Install engine covers (WP 0147 00).
17. Install air cleaner (WP 0024 00).
18. Connect batteries (WP 0107 00).
19. Operate engine, check for loose mounts and excessive vibration (TM 10-3930-660-10).

END OF WORK PACKAGE

ENGINE LIFTING BRACKETS REPLACEMENT 0212 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Sealant, Loctite (Item 45, WP 0323 00)

References

WP 0316 00

WP 0317 00

Equipment Condition

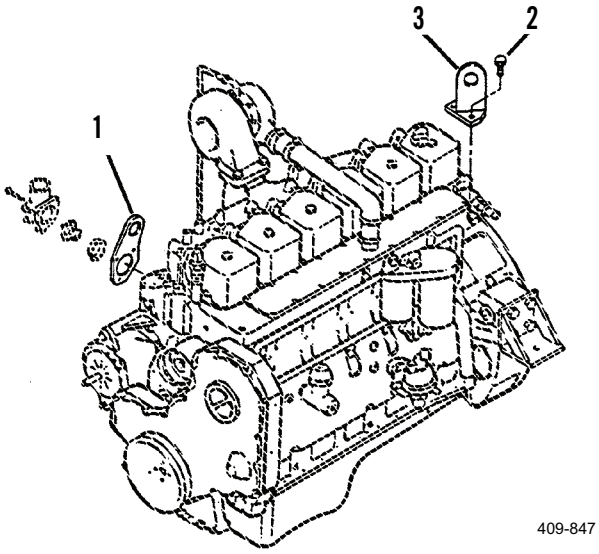
Thermostat removed (WP 0055 00)

REMOVAL

NOTE

"Front" and "rear" engine references used in this paragraph are relative to the front and rear of the vehicle, with engine mounted in the vehicle. The fan side of the engine is designated the rear of the engine, and the flywheel end of the engine is identified as the front of the engine.

1. With thermostat removed, remove engine rear lifting bracket (1).
2. Remove two capscrews (2) and front lifting bracket (3).



409-847

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

NOTE

Apply loctite to capscrews as installed.

1. Install front lifting bracket (3) and two capscrews (2). Torque capscrews (2) to 57 lb-ft (77 Nm).
2. Assemble engine rear lifting bracket (1) to engine, then install thermostat (WP 0055 00).

END OF WORK PACKAGE

CYLINDER HEAD REPLACEMENT 0213 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 200 lb capacity

Materials/Parts

Oil, lubricating (Item 30, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Gasket (7)

Lockwasher (2)

References

WP 0013 00

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Engine oil drained (WP 0012 00)

Air cleaner removed (WP 0024 00)

Engine covers removed (WP 0147 00)

Radiator removed (WP 0053 00)

Heater hoses disconnected from engine (WP 0170 00)

High pressure fuel lines removed (WP 0034 00 or WP 0035 00)

Fuel injector nozzles removed (WP 0223 00)

Fuel filter head removed (WP 0042 00 or WP 0043 00)

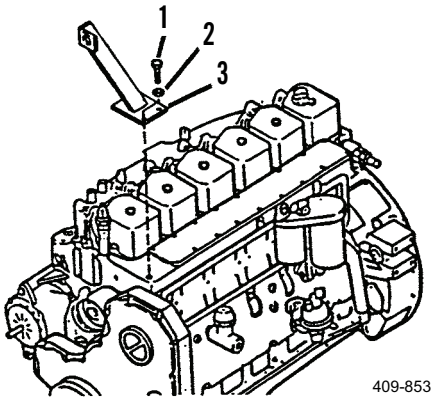
Exhaust manifold removed (WP 0018 00)

Rocker lever covers removed (WP 0014 00)

Rocker lever assembly removed (WP 0216 00)

REMOVAL

1. Remove three capscrews (1), lockwashers (2) and top radiator mount (3). Discard lockwashers.

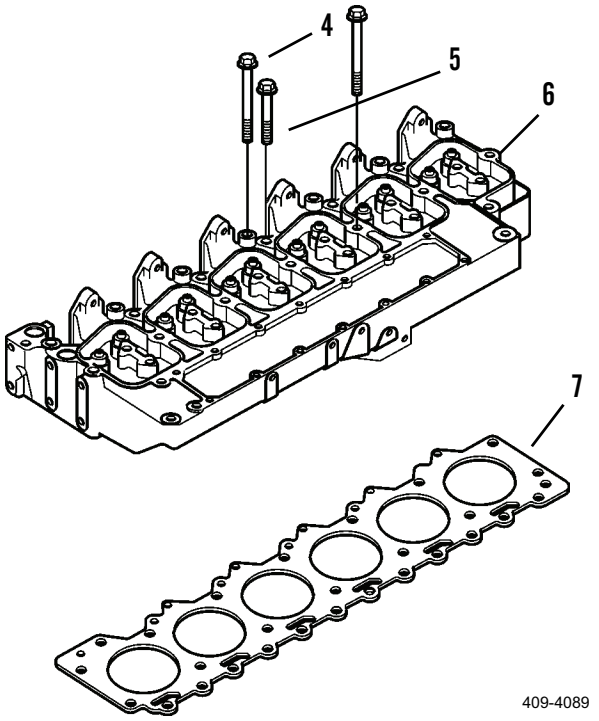


REMOVAL - CONTINUED

2. Remove 14 capscrews (4) and six capscrews (5) from cylinder head (6). Working from center to ends of cylinder head.
3. Attach lifting chains and hoist to engine lifting brackets. The cylinder head weighs approximately 114 lb (52 kg).

WARNING

Lifting equipment used for lifting machine must be in good condition and of suitable load capacity. Failure to follow this warning may cause injury or death, or damage to equipment.



CAUTION

Do not lower cylinder head onto a flat surface, this could damage the valves.

4. Slowly and carefully lift the cylinder head from the cylinder block and place it on a suitable stand or platform that will support the bottom perimeter of the cylinder head.
5. Remove and discard cylinder head gasket (7).

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

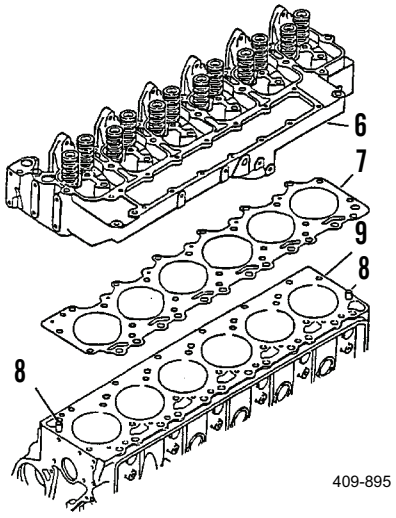
WARNING

Lifting equipment used for lifting machine must be in good condition and of suitable load capacity. Failure to follow this warning may cause injury or death, or damage to equipment.

CAUTION

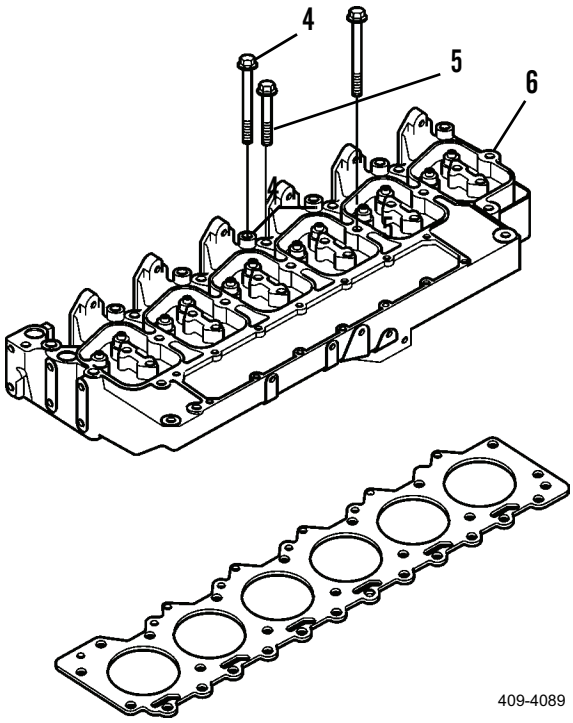
The bottom surface of the cylinder head and top of cylinder block must be clean of all residue and dry. Dirty surfaces could cause leaks or incorrect seat between the cylinder head and block.

1. Install new cylinder head gasket (7) over the cylinder block dowels (8). Be sure gasket is correctly aligned with holes in block.
2. Attach lifting chains and hoist to engine lifting brackets. The cylinder head weighs approximately 114 lb (52 kg).
3. Carefully place cylinder head (6) over the block dowels (8) and onto block (9).

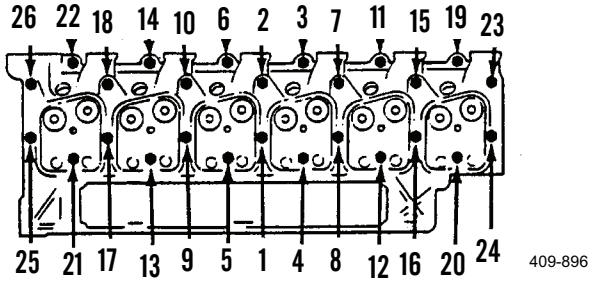


INSTALLATION - CONTINUED

4. Remove lifting chains and hoist.
5. Install rocker lever assembly (WP 0216 00). Do not tighten mounting capscrews at this time.
6. Apply clean lubricating oil under the heads and on the threads of the cylinder head mounting capscrews (4 and 5).
7. Install capscrews (4 and 5) finger tight.
8. Tighten cylinder head capscrews (4 and 5) and the rocker lever pedestal M12 capscrews in the sequence shown to the final torque value in three steps.

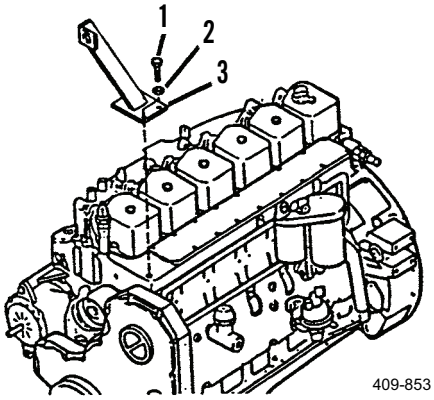


Step	Torque Value
1	29 lb-ft (39 Nm)
2	62 lb-ft (84 Nm)
3	92 lb-ft (125 Nm)



9. Tighten rocker lever pedestal M8 capscrews to 18 lb-ft (24 Nm).

INSTALLATION - CONTINUED



10. Adjust valves (WP 0013 00).
11. Install rocker lever covers (WP 0014 00).
12. Apply loctite to threads of capscrews (1). Install top radiator mount (3), and three new lockwashers (2) and capscrews (1).
13. Connect heater hoses to engine (WP 0170 00).
14. Install fuel filter head (WP 0042 00 or WP 0043 00).
15. Install exhaust manifold (WP 0018 00).
16. Install fuel injector nozzles (WP 0223 00).
17. Install high pressure, supply and drain fuel lines (WP 0034 00 or WP 0035 00).
18. Install air cleaner (WP 0024 00).
19. Install radiator (WP 0053 00).
20. Install engine covers (WP 0147 00).
21. Fill engine oil (WP 0012 00).
22. Operating engine, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FLYWHEEL MAINTENANCE 0214 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Tool, barring (Item 34, WP 0324 00)

Capscrews, two

Lifting device, 200 lb capacity

Materials/Parts

Sealant, Loctite (Item 43, WP 0323 00)

Capscrew (1, 5 and 9)

Lockwasher (2 and 6)

Washer (10)

Personnel Required

Two

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

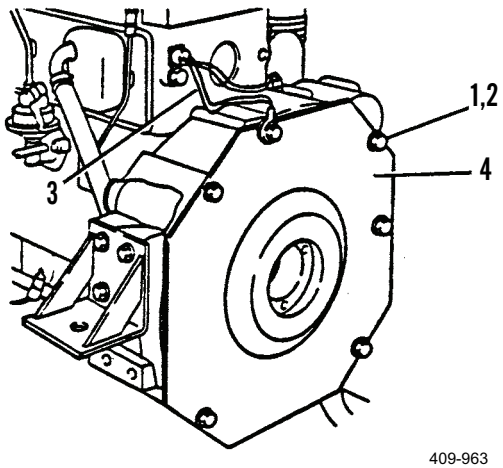
Equipment Condition

Engine removed (WP 0209 00 or WP 0210 00)

Starting motor removed (WP 0064 00)

REMOVAL

1. Remove six capscrews (1) and lockwashers (2), ground wire (3) and flywheel housing cover (4). Discard lockwashers.



409-963

REMOVAL - CONTINUED

WARNING

Use 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 by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

Do not use timing pin to lock the engine. Using timing pin as a locking device while loosening flywheel mounting hardware could damage the pin.

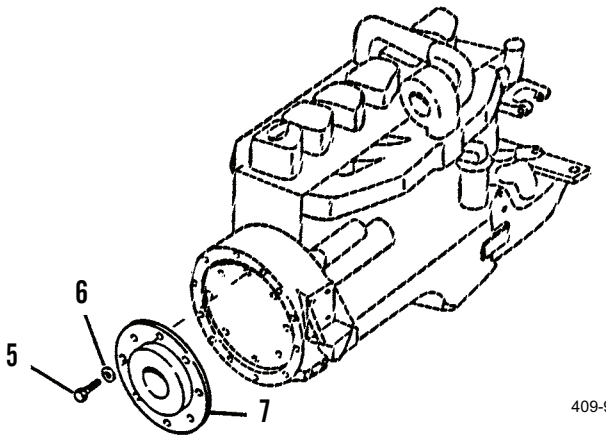
NOTE

The flywheel weighs more than 50 lb (23 kg).

2. Remove eight capscrews (5), lockwashers (6) and 10 in. coupling (7). Discard lockwashers.

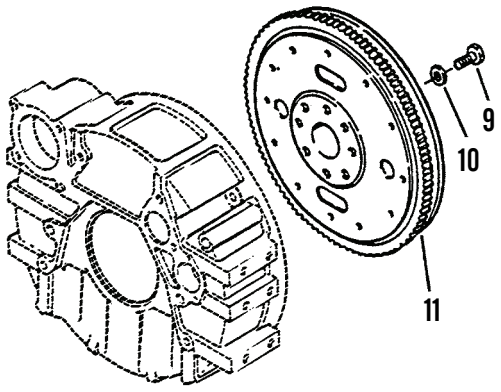
NOTE

If necessary, install two capscrews in tapped holes of coupling to push coupling from flywheel.



409-964

3. At front of engine, install two long capscrews in vibration damper. Use a bar between the long capscrews to hold vibration damper (and flywheel) from turning.
4. Attach lifting device and hoist to the flywheel.
5. Firmly hold barring tool to keep flywheel from turning. Loosen eight capscrews (9).
6. Remove barring tool. Remove eight capscrews (9), washers (10), and flywheel (11). Discard capscrews and washers.



409-965

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

WARNING

Use 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 by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

Do not use the timing pin to lock the engine. Use a barring tool to hold the engine crankshaft during flywheel installation. Using the timing pin as a locking device while tightening the flywheel mounting hardware could damage the pin.

NOTE

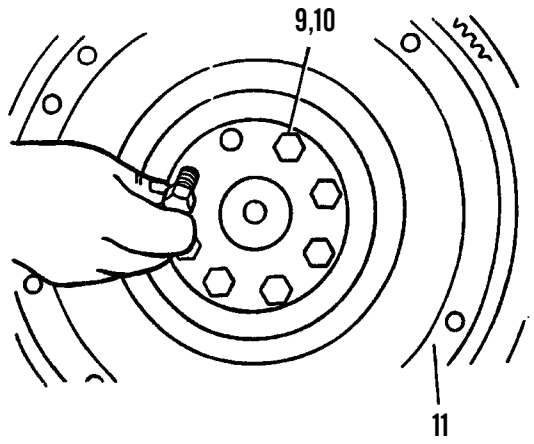
The flywheel weighs more than 50 lb (23 kg).

1. Attach lifting device and hoist to the flywheel.

CAUTION

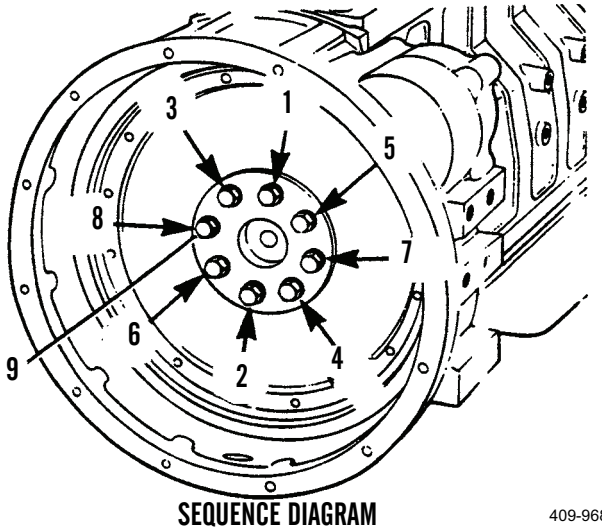
Install new capscrews each time flywheel is removed to help prevent possible engine failure.

2. Lift flywheel (11) against end of crankshaft and install eight new capscrews (9) and new washers (10). Remove hoist and lifting device.



409-967

3. Install barring tool between long capscrews in vibration damper.
4. Firmly hold barring tool to keep flywheel from turning, and torque new capscrews (9), in the sequence shown, to 101 lb-ft (137 Nm) torque.
5. Remove barring tool and two long capscrews.

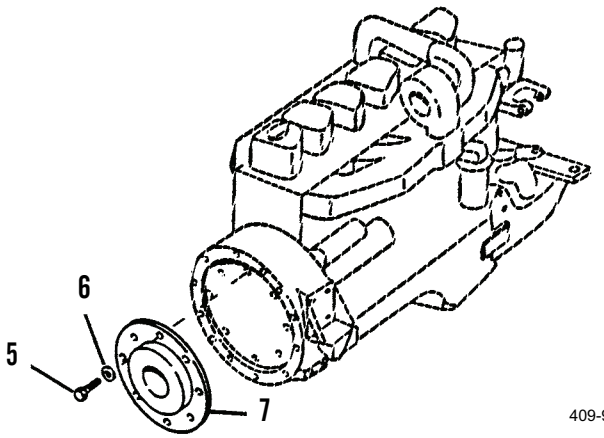


SEQUENCE DIAGRAM

409-968

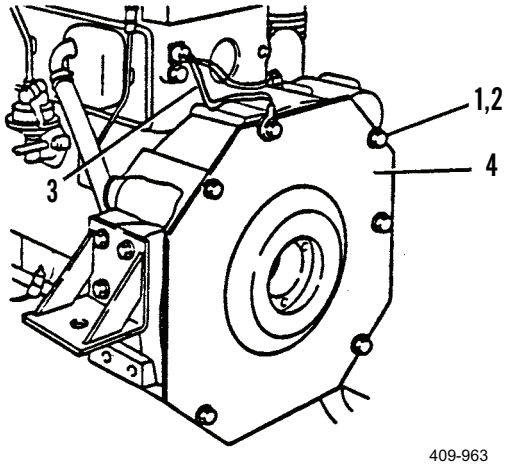
INSTALLATION - CONTINUED

6. Apply loctite to threads of capscrews (5).
7. Install 10 in. coupling (7), new lockwashers (6) and capscrews (5). Torque to 25 lb-ft (34 Nm) and let set for 24 hours before operating engine.



409-964

8. Install flywheel housing cover (4), ether start thermostat ground wire (3), and six new lockwashers (2) and capscrews (1).



409-963

9. Install starting motor (WP 0064 00).
10. Install engine (WP 0209 00 or WP 0210 00).
11. Operate engine, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FLYWHEEL HOUSING AND COVER MAINTENANCE 0215 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Alignment tool (Item 2, WP 0324 00)

Driver group (Item 9, WP 0324 00)

Lifting device, 300 lb capacity

Materials/Parts

Rag, wiping (Item 40, WP 0323 00)

Gasket (6)

O-ring (3 and 12)

Oil seal (8)

Personnel Required

Two

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Flywheel removed (WP 0214 00)

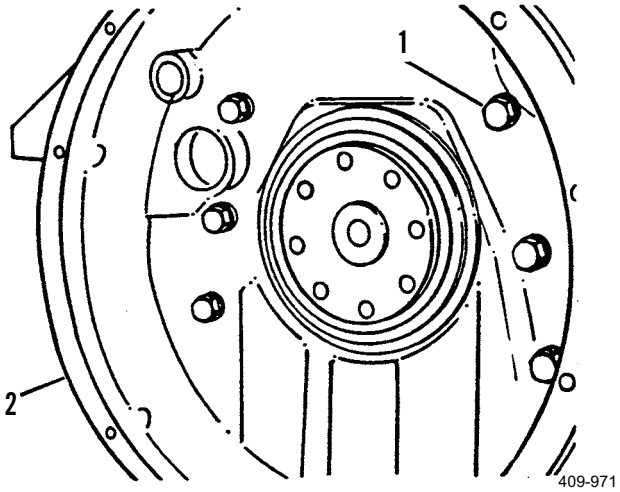
Oil pan removed (WP 0219 00)

WARNING

Use 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

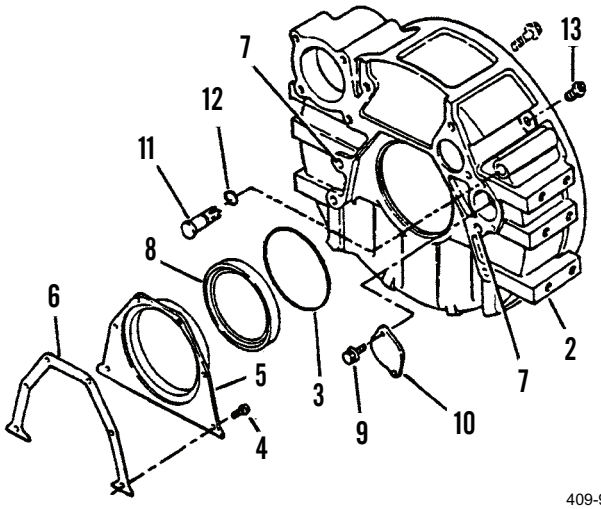
1. With assistance, attach lifting device and hoist to the flywheel housing.
2. Remove eight capscrews (1) and lift flywheel housing (2) from engine.
3. Remove and discard O-ring (3).
4. Remove six capscrews (4) and rear cover (5).
5. Remove and discard gasket (6).
6. Remove two ring dowels (7) only if damaged.



409-971

DISASSEMBLY

1. Use driver tool and press rear oil seal (8) from rear cover (5). Discard seal.
2. Remove two capscrews (9) and cover plate (10) from flywheel housing (2).
3. Remove O-ring plug (11) and O-ring (12). Discard O-ring.
4. Remove threaded plug (13).



409-972

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

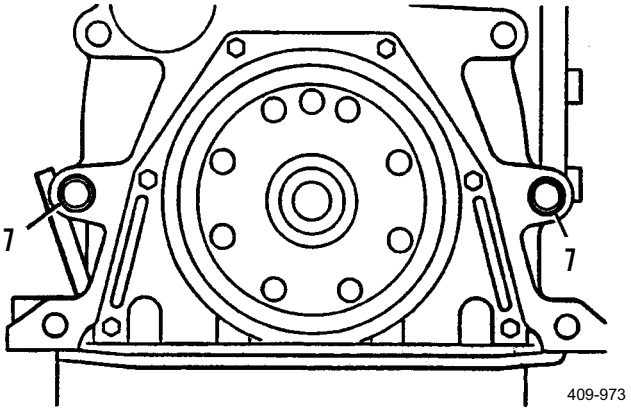
See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. Install threaded plug (13).
2. Install O-ring plug (11) and new O-ring (12).
3. Install cover plate (10) and two capscrews (9).

INSTALLATION

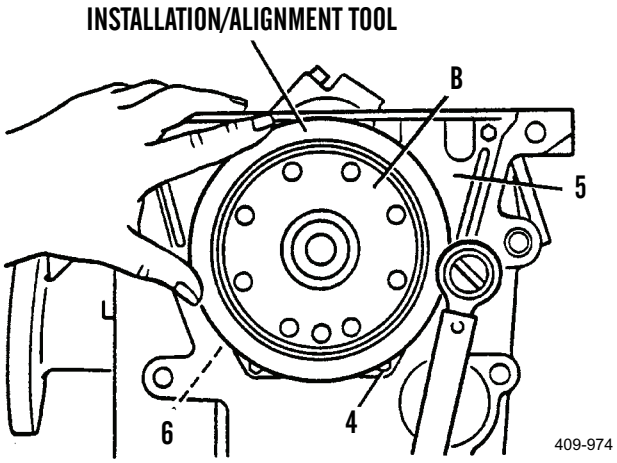
1. Drive two ring dowels (7) into cylinder block until they are against bottom of bore.
2. Clean and dry rear crankshaft sealing surface.



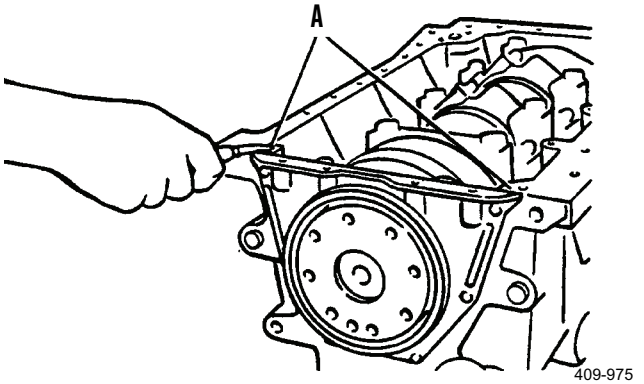
NOTE

Ensure oil seal sealing surface on the crankshaft is clean to help prevent seal leaks.

3. Install new gasket (6) and rear cover (5) onto cylinder block.
4. Loosely install six capscrews (4).
5. Place installation and alignment tool supplied with oil seal kit over the crankshaft (B) and into the rear cover (5). This aligns the cover to the crankshaft.
6. Align rear cover (5) with both sides of the cylinder block oil pan rail until surfaces are flush. Torque six capscrews (4) to 7 lb-ft (10 Nm).



7. Remove installation and alignment tool and trim gasket evenly with oil pan mounting surface at points “A”.



INSTALLATION - CONTINUED

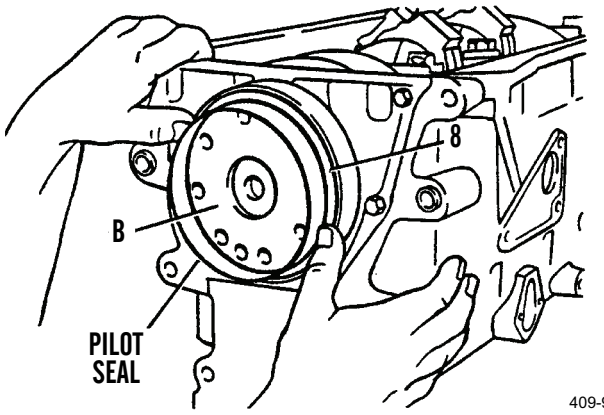
CAUTION

Always use the seal pilot to install rear seal. Failure to do so could result in damaged seal.

NOTE

Ensure rear oil seal lip is clean to help prevent seal leaks.

8. Install new oil seal (8) with seal pilot onto crankshaft (B).
9. Push new oil seal onto crank (B) and remove seal pilot.

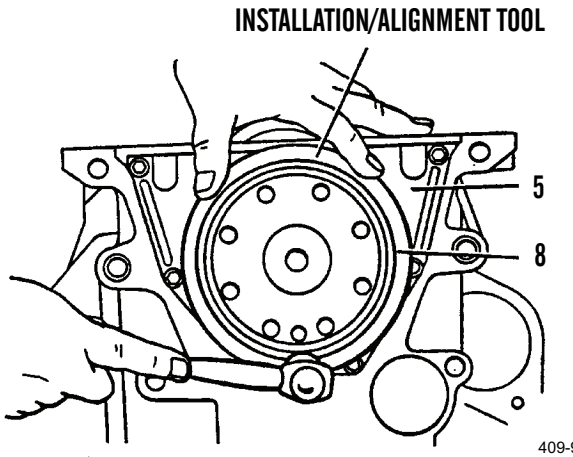


409-976

CAUTION

Tap alignment and installation tool at the 12, 3, 6 and 9 o'clock positions only. Striking the tool at other locations could damage the seal carrier.

10. Place installation and alignment tool onto crankshaft and against new oil seal (8) carrier.
11. Tap tool with a plastic hammer at the 12, 3, 6 and 9 o'clock positions to drive new oil seal (8) evenly into position and to prevent damaging the seal carrier.
12. Drive new oil seal (8) into rear cover (5) until installation and alignment tool stops against the cover.
13. Remove installation and alignment tool from crankshaft.



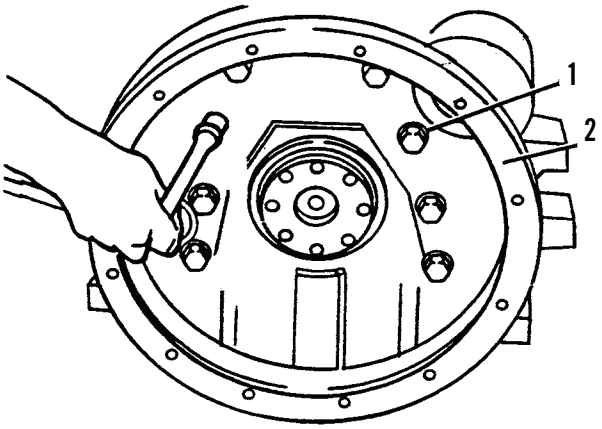
409-977

INSTALLATION - CONTINUED

WARNING

Use 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.

14. With assistance, attach lifting device and hoist to flywheel housing (2) and lift housing into position on engine.
15. Install eight capscrews (1). Torque capscrews to 57 lb-ft (77 Nm) in the sequence shown.



409-979

16. Install oil pan (WP 0219 00).
17. Install flywheel (WP 0214 00).
18. Operate engine, check for leakage, excessive vibration and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

ROCKER LEVER ASSEMBLY MAINTENANCE 0216 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 30, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Expansion plug (7)

References

WP 0013 00

WP 0316 00

WP 0317 00

Equipment Condition

Engine off and cool (TM 10-3930-660-10)

Battery cables disconnected (WP 0107 00)

Rocker lever covers removed (WP 0014 00)

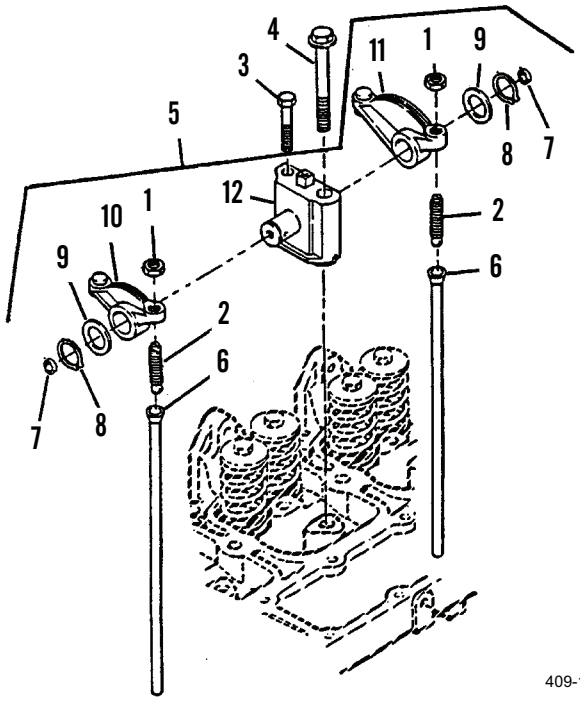
REMOVAL

NOTE

Tag or mark rocker arm assemblies to include push rods so assemblies can be installed into the same position from which they were removed.

REMOVAL - CONTINUED

1. Loosen two adjusting screw nuts (1).
2. Loosen two adjusting screws (2).
3. Remove capscrew (3), capscrew (4), and remove rocker arm assembly (5).
4. Remove push rods (6).



409-1007

DISASSEMBLY

NOTE

- Keep each rocker arm assembly together as a set.
- Remove expansion plug only if necessary.

1. Remove two expansion plugs (7), retaining rings (8) and washers (9).

NOTE

Do not remove shaft from support. The support and shaft must be replaced as an assembly.

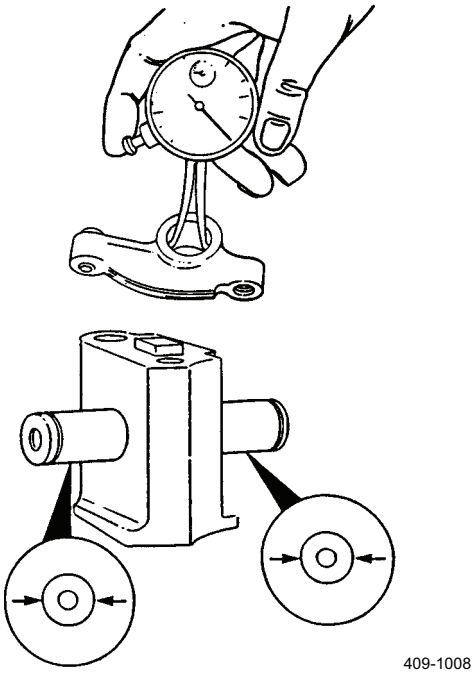
2. Remove intake rocker arm (10) and exhaust rocker arm (11) from support (12).
3. Remove nuts (1) and adjusting screws (2) from rocker levers (10 and 11).
4. Repeat steps 1 thru 7 for other five rocker arm assemblies (5).

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. See *Inspection* instructions (WP 0317 00).
2. Measure rocker arm bore. Maximum allowable diameter is 0.750 in. (19.05 mm).
3. Measure rocker arm support shaft diameter. Minimum allowable diameter is 0.746 in. (18.948 mm).


409-1008

ASSEMBLY

NOTE

Ensure to assemble intake rocker arm and exhaust rocker arm in the correct location.

1. Assemble adjusting screws (2) and nuts (1) to rocker levers (10 and 11).
2. Lubricate both ends of support shaft with clean lubricating oil.
3. Check to make sure adjusting screws (2) are completely backed out.
4. Assemble intake rocker arm (10) and exhaust rocker arm (11) onto support (12) shaft.
5. Install two washers (9), retaining rings (8) and new expansion plugs (7) if removed.
6. Repeat steps 1 thru 6 for other five rocker arm assemblies (5).

INSTALLATION

1. Install 12 push rods (6) into same position in engine as originally placed. Lubricate push rod sockets with clean lubricating oil.
2. Position rocker arm assembly (5) onto cylinder head in original position.
3. Apply clean lubricating oil to threads and under the heads of capscrews (3 and 4).
4. Install six M8 capscrews (3) and six M12 capscrews (4). Tighten M12 capscrews (4) to final torque value in three steps:
   a. Step 1: 29 lb-ft (39 Nm).
   b. Step 2: 62 lb-ft (84 Nm).
   c. Step 3: 92 lb-ft (125 Nm).
5. Tighten M8 capscrews (3) to 18 lb-ft (24 Nm).
6. Repeat steps 2 thru 5 for other five rocker arm assemblies (5).
7. Adjust valves (WP 0013 00).
8. Install rocker lever covers (WP 0014 00).
9. Connect battery cables (WP 0107 00).
10. Start engine, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

VALVE TAPPETS REPLACEMENT 0217 00

THIS WORK PACKAGE COVERS

Removal, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 38, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Lubriplate (Item 25, WP 0323 00)

References

TM 10-3930-660-10

Equipment Condition

Camshaft removed (WP 0278 00)

Oil pan removed (WP 0219 00)

REMOVAL

NOTE

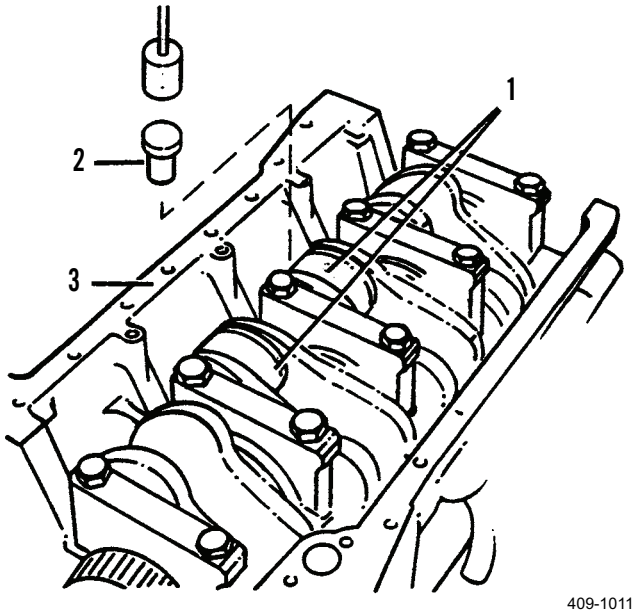
If new camshaft is being installed, all tappets must be replaced.

1. Turn engine stand so crankshaft (1) is facing up.

CAUTION

Be careful not to drop tappets into bottom of pistons during tappet removal as this could damage pistons.

2. Use a magnet to remove tappets (2) from cylinder block (3).



409-1011

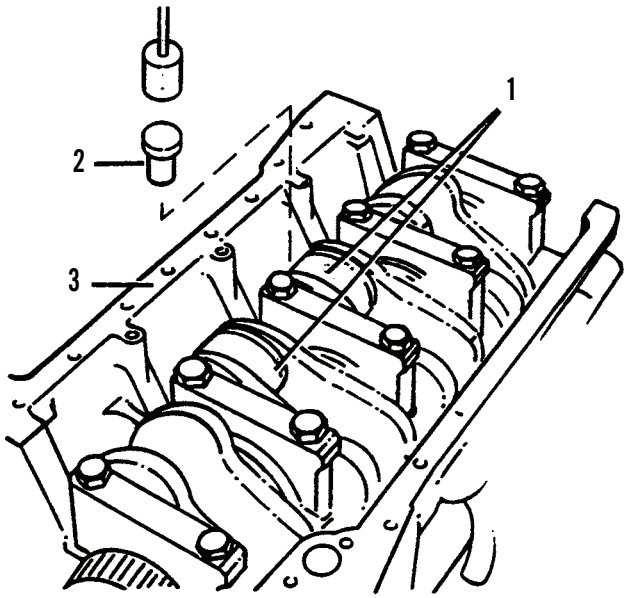
INSTALLATION

1. Turn engine stand so crankshaft (1) is facing up.

CAUTION

Be careful not to drop tappets into bottom of pistons during tappet installation as this could damage pistons.

2. Apply lubriplate to outside diameter of tappet (2).
3. Use a magnet to install tappets (2) into cylinder block (3).



409-1011

NOTE

If new tappets were installed, a new camshaft must also be installed.

4. Install camshaft (WP 0278 00).
5. Install oil pan (WP 0219 00).
6. Operate engine and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

PUSH ROD COVER REPLACEMENT 0218 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

K&W copper coat 1504 (Item 23, WP 0323 00)

Gasket (7)

Grommet seal (5)

References

TM 10-3930-660-10

Equipment Condition

Fuel filter head removed (WP 0042 00)

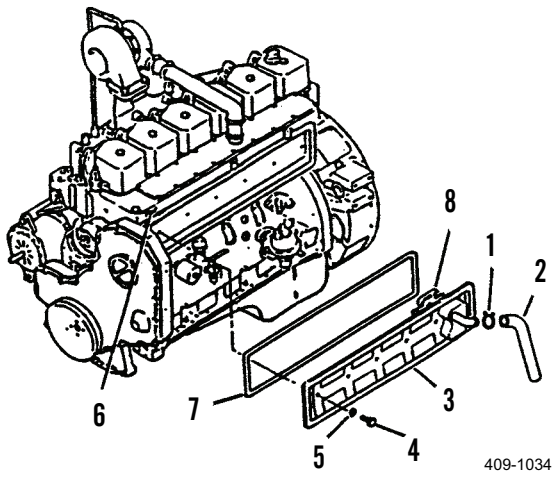
Fuel injection pump removed (WP 0224 00 or WP 0225 00)

NOTE

The push rod cover is accessed through the right-hand engine access door.

REMOVAL

1. Remove spring clamp (1) from hose (2) and remove hose from push rod cover (3).
2. Remove six capscrews (4) with six grommet seals (5) which secure push rod cover (3) to engine block (6). Discard grommet seals.
3. Remove rod cover (3) and push rod cover gasket (7) from engine block (6). Discard gasket.
4. If necessary, remove baffle (8) from push rod cover (3).



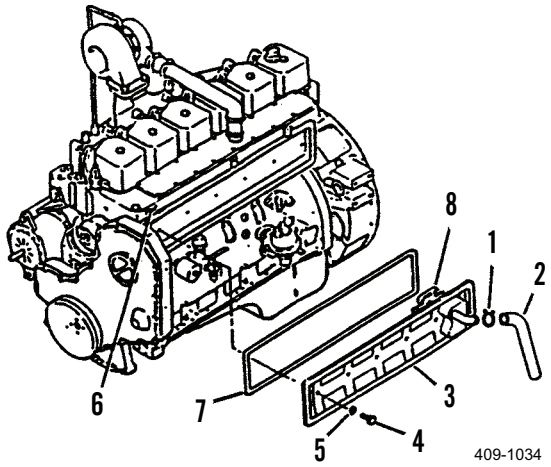
INSTALLATION

1. If removed, align baffle (8) on push rod cover (3).

NOTE

Position adhesive side of gasket towards cover. Apply copper coat to engine block side of gasket.

2. Position push rod cover with new gasket (7) in place on engine block (6).
3. Secure push rod cover (3) to block (6) using six capscrews (4) with six new grommet seals (5). Torque capscrews to 6 lb-ft (8 Nm).
4. Position hose (2) on fitting at push rod cover (3). Secure hose with spring clamp (1).
5. Install fuel injection pump (WP 0224 00 or WP 0225 00).
6. Install fuel filter assembly (WP 0042 00).
7. Operate engine, check for proper operation and leaks (TM 10-3930-660-10).



END OF WORK PACKAGE

OIL PAN MAINTENANCE 0219 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

K&W copper coat 1504 (Item 23, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Gasket (3)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

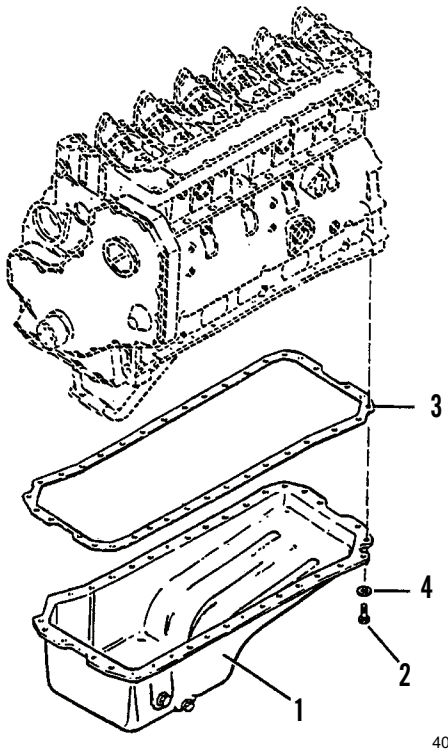
Equipment Condition

Battery cables disconnected (WP 0107 00)

Engine oil drained (WP 0012 00)

REMOVAL

1. Place container under oil pan (1).
2. Remove thirty-six capscrews (2) and special washers (4).
3. Remove oil pan (1) and gasket (3). Discard gasket.



409-1035

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

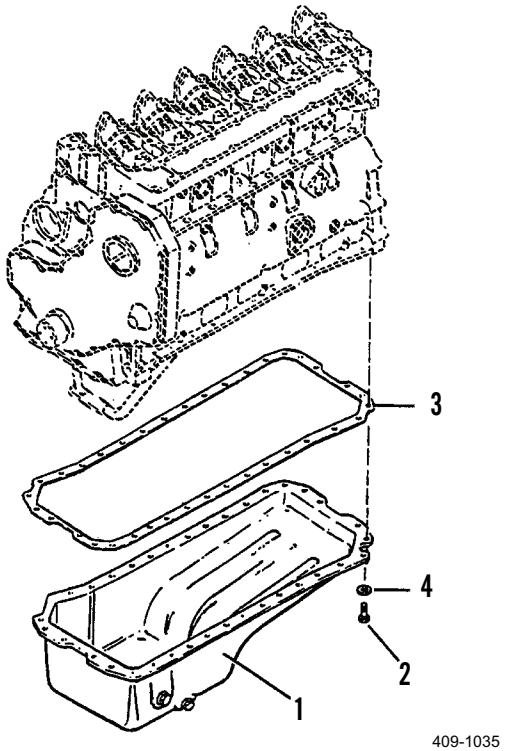
INSTALLATION

1. Coat both sides of new gasket (3) with sealant.

NOTE

Install special washers with concave side towards oil pan.

2. Install new gasket (3) and oil pan (1) and secure with thirty-six special washers (4) and capscrews (2).
3. Torque capscrews (2) to 6 lb-ft (8 Nm).



409-1035

4. Fill engine with oil (WP 0012 00).
5. Connect battery cables (WP 0107 00).
6. Run engine and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

ENGINE OIL PUMP INLET TUBE MAINTENANCE 0220 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

K&W copper coat 1504 (Item 23, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Gasket (2 and 8)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

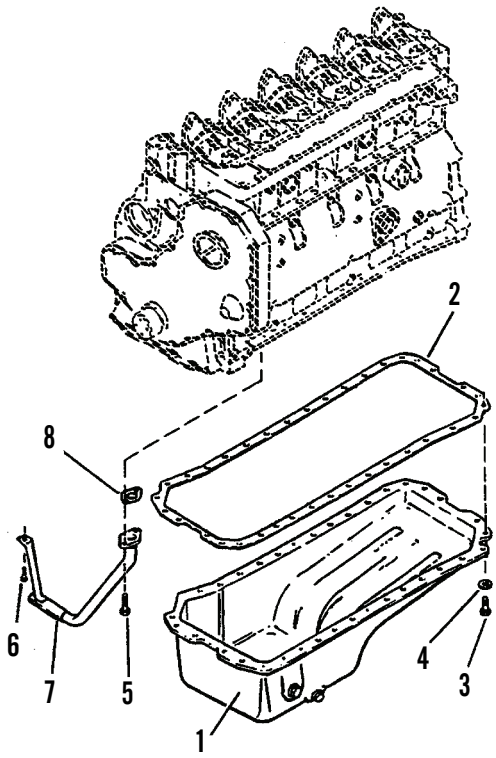
Equipment Condition

Engine oil drained (WP 0012 00)

Battery cables disconnected (WP 0107 00)

REMOVAL

1. Place container under oil pan (1).
2. Remove oil pan (1) and oil pan gasket (2) by removing thirty-six capscrews (3) and special washers (4). Discard gasket.
3. Remove two capscrews (5) and one capscrew (6) which retain oil pump inlet tube (7).
4. Remove oil pump inlet tube (7) and gasket (8). Discard gasket.



409-1036

CLEANING

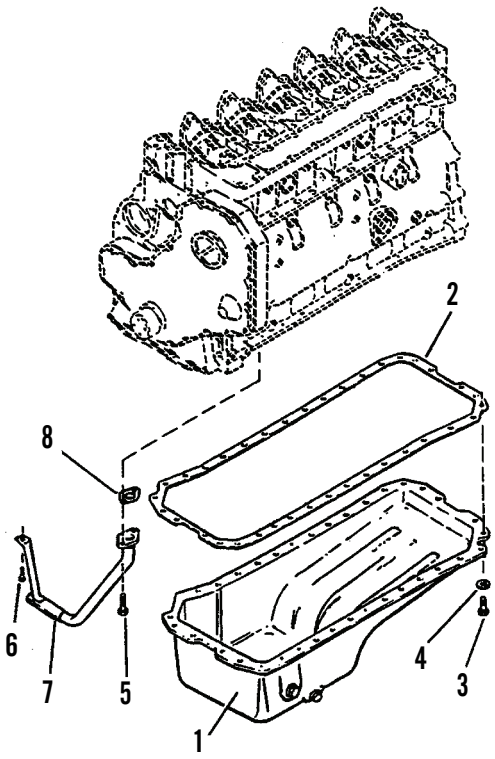
See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

1. Position new gasket (8) on oil pump inlet tube (7).
2. Install oil pump inlet tube (7) and secure with two capscrews (5) and one capscrew (6). Tighten capscrews to 6 lb-ft (8 Nm).
3. Coat both sides of new oil pan gasket (2) with copper coat.
4. Install new oil pan gasket (2) and oil pan (1). Install thirty-six capscrews (3) and special washers (4). Torque capscrews to 6 lb-ft (8 Nm).



409-1036

5. Fill engine with oil (WP 0012 00).
6. Connect battery cables (WP 0107 00).
7. Run engine and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

ENGINE OIL PUMP MAINTENANCE 0221 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 30, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Gasket (14)

Seal, kit

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

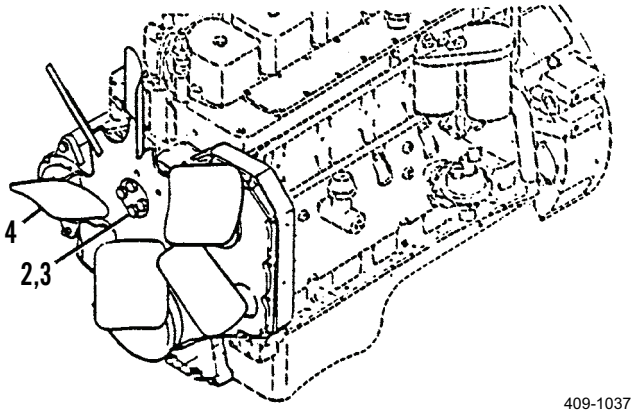
Equipment Condition

Engine oil drained (WP 0012 00)

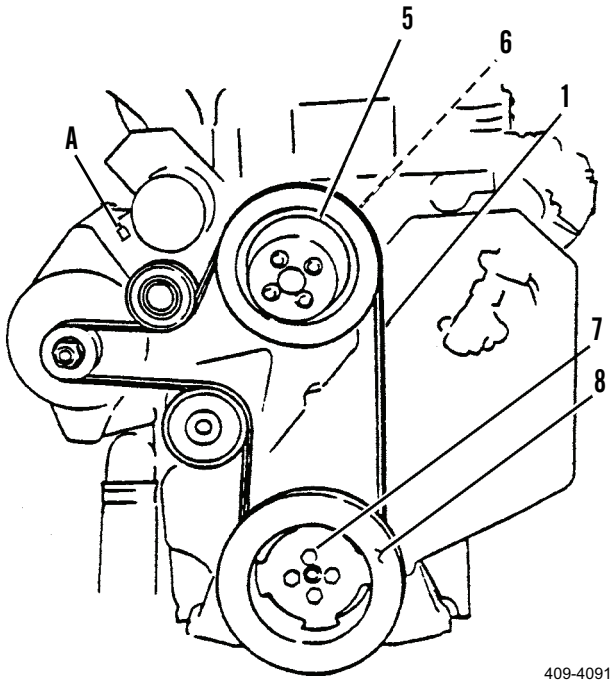
Radiator removed (WP 0053 00)

REMOVAL

1. Place a 1/2 in. socket driver in hole (A) and pull up to release tension on drive belt (1).
2. Remove drive belt (1).
3. Remove four capscrews (2), four flatwashers (3), cooling fan (4), fan pulley (5) and spacer (6).
4. Remove four capscrews (7) and vibration damper (8).
5. Remove tachometer drive (WP 0053 00).



409-1037



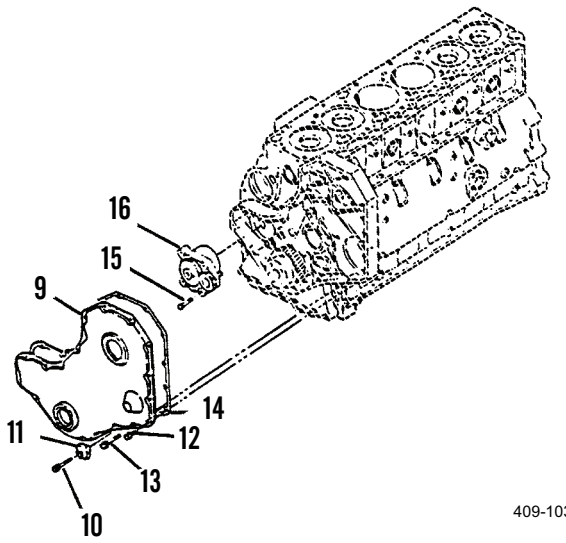
409-4091

REMOVAL - CONTINUED

NOTE

Capscrews which retain timing gear cover are of three sizes. Note size and location of capscrews before removal to allow correct location at assembly.

6. Remove capscrew (10) and belt guide (11).
7. Remove eleven capscrews (12) and eight capscrews (13).
8. Remove timing gear cover (9) and gasket (14). Discard gasket.
9. Remove four capscrews (15).
10. Remove oil pump (16).



409-1039

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

CAUTION

When installing oil pump, be sure idler gear pin is installed in the locating bore in the cylinder block. Failure to properly locate oil pump can result in damage to pump and to cylinder block bore.

NOTE

- Filling oil pump with oil prior to installation will help to prime pump at engine start-up.
- Back plate on pump seats against bottom of cylinder block bore. When pump is correctly installed, flange on pump will not touch cylinder block.

1. Install oil pump (16) into cylinder block bore and secure with four capscrews (15).
2. Torque capscrews (15) in opposite pairs to 6 lb-ft (8 Nm).

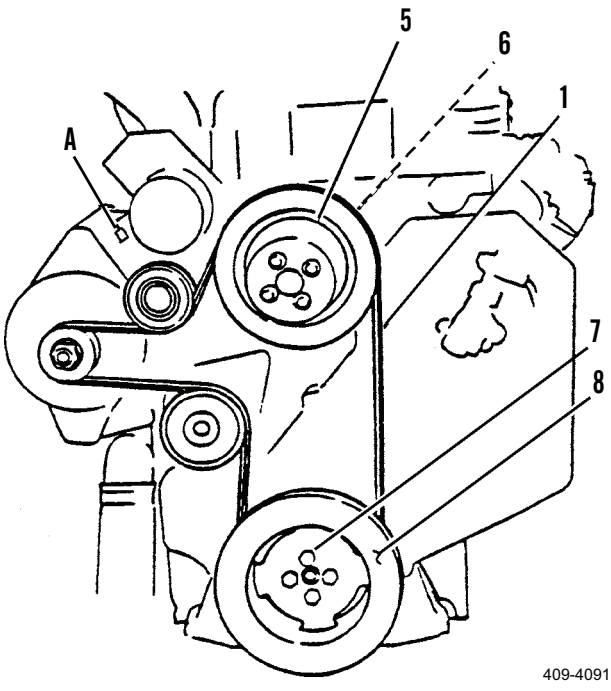
CAUTION

- Lips of seal in cover and seal surface on crankshaft end must be clean and free of oil. Failure to properly clean sealing surfaces may cause oil to leak at seal.
- When installing timing gear cover, be careful not to damage lips of seal. Failure to protect seal lips during installation of seal over crankshaft end may damage oil seal lips and cause oil leakage.

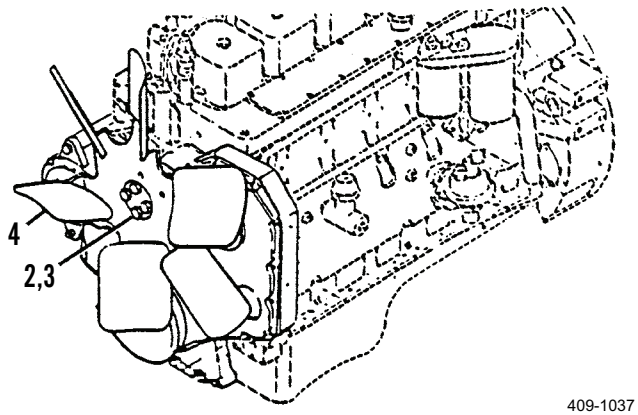
3. Install pilot tool from seal kit inside diameter of seal to protect seal lips during gear cover (9) installation.
4. Install new gasket (14) and timing gear cover (9) onto engine block.
5. Remove pilot tool from seal bore.

INSTALLATION - CONTINUED

6. Install eleven capscrews (12) and eight capscrews (13) as noted at disassembly.
7. Install belt guide (11) and secure with capscrew (10). Torque capscrews (10, 12 and 13) to 6 lb-ft (8 Nm).
8. Install tachometer drive (WP 0053 00).
9. Install vibration damper (8) and secure with four capscrews (7). Torque capscrews to 101 lb-ft (137 Nm).
10. Install fan pulley (5), spacer (6), cooling fan (4), four flatwashers (3) and four capscrews (2).
11. Place a 1/2 in. socket driver in hole (A) and pull up to allow installation of drive belt (1).
12. Install drive belt (1).



409-4091



409-1037

13. Install radiator (WP 0053 00).
14. Fill engine with oil (WP 0012 00).
15. Operate engine and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

ENGINE OIL FILTER HEAD MAINTENANCE 0222 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 48, WP 0323 00)

Gasket (9 and 11)

Seal, kit

Materials/Parts - Continued

O-ring (2)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Engine oil filter removed (WP 0012 00)

Cooling system drained (WP 0053 00)

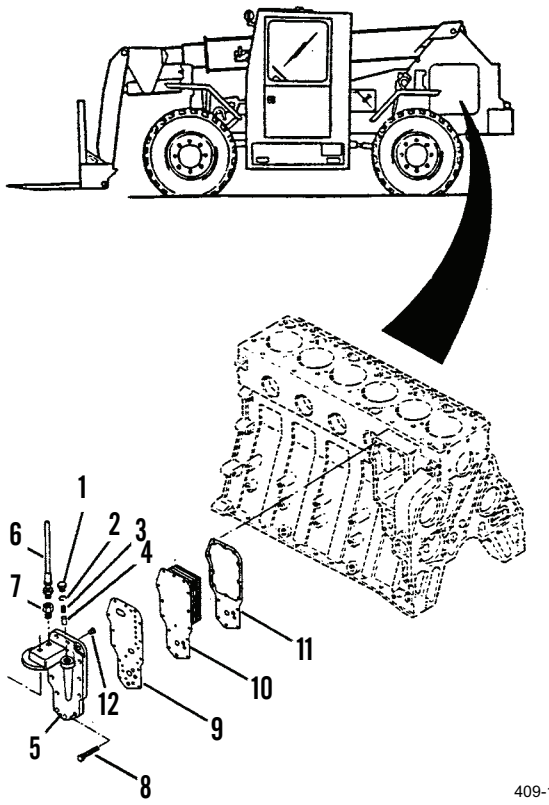
REMOVAL

1. If necessary, remove threaded plug (1), O-ring (2), compression spring (3) and plunger (4) from oil filter head (5). Discard O-ring.

CAUTION

Area around turbocharger supply line should be cleaned thoroughly before removal of line. Failure to do so could result in contamination of turbocharger lubricant and premature turbocharger failure.

2. Disconnect turbocharger supply line (6) from top of oil filter head (5). If necessary, remove adapter (7).
3. Remove fourteen capscrews (8) which retain the oil filter head (5).
4. Remove oil filter head (5), filter head gasket (9), oil cooler core (10) and oil cooler gasket (11). Discard filter head gasket and oil cooler gasket.
5. If necessary, use a screwdriver to remove bypass valve (12) from back of filter head (5).



409-1042

CLEANING

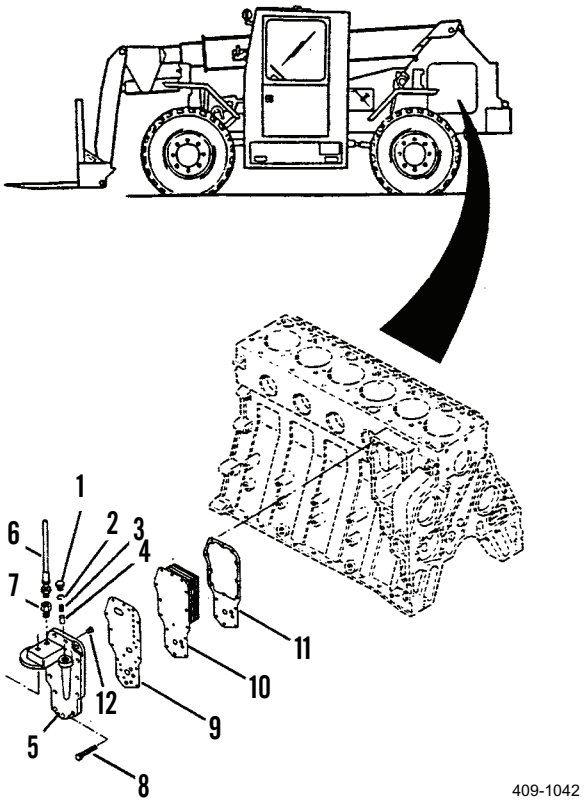
See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

1. If removed, install bypass valve (12) into back of filter head (5) with a mallet and driver.
2. Install new oil cooler gasket (11), oil cooler core (10), new filter head gasket (9) and filter head (5).
3. Install fourteen capscrews (8) and torque to 6 lb-ft (8 Nm).
4. Connect turbocharger supply line (6) to top of filter head (5).
5. If removed, apply loctite to threads of adapter (7). Install adapter (7).
6. Connect turbocharger supply line (6) to adapter (7).
7. If removed, install plunger (4), compression spring (3), new O-ring (2), and plug (1). Torque plug to 60 lb-ft (81 Nm).



409-1042

8. Install oil filter and fill engine oil to proper level (WP 0012 00).
9. Fill cooling system (WP 0053 00).
10. Operate engine and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FUEL INJECTOR MAINTENANCE 0223 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Testing, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance, (Item 21, WP 0324 00)

Shop equipment, fuel and electric (Item 22, WP 0324 00)

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Compound, anti-seize (Item 11, WP 0323 00)

Oil, fuel, diesel, DF1 (Item 27, WP 0323 00)

Solvent, rust penetrating (Item 54, WP 0323 00)

Materials/Parts - Continued

Banjo connector seal (10)

Copper injector seal (13)

Grommet seal (11)

References

WP 0034 00

WP 0316 00

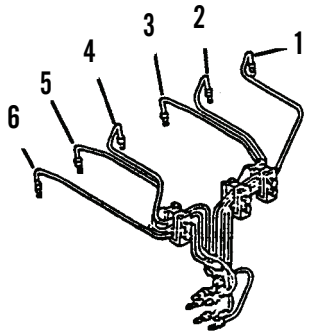
Equipment Condition

Engine off and cool (TM 10-3930-660-10)

Battery cables disconnected (WP 0107 00)

REMOVAL

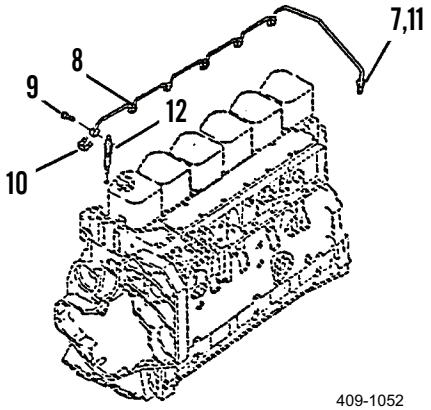
1. Disconnect fuel supply tubes (1 thru 6) from injectors. Position lines clear of injectors without putting kinks in lines.



409-1051

REMOVAL - CONTINUED

2. Loosen nut (7) to remove fuel manifold (8) from tee fitting.
3. Remove six banjo connector screws (9) and fuel manifold (8).
4. Remove and discard six banjo connector seals (10) and grommet seal (11).



409-1052

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.

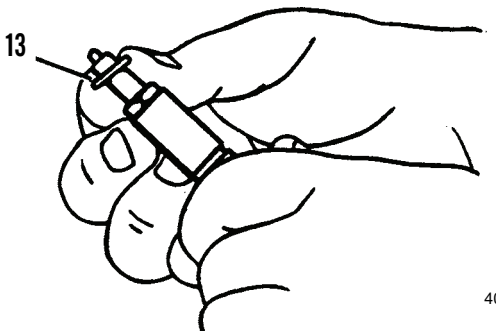
5. Clean area of cylinder head around injectors (12) with a soft brush and low pressure compressed air.

CAUTION

If rust has formed on injector hold-down nut, injector can turn in its bore as hold-down nut is loosened. Dissolve and loosen rust as instructed. Failure to follow instructions can result in severe damage to cylinder head.

NOTE

If necessary, apply rust penetrating solvent to injector hold-down nut and allow solvent to remain for a minimum of three minutes. Then tap against injector body with hammer and drift pin to loosen rust.



409-1053

6. Hold injector body with a wrench while turning hold-down nut out of injector bore with a box end wrench.
7. Remove injector (12) and remove and discard copper injector seal (13).

CLEANING

WARNING

Cleaning compound, solvent 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.

Rinse nozzle with solvent (WP 0316 00).

INSPECTION

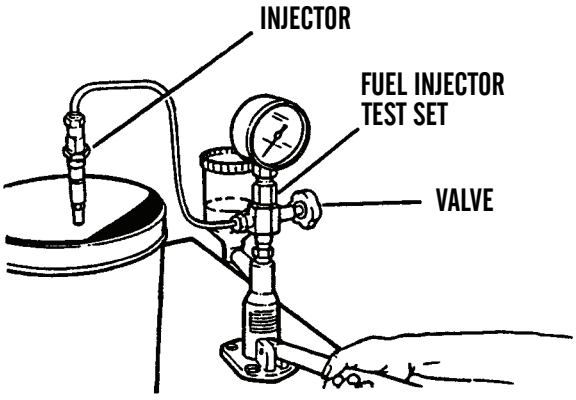
Inspect needle tip for roughness or erosion. Note that rough machined appearance is normal for pressure shoulder.

TESTING

WARNING

- Keep clear of test spray from nozzle. Fluid at test pressures can penetrate skin, causing infection and possible death.
- 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 caution when disassembling them, to avoid injury.

1. Connect injector to fuel injector test set.
2. Open valve and operate pump lever at a rate of one stroke per second while observing test pressure gauge
3. Spray must begin at a pressure of 3,553 +/- 73 psi (2450 +/- 503 kPa).



409-1054

NOTE

If spray does not begin within pressure range specified in step 4, change thickness of shims. Adding shims will increase opening pressure. Remove shims to decrease opening pressure.

4. Check for well-atomized spray pattern.

NOTE

For leakage test, use same test set up for opening pressure test.

5. Open valve on test set.

TESTING - CONTINUED

6. Operate pump lever as necessary to hold pressure at a level about 290 psi (1999 kPa) below opening pressure noted in above.

7. No drops must fall from nozzle tip for a period of 10 seconds, while maintaining pressure specified above. If drops do appear within 10 seconds, replace injector.

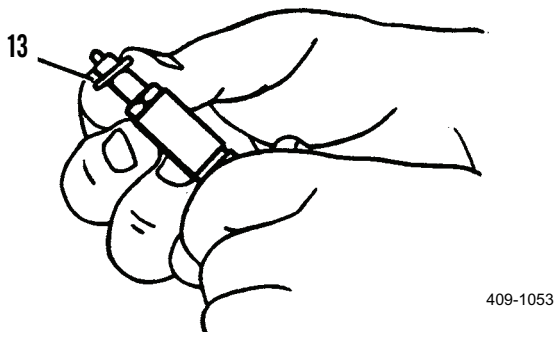
NOTE

- For chatter test, use same test set up for opening pressure test.
- Do not evaluate used nozzles at lower pumping rates. A used nozzle is serviceable if it passes the leakage test, chatters audibly at higher pumping rates and uniformly atomizes fuel.

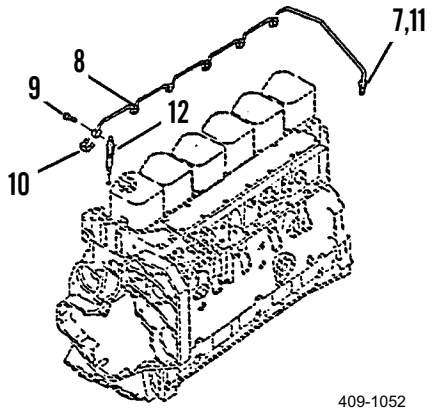
8. Operate pump lever at a rate that causes nozzle to chatter softly while discharging fuel in a broad and finely atomized pattern. If conditions of prior note are not met, replace nozzle.

INSTALLATION

1. Apply anti-seize compound to hold down nut threads.
2. Install fuel injectors (12).
3. Install one new copper injector seal (13) on each nozzle.

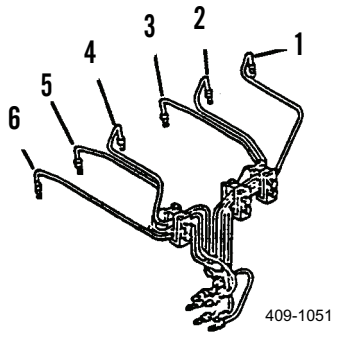


4. Install injector (12) using care to align button on injector nozzle holder with notch in cylinder head bore.
5. Torque injector (12) nut to 44 lb-ft (60 Nm).
6. Install new banjo connector seal (10) in gap between nozzle holder and injector nut.
7. Install fuel manifold (8), new seals (11) and secure to injectors with screws (9). Tighten nuts (7) on manifold (8).



INSTALLATION - CONTINUED

8. Loosely connect fuel high pressure tubes (1 thru 6) to fuel injectors. Leave connections loose until bleeding procedure is completed.



9. Connect battery cables (WP 0107 00).
10. Bleed fuel system (WP 0034 00).
11. Operate engine and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FUEL INJECTOR PUMP REPLACEMENT (152 HP) 0224 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Gasket (9 and 29)

Lockwasher (26)

Seal (10)

References

WP 0223 00

WP 0280 00

WP 0316 00

WP 0317 00

TM 10-3930-660-10

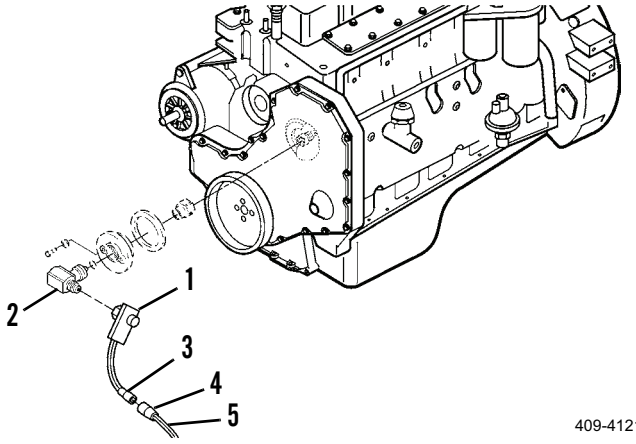
Equipment Condition

Battery cables disconnected (WP 0107 00)

Crankshaft vibration damper removed (WP 0275 00)

REMOVAL

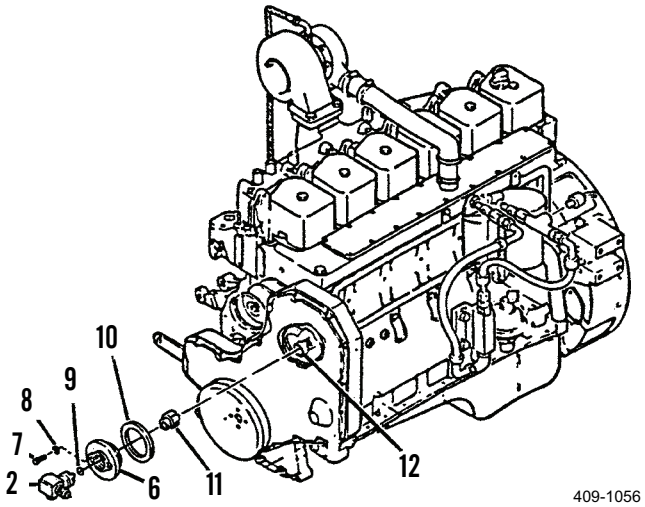
1. To remove tachometer (1) from tachometer drive (2), separate male connector (3) from female connector (4) on wiring harness (5).
2. Loosen nut on tachometer (1) and remove tachometer from tachometer drive (2).



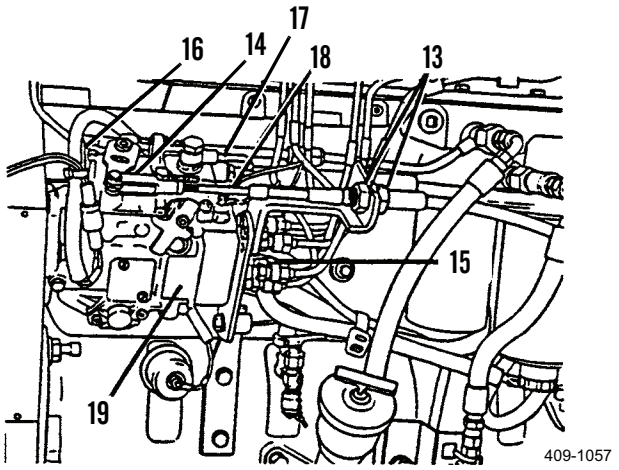
409-4121

REMOVAL - CONTINUED

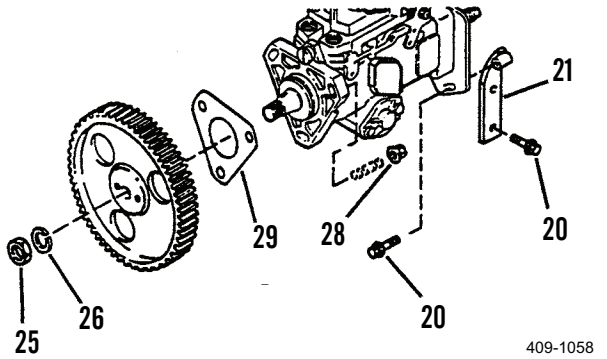
3. Remove tachometer drive (2) from cover (6) by removing two screws (7) and flatwashers (8).
4. Remove and discard gasket (9).
5. Remove cover (6) from front cover by turning cover counterclockwise.
6. Remove and discard seal (10).
7. Remove hub (11) from injection pump shaft (12).



8. Loosen nuts (13).
9. Disconnect accelerator cable (14) from fuel injection pump control lever.
10. Disconnect six high fuel pressure lines (15), fuel supply line (16), fuel drain line (17) and fuel shut-off valve wiring lead (18) from fuel injection pump (19).



11. Remove three capscrews (20) and brace (21).

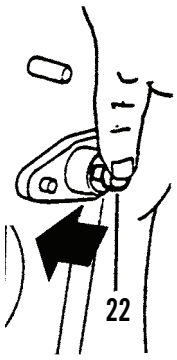


REMOVAL - CONTINUED

NOTE

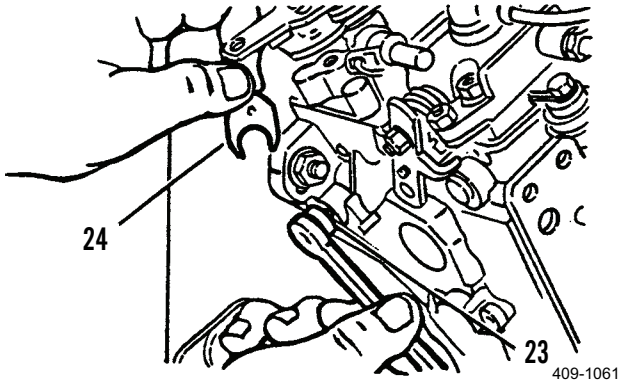
Steps 12 thru 14 must be performed in order to time fuel injection pump to engine when pump is installed.

12. Locate TDC for cylinder no. 1 by slowly turning engine crankshaft while pushing in on TDC pin (22). Pin will fit into a hole on the camshaft gear when engine is at TDC for cylinder no. 1.
13. Disengage TDC pin (22) immediately after locating TDC for cylinder no. 1 to prevent damage to pin.



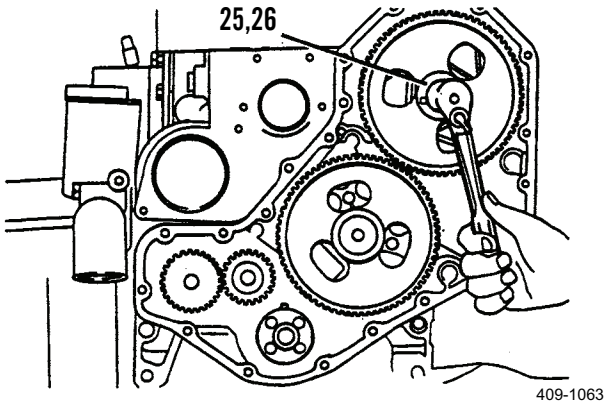
409-1059

14. Loosen screw (23) and remove timing lock plate (24). Tighten screw (23) against fuel injection pump shaft. Secure timing lock plate (24) to fuel injection pump with a wire to prevent its loss.
15. Remove front cover (WP 0280 00).



409-1061

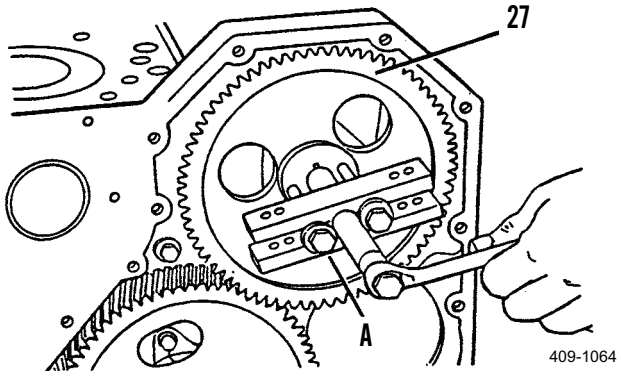
16. Hold crankshaft to prevent locked fuel injection pump from turning while loosening nut (25).
17. Use care not to drop nut (25) or lockwasher (26) behind front cover. Remove nut (25) and lockwasher (26). Discard lockwasher.



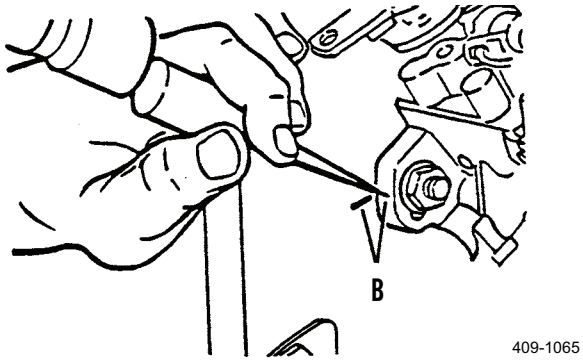
409-1063

REMOVAL - CONTINUED

18. Remove drive gear (27) from fuel injection pump shaft, using puller (A) as shown.

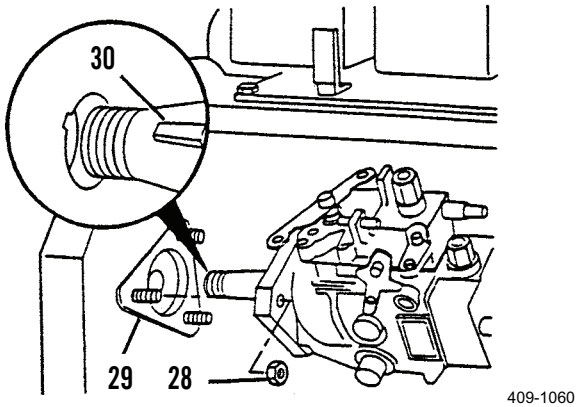


19. Make sure scribe marks (B) are present and visible on injection pump and timing gear housing.



20. Remove three nuts (28) and carefully remove fuel injection pump and mounting gasket (29). Do not allow key (30) to drop from pump shaft into timing gear housing.

21. Discard gasket (29) and clean gasket residue from surface on timing gear housing.



CLEANING

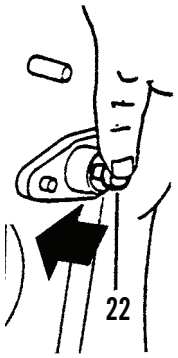
See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

1. Push in TDC pin (22) to verify cylinder no. 1 is at TDC. If necessary, turn engine crankshaft until TDC pin can be pushed in fully.



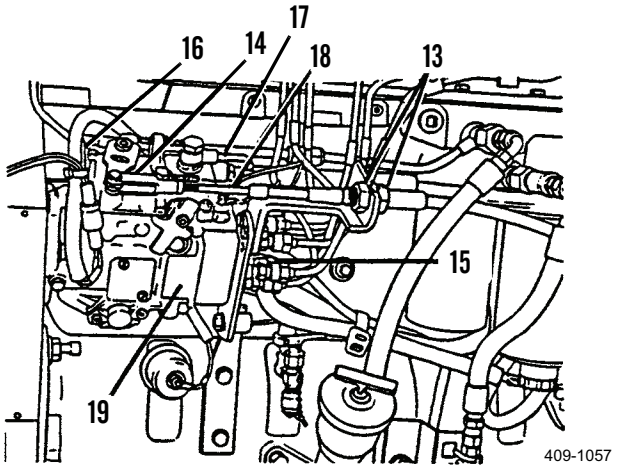
409-1059

2. Place new gasket (29) on pump mounting studs.

NOTE

New and reconditioned fuel injection pumps come with driveshafts locked at an angle which aligns shaft key with keyway in drive gear. Screw is tightened against shaft to lock shaft. Do not loosen screw until instructed to do so below.

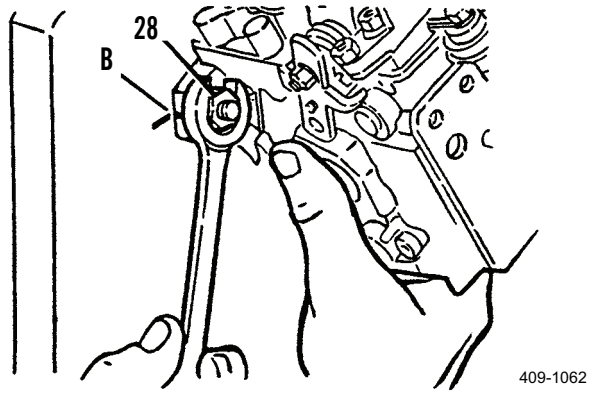
3. Position fuel injection pump (19) on mounting studs, using care to prevent key (30) from dropping into timing gear housing while aligning key (30) with keyway in gear.



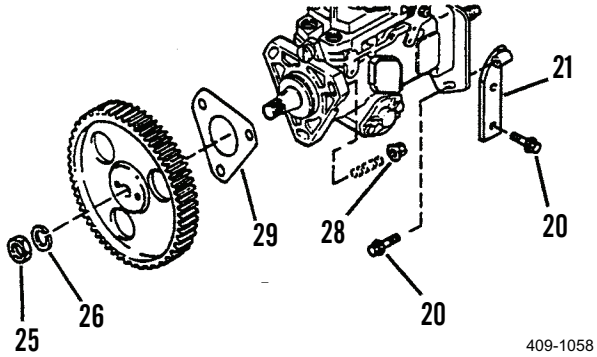
409-1057

INSTALLATION - CONTINUED

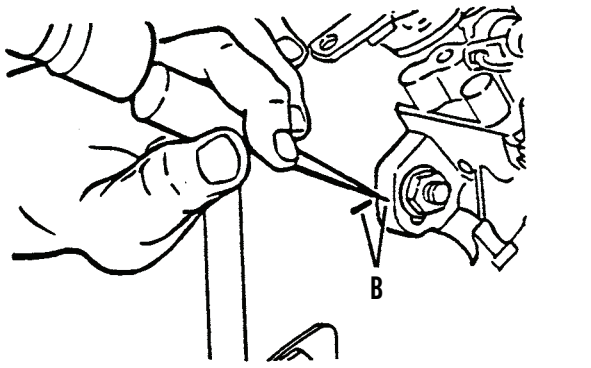
4. Install three nuts (28) finger tight on pump mounting studs. Pump must be free to move until timing has been set.



5. Install new lockwasher (26) and nut (25).

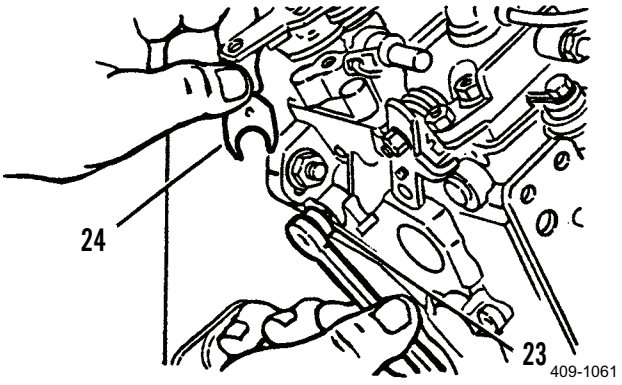


6. If original pump is being installed, rotate pump to align scribe marks (B). Then torque three nuts (28) to 18 lb-ft (24 Nm).
7. If installing a new or rebuilt pump without scribe mark, rotate pump against direction of drive rotation to take up backlash in gearing and torque nuts (28) to 18 lb-ft (24 Nm). Then place scribe mark (B) on pump flange using a hammer and small chisel.

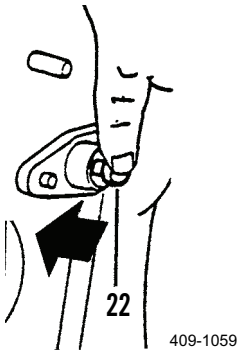


INSTALLATION - CONTINUED

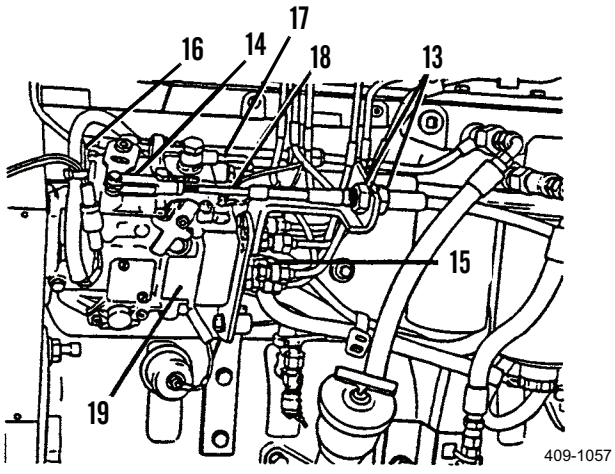
8. Loosen screw (23) and insert timing lock plate (24) under head of screw (23). Torque screw (23) to 120 lb-in. (163 Nm).



9. Disengage TDC pin (22).

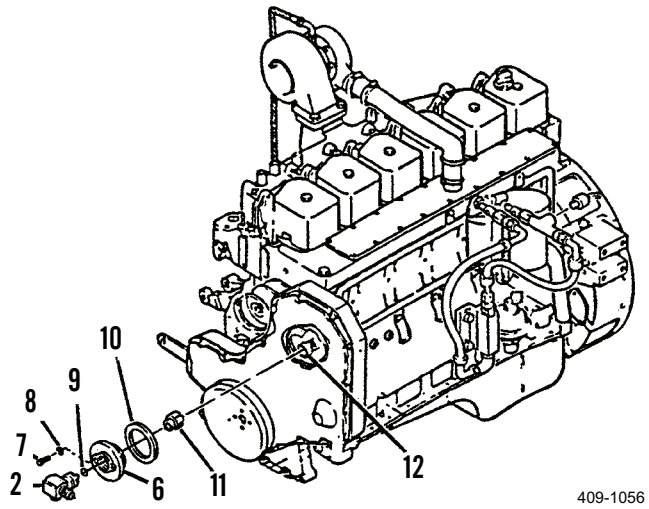


10. Torque nut (25) to 48 lb-ft (65 Nm).
11. Install front cover (WP 0252 00).
12. Install brace (21) and three capscrews (20). Leave capscrews (20) finger tight until certain that brace (21) is properly positioned.
13. In order, torque two brace-to-block capscrews (20) and then one brace-to-pump flange capscrew to 6 lb-ft (8 Nm).
14. Tighten nuts (13).
15. Connect electrical lead (18) to fuel shutoff valve, connect fuel drain line (17), connect fuel supply line (16) and connect six high fuel pressure lines (15) to fuel injection pump (19).
16. Install STE/ICE-R pulse tachometer and drive.



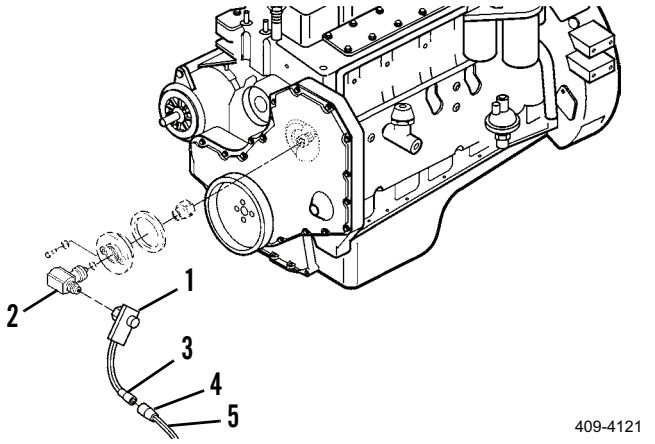
INSTALLATION - CONTINUED

17. Install hub (11) on shaft (12).
18. Install new seal (10) and cover (6).
19. Install new gasket (9), drive (2), two screws (7) and two flatwashers (8).



409-1056

20. Install tachometer (1) on drive (2) and tighten nut.
21. Connect male connector (3) to female connector (4) on wiring harness (5).



409-4121

22. Install vibration damper (WP 0275 00).
23. Connect battery cables (WP 0107 00).
24. Bleed fuel lines (WP 0223 00).
25. Start engine and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FUEL INJECTOR PUMP REPLACEMENT (165 HP) 0225 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Tool, engine barring (Item 35, WP 0324 00)

Materials/Parts

Compound, sealing (Item 14, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Gasket (13)

Lockwasher (16)

O-ring (11)

Sealing washer (27)

References

WP 0226 00

WP 0316 00

WP 0317 00

References - Continued

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Fuel shut-off solenoid disconnected (WP 0021 00)

Fuel drain tubes disconnected (WP 0037 00)

Fuel supply tubes disconnected (WP 0039 00)

High pressure fuel tubes disconnected (WP 0035 00)

STE/ICE-R pulse tachometer and drive assembly removed (WP 0089 00)

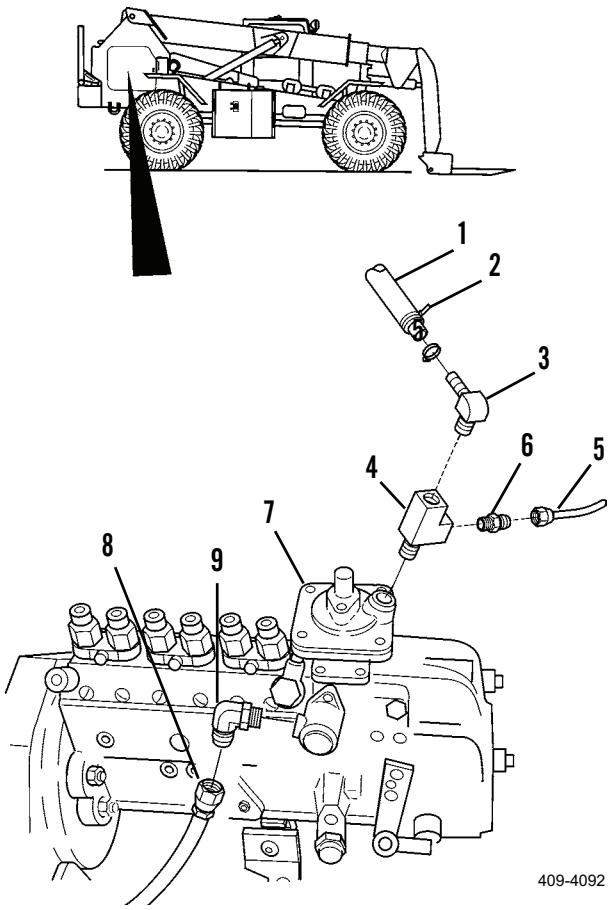
Accelerator cable removed (WP 0049 00)

REMOVAL

WARNING

Spilled fuel is slippery and flammable. Clean up and dispose of spilled fuel properly. Failure to follow this warning may cause injury or death.

1. Tag and mark hose (1). Loosen hose clamp (2) and disconnect hose from elbow (3). Remove elbow from tee (4).
2. Tag and mark hose (5). Disconnect hose from adapter (6) and remove adapter from tee (4). Remove elbow from tee.
3. Remove tee (4) from fuel injection pump (7).
4. Tag and mark hose (8). Disconnect hose from elbow (9) and remove elbow from fuel injection pump (7).



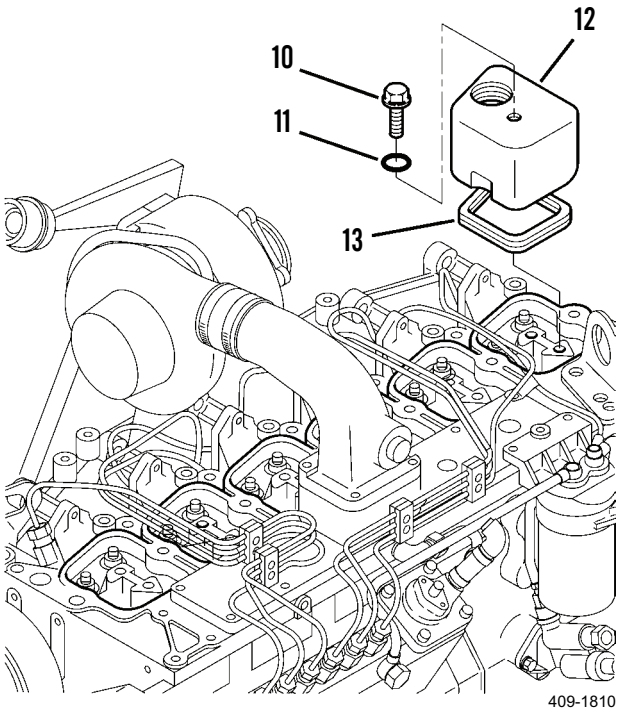
REMOVAL - CONTINUED

5. Locate top dead center for no. 1 cylinder.

NOTE

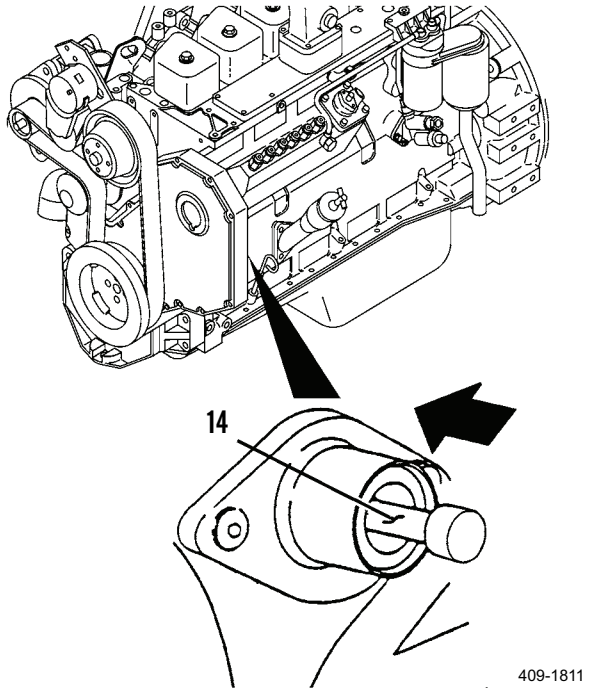
- If engine timing pin is not serviceable, TDC is achieved when exhaust valve stops moving and intake valve is beginning to open.
- Disengage timing pin immediately after locating top dead center.
- Mark flywheel housing and flywheel housing coupling for aid in installation.

6. Remove screw (10), O-ring (11), no. 6 cover (12) and gasket (13). Discard O-ring and gasket.



409-1810

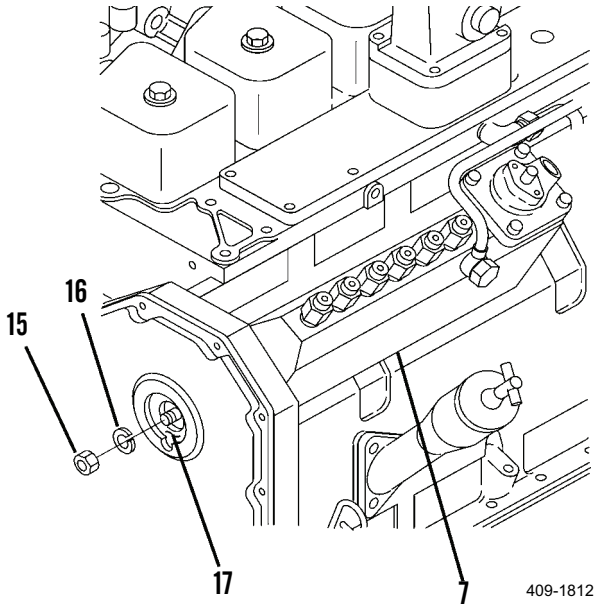
7. Rotate engine counterclockwise while observing position of exhaust and intake valves. When exhaust valve is closing, push engine timing pin (14) into hole in the camshaft gear.
8. Mark flywheel housing/flywheel housing coupling for aid in installation.



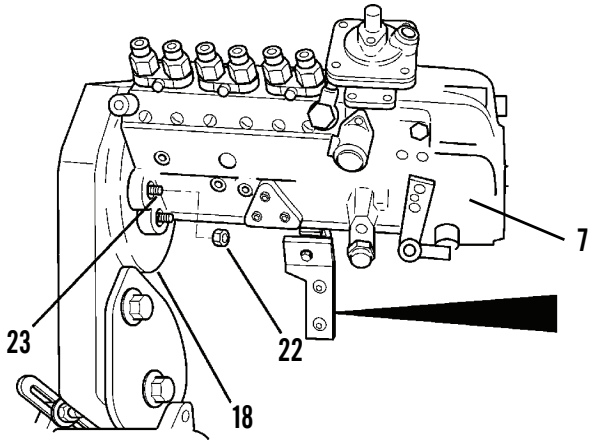
409-1811

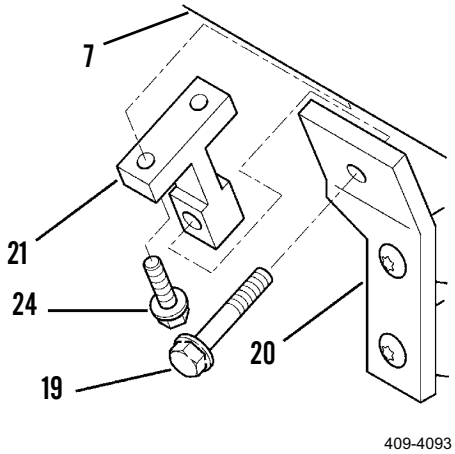
REMOVAL - CONTINUED

9. Remove nut (15) and lockwasher (16) from fuel injection pump (7) shaft. Discard lockwasher.
10. Pull drive gear (17) loose from fuel injection pump (7) shaft.



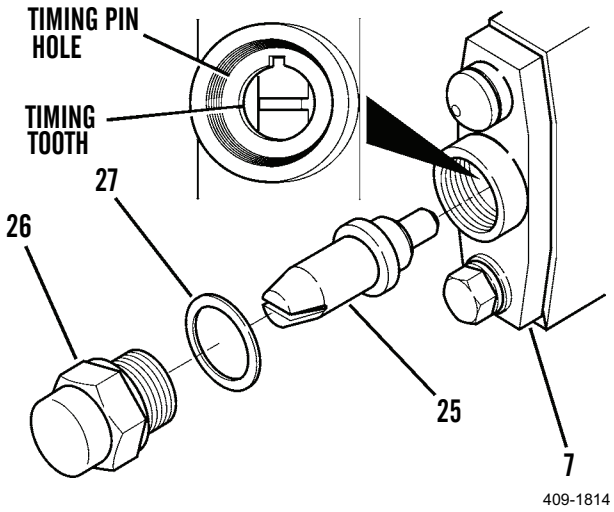
11. Mark fuel injection pump (7) and timing gear housing (18) for aid in installation.
12. Remove screw (19) from bracket (20) and mounting bracket (21).
13. Remove four nuts (22) and fuel injection pump (7) from timing gear housing studs (23).
14. Remove two screws (24) and mounting bracket (21) from fuel injection pump (7).



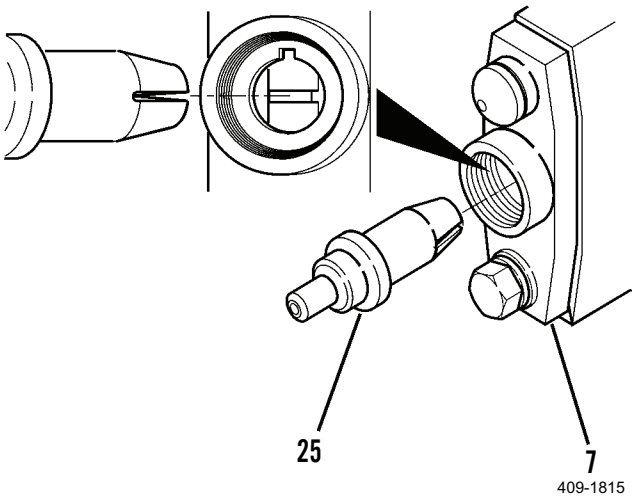


REMOVAL - CONTINUED

15. Remove plug (26), sealing washer (27) and timing pin (25) from fuel injection pump (7). Discard sealing washer.
16. If timing tooth is not aligned with timing pin hole, rotate fuel injection pump (7) shaft until timing tooth aligns.



17. Reverse position of timing pin (25) so the slot in pin will fit over timing tooth in fuel injection pump (7).
18. Remove fuel shut-off solenoid and bracket (WP 0226 00).



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

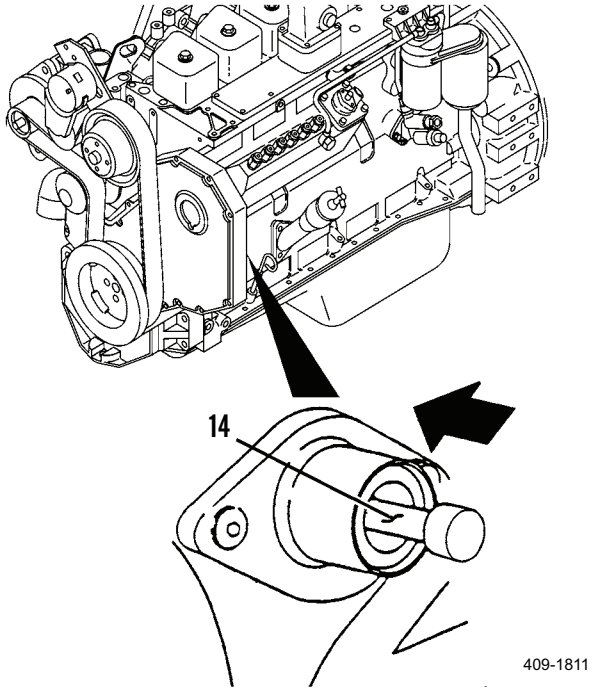
INSTALLATION

1. Push in engine timing pin (14) to verify top dead center for no. 1 cylinder. If necessary, rotate engine counterclockwise at universal joint of transmission input shaft while assistant pushes on engine timing pin.

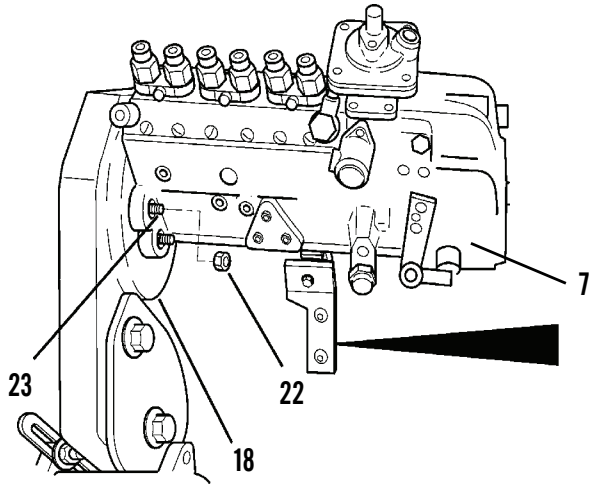
NOTE

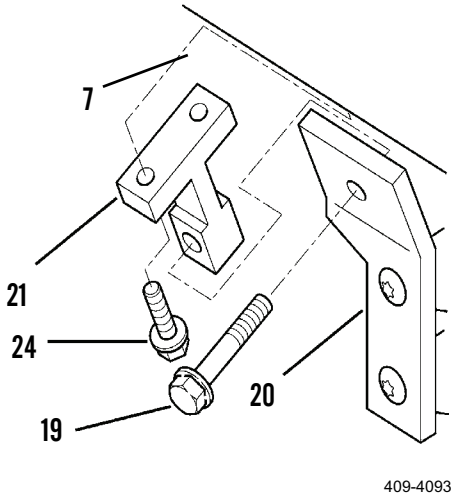
Verify TDC by examining marks on flywheel housing and flywheel housing coupling. If necessary, align marks by turning engine.

2. Install fuel shut-off solenoid and bracket (WP 0226 00).



3. Install mounting bracket (21) and two screws (24) on fuel injection pump (7).
4. Install fuel injection pump (7) and four nuts (22) on timing gear housing studs (23). Torque nuts to 32 lb-ft (43 Nm).
5. Install screw (19) on mounting bracket (21) and bracket (20).



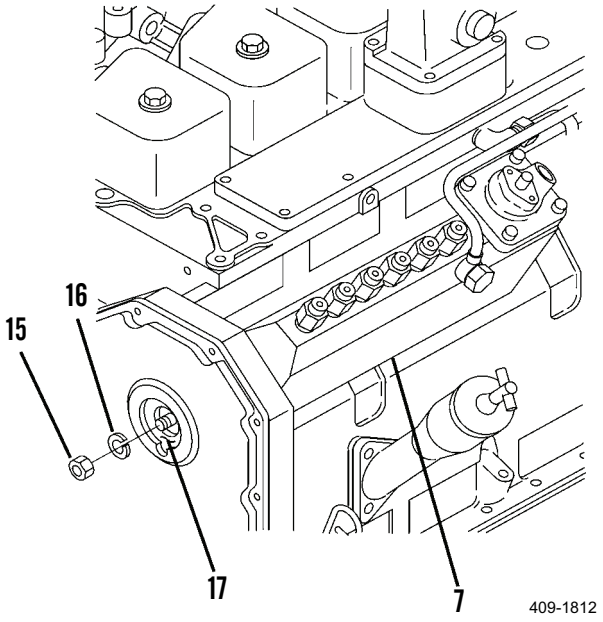


INSTALLATION - CONTINUED

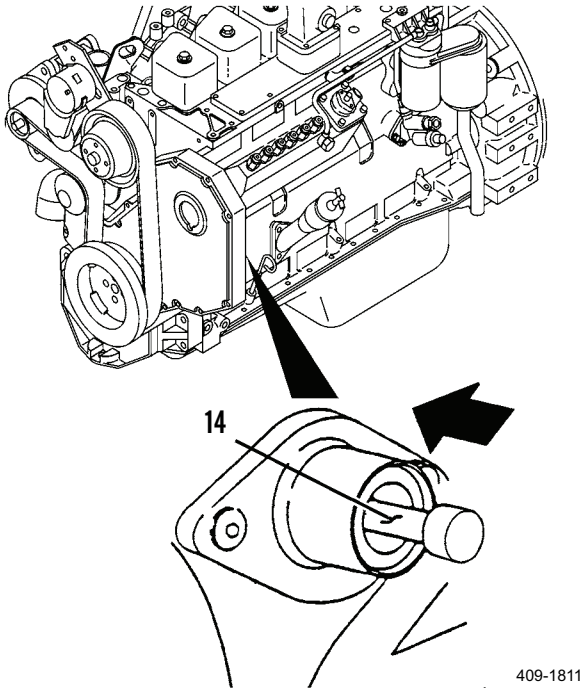
CAUTION

To prevent damage to timing pin, do not exceed torque value in step 6 below.

6. Install new lockwasher (16) and nut (15) on fuel injection pump (7) shaft. Torque nuts to 7-15 lb-ft (9.5-20.3 Nm).

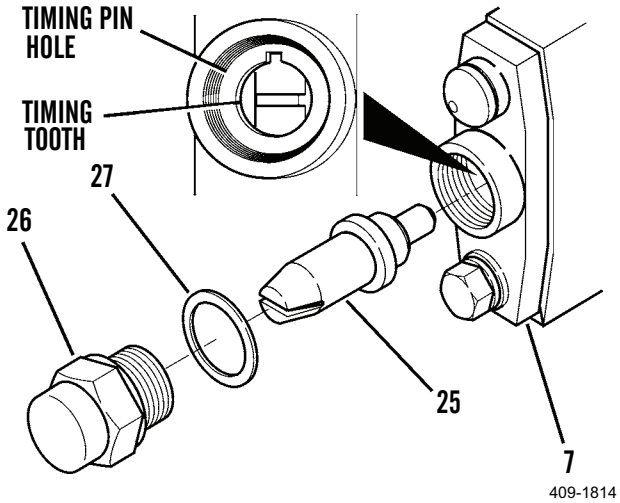


7. Disengage engine timing pin (14).

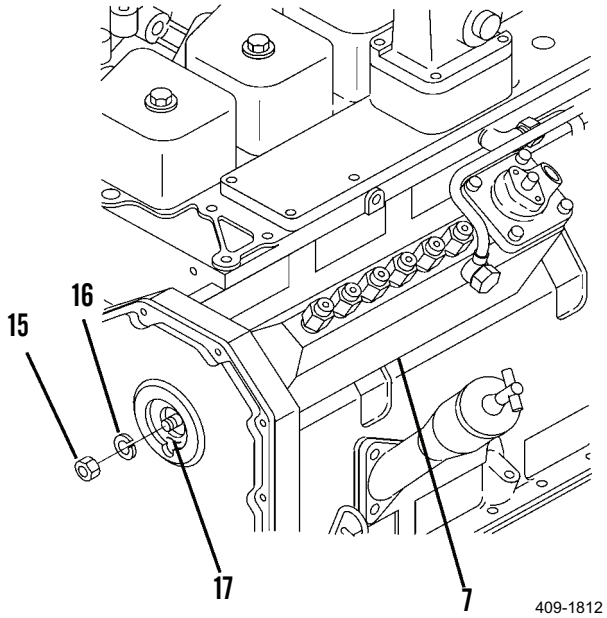


INSTALLATION - CONTINUED

8. Reposition timing pin (25) in fuel injection pump (7).
9. Remove plug (26), sealing washer (27) and timing pin (25) from fuel injection pump (7). Discard sealing washer.
10. Reverse position of timing pin (25) so the slot in pin will fit in the over timing tooth in fuel injection pump (7).
11. Install plug (26) and new sealing washer (27).

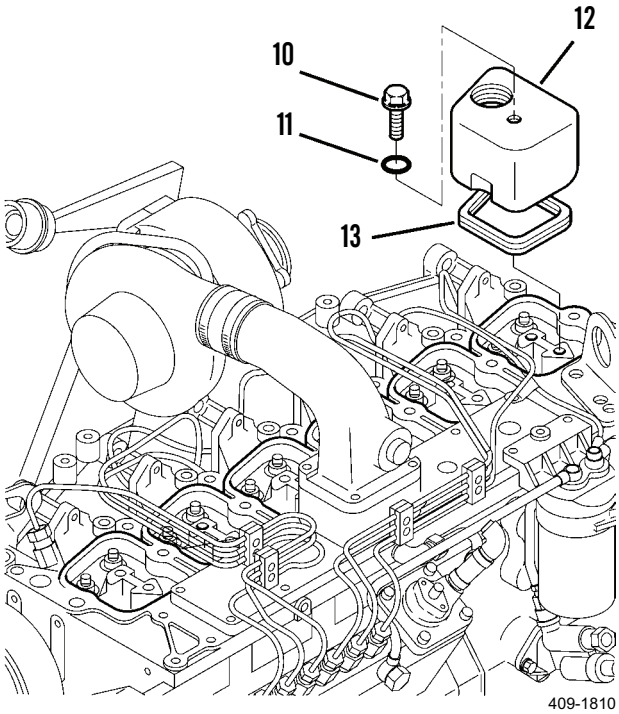


12. Torque nut (15) to 66 lb-ft (89 Nm).



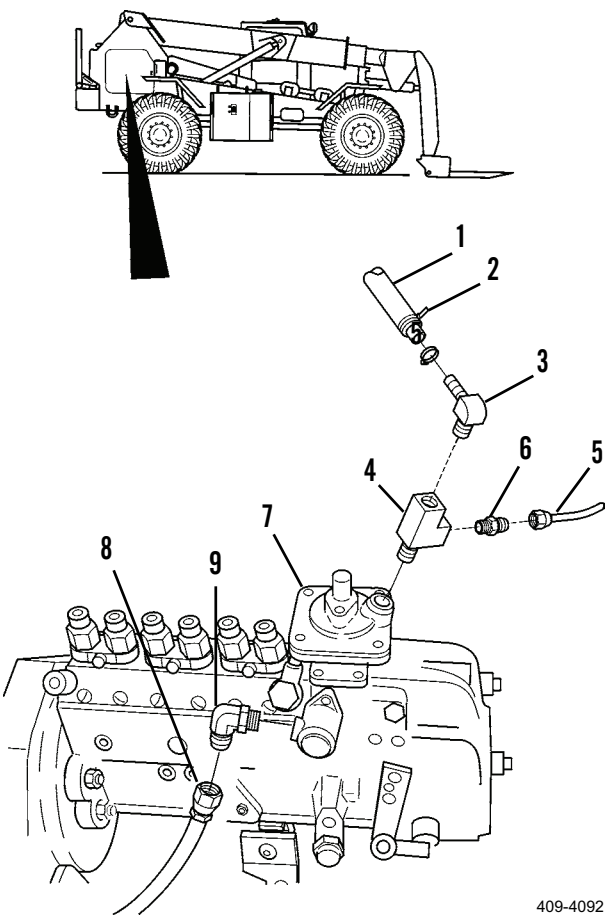
INSTALLATION - CONTINUED

13. Install new gasket (13), number 6 valve cover (12), new O-ring (11) and screw (10). Torque screw to 18 lb-ft (24 Nm).



INSTALLATION - CONTINUED

14. Install elbow (9) to fuel injection pump (7). Connect hose (8) to elbow.
15. Install tee (4) to fuel injection pump (7).
16. Install adapter (6) to tee (4). Connect hose (5) to adapter.
17. Install elbow (3) to tee (4). Connect hose (1) to elbow and tighten hose (1) to elbow and tighten hose clamp (2).
18. Install accelerator cable (WP 0049 00).
19. Install STE/ICE-R pulse tachometer and drive assembly (WP 0089 00).
20. Connect high pressure fuel tubes (WP 0035 00).
21. Connect fuel supply tubes (WP 0039 00).
22. Connect fuel drain tubes (WP 0037 00).
23. Connect fuel shut-off solenoid (WP 0021 00).



24. Operate equipment and check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

FUEL SHUTOFF SOLENOID REPLACEMENT (152 HP) 0226 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Rag, wiping (Item 40, WP 0323 00)

Lockwasher (7)

O-ring (5)

Equipment Condition

Machine parked on level ground

Engine off and cool (TM 10-3930-660-10)

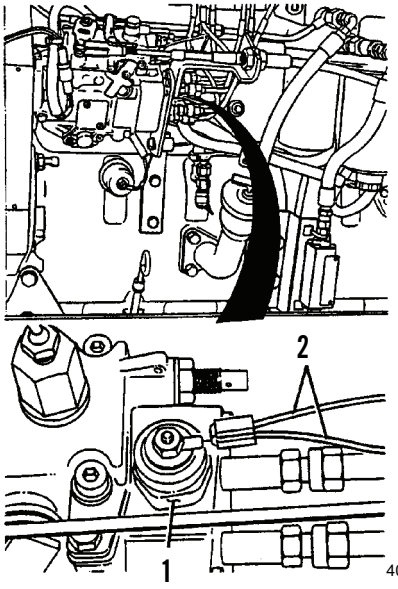
Battery cables disconnected (WP 0107 00)

WARNING

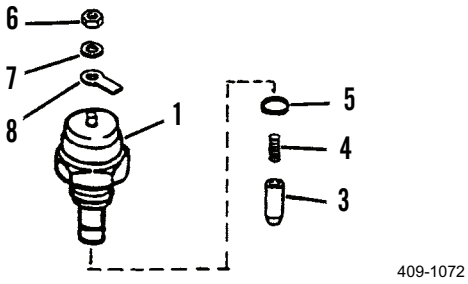
- DO NOT smoke or permit any open flame in area of vehicle while you are servicing diesel fuel system. Be sure hose nozzle is grounded against filler tube during refueling to prevent static electricity. Failure to follow this warning may cause injury to personnel, or equipment damage.
- DO NOT perform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

REMOVAL

1. Clean fuel shut-off solenoid (1) and surrounding area of pump to prevent entry of contaminants into valve.
2. Disconnect electrical wires (2) from shut-off solenoid (1).



3. Remove shut-off solenoid (1), using care not to drop plunger (3) and spring (4).
4. Remove O-ring (5), nut (6), lockwasher (7) and spade terminal (8). Discard O-ring and lockwasher.



NOTE

Discard entire shut-off solenoid assembly, which includes plunger and spring, if shut-off solenoid is defective.

INSTALLATION

1. Install new O-ring (5), spade terminal (8), new lockwasher (7) and nut (6) on shut-off solenoid (1).
2. Place plunger (3) and spring (4) in position in shut-off solenoid bore.
3. Install shut-off solenoid (1), making certain that plunger (3) and spring (4) remain properly assembled to solenoid (1) during installation.
4. Connect electrical lead (2) to shut-off solenoid (1).
5. Connect battery cables (WP 0107 00).
6. Operate engine and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FUEL SHUTOFF SOLENOID REPLACEMENT (165 HP) 0227 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's automotive (Item 39, WP 0324 00)

Materials/Parts

Locknut (6)

Equipment Condition

Vehicle parked on level ground (TM 10-3930-660-10)

Engine off and cool (TM 10-3930-660-10)

Battery cables disconnected (WP 0107 00)

REMOVAL

NOTE

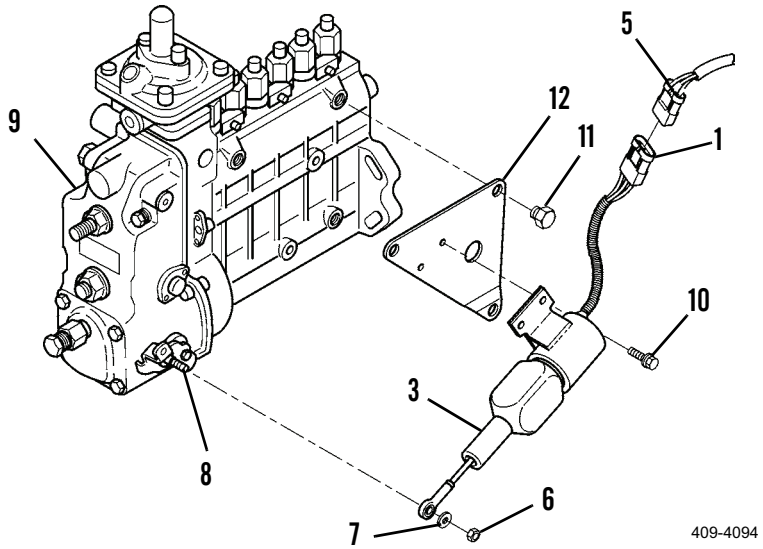
Cover of air cleaner, bracket of throttle cable and lever of fuel injection pump may be removed for easier access to fuel shutoff solenoid.

1. Disconnect connector (1 or 2) of fuel shutoff solenoid (3 or 4) from connector (5) of engine wiring harness.
2. Remove locknut (6) and washer (7), if equipped, from threaded stud (8) of fuel injection pump (9). Discard locknut.

NOTE

- Perform steps 3 and 4 if vehicle is equipped with original fuel shutoff solenoid which includes a separate bracket.
- If fuel shutoff solenoid is to be replaced by a new solenoid, DISCARD solenoid (3), two screws (10), one of three screws (11) and bracket (12) when removed.

3. Remove two screws (10) and fuel shutoff solenoid (3) from bracket (12) and threaded stud (8).
4. Remove three screws (11) and bracket (12) from side of fuel injection pump (9).

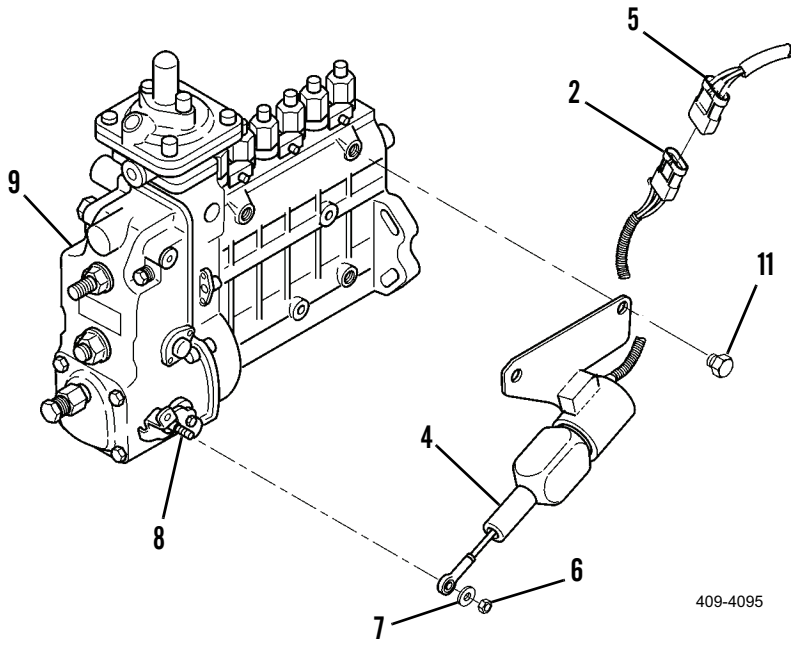


ORIGINAL DESIGN SOLENOID (WITH BRACKET)

NOTE

Perform step 5 if vehicle is equipped with new fuel shutoff solenoid.

5. Remove two screws (11) and fuel shutoff solenoid (4) from side of fuel injection pump (9) and threaded stud (8).



NEW DESIGN SOLENIOD (WITHOUT BRACKET)

INSTALLATION

NOTE

Perform steps 1, 4 and 5 to install new fuel shutoff solenoid to vehicle.

1. Install fuel shutoff solenoid (4) to side of fuel injection pump (9) and threaded stud (8) with two screws (11).

NOTE

Perform steps 2 and 3 to install original fuel shutoff solenoid, which includes a separate bracket.

2. Install bracket (12) to side of fuel injection pump (9) with three screws (11).
3. Install fuel shutoff solenoid (3) to bracket (12) and threaded stud (8) with two screws (10).
4. Install washer (7), if equipped, and new locknut (6) to threaded stud (8).
5. Connect connector (1 or 2) of fuel shutoff solenoid (3 or 4) to connector (5) of engine wiring harness.
6. Connect battery cables (WP 0107 00).
7. Operate engine and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

FUEL/HYDRAULIC TANK MAINTENANCE 0228 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Tool kit, body and fender repair (Item 37, WP 0324 00)

Lifting device, 500 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Materials/Parts - Continued

Gasket (21, 28, 32 and 37)

Lockwasher (13, 17, 19, 26 and 35)

Personnel Required

Two

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

TM 9-237

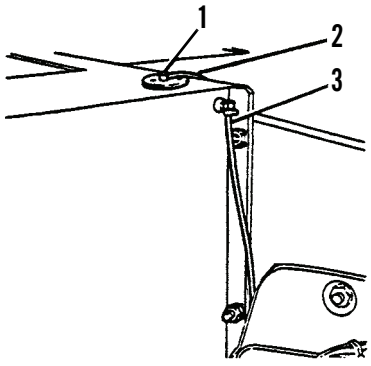
Equipment Condition

Battery cables disconnected (WP 0107 00)

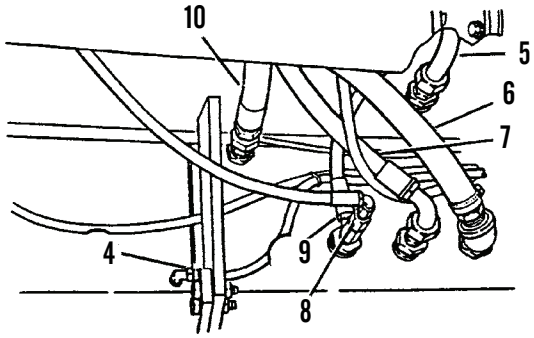
Fuel and hydraulic tanks drained (WP 0032 00)

REMOVAL

1. Remove nut (1). Disconnect electrical lead (2) from fuel level sender.
2. Disconnect two fuel lines (3 and 4) and six hydraulic lines (5 thru 10). Tag each line as it is disconnected to ensure proper connections and plug and cap all openings.



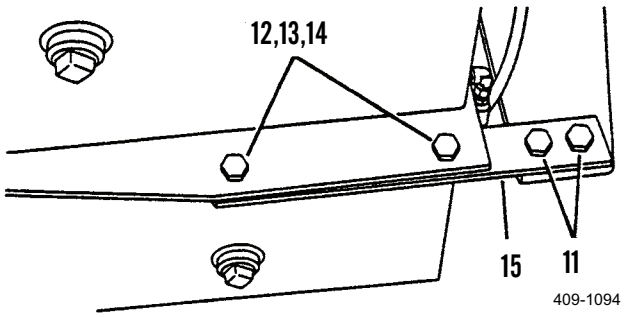
409-1085



409-1086

REMOVAL - CONTINUED

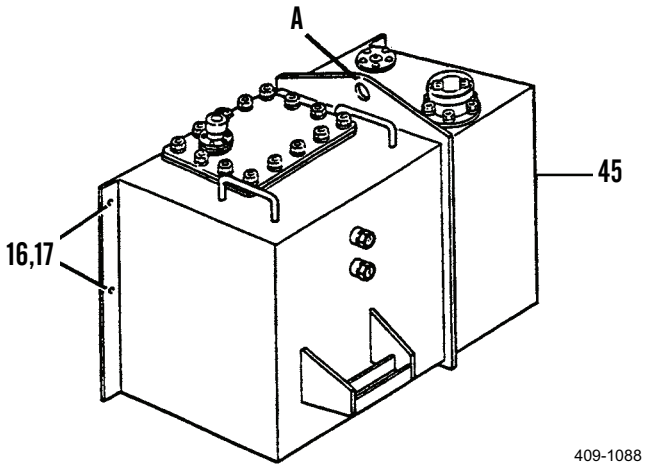
3. Loosen two nuts (11).
4. Remove two nuts (12), lockwashers (13) and capscrews (14) attaching tank assembly (45) to support bar (15). Discard lockwashers.



WARNING

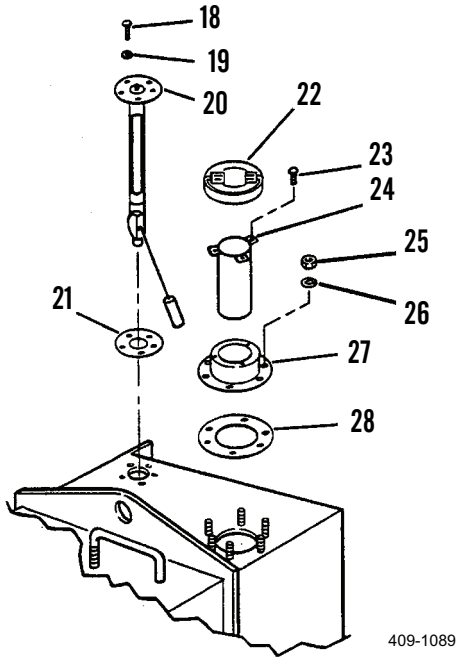
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

5. With assistance, connect a hoist or other suitable lifting device to lifting eye (A) on top of tank assembly (45).
6. Take up slack in lifting device and then remove four nuts (16) and lockwashers (17). Discard lockwashers.
7. Lift tank assembly (45) away from vehicle frame.

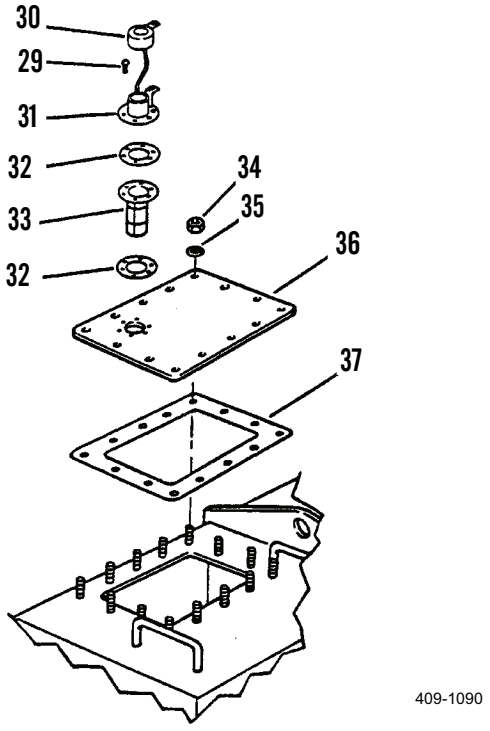


DISASSEMBLY

1. Remove five screws (18) and lockwashers (19). Discard lockwashers.
2. Remove fuel sender unit (20) and gasket (21). Discard gasket.
3. Remove filler cap (22).
4. Remove three screws (23) and strainer (24).
5. Remove six nuts (25) and lockwashers (26). Discard lockwashers.
6. Remove filler neck (27) and gasket (28). Discard gasket.

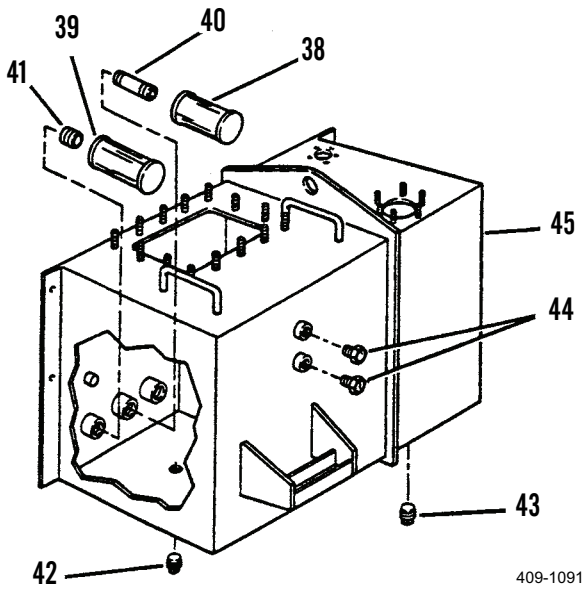


7. Remove six screws (29).
8. Remove filler cap/breather (30).
9. If required, remove filler neck (31), two gaskets (32) and strainer (33). Discard gaskets.
10. Remove 14 nuts (34), lockwashers (35), cover (36) and gasket (37). Discard gasket and lockwasher.



DISASSEMBLY - CONTINUED

11. Remove strainers (38 and 39), nipples (38 and 41), drain plugs (42 and 43) and two sight gauges (44) from tank assembly (45) as required for replacement.



CLEANING

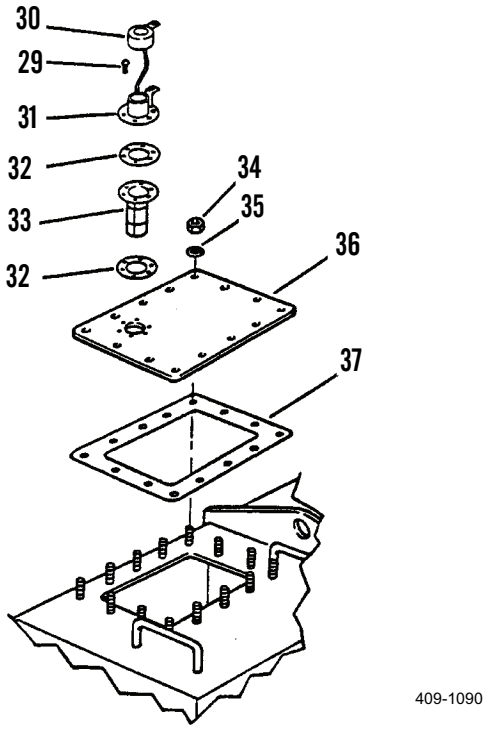
See *Cleaning* instructions (WP 0316 00).

INSPECTION

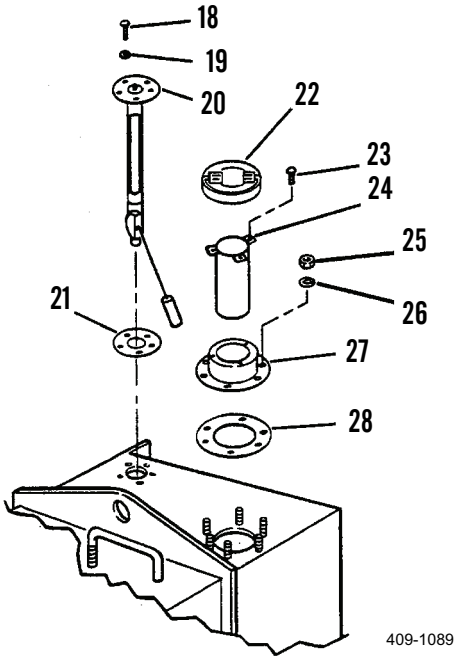
1. Inspect exterior surfaces, hardware and threaded fittings for corrosion or damage (WP 0317 00). Repair breaks in tank walls, if possible by welding (TM 9-237).
2. Inspect fuel and hydraulic oil strainers for damage or signs of clogging. Replace strainers as required.

ASSEMBLY

1. Install new gasket (37) and new lockwashers (35).
2. Tighten fourteen nuts (34) in even increments to prevent distortion of cover (36).
3. If items (31 thru 33) were removed, install new gaskets (32).
4. Attach chain of filler cap/breather using one screw (29).



5. Install new gasket (28) and tighten six nuts (25) in even increments.
6. Install new gasket (21) and fuel level sender (20). Secure with five screws (18) and new lockwashers (19).

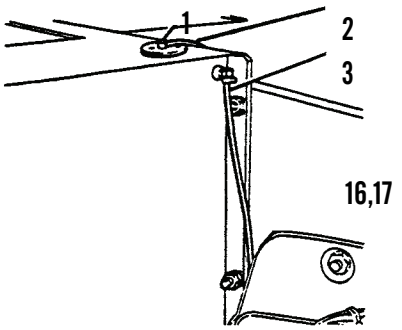


INSTALLATION

WARNING

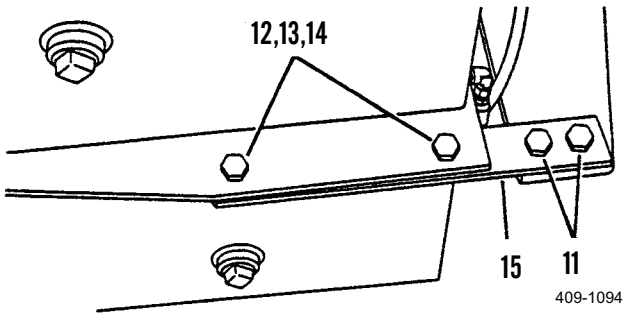
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

1. With assistance, lift tank assembly into place on vehicle and engage mounting studs.
2. Install four new lockwashers (17) and nuts (16).
3. Remove lifting device.



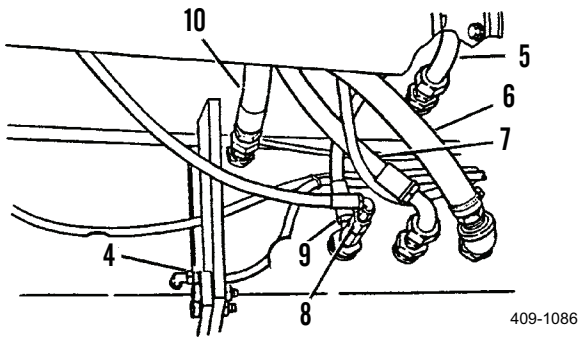
409-1085

4. Install two capscrews (12), nuts (14) and new lockwashers (13) to secure tank to support bar (15). Tighten capscrews (11).



409-1094

5. Connect fuel lines (3 and 4), hydraulic lines (5 thru 10) and electrical wire (2). Tighten nut (1) to secure electrical wire (2).



409-1086

INSTALLATION - CONTINUED

6. Fill fuel and hydraulic tank (WP 0032 00).
7. Connect battery cables (WP 0107 00).
8. Operate vehicle and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

BOOM ELECTRICAL BOX ASSEMBLY MAINTENANCE 0229 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Strap, tie down (Item 56, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Grommet (14 and 15)

Lockwasher (5, 17 and 20)

References

WP 0316 00

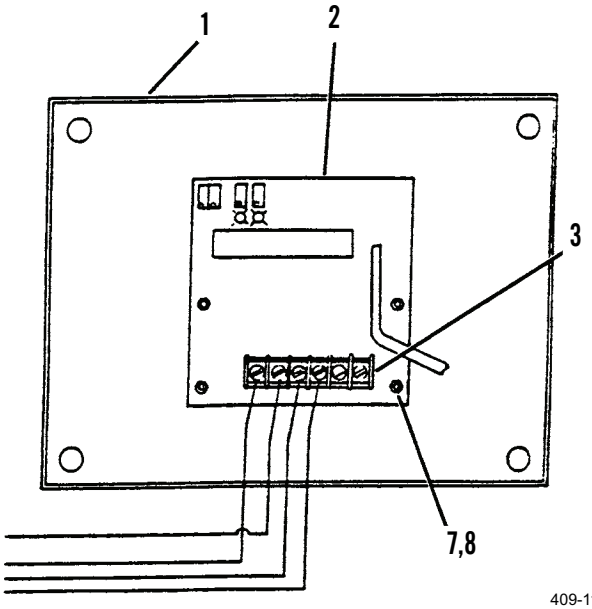
Equipment Condition

Vehicle parked on level ground and forks lowered to ground (TM 10-3930-660-10)

Battery cables disconnected (WP 0107 00)

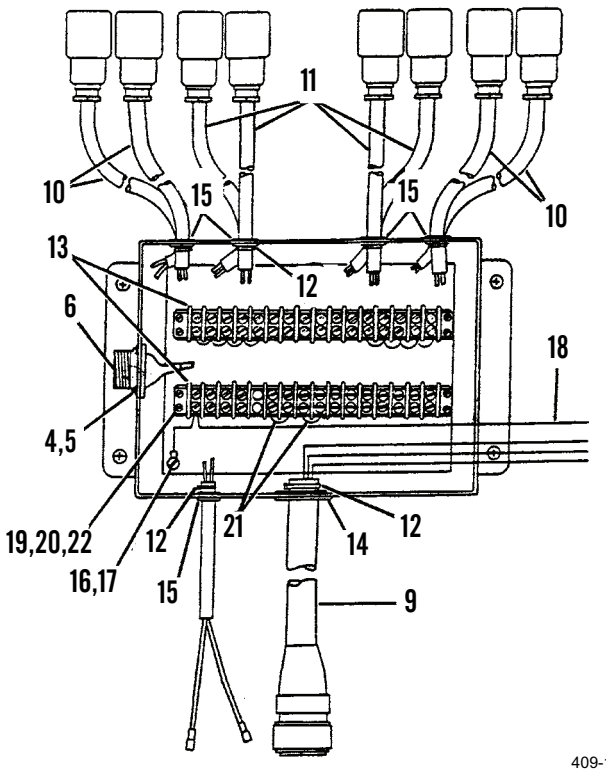
DISASSEMBLY

1. Remove four screws (not shown) and enclosure cover (1).
2. Tag and disconnect four wires connected circuit board (2) and terminal strip (3).



409-1117

3. Remove four screws (4) and four lockwashers (5) from connector (6). Connector is part of circuit board (2). Discard lockwashers.
4. Remove four nuts (7) and four screws (8) to remove circuit board (2).
5. Cut cable ties (12) from cable to be removed.
6. Remove cables (9 thru 11) as necessary for replacement.
7. Tag and disconnect cable wires from terminal strip (13).
8. Push grommets (14 and 15) to outside of enclosure, using care not to damage grommet.
9. Remove and discard grommets (14 and 15) from cable (9 thru 11).
10. Remove screw (16) and lockwasher (17) and disconnect wire assembly (18) from lower terminal strip (13) and from terminal strip (3). Discard lockwasher.
11. Remove eight screws (22), nuts (19) and lockwashers (20) to remove terminal strips (13). Discard lockwashers.
12. Remove two jumper terminals (21).



409-1118

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Visually inspect cables (9 thru 11) for damage or other defects.
2. Inspect grommets (14 and 15) for tears, deterioration or other condition which may allow moisture or dirt into enclosure. Replace defective grommets.
3. Using an ohmmeter, check continuity of individual wires in cables (9 thru 11), between connector pins and terminal lugs. Replace complete cable if open wires are detected.

ASSEMBLY

1. Connect jumper terminals (21) to proper terminals on lower terminal strip (13).
2. Install terminal strips (13). Secure with eight screws (18), nuts (19) and new lockwashers (20).
3. Connect wire assembly (18) to lower terminal strips (13) and terminal strip (3), and install screw (16) and new lockwasher (17).
4. Install new grommets (14 and 15) on cables (9 thru 11).
5. Carefully push cable through entrance in enclosure and work new grommets (14 and 15) into place in cable entrance.
6. Connect cable wires to proper terminals on terminal strip (13).
7. Install new cable ties (12), as necessary.
8. Secure circuit board (2) to enclosure cover (1), using four screws (8) and nuts (7).
9. Install connector (6), using four screws (4) and new lockwashers (5).
10. Connect four wires to terminal strip (3) on circuit board (2). Observe tags placed during board removal.
11. Install enclosure cover (1) using four screws (not shown).
12. Connect battery cables (WP 0107 00).
13. Operate boom and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

BATTERY BOXES MAINTENANCE 0230 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

References

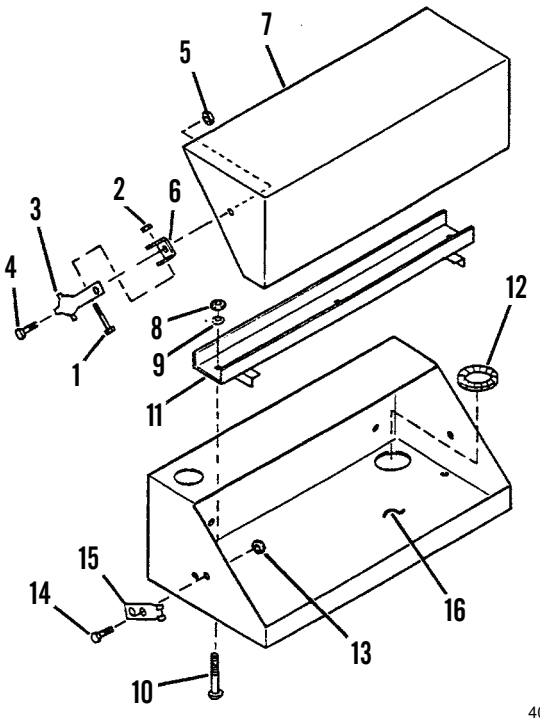
WP 0316 00

Equipment Condition

Battery box removed (WP 0108 00)

DISASSEMBLY

1. Remove two screws (1), two nuts (2) and two latch anchors (3).
2. Remove two screws (4), two nuts (5) and two latch brackets (6). Remove cover (7).
3. Remove three nuts (8), three flatwashers (9), three screws (10) and hold-down (11).
4. Remove two nuts (13), two screws (14) and two latch hooks (15).
5. If necessary, remove grommet (12).



409-1120

CLEANING

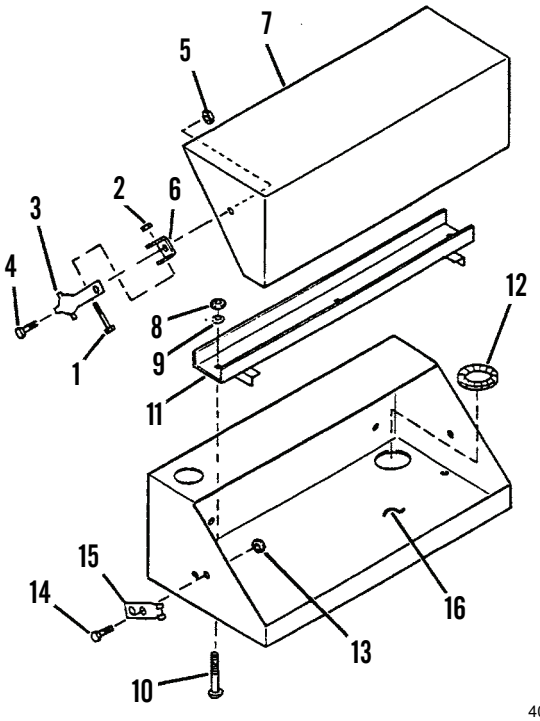
See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Check cover (7) and box (16) for damage or excessive corrosion. Straighten minor dents. If damage is severe, replace part.
2. Inspect latch parts (3, 6 and 15) for cracks or distortion which may prevent proper latching. Replace parts as necessary.
3. Inspect grommet (12) for tears or deterioration. Replace if necessary.

ASSEMBLY

1. If removed, install grommet (12).
2. Install two latch hooks (15), two screws (14) and two nuts (13).
3. Install hold-down (11), three screws (10), three flat-washers (9) and three nuts (8).
4. Install cover (7).
5. Install two latch brackets (6), two screws (4) and two nuts (5).
6. Install two latch anchors (3), two screws (1) and two nuts (2).



409-1120

7. Install battery box (WP 0108 00).

END OF WORK PACKAGE

CAB WIRING HARNESS MAINTENANCE 0231 00

THIS WORK PACKAGE COVERS

Removal, Test and Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Tag, marker (Item 57, WP 0323 00)

Lockwasher (12, 13, 15 and 18)

Equipment Condition

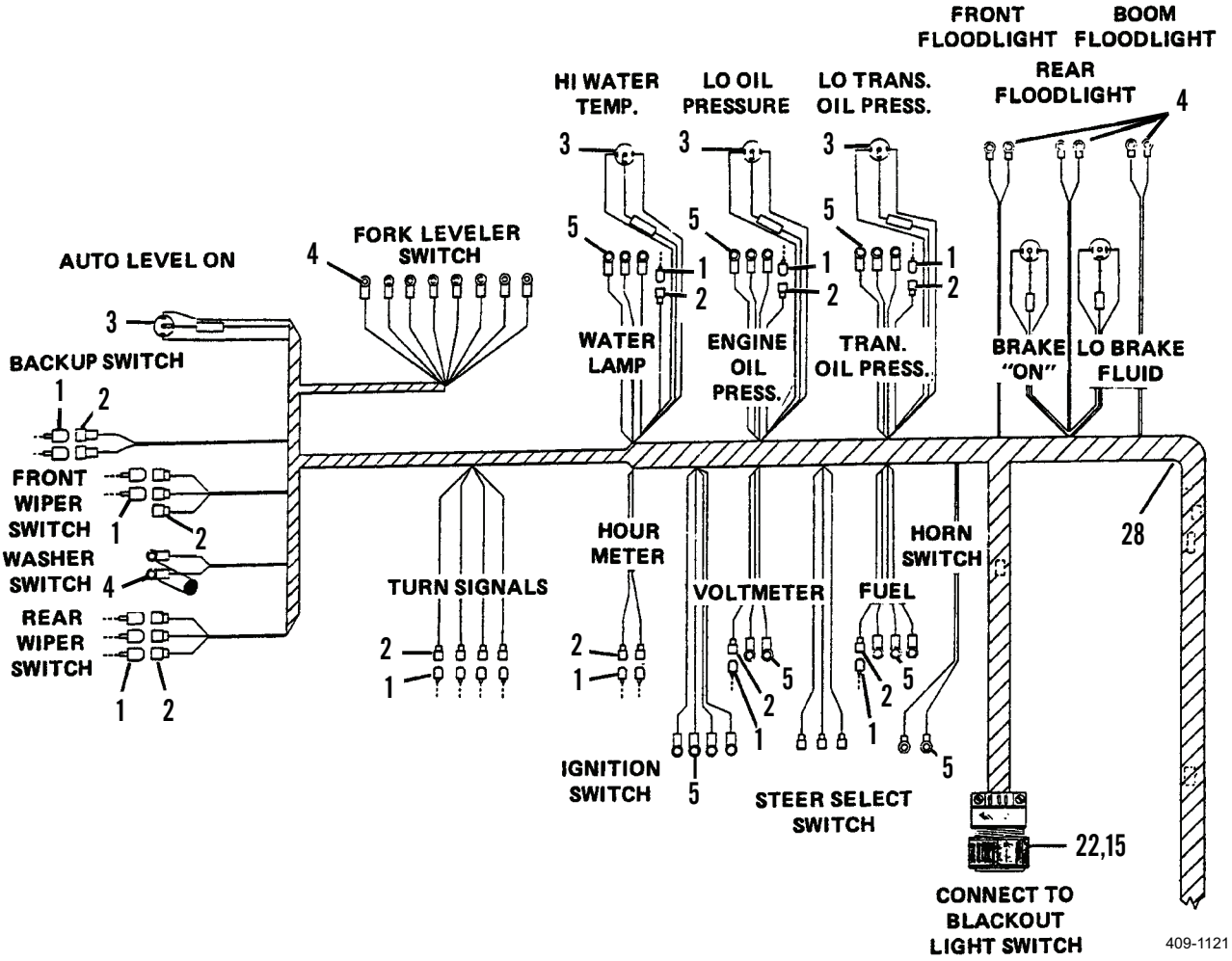
Battery cables disconnected (WP 0107 00)

REMOVAL

NOTE

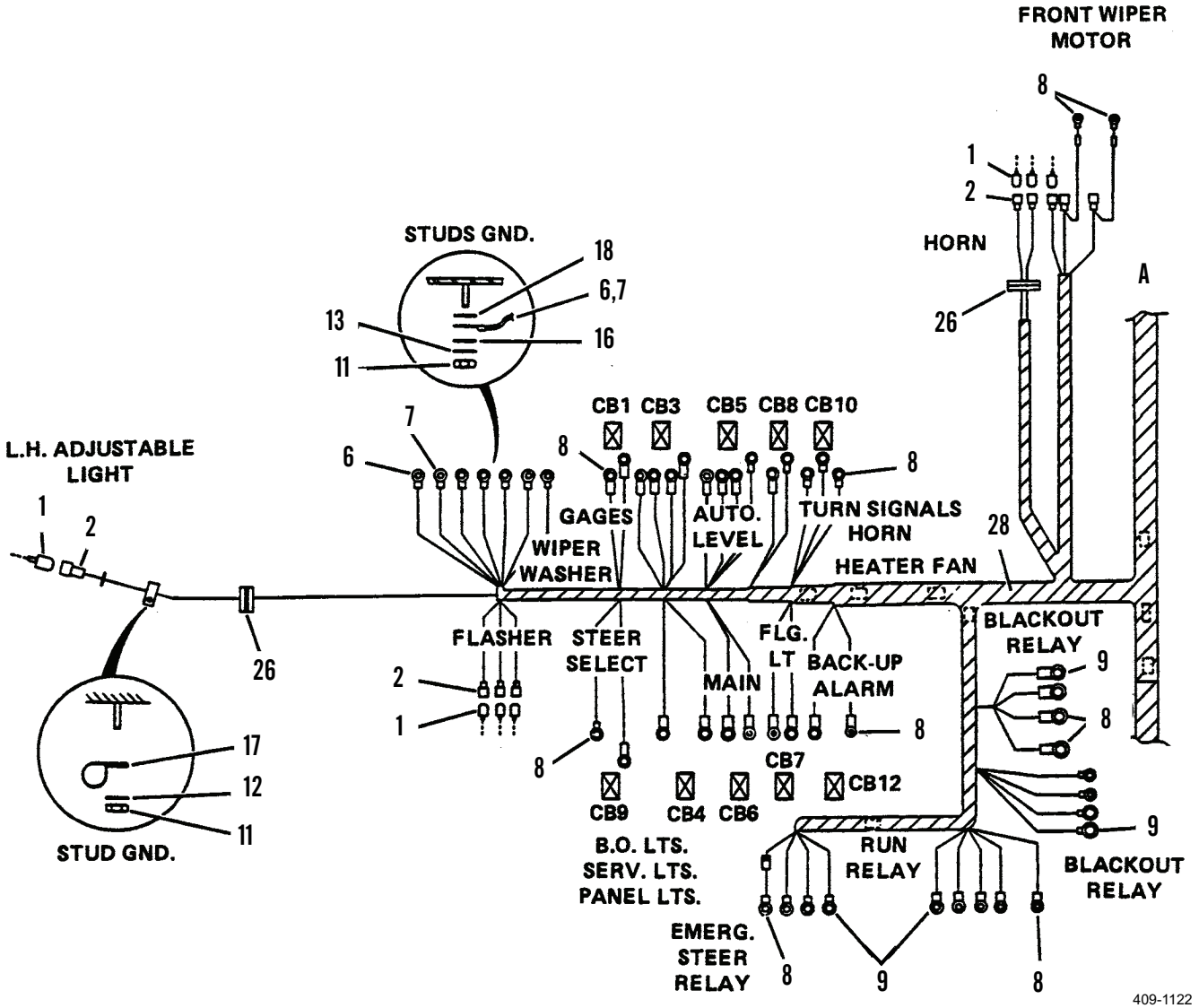
Tag all electrical leads as removed for use during installation.

1. Unplug forty-four female connectors (2) from male connectors (1).
2. Disconnect wires from six lamp holders (3).



REMOVAL - CONTINUED

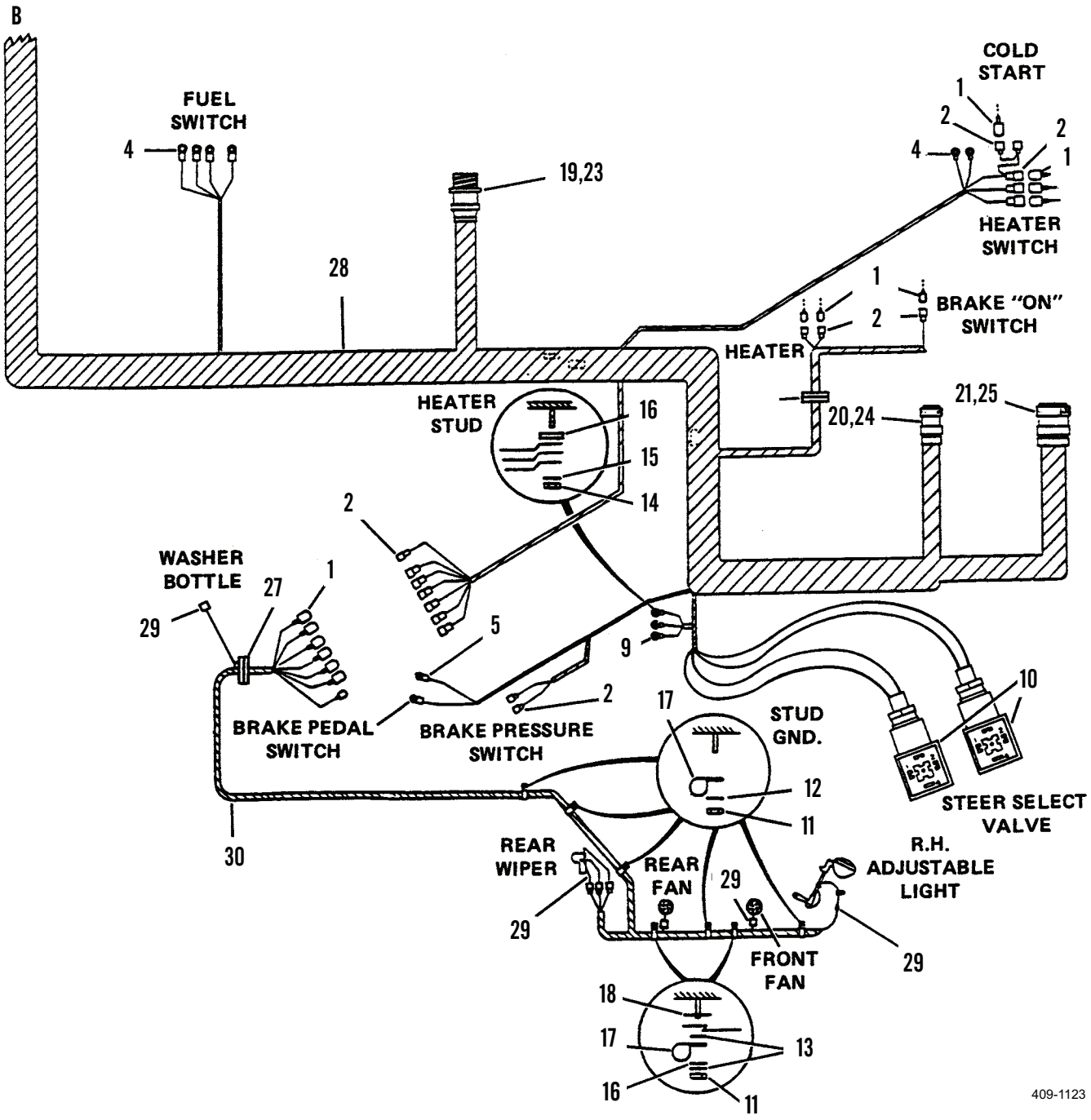
3. Disconnect eighteen connectors (4), twenty-seven connectors (5), connector (6), six connectors (7), thirty-four connectors (8) and eleven connectors (9) from devices indicated.
4. Disconnect two connectors (10) from steer select valve.
5. Remove fourteen nuts (11), ten lockwashers (12), six lockwashers (13), nut (14), lockwasher (15), five flatwashers (16), twelve clamps (17) and four lockwashers (18). Discard lockwashers.



CAB WIRING HARNESS MAINTENANCE - CONTINUED 0231 00

REMOVAL - CONTINUED

6. Remove cable clamps (19 thru 21) and disconnect connectors (22 thru 25).
7. Carefully push out two grommets (26) and grommet (27) from front harness section (28).
8. Remove front harness section (28).
9. Disconnect seven terminals (29) from devices indicated. Remove rear wire harness section (30) and grommet (27).



TEST AND INSPECTION

1. Check continuity of individual wires suspected of being open using an ohmmeter. Identify wire ends by the markers.
2. Check connectors (22 and 23) for loose or broken pins.
3. Check grommets (26 and 27) for tears or deterioration.
4. Check terminals and single connectors for poor joints with wire, or other defects.

INSTALLATION

NOTE

Connect all electrical leads as tagged during removal.

1. Secure rear wire harness section (30) with eight cable clamps (17), six nuts (11), six new lockwashers (12), four new lockwashers (13) and two flatwashers (16). Install grommet (27).
2. Insert R.H. adjustable light wire terminal (29) through cab wall. Connect terminal (29) to R.H. adjustable light.
3. Connect remaining six terminals (29) to devices indicated.
4. Connect connectors (22 thru 25) to original locations. Install cable clamps (19 thru 21).
5. Install two grommets (26) and grommet (27) to front harness section (28).
6. Connect eleven connector (9), thirty-four connectors (8), six connectors (7), connectors (6), twenty-seven connectors (5) and eighteen connectors (4) to devices indicated.
7. Secure leads to heater stud with flatwasher (16) and nut (14).
8. Secure leads to two ground studs under instrument panel with nuts (11), new lockwashers (13), flatwashers (16) and new lockwashers (18).
9. Connect forty-four female connectors (2) to male connectors (1).
10. Insert L.H. adjustable light connector (2) through hole in cab wall and plug into L.H. adjustable light. Install grommet (26) and four cable clamps (17).
11. Connect battery cables (WP 0107 00).

END OF WORK PACKAGE

MAIN WIRING HARNESS REPLACEMENT 0232 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Tag, marker (Item 57, WP 0323 00)

Lockwasher (13 and 17)

Equipment Condition

Battery cables disconnected (WP 0107 00)

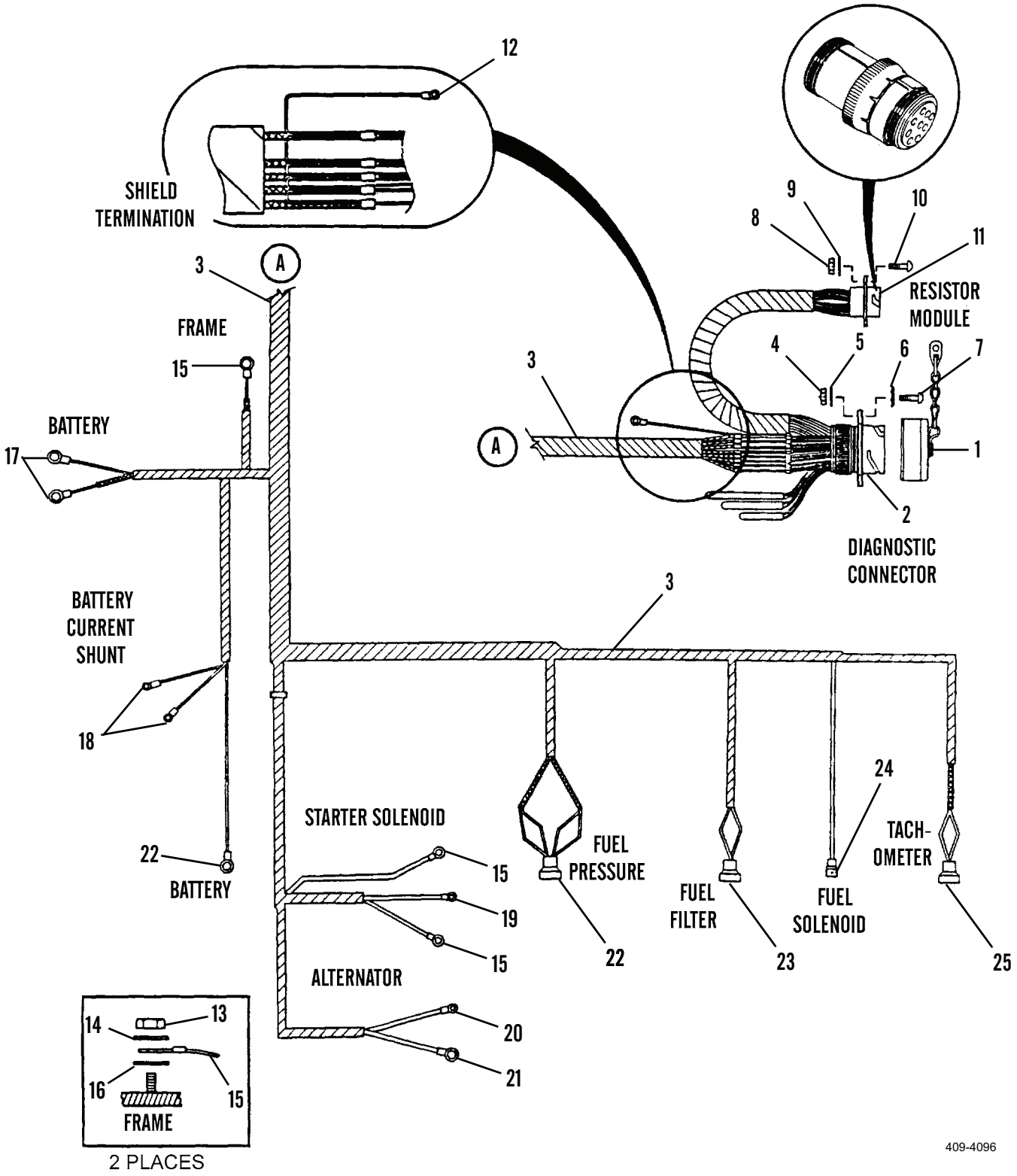
REMOVAL

NOTE

Tag all electrical connections before removing for use during installation.

1. Unplug 25 male connectors (1), three spade terminals (2) and female receptacle (3) from devices indicated.
2. Disconnect four terminal rings (4), two terminal rings (5), eight terminal rings (6), terminal ring (7), twelve terminal rings (8), terminal ring (9), terminal ring (10), terminal ring (24) and terminal ring (11) from devices indicated.
3. To disconnect ground terminal rings (6 and 7), remove five nuts (12), five lockwashers (13) and five flatwashers (14). Discard lockwashers.
4. Remove four capscrews (15), nuts (16), lockwashers (17) and cable clamps (18). Discard lockwashers.
5. Carefully push out four grommets (19).

REMOVAL

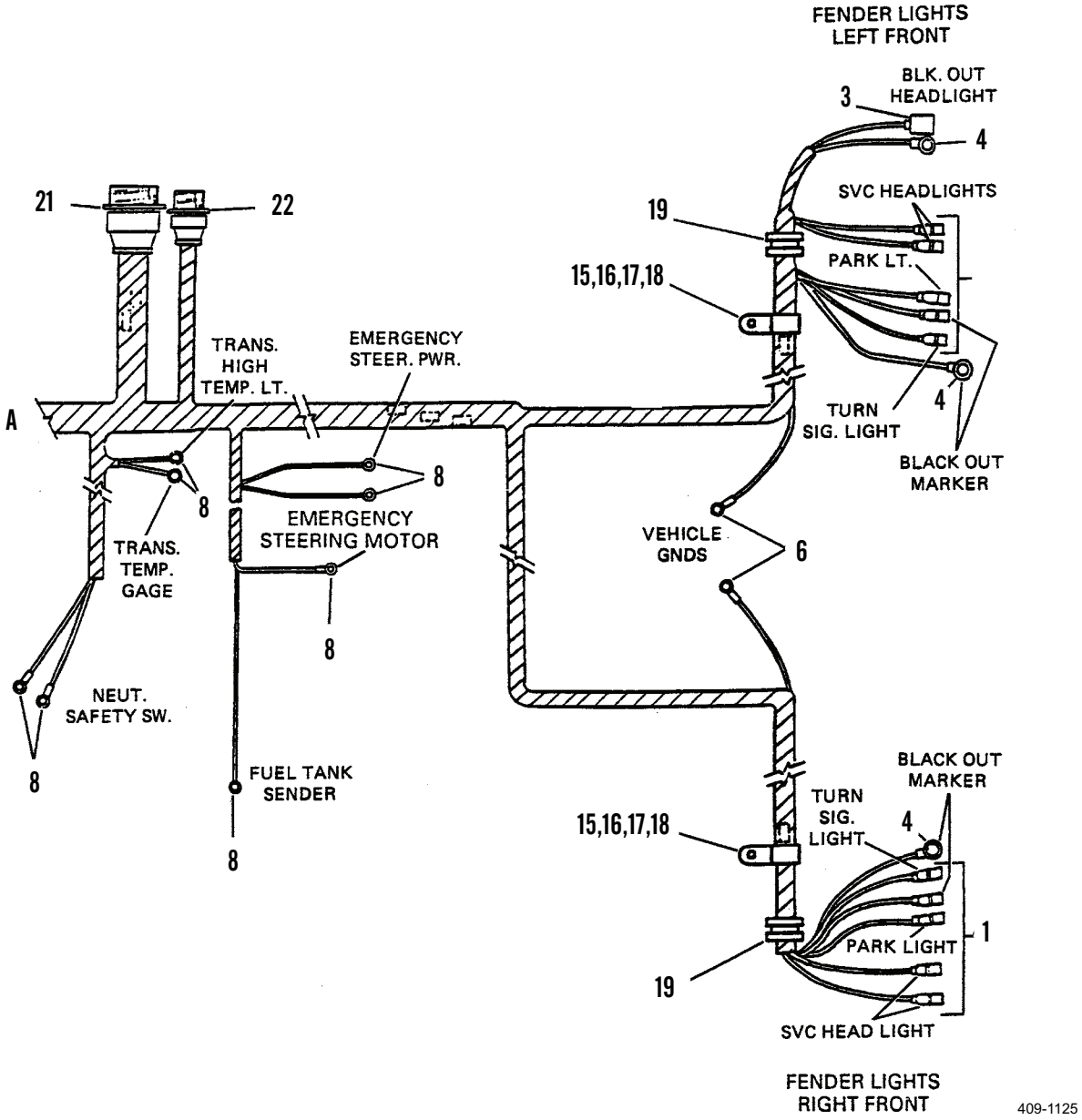

12
SHIELD TERMINATION
9
10
8
11
RESISTOR MODULE
3
A
FRAME
15
4
5
6
7
3
BATTERY
17
A
1
2
DIAGNOSTIC CONNECTOR
3
BATTERY CURRENT SHUNT
18
STARTER SOLENOID
22
BATTERY
15
19
15
FUEL PRESSURE
22
FUEL FILTER
23
24
FUEL SOLENOID
TACH-OMETER
25
ALTERNATOR
20
21
14
13
16
15
FRAME
2 PLACES
409-4096

REMOVAL - CONTINUED

6. Disconnect connectors (20 thru 22).
7. Remove main wiring harness (23).

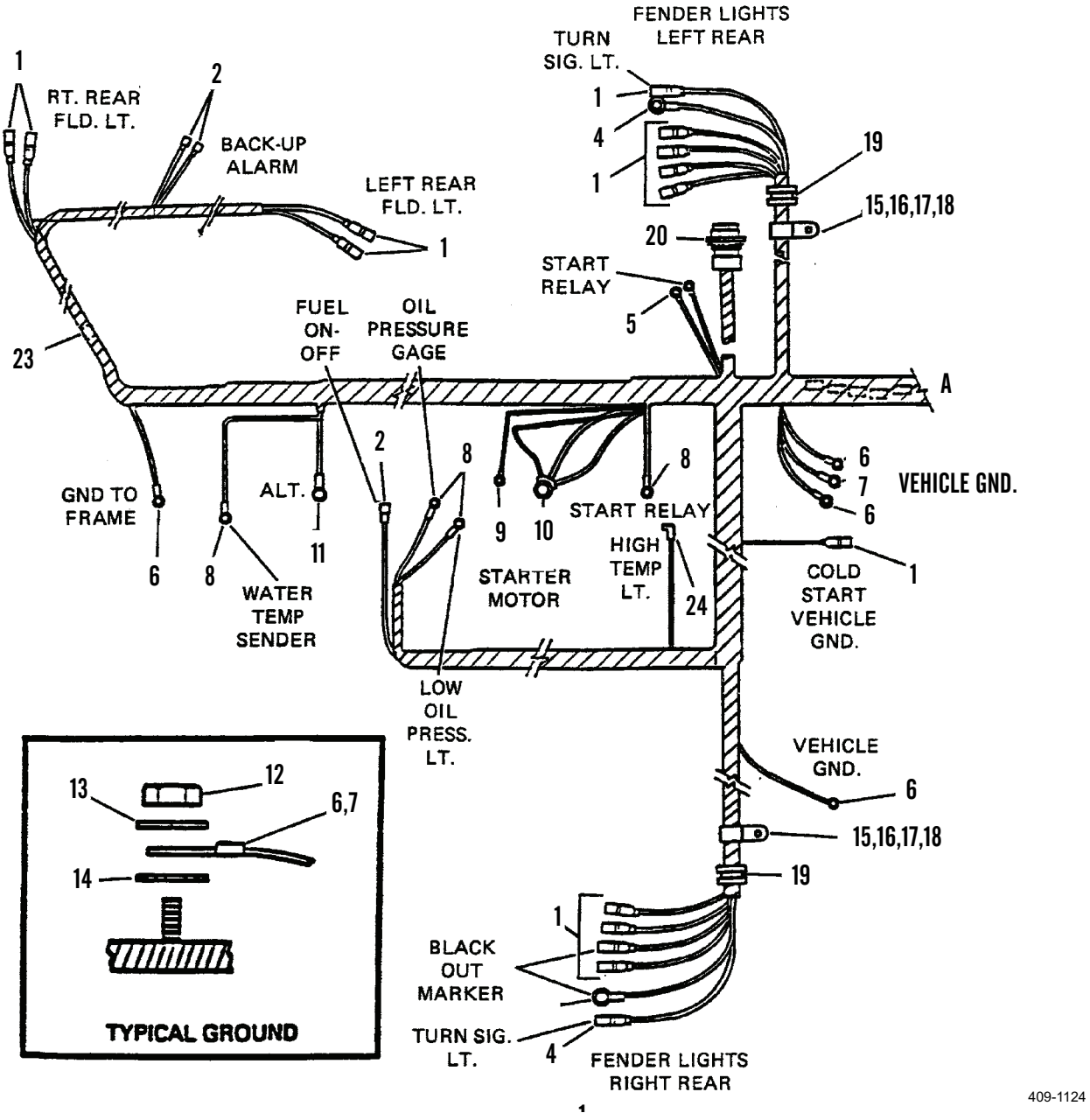
INSTALLATION

1. Secure main wire harness (23) with four cable clamps (18), four new lockwashers (17), four nuts (16) and four capscrews (15).
2. Insert wire harness branches through holes in frame and install four grommets (19).
3. Connect connectors (20 thru 22) to original locations.



INSTALLATION - CONTINUED

4. Connect ground terminal rings (6 and 7), install five nuts (12), five new lockwashers (13) and five flatwashers (14).
5. Connect four terminal rings (4), two terminal rings (5), eight terminal rings (6), terminal ring (7), twelve terminal rings (8), terminal ring (9), terminal ring (10), terminal ring (11) and terminal ring (24) to devices indicated.
6. Plug in 25 male connectors (1), three spade terminals (2) and female receptacle (3) to devices indicated.
7. Connect battery cables (WP 0107 00).



409-1124

END OF WORK PACKAGE

BOOM ELECTRICAL CABLE REPLACEMENT 0233 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Strap, tie down (Item 56, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Tape, electrical (Item 58, WP 0323 00)

Lockwasher (16, 23, 27 and 31)

Rope, 25 ft

References

WP 0107 00

WP 0111 00

Personnel Required

Two

Equipment Condition

Machine parked on level ground (TM 10-3930-660-10)

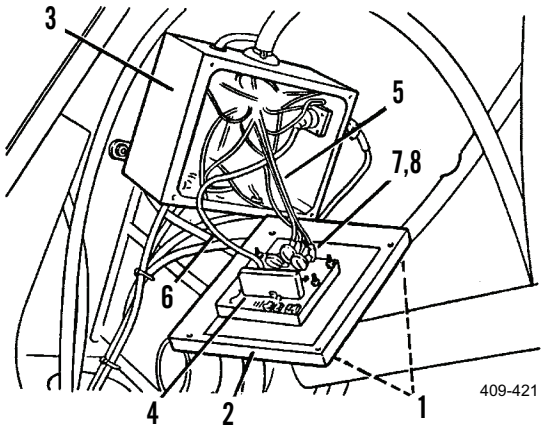
Load backrest removed from MLRS attachment, if stored (TM 10-3930-660-10)

REMOVAL

NOTE

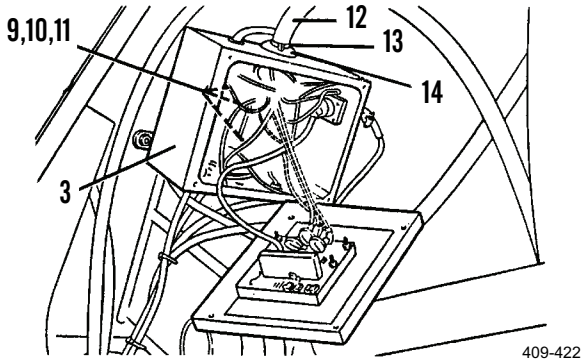
- If an individual wire in a wiring harness is broken, it is not necessary to discard entire wiring harness. Refer to *Repair* in WP 0111 00.
- Tag all electrical connections before removing for use during installation.

1. Start engine (TM 10-3930-660-10). Raise forks approximately one foot off ground. Stop engine (TM 10-3930-660-10).
2. Disconnect battery cables (WP 0107 00).
3. Loosen four screws (1) and separate cover (2) from boom electrical box (3).
4. Disconnect four electrical leads (5) at terminal strip (7) of circuit board (4).
5. Loosen four screws (8) on terminal strip (7) and remove leads (5).

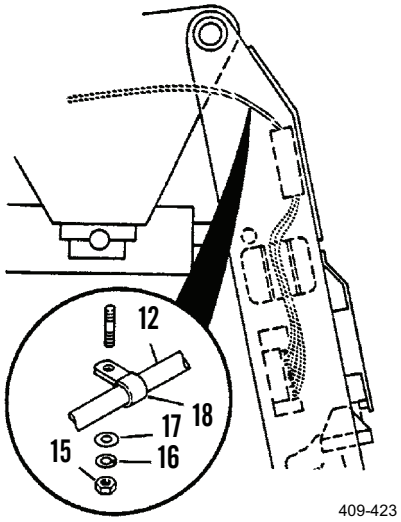


REMOVAL - CONTINUED

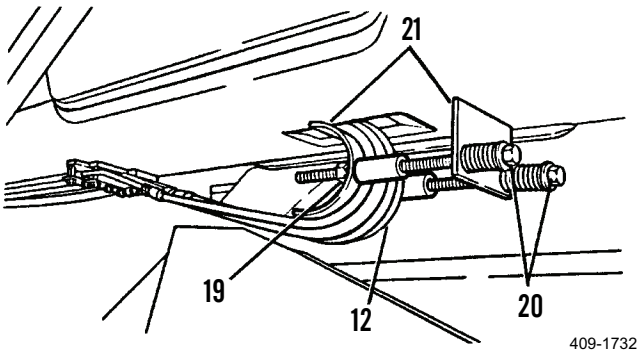
6. Disconnect electrical lead (9) on terminal strip (10) by loosening screw (11).
7. To remove boom electrical cable (12), cut two tie straps (13) where cable (12) enters electrical box (3). Discard tie straps.
8. Carefully pull cable (12) from electrical box (3).



9. Remove nut (15), lockwasher (16) and flatwasher (17) securing clamp (18) and cable (12) to MLRS attachment. Discard lockwasher.



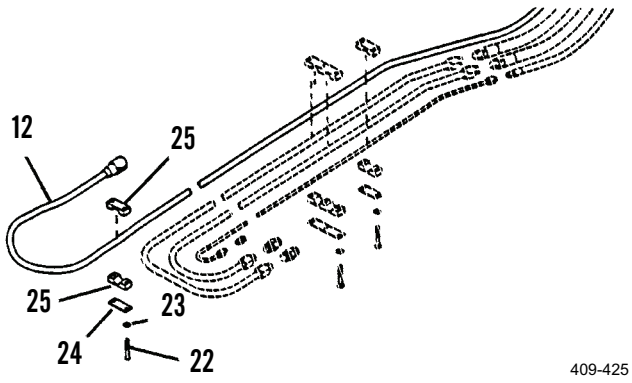
10. Loosen two jamnuts (19) and two capscrews (20) at hose tensioner (21) to release tension on boom electrical cable (12).



BOOM ELECTRICAL CABLE REPLACEMENT - CONTINUED 0233 00

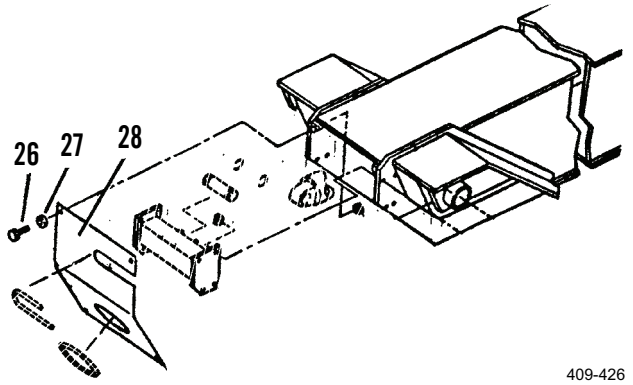
REMOVAL - CONTINUED

11. Remove two capscrews (22), two lockwashers (23) and one cover plate (24) at each set of clamp halves (25). Discard lockwashers.
12. Remove clamp halves (25) from electrical cable (12).



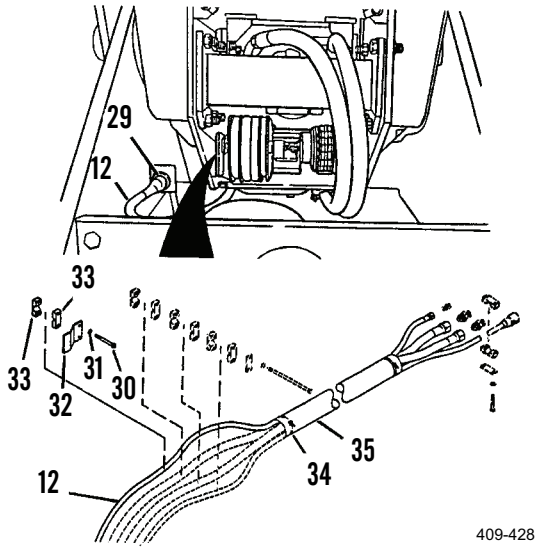
409-425

13. Remove four capscrews (26), four lockwashers (27) and cover (28) from rear of outer boom. Discard lockwashers.



409-426

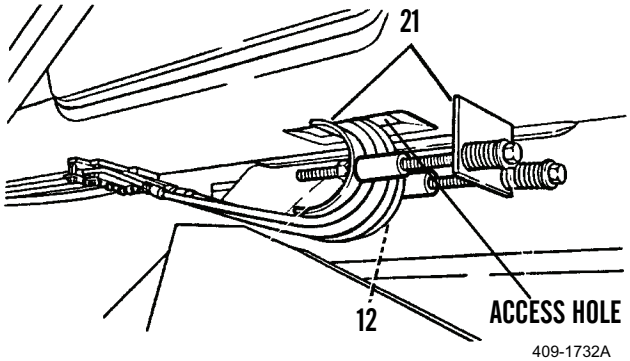
14. Unplug boom electrical cable (12) at connector (29).
15. Remove two capscrews (30), lockwashers (31), cable guide bracket (32) and clamp halves (33) from boom electrical cable (12). Discard lockwashers.
16. Remove tie strap (34) from end of sleeve (35) inside boom.
17. Tie a rope of sufficient length to end of boom electrical cable (12) at front of boom.
18. Wrap one end of rope around cable (12) several times and secure with knot.
19. Cover knot area with electrical tape to prevent knot from snagging inside of boom.



409-428

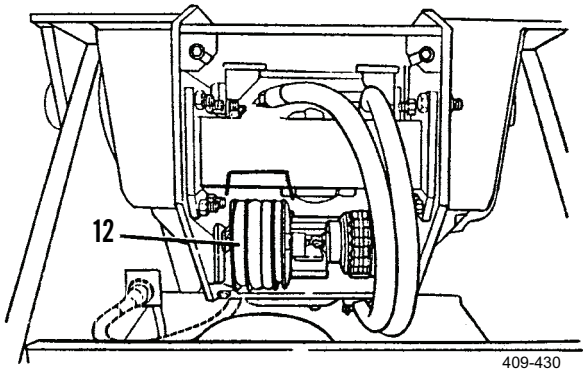
REMOVAL - CONTINUED

20. Tie other end of rope to MLRS attachment to prevent rope from being pulled entirely through boom during cable removal.
21. Remove electrical cable (12) from inside boom.
22. Carefully pull cable (12) at rear of boom until rope appears.
23. Carefully pull cable (12) through access hole at hose tensioner (21) until rope appears.
24. Untie rope end from cable (12) and tie rope end to hose tensioner assembly (21).



INSTALLATION

1. Untie rope end from hose tensioner (21) and tie rope end to electrical cable (12). Cover knot area with electrical tape to prevent knot from snagging side boom.



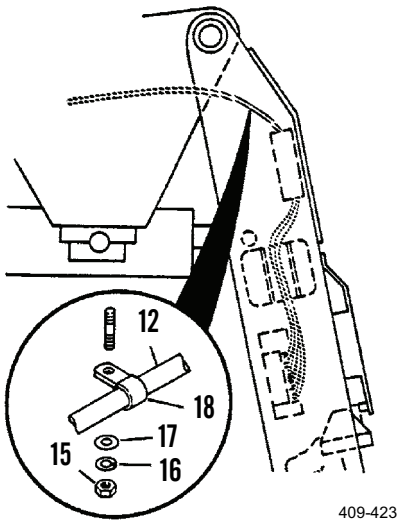
2. Have an assistant feed cable (12) through access hole at hose tensioner (21). Pull rope from rear of boom until cable appears.

INSTALLATION - CONTINUED

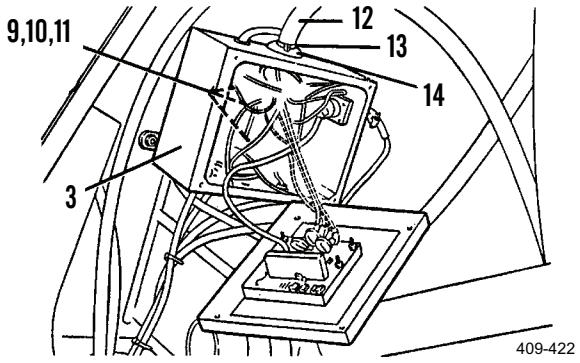
NOTE

- Guide cable over pulley at rear of boom before pulling cable tight in step 3. Be sure cable is properly positioned in sheave of pulley.
- Be sure cable is positioned through sleeve inside boom during step 3.

3. Have an assistant feed cable (12) through hole at rear of boom. Carefully pull rope at front of boom until cable (12) appears.
4. Untie rope at front of boom from cable (12) and MLRS attachment.
5. Secure clamp (18) and cable (12) to underside of MLRS attachment with flatwasher (17), new lockwasher (16) and nut (15).

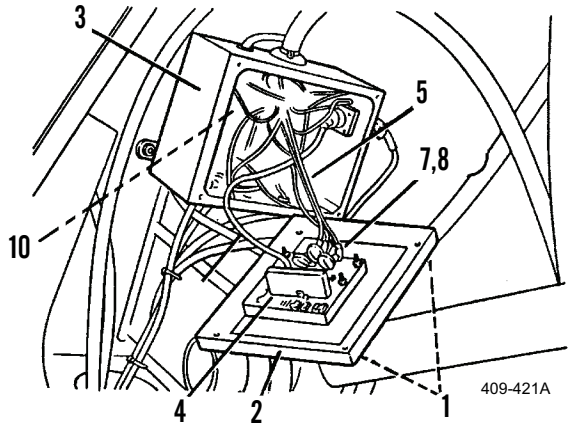


6. Carefully pull cable through grommet (14) and into electrical box (3).
7. Secure electrical cable (12) to electrical box (3) with two new tie straps (13).
8. Connect boom cable leads (9) to boom electrical box (3), as tagged.
9. Place electrical leads (9), as tagged, on terminal strips (10) inside electrical box (3).
10. Tighten screws (11) on terminal strips (10) to secure leads (9).



INSTALLATION - CONTINUED

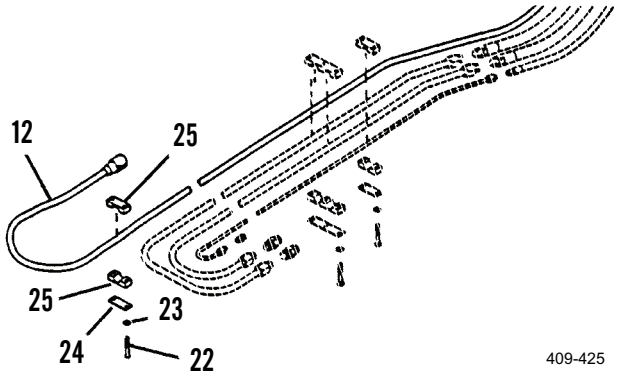
11. Connect four electrical leads (5) at autoleveler circuit board (4) as tagged.
12. Install cover (2) to electrical box (3) with four screws (1).



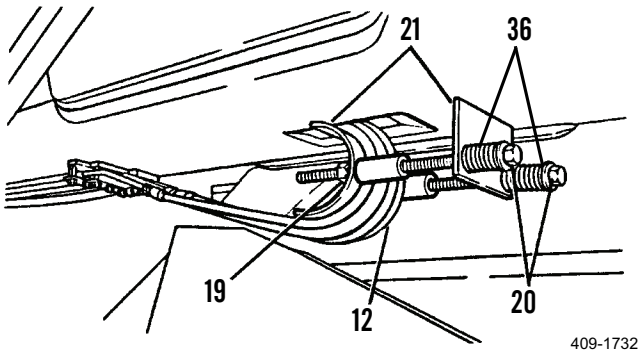
NOTE

Install clamp assembly closest to hose tensioner first.

13. Have assistant pull boom cable snug, but not tight, from rear of hose tensioner (21).
14. Have assistant continue to hold cable (12) snug.
15. Secure cable (12) to underside of outer boom with cable clamp halves (25), cover plates (24), new lockwashers (23) and capscrews (22).

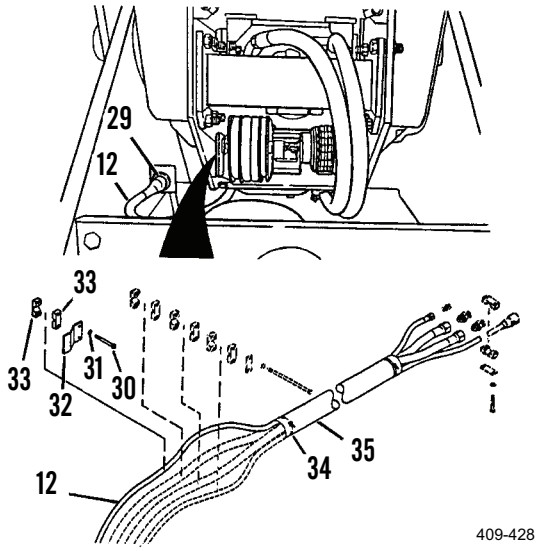


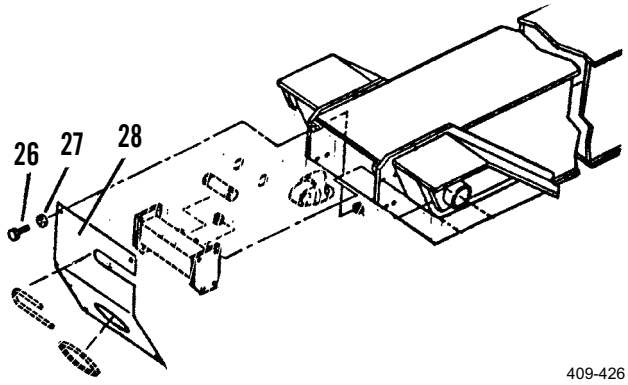
16. Adjust tension of cable (12) at tensioner (21).
17. Adjust two capscrews (19) until length of compressed spring (36) is 2 1/4 - 2 1/2 in. (57.15-63.5 mm) long.
18. Tighten two jamnuts (19) after adjusting two capscrews (20).



INSTALLATION - CONTINUED

19. Install new tie strap (34) to end of sleeve (35) inside boom.
20. Install clamp halves (33), cable guide bracket (32), two new lockwashers (31) and two capscrews (30) to secure cable (12) to boom.
21. Plug boom electrical cable (12) into connector (29).
22. Check for proper installation of boom electrical cable (12).
23. Connect batteries (WP 0107 00).
24. Start engine.
25. Test all boom and attachment functions to ensure proper cable installation.
26. Check that cable and hoses track properly in the boom.
27. Check boom hose and cable tension and adjust, if necessary.
28. Position cover (28) on rear of outer boom and secure with four new lockwashers (27) and four capscrews (26).





29. Install load backrest to MLRS attachment, if removed (TM 10-3930-660-10).
30. Operate boom and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

STE/ICE-R WIRING HARNESS MAINTENANCE 0234 00

THIS WORK PACKAGE COVERS

Removal, Testing and Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Strap, tiedown (Item 56, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Materials/Parts - Continued

Lockwasher (5, 9 and 14)

Equipment Condition

Battery cables disconnected (WP 0107 00)

STE/ICE-R resistor removed (WP 0086 00)

REMOVAL

NOTE

Tag all electrical leads before removing to ensure correct installation.

1. Remove cover (1) from diagnostic connector (2) of STE/ICE-R wiring harness (3).
2. Remove four nuts (4), lockwashers (5), washers (6), screws (7), chain of cover (1) and diagnostic connector (2).
3. Remove four nuts (8), lockwashers (9), screws (10) and STE /ICE-R resistor connector (11). Discard lockwashers.
4. Disconnect ring terminal (12).
5. Remove nut (13), lockwasher (14), one ring terminal (15) and washer (16). Discard lockwasher.
6. Disconnect two additional ring terminals (15).
7. Disconnect three ring terminals (17).
8. Disconnect two ring terminals (18).
9. Disconnect ring terminals (19, 20 and 21).
10. Disconnect connectors (22, 23, 24 and 25).
11. Remove 12 tiedown straps that secure STE/ICE-R wiring harness (3) and remove harness.

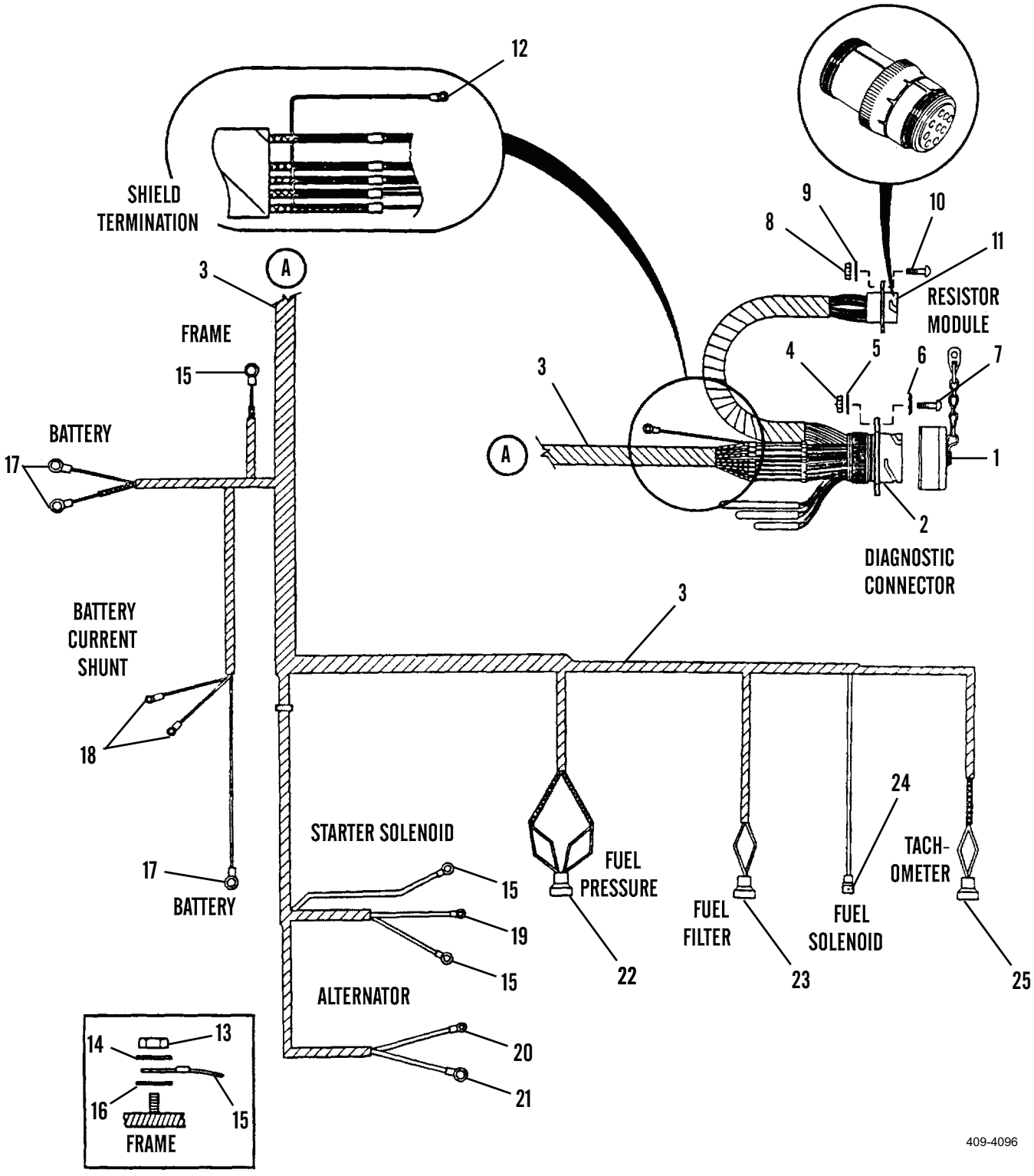
TESTING AND INSPECTION

1. Using an ohmmeter, check continuity of individual wires suspected of being open. Identify wire ends by the markers.
2. Check connectors (2, 11, 22, 23, 24 and 25) for loose or broken pins.
3. Check ring terminals for poor joints with wire and other defects.

INSTALLATION

1. Position STE/ICE-R wiring harness (3) and connect connectors (22, 23, 24 and 25).
2. Connect ring terminals (19, 20 and 21).
3. Connect two ring terminals (18).
4. Connect three ring terminals (17).
5. Connect two ring terminals (15).
6. Install additional ring terminal (15) with washer (16), new lockwasher (14) and nut (13).
7. Connect ring terminal (12).
8. Install STE/ICE-R resistor connector (11) with four screws (10), new lockwashers (9) and nuts (8).
9. Install diagnostic connector (2) and chain of cover (1) with four screws (7), washers (6), new lockwashers (5) and four nuts (4).
10. Install cover (1) to diagnostic connector (2).
11. Secure STE/ICE-R wiring harness (3) with 12 tiedown straps.
12. Install STE/ICE-R resistor (WP 0086 00).
13. Connect battery cables (WP 0107 00).

INSTALLATION - CONTINUED



END OF WORK PACKAGE

ELECTRIC JOYSTICK MAINTENANCE 0235 00

THIS WORK PACKAGE COVERS

Removal of Microswitches, Removal of Handle Pushbutton Switch, Inspection, Installation of Handle Pushbutton Switch, Installation of Microswitches, Testing and Adjustment of Joystick “Threshold” and “Max Out” Settings

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic’s (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Bowed washer (12)

References

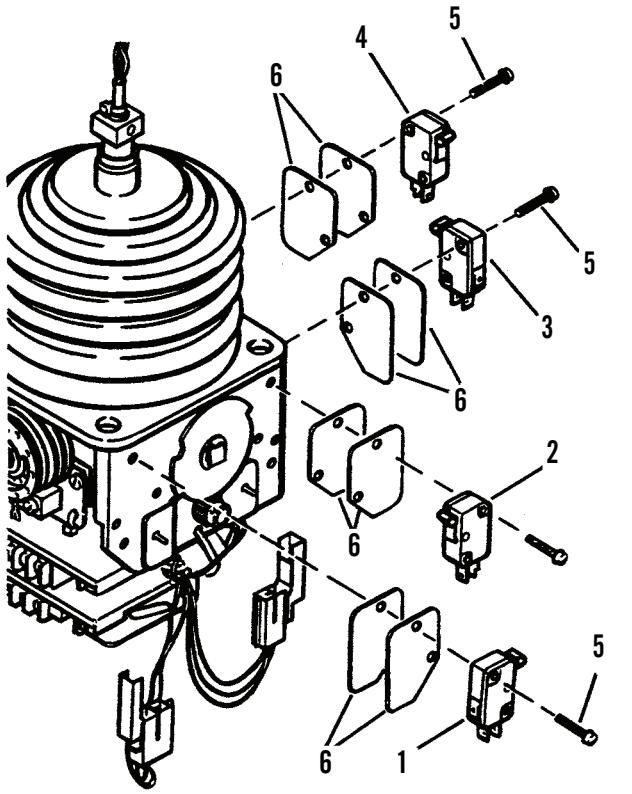
TM 10-3930-660-10

Equipment Condition

Electric joystick removed (WP 0078 00)

REMOVAL OF MICROSWITCHES

1. Disconnect plug from microswitch (1).
2. Remove two screws (5), microswitch (1) and two spacers (6).
3. Repeat steps 1 and 2 for microswitches (2, 3 and 4).



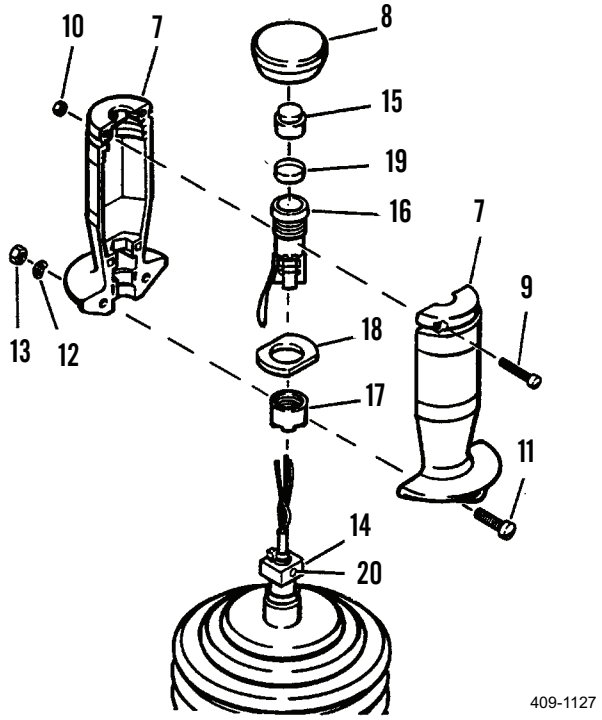
409-1126

REMOVAL OF HANDLE PUSHBUTTON SWITCH

1. Pull off boot (8) from handle sections (7).
2. Remove two screws (9) and two nuts (10) at top of handle sections (7).
3. Remove two screws (11), two bowed washers (12) and two nuts (13) at bottom of handle sections (7). Discard bowed washers.
4. Separate handle sections (7) and remove them from shaft coupling (14).
5. Remove actuating button (15).
6. Remove pushbutton switch (16), nut (17) and flange (18) as a unit from handle sections (7).

WARNING

- 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 caution when disassembling them, to avoid injury.



7. Carefully unsolder all leads from pushbutton switch (16).
8. Remove nut (17) and flange (18) from pushbutton switch (16).
9. Remove cover (19) from pushbutton switch (16).

INSPECTION

1. Check for loose or disconnected plugs at switches (1 thru 4).
2. Check all switches for loose mounting hardware or visible damage.

INSTALLATION OF HANDLE PUSHBUTTON SWITCH

1. Assemble parts (17 thru 19) and solder four leads to pushbutton switch (16).
2. Install cover (19) to pushbutton switch.
3. Install flange (18) and nut (17) to pushbutton switch (16).

NOTE

Pin numbers are printed on body of pushbutton switch.

4. Solder green electrical lead of joystick to pin 1 of pushbutton switch (16).
5. Solder yellow electrical lead of joystick to pin 2 of pushbutton switch (16).
6. Solder green jumper lead to pin 1 and pin 3 of pushbutton switch (16).

INSTALLATION OF HANDLE PUSHBUTTON SWITCH - CONTINUED

7. Solder red electrical lead of joystick to pin 4 of pushbutton switch (16).

NOTE

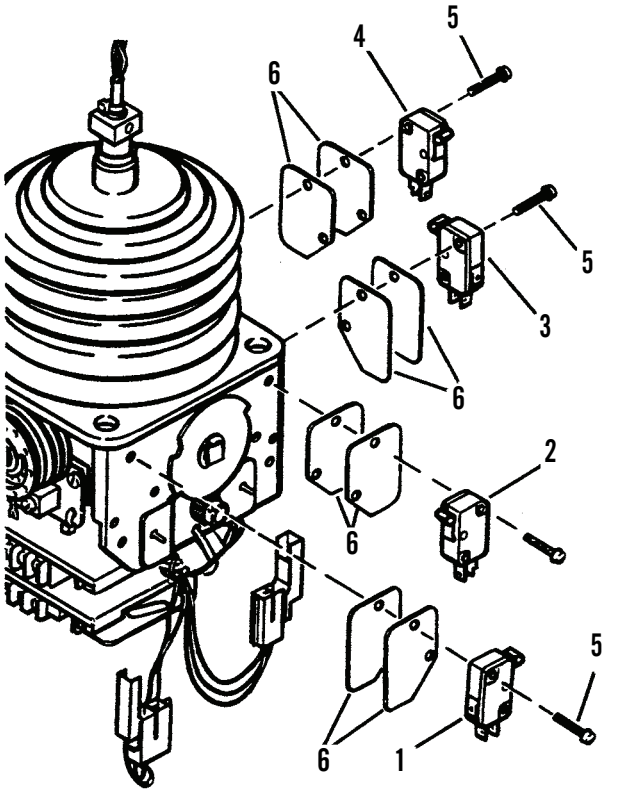
Align handle section on shaft coupling so that coupling set screw is facing center of handle section.

8. Place one handle section (7) on shaft coupling (14).

NOTE

Place switch flange in lowest slot with flat surface of flange facing center of handle section.

9. Install pushbutton switch (16), flange (18) and nut (17) as a unit to handle section (7).
10. Install actuating button (15) with smaller diameter of button extending through top of handle section (7).
11. Place other handle section (7) on shaft coupling (14).
12. Install two screws (11), two new bowed washers (12) and two nuts (13) at bottom of handle sections (7).
13. Install two screws (9) and two nuts (10) at top of handle sections (7).
14. Place boot (8) on handle sections (7).



409-1126

INSTALLATION OF MICROSWITCHES

NOTE

- Plug with red and black leads from upper circuit board connects to microswitch.
- Plug with white, blue and yellow leads from upper circuit board connects to microswitch.
- Plug with red and black leads from lower circuit board connects to microswitch.
- Plug with white, blue and yellow leads from upper circuit board connects to microswitch.

1. Secure microswitch (1) and two spacers (6) with two screws (5).
2. Connect plug to microswitch (1).
3. Repeat steps 1 and 2 for microswitches (2 thru 4).

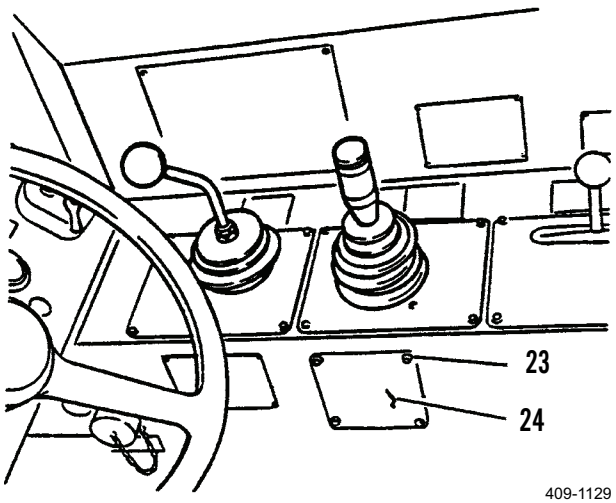
TESTING AND ADJUSTING OF JOYSTICK "THRESHOLD" AND "MAX OUT" SETTINGS

1. Install electric joystick (WP 0078 00).

WARNING

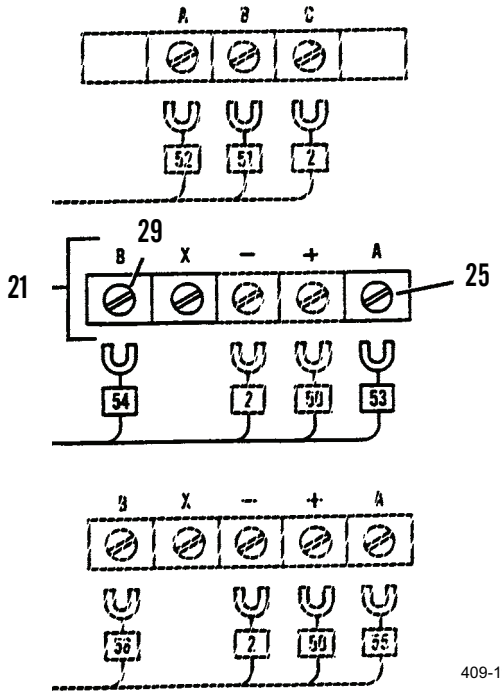
Take necessary precautions to ensure adequate personal safety while testing electrical leads when electrical power is connected. Failure to do so can result in injury or death.

2. Remove four capscrews (23) and plate (24).
3. Measure current flow to upper circuit board (21). If necessary, adjust threshold and max out controls.

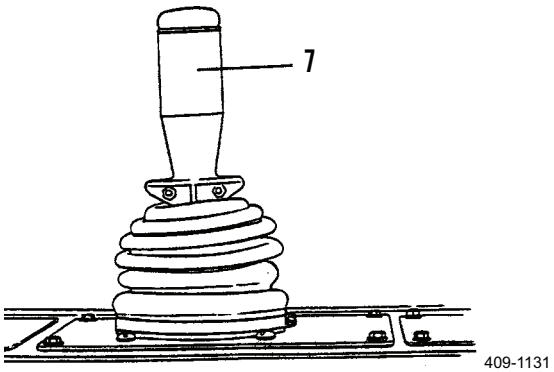


409-1129

4. Loosen screw (25) at terminal A of upper circuit board (21) and disconnect electrical lead no. 53.
5. Connect positive (+) lead of suitable ammeter to terminal A of upper circuit board (21).
6. Connect negative (-) lead of ammeter to disconnected electrical lead no. 53.
7. Turn starter switch to the RUN position but do not start the engine (TM 10-3930-660-10).
8. Slowly move joystick handle (7) to the left until indicator light (26) just comes on. Ammeter reading should be between 300 and 340 mA.



409-1130



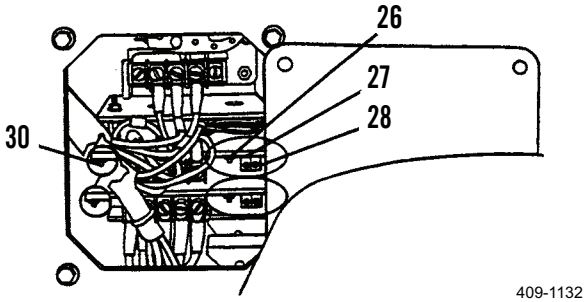
409-1131

TESTING AND ADJUSTMENT OF JOYSTICK "THRESHOLD" AND "MAX OUT" SETTINGS - CONTINUED

NOTE

During step 9, turn threshold control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

9. If reading in step 8 was not within limits of 300 to 340 mA, adjust threshold control (27) and repeat step 8 until ammeter reads approximately 320 mA.



10. Move joystick handle (7) fully to the left and observe ammeter reading. Reading should be between 600 and 640 mA.

NOTE

During step 11, turn max out control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

11. If reading in step 10 was not within limits of 600 to 640 mA, adjust max out control (28) and repeat step 10 until ammeter reads approximately 620 mA.
12. Turn starter switch off (TM 10-3930-660-10).
13. Disconnect leads of ammeter. Secure electrical lead no. 53 to terminal A of top circuit board (21) with screw (25).
14. Loosen screw (29) at terminal B of top circuit board (21) and disconnect electrical lead no. 54.
15. Connect positive (+) lead of suitable ammeter to terminal B to top circuit board (21).
16. Connect negative (-) lead of ammeter to disconnected electrical lead no. 54.
17. Turn starter switch to the RUN position but do not start the engine (TM 10-3930-660-10).
18. Slowly move joystick handle (7) to the right until indicator light (30) just comes on. Ammeter reading should be between 300 and 340 mA.

NOTE

During step 19, turn threshold control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

19. If reading in step 18 was not within limits of 300 to 340 mA, adjust threshold control (27) and repeat step 18 until ammeter reads approximately 320 mA.
20. Move joystick handle (7) fully to the right and observe ammeter reading. Reading should be between 600 to 640 mA.

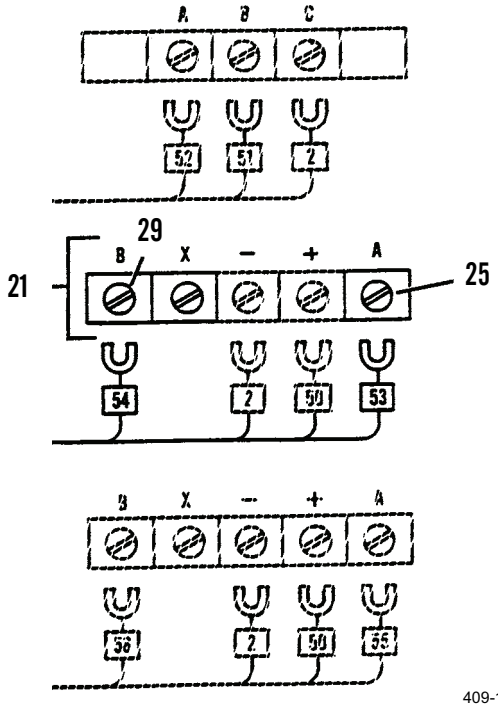
NOTE

During step 21, turn max out control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

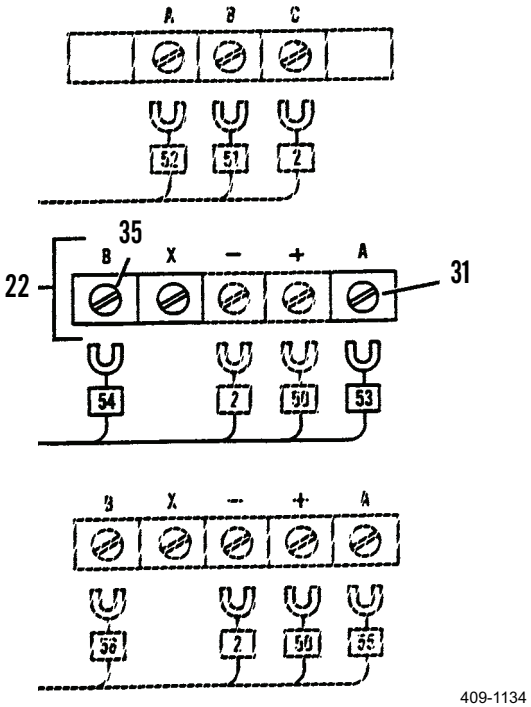
21. If reading in step 20 was not within limits of 600 to 640 mA, adjust max out control (28) and repeat step 20 until ammeter reads approximately 620 mA.

TESTING AND ADJUSTMENT OF JOYSTICK "THRESHOLD" AND "MAX OUT" SETTINGS - CONTINUED

22. Turn starter switch off (TM 10-3930-660-10).
23. Disconnect leads of ammeter. Secure electrical lead no. 54 to terminal B of top circuit board (21) with screw (29).
24. Repeat steps 4 thru 13 and check that current readings are still within limits. Readjust threshold (27) and max out (28) controls as required.

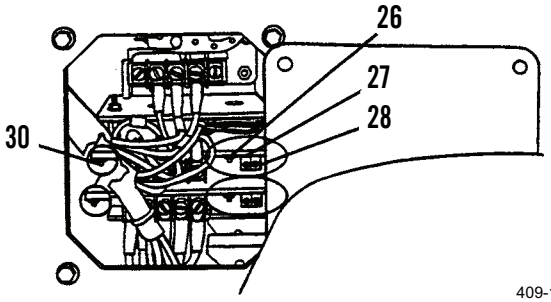


409-1130



409-1134

25. Measure current flow to lower circuit board (22). If necessary, adjust threshold and max out controls.
26. Loosen screw (31) at terminal A of bottom circuit board (22) and disconnect electrical lead no. 55.
27. Connect positive (+) lead of suitable ammeter to terminal A of bottom circuit board (22).
28. Connect negative (-) lead of ammeter to disconnected electrical lead no. 55.
29. Turn starter switch to RUN position but do not start the engine (TM 10-3930-660-10).



409-1132

TESTING AND ADJUSTMENT OF JOYSTICK "THRESHOLD" AND "MAX OUT" SETTINGS - CONTINUED

30. Slowly move joystick handle (7) rearward until indicator light (32) just comes on. Ammeter reading should be between 300 and 340 mA.

NOTE

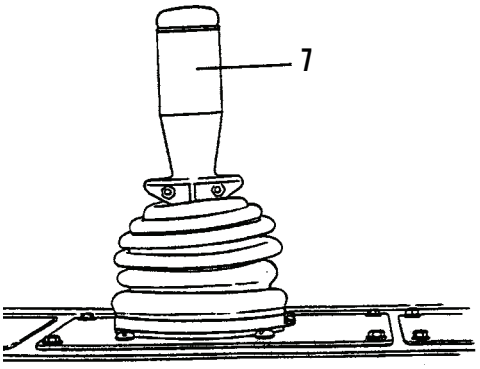
During step 31, turn threshold control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

31. If reading in step 30 was not within limits of 300 to 340 mA, adjust threshold control (33) and repeat step 30 until ammeter reads approximately 320 mA.
32. Move joystick handle (3) fully rearward and observe ammeter reading. Reading should be between 600 and 640 mA.

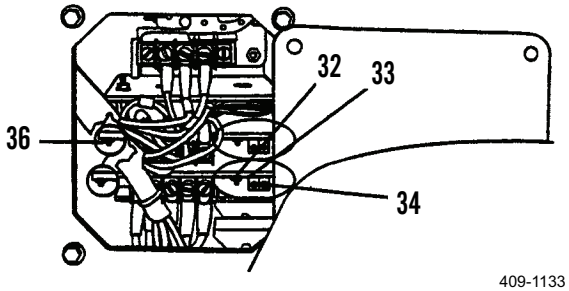
NOTE

During step 33, turn max out control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

33. If reading in step 32 was not within limits of 600 to 640 mA, adjust max out control (34) and repeat step 32 until ammeter reads approximately 620 mA.
34. Turn starter switch off (TM 10-3930-660-10).
35. Disconnect leads of ammeter. Secure electrical lead no. 55 to terminal A of bottom circuit board (22) with screw (31).
36. Loosen screw (35) at terminal B of bottom circuit board (22) and disconnect electrical lead no. 56.
37. Connect positive (+) lead of suitable ammeter to terminal B of bottom circuit board (22).
38. Connect negative (-) lead of ammeter to disconnected electrical lead no. 56.
39. Turn starter switch to the RUN position but do not start the engine (TM 10-3930-660-10).



409-1131



409-1133

40. Move joystick handle (7) forward until indicator light (36) just comes on. Ammeter reading should be between 300 and 340 mA.

NOTE

During step 41, turn threshold control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

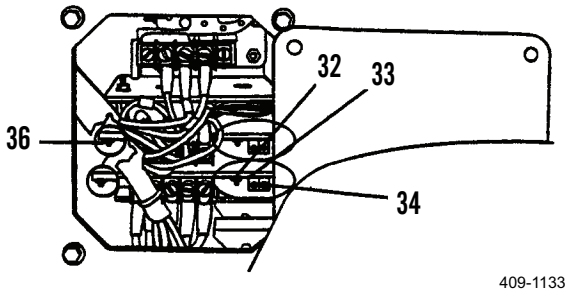
41. If reading in step 40 was not within limits of 300 to 340 mA, adjust threshold control (33) and repeat step 30 until ammeter reads approximately 320 mA.
42. Move joystick handle (7) fully forward and observe ammeter reading. Reading should be between 600 and 640 mA.

TESTING AND ADJUSTMENT OF JOYSTICK "THRESHOLD" AND "MAX OUT" SETTINGS - CONTINUED

NOTE

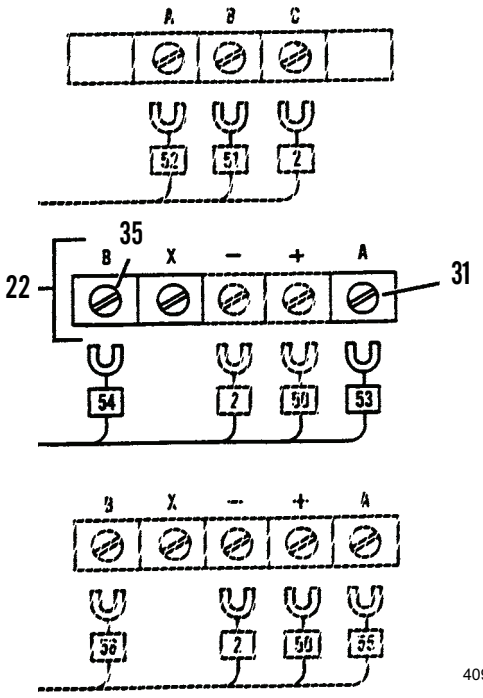
During step 43 turn max out control counterclockwise to lower ammeter reading and clockwise to raise ammeter reading.

43. If reading in step 42 was not within limits of 600 to 640 mA, adjust max out control (34) and repeat step 42 until ammeter reads approximately 620 mA.

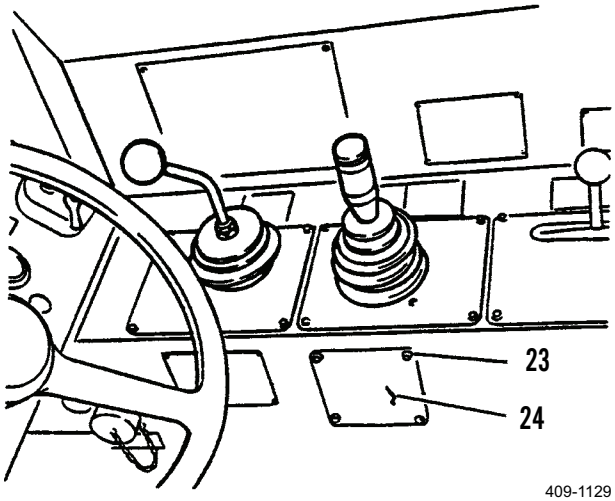


409-1133

44. Turn starter switch off (TM 10-3930-660-10).
45. Disconnect leads of ammeter. Secure electrical lead no. 56 to terminal B of bottom circuit board (22) with screw (35).
46. Repeat steps 25 thru 45 and check that current readings are still within limits. Readjust threshold (33) and max out (34) controls as required.
47. Secure plate (24) with four capscrews (23).



409-1134



409-1129

48. Operate joystick and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TORQUE CONVERTER REPLACEMENT 0236 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 00325 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Cloth, emery (Item 11, WP 0323 00)

Lockwasher (11)

Materials/Parts - Continued

Seal (13)

Starwasher (6)

References

WP 0316 00

WP 0317 00

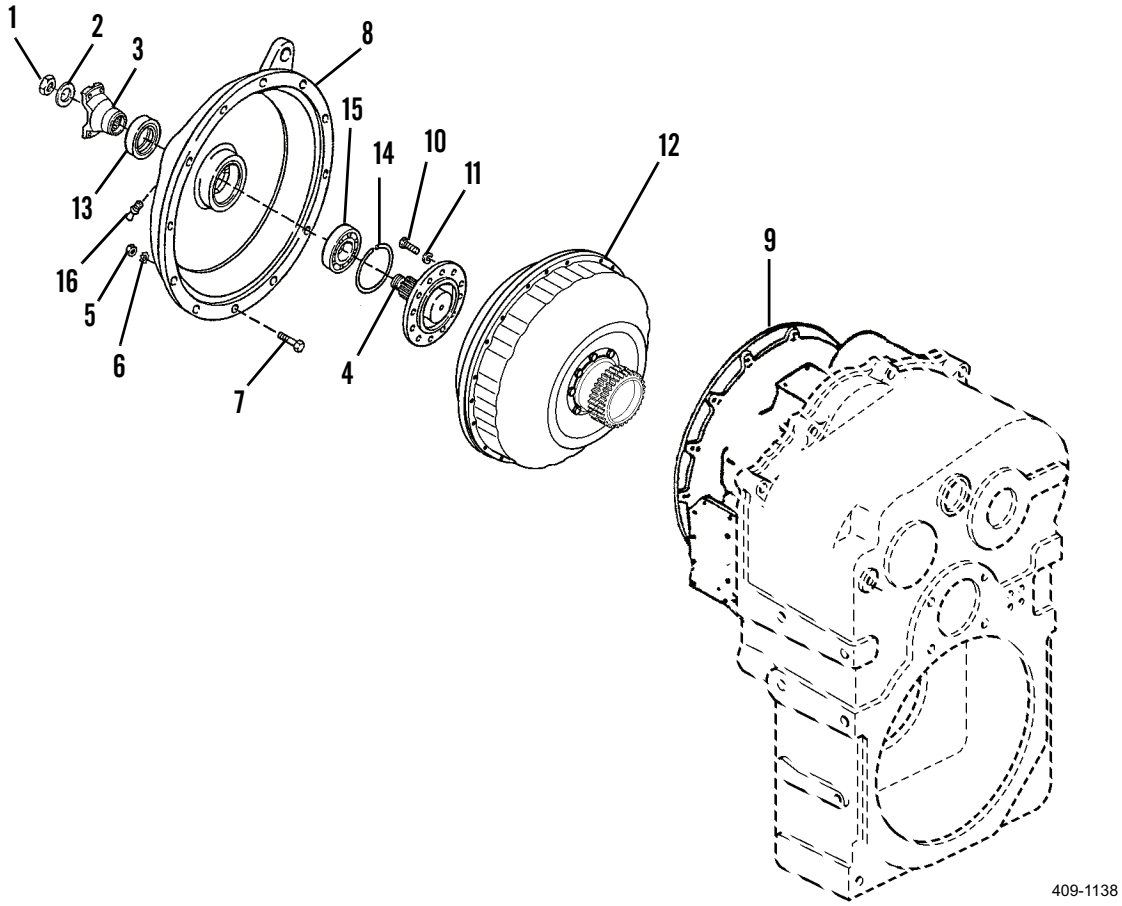
TM 10-3930-660-10

Equipment Condition

Transmission driveshaft removed (WP 0119 00)

REMOVAL

1. Remove nut (1), washer (2) and yoke (3) from torque converter input shaft (4).
2. Remove twelve hex nuts (5), starwashers (6) and capscrews (7) from torque converter cover (8). Remove torque converter cover and discard starwashers.
3. Remove torque converter cover (8) from transmission bell housing (9) and place on clean workbench with front cover facing up.
4. If required, remove twelve capscrews (10), lockwashers (11) and converter input shaft (4) from torque converter assembly (12). Discard lockwashers.
5. If required, remove seal (13), snap ring (14) and bearing (15) from torque converter cover (8). Discard seal.
6. If required, remove grease fitting (16) from torque converter cover (8).



CLEANING

1. Remove all rust and corrosion from torque converter input shaft (4) with emery cloth.
2. See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Check torque converter input shaft (4) for burrs and damage to splines and shaft. If damaged, replace input shaft.
2. See *Inspection* instructions (WP 0317 00).

INSTALLATION

1. If removed, install grease fitting (16) to torque converter cover (8).

NOTE

Apply a sufficient amount of grease to bearing prior to installation.

2. If removed, install new seal (13), bearing (15) and snap ring (14) to torque converter cover (8).
3. If removed, position torque converter input shaft (4) to torque converter assembly (12) and secure with twelve capscrews (10), and new lockwashers (11).

CAUTION

Use extreme care not to damage input shaft during installation of torque converter assembly.

NOTE

- Fill torque converter with one quart of clean lubricating oil and occasionally tip the converter to the side to allow oil to flow to bottom of the torque converter.
- Clean any spilled oil from inside of bell housing assembly prior to and after installation of torque converter assembly.
- Check torque converter assembly for free movement and is properly seated in bell housing.

4. Install torque converter assembly (12) into transmission bell housing (9).
5. Position torque converter cover (8) on torque converter assembly (12) and secure with twelve hex nuts (5), new starwashers (6) and capscrews (7).
6. Install yoke (3), washer (2) and nut (1). Torque nut to 300-350 lb-ft (407-475 Nm).
7. Install transmission driveshaft (WP 0119 00).
8. Operate equipment and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION ASSEMBLY REPLACEMENT 0237 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 10,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Strap, tie down (Item 56, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Cotter pin (11)

Lockwashers (2, 5, 10, 34 and 47)

Materials/Parts - Continued

O-ring (45 and 49)

Wood block

References

WP 0173 00

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Transmission oil drained (WP 0118 00)

Transmission cover removed (WP 0150 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 3,000 psi (20685 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 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

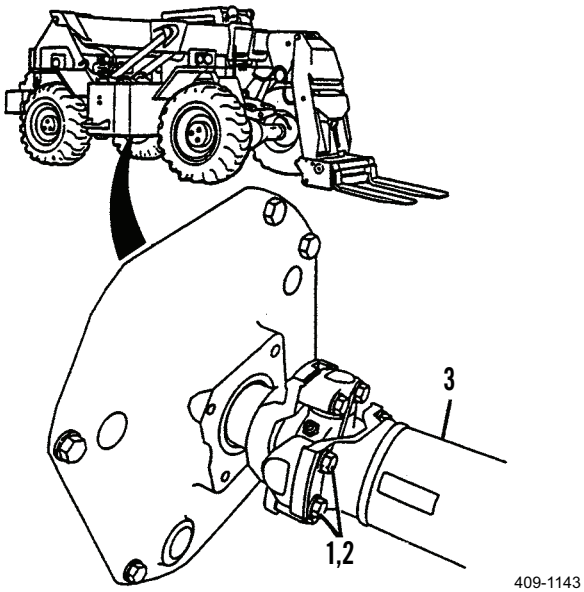
Wipe the area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug hoes after removing lines. Contamination of the hydraulic system could result in premature failure. Use metal caps when specified.

REMOVAL - CONTINUED

NOTE

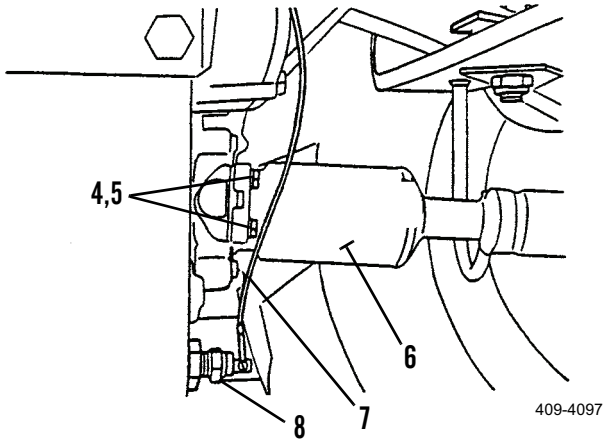
- If more than one hydraulic line is to be removed, identify lines to ensure proper installation. Use container to catch any hydraulic oil that may drain from system.
- Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on hydraulic components and hoses clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.
- Tag all electrical connections before removing for use during installation.

1. Raise boom to maximum height (TM 10-3930-660-10). Use a hoist with sling or other device to support boom.
2. Remove four capscrews (1), four lockwashers (2) and disconnect front propeller shaft (3). Discard lockwashers. Carefully lower front propeller shaft (3) to ground.



409-1143

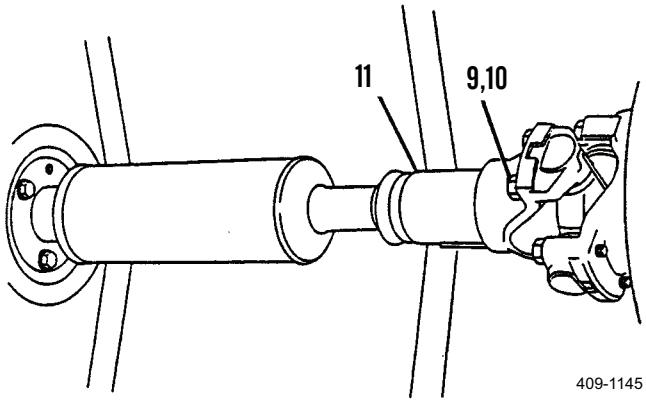
3. Remove four capscrews (4), four lockwashers (5) and disconnect rear propeller shaft (6). Discard lockwashers.
4. Tag and disconnect lead (7) from transmission temperature switch (8).



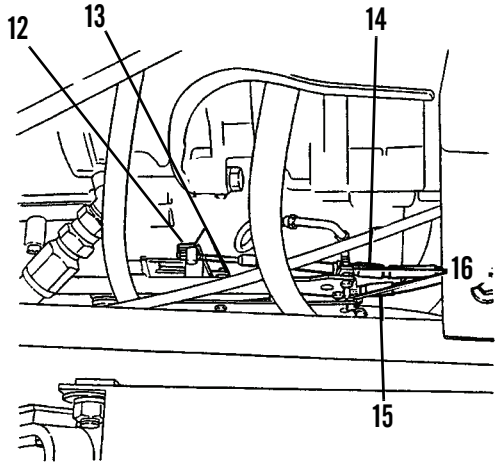
409-4097

REMOVAL - CONTINUED

5. Remove four capscrews (9), four lockwashers (10) and disconnect transmission propeller shaft (11). Discard lockwashers. Slide yoke of shaft toward engine to provide clearance.

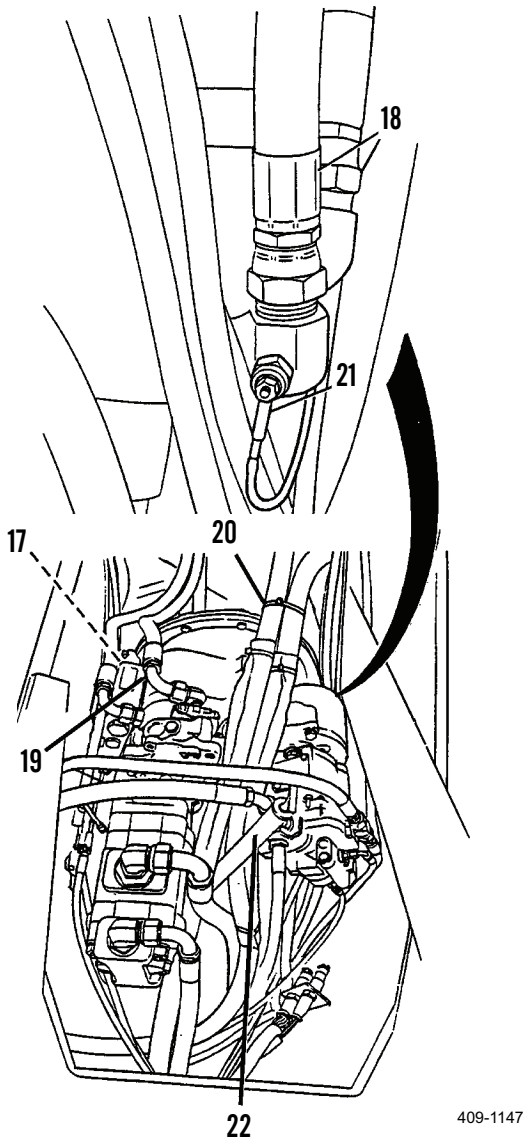


6. Remove cotter pin (12) and washer (13) from each transmission cable (14 and 15) at transmission control valve. Discard cotter pins.
7. Remove four nuts (16) securing clamps for transmission cables (14 and 15).
8. Disconnect transmission cables (14 and 15) from transmission control valve. Tag cables for installation.



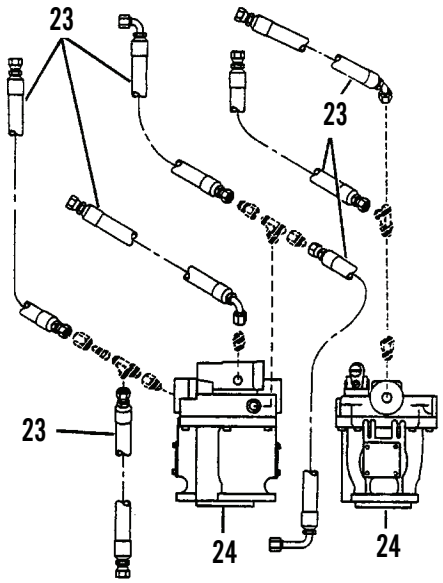
REMOVAL - CONTINUED

9. Disconnect transmission disconnect valve hose (17) from transmission control valve. Cap or plug fitting.
10. Disconnect two transmission oil cooler hoses (18) from transmission.
11. Disconnect two transmission oil filter hoses (19) from transmission.
12. Cut and discard tie down strap (20) from upper hydraulic hoses that connect hydraulic control valve to transmission and hydraulic pumps.
13. Disconnect lead (21) from transmission temperature sender.
14. Remove transmission oil filler tube (22).

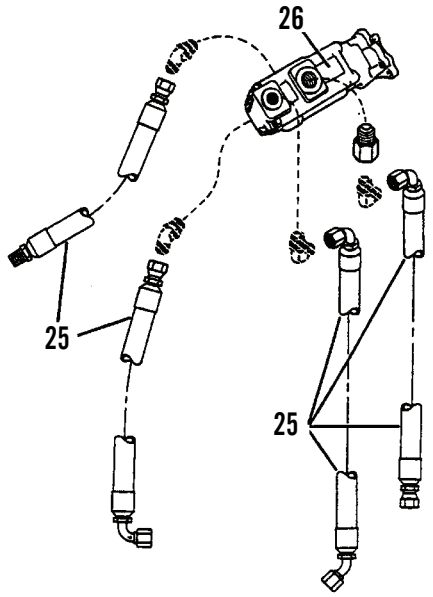


REMOVAL - CONTINUED

15. Disconnect seven hydraulic hoses (23) at piston pump (24).
16. Disconnect four hydraulic hoses (25) at tandem gear pump (26).

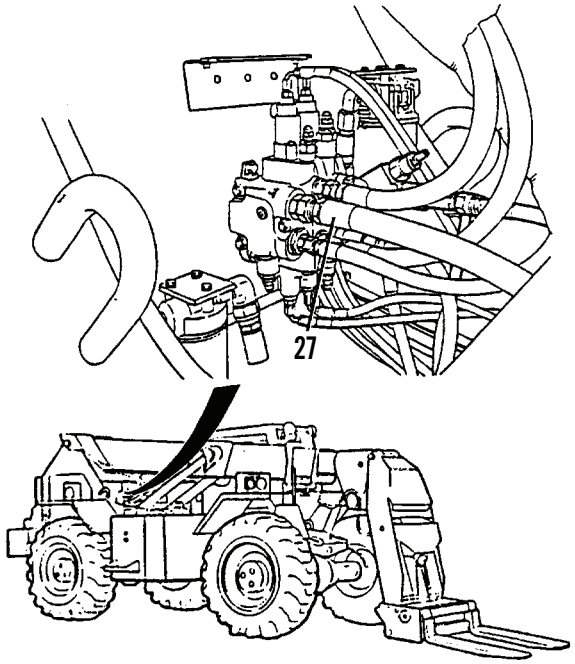


409-1148



409-1149

17. Disconnect hose (27) at main control valve assembly. Move all other hoses to either side of transmission to provide clearance.



409-1150

REMOVAL - CONTINUED

18. Disconnect two leads from neutral safety switch (28).
19. Remove two hex head capscrews (29), two nuts (30), two rebound washers (31) and two rubber mounts (32).

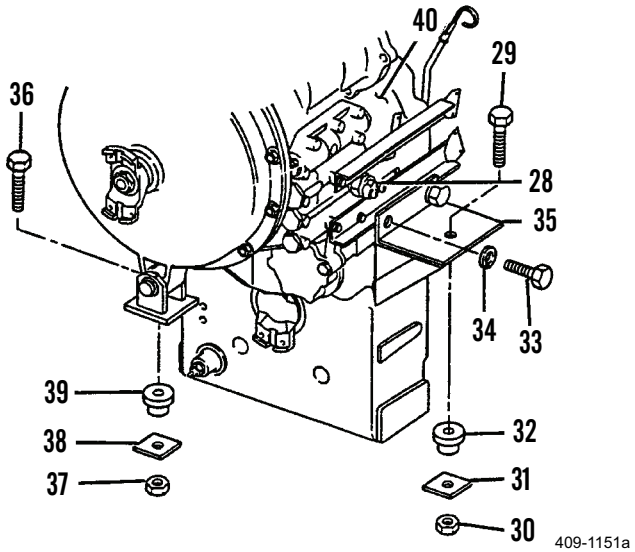
WARNING

Use 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 transmission is approximately 950 lb (431 kg).

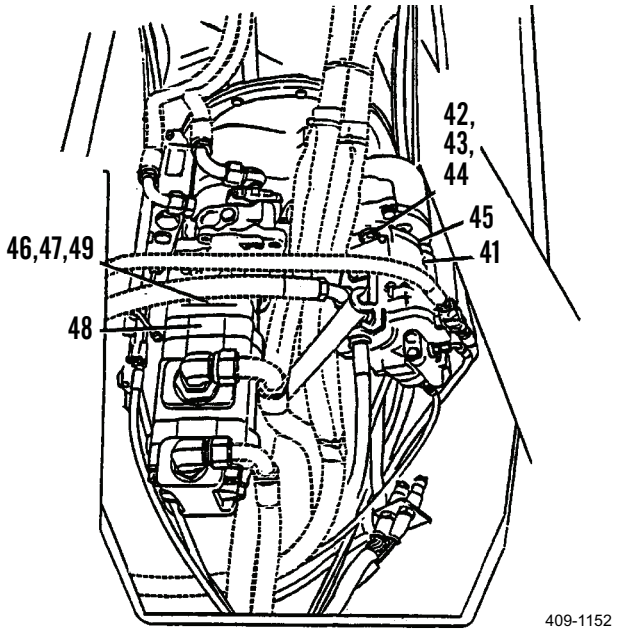
20. Use a hoist with slings or other lifting device to support transmission. Place slings under input yoke and output yokes. Secure slings together.
21. Remove four hex head capscrews (33), four lockwashers (34) and right front transmission mounting bracket (35). Discard lockwashers.
22. Place a drift and wedge between capscrew (36) and side of rear transmission mount to prevent capscrew from moving when removing nut.
23. Remove nut (37), rebound washer (38) and rubber mount (39) from rear transmission mount.



24. Use hoist to slowly lift transmission (40) until it clears vehicle frame. Ensure that hoses and other obstructions are clear of transmission during removal.

REMOVAL - CONTINUED

25. Lift transmission forward and to the side so it clears boom lift cylinders.
26. Support piston pump (41) and remove two hex head capscrews (42), two lockwashers (43), two flatwashers (44) and piston pump. Discard lockwashers.
27. Remove and discard O-ring (45) from hydraulic piston pump drive adapter.
28. Remove two hex head capscrews (46), two lockwashers (47) and tandem gear pump (48). Discard lockwashers.
29. Remove and discard O-ring (49) from hydraulic gear pump drive.



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

NOTE

After transmission replacement, ensure that parts not issued with transmission are removed and installed on new transmission.

1. Install tandem gear pump (48) on transmission.
2. Install new O-ring (49) on hydraulic gear pump drive.
3. Place tandem gear pump (48) in position on transmission oil pump.
4. Install two new lockwashers (47) and two hex head capscrews (46).
5. Install piston pump (41) on transmission.
6. Install a new O-ring (45) on hydraulic piston pump drive adapter.
7. Place piston pump (41) in position on transmission.
8. Install two flatwashers (44), two new lockwashers (43) and two hex head capscrews (42).
9. Install transmission in vehicle.

INSTALLATION - CONTINUED

10. Apply loctite to threads of four capscrews (33). Install left front transmission mounting bracket (35), four new lockwashers (34) and four capscrews (33). Torque capscrews to 220 lb-ft (298 Nm).

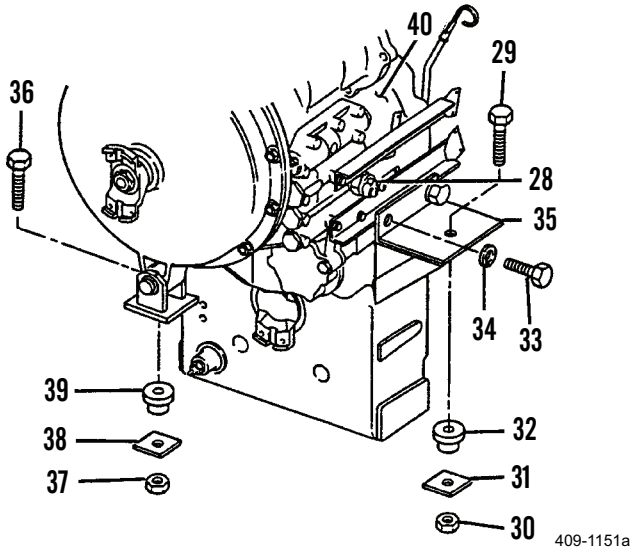
WARNING

Use 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 transmission is 950 lb (431 kg).

11. With assistance, attach a hoist with slings to transmission (40). Place slings under input yoke and output yokes. Secure slings together.
12. Lift transmission (40) into vehicle. Ensure that hoses and other obstructions are clear of transmission during installation. Lower transmission until its mounts are resting on transmission supports.



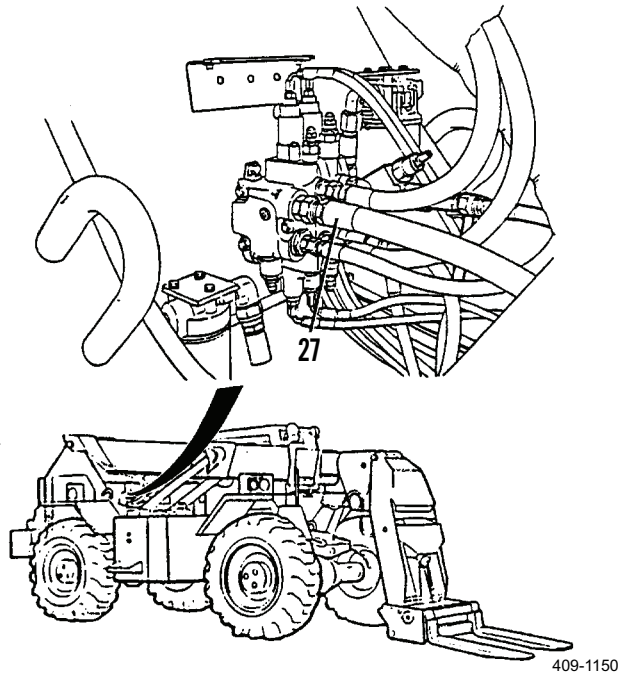
NOTE

Place a drift and wedge between capscrew and side of rear transmission mount to prevent capscrew from moving when tightening nut.

13. Apply loctite to threads of capscrew (36). Install nut (37), rebound washer (38), rubber mount (39) and capscrew in rear transmission mount. Torque nut to 307 lb-ft (416 Nm).
14. Apply loctite to threads of two hex head capscrews (29). Install two rubber mounts (32), two rebound washers (31), two nuts (30) and two hex head capscrews. Torque nuts to 307 lb-ft (416 Nm).
15. Remove slings from transmission (40).
16. Connect two leads to neutral safety switch (28).

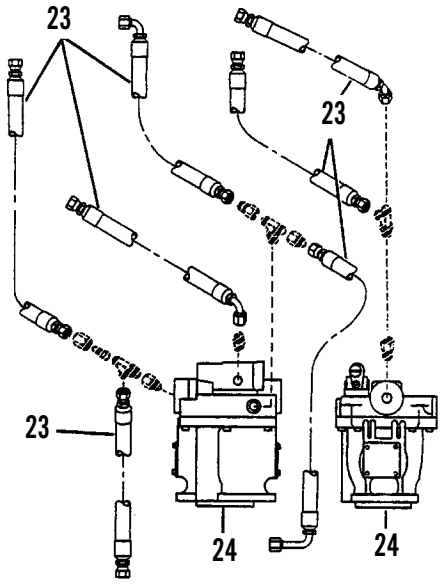
INSTALLATION - CONTINUED

17. Connect hose (27) at main control valve (between main control valve assembly and priority valve).

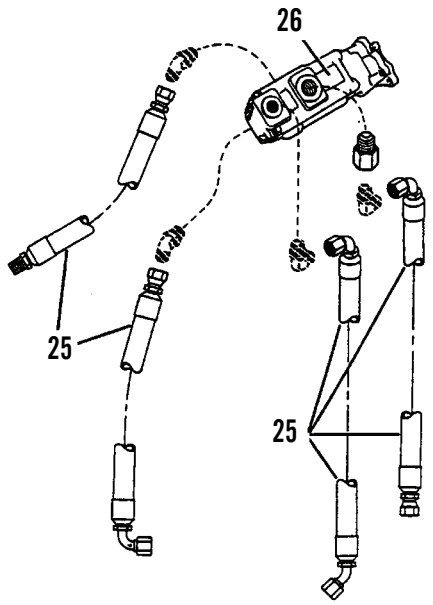


409-1150

18. Install seven hydraulic hoses (23) to piston pump (24).
19. Install four hydraulic hoses (25) to tandem gear pump (25).



409-1148



409-1149

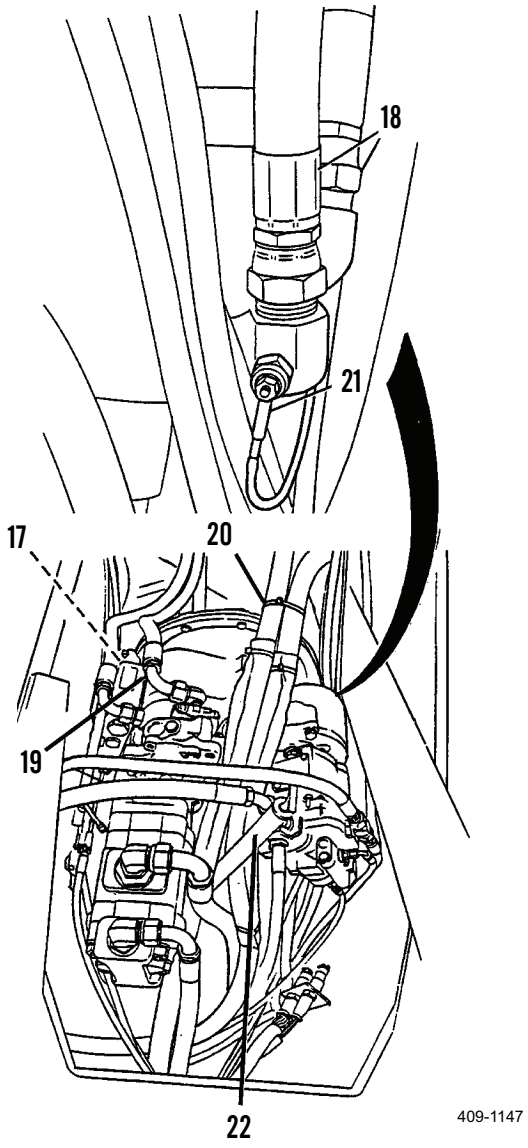
INSTALLATION - CONTINUED

20. Install transmission oil filler tube (22).
21. Connect lead (21) to transmission temperature sender.
22. Install a new tie down strap (20) to upper hoses that connect hydraulic control valve to transmission and hydraulic pumps.

NOTE

Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on transmission and hoses clean and dry. Apply film of clean transmission oil as they are installed.

23. Connect two transmission oil filter hoses (19) on transmission.
24. Connect two transmission oil cooler hoses (18) on transmission.
25. Connect transmission disconnect valve hose (17) to transmission control valve.



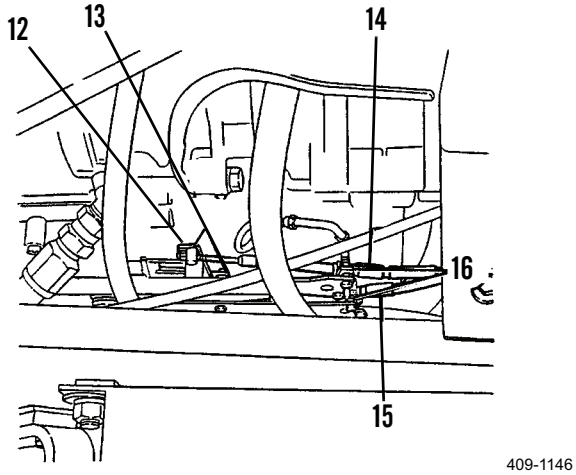
409-1147

INSTALLATION - CONTINUED

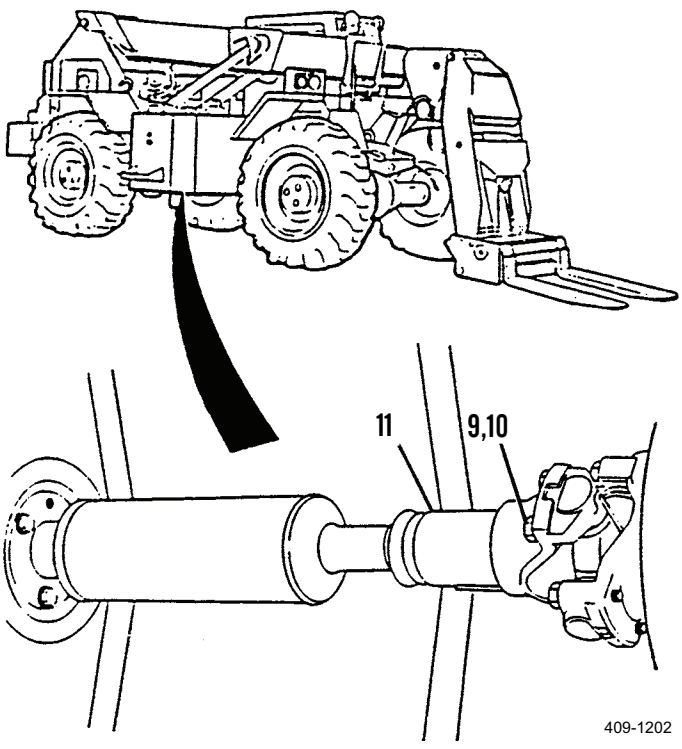
NOTE

Ensure that cables are connected correctly for proper function.

26. Install four nuts (16) that secure clamps for transmission cables (14 and 15).
27. Install washer (13) and new cotter pin (12) for each transmission cable (14 and 15) at transmission control valve.



28. Apply loctite on threads of four capscrews (9). Slide yoke of transmission propeller shaft (11) toward transmission input yoke and secure with four new lockwashers (10) and four capscrews (9). Torque capscrews to 45 lb-ft (61 Nm).



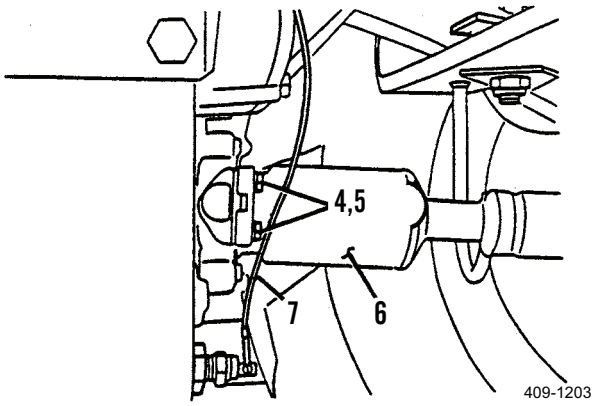
INSTALLATION - CONTINUED

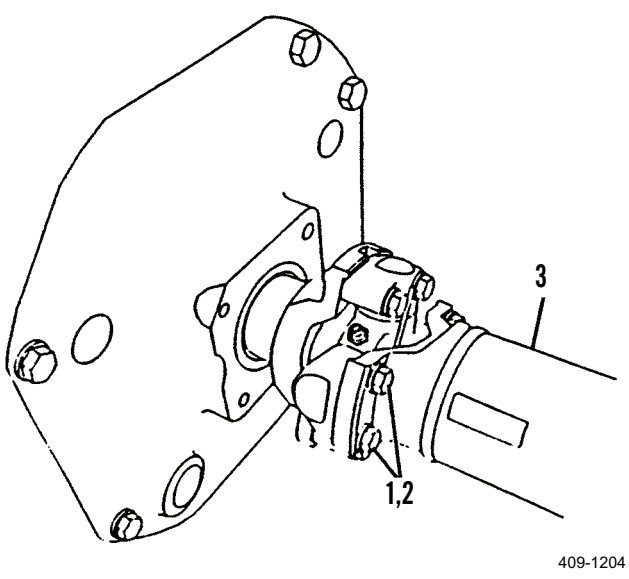
29. Connect lead (7) to transmission temperature switch (8).

30. Connect shafts (3 and 6) on transmission.

31. Apply loctite on threads of capscrews (4). Install rear propeller shaft (6) and secure with four new lockwashers (5) and four capscrews. Torque capscrews to 45 lb-ft (61 Nm).

32. Apply loctite on threads of capscrews (1). Install front propeller shaft (3) and secure with four new lockwashers (2) and four capscrews. Torque capscrews to 45 lb-ft (61 Nm).





33. Ensure that transmission drain plug is in position.

34. Service transmission (WP 0118 00).

CAUTION

Do not start engine until both piston and tandem gear pumps are primed. Failure to follow this instruction may result in damage to pumps.

35. Purge air (prime) from piston and tandem gear pumps (WP 0173 00).

36. Start engine and allow to run for several minutes (TM 10-3930-660-10).

37. Shut engine down and check for leaks (TM 10-3930-660-10). Check fluid level and refill as necessary (TM 10-3930-660-10).

38. Install transmission cover (WP 0150 00).

END OF WORK PACKAGE

TRANSMISSION FRONT COVER ASSEMBLY REPLACEMENT 0238 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 2,000 lb capacity

Materials/Parts

Gasket (7)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Transmission assembly removed (WP 0237 00)

Transmission control valve removed (WP 0239 00)

Torque converter removed (WP 0236 00)

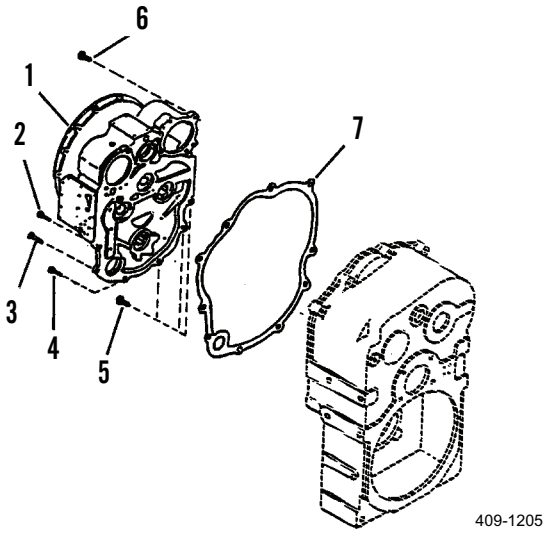
Transmission oil pump removed (WP 0240 00)

REMOVAL

NOTE

Transmission must be laying flat for front cover removal.

1. Attach lifting device to mounting brackets on front cover assembly (1).
2. Remove capscrews (2 thru 4), three capscrews (5) and four capscrews (6).



REMOVAL - CONTINUED

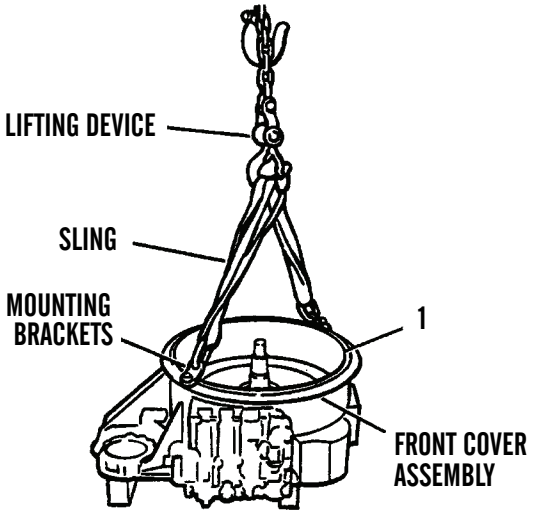
WARNING

Use 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.

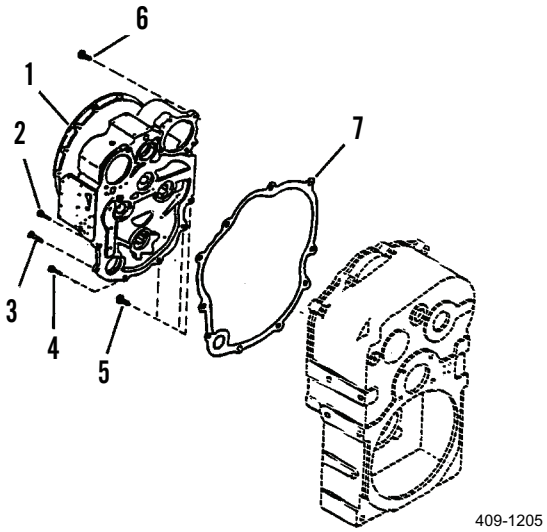
CAUTION

Use care when removing cover assembly. Clutch packs must remain in housing or clutch packs could be damaged during removal.

3. Use hoist to lift front cover assembly (1) off main case.



4. Place front cover assembly (1) on suitable supports.
5. Remove and discard gasket (7).



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

WARNING

Use 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

Ensure that two locator bushings are in position on main case. The locator bushings align front cover assembly.

1. Position new gasket (7) on main case.
2. Use a hoist to lift front cover assembly (1) and place it on main case.

NOTE

It may be necessary to rotate input shaft slightly to line up gear teeth in front cover clutch packs.

3. Install four capscrews (6), three capscrews (5) and capscrews (2 thru 4). Torque capscrews to 50 lb-ft (68 Nm).
4. Install transmission oil pump (WP 0240 00).
5. Install torque converter (WP 0236 00).
6. Install transmission control valve (WP 0239 00).
7. Install transmission assembly (WP 0237 00).
8. Operate transmission and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION CONTROL VALVE REPLACEMENT 0239 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Gasket (6)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Transmission removed (WP 0237 00)

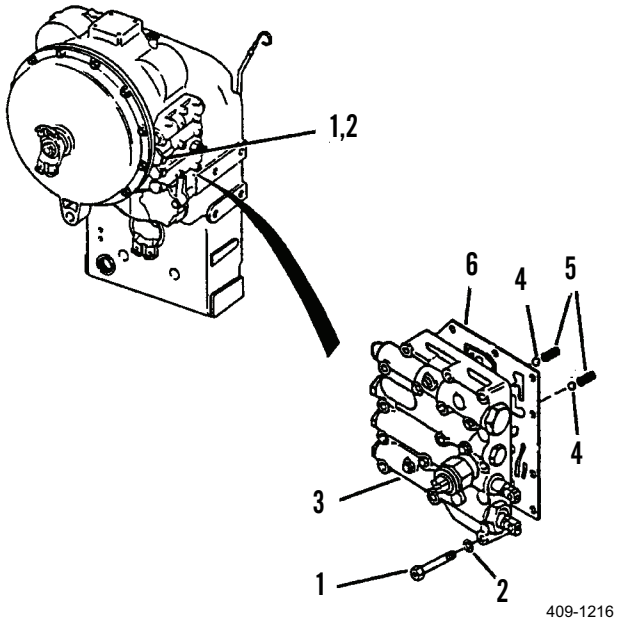
REMOVAL

1. Remove thirteen socket head capscrews (1) and thirteen washers (2) from transmission valve (3).

NOTE

Note position of balls and springs.

2. Pull transmission valve (3) straight out. Detent balls (4) are spring loaded and may fall out.
3. Remove and discard gasket (6).
4. Remove two detent balls (4) and two springs (5) from back of transmission valve (3).



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

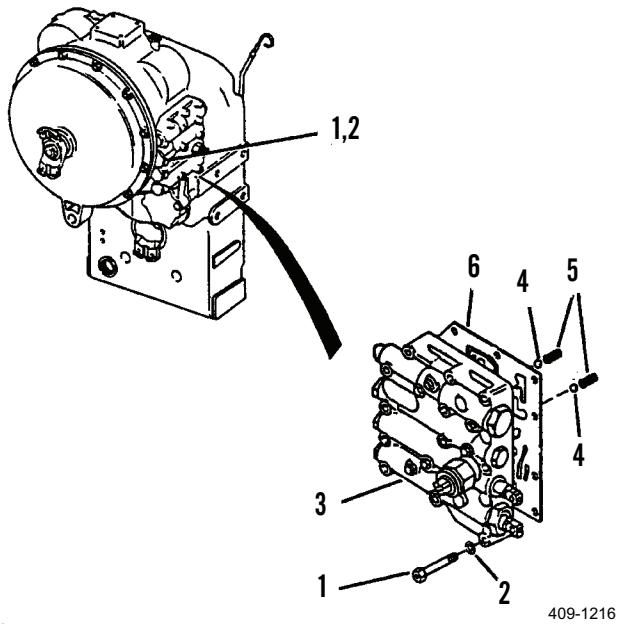
INSTALLATION

1. Install two springs (5) and two detent balls (4) in back of transmission control valve (3).
2. Install new gasket (6).

CAUTION

Use care when installing transmission control valve so as to not lose balls and spring.

3. Install transmission control valve (3) over new gasket (6).
4. Install thirteen washers (2) and thirteen socket head capscrews (1).



5. Install transmission (WP 0237 00).
6. Operate transmission and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION OIL PUMP REPLACEMENT 0240 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Gasket (6)

Materials/Parts - Continued

Lockwasher (5)

O-ring (7)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

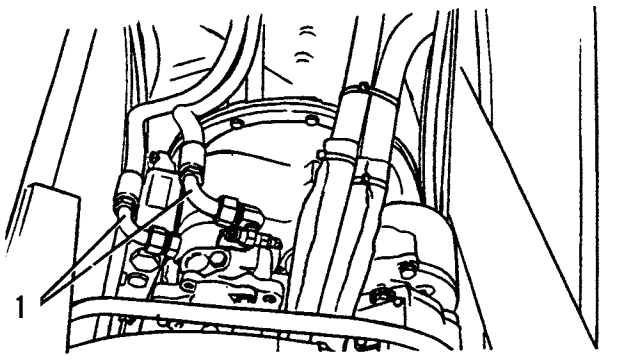
Tandem gear pump removed (WP 0173 00)

REMOVAL

CAUTION

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

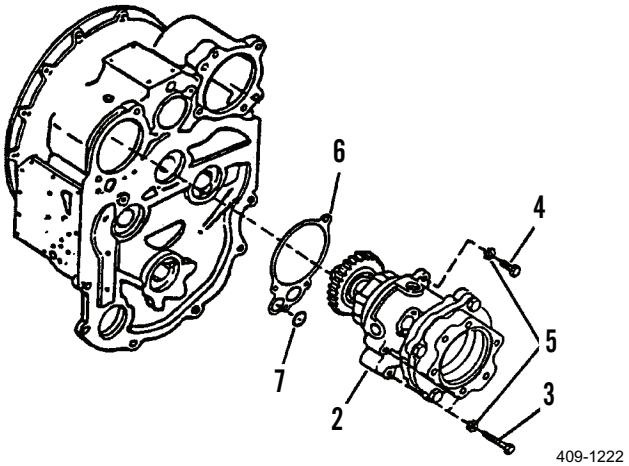
1. Disconnect two oil lines (1). Cap or plug all openings.



409-1221

REMOVAL - CONTINUED

2. Scribe transmission oil pump (2) and front cover assembly. These marks will ensure correct alignment during assembly.
3. Remove three capscrews (3), one capscrew (4), four lockwashers (5) and transmission oil pump (2). Discard lockwashers.
4. Remove and discard gasket (6) and O-ring (7).



409-1222

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

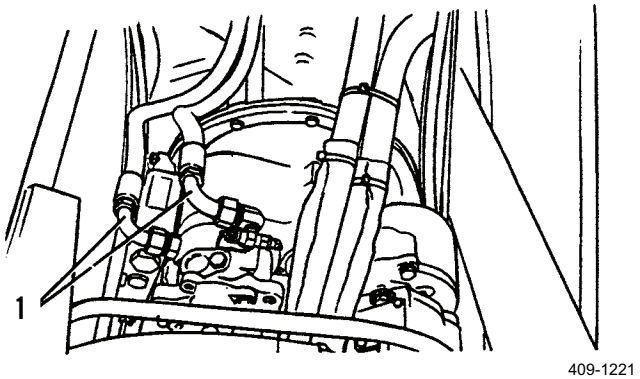
See *Inspection* instructions (WP 0317 00).

INSTALLATION

NOTE

Remove caps and plugs from openings during installation. Wipe all sealing surfaces clean and dry.

1. Install new O-ring (7) and new gasket (6).
2. Install transmission oil pump (2). Ensure that scribe marks align.
3. Install four new lockwashers (5), one capscrew (4) and three capscrews (3).
4. Connect two oil lines (1) to transmission oil pump.



409-1221

5. Install tandem gear pump (WP 0173 00).
6. Operate transmission and check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FRONT AXLE ASSEMBLY REPLACEMENT 0241 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 38, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Steel bar, 6 ft long, 1 in. dia (183 cm long, 2.5 cm dia)

Block, wood, 3 in. (7.6 cm) thick

Lifting device, 2,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Oil, lubricating (Item 32, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Locknut (8)

Lockwasher (5)

References

WP 0124 00

WP 0127 00

WP 0141 00

WP 0183 00

WP 0249 00

WP 0316 00

WP 0317 00

Personnel Required

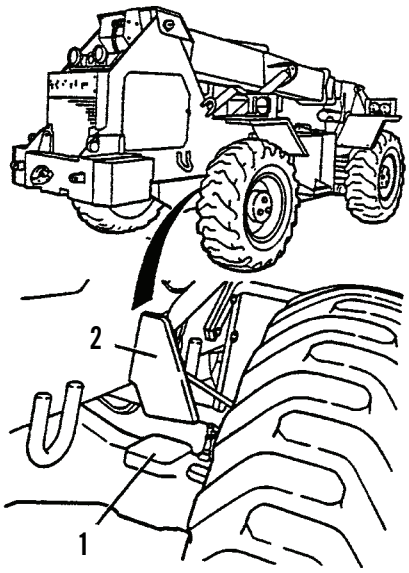
Two

Equipment Condition

Vehicle parked on level ground (TM 10-3930-660-10)

REMOVAL

1. Place wood blocks between frame pads (1) on rear axle and frame tilt stop pads (2). This will prevent frame from tilting when removing front tilt cylinders.



409-1227


WARNING


- Do not raise or extend boom until the frame is level. Failure to do so could cause the load to drop or machine to tip.
- Do not raise or extend boom unless the frame is level.
- Extreme care must be taken to ensure that the boom does not come near overhead wires. Death or injury may result from contacting power lines. Never operate this vehicle close to electric power or other lines. If lines are near to your operating area, notify your supervisor of the lines prior to starting work.

2. Start engine and raise boom for sufficient work clearance (TM 10-3930-660-10).
3. Disconnect parking brake cable (WP 0127 00).
4. Remove front propeller shaft (WP 0124 00).

REMOVAL - CONTINUED

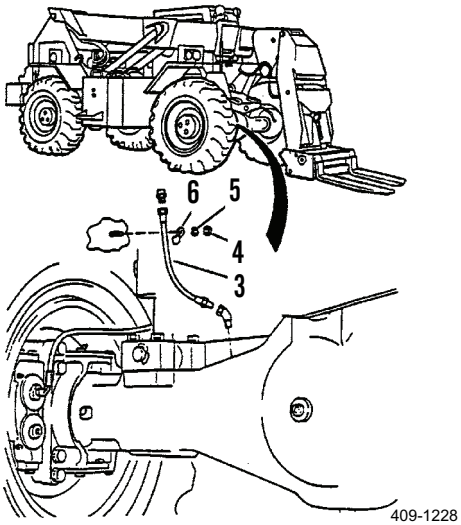
WARNING

Use 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 axle assembly is 1,650 lb (748 kg).

5. With assistance, raise front of vehicle 8 in. (20.3 cm) off ground and support under frame.
6. Remove frame tilt cylinder (WP 0183 00).
7. Remove front disk brake assemblies (WP 0249 00).
8. Disconnect axle breather hose (3) from frame by removing nut (4), lockwasher (5) and clamp (6). Discard lockwasher.



REMOVAL - 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 3,000 psi (20685 kPa), even with engine and pump OFF. After maintenance, tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing 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.

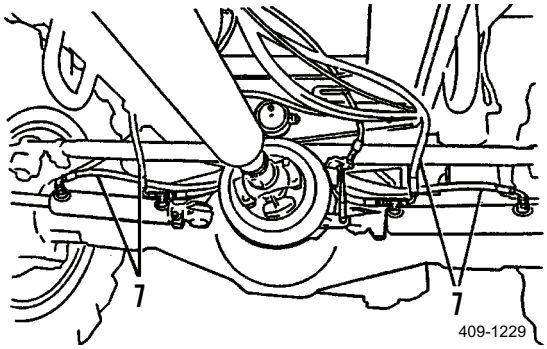
CAUTION

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

NOTE

If more than one hydraulic line is to be removed, tag and identify lines to ensure proper installation. Use container to catch any hydraulic oil that may drain from the system.

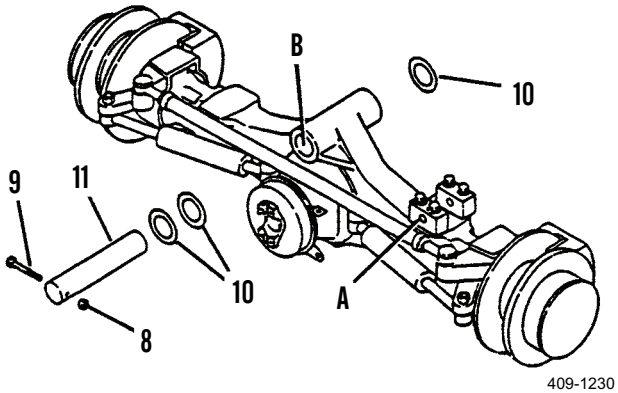
9. Disconnect front steering cylinder hydraulic supply hoses (7).



10. Use a floor jack to support weight of front axle assembly.
11. Remove locknut (8) and retaining capscrew (9). Discard locknut.

NOTE

Note the location and quantity of washer spacers during removal. Keep washer spacers together as a set.



12. Remove axle aligning rod (11) and washer spacers (10).
13. Place a steel bar, minimum 1 in. diameter and 6 ft long (2.5 cm diameter and 183 cm long), in the tilt cylinder rod pivot pin mounting hole (A). The bar will prevent the axle assembly from rotating when the axle is removed.
14. Lower floor jack and roll axle assembly to the front from under vehicle, using floor jack and 6 ft (183 cm) bar, to prevent axle assembly from rotating.
15. Raise axle assembly using floor jack. Support axle assembly and wheels using stands.

CLEANING

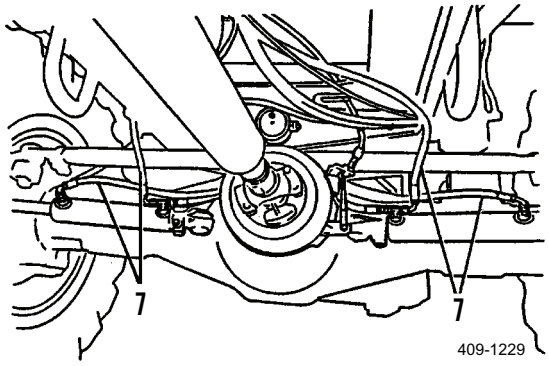
See *Cleaning* instructions (WP 0316 00).

INSPECTION

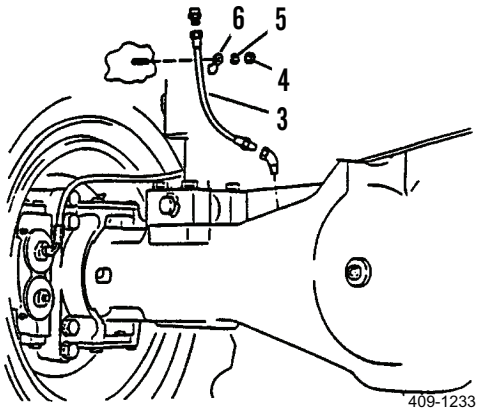
See *Inspection* instructions (WP 0317 00).

INSTALLATION

1. Place a steel bar in the tilt cylinder rod pivot pin mounting hole (A). The bar will prevent the axle assembly from rotating when installed.
2. Use a floor jack to raise axle assembly.
3. Remove stands and lower axle assembly until it is supported by tires.
4. Roll axle assembly under vehicle, using 6 ft (183 cm) bar and floor jack to prevent the axle assembly from rotating.
5. Align axle aligning rod hole (B) with frame aligning rod holes.
6. Ensure washer spacers (10) are in place on frame pivot pin hole; use floor jack to carefully raise axle assembly while assistant holds assembly steady using 6 ft (183 cm) bar tilt cylinder rod pivot pin mounting hole (A).
7. Raise floor jack until axle aligning rod hole (B) is aligned with frame aligning rod holes.
8. Secure front axle to frame with axle aligning rod (11) and washer spacers (10). At least one washer spacer on each side of axle aligning rod hole is required.
9. Secure axle aligning rod with retaining capscrew (9) and new locknut (8). Torque capscrew (9) to 100 lb-ft (136 Nm).
10. Use a floor jack to raise front of vehicle until vehicle frame clears jackstands. Remove jackstands and carefully lower vehicle.
11. Connect front steering cylinder hydraulic supply hoses (7).

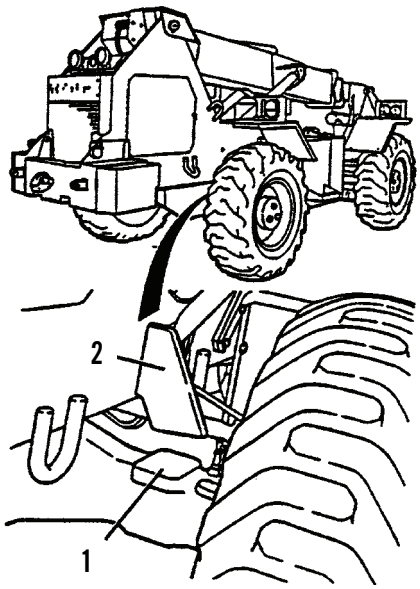


12. Connect axle breather hose (3) in frame with clamp (6), new lockwasher (5) and nut (4).



INSTALLATION - CONTINUED

13. Install front disc brake assemblies (WP 0249 00).
14. Install frame tilt cylinder (WP 0183 00).
15. Install front propeller shaft (WP 0124 00).
16. Install parking brake cable (WP 0127 00).
17. Remove wood blocks from between frame pads (1) on rear axle and frame tilt stop pads (2).



409-1234

18. Bleed hydraulic steering cylinders (WP 0141 00).
19. Remove rear wheel chocks (TM 10-3930-660-10).
20. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

FRONT AXLE ALIGNING ROD REPLACEMENT 0242 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, 0324 00)

Materials/Parts

Locknut (2)

References

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Frame tilt cylinder removed (WP 0183 00)

WARNING

Use 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

Perform this procedure to replace front or rear axle aligning rod. Front axle aligning rod is shown.

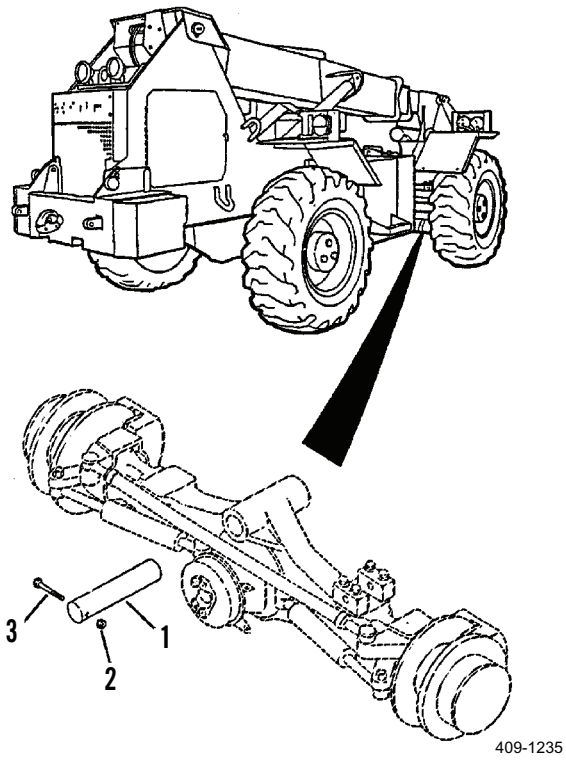
AXLE PIVOT REPLACEMENT - CONTINUED 0242 00

REMOVAL

1. With assistance, use hydraulic jack to raise vehicle by the frame so that weight of vehicle is off aligning rod (1). Do not raise vehicle off ground (TM 10-3930-660-10).
2. Support vehicle under frame using suitable stands.
3. Remove locknut (2) and capscrew (3). Discard locknut.
4. Remove axle aligning rod (1).

INSTALLATION

1. Install axle aligning rod (1).
2. Install capscrew (3) and new locknut (2).
3. Torque capscrew (3) to 100 lb-ft (136 Nm).
4. Use hydraulic jack to raise vehicle and remove stands (TM 10-3930-660-10).



409-1235

5. Lower vehicle (TM 10-3930-660-10).
6. Install frame tilt cylinder (WP 0183 00).
7. Operate equipment and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

FRONT DIFFERENTIAL CARRIER ASSEMBLY REPLACEMENT 0243 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Adjustment, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 4,000 lb capacity

Materials/Parts

Sealant, Loctite (Item 46, WP 0323 00)

Compound, sealing (Item 14, WP 0323 00)

Oil, lubricating (Item 32, WP 0323 00)

Wood block

References

WP 0316 00

WP 0317 00

Personnel Required

Two

Equipment Condition

Front axle assembly removed (WP 0241 00)

Wheel assemblies removed (WP 0134 00)

Axle housing lubricant drained (WP 0125 00)

Both disc brake assemblies removed (WP 0249 00)

Front planetary wheel ends removed (WP 0244 00)

REMOVAL

WARNING

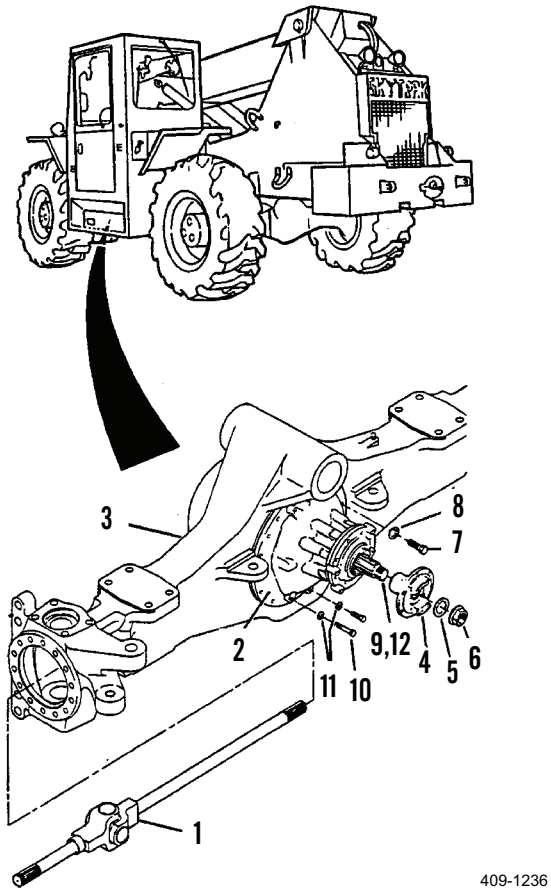
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

1. Remove axle shafts (1).
2. Remove differential carrier (2) from axle housing (3).
3. Carefully tip axle assembly so that front differential carrier (2) faces up.
4. Reinstall companion flange (4), washer (5) and nut (6) that were removed with park brake assembly. The drive yoke will provide a lifting point for differential carrier (2) during removal.

NOTE

Capscrews from differential carrier to axle housing are of three different sizes. Note size, location and quantity of capscrews when removing for correct location during replacement.

5. Remove twelve capscrews (7), twelve flatwashers (8), two capscrews (9), two capscrews (10) and four flatwashers (11) from differential carrier (2).
6. Use a leather or rubber mallet to loosen differential carrier (2) in axle housing.
7. Use a sling placed around bevel pinion, behind companion flange (4), to lift and support the differential carrier (2) during removal.
8. Carefully remove differential carrier (2) from axle housing (3).
9. Place differential carrier (2) on stand or bench, with ring gear up. Clamp securely.



409-1236

10. Remove companion flange (4), nut (6) and washer (5) from bevel pinion (12).

CLEANING

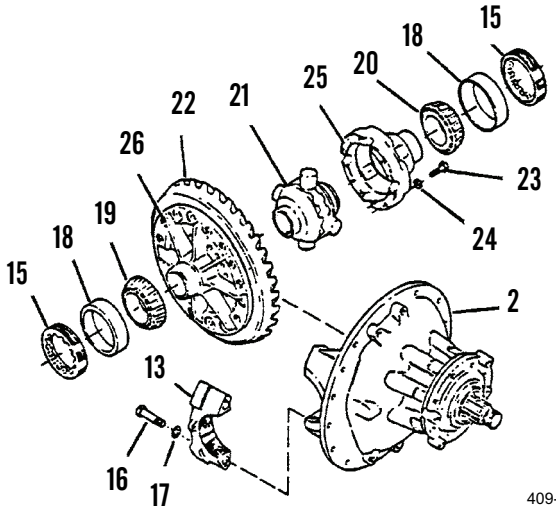
See *Cleaning* instructions (WP 0316 00).

INSPECTION

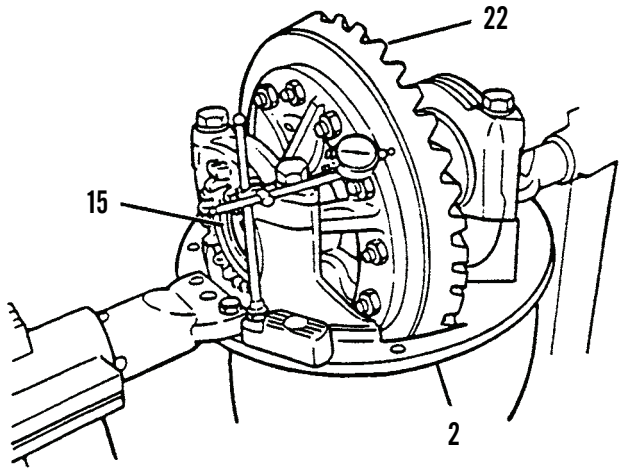
See *Inspection* instructions (WP 0317 00).

ADJUSTMENT

1. Adjust preload of differential bearings (18 thru 20).
2. Attach a dial indicator on the mounting flange of the differential carrier (2).
3. Adjust the dial indicator so that the plunger is against the back surface of the ring gear (22).



409-1249



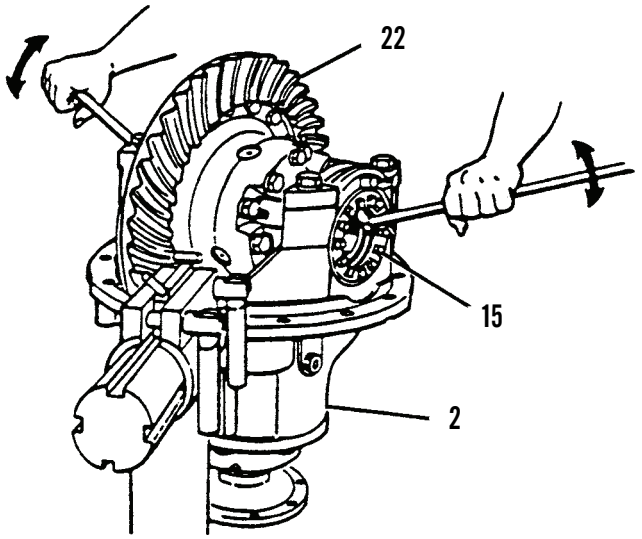
409-1253

CAUTION

When turning bearing adjusting rings, always use a tool that engages two or more opposite notches in the ring. A large screwdriver can be used for this purpose. Failure to do so could cause damage to adjusting ring lugs.

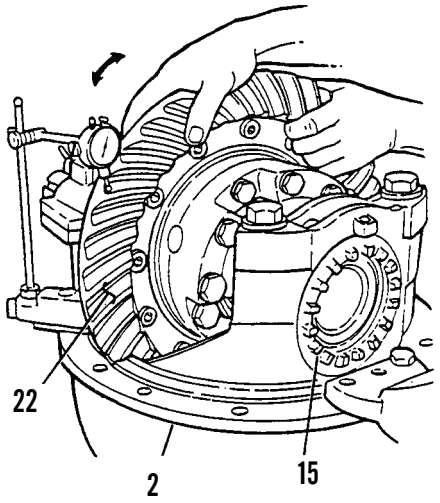
ADJUSTMENT - CONTINUED

4. Loosen the bearing adjustment ring (15) opposite ring gear (22) so that a small amount of end play shows on dial indicator. Move differential assembly and ring gear left and right with pry bars while reading dial indicator. Do not allow pry bars to touch bearings (18 thru 20).
5. Tighten bearing adjustment ring (15) opposite ring gear (22) so that no end play shows on dial indicator. Move the differential assembly and ring gear left and right as needed.
6. Tighten each bearing adjusting ring (15) one notch from zero end play measured in step 5.
7. Check runout of ring gear (22).
8. Attach dial indicator on mounting flange of differential carrier (2). Adjust dial indicator so that plunger is against back surface of ring gear (22).
9. Adjust dial of indicator to zero.



409-1254

10. Rotate differential assembly and ring gear (22) and read dial indicator. If runout of ring gear exceeds 0.008 in. (0.203 mm), remove differential assembly and ring gear and inspect differential assembly for problem. Replace defective parts and reinstall differential assembly and ring gear into differential carrier (2). Repeat preload adjustment of differential bearings.
11. Adjust backlash of ring gear (22).
12. Attach a dial indicator to the mounting flange on differential carrier (2).
13. Adjust dial indicator so that plunger is against the tooth surface on ring gear (22).
14. Adjust dial of indicator to zero.
15. Hold bevel pinion in position.
16. Read dial indicator while rotating ring gear (22) a small amount in both directions.
17. Adjust backlash of old gear set to setting measured before carrier was disassembled (0.008 to 0.018 in.), (0.203 to 0.457 mm).



409-1255

18. If new gear set is installed, adjust backlash to 0.012 in. (0.305 mm).

ADJUSTMENT - CONTINUED

NOTE

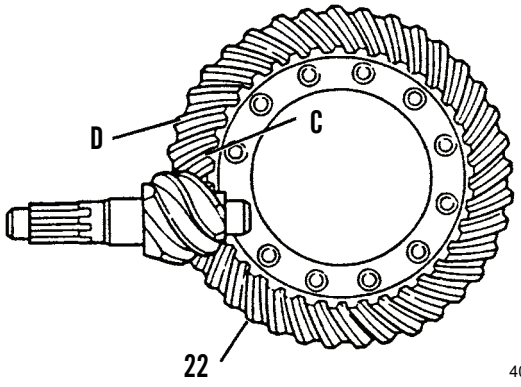
When adjusting backlash, adjust only the ring gear; do not adjust the bevel pinion.

19. Increase backlash by loosening bearing adjusting ring (15) opposite teeth of ring gear (22), and tightening bearing adjusting ring on ring gear side of differential assembly. Make adjustments one notch at a time until backlash is within specifications.
20. Decrease backlash by tightening bearing adjusting ring (15) opposite teeth of ring gear (22), and loosening bearing adjusting ring on ring gear side of differential assembly. Make adjustments one notch at a time until backlash is within specifications.
21. Check tooth contact patterns of the gear set.

NOTE

- In the following steps, movement of contact pattern in length of tooth is indicated as toward “toe” (C) or “heel” (D) of ring gear.
- Always check tooth contact patterns on drive side of gear teeth.

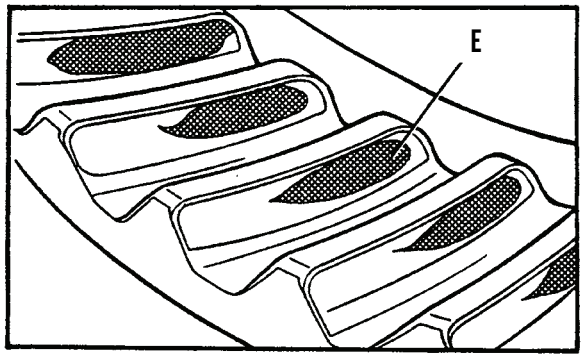
22. Apply marking compound (prussian blue, red lead) to 12 gear teeth of ring gear. Rotate ring gear so that 12 gear teeth are next to bevel pinion.
23. Rotate ring gear (22) forward and backward so that 12 marked teeth go past bevel pinion 6 times to get contact patterns. Repeat, if necessary, to get a more clear pattern.



409-1256

ADJUSTMENT - CONTINUED

24. Inspect contact patterns on ring gear (22). Good hand rolled pattern (E) will show contact toward toe of gear tooth and in the center between top and bottom of tooth. A high pattern (F) will show contact closer to top of gear tooth. A low pattern (G) will show contact toward bottom of gear tooth. When in operation, pattern will extend to approximately full length of gear tooth.



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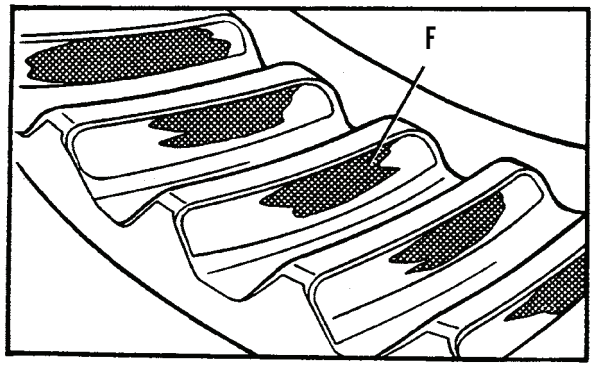
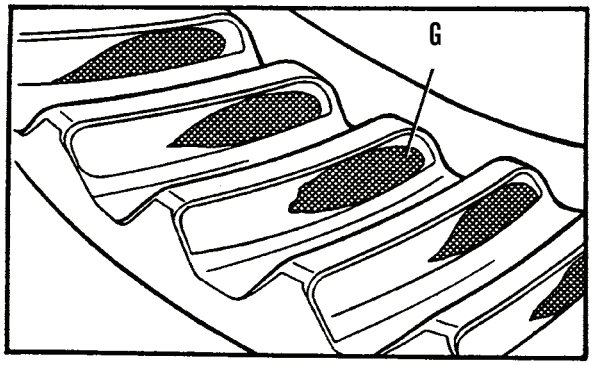


409-1258

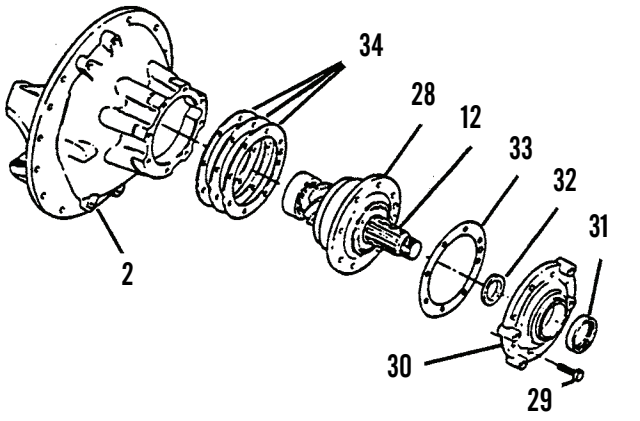


409-1259

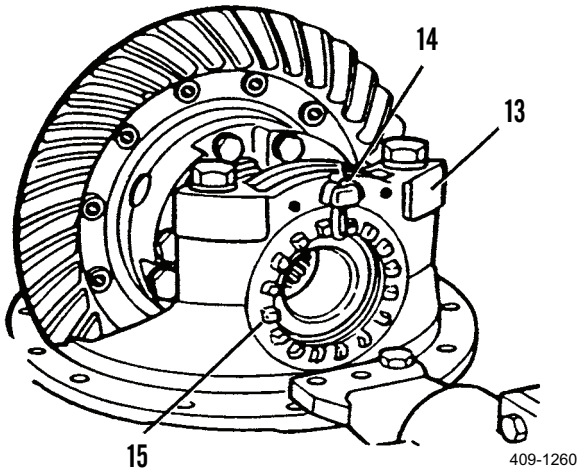
25. If necessary, install thinner shim pack (34) under pinion bearing cage (28) to correct high contact pattern.
26. If necessary, install thicker shim pack (34) under pinion bearing cage (28) to correct low contact pattern.
27. If necessary, decrease backlash to move contact patterns toward toe of ring gear teeth.
28. If necessary, increase backlash to move contact patterns toward heel of ring gear teeth.

ADJUSTMENT - CONTINUED

29. Install two new cotter pins (14) that hold two bearing adjusting rings (15) in position. Install cotter pins (14) through boss of bearing cap (13) and between lugs of adjusting ring.



409-1241



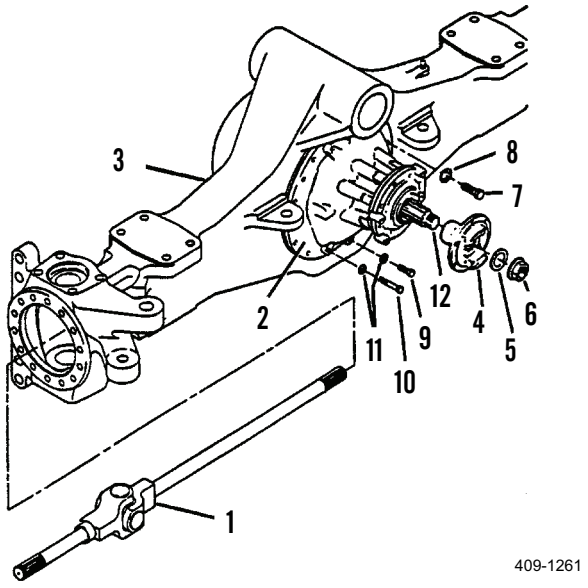
409-1260

INSTALLATION

NOTE

- Apply silicone RTV-732 clear sealing compound to mounting surface of axle housing that fastens differential carrier.
- Inside of axle housing and mounting flange where carrier fastens should be clean and dry before installing carrier.

1. Install differential carrier (2) into axle housing (3).
2. Install companion flange (4), washer (5) and nut (6) onto bevel pinion (12).



409-1261

INSTALLATION - CONTINUED

Minor concentration of acetic acid may be produced during application of silicone RTV-732 clear sealing compound. Adequate ventilation should be provided when silicone RTV is applied in confined areas. Failure to do so could cause respiratory irritation, headaches and nausea. Eye contact with silicone RTV-732 clear sealing compound may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

3. Apply a 1/8 in. bead of silicone RTV-732 clear sealing compound to mounting surface of axle housing (3) that differential carrier (2) fastens.
4. Install differential carrier (2) into axle housing (3).

CAUTION

Four initially installed capscrews must be evenly spaced to prevent uneven pressure on differential carrier when torquing. Failure to do so could cause component failure.

5. Install four capscrews (7) and flatwashers (8) into corner locations around differential carrier (2) and axle housing (3). Hand tighten.
6. Carefully push differential carrier (2) into position. Tighten four capscrews (7) two or three turns each in a pattern opposite each other.

NOTE

Torque capscrews in pairs on opposing sides of differential carrier.

7. Torque capscrews (7) to between 50 and 75 lb-ft. Torque in pairs across from each other.
8. Install remaining eight capscrews (7), two capscrews (9), two capscrews (10), four flatwashers (11) and eight flatwashers (8). Be sure fasteners are in correct location as noted during disassembly.
9. Install axle shafts (1) into axle housing (3).
10. Carefully tip axle housing (3) upright.
11. Install front planetary wheel ends (WP 0244 00).
12. Install both disc brake assemblies (WP 0249 00).
13. Fill axle housing with lubricant (WP 0125 00).
14. Install wheel assemblies (WP 0134 00).
15. Install front axle assembly on vehicle (WP 0241 00).

END OF WORK PACKAGE

FRONT PLANETARY WHEEL ENDS REPLACEMENT 0244 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Planetary hub drag tool (Item 15, WP 0324 00)

Lifting device, 200 lb (91 kg) capacity

4 in. x 4 1/2 in. deep six-point socket

Materials/Parts

Compound, sealing (Item 14, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Snap ring (5 and 9)

Seal (17 and 25)

Personnel Required

Two

References

WP 0317 00

WP 0318 00

Equipment Condition

Front of vehicle raised 8 in. (20.3 cm) and supported under front axle (TM 10-3930-660-10)

Planetary wheel ends drained (WP 0126 00)

Wheel assemblies removed (WP 0134 00)

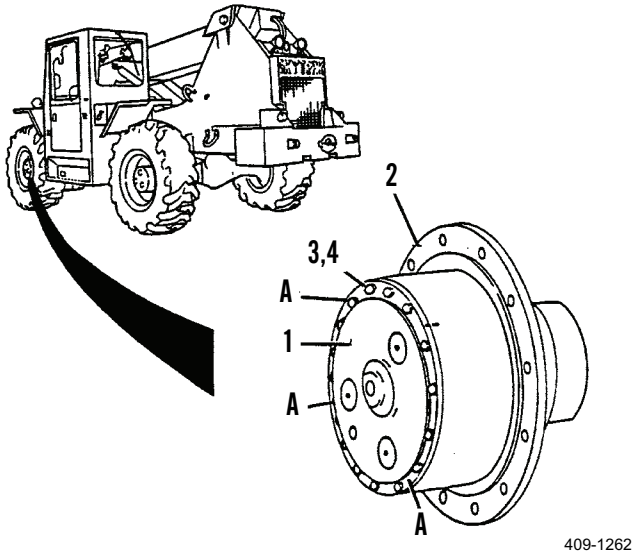
Front disc brake assemblies removed (WP 0249 00)

REMOVAL

NOTE

Mark planetary spider and wheel hub for correct alignment during installation.

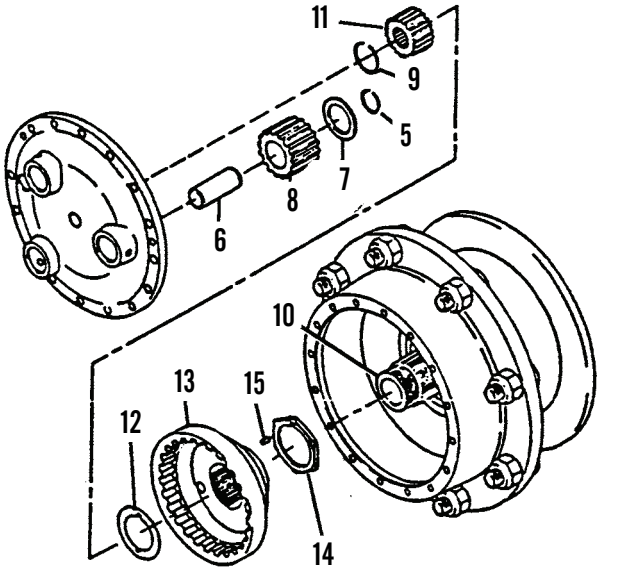
1. Place a suitable container under planetary wheel end assembly.
2. Remove sixteen capscrews (3) and sixteen flatwashers (4) from planetary spider (1).
3. Use three capscrews (3) in jack screw holes (A) and tighten to remove planetary spider (1).



409-1262

REMOVAL - CONTINUED

4. Remove and discard three snap rings (5) from planetary pinion shafts (6).
5. Remove three thrust washers (7) and planetary gears (8) from planetary pinion shafts (6).
6. Remove planetary sun gear (11) and ring gear (13).
7. Remove and discard snap ring (9) from end of wheel bearing spindle (10).
8. Remove planetary sun gear (11).
9. Remove sun gear thrust washer (12).
10. Remove planetary ring gear (13).



409-1263

REMOVAL - CONTINUED

11. Remove wheel hub and disc assembly (16).

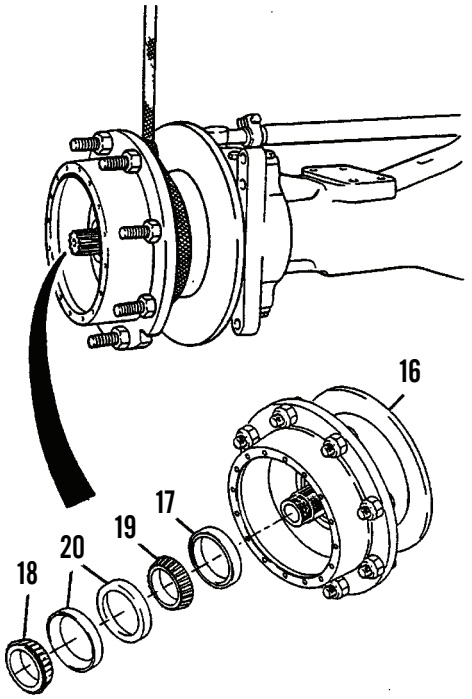
WARNING

Use 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

Hub assembly weighs more than 100 lb (45 kg).

12. Use a sling and hoist or other suitable lifting device to support hub weight during removal.
13. Remove hub bearing nut (14). If necessary, remove dowel pin (15).
14. Wobble wheel hub and disc assembly (16) to unseat oil seal (17), inner (19) and outer (18) bearing cone.
15. Remove outer bearing cone (18).
16. Remove wheel hub and disc assembly (16).
17. Remove and discard inner oil seal (17).
18. Remove inner bearing cone (19).
19. If necessary, remove two bearing cups (20) with a suitable puller.



409-1264

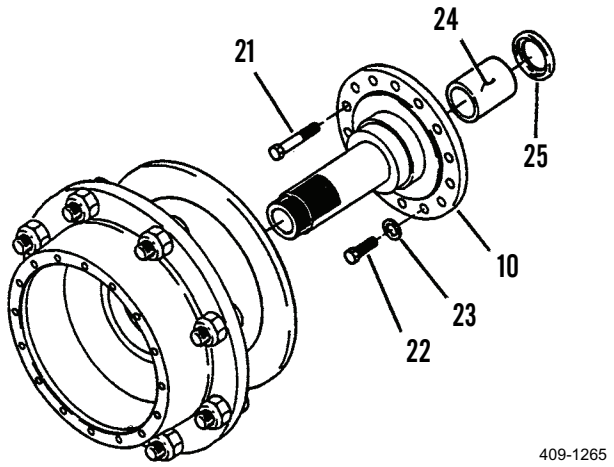
REMOVAL - CONTINUED

20. To remove spindle assembly, remove ten spindle capscrews (21), four shorter capscrews (22), and fourteen flatwashers (23).

CAUTION

Inner oil seal and bushing in bore of spindle can be damaged when sliding spindle past axle splines. Remove spindle carefully to avoid damaging bushing and inner oil seal. Failure to do so could cause premature component failure.

21. Remove wheel bearing spindle (10).
22. Remove and discard oil seal (25).
23. If necessary, remove bushing (24).



409-1265

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

1. If removed, push bushing (24) into spindle (10) until top of bushing is flush or just below bottom of bore for new oil seal (25).
2. Push new oil seal (25) to bottom of bore.
3. Apply a thin film of clean oil to lips of new oil seal (25) in spindle (10) bore, bore of bronze bushing (24) in spindle and oil seal journal on axle shaft short end.

CAUTION

Inner oil seal and bushing in bore of spindle could be damaged when sliding spindle past axle splines. Install spindle carefully to avoid damaging bushing inner oil seal. Failure to do so could cause premature component failure.

4. Install spindle (10).

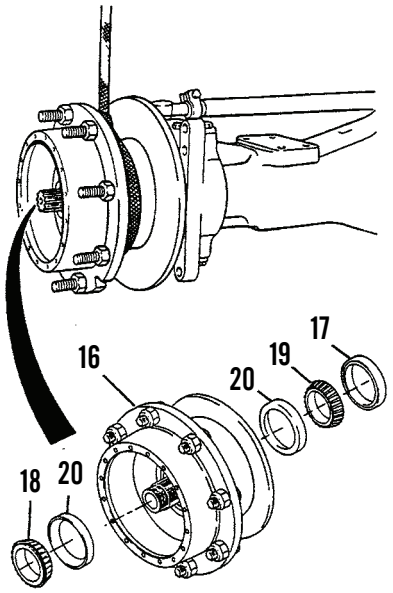
NOTE

Install two shorter capscrews at two top holes and two capscrews at bottom two holes.

5. Install ten capscrews (21), four shorter capscrews (22) and fourteen flatwashers (23) to secure wheel bearing spindle (10). Torque capscrews to 150 lb-ft (203 Nm).

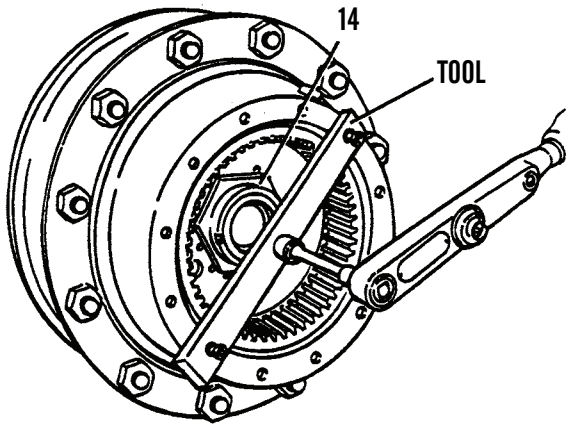
INSTALLATION - CONTINUED

6. Install wheel hub and disc assembly (16).
7. Install two bearing cups (20) with a suitable driving sleeve into wheel hub.
8. Place wheel hub and disc assembly (16) on floor or bench with the brake disc up.
9. Apply a thin film of clean lubricating oil to inner bearing (19) and install in inner bearing cup (20).
10. Install new oil seal (17) with a suitable driver.
11. Use a sling and hoist or other suitable lifting device to support weight of wheel hub and disc assembly (16).
12. Apply a thin film of clean oil to inside diameter of new oil seal (17) and to oil seal journal surface of wheel bearing spindle (10).
13. Align wheel hub and disc assembly (16) with wheel bearing spindle (10). Push wheel hub and disk assembly onto spindle.



409-1266

14. Install outer bearing cone (18) in outer bearing cup (20).
15. Install hub bearing nut (14) and draw wheel hub and disc assembly (16) into position while rotating wheel hub.
16. To preload wheel bearings, seat bearings and related components by tightening the hub bearing nut (14) to 100 lb-ft (136 Nm) while hub is rotated in both directions.
17. Back off hub bearing nut (14) to relieve preload on bearings. Torque on nut should be 0 lb-ft (0 Nm).
18. Use planetary hub drag tool and a torque wrench to check rolling torque while hub is rotating at a steady rate (not starting torque). Record torque.



409-1267

19. Tighten hub bearing nut (14) and check hub rolling torque again. Increase in rolling torque from zero preload should be 3 to 5 lb-ft (4.07 to 6.78 Nm) for new bearings.

INSTALLATION - CONTINUED

NOTE

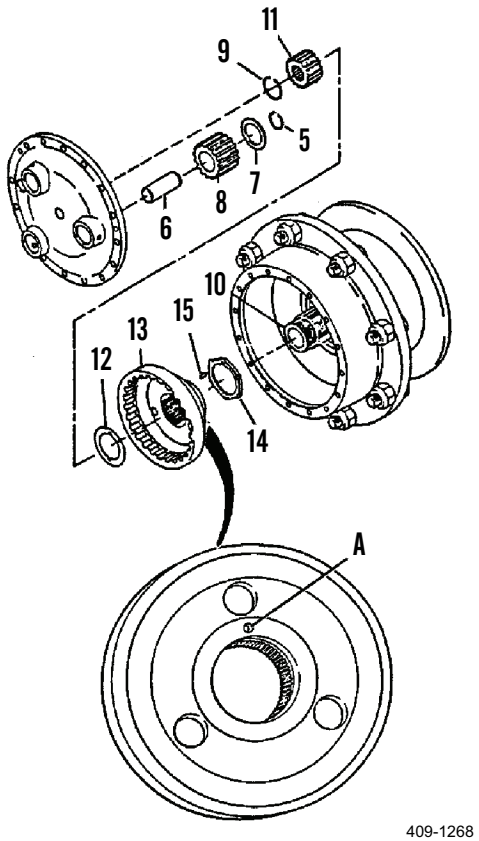
If bearings are to be reused, the increase in rolling torque should be 1.5 to 2.5 lb-ft (2.03 to 3.4 Nm).

20. Install planetary ring gear (13) and sun gear (11).
21. Install dowel pin (15), if removed.
22. Locate hole (A) on back of planetary ring gear (13). Orient ring gear with respect to dowel pin (15) on wheel hub bearing nut (14).

NOTE

If pin is not aligned with hole (A) of ring gear, spider assembly will not fit tight to wheel hub.

23. Install planetary ring gear (13). It may be necessary to turn hub bearing nut (14) to match hole (A) on back of planetary ring gear (13). Hub bearing nut may be tightened to match dowel pin (15) with planetary ring gear, but torque on hub bearing nut should not exceed 150 lb-ft (203 Nm).



409-1268

24. Install sun gear thrust washer (12), sun gear (11) and new spindle snap ring (9). Tangs on thrust washer must engage slots in ring gear (13).
25. Apply a thin film of clean lubricating oil to bore of planetary gear (8). Slide planetary gear and outer thrust washer (7) onto planetary pinion shaft (6).
26. Install new snap ring (5) onto planetary pinion shaft (6).
27. Repeat steps 29 and 30 for second and third sets of planetary gears (8), thrust washers (7) and snap rings (5).

NOTE

Remove dirt, grease or moisture from the mating surfaces of the spider flange and hub mounting face and dry both surfaces.

INSTALLATION - CONTINUED

WARNING

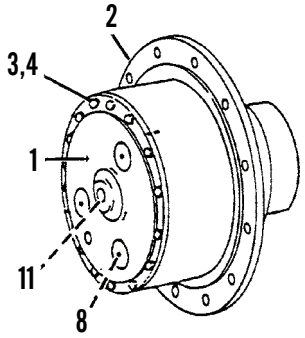
Minor concentrations of acetic acid may be produced during application of silicone TRTV-732 sealing compound. Adequate ventilation must be provided when silicone RTV-732 clear sealing compound is applied in confined areas. Failure to do so could cause respiratory irritation, headaches and nausea. Eye contact with silicone RTV-732 sealing compound may cause irritation. If eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

28. Apply a continuous bead of sealing compound approximately 1/8 in. in diameter completely around the hub mounting face and around the inner edge of all fastener holes to ensure complete sealing and prevent leakage.

NOTE

Assemble components immediately to permit sealing compound to spread evenly. Failure to do so could cause axle to leak.

29. Start planetary spider (1) onto wheel hub (2), aligning teeth of planetary gears (8) with sun gear (11) and ring gear (13) teeth.
30. Align the match marks on the spider flange and wheel hub as previously marked during removal.
31. Align holes on wheel hub (2) with holes on planetary spider (1) flange and push spider assembly against hub (2).
32. Install sixteen capscrews (3) and flatwashers (4).
33. Torque capscrews (3) and torque to 60 to 75 lb-ft (81 to 102 Nm).
34. Fill planetary wheel ends (WP 0126 00).
35. Install front disc brake assembly (WP 0249 00).



409-1270

36. Install wheel assembly (WP 0134 00).
37. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

REAR AXLE ASSEMBLY REPLACEMENT 0245 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Floor jack, 2,000 lb (907 kg) capacity

Lifting capacity, 2,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Oil, lubricating (Item 32, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Locknut (4)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Rear propeller shaft removed (WP 0124 00)

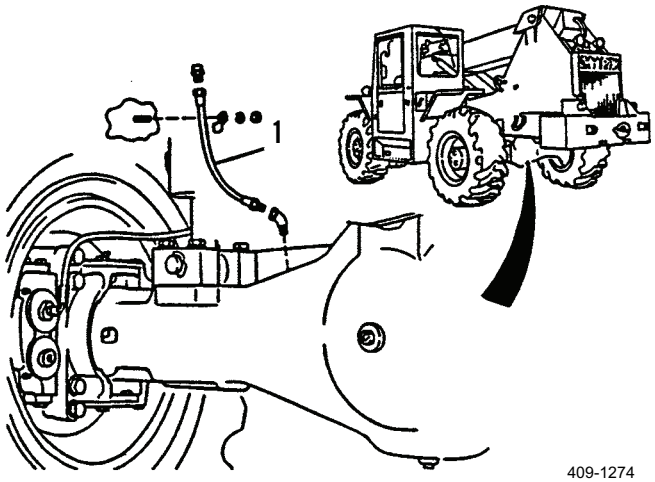
Rear tire assemblies removed (WP 0134 00)

Rear disc brake assemblies removed (WP 0249 00)

Counterweight removed (WP 0145 00)

REMOVAL

1. Disconnect axle breather hose (1) from frame.



REMOVAL - CONTINUED

WARNING

Use 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.

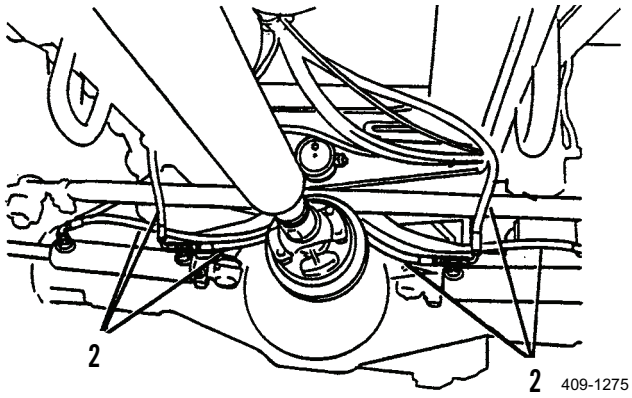
CAUTION

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

NOTE

If more than one hydraulic line is to be removed, tag and identify lines to ensure proper installation. Use container to catch any hydraulic oil that may drain from the system.

2. Disconnect and plug rear steering cylinder hydraulic supply hoses (2).



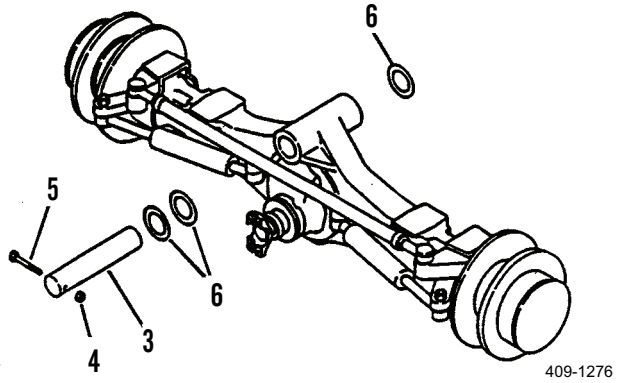
NOTE

- Weight of axle assembly is 1,650 lb (748 kg).
- Do not raise frame off jackstands.

3. Use a floor jack to support weight of rear axle assembly.
4. Remove axle aligning rod (3).
5. Remove locknut (4) and retaining bolt (5). Discard locknut.

NOTE

Note location and quantity of washer spacers during disassembly. Keep washer spacers together as a set. Do not mix washer spacers sets.



6. Remove axle aligning rod (3) and washer spacers (6).
7. Lower floor jack until top of axle housing is clear of frame and exhaust pipe. Carefully pull jack supporting axle assembly from under vehicle while assistant holds axle assembly steady.
8. Support axle assembly using jack stands or blocks.

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

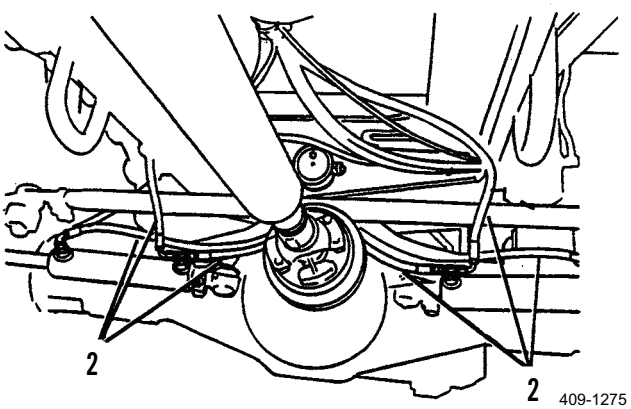
WARNING

Use 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

At least one washer spacer must be installed on each side of axle pivot hole.

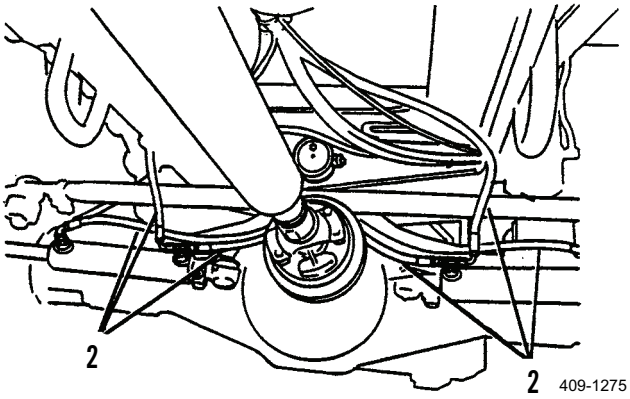
1. Place washer spacers (6) on frame pivot pin holes. Use thin film of grease to retain washer spacers (6).
2. Install axle assembly and align with frame pivot pin holes.
3. Place floor jack under center of axle assembly. Use floor jack to raise axle assembly. Have assistant hold axle assembly steady.
4. Remove stands or blocks.
5. Carefully move axle under vehicle with jack and position axle pivot hole in line with frame pivot holes.
6. Lower floor jack to allow axle assembly to clear frame.
7. Use floor jack to carefully raise axle assembly while assistant holds assembly steady. Keep shims (6) in position.
8. Raise floor jack until axle pivot pin hole is aligned with frame pivot pin holes.
9. Secure rear axle to frame with axle pivot pin (3).
10. Secure axle pivot pin with retaining bolt (5) and new locknut (4). Torque bolt (5) to 100 lb-ft (136 Nm).
11. Install rear propeller shaft (WP 0124 00).
12. Install rear disc brake assemblies (WP 0249 00).
13. Install rear tire assemblies (WP 0134 00).
14. Use a floor jack to raise rear of vehicle until vehicle frame clears jackstands. Remove jackstands and carefully lower vehicle.



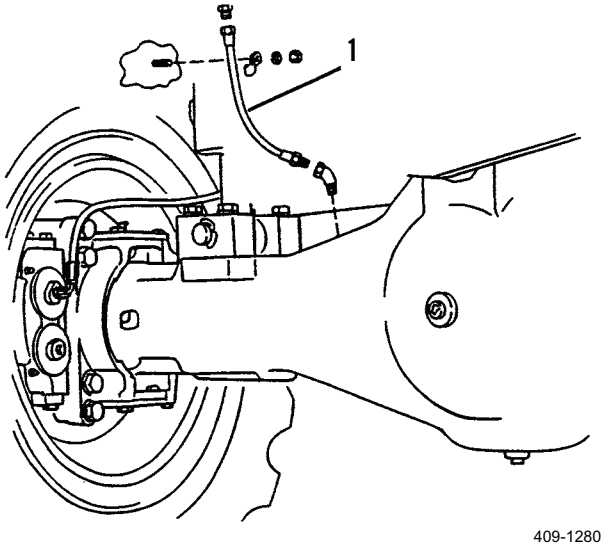
409-1275

INSTALLATION - CONTINUED

15. Connect rear steering cylinder hydraulic supply hoses (2).



16. Connect axle breather hose (1) to frame.



17. Install counterweight (WP 0145 00).
18. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

REAR AXLE ALIGNING ROD REPLACEMENT 0246 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Locknut (2)

Personnel Required

Two

Equipment Condition

Vehicle parked on level ground (TM 10-3930-660-10)

Parking brake set (TM 10-3930-660-10)

WARNING

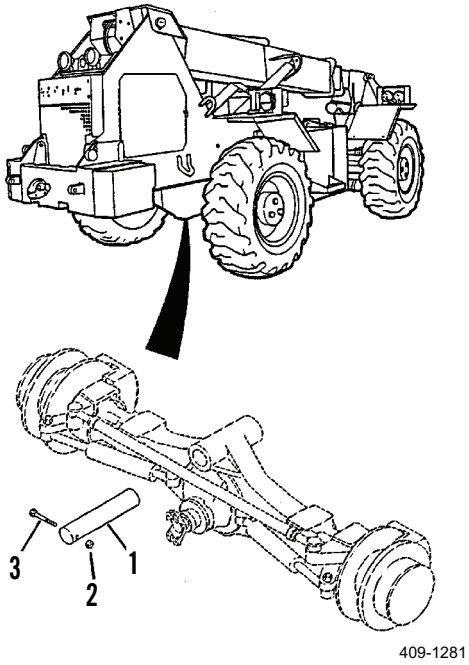
Lifting equipment used for lifting vehicle must be in good condition and of suitable load capacity. Failure to follow this warning may cause injury or death, or damage to equipment.

REMOVAL

1. With assistance, raise vehicle by the frame so that weight of vehicle is off aligning rod (1). Do not raise vehicle off ground.
2. Support vehicle under frame using stands.
3. Remove locknut (2) and bolt (3). Discard locknut.
4. Remove axle aligning rod (1).

INSTALLATION

1. Install axle aligning rod (1).
2. Install bolt (3) and new locknut (2).
3. Torque bolt (3) to 100 lb-ft (136 Nm).
4. Raise vehicle and remove stands.
5. Lower vehicle.



409-1281

END OF WORK PACKAGE

REAR DIFFERENTIAL CARRIER ASSEMBLY REPLACEMENT 0247 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 4,000 lb capacity

Materials/Parts

Compound, prussian blue marking (Item 13, WP 0323 00)

Compound, sealing (Item 13, WP 0323 00)

Sealant, Loctite (Item 46, WP 0323 00)

Materials/Parts - Continued

Oil, lubricating (Item 32, WP 0323 00)

Personnel Required

Two

References

WP 0316 00

WP 0317 00

Equipment Condition

Rear axle assembly removed (WP 0245 00)

Axle housing drained (WP 0125 00)

Rear planetary wheel ends removed (WP 0259 00)

REMOVAL

WARNING

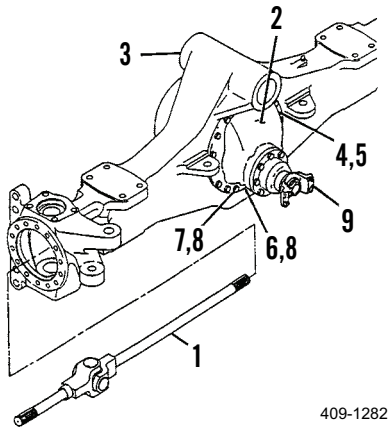
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

1. Remove differential carrier (2) from axle housing (3).
2. Carefully tip axle assembly so that rear differential carrier (2) is up.

NOTE

Capscrews from differential carrier to axle housing are of three different sizes. Note size, location and quantity of capscrews when removing for correct location during replacement.

3. Remove twelve capscrews (4), twelve flatwashers (5), two capscrews (6), two capscrews (7) and four flatwashers (8) from differential carrier (2).



409-1282

REMOVAL - CONTINUED

4. Use a sling placed around the bevel pinion, behind companion yoke (9) to lift and support the differential carrier (2) during removal.
5. Use a leather or rubber mallet to loosen the differential carrier (2) in the axle housing.
6. Carefully remove the differential carrier (2) from the axle housing (3).
7. Place differential carrier (2) on suitable stand or bench with ring gear up and clamp securely.

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00.

INSTALLATION

WARNING

- Minor concentrations of acetic acid may be produced during application of silicone RTV-732 sealing compound. Adequate ventilation must be provided when silicone RTV-732 sealing compound is applied in confined areas. Failure to do so could cause respiratory irritation, headaches and nausea. Eye contact with silicone RTV-732 sealing compound may cause irritation. If eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.
- 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

Be sure bearing caps of differential fit inside lugs inside of axle housing. Do not force differential into housing or damage will occur to housing and differential.

NOTE

- When installing differential carrier, apply silicone sealant to the mounting surface of the axle housing.
- Inside of axle housing and mounting flange where carrier fastens should be clean and dry before installing carrier.

INSTALLATION - CONTINUED

1. Apply a 1/8 in. (32 mm) bead of silicone RTV-732 clear sealing compound to differential mounting surface of axle housing (3). Be sure to apply sealing compound around each tapped hole of mounting surface.

WARNING

Use 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.

2. Install differential carrier (2) into axle housing (3).

CAUTION

First four installed capscrews must be evenly spaced to prevent uneven pressure on differential carrier when torquing. Failure to do so could cause component damage.

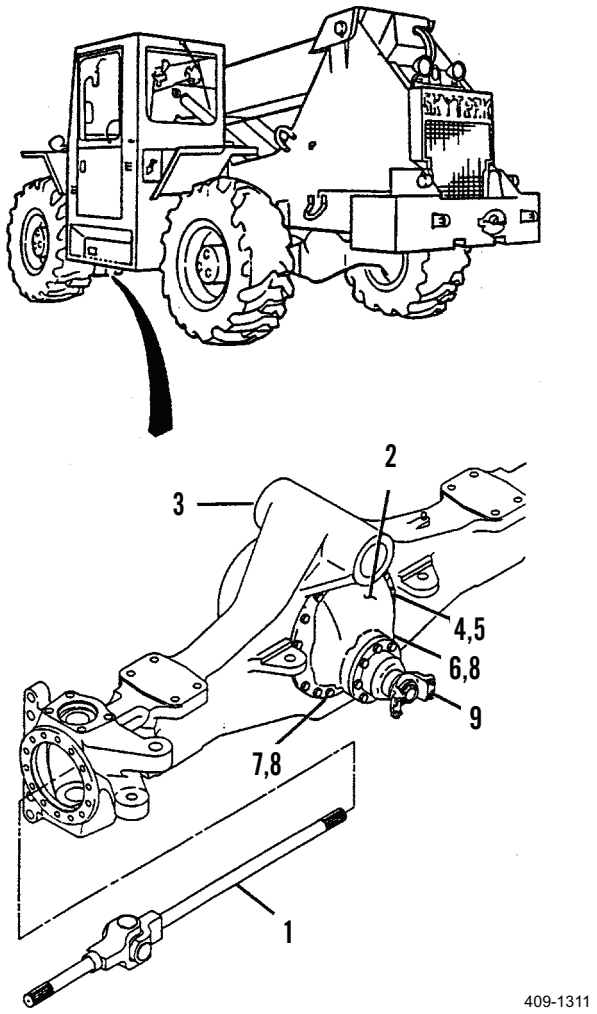
3. Install four capscrews (4) and flatwashers (5) into corner locations around differential carrier (2) and axle housing (3). Hand tighten.

4. Carefully push differential carrier (2) into position. Tighten four capscrews (4) two or three turns each in a pattern opposite each other.

NOTE

Torque capscrews in pairs on opposing sides of differential carrier.

5. Torque capscrews (4) to 50 to 75 lb-ft (68 to 102 Nm). Torque in pairs across from each other.



INSTALLATION - CONTINUED

6. Install remaining eight capscrews (4), two capscrews (6), two capscrews (7), four flatwashers (8) and eight flatwashers (5). Be sure flatwashers are in correct location as noted during disassembly.
7. Carefully install axle shafts (1) into axle housing (3) so not to damage bushings or seals in axle housing.
8. Carefully move axle housing (3) to upright position.
9. Install rear planetary wheel ends (WP 0248 00).
10. Fill axle housing (WP 0125 00).
11. Install rear axle assembly on vehicle (WP 0245 00).
12. Operate vehicle, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

REAR PLANETARY WHEEL ENDS REPLACEMENT 0248 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 200 lb (91 kg) capacity

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Personnel Required

Two

References

WP 0316 00

WP 0317 00

Equipment Condition

Rear of vehicle raised 8 in. (20 cm) and supported under rear axle

Rear planetary wheel end drained (WP 0126 00)

Tire assembly removed (WP 0134 00)

Rear disc brake assembly removed (WP 0249 00)

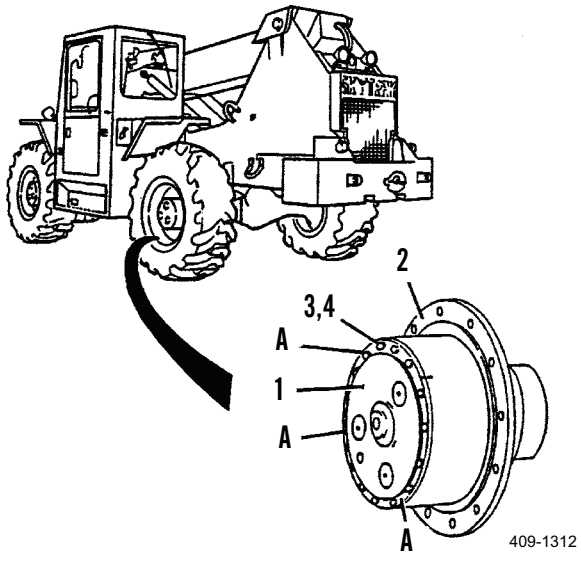
REMOVAL

1. Mark planetary spider (1) and wheel hub (2) for correct alignment during installation.
2. Place a suitable container under planetary wheel end assembly.

WARNING

Use 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.

3. Remove sixteen capscrews (3) and sixteen flatwashers (4) from planetary spider (1).
4. Place three capscrews (3) in jack screw holes (A) and tighten to remove planetary spider (1).
5. Remove planetary wheel assembly.



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

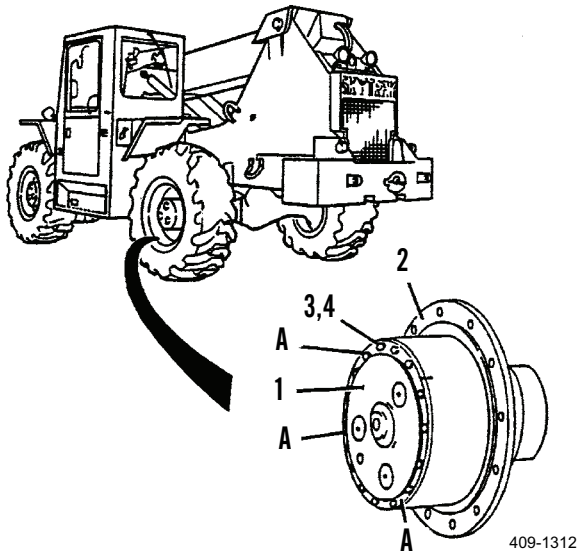
See *Inspection* instructions (WP 0317 00).

WARNING

Use 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.

INSTALLATION

1. Align the match marks on the spider flange and wheel hub as previously marked during removal.
2. Align holes on wheel hub (2) with holes on planetary spider (1) flange and push spider assembly against hub (2).
3. Install sixteen capscrews (3) and flatwashers (4).
4. Tighten capscrews (3) and torque to 60 to 75 lb-ft (81 to 102 Nm).



5. Fill rear planetary wheel ends (WP 0126 00).
6. Install rear disc brake assembly (WP 0249 00).
7. Install tire assembly (WP 0134 00).
8. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

DISC BRAKE ASSEMBLY MAINTENANCE 0249 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Wood block

Materials/Parts

Cloth, emery (Item 12, WP 0323 00)

Sealant, Loctite (Item 45, WP 0323 00)

Sealant, Loctite (Item 48, WP 0323 00)

Oil, lubricating (Item 31, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Materials/Parts - Continued

Back-up ring (14)

Dust seal (12)

O-ring (11 and 13)

References

WP 0129 00

WP 0316 00

TM 10-3930-660-10

Equipment Condition

Tire assembly removed (WP 0134 00)

Brake pads removed (WP 0130 00)

WARNING

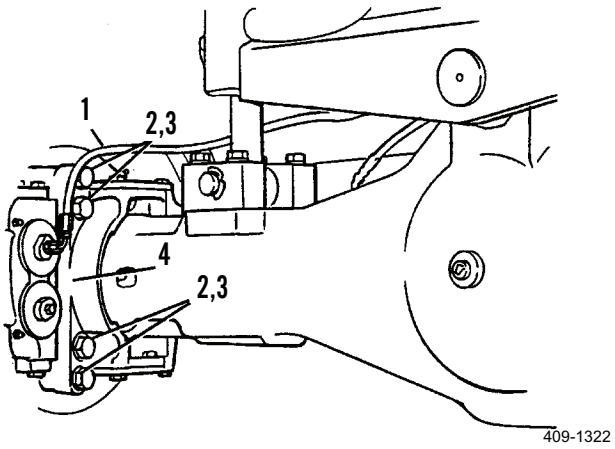
Always use blocks, jackstands or other rigid, stable supports when working beneath raised equipment. Ensure that hoists or jacks are in good condition. Never use frayed, twisted or pinched cables. Never use bent or distorted hooks. Failure to follow this precaution could result in severe personal injury or machine damage.

CAUTION

Wipe the area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug holes after removing lines. Contamination of the hydraulic system could result in premature failure.

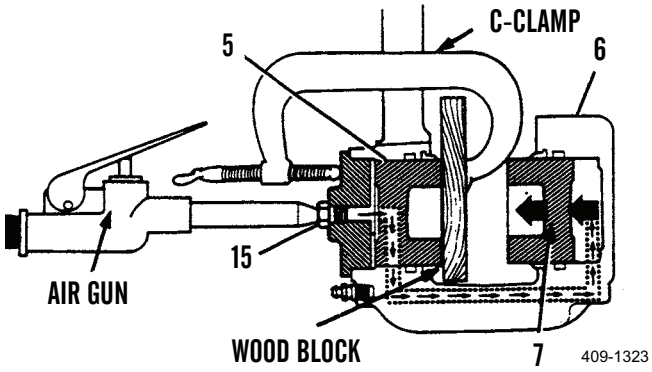
REMOVAL

1. Disconnect line (1) from brake housing.
2. Remove four capscrews (2) and four washers (3).
3. Remove disc brake (4).
4. Repeat steps 1 thru 3 for other disc brakes.



DISASSEMBLY

1. Use a C-clamp to hold a wood block against the two pistons (5) on mounting side of housing (6).
2. Use compressed air at inlet fitting (15) to force pistons (7) out of housing (6). Place a piece of wood in front of the piston (7) that comes out first so other piston will be forced out.

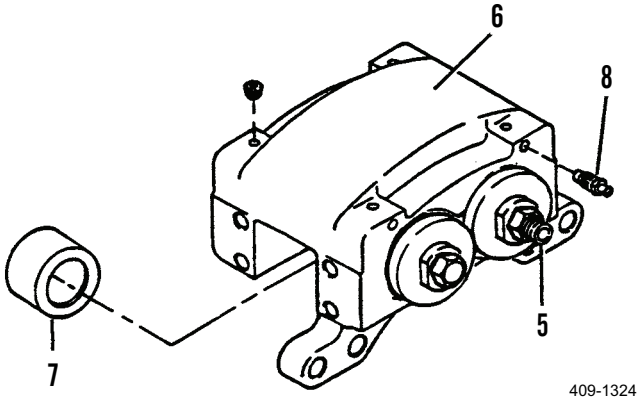


WARNING

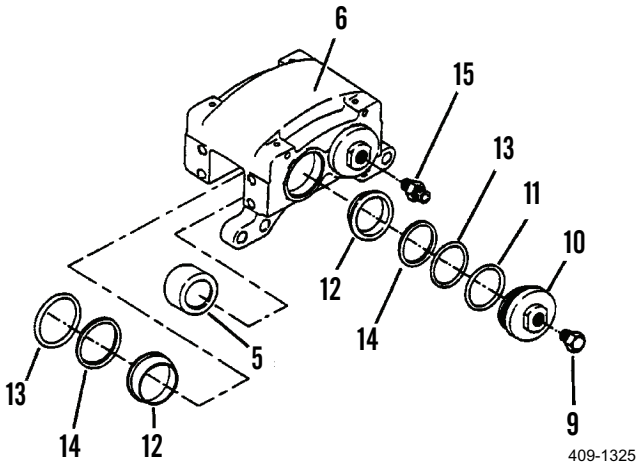
- Do not put hands in front of the pistons when forcing out the pistons. Failure to follow this precaution could result in severe personal injury.
- Do not exceed 30 psi (207 kPa) nozzle pressure. Always wear safety glasses. Do not direct compressed air against human skin. Failure to follow these instructions may result in serious injury or death.

DISASSEMBLY - CONTINUED

3. Remove two pistons (7) from housing (6) bores opposite from mounting plate.
4. Remove two bleeder screws (8) from housing (6).



5. Remove plug (9) and fitting (15) from two cylinder heads (10).
6. Use a wrench on the two flat areas on top of cylinder head (10). Remove two cylinder heads (10) from housing (6).
7. Remove and discard O-ring (11) from each cylinder head (10).
8. Use a wood block or dowel and push on two pistons (5) to force pistons out from the mounting side of housing (6) towards disc side.
9. Remove and discard four dust seals (12) from housing (6).



10. Remove four O-rings (13) and four backup rings (14). Discard O-rings and back-up rings.

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Inspect pistons (5 and 7) for scratches and rust. Use emery cloth to remove small scratches and rust. Discard parts if there are large scratches or amounts of rust.
2. Measure outer diameter of pistons (5 and 7). Discard pistons if the outer diameter is less than 2.995 in. (76 mm).
3. Inspect piston bores and ring grooves in housing for scratches and rust. Use emery cloth to remove small scratches and rust. Discard housing if there are large scratches or amounts of rust.
4. Measure inner diameter of piston bores in housing (6). Discard housing if inner diameter of bore is more than 3.003 in. (76.2 mm),

ASSEMBLY

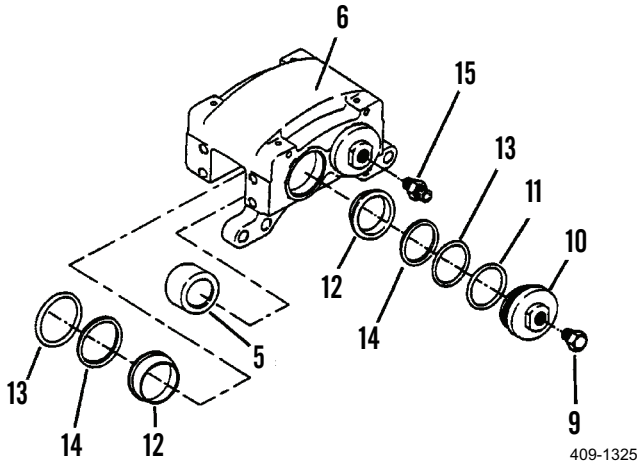
WARNING

Use only specified parts when assembling the disc brake. Do not mix parts from other disc brakes. If installing the wrong parts, the disc brake will not operate correctly and could result in severe personal injury and equipment damage.

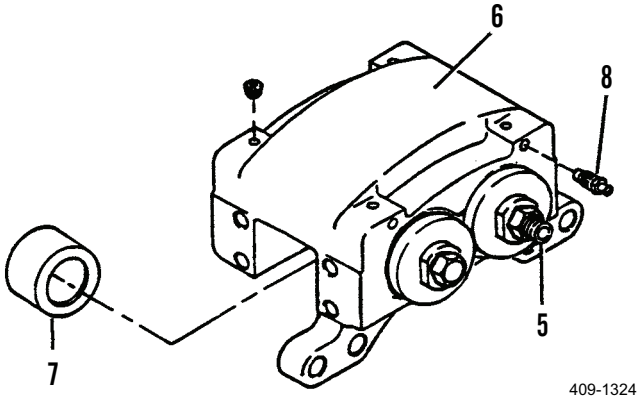
NOTE

Wipe all sealing surfaces on disc brake clean and dry. Apply film of clean hydraulic oil to all seals, pistons and bores as parts are installed.

1. Install new back-up ring (14) and new O-ring (13) in middle groove of each bore. The new back-up ring is installed toward the lining side of housing (6). The new O-ring is installed towards the outside of the housing.
2. Install four new dust seals (12) in inner groove of housing bore.
3. Install pistons (5 and 7) in from lining side of housing (6).
4. Ensure that pistons (5 and 7) are straight in housing (6) bores. Push each piston (5 and 7) into housing bore until top of piston is even with top of new dust seal (12).
5. Install a new O-ring (11) on two cylinder heads (10). Ensure that new O-rings are not cut by threads on cylinder head.
6. Install two cylinder heads (10) in housing (6). Torque cylinder heads to 75 lb-ft (102 Nm).
7. Apply loctite sealant to threads of plug (9) and fitting (15). Install plug and fitting in two cylinder heads (10).
8. Install two bleeder screws (8) in housing (6).



409-1325



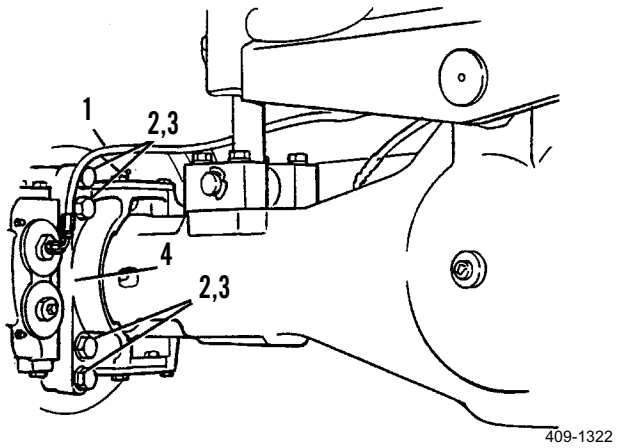
409-1324

INSTALLATION

NOTE

Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on disc brake clean and dry.

1. Position disc brake (4) on disc.
2. Check proper location of disc brake in relation with the disc.
3. Verify that disc is centered between disc brake housing.
4. Apply loctite on capscrew (2) threads install four washers (3) and four capscrews (2). Torque capscrews to 280 lb-ft (380 Nm).



5. Install brake pads (WP 0130 00).
6. Check to see that brake pads are free to move.
7. Connect line (1) to brake housing.
8. Bleed air from brakes (WP 0129 00).
9. Install tire assembly (WP 0134 00).
10. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

STEERING KNUCKLE MAINTENANCE 0250 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation, Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Jacking screws

Materials/Parts

Grease (Item 20, WP 0323 00)

Sealant, Loctite (Item 45, WP 0323 00)

References

WP 0138 00

WP 0316 00

WP 0317 00

TM 10-3930-660-10

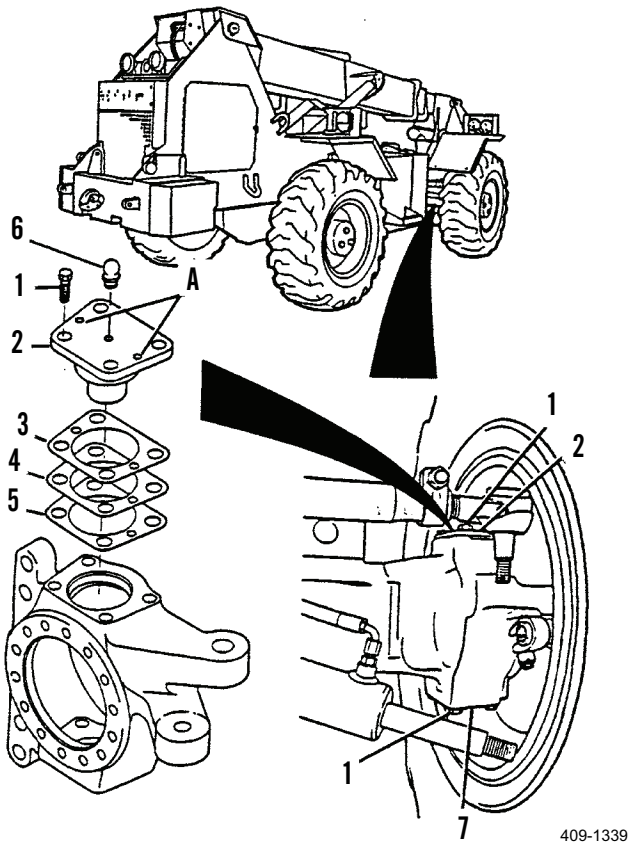
Equipment Condition

Planetary wheel ends removed (WP 0244 00 and WP 0248 00)

Tie rod removed (WP 0251 00)

REMOVAL

1. Mark steering knuckle caps. Upper (2) and lower (7) caps are not interchangeable.
2. Remove four capscrews (1) from each steering knuckle cap (2 and 7).
3. Install jacking screws in holes (A). Tighten jacking screws to loosen caps (2 and 7).

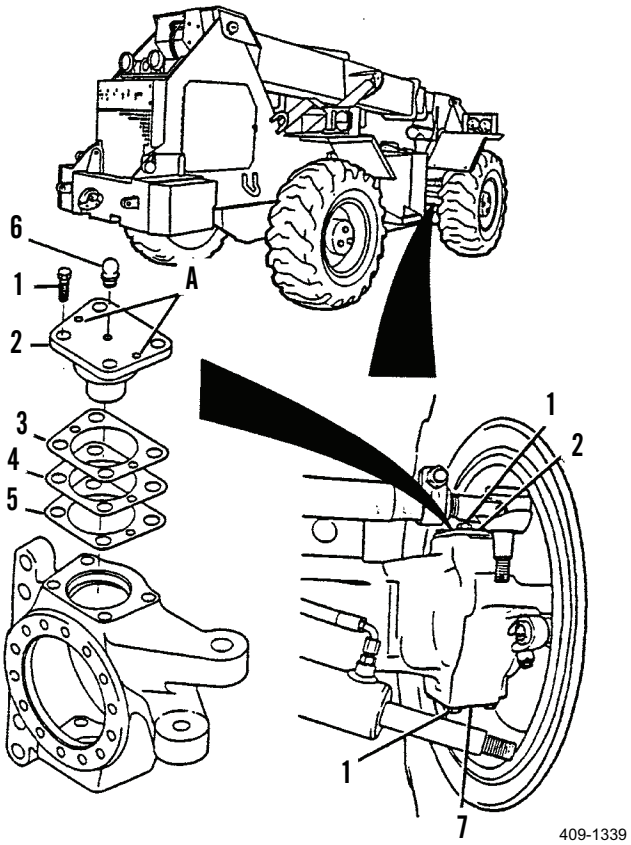


REMOVAL - CONTINUED

NOTE

Do not mix upper and lower shims. Keep shims together as a set for assembly.

4. Remove lower steering knuckle cap (7), thrust washer (8) and shims (9 thru 11).
5. Remove upper steering knuckle cap (2) and shims (3 thru 5).
6. Remove grease fittings (6) from steering knuckle caps (2 and 7), if necessary.
7. Remove steering knuckle (12) from end of axle.
8. Repeat steps 1 thru 7 for other side.



409-1339

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

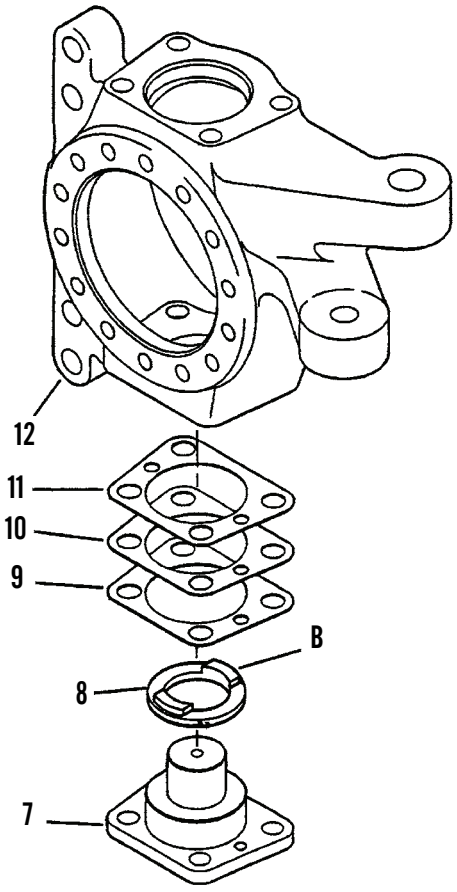
See Inspection instructions (WP 0317 00).

INSTALLATION

1. If removal was necessary, install grease fitting (6) in caps (2 and 7).
2. Apply grease in bores of steering knuckle for caps.

INSTALLATION - CONTINUED

3. Install steering knuckle (12) end of axle.
4. Apply grease to groove face of thrust washer (8).
5. Install shims (9 thru 11) and thrust washer (8) on lower steering knuckle cap (7). Tabs (B) on thrust washer must be up.
6. Install lower cap assembly. Ensure that thrust washer (8) tabs engage slots in end of axle housing before final tightening of capscrews (1).
7. Apply loctite to threads of capscrews (1). Torque capscrews (1) to 85 to 117 lb-ft (115 to 159 Nm).
8. Install shims (3 thru 5) on upper steering knuckle cap (2).
9. Install upper cap assembly.
10. Apply loctite to threads of capscrews (1). Torque capscrews (1) to 85 to 115 lb-ft (115 to 159 Nm).
11. Repeat steps 1 thru 10 for other steering knuckle, if necessary.



409-1340

12. Install planetary wheel ends (WP 0244 00 and WP 0248 00).
13. Install tie rod (WP 0251 00).
14. Adjust tie rod (WP 0138 00).

ADJUSTMENT

1. If wheels are on ground, use a feeler gauge to measure gap between upper steering knuckle cap shoulder and top machined surface of end of the axle housing.
2. If wheels are removed (axle supported by blocks), use a hydraulic jack or pry bar to push steering knuckle up until bottom of steering knuckle is tight against bottom of axle. Measure gap as in step 1.
3. Vertical end play may also be measured by checking maximum vertical movement of knuckle with a dial indicator.
4. Record measurement.
5. If end play is 0.013 in. (0.33 mm) or less, no adjustment is necessary.
6. If vertical end play exceeds 0.013 in. (0.33 mm), go to step 9.

ADJUSTMENT - CONTINUED

7. Remove upper and lower steering knuckle caps. Measure total current shim pack thickness (upper and lower shim packs combined).
8. Subtract actual end play (value obtained in step 1) from total shim pack thickness obtained in step 7. Divide this result by two.
9. Make new lower shim thickness the same value as calculated in step 8. If this thickness cannot be met exactly, choose nearest thicker shim pack.
10. Make new upper shim thickness the same as value obtained in step 8, plus 0.005 in. (0.127 mm). If the result cannot be met exactly, choose nearest thicker shim pack.
11. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TIE ROD REPLACEMENT 0251 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Cotter pin (7)

Equipment Condition

Vehicle parked on level ground

Parking/emergency brake applied (TM 10-3930-660-10)

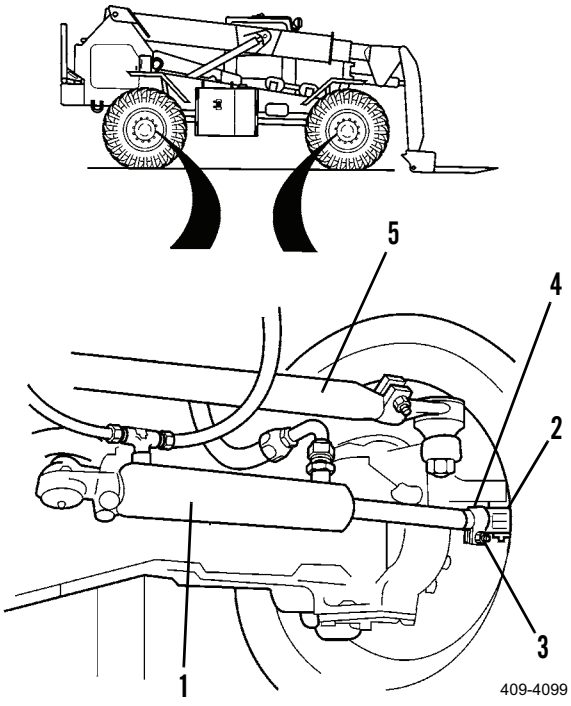
Wheel and tire assembly removed (WP 0134 00)

NOTE

The following procedures apply to both the front and rear tie rods.

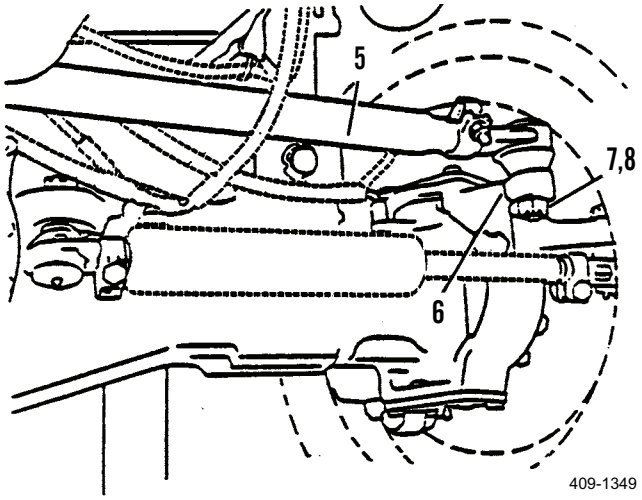
REMOVAL

1. To provide access, disconnect rod ends of both steering cylinders (1) from ball joints (2). Swing cylinders (1) out to provide access.
2. Count and record number of threads visible at rod end of steering cylinder (1) between ball joint (2) and end of threads on rod.
3. Loosen nut and capscrew (3) of clamp (4).
4. Unscrew rod end of steering cylinder (1) from socket of ball joint (2) until rod end is disengaged.
5. Swing cylinder (1) away from axle to provide sufficient access.
6. Repeat steps 1 thru 5 for other steering cylinder.



REMOVAL - CONTINUED

7. Remove tie rod (5) from spindle knuckle (6).
8. Remove and discard cotter pin (7) from tie rod end.
9. Loosen castle nut (8).
10. Tap castle nut (8) with a soft mallet to loosen tie rod end from spindle knuckle (6).
11. Remove castle nut (8).
12. Repeat steps 2 thru 5 for other end of tie rod (5).
13. Remove tie rod (5) from vehicle.



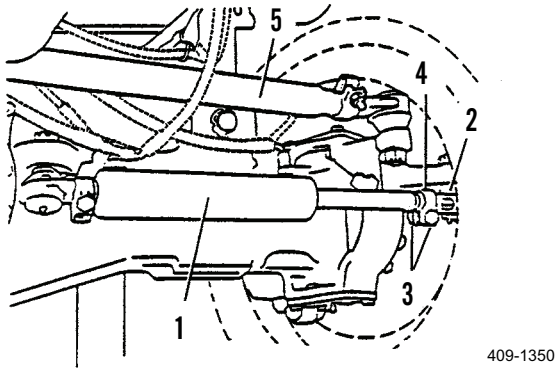
409-1349

INSTALLATION

NOTE

It may be necessary to turn the wheels slightly when installing tie rod ends.

1. Position tie rod (5) ends into holes of steering spindle knuckles (6).
2. Install castle nuts (8) on each tie rod end. Torque castle nuts (8) to 200 to 250 lb-ft (271 to 339 Nm).
3. Further tighten castle nuts (8) as necessary until notches on each nut (8) align with cotter pin hole on each tie rod end.
4. Install new cotter pins (7) through notches on castle nuts (8) and through holes on tie rod ends.
5. Connect rod ends of steering cylinders (1) to ball joints (2).
6. Swing cylinder (1) toward axle until cylinder rod end is aligned with socket of ball joint (2).
7. Screw cylinder rod end into socket of ball joint (2) until number of threads visible is the same as noted in step 2 of *Removal*.
8. Torque nut and capscrew (3) of clamp (4) to 50 to 65 lb-ft (68 to 88 Nm).



409-1350

9. Repeat steps 1 thru 8 for other steering cylinder.
10. Install wheel and tire assembly (WP 0134 00).
11. Adjust tie rod (WP 0138 00).

END OF WORK PACKAGE

EMERGENCY STEERING PUMP ASSEMBLY REPAIR 0252 00

THIS WORK PACKAGE COVERS

Disassembly, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Equipment Condition

Emergency steering pump removed (WP 0139 00)

References

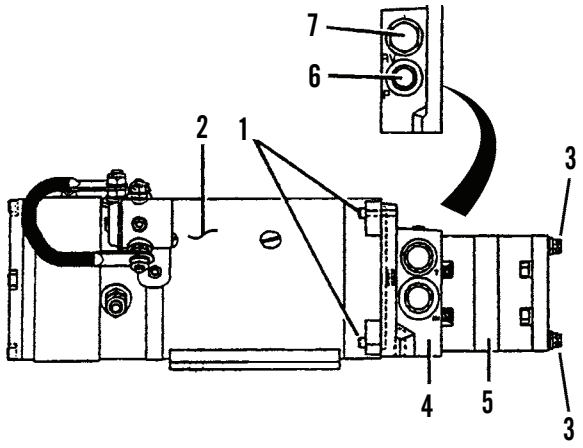
TM 10-3930-660-10

DISASSEMBLY

NOTE

The motor, pump/motor endhead and pump assemblies are not repairable. Each must be replaced as an assembly.

1. Remove four capscrews (1) and motor assembly (2).
2. Remove two capscrews (3) to separate pump/motor endhead (4) from pump (5).
3. Remove check valve assembly (6) and relief valve assembly (7), if necessary.



409-4100

ASSEMBLY

1. If removal was necessary, install relief valve assembly (7) and check valve assembly (6).
2. Install pump/motor endhead (4) to pump (5). Install two capscrews (3).
3. Install pump/motor endhead (4) to motor assembly (2). Install four capscrews (1).
4. Install emergency steering pump (WP 0139 00).
5. Operate vehicle, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

CAB ASSEMBLY WITH ROPS/FOPS MAINTENANCE 0253 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Tool kit, body and fender repair (Item 37, WP 0324 00)

Lifting device, 1-ton capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Starwasher (14 and 15)

References

WP 0090 00

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Cooling system drained (WP 0059 00)

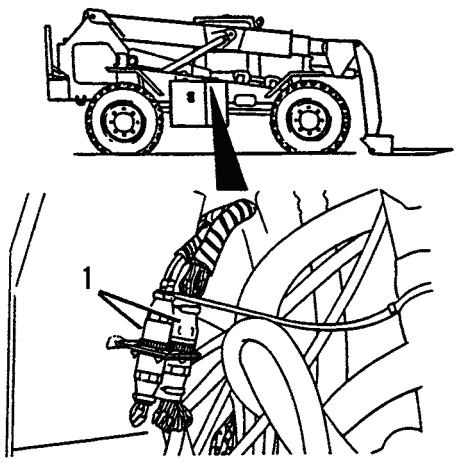
Hydraulic system drained (WP 0032 00)

Batteries removed (WP 0106 00)

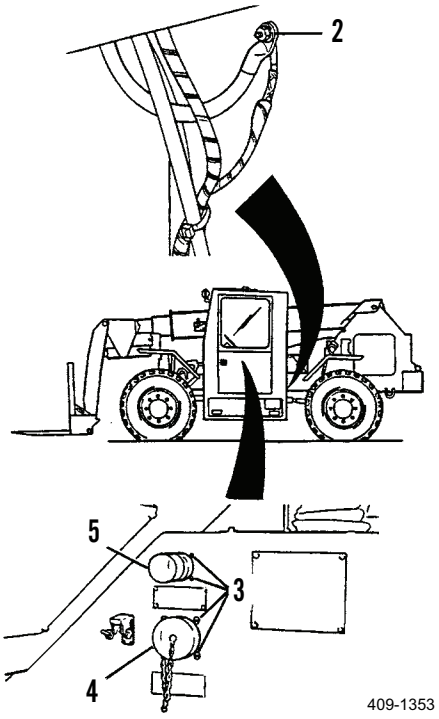
Transmission cover removed (WP 0150 00)

REMOVAL

1. Tag and disconnect two cab wiring harness connectors (1).
2. Disconnect wiring at STE/ICE-R shunt (WP 0090 00).

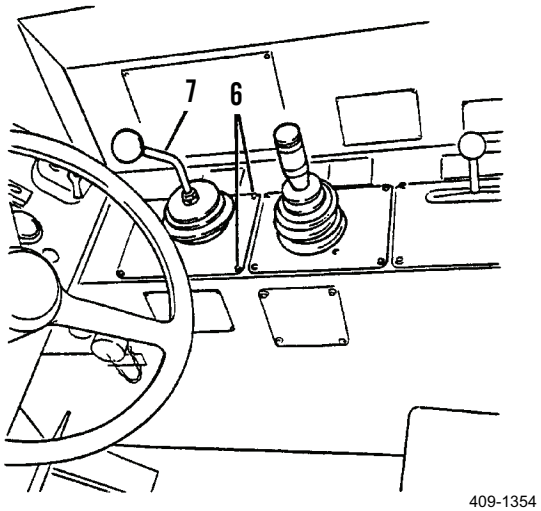


3. Tag and disconnect wiring at stud ground connection (2) on vehicle frame.
4. Remove eight screws (3) securing STE/ICE-R diagnostic receptacle (4) and resistor module receptacle (5).

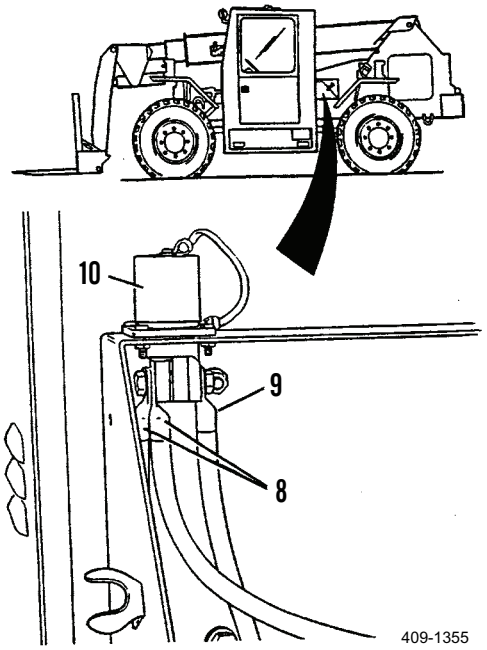


REMOVAL - CONTINUED

5. Remove four screws (6) and pull up on cover/hydraulic joystick control assembly (7) to allow access behind side console.



6. Reach inside console and position receptacles (4 and 5) so they can be pulled from bottom of cab.
7. Pull receptacles (4 and 5) from bottom of cab.
8. Disconnect three cables (8 and 9) from NATO slave receptacle (10).
9. Disconnect accelerator cable at engine (WP 0048 00).
10. Disconnect transmission cables at transmission (WP 0115 00).
11. Disconnect parking brake cable at parking brake lever in cab (WP 0128 00).
12. Disconnect heater hoses at temperature control valve and heater (WP 0170 00).



REMOVAL - 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 3,000 psi (20685 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 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

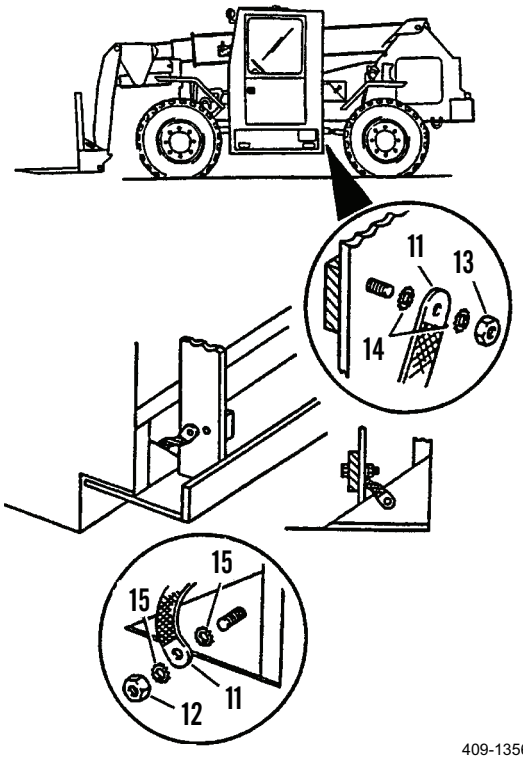
Wipe area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug holes after removing lines. Contamination of hydraulic system could result in premature failure.

NOTE

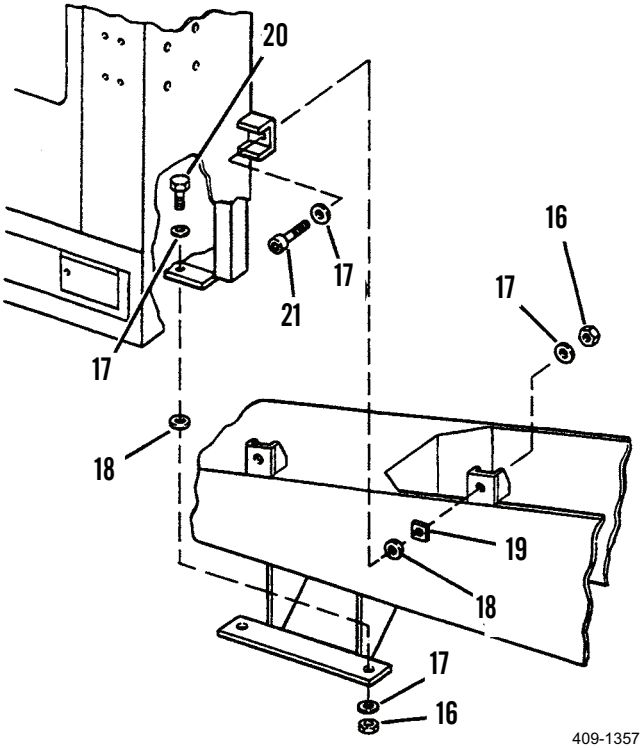
If more than one hydraulic line is removed, tag lines to ensure proper installation. Use container to catch any hydraulic oil that may drain from system.

13. Disconnect two hydraulic steering control lines at priority valve (WP 0143 00).
14. Disconnect six hydraulic lines from hydraulic joystick, four at boom control valve, one at shuttle valve (WP 0181 00).
15. Disconnect one hydraulic line from transmission disconnect master cylinder at transmission control valve (WP 0122 00).
16. Disconnect four hydraulic brake lines; one at each brake tee and two at frame tilt/brake relief valve (WP 0133 00).
17. Disconnect hydraulic line at tee of all four steering cylinders (WP 0141 00).
18. Disconnect hydraulic lines at frame tilt cylinder port (WP 0183 00).
19. Disconnect hydraulic line at hydraulic piston pump (WP 0174 00).
20. Remove nuts (12 and 13), grounding strap (11) and starwashers (14 and 15). Discard starwashers.
21. Attach a suitable sling and a lifting device to cab. Raise lifting device to take up slack.
22. Remove four nuts (16), eight flatwashers (17), two washers (shims) (19), four rubber washers (18), two capscrews (20) and two capscrews (21).

REMOVAL - CONTINUED



409-1356



409-1357

WARNING

Use 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.

23. Remove cab assembly. Have assistant check for any electrical or hydraulic connections which might have been missed and need to be disconnected.

CAUTION

When placing cab on stands, be sure no hoses or wires are between cab and stands. Failure to follow this procedure may result in damage to hoses or wiring.

24. Place cab on suitable stands.

DISASSEMBLY

NOTE

If necessary, components may be removed from old cab and installed on new cab assembly.

1. Remove turn signal switch (WP 0093 00).
2. Remove steering wheel and column (WP 0136 00 and WP 0137 00).
3. Remove steering control valve (WP 0143 00).
4. Remove transmission shifter and cables (WP 0114 00 and WP 0115 00).
5. Remove back-up alarm switch (WP 0103 00).
6. Remove gauges and meters (WP 0068 00).
7. Remove blackout/service light switch (WP 0094 00).
8. Remove starter switch (WP 0072 00).
9. Remove horn button (WP 0105 00).
10. Remove fork autoleveler switch (WP 0079 00).
11. Remove spotlights (WP 0095 00).
12. Remove warning lights (WP 0092 00).
13. Remove spotlight switches (WP 0095 00).
14. Remove circuit breakers (WP 0071 00).
15. Remove underdash relays (WP 0083 00).
16. Remove steering select valve (WP 0144 00).
17. Remove brake and transmission disconnect pedals (WP 0116 00).
18. Remove transmission disconnect valve (WP 0116 00).
19. Remove brake control valve (WP 0131 00).
20. Remove brake accumulator (WP 0132 00).
21. Remove accelerator pedal and cable (WP 0050 00).
22. Remove parking brake lever and cable (WP 0128 00).
23. Remove hydraulic joystick control valve (WP 0305 00).
24. Remove frame tilt valve (WP 0180 00).
25. Remove heater temperature control valve and cable (WP 0169 00).
26. Remove engine primer button (WP 0069 00).
27. Remove cab heater (WP 0168 00).
28. Remove seat and seat belt (WP 0160 00 and WP 0161 00).
29. Remove cab heater, hoses, lines and fittings (WP 0170 00).
30. Remove fire extinguisher and bracket (WP 0152 00).
31. Remove manual holder.
32. Remove windshield washer assembly (WP 0165 00).
33. Remove data plates (WP 0171 00).
34. Remove electric joystick controller (WP 0235 00).
35. Remove composite lights (WP 0097 00).
36. Remove front and rear windshield wiper assemblies (WP 0163 00 and WP 0164 00).
37. Remove cab wire harness (WP 0109 00).
38. Remove neutral safety switch (WP 0066 00).
39. Remove battery box (WP 0108 00).
40. Remove tool box door latch (WP 0153 00).

DISASSEMBLY - CONTINUED

41. Remove cab windshield and windows (WP 0157 00, WP 0158 00 and WP 0159 00).
42. Remove cab door latch (WP 0151 00).
43. Remove sound suppression panels (WP 0254 00).
44. Remove cab level gauge (WP 0068 00).
45. Remove heater temperature control valve (WP 0168 00).

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. Install heater control valve (WP 0168 00).
2. Install cab level gauge (WP 0068 00).
3. Install new sound suppression panels into new cab (WP 0254 00).
4. Install cab door latch (WP 0151 00).
5. Install windshield and windows (WP 0157 00, WP 0158 00 and WP 0159 00).
6. Install tool box door latch into new cab (WP 0153 00).
7. Install battery box into new cab (WP 0108 00).
8. Install neutral safety switch into new cab (WP 0066 00).
9. Install cab wire harness into new cab (WP 0109 00).
10. Install front and rear windshield wiper assemblies into new cab (WP 0163 00 and WP 0164 00).
11. Install composite lights into new cab (WP 0097 00).
12. Install electric joystick controller into new cab (WP 0235 00).
13. Install data plates into new cab (WP 0171 00).
14. Install windshield washer assembly into new cab (WP 0165 00).
15. Install manual holder into new cab.
16. Install fire extinguisher and bracket into new cab (WP 0152 00).
17. Install cab heater, hoses, lines and fittings into new cab (WP 0170 00).
18. Install seat and seat belt into new cab (WP 0160 00 and WP 0161 00).
19. Install cab heater switch (WP 0168 00).
20. Install engine primer button (WP 0069 00).
21. Install heater temperature control valve and cable (WP 0169 00).
22. Install frame tilt valve into new cab (WP 0180 00).
23. Install hydraulic joystick control valve into new cab (WP 0305 00).
24. Install parking brake lever and cable into new cab (WP 0128 00).
25. Install accelerator pedal and cable into new cab (WP 0050 00).
26. Install brake accumulator into new cab (WP 0132 00).
27. Install brake control valve into new cab (WP 0131 00).
28. Install transmission disconnect valve into new cab (WP 0116 00).
29. Install brake and transmission disconnect pedals into new cab (WP 0116 00).
30. Install steering select valve into new cab (WP 0144 00).

ASSEMBLY - CONTINUED

31. Install underdash relays into new cab (WP 0083 00).
32. Install circuit breakers into new cab (WP 0071 00).
33. Install spotlight switches (WP 0095 00).
34. Install warning lights (WP 0092 00).
35. Install spotlights (WP 0095 00).
36. Install fork autoleveler switch (WP 0079 00).
37. Install horn button (WP 0105 00).
38. Install starter switch control (WP 0072 00).
39. Install blackout/service light switch into new cab (WP 0094 00).
40. Install gauges and meters into new cab (WP 0068 00).
41. Install back-up alarm switch into new cab (WP 0103 00).
42. Install transmission shifter and cables into new cab (WP 0114 00 and WP 0115 00).
43. Install steering control valve into new cab (WP 0143 00).
44. Install steering wheel and column into new cab (WP 0136 and WP 0137 00).
45. Install turn signal switch into new cab (WP 0093 00).

INSTALLATION

WARNING

Use 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.

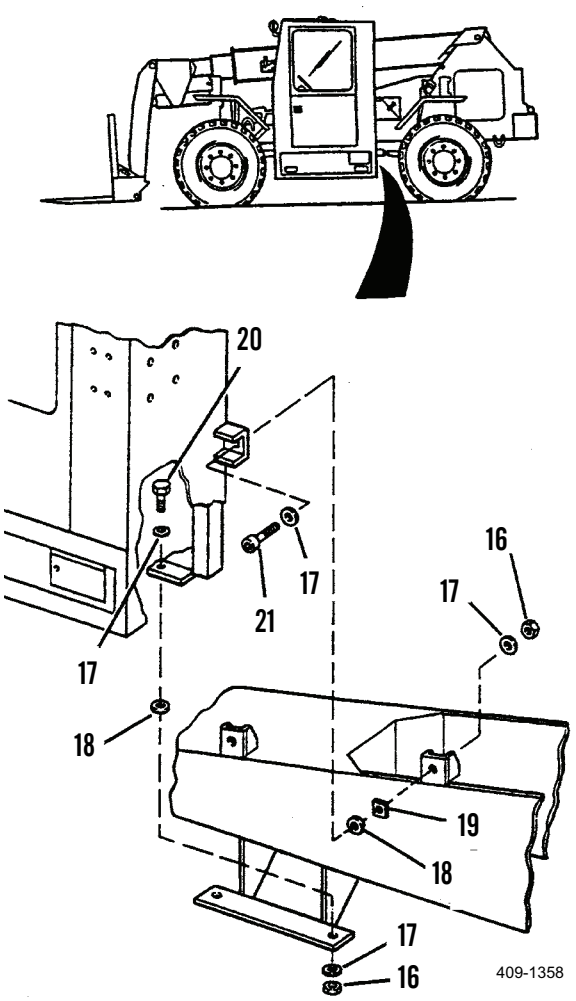
INSTALLATION - CONTINUED

1. Use a hoist and sling to position cab on vehicle.

NOTE

- Apply loctite to threads of capscrews as installed.
- Use washers to shim cab so side of cab to boom hoist cylinder anchor clearance, with vehicle level and boom centered, is 2.75 in. (70 mm) minimum. Shim both upper cab mounts equally. Use as few washers as possible. Do not overshim.

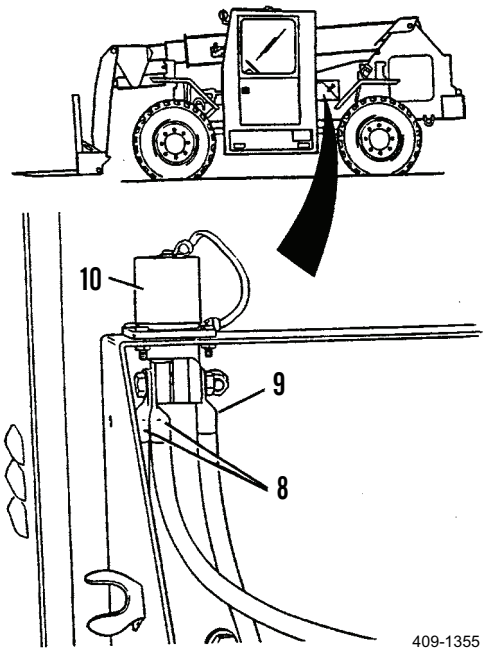
2. Align cab and frame mounting holes and install two capscrews (21), two capscrews (20), eight flatwashers (17), two washers (shims) (19), four rubber washers (18) and four nuts (16).
3. Torque cab mounting hardware to 640 lb-ft (868 Nm) of torque.
4. Remove hoist and sling.
5. Connect hydraulic lines. Use tags placed on lines at disassembly to ensure correct connection. Refer to *Removal*, steps 13-19.
6. Connect heater hoses at temperature control valve and heater (WP 0170 00).
7. Connect parking brake cable (WP 0128 00).



8. Connect transmission cable at the transmission (WP 0115 00).
9. Connect accelerator cable at engine (WP 0048 00).

INSTALLATION - CONTINUED

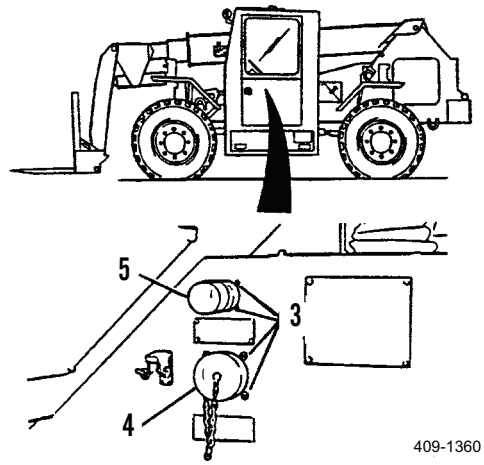
10. Connect three cables (8 and 9) to the NATO slave receptacle (10).



NOTE

Apply loctite to threads of screws as installed.

11. Position receptacles (4 and 5) in operator side console and secure with eight screws (3).

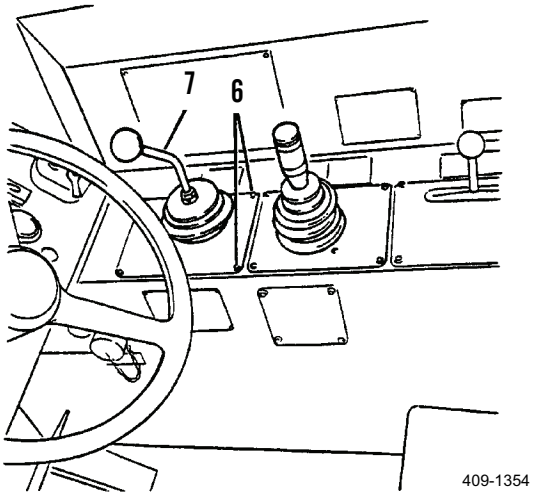


INSTALLATION - CONTINUED

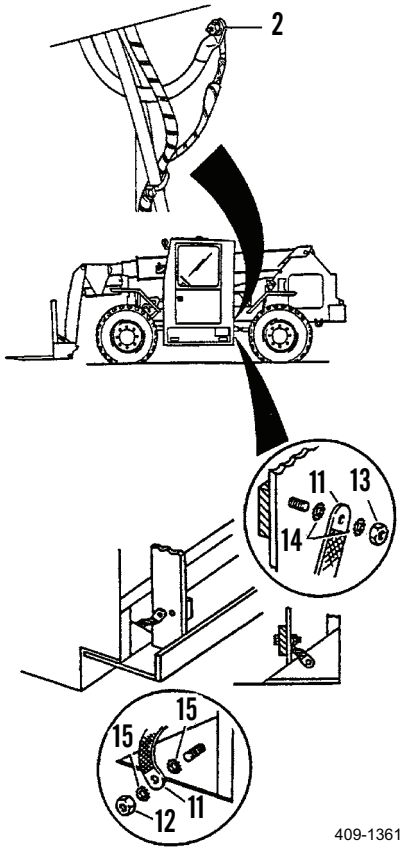
NOTE

Apply loctite to threads of screws as installed.

12. Secure joystick control assembly (7) with four screws (6).

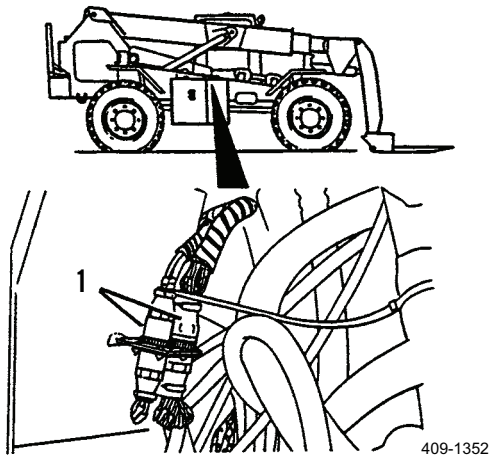


13. Connect wiring at stud ground connection (2) on vehicle frame.



INSTALLATION - CONTINUED

14. Connect wiring at STE/ICE-R shunt (WP 0046 00).
15. Connect two cab wiring harness connectors (1).



16. Install two new starwashers (14 and 15).
17. Install grounding strap (11) and two nuts (12 and 13). Tighten nuts securely.
18. Install transmission cover (WP 0150 00).
19. Install batteries (WP 0106 00).
20. Fill hydraulic system (WP 0032 00).
21. Fill cooling system (WP 0059 00).
22. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

SOUND SUPPRESSION PANELS REPLACEMENT 0254 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Adhesive (Item 1, WP 0324 00)

Panels (1 thru 10)

References

WP 0316 00

WP 0317 00

Equipment Condition

Seat removed (WP 0160 00)

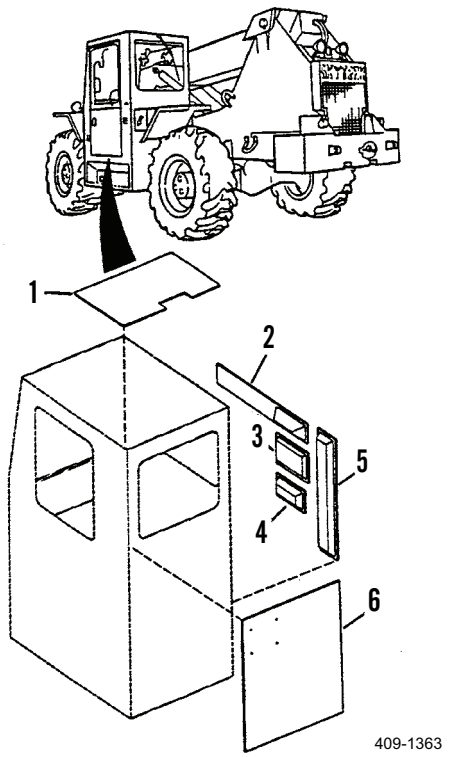
Windshield washer reservoir removed (WP 0165 00)

REMOVAL

NOTE

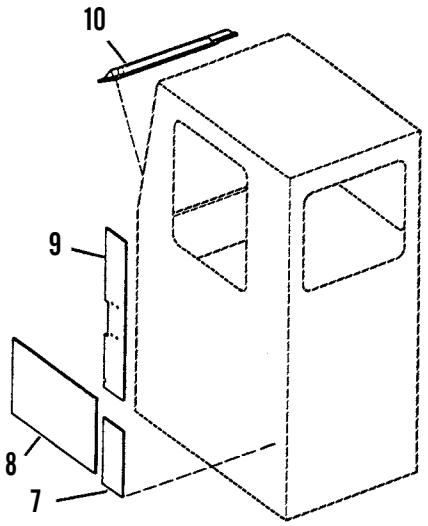
Sound suppression panels are glued to vehicle. Use a knife or single edged razor blade to cut panels from vehicle. After removing panel, remove as much of old adhesive and panel material as possible. Remove remainder of old adhesive with cleaning solvent. Refer to *Cleaning* instructions (WP 0317 00).

1. Remove headliner panel (1). Discard panel.
2. Remove right sidewall upper panel (2). Discard panel.
3. Remove right sidewall center panel (3). Discard panel.
4. Remove right sidewall lower panel (4). Discard panel.
5. Remove right sidewall rear panel (5). Discard panel.
6. Remove rear panel (6). Discard panel.



REMOVAL - CONTINUED

7. Remove left rear sidewall lower panel (7). Discard panel.
8. Remove lower door panel (8). Discard panel.
9. Remove left rear sidewall upper panel (9). Discard panel.
10. Remove upper dash panel (10). Discard panel.



409-1364

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

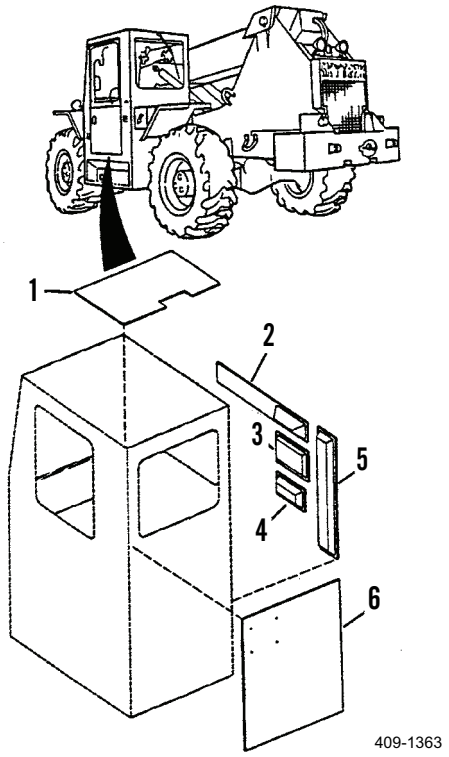
NOTE

When installing sound suppression panels, apply adhesive to both vehicle sheet metal and back of sound suppression panel to be installed. Position panel on vehicle and press into place.

1. Install new upper dash panel (10).
2. Install new left rear sidewall upper panel (9).
3. Install new lower door panel (8).
4. Install new left rear sidewall lower panel (7).

INSTALLATION - CONTINUED

5. Install new rear panel (6).
6. Install new right sidewall rear panel (5).
7. Install new right sidewall lower panel (4).
8. Install new right sidewall center panel (3).
9. Install new right sidewall upper panel (2).
10. Install new headliner panel (1).
11. Install windshield washer reservoir (WP 0165 00).
12. Install seat (WP 0160 00).



END OF WORK PACKAGE

24V HEATER ASSEMBLY REPAIR 0255 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Rag, wiping (Item 40, WP 0323 00)

References

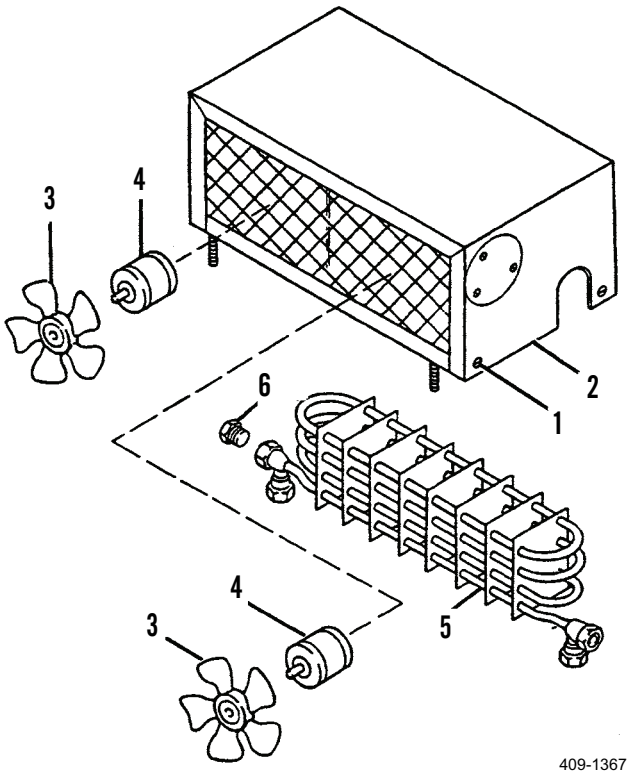
TM 10-3930-660-10

Equipment Condition

Cab heater removed (WP 0168 00)

DISASSEMBLY

1. Remove screws (1) and cover (2), with two fan blades (3) and motors (4).
2. Remove heater core (5).
3. If necessary, remove two fittings (6).
4. Remove fan assemblies and blades (3) from motors (4).



409-1367

CLEANING

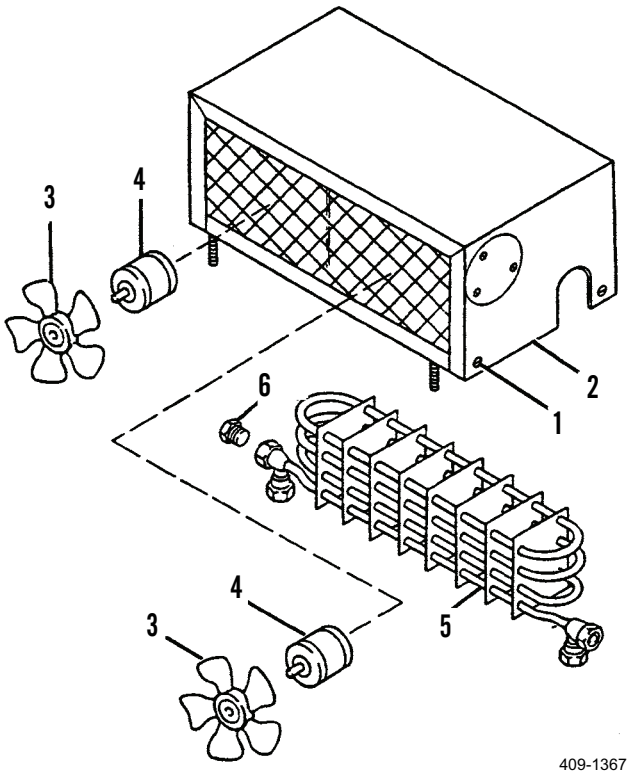
WARNING

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.

1. Wipe dust or other deposits from blades of fans (3).
2. Clean heater coil (4) using a brush or low pressure compressed air.

INSPECTION

1. Check heater coil (5) for kinks or for signs of leaking. Replace leaking or damaged heater coil (5).
2. Check for loose or bent fan blades (3).
3. Check motors (4) for bad wiring connections or worn insulation.



409-1367

ASSEMBLY

1. If removed, install fittings (6).
2. Install blades (3) on motors (4) and install fan assemblies in cover (2).
3. Install heater coil (5).
4. Install cover (2) and attaching screws (1).
5. Install heater assembly (WP 0168 00).
6. Operate heater and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

PISTON PUMP MAINTENANCE 0256 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Driver, group (Item 9, WP 0324 00)

Materials/Parts

Rag, wiping (Item 40, WP 0323 00)

Gasket (4 and 10)

Materials/Parts - Continued

O-ring (5, 32 and 46)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

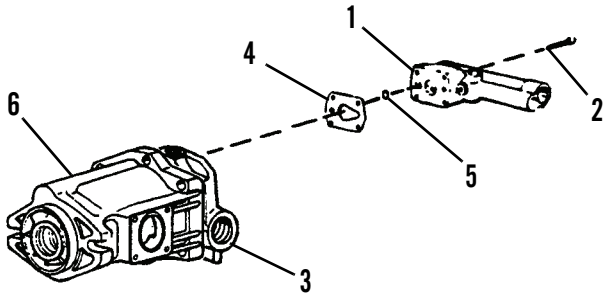
Piston pump removed (WP 0174 00)

DISASSEMBLY

NOTE

Clean outside surfaces of the valve block and compensator before disassembly.

1. Remove four screws (2) and pull compensator (1) from valve block (3).
2. Remove gasket (4) and O-ring (5) from compensator (1). Discard gasket and O-ring.
3. Remove rotating group parts from housing (6) and valve block (3).



409-4101

DISASSEMBLY - CONTINUED

NOTE

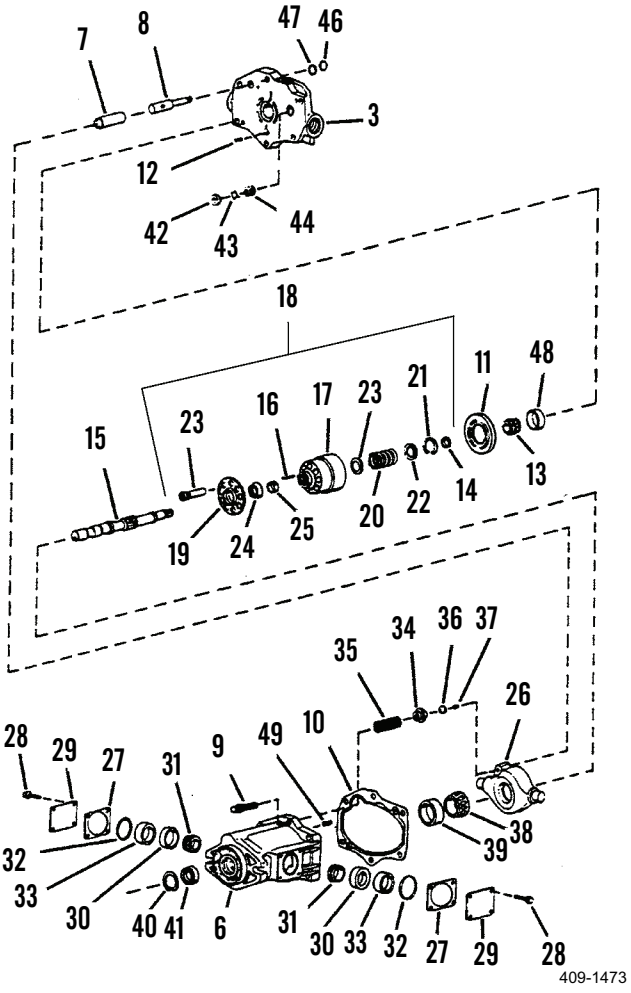
Piston will slide from rod piston and drop into the pump housing when valve block is removed from the pump housing.

4. Remove six screws (9) and remove valve block (3) from housing (6).
5. Remove and discard gasket (10).
6. Remove wafer plate (11) from valve block (3).
7. If necessary, remove pin (12) from valve block (3).
8. Remove bearing (13) and spacer (14) from drive shaft (15).

NOTE

- Three pins will drop from the cylinder block when rotating group parts are removed from shaft.
- The rotating group consists of components (11, 14, 16, 17 and 19-25).

9. Hold shoe plate (19) with both hands to prevent rotating group parts from separating during removal, then remove rotating group parts (18) from pump housing (6).
10. Remove pin retainer (24) from cylinder block (17).
11. Remove piston (7) from housing (6).

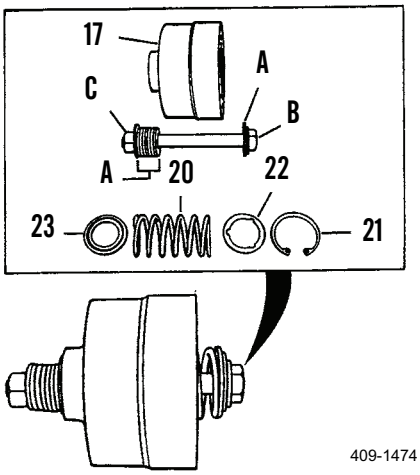


DISASSEMBLY - CONTINUED

WARNING

Spring located in the cylinder block is under high tension and can cause severe personal injury if retaining ring is not removed correctly.

12. Place flatwashers (A), as required, under head of capscrew (B). Slide capscrew (B) through retaining ring (21) and spring (20) until threaded end of capscrew is visible through hole on other side of cylinder block (17).
13. Place additional flatwashers (A), as required, and nut (C) on threaded end of capscrew (B).
14. Carefully tighten nut (C) and capscrew (B) until spring tension is removed from retaining ring (21).

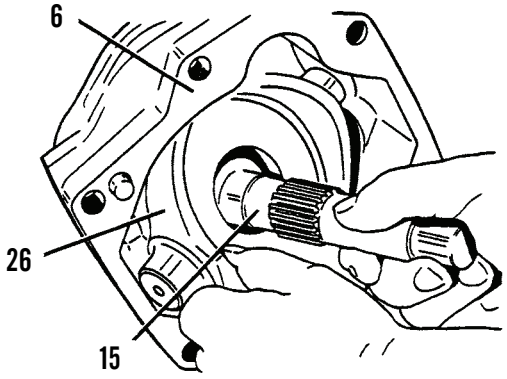


409-1474

NOTE

Use care when handling close tolerance parts that are removed in steps 15 and 16, to prevent burrs from forming.

15. Remove retaining ring (21). Carefully loosen nut (C) and capscrew (B) until spring (21) is fully extended. Separate spring washer (22), spring (21) and spring washer (23) from cylinder block (17).
16. Remove yoke (26) and shaft (15).



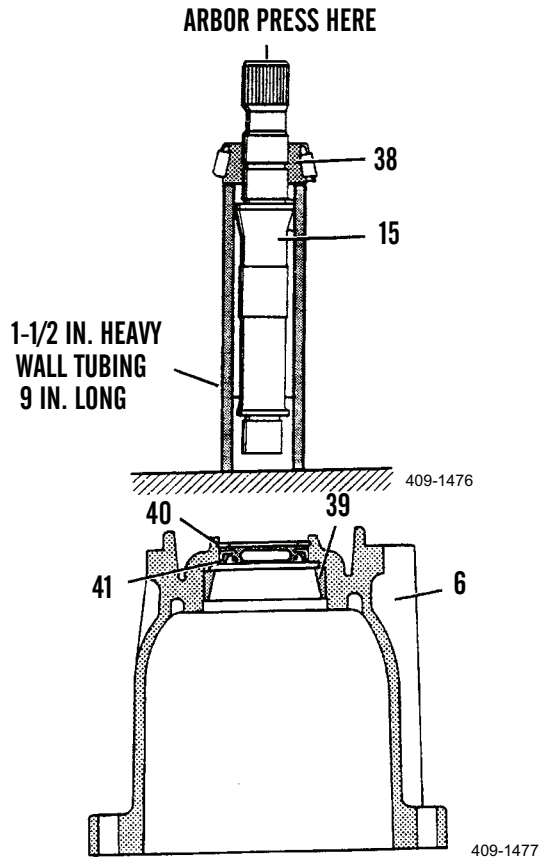
409-1475

DISASSEMBLY - CONTINUED

NOTE

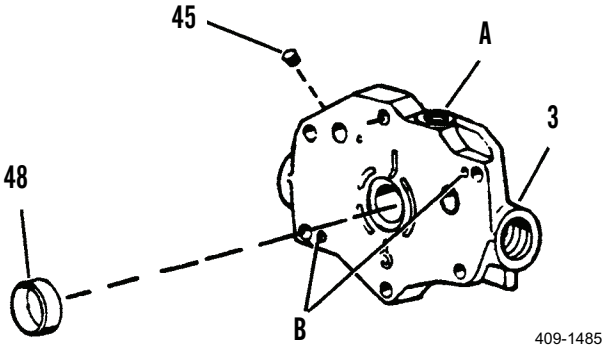
Be careful not to damage shims when removing pintle covers.

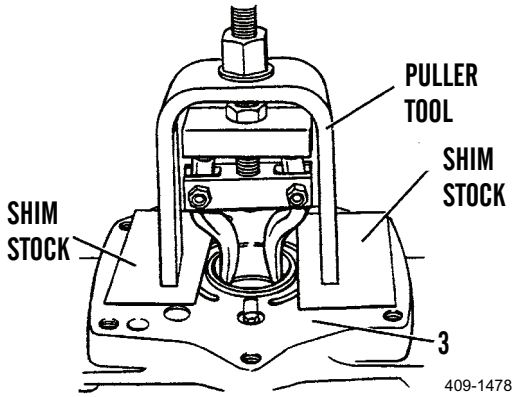
17. Remove eight screws (28), then remove pintle covers (29) from each side of housing (6).
18. Retain shims (27), if possible, and use a micrometer to measure total shim thickness. If bearing subassemblies (30 and 31) are not defective, use the same shims (27), or a new shim with the same thickness, to preload bearing subassemblies (30 and 31) at installation.
19. Remove O-rings (32) and bearing spacer (33) from each pintle.
20. Slide yoke (26) from side to side to loosen yoke bearing races (30) within housing (6). Use a wrench between yoke (26) and pintle bearing (31) to help remove races (30). Apply pressure at the approximate center of bearing (31) and allow bearing rollers to gently press race (30) out of housing (6).
21. Remove yoke (26) and driveshaft (15) from housing (6) as an assembly. Turn yoke (26) at an angle and slide the two parts out of housing (6).
22. Remove seat (34) and yoke spring (35). Seat (36) and roll pin (27) will be attached to yoke (26).
23. Remove bearing (38) from driveshaft (15), if necessary.
24. Use fabricated tool and an arbor press to remove bearing (38) from driveshaft (15).
25. Remove bearing race (39) from housing (6), if necessary.
26. Use fabricated tool and an arbor press to remove bearing race (39) from housing (6). Discard bearing race (39).
27. Remove retaining ring (40).
28. Use fabricated tool and arbor press to remove shaft seal (41) from housing (6).



DISASSEMBLY - CONTINUED

29. Disassemble valve block (3), if necessary.





NOTE

Do not disassemble check valve parts unless there is a problem with valve operation. See *Inspection* steps 3 and 8.

30. If necessary, remove seat (42), valve (43) and spring (44) from valve block (3).

31. Remove plug (45), O-ring (46), retaining ring (47) and piston rod (8) from valve block (3).

NOTE

Be careful not to scratch the face of the valve block during bearing race removal.

32. Use fabricated tool and shim stock to remove bearing race (48) from valve block (3).

33. If necessary, remove two alignment pins (49) from housing (6).

34. If necessary, remove two plugs (50) from compensator (1).

CLEANING

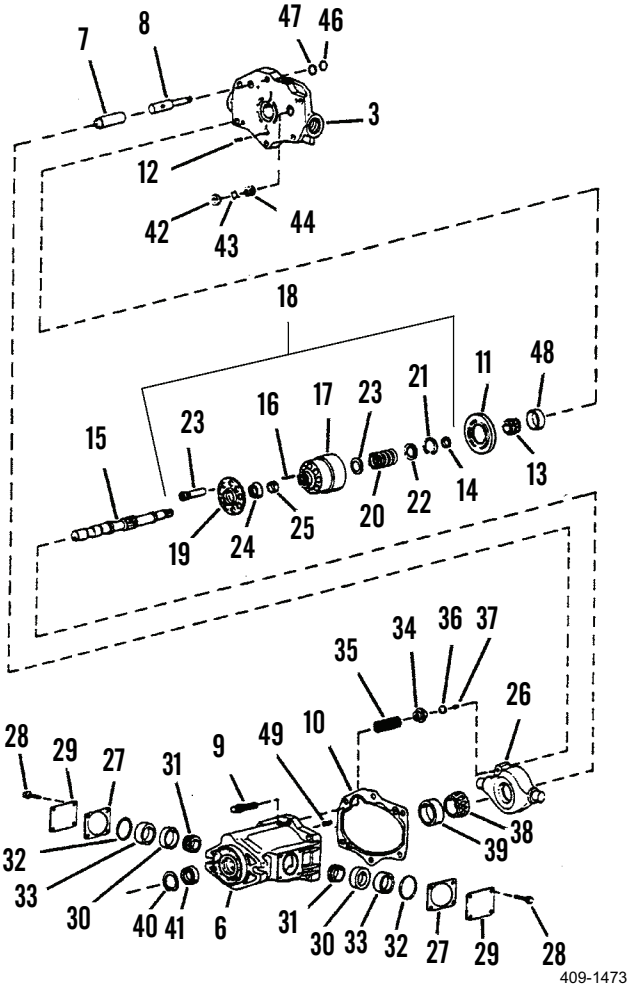
See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. See *Inspection* instructions (WP 0317 00).

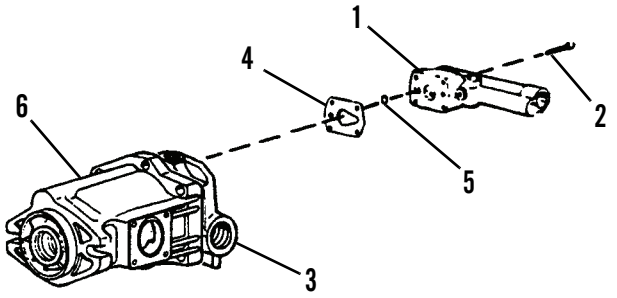
2. Turn piston (7) on rod (8) 360 degrees. If binding occurs, replace piston and rod.

3. Check that check valve seat (42) is tight within valve block (3) and that it does not protrude above the valve block face.



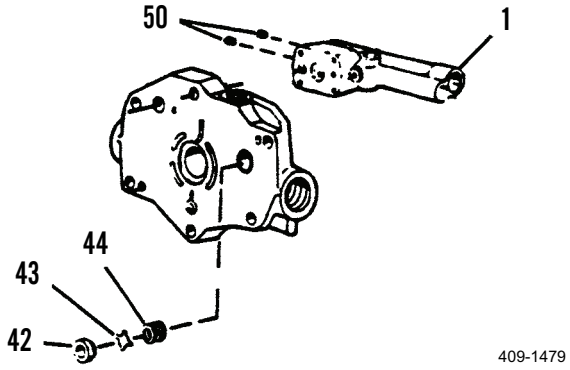
INSPECTION - CONTINUED

4. Inspect pins (16) for equal length, excessive wear and bends.
5. Replace all pins (16) if one is defective.
6. Inspect shoe plate (19) for excessive wear and cracking in the area of spherical washer (24).
7. If heavy wear or cracks are found, replace the shoe plate (19) and spherical washer (24) at the same time.
8. Measure end play between piston (7) and shoe (23). End play must not exceed 0.005 in. between piston and shoe.



409-4101

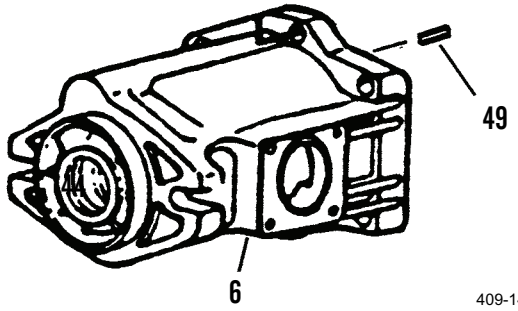
9. Measure face thickness of each shoe. The face thickness of all shoes must be within 0.001 in. (0.025 mm) of each other.
10. Inspect cylinder block bore for wear, scratches and/or erosion between cylinders. Check the spring, washers and retaining ring located within the cylinder block for wear.
11. Check each cylinder block bore for excessive wear by sliding the piston and shoe subassemblies through the bores. If binding is evident, clean cylinder block and piston, lubricate parts with clean hydraulic fluid and again check for binding.
12. Press check valve (43) against spring (44). Valve (43) should return and hold firm against seat (42).
13. If replacement is necessary, spring (44), valve (43) and seat (42) must be replaced as a set.



409-1479

ASSEMBLY

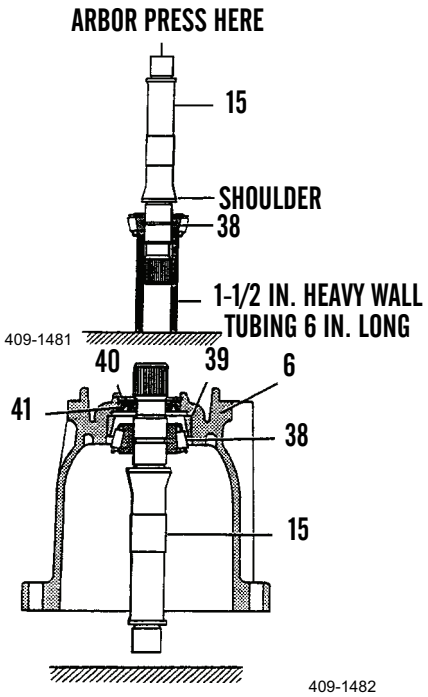
1. If removed, install two plugs (50) to compensator (1).
2. If removed, install alignment pins (49) into housing (6).



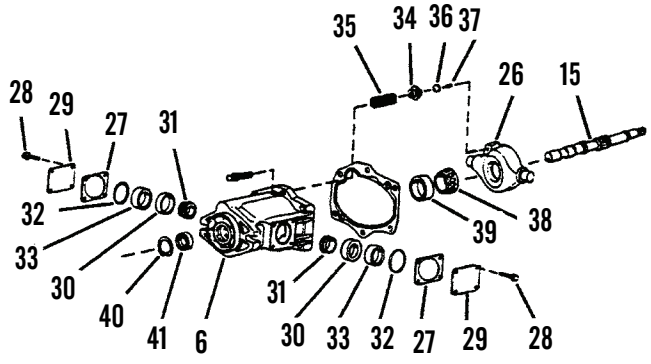
409-1480

ASSEMBLY - CONTINUED

3. Install new drive shaft bearing (38) and seal (41).
4. Use fabricated tool and an arbor press to press shaft (15) through bearing (38). Press shaft until bearing (38) bottoms against drive shaft (15) shoulder.
5. Use fabricated tool and an arbor press to install new bearing race (39) into housing (6). Press race until it bottom against housing shoulder.
6. Install shaft (15) into housing (6) and check that bearing rollers (38) move freely in bearing race (39) as shaft is turned. Remove shaft (15) from housing.
7. Use fabricated tool and an arbor press to install new shaft seal (41) into housing (6). End of seal (41) must be positioned 0.25 in. (6.35 mm) from edge of housing (6) (just below retaining ring (40) groove).
8. Wrap plastic tape around spline end of driveshaft (15) to prevent damage to shaft seal (41).



9. Place housing (6) on a clean, flat surface with shaft seal (41) end down.
10. Insert spline end of driveshaft (15) into housing (6). Position driveshaft so that front shaft bearing (38) is inside bearing race (39).
11. Install yoke spring (35) and seat (34) into housing (6).
12. Install yoke (26) into housing (6).
13. Install pintle bearings (31) on each end of yoke (26) and install bearing race (30).
14. Install bearing spacer (33) at one pintle end.
15. Install new O-ring (32) against spacer and into groove at one pintle end.
16. Install a 0.010 in. (0.254 mm) shim under pintle cover (29) at one pintle end.
17. Install four pintle cover screws (28) into pintle cover installed in step 18 above and torque screws to 175-185 lb-in. (20-21 Nm).
18. Place housing (6) on its side so other end of pintle is facing up. Install bearing spacer (33).



19. Turn yoke (26) back and forth to seat bearings (31) in bearing races (30).
20. Install correct pintle shims (27).

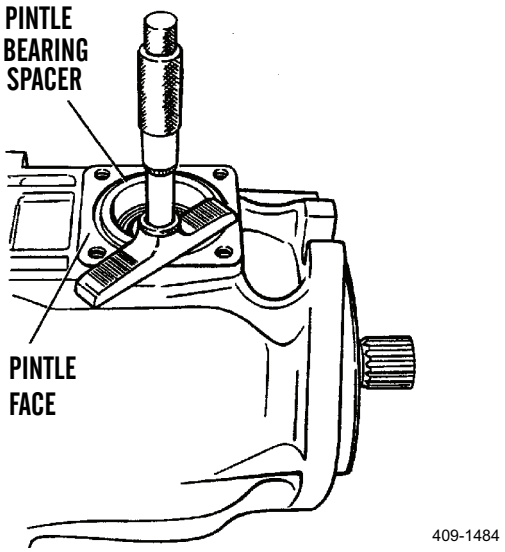
ASSEMBLY - CONTINUED

21. With spacer (33) fully installed against bearing race (30), measure height of spacer with respect to the housing pintle face using a micrometer. Take measurements in two places, 180 degrees apart.
22. Average the two readings taken in step 23 above to obtain a nominal value.

NOTE

A 0.007 to 0.009 in. (0.177 to 0.228 mm) preload is required on the pintle bearings.

23. Determine the number of shims required to obtain a preload between 0.007 and 0.009 in. (0.177 to 0.228 mm) by subtracting the nominal preload (0.008 [0.203 mm]) from the calculated nominal valve (step 24).



Example: Let's assume the depth readings were 0.029 and 0.027 in. (0.736 and 0.685 mm). Add these two figures together and divide by two to obtain the average (nominal value):

0.029 + 0.027 = 0.056 in. (0.736 + 0.685 = 1.421 mm)

0.056/2 = 0.028 (1.421/2 = 0.710 mm) (nominal calculated valve)

Nominal Calculated Value - Nominal Preload Value = Required Shim Thickness

0.028 - 0.008 = 0.020 in. (0.711 - 0.203 = 0.508 mm) of shim thickness

NOTE

If calculated shim thickness is greater than 0.020 in. (0.508 mm), another shim must be added to the opposite side of the yoke to reduce total shim thickness to less than 0.020 (0.508 mm). Shim thickness at either pintle must not exceed 0.020 in. (0.508 mm). This is necessary to provide proper O-ring compression and prevent pintle seal leakage.

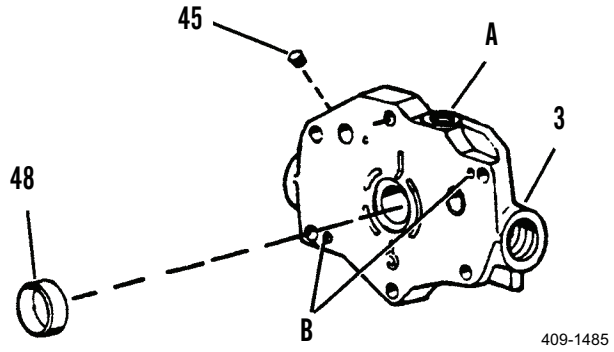
ASSEMBLY - CONTINUED

24. Install correct shims (27).

25. Install pintle cover (29) and cross torque cover screws (28) to 175-185 lb-in. (20-21 Nm).

NOTE

Yoke rotation will be stiff, but should be loose enough to be moved by hand (approximately 20 lb-in. (2.25 Nm) torque). This tightness/drag indicates that bearings are preloaded. If yoke cannot be moved by hand, preload is too great and the preload adjustment must be repeated until correct.



26. Use fabricated tool and an arbor press to install new bearing race (48). Press race (48) until it bottoms against shoulder in valve block (3).

NOTE

Check flatness of valve block face in area around locating pin holes (B) and at mounting screw (A) holes. If necessary, use an India stone to remove burrs or raised metal in these areas.

27. Install pipe plug (45) into valve block.

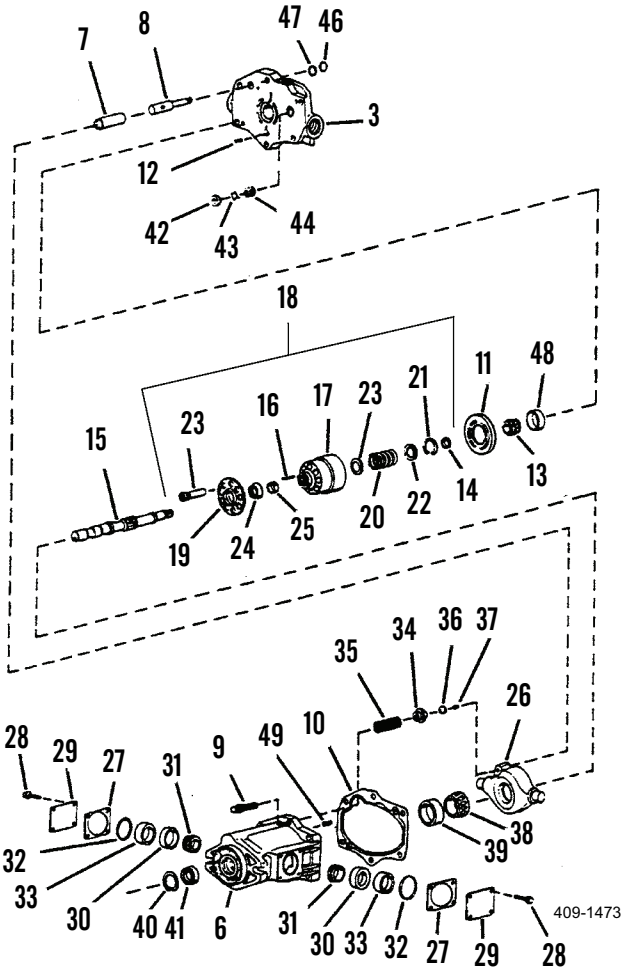
NOTE

- If the shaft bearings, shaft, valve block or housing were not replaced, use the bearing spacer removed during disassembly to preload the shaft and perform step 28. If any of these items were replaced, preload adjustment is required.
- The bearing spacer kit contains several different sizes of bearing spacers.

28. Install thickest bearing spacer (14) over driveshaft (15) with chamfer facing into housing (6).

29. Slide bearing (13) onto shaft (15). Small diameter of bearing must face out of housing.

30. Temporarily install bearing (6) on valve block (3). Do not install gasket (10) or rotating group parts (18) at this time. Turn shaft (15) to seat bearings, then torque six screws (9) to 5 lb-in. (0.5 Nm).



ASSEMBLY - CONTINUED

31. Use tapered feeler gauge to measure opening between valve block (3) and housing (6). Four measurements should be obtained equidistant around unit. Average four readings by adding them together and dividing by 4. Calculate thickness of shaft bearing spacer as shown in the following example:

    + 0.150 in. (3.81 mm) = measured thickness of bearing spacer

    - 0.027 in. (0.68 mm) = average gap (estimated)

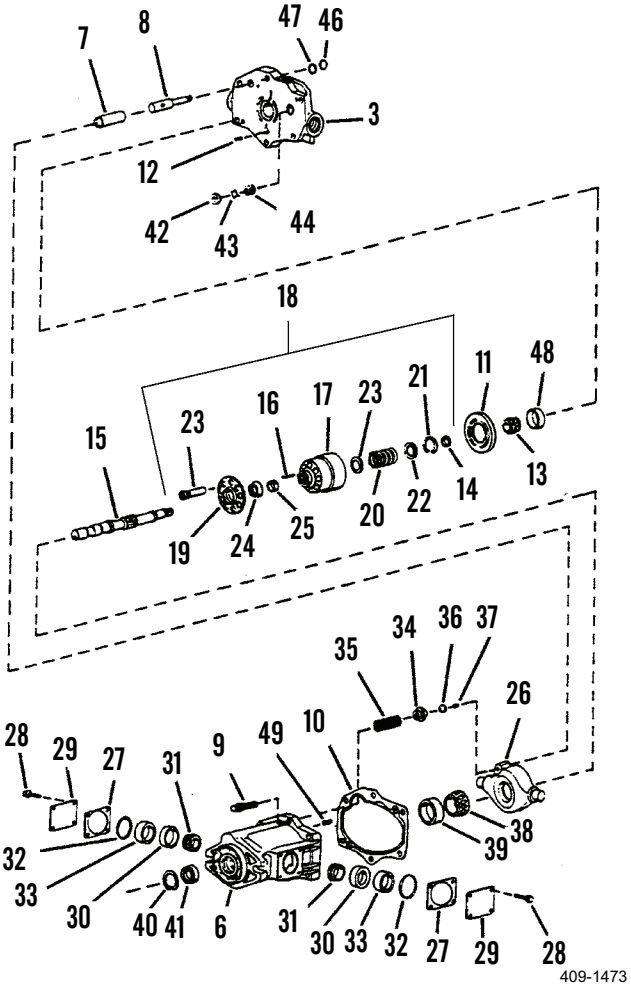
    +0.003 in. (0.076 mm) $\pm$

    0.001 in. (0.025 mm) = preload setting

    +0.020 in. (0.508 mm) = compressed thickness of gasket

    0.146 $\pm$ 0.001 in. = required bearing spacer thickness to provide a 0.003 $\pm$ 0.001 in. bearing preload

32. Remove the six mounting screws (8), then remove housing (6) from valve block (3).
33. Remove bearing (13) and thickest bearing spacer (14) from shaft (15).
34. Locate bearing spacer (14) in kit with dimensions calculated in step 35 above. Place spacer (14) next to the new bearing (13) on shaft (15), with chamfer of spacer facing the shaft shoulder. Use the original spacer (14) and bearing (13) if preload is not required. Set aside until final assembly is performed.



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ASSEMBLY - CONTINUED

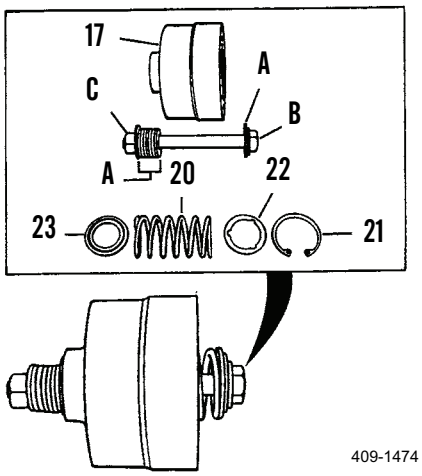
WARNING

Spring can cause severe personal injury if retaining ring is not properly installed. Use capscrew and flatwashers as required and nut to temporarily relieve pressure of spring when installing retaining ring.

NOTE

Use care when assembling parts in cylinder block to prevent burrs from forming.

35. Install spring (20), spring washer (23) and spring washer (22) in cylinder block (17).
36. Place flatwashers (A), as required, on hex end of capscrew (B). Insert capscrew (B) through spring (20) until threaded end of capscrew is visible through hole on other side of cylinder block (17).
37. Place additional flatwashers (A), as required, and nut (C) on threaded end of capscrew (B).
38. Carefully tighten nut (C) and capscrew (B) and install retaining ring (21).
39. Slowly and carefully loosen nut (C) and capscrew (B) until pressure of spring (20) is on retaining ring (21). Remove capscrew (B), flatwashers (A) and nut (C) from cylinder block (17).



40. Install pin retainer (24) into cylinder block (17) with the open end of retainer facing away from the large spline openings. Position pin retainer (24) so that it is approximately 1/4 in. (6.35 mm) below the surface of the cylinder block.
41. Install three pins (16) into cylinder block (17) until they bottom against spring washer (23) already installed in cylinder block.
42. Place spherical washer (24) on top of the three pins (16). Install shoe plate (19) and nine piston and shoe assemblies (23) over spherical washer (24) and into cylinder block (17). Move shoe plate (19) in a side to side and up and down motion to make sure each piston moves freely in its bore.
43. Place housing (6) on its side and hold shaft (15) horizontal. Install rotating group parts (18) into housing (6). Turn shaft (15) to match splines in cylinder block (17) and spherical washer (24).
44. Place new gasket (10) over pins (49) and put housing (6) aside for final assembly.

NOTE

Lubricate all moving parts of piston pump with hydraulic oil to facilitate assembly and provide initial lubrication. Pour hydraulic oil liberally over rotating group parts and wafer plate as these components are without lubrication until the pump primes.

45. If removed, install locating pin (12) in valve block (3).

ASSEMBLY - CONTINUED

NOTE

The side of the wafer plate with the locating pin groove must face the valve block.

46. Assemble wafer plate (11) over bearing race (48) and plate groove over locating pin (12).

CAUTION

Wafer plate must be flat against valve block face. Check to make sure it does not rock back and forth. If rocking motion occurs, make sure locating pin is bottomed out in the valve block. Wafer plate rocking will induce high stress conditions and cause fractures in the wafer plate.

47. Place valve block (3) on its side. Install piston rod (8) into valve block (3) and attach retaining ring (47).

48. Install new O-ring (46) in the piston rod (8) O-ring groove.

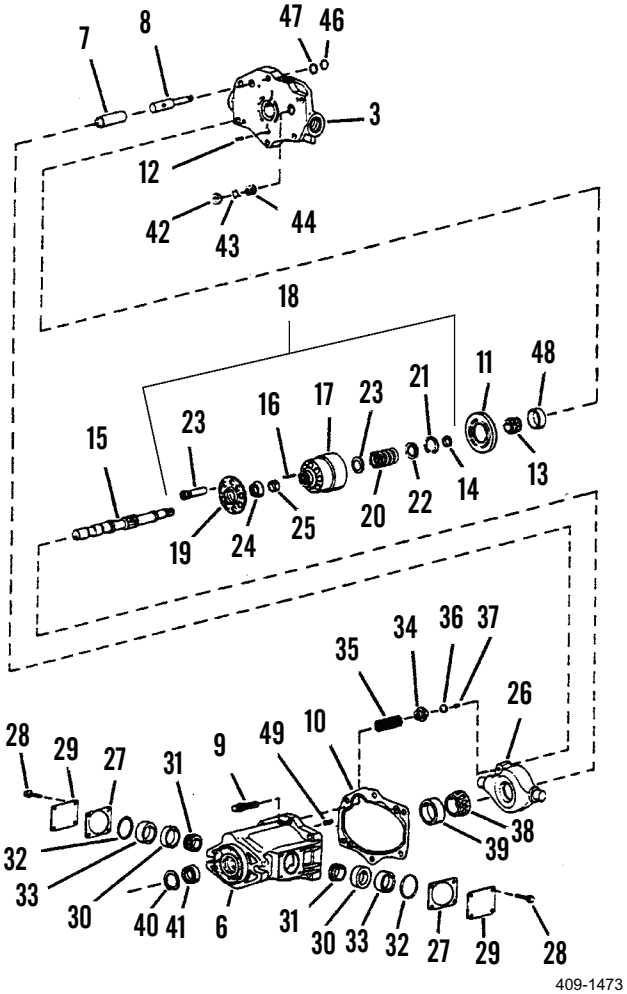
CAUTION

Be careful not to allow the piston to drop from piston rod as this could damage the piston.

49. Install piston (7) over piston rod (8).

50. Assemble valve block (3) to housing (6) with six screws (9).

51. Cross-torque screws (9) to bring valve block and housing evenly together against gasket (10). Torque screws (9) to 60-70 lb-ft (81-95 Nm).

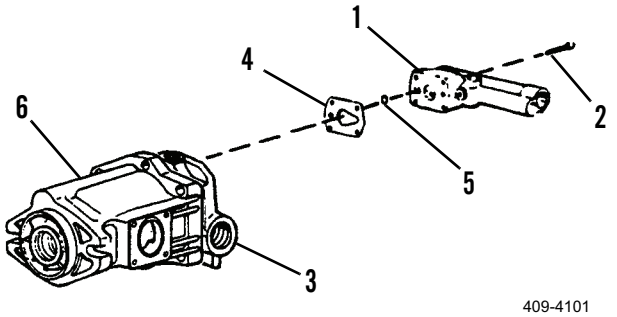


409-1473

52. Check shaft torque to verify correct bearing preload. If shaft torque is greater than 6 lb-ft (8 Nm), adjust shaft bearing preload. See steps 22-27.

ASSEMBLY - CONTINUED

53. Install new O-ring (5) in compensator and new gasket (4) on compensator face surface.



54. Install compensator (1) on valve block (3) and install four screws (2).
55. Cross-torque screws to 60-70 lb-in. (7-8 Nm).
56. Install piston pump (WP 0174 00).
57. Operate vehicle, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

PRIORITY VALVE REPAIR 0257 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

O-ring (3, 5 and 7)

References

WP 0316 00

WP 0317 00

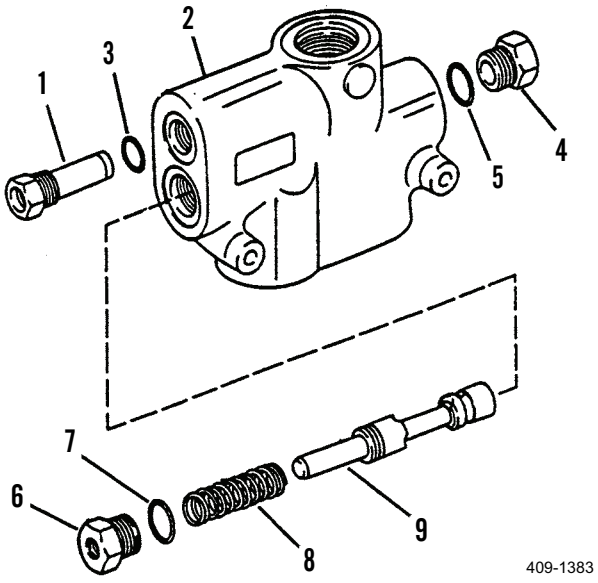
TM 10-3930-660-10

Equipment Condition

Priority valve removed (WP 0177 00)

DISASSEMBLY

1. Remove relief valve cartridge (1) from housing (2).
2. Remove and discard O-ring (3).
3. Remove plug (4). Remove and discard O-ring (5).
4. Remove plug (6). Remove and discard O-ring (7).
5. Remove spring (8) and spool (9).



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Wipe all sealing surfaces of valve clean and dry. Apply film of clean lubricating oil to all seals as they are installed.

1. Install new O-ring (5) on plug (4). Install plug (4) in housing (2). Finger-tighten plug (4).
2. Install spool (9) and spring (8).
3. Install new O-ring (7) on plug (6). Install plug (6) in housing (2). Finger-tighten plug (6).
4. Install new O-ring (3) on relief valve cartridge (1). Install relief valve cartridge (1) in housing (2).
5. Install priority valve (WP 0177 00).
6. Operate vehicle hydraulic system, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FRAME TILT/BRAKES RELIEF VALVE REPAIR 0258 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

O-ring (5, 10, 11 and 15)

References

WP 0316 00

WP 0317 00

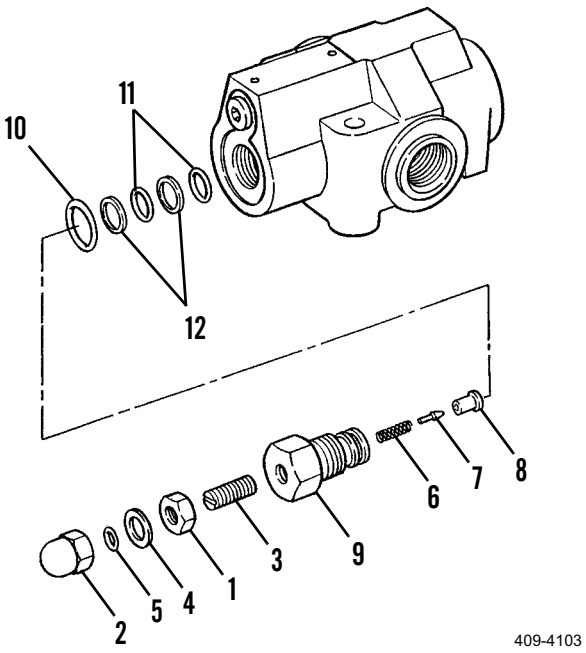
TM 10-3930-660-10

Equipment Condition

Frame tilt/brakes relief valve removed (WP 0178 00)

DISASSEMBLY

1. Use a wrench to hold jamnut (1) in place and remove acorn nut (2).
2. Hold setscrew (3) in place and loosen jamnut (1).
3. Record number of turns required to remove setscrew (3).
4. Remove two sealing washers (4) and O-rings (5). Discard O-rings.
5. Remove spring (6), plunger (7) and seat (8) from cap (9).
6. Remove and discard O-ring (10) and two O-rings (11). Back-up rings (12) are not removed.



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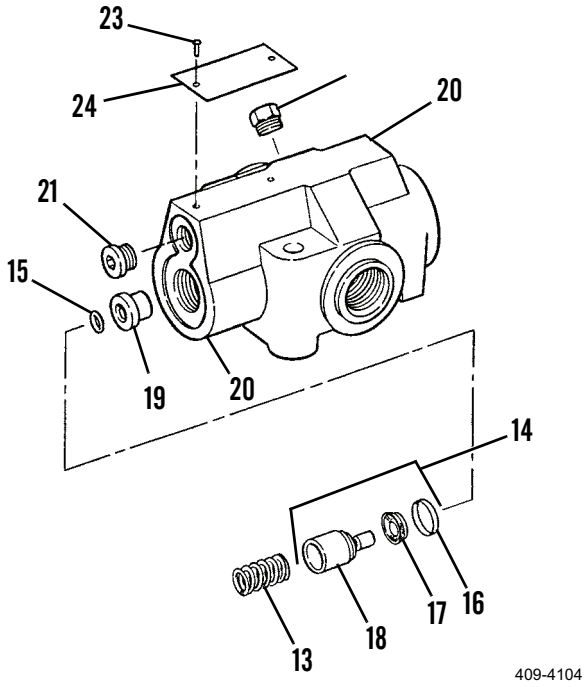
DISASSEMBLY - CONTINUED

7. Remove spring (13), poppet assembly (14) and O-ring (15) from valve seat (19). Discard O-ring.
8. Remove retainer (16), screw (17) and poppet (18), if necessary.

NOTE

Do not remove seat from body.

9. Remove plugs (21 and 22) from valve body (20), if necessary.
10. Remove two screws (23) and nameplate (24) from valve body (20), if necessary.



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

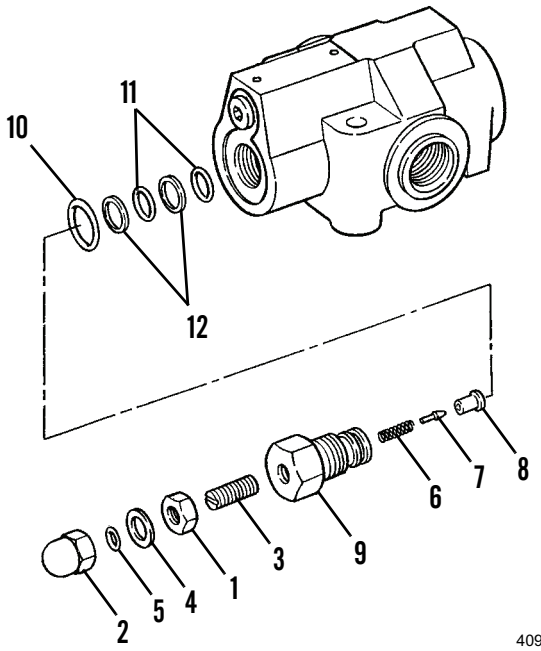
NOTE

Wipe all sealing surfaces of valve clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.

1. If removal was necessary, install nameplate (24) and two screws (23) on valve body (20).
2. If removal was necessary, install plugs (21 and 22) on valve body (20).

ASSEMBLY - CONTINUED

3. Install new O-ring (15) in seat (19).
4. If removal was necessary, install screw (17) and retainer (16) on poppet (18).
5. Install poppet assembly (14) and spring (13) into body (20).
6. Install two new O-rings (11) and new O-ring (10) on cap (9). Ensure that back-up rings (12) are correctly positioned.
7. Install spring (6), plunger (7) and seat (8) in cap (9).
8. Install cap (9). Ensure that spring (13) is positioned over seat (8).
9. Install setscrew (3) using the same number of turns as was noted during *Disassembly.*
10. Install jamnut (1) and tighten to hold setting.
11. Install two new O-rings (5) with sealing washers (4).
12. Hold jamnut (1) in position and install acorn nut (2).



409-4103

13. Install frame tilt/brakes relief valve (WP 0178 00).
14. Operate vehicle, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FRAME TILT VALVE REPAIR 0259 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

O-ring (6, 8 and 17)

References

WP 0316 00

WP 0317 00

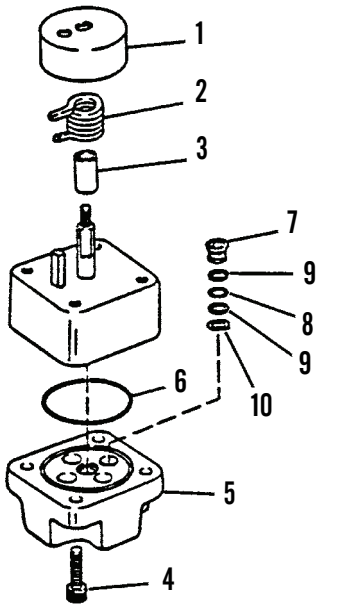
TM 10-3930-660-10

Equipment Condition

Frame tilt valve removed (WP 0180 00)

DISASSEMBLY

1. Remove hub (1). Remove spring (2). Remove bushing (3).
2. Remove four socket head screws (4), body (5) and O-ring (6). Discard O-ring.
3. Remove four seals (7), four O-rings (8), eight back-up rings (9) and four seal springs (10). Discard O-rings.



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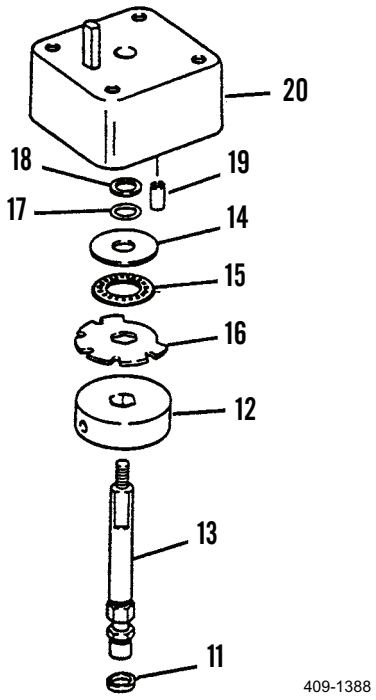
DISASSEMBLY - CONTINUED

4. Remove shaft washer (11) and disk assembly (12) from shaft (13).
5. Remove bearing race (14), bearing (15) and stop plate (16).
6. Remove O-ring (17) and back-up ring (18). Discard O-ring.
7. Do not remove stop pin (19) from cap (20) unless damage is visible.



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

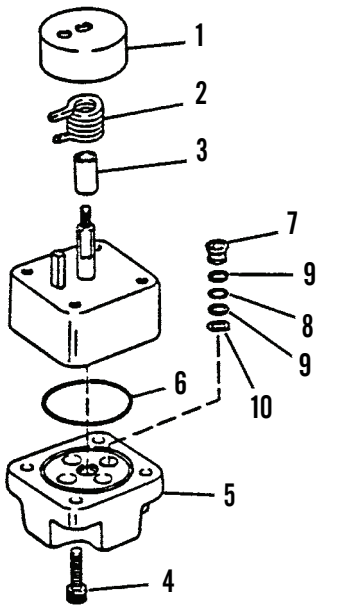
See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Wipe all sealing surfaces of valve clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.

1. If removal was necessary, install stop pin (19) in cap (20).
2. Install back-up ring (18) and new O-ring (17) in bore of cap (20).
3. Slide shaft (13) through hole in cap (20). Install bushing (3) on shaft (13).
4. Use pliers to install spring (2) on shaft (13).
5. Install hub (1).
6. Install bearing race (14) and bearing (15).
7. Install stop plate (16). Ensure that stop pin (19) is centered in wide gap of plate (16).
8. Install disk assembly (12) on shaft (13). The side of disk assembly (12) with holes drilled through it must face away from cap (20). Ensure that one of two holes drilled on outer surface of disk assembly (12) align with stop pin (19).



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9. Install shaft washer (11) on shaft (13).
10. Install four seal springs (10), eight back-up rings (9), four new O-rings (8) and four seals (7) in body (4).
11. Install new O-ring (6) in groove on body (5).
12. Install body (5) to cap (20). Install four socket head screws (4).
13. Install frame tilt valve (WP 0180 00).
14. Operate vehicle, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

CARRIAGE ASSEMBLY REPLACEMENT 0260 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 4,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Compound, antiseize (Item 11, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Locknut (4 and 8)

Wood block

References

WP 0186 00

WP 0310 00

Equipment Condition

MLRS attachment fully lowered (TM 10-3930-660-10)

Backrest removed (WP 0160 00)

Fork auto leveler switch removed (WP 0080 00)

REMOVAL

WARNING

At operating temperature, hydraulic oil is hot and under pressure. Hot oil can cause injuries. Allow hydraulic oil to cool before disconnecting any hydraulic lines.

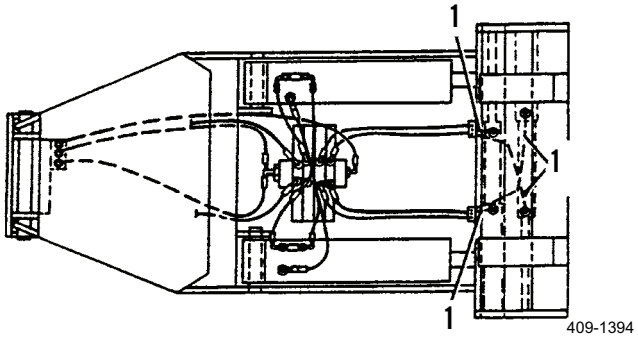
CAUTION

Wipe the area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug holes after removing lines. Contamination of the hydraulic system could result in premature failure.

NOTE

Identify lines to ensure proper installation. Use container to catch any hydraulic oil that may drain from system.

1. Tag and disconnect four hydraulic lines (1) from fork sideshift cylinders.



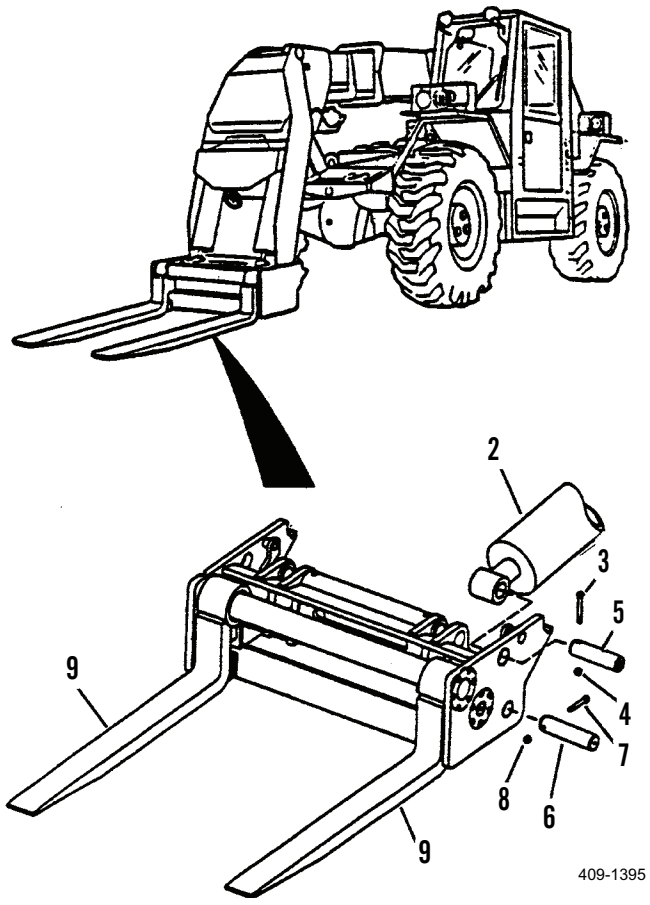
WARNING

Use 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.

2. Attach carriage assembly to a hoist through a sling.
3. Take up slack in lifting sling to allow hoist to support carriage assembly.

REMOVAL - CONTINUED

4. Remove capscrew (3) and locknut (4) from tilt cylinder pivot pin (5). Discard locknut.
5. While supporting tilt cylinder (2) to prevent it from dropping, remove tilt cylinder pivot pin (5) using a pin puller.
6. Carefully lower tilt cylinder (2) onto MLRS frame.
7. Repeat steps 3 thru 6 for tilt cylinder on other side.
8. Start engine (TM 10-3930-660-10).
9. Slowly lower boom until base of carriage just contacts the ground, and fork tips are about one inch above the ground. This takes weight off of carriage pins (6).
10. Shut off engine (TM 10-3930-660-10).
11. Place wood block under each fork tip.
12. Remove carriage pivot pins (6).
13. Remove capscrew (7) and locknut (8) from carriage pivot pin (6). Discard locknut.
14. Remove carriage pivot pin (6).
15. Repeat steps 13 and 14 to remove second carriage pivot pin (6).
16. If necessary, remove forks (9) (WP 0186 00).
17. If necessary, remove fork sideshift cylinders (WP 0310 00).



INSTALLATION

NOTE

Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on valve and hoses clean and dry.

1. If removed, install fork sideshift cylinders (WP 0310 00).
2. If removed, install forks (9) (WP 0186 00).

WARNING

Use 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.

3. Using a hoist and sling, move carriage assembly into position on MLRS attachment.

INSTALLATION - CONTINUED

4. Install carriage pivot pins (6).
5. Operate hoist as necessary to align mounting holes in carriage and MLRS frame.

NOTE

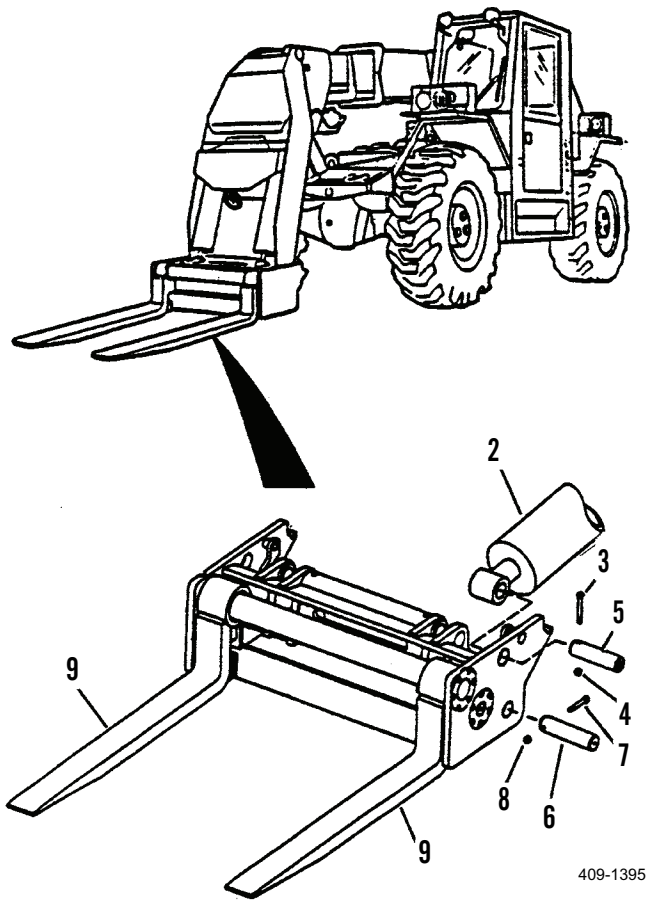
Apply antiseize compound on pins as installed.

6. Install two carriage pivot pins (6), two capscrews (7) and two new locknuts (8).
7. Connect four hydraulic lines (1) to fork sideshift cylinders.
8. Start engine (TM 10-3930-660-10).
9. Extend carriage tilt cylinders (1) to align pivot pin holes in carriage frame and in cylinder rod ends.

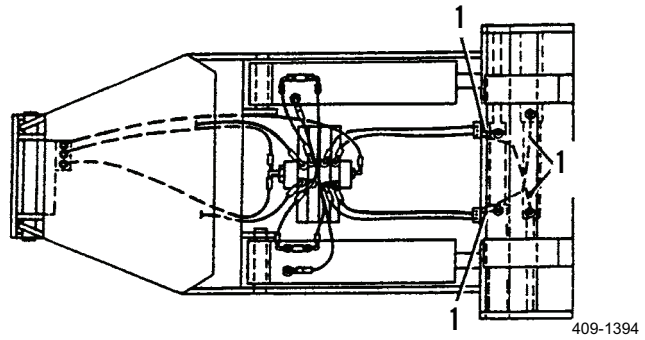
NOTE

Apply anti-seize compound on pins.

10. Install two carriage tilt cylinder pivot pins (5), two capscrews (3) and two new locknuts (4).
11. Shut off engine (TM 10-3930-660-10).
12. Disconnect hoist and remove lifting sling from carriage frame.
13. Install fork auto leveler switch (WP 0080 00).
14. Install backrest (WP 0160 00).
15. Lubricate carriage tilt cylinder pivot pins (4) and carriage pivot pins (5).
16. Start engine (TM 10-3930-660-10).
17. Operate fork sideshift function several times in each direction to bleed fork sideshift lines of air.
18. Shut off engine (TM 10-3930-660-10).



409-1395



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END OF WORK PACKAGE

BOOM ASSEMBLY REPLACEMENT 0261 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 10,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Compound, antiseize (Item 11, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Strap, tie down (Item 56, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Lockwasher (6)

Materials/Parts - Continued

Locknut (15 and 18)

Wood blocks, 2 in x 4 in x 12 in (51 mm x 101 mm x 305 mm)

References

WP 0262 00

WP 0263 00

WP 0264 00

Personnel Required

Two

Equipment Condition

MLRS attachment cylinder removed (WP 0185 00)

MLRS attachment removed (WP 0188 00)

Transmission cover removed (WP 0150 00)

Boom assembly fully retracted (TM 10-3930-660-10)

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 3,000 psi (20685 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 injury or death.

CAUTION

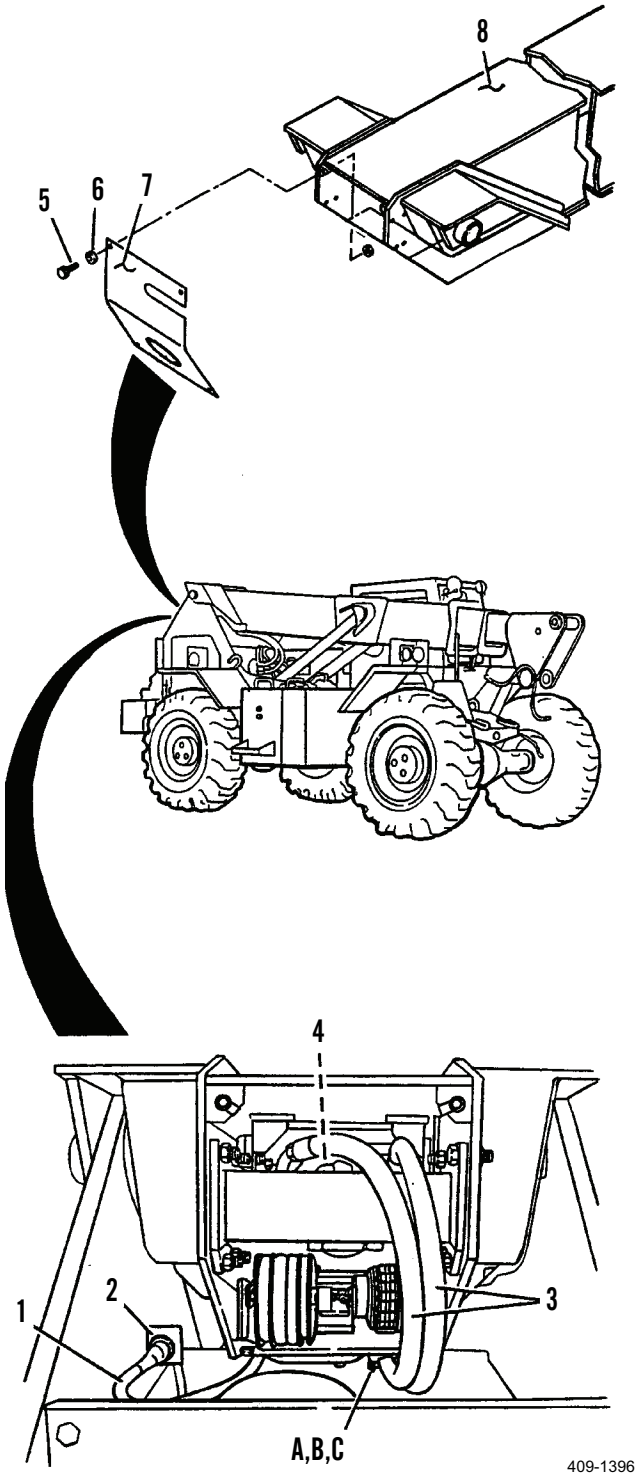
Wipe area clean around all hydraulic connections to be opened during removal. Cap oil lines to assure proper installation. Use container to catch any hydraulic oil that may drain from system.

NOTE

- In this procedure, the inner, intermediate and outer boom sections are removed as a unit. For removal of individual boom sections, refer to WP 0262 00, WP 0263 00 and WP 0264 00.
- If more than one hydraulic line is to be removed, tag lines to assure proper installation. Use container to catch any hydraulic oil that may drain from system.

REMOVAL - CONTINUED

1. Disconnect boom electrical cable (1) from socket (2) on vehicle frame.
2. Disconnect two hoses (3) from boom extend cylinder (4).
3. Remove four bolts (5), four lockwashers (6) and cover (7) from rear of boom assembly (8). Discard lockwashers.
4. Tag and disconnect two hoses from boom extend cylinder (4). Close hoses (3) securely with caps.
5. Remove locknuts (A), capscrews (B) and clamp halves (C) securing hydraulic hoses (3) to bottom of boom assembly.



REMOVAL - CONTINUED

WARNING

Use 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

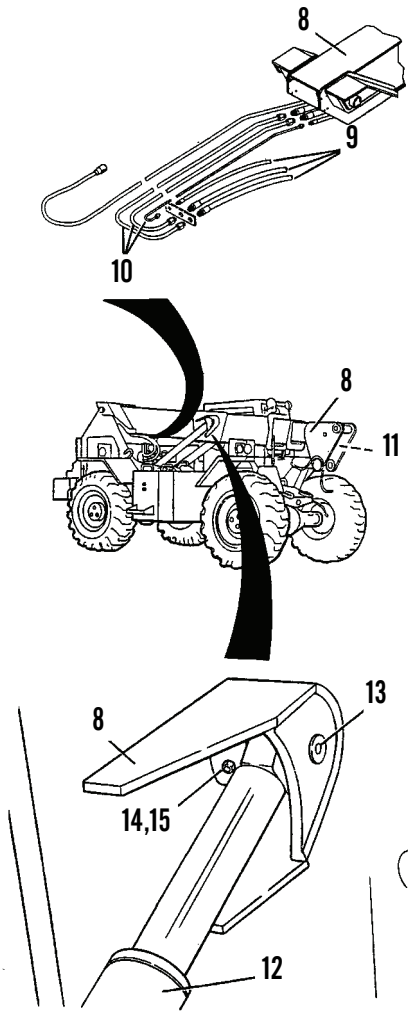
Weight of boom assembly including boom extend cylinder is approximately 10,000 lb (4535 kg).

6. Disconnect three hoses (9) from lines (10) at underside of boom assembly (8).

WARNING

Before performing step 7, make sure hoses at front of boom assembly are closed securely using plugs. Hydraulic oil under pressure can spray from hoses causing bodily injury if hoses are not closed securely.

7. Start engine and raise boom assembly (8) as necessary to access hoses (9). Stop engine (TM 10-3930-660-10).
8. Tag and disconnect three hoses (9) from lines (10) at underside of boom assembly (8). Plug three hoses (9) with metal caps.
9. Disconnect rod end of boom hoist cylinders (12) from boom assembly (8).
10. Start engine. Lower boom assembly (8) until cylinder pivot pins (13) are just above cab. Stop engine (TM 10-3930-660-10).
11. Support boom assembly (8) with hoist and slings or other suitable lifting device positioned at front of boom assembly (8).
12. Place wood block across vehicle deck behind cab to support boom hoist cylinders (12) when cylinders are lowered.
13. Remove capscrew (14) and locknut (15) securing pivot pin (13) to boom hoist cylinder (12). Discard locknut.
14. Support boom hoist cylinder (12). Remove pivot pin (13) from boom assembly (8) and boom hoist cylinder (12).



409-1397

REMOVAL - CONTINUED

NOTE

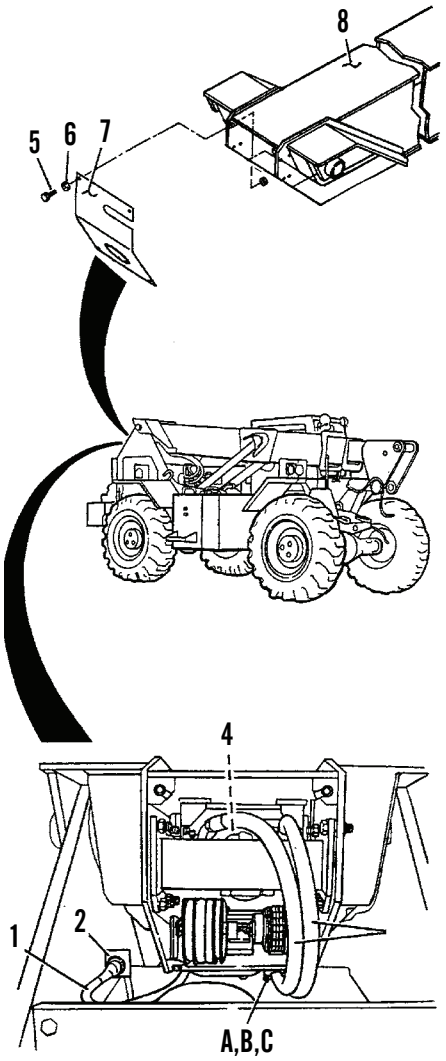
In step 15, release hydraulic joystick immediately after boom hoist cylinder to be removed has fully retracted. If joystick is allowed to remain open, the other cylinder will start to retract, putting extreme stress on lifting equipment and boom assembly.

15. Start engine and run at full throttle (TM 10-3930-660-10).

NOTE

Cylinder will retract very slowly.

16. Fully retract boom hoist cylinder (12) using joystick. Stop engine (TM 10-3930-660-10).
17. Carefully lower cylinder (12) onto board placed across vehicle deck so hydraulic line on cylinder is not damaged.
18. Repeat steps 13 thru 17 for other cylinder (6).
19. Place jackstand or support on front of vehicle deck. Adjust support so that boom assembly (8) will be level when lowered.
20. Carefully lower boom assembly (8) with hoist and sling until front of outer boom section is on jackstand or other suitable support.
21. Remove boom assembly (8) from vehicle frame.



409-1396a

REMOVAL - CONTINUED

NOTE

Center of gravity for boom assembly is approximately 9 ft (2.74 Nm) from rear end of boom assembly.

CAUTION

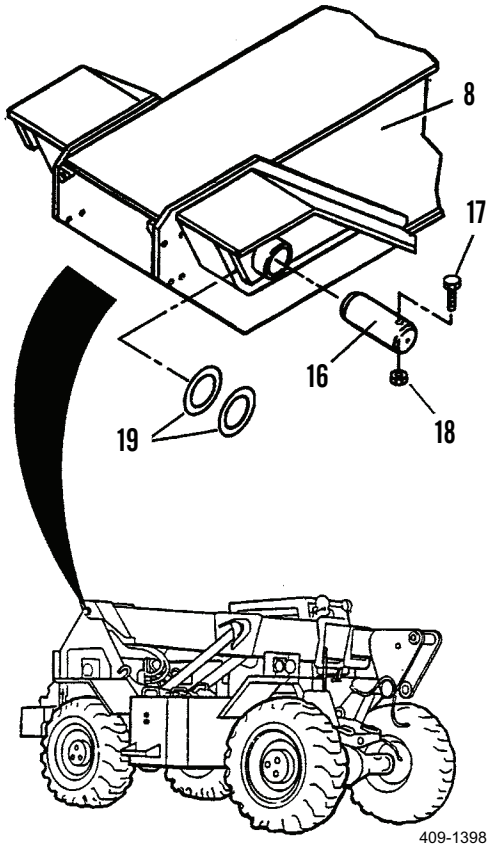
To prevent damage to lines and electrical cable during step 21, place wood boards between underside of outer boom section and slings.

22. Reposition hoist and slings to center of gravity for boom assembly (8). Carefully raise boom assembly (8) until weight of boom is removed from boom pivot pins (16).
23. Remove capscrew (17) and locknut (18) securing boom pivot pin (16) to vehicle frame. Discard locknut.

NOTE

Shims may fallout as pivot pins are removed.

24. Remove boom pivot pin (16) from boom assembly (8) from vehicle frame.
25. Remove shims (19) from between boom assembly (8) and vehicle frame. Note quantity and position of shims (19) for use during *Installation*.
26. Repeat steps 23 thru 25 for other boom pivot pin.



409-1398

REMOVAL - CONTINUED

CAUTION

Be careful that lines and electrical cable on underside of outer boom section are not damaged when boom assembly is lowered onto supports.

27. Carefully remove boom assembly (8) from vehicle frame and lower boom assembly (8) onto supports.
28. Remove tensioner (20) from boom assembly.

NOTE

Remove and discard two tie wraps from rubber hoses as necessary.

29. Remove four nuts (21), tensioner (20), two rubber hoses (22), threaded studs (23), springs (24) and spring retainers (25) from bracket of outer boom.

INSTALLATION

1. Install two spring retainers (25), springs (24), threaded studs (23), rubber hoses (22) and tensioner (20) to bracket of outer boom with four nuts (21).
2. Install two new tie down straps to secure rubber hoses (22) to threaded studs (23).

INSTALLATION - CONTINUED

CAUTION

To prevent damage to lines and electrical cable during step 3, place wood boards between underside of outer boom section and slings.

NOTE

- Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on hydraulic components and hoses clean and dry.
- Center of gravity for boom assembly is approximately 9 ft (2.7 m) from rear end of boom assembly.

WARNING

Use 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

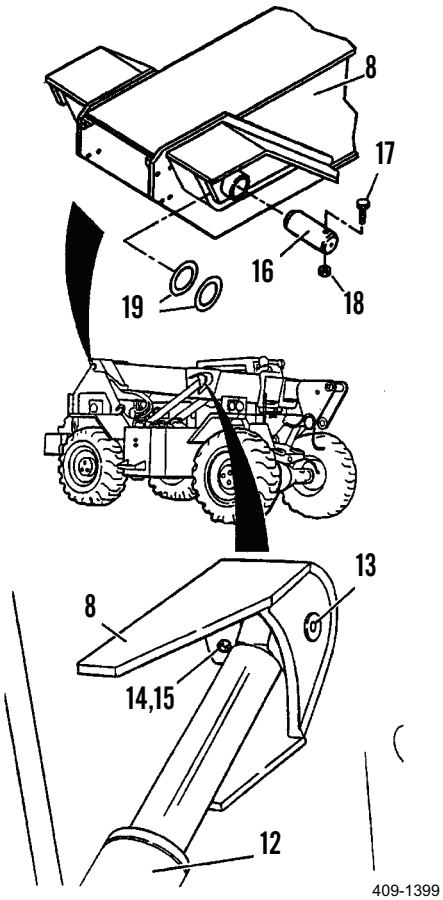
Weight of boom assembly including boom extend cylinder is approximately 10,000 lb (4535 kg).

3. Carefully lift boom assembly (8) into position over vehicle with hoist and sling or other suitable lifting device. Lower boom assembly (8) as required to align boom pivot pin holes.

NOTE

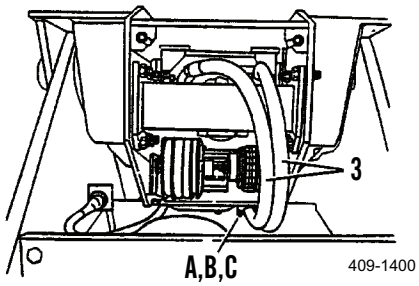
Apply antiseize compound to boom pivot pin as installed.

4. Position shims (19) between outer boom section and inside surface of vehicle frame. Install boom pivot pin (16).
5. Secure boom pivot pin (16) to vehicle frame with capscrew (17) and new locknut (18).
6. Repeat steps 4 and 5 for other pivot pin (16).
7. Place jackstand or support on front of vehicle deck. Adjust support so boom assembly (8) is level when lowered.



INSTALLATION - CONTINUED

8. Carefully lower boom assembly (8) with hoist and sling until front of outer boom section is on jackstand or support.
9. Secure hydraulic hoses (3) to bottom of boom assembly with new locknuts (A), capscrews (B) and clamp halves (C).
10. Connect rod ends of boom hoist cylinder (12) to boom assembly (8).
11. Reposition slings to front of outer boom section.
12. Lift boom assembly (8) until cylinder pivot pin holes of boom assembly (8) are just above cab.
13. Lift boom hoist cylinders (12) into position and support cylinders.



409-1400

CAUTION

Use hoist and sling to make final alignment with cylinder rod eye and pivot pin hole. Do not use the joystick to make final alignment; damage to rod eye bushing could result.

NOTE

One boom hoist cylinder will begin to extend before the other. Install this cylinder first. Second cylinder will begin to extend after first cylinder is connected.

14. Start engine (TM 10-3930-660-10).
15. Use joystick to extend boom hoist cylinder (12) until cylinder rod eye is aligned with pivot pin hole of boom assembly (8). Stop engine (TM 10-3930-660-10).

NOTE

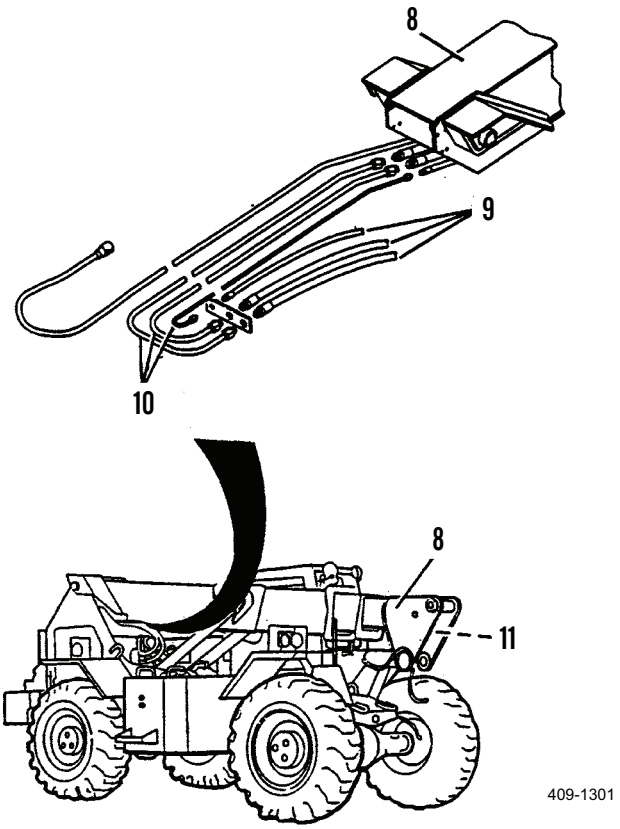
Apply antiseize compound to pivot pin as installed.

16. Secure pivot pin (13) to boom assembly (8) with capscrew (14) and new locknut (15).
17. Repeat steps 14 thru 16 for other boom hoist cylinder (12).
18. Connect three hoses (9) to lines (10) at underside of boom assembly (8).
19. Start engine and raise boom assembly (8) as required to access lines (10). Stop engine (TM 10-3930-660-10).

WARNING

Remove hose caps carefully prior to connecting hoses in step 20. Hydraulic oil may be under pressure.

20. Connect three hoses (9) to three lines (10) at underside of boom assembly (8).
21. Start engine and lower boom assembly (8) until horizontal. Stop engine (TM 10-3930-660-10).



409-1301

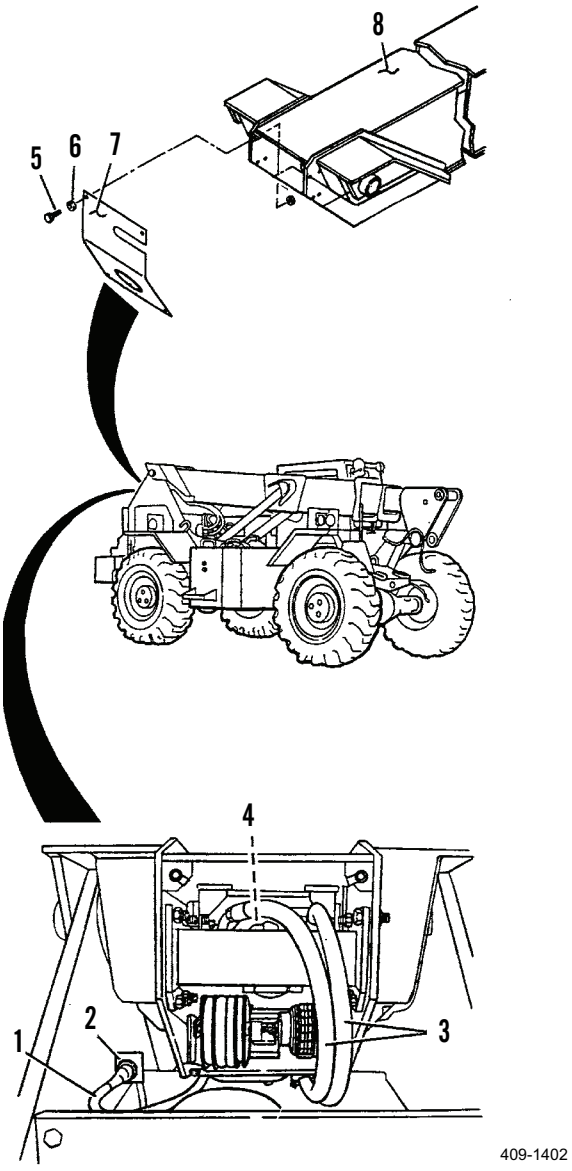
INSTALLATION - CONTINUED

22. Connect two hoses (3) to boom extend cylinder (4).
23. Connect two hoses (3) to boom extend cylinder (4) as tagged.

NOTE

Apply loctite to threads of bolts as installed.

24. Place cover (7) on rear of boom assembly (8) and secure with four bolts (5) and four new lockwashers (6).
25. Connect boom electrical cable (1) to socket (2) on vehicle frame.
26. Install MLRS attachment (WP 0188 00).
27. Install MLRS attachment cylinder (WP 0185 00).
28. Install transmission cover (WP 0150 00).
29. Lubricate boom pivot pins and boom hoist cylinder upper pivot pins.
30. Operate boom assembly and check for proper operations (TM 10-3930-660-10).



409-1402

END OF WORK PACKAGE

INNER BOOM MAINTENANCE 0262 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 4,000 lb capacity

Lifting chain

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Compound, antiseize (Item 11, WP 0323 00)

Rag, wiping (Item 37, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Cotter pin (61)

Lockwasher (9, 22, 28, 42, 47 and 54)

Rope, 30 ft (9 m)

Wood block 1 ft (30 cm)

References

WP 0111 00

WP 0193 00

WP 0194 00

WP 0262 00

WP 0269 00

WP 0316 00

WP 0317 00

Personnel Required

Three

Equipment Condition

MLRS attachment removed (WP 0188 00)

MLRS attachment cylinder removed (WP 0185 00)

Transmission cover removed (WP 0150 00)

Boom level and retracted (TM 10-3930-660-10)

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 3,000 psi (20685 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 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 the area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug holes after removing lines. Contamination of the hydraulic system could result in premature failure.

NOTE

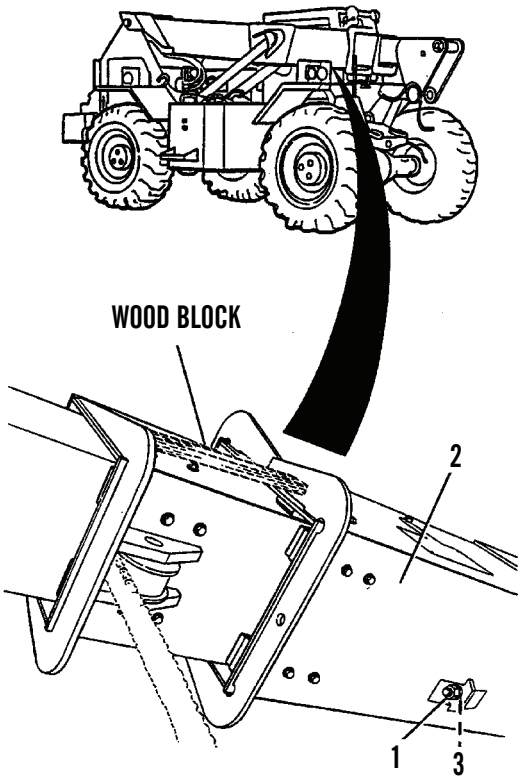
- If more than one hydraulic line is to be removed, identify lines to assure proper installation. Use suitable container to catch any hydraulic oil that may drain from system.
- Combined weight of outer boom weldment and boom extend cylinder is approximately 1,500 lb (680 kg).

REMOVAL

NOTE

Count and record number of turns nut is loosened in step 1.

1. Loosen, but do not remove nut (1) on underside of outer boom (2) to relieve tension on extended chain (3).



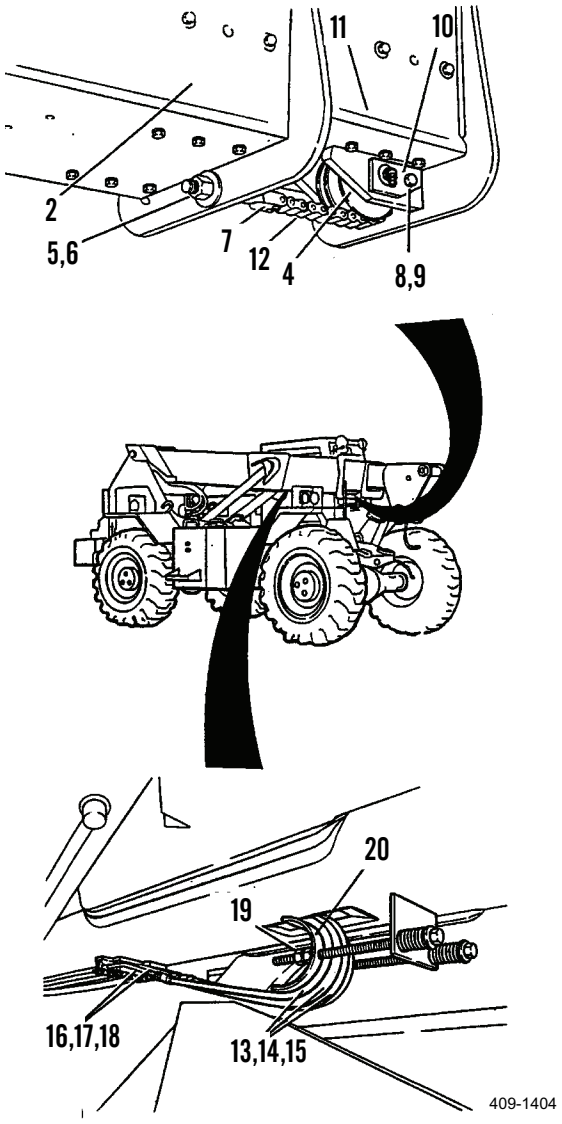
REMOVAL - CONTINUED

2. Remove retract chain pulley (4).

NOTE

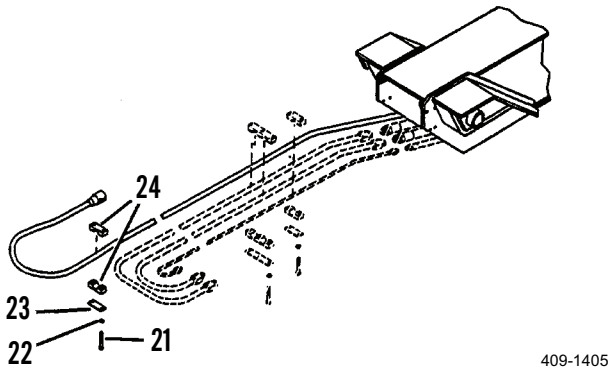
Record the number of turns nut is loosened in step 3 for use during installation.

3. Remove nut (5) and flatwasher (6) securing clevis (7). Remove clevis (7) from outer boom (2).
4. Remove capscrew (8) and lockwasher (9). Remove pin (10) and chain pulley (4) from intermediate boom (11). Discard lockwasher.
5. Lift retract chain (12) through hole and over flange of intermediate boom (11). This will allow retract chain (12) to fall freely when inner boom is removed.
6. Loosen four nuts (19) at tensioner (20) to relieve tension on hoses (13 thru 15).
7. Tag and disconnect hoses (13 thru 15) from lines (16 thru 18).
8. Close end of lines (16 thru 18) with metal plugs.



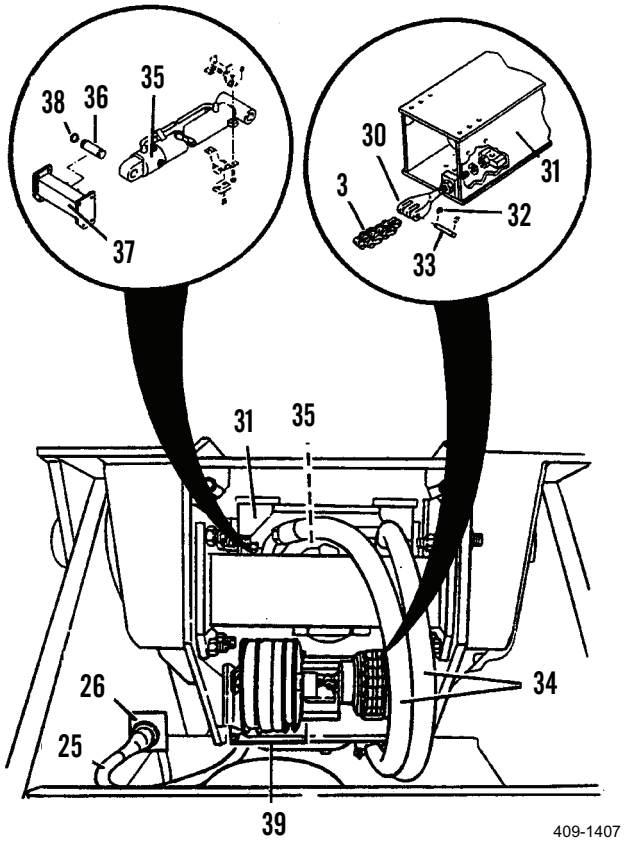
REMOVAL - CONTINUED

9. Remove two capscrews (21) and two lockwashers (22) securing spacer plate (23) and clamp halves (24). Discard lockwashers.
10. Repeat step 9 for all remaining electrical cable clamp assemblies under boom.



409-1405

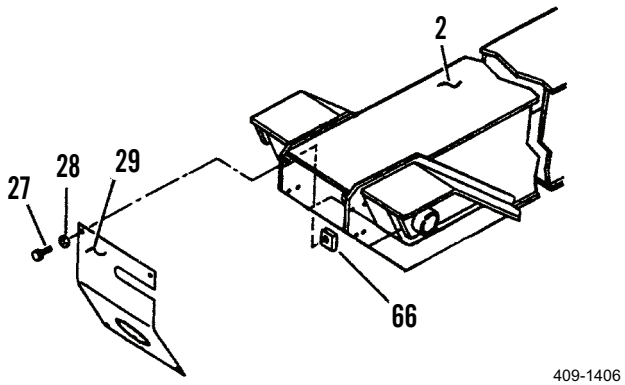
11. Disconnect boom electrical cable (25) from socket (26) on vehicle frame.



409-1407

REMOVAL - CONTINUED

12. Remove four bolts (27), four lockwashers (28) and cover (29) from rear of outer boom (2). Discard lockwashers. If necessary, remove retainer (66).
13. Separate extend chain (3) from clevis (30) at rear of inner boom (31).



14. Remove retaining ring (32) from pin (33).
15. Remove pin (33) from clevis (30) and separate extend chain (3) from clevis (30).
16. Tag and remove two hoses (34) from boom extend cylinder (35).
17. Place wood block under boom extend cylinder (35), between cylinder (35) and inner boom (31). Wood block will support cylinder (35) when pin (36) is removed.
18. Disconnect pin (36) securing base of boom extend cylinder (35) to anchor (37).
19. Remove two retaining rings (38) from pin (36).
20. Slide pin (36) right or left through hole in anchor (37) until pin (36) touches outer boom (2).

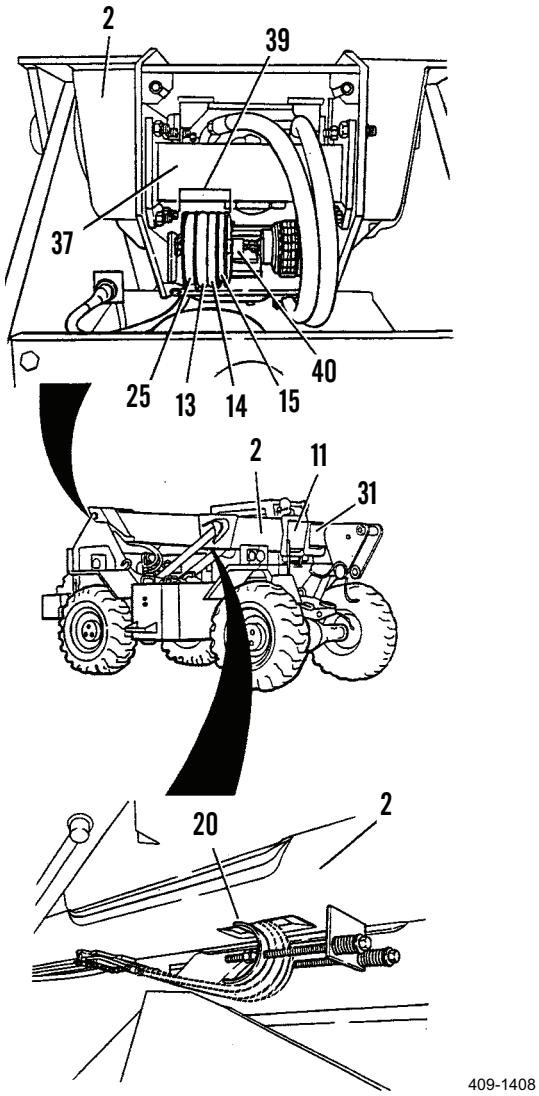
REMOVAL - CONTINUED

21. Carefully pull hoses (13 thru 15) from underside of hose pulley (39) out the rear of outer boom (2).
22. Remove boom electrical cable (25) from outer boom (2).
23. Tie one end of a rope to anchor (37) at rear of outer boom (2).
24. Tie other end of rope to hose pulley support bracket (40).
25. Using chain, rope or hand winch, attach inner boom (31) and intermediate boom (11) together at flanges.
26. Pull inner boom (31) and intermediate boom (11) out as an assembly until boom hose pulley (39) and rope end are visible through hole near tensioner (20).

NOTE

Leave rope tied to cable.

27. Untie rope from hose pulley support bracket (40). Tie same rope end to plug end of boom electrical cable (25).
28. Pull rope from rear of outer boom until cable (25) is not looped inside outer boom (2).



409-1408

CAUTION

To prevent damage to hoses and boom electrical cable, have assistant guide hoses out rear of outer boom during step 29.

29. Use hoist and sling (or other suitable lifting device) to push intermediate boom (11) and inner boom (31) as an assembly into outer boom (2) until intermediate boom extends approximately 1 ft (0.3 m) from outer boom (2).

REMOVAL - CONTINUED

NOTE

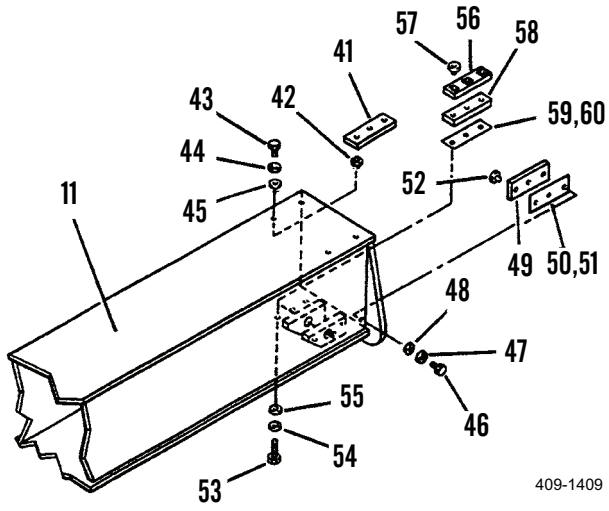
Adjust hoist and sling as required during steps 30 thru 32 to provide work room when removing wear pad assemblies.

30. Remove capscrews (41), lockwashers (42) and flatwashers (43). Discard lockwashers.

NOTE

Note location and quantity of wear pad components. Tag all wear pad components as removed.

31. Remove wear pad (44) and wear pad inserts (45).
32. Remove capscrews (46), lockwashers (47) and flatwashers (48). Discard lockwashers.



NOTE

Shims are used as required. Note location and quantity of shims as removed.

33. Remove wear pad (49), shims (50 and 51) and wear pad inserts (52).
34. Remove capscrews (53), lockwashers (54) and flatwashers (55). Discard lockwashers.

NOTE

Shims are used as required. Note location and quantity of shims as removed.

35. Lift inner boom (31) and remove wear pad (56), wear pad inserts (57), spacers (58) and shims (59 and 60).

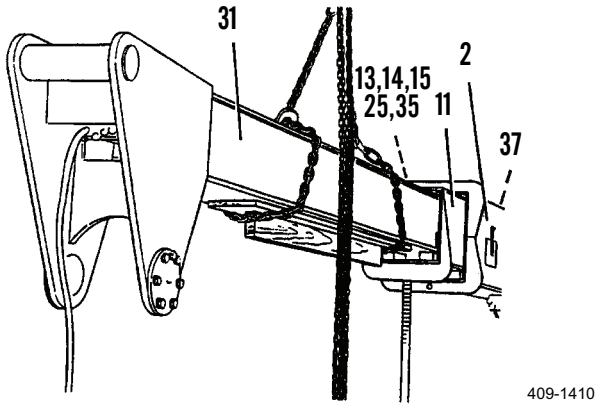
REMOVAL - CONTINUED

36. Using chain, rope or hand winch, attach outer boom (2) to intermediate boom (11).
37. Pull out inner boom (31) from intermediate boom (11) approximately 12 ft (3.7 m).

NOTE

Center of gravity for inner boom with extend cylinder is approximately 92 in. (2.3 m) from front end of inner boom.

38. Reposition hoist and sling at center of gravity for inner boom (31). Place spreader bar between slings at underside of boom (31).



409-1410

NOTE

Have assistant guide hoses and boom electrical cable from intermediate boom as inner boom is removed.

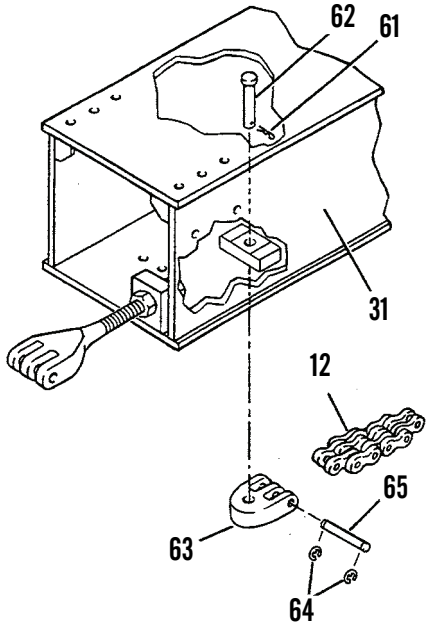
39. Slowly remove inner boom (31) from intermediate boom (11) while guiding hoses (13 thru 15) and boom electrical cable (25) from intermediate boom (11).
40. Untie rope from boom electrical cable (25).
41. Place inner boom (31) on supports.

NOTE

Leave other end of rope tied to anchor at rear of outer boom. Rope will be used during installation of inner boom.

DISASSEMBLY

1. Remove remaining wear pads from inner boom, if necessary (WP 0262 00).
2. Remove boom extend cylinder, if necessary (WP 0269 00).
3. Remove boom hydraulic hoses from inner boom (WP 0194 00).
4. Remove boom electrical cable from inner boom (WP 0111 00).
5. Remove retract chain (12) from inner boom (31).
6. Remove cotter pin (61) and pin (62) securing clevis (63) to inner boom (31). Discard cotter pin.
7. Remove retaining rings (64) and pin (65) securing clevis (63) to retract chain (12).



409-1411

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. If removal was necessary, install boom electrical cable to inner boom (WP 0111 00).
2. If removal was necessary, install boom hydraulic hoses to inner boom (WP 0194 00).
3. If removal was necessary, install boom extend cylinder inside inner boom (WP 0269 00).
4. If removal was necessary, install wear pads to inner boom (WP 0262 00).
5. If removal was necessary, install retract chain (12) to inner boom (31).
6. Secure clevis (63) to retract chain with pin (65) and retaining rings (64).
7. Secure clevis (63) to inner boom (31) with pin (62) and new cotter pin (61).

INSTALLATION

NOTE

- Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on hydraulic components and hoses clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.
- Be sure that wood block placed between boom extend cylinder and inner boom during inner boom removal remains in place during inner boom installation.

1. Support wood block between flanges of outer boom (2) and intermediate boom (11).
2. Position hoist and sling (or other suitable lifting device) at center of gravity for inner boom (31). Place spreader bar between slings at underside of boom (31).
3. Position inner boom (31) in front of intermediate boom (11) with hoist and sling.
4. Tie end of rope to boom electrical cable (25).
5. Tape ends of hoses (13 thru 15) to boom electrical cable (25).
6. Place ends of boom electrical cable (25) and hoses (13 thru 15) inside intermediate boom (11).
7. Pull cable (25) and hoses (13 thru 15) with rope at rear of outer boom until they are free of slack.
8. Put free end of retract chain (12) through pulley hole of intermediate boom (11). Allow all slack of chain (12) to hang from hole.

NOTE

During step 8, have assistant guide cable and hoses into front of intermediate boom. Have second assistant pull rope at rear of outer boom. This will prevent hoses and cable from being crushed and damaged.

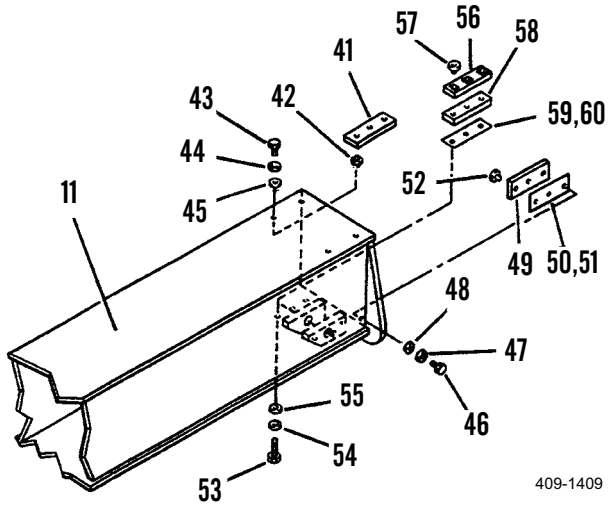
9. Install inner boom (31) into intermediate boom (11) approximately 3 ft (0.9 m).

INSTALLATION - CONTINUED

NOTE

- Adjust hoist and sling as required during following steps to provide work room when installing wear pad assemblies.
- All used wear pads installed in following steps must be at least 3/8 in. (9.5 mm) thick. If wear pad is worn to less than 3/8 in. (9.5 mm) thick, discard old wear pad and replace with new wear pad.
- Shims are used as required. Install same quantity of shims as noted during removal.

10. Lift inner boom (2) to provide adequate space between inner boom (2) and intermediate boom (11).
11. Position spacers (58), shims (59 and 60), wear pads (56) and wear pad inserts (57) between intermediate boom (11) and inner boom (31). Chamfered side of wear pad (56) must be facing towards inner boom (31). Widest portion of wear pad (56) must be facing towards outside of intermediate boom (11).



NOTE

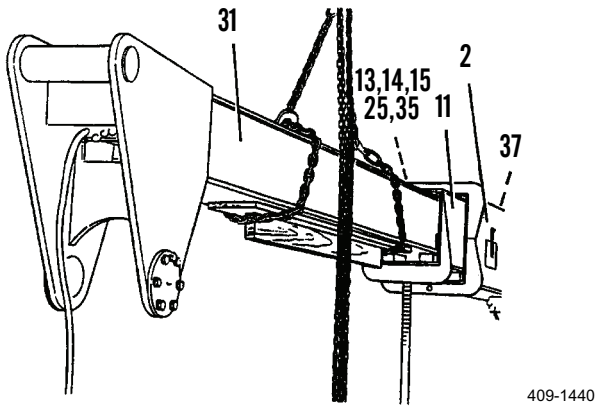
Apply loctite to capscrews as installed in steps 12, 14 and 16.

12. Secure wear pad assemblies, parts (56 thru 60) to intermediate boom (11) with flatwashers (55), new lockwashers (54) and capscrews (53). Torque capscrews to 30 lb-ft (41 Nm).

NOTE

Shims are used as required. Install same quantity of shims as noted during removal.

13. Position wear pads (49), shims (50 and 51) and wear pad inserts (52) between intermediate boom (11) and inner boom (31). Chamfered side of wear pad (49) must be facing towards inner boom (31). Widest portion of wear pad (49) must be facing towards bottom of intermediate boom (11).
14. Secure wear pad assemblies, parts (49 thru 52) to intermediate boom (11) with flatwashers (48), new lockwashers (47) and capscrews (46). Torque capscrews to 30 lb-ft (41 Nm).



15. Position wear pads (44) and wear pad inserts (45) between intermediate boom (11) and inner boom (31). Chamfered side of wear pad (44) must be facing towards inner boom (31). Widest portion of wear pad (44) must be facing towards outside of intermediate boom (11).
16. Secure wear pad assemblies, parts (44 and 45) with flatwashers (43), new lockwashers (42) and capscrews (41). Torque capscrews to 30 lb-ft (41 Nm).

INSTALLATION - CONTINUED

17. Using hoist and sling to move inner boom, check for clearance of 0.01 to 0.13 in. (0.25 to 3.30 mm) between inner boom surface and wear pads. If necessary, add or subtract shims (50, 51, 59 and 60) until clearance is within specification.

CAUTION

To prevent damage to hoses and boom electrical cable, have assistant pull rope attached to boom electrical cable and hoses at rear of outer boom.

NOTE

Be sure wood block placed between flanges of outer boom and intermediate boom during step 2, is still in place.

18. Push inner boom (31) into intermediate boom (11) until approximately 4 ft of inner boom (31) extends from front of intermediate boom (11).

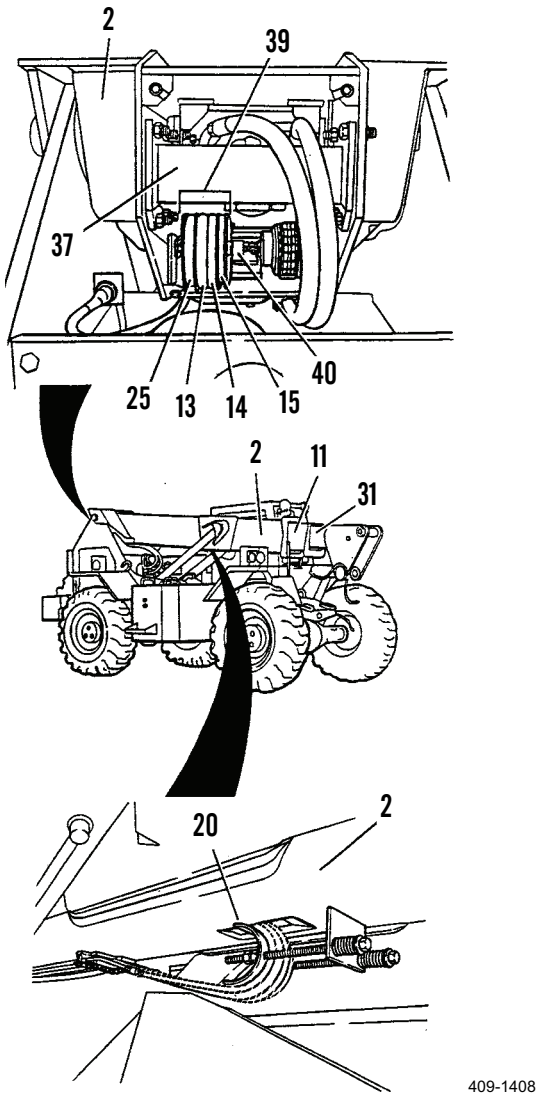
19. Position hoses (13 thru 15) and boom electrical cable (25) into shives on top side of hose pulley (39).

20. Untie rope from anchor (37) at rear of outer boom (2). Tie same rope end of hose pulley support bracket (40).

21. Using chain, rope or hand winch, attach inner boom (2) and intermediate boom (11) together.

22. Pull inner boom (31) and intermediate boom (11) from outer boom (2) as an assembly until boom hose pulley (39) and rope end are visible through hole near tensioner (20).

23. Untie rope end from hose pulley support bracket (40). Pull rope, hoses (13 thru 15) and boom electrical cable (25) through hole near tensioner until free of slack.



CAUTION

Have assistant guide hoses through hole near tensioner while installing booms.

24. Make sure that hoses (13 thru 15) and boom electrical cable (25) wrap around boom pulley (39) and remain in proper position.

25. Push inner boom (31) and intermediate boom (11) into outer boom (2) as an assembly until outer boom is approximately 1 ft (0.3 m) from flange of intermediate boom (11).

26. Remove tape from around boom electrical cable (25) and hoses (13 thru 15). Untie rope end from cable (25).

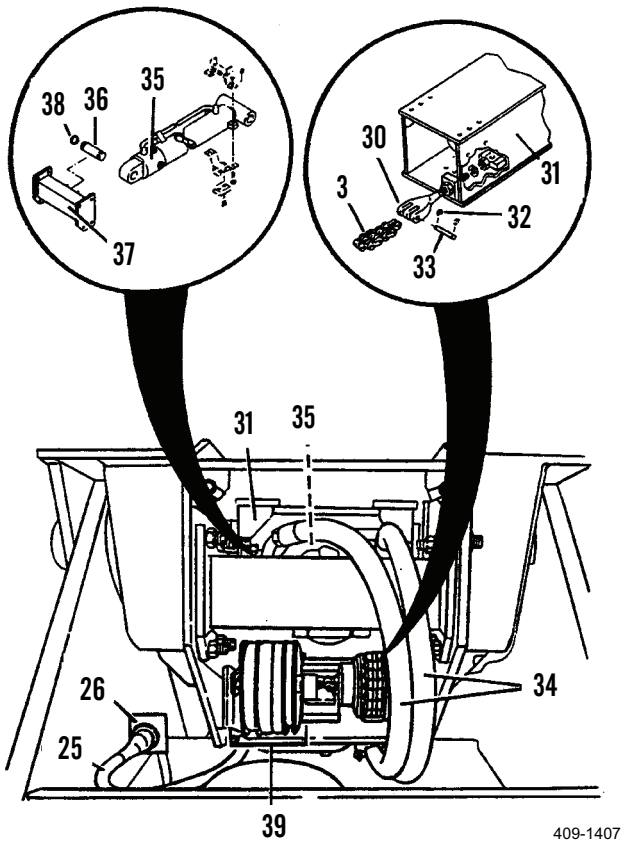
INSTALLATION - CONTINUED

27. Push inner boom (2) in until mounting hole of cylinder (35) is aligned with mounting holes of anchor (37).

NOTE

Apply antiseize compound to pin as installed.

28. Secure cylinder (35) to anchor (37) by sliding pin (36) into place. Secure pin (36) with two retaining rings (38).
29. Remove wood block from under cylinder (35).
30. Position chain (3) around extend chain sheave and align holes of chain (3) with holes in clevis (30).



31. Attach chain (3) to clevis (30) with pin (33).
32. Secure pin (33) with two remaining rings (32).
33. Connect two hydraulic hoses (34) to boom extend cylinder (35).

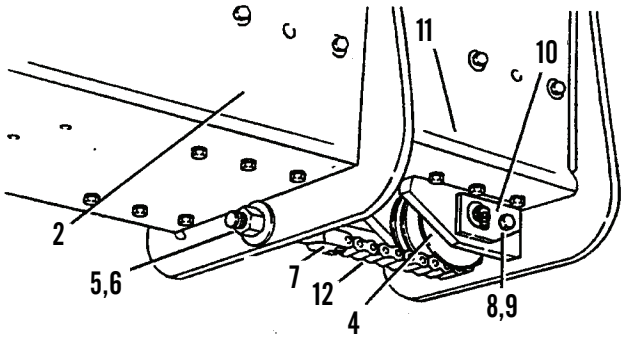
INSTALLATION - CONTINUED

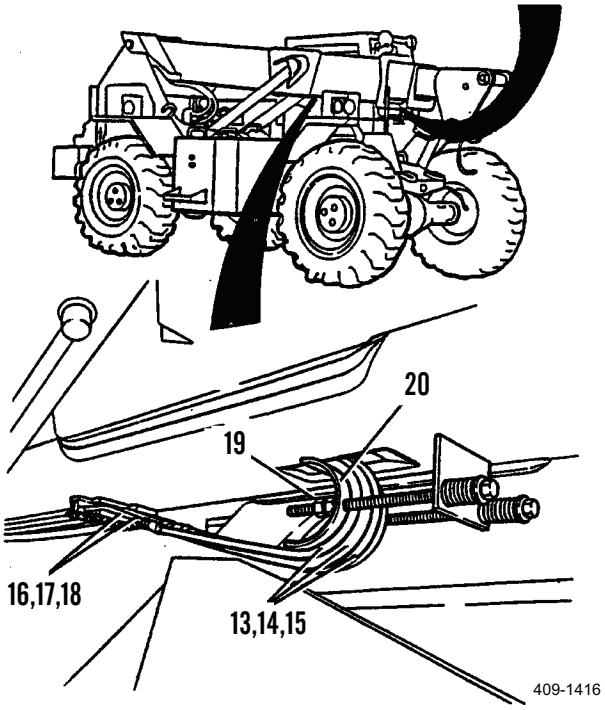
34. Connect hoses (13 thru 15) to lines (16 thru 18) at tensioner.
35. With retract chain (12) around pulley (4), align pulley (4) and intermediate boom holes. Install pin (10).
36. Apply Loctite to capscrew (8).
37. Install capscrew (8) and new lockwasher (9).

NOTE

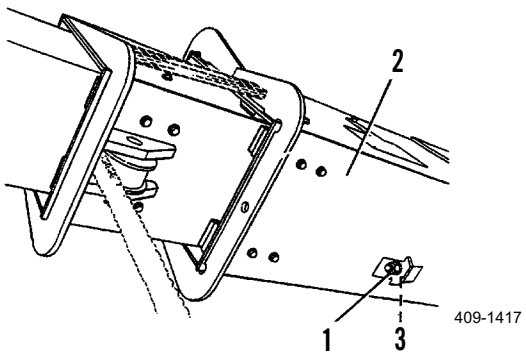
Tighten nut same number of turns as noted during removal.

38. Insert clevis (7) into hole in outer boom (2) and secure with flatwasher (6) and nut (5).



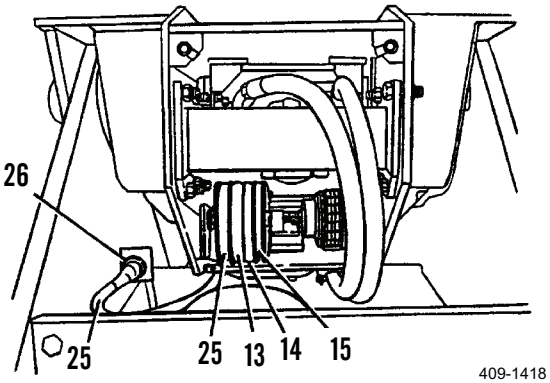


39. Tighten nut (1) on underside of outer boom (2) to adjust tension of extend chain (3) (WP 0193 00).
40. Adjust hydraulic hose tension (WP 0194 00).

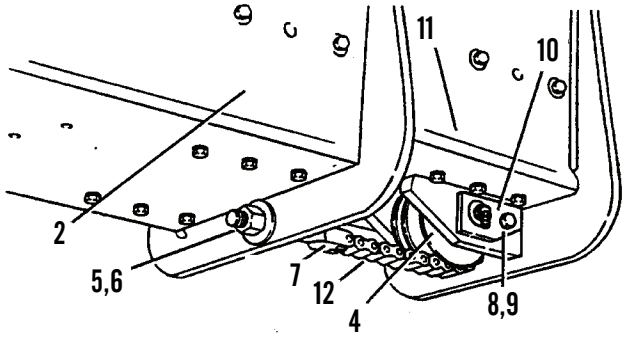


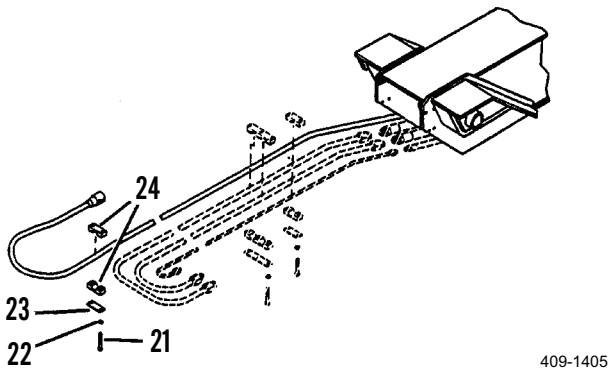
INSTALLATION - CONTINUED

41. Apply loctite to capscrews (21).
42. While pulling cable (25) tight, install clamp halves (24), spacer plate (23) and two capscrews (21) to outer boom, closest to tensioner (20).
43. Install remaining three cable clamps while pulling cable (25) tight.
44. Connect boom electrical cable (25) to socket (26) on vehicle frame.

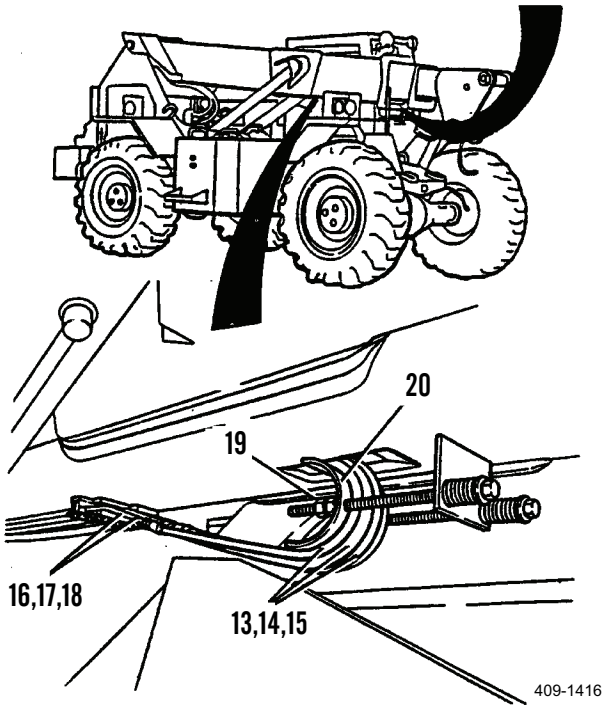


409-1418





409-1405



409-1416

INSTALLATION - CONTINUED

NOTE

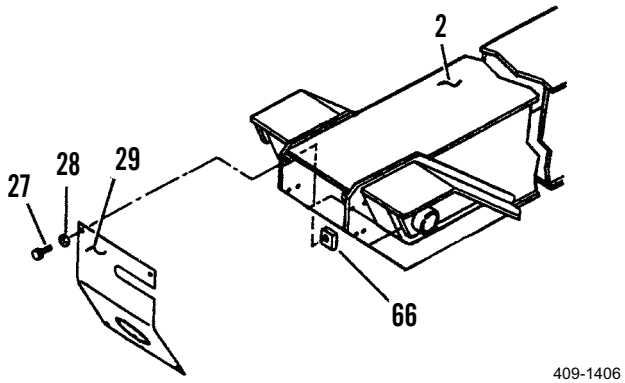
Be sure that hoses and boom electrical cable are properly routed around tensioner.

45. Install MLRS attachment (WP 0188 00).
46. Install MLRS attachment cylinder (WP 0185 00).

NOTE

- Before performing step 47, check all hydraulic boom functions for proper operation.
- Apply loctite to threads of bolts as installed.

47. If removal was necessary, install retainer (66). Place cover (29) on rear of outer boom (2) and secure with four bolts (27) and four new lockwashers (28).



48. Install transmission cover (WP 0150 00).
49. Operate boom and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

INTERMEDIATE BOOM MAINTENANCE 0263 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 2,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Lockwasher (6, 13 and 21)

Wood block, 1 ft (30 cm)

References

WP 0190 00

WP 0191 00

WP 0193 00

WP 0266 00

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Inner boom removed (WP 0263 00)

WARNING

Use 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

The weight of the intermediate boom is 830 lb (377 kg).

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 3,000 psi (20685 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 injury or death.

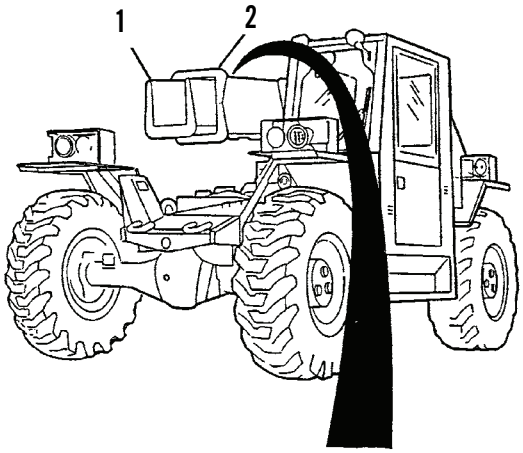
CAUTION

Wipe the area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug holes after removing lines. Contamination of the hydraulic system could result in premature failure.

NOTE

- If more than one hydraulic line is to be removed, identify lines to assure proper installation. Use container to catch any hydraulic oil that may drain from system.
- Be sure rope used during inner boom removal (WP 0263 00) is placed in intermediate boom and fastened at each end.

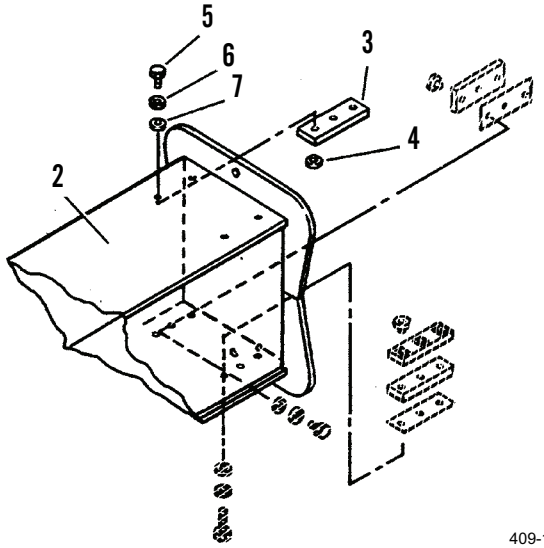
1. Attach a hoist with slings (or other lifting device) to intermediate boom (1). Use hoist to remove intermediate boom (1) 3/4 way out from outer boom (2).



NOTE

- Note location and quantity of wear pad components. Tag all components as removed.
- Raise or lower sling as required during steps 2 and 3 to provide work room when removing wear pad assemblies.

2. Remove capscrews (5), lockwashers (6) and flatwashers (7). Discard lockwashers.
3. Remove wear pads (3) and wear pad inserts (4) from front of outer boom (2).



409-1420

REMOVAL - CONTINUED

4. Remove capscrews (12), lockwashers (13) and flatwashers (14). Discard lockwashers.

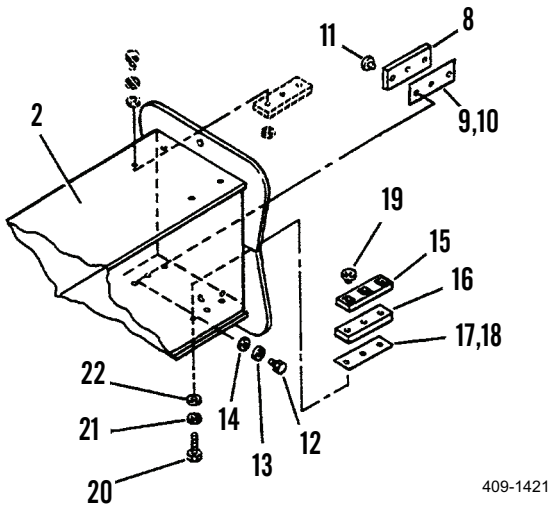
NOTE

Shims are used as required. Note location and quantity of shims as removed.

5. Remove wear pads (8), shims (9 and 10) and wear pad inserts (11) from outer boom (2).
6. Remove capscrews (20), lockwashers (21) and flatwashers (22). Discard lockwashers.

NOTE

Shims are used as required. Note location and quantity of shims as removed.

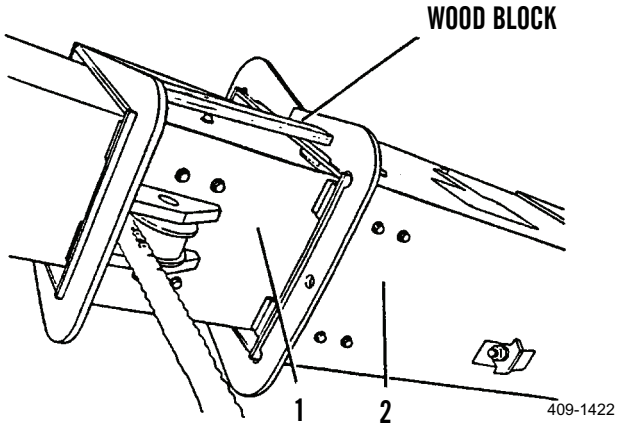


7. Remove wear pads (15), spacer plates (16), shims (17 and 18) and wear pad inserts (19) from front of outer boom (2).

NOTE

Center of gravity for intermediate boom is approximately 82 in. (208 cm) from front flange of boom. Position hoist at center of gravity during step 8.

8. Place a spreader bar under intermediate boom (1) and hold in place. Attach hoist with slings around spreader bar and intermediate boom (1).
9. Use hoist to remove intermediate boom (1) from outer boom (2). Place intermediate boom (1) on supports.



DISASSEMBLY

1. Remove boom retract chain sheave (WP 0193 00), if necessary.
2. Remove boom hose pulley (WP 0191 00), if necessary.
3. Remove wear pads (WP 0266 00) from intermediate boom (1), if necessary.

CLEANING

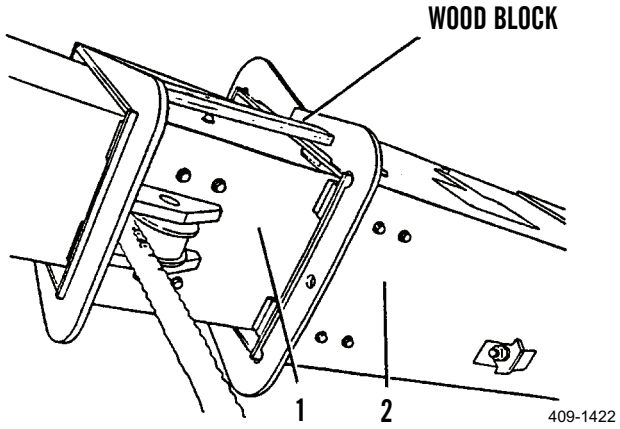
See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00) and (WP 0190 00).

ASSEMBLY

1. If removal was necessary, install wear pads (WP 0267 00) inside intermediate boom (1).
2. If removal was necessary, install boom hose pulley retract chain sheave (WP 0191 00).
3. If removal was necessary, install boom retract chain sheave (WP 0193 00).

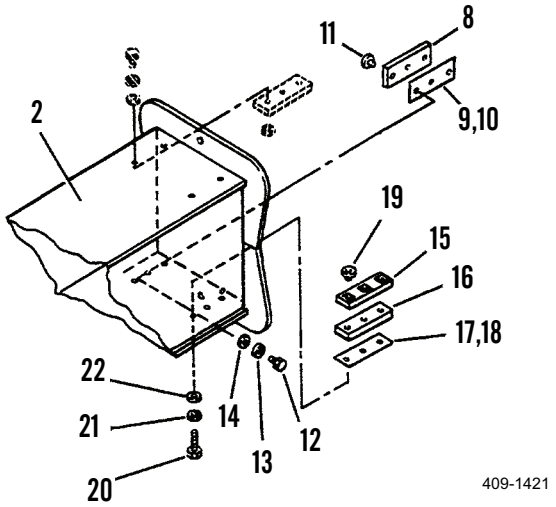


INSTALLATION

NOTE

Center of gravity for intermediate boom is approximately 82 in. (208 cm) from front flange of boom. Position hoist at center of gravity.

1. Place a spreader bar under intermediate boom (1). Hold spreader bar in place until hoist with slings is installed.
2. Use hoist or other suitable lifting device to install intermediate boom (1) into outer boom (2). Slide the intermediate boom (1) 1/4 of the way into outer boom (2).
3. Move hoist with slings to the front end of intermediate boom (1).



NOTE

- All used wear pads installed in steps 5 thru 11 must be at least 3/8 in. (9.5 mm) thick. If wear pad is worn to less than 3/8 in. (9.5 mm) thick, discard old wear pad and replace with new wear pad.
- Adjust hoist and sling as required during steps 5, 8 and 11 to provide work room when installing wear pad assemblies.
- Shims are used as required. Install same quantity of shims as noted during removal.

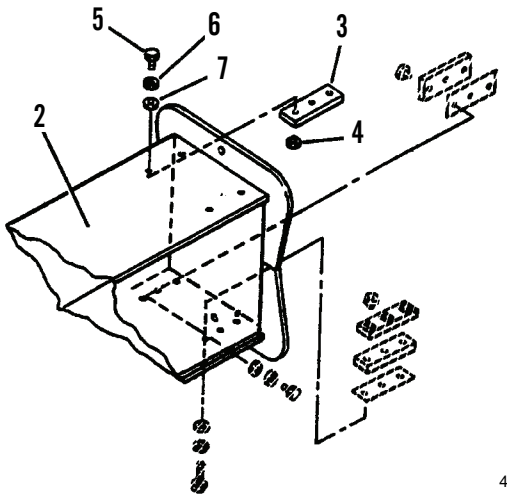
INSTALLATION - CONTINUED

4. Position shims (17 and 18), spacers plates (16), wear pads (15) and wear pad inserts (19) between intermediate boom (1) and outer boom (2). Chamfered side of wear pad (15) must be facing towards intermediate boom (1). Widest portion of wear pad (15) must be facing towards outside of outer boom (2).
5. Apply loctite to capscrews (20). Secure wear pad assemblies, parts (15 thru 19) to outer boom (2) with flatwashers (22), new lockwashers (21) and capscrews (20). Torque capscrews (20) to 30 lb-ft (40 Nm).

NOTE

Shims are used as required. Install same quantity of shims as noted during removal.

6. Position wear pads (8), shims (9 and 10) and wear pad inserts (11), between outer boom (2) and intermediate boom (1). Chamfered side of wear pad (8) must be facing towards intermediate boom (1). Widest portion of wear pad (8) must be facing towards bottom of outer boom (2).
7. Apply loctite to capscrews (12). Secure wear pad assemblies, parts (8 thru 11) to outer boom (2) with flatwashers (14), new lockwashers (13) and capscrews (12). Torque capscrews (12) to 30 lb-ft (40 Nm).
8. Position wear pads (3) and wear pad inserts (4) between outer boom (2) and intermediate boom (1). Chamfered side of wear pad (3) must be facing towards intermediate boom (1). Widest portion of wear pad (3) must be facing towards outside of outer boom (2).
9. Apply loctite to capscrews (5). Secure wear pad assemblies, parts (3 and 4) with flatwashers (7), new lockwashers (6) and capscrews (5). Torque capscrews (5) to 30 lb-ft (40 Nm).



10. Using hoist and sling to move inner boom, check for clearance of 0.01 to 0.13 in. (0.25 to 3.30 mm) between intermediate boom surface and wear pads. If necessary, add or subtract shims (9, 10, 17 and 18) until clearance is within specifications.
11. Use hoist to slide intermediate boom (1) in until it is approximately 1 ft (0.3 m) from end of outer boom (2).
12. Install wood block between outer boom (2) and intermediate boom (1) for use during installation of inner boom.
13. Install inner boom (WP 0263 00).
14. Remove wood block.
15. Operate boom and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

OUTER BOOM MAINTENANCE 0264 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive (Item 21, WP 0324 00)

Lifting device, 2,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Compound, antiseize (Item 11, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Locknut (11 and 14)

Materials/Parts - Continued

Lockwasher (17 and 21)

Wood block

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Intermediate boom removed (WP 0263 00)

WARNING

Use 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 the outer boom is 1,600 lb (726 kg).

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 3000 psi (20685 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 injury or death.
- Before performing step 2, make sure lines and extend cylinder hoses under boom are closed securely using metal plugs. Hydraulic oil under pressure can spray from hoses and lines causing bodily injury if lines and hoses are not closed securely.

CAUTION

Wipe the area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug holes after removing lines. Contamination of the hydraulic system could result in premature failure.

NOTE

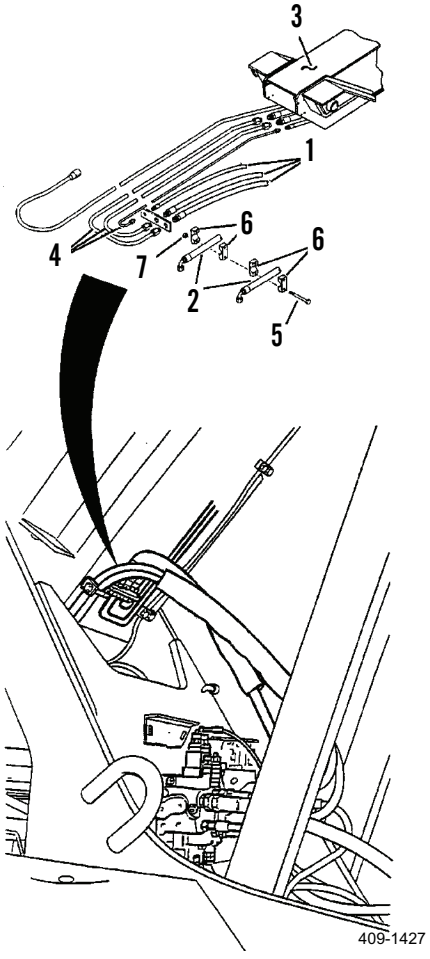
If more than one hydraulic line is to be removed, tag lines to assure proper installation. Use suitable container to catch any hydraulic oil that may drain from system.

1. Start engine and raise outer boom (3) as necessary to access hoses (1 and 2). Stop engine (TM 10-3930-660-10).

WARNING

Disconnect hoses carefully during step 3. Hydraulic oil may be under pressure. Failure to follow this precaution will cause personal injury.

2. Tag and disconnect three hoses (1) from lines (4) at bulkhead. Plug three hoses (1) with metal caps.
3. Remove capscrew (5), four clamp halves (6) and nut (7) securing two hoses (2). Leave hoses (2) plugged with metal caps.



REMOVAL - CONTINUED

4. Place wood blocks on machine deck behind cab to support boom hoist cylinders (8) when cylinders are lowered.
5. Start engine. Lower outer boom until cylinder pivot pins (9) are just above cab. Stop engine (TM 10-3930-660-10).
6. Support outer boom (3) with hoist and slings positioned at front of boom (3).
7. Remove capscrew (10) and locknut (11) securing pivot pin (9) to boom hoist cylinder (8). Discard locknut.
8. Support boom hoist cylinder (8). Remove pivot pin (9) from outer boom (3) and boom hoist cylinder (8).

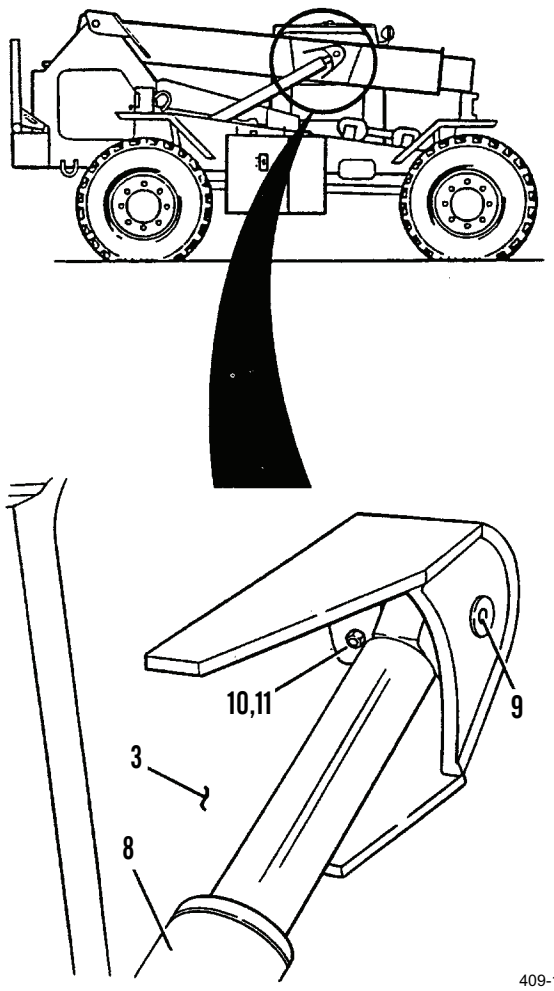
CAUTION

In step 9, release hydraulic joystick immediately after boom hoist cylinder being removed has fully retracted. If joystick is allowed to remain open, the other cylinder will start to retract, putting extreme stress on lifting equipment and boom, which may result in damaged equipment.

NOTE

Cylinder will retract very slowly.

9. Start engine and run at full throttle. Fully retract boom hoist cylinder (8). Stop engine (TM 10-3930-660-10).
10. Carefully lower cylinder (8) onto board placed across vehicle deck so hydraulic line on cylinder (7) is not damaged.
11. Repeat steps 7 thru 10 for other cylinder (8).



409-1428

REMOVAL - CONTINUED

NOTE

Place jackstand or support on front of vehicle deck. Adjust support so that outer boom will be level when lowered.

12. Carefully lower outer boom (3) with hoist and sling until front of boom (3) is on jackstand or support.
13. Remove outer boom (3) from vehicle frame.

NOTE

Center of gravity for outer boom is approximately 92.5 in. (235 cm) from front flange of outer boom.

CAUTION

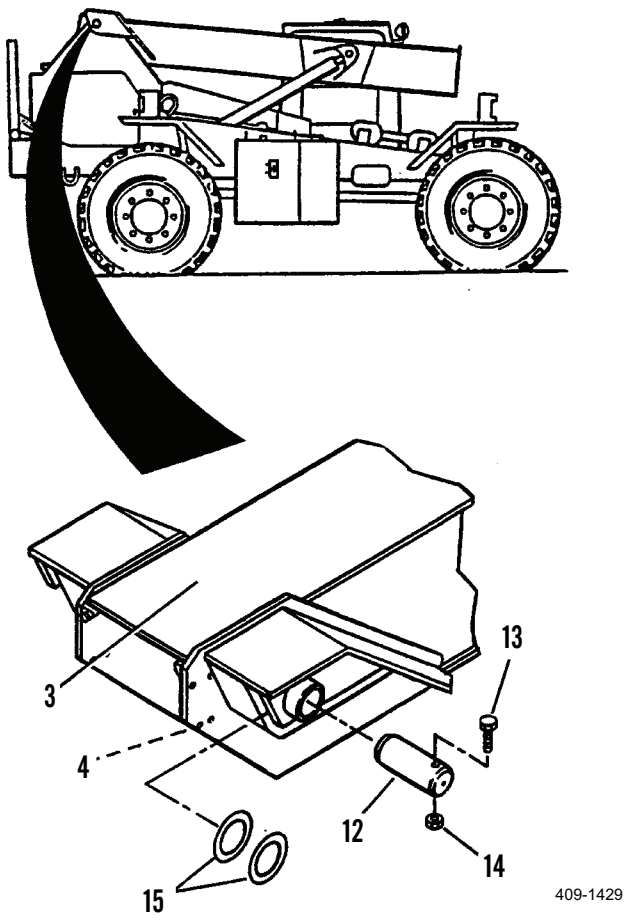
To prevent damage to lines during step 14, place wood boards between underside of outer boom and slings.

14. Reposition hoist and slings to center of gravity for outer boom (3). Carefully raise outer boom (3) until weight of boom is removed from boom pivot pins (12).
15. Remove capscrew (13) and locknut (14) securing boom pivot pin (12) to vehicle frame. Discard locknut.

NOTE

Shims may fall out as pivot pins are removed.

16. Remove boom pivot pin (12) from outer boom (3) and vehicle frame.
17. Remove shims (15) from between outer boom (3) and vehicle frame. Note quantity and position of shims (15) for use during installation.
18. Repeat steps 15 thru 17 for other boom pivot pin (12).



409-1429

CAUTION

Be careful that lines on underside of outer boom are not damaged when boom is lowered onto supports. Failure to do so could cause vehicle damage.

19. Carefully remove outer boom (3) from vehicle and lower boom (3) onto supports.

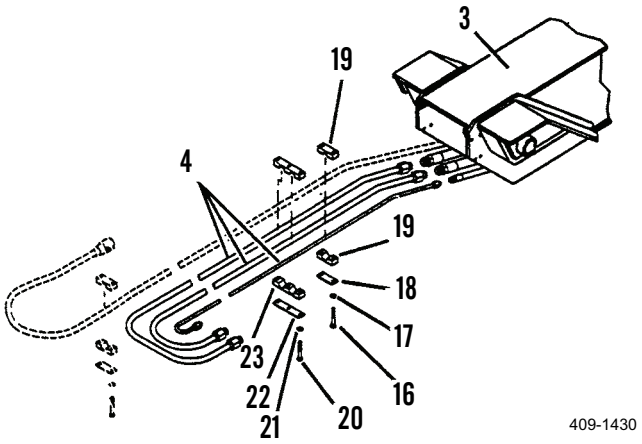
DISASSEMBLY

1. If necessary, remove three lines (4) from underside of outer boom (3).

NOTE

Lines are not interchangeable. Note location of each line for use during installation.

2. Remove two capscrews (16), two lockwashers (17) and one clamp cover (18) from each pair of clamp halves (19). Discard lockwashers. Note location and orientation of clamp halves (19) for use during installation.
3. Remove three capscrews (20), three lockwashers (21) and one clamp cover (22), from each pair of clamp halves (23). Discard lockwasher. Note location and orientation of clamp halves (23) for use during installation.
4. Remove three lines (4) from underside of outer boom (3).



409-1430

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Lines are not interchangeable. Install lines in locations noted during removal.

1. Position three lines (4) on underside of outer boom (3).

NOTE

Apply loctite to capscrews as installed.

2. Install one clamp cover (22), three new lockwashers (21) and three capscrews (20) to each pair of clamp halves (23). Ensure that clamp halves (23) are positioned as noted during disassembly.
3. Install one clamp cover (18), two new lockwashers (17) and two capscrews (16) to each pair of clamp halves (19). Ensure that clamp halves (19) are positioned as noted during disassembly.

INSTALLATION

NOTE

Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on hydraulic components and hoses clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.

CAUTION

To prevent damage to steel tubes during step 1, place wood boards between underside of outer boom and slings.

NOTE

Center of gravity for outer boom is approximately 92.5 in. (235 cm) from front flange of boom.

1. Carefully lift outer boom (3) into position over vehicle with hoist and sling. Lower boom (3) as required to align boom pivot pin holes.

NOTE

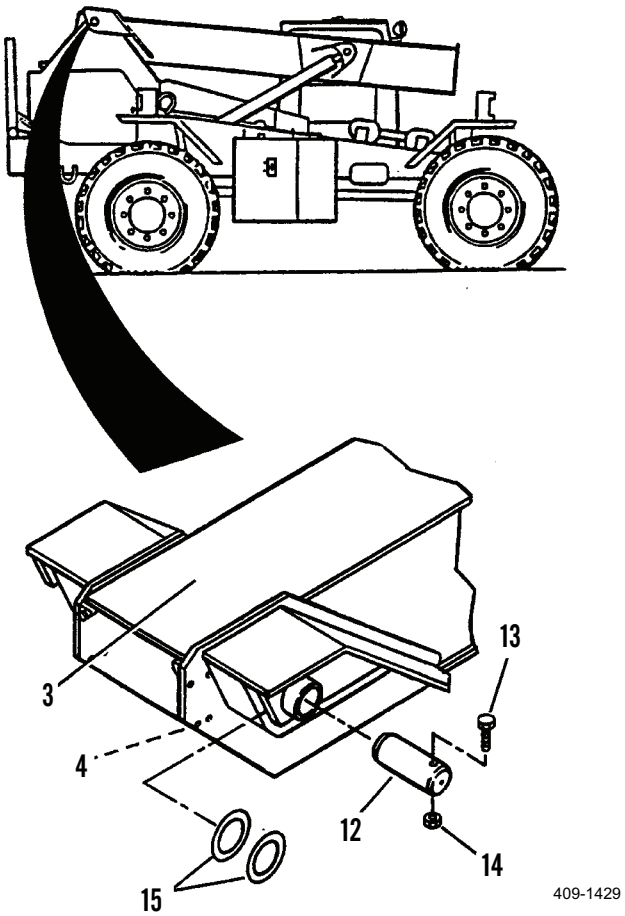
Apply antiseize compound to pivot pin as installed.

2. Position shims (15) between outer boom (3) and inside surface of vehicle frame. Install boom pivot pin (12).
3. Secure boom pivot pin (12) to vehicle frame with capscrew (13) and new locknut (14).
4. Repeat steps 2 and 3 for other pivot pin.

NOTE

Place jackstand or support on front of vehicle deck. Adjust support so outer boom is level when lowered.

5. Carefully lower outer boom (3) with hoist and sling until front of boom (3) is resting on support.



INSTALLATION - CONTINUED

6. Connect rod ends of boom hoist cylinders (8) to outer boom (3).
7. Reposition slings to front of outer boom (3).
8. Lift outer boom (3) until cylinder pivot pin holes of boom (3) are just above cab.
9. Lift and support boom hoist cylinders (8).

NOTE

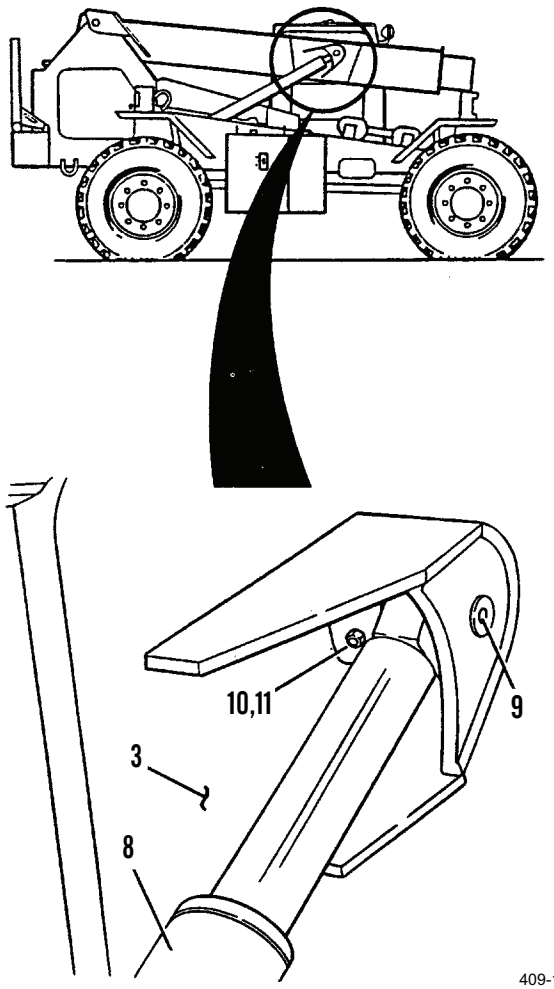
One boom hoist cylinder will begin to extend before the other. Install this cylinder first. Second cylinder will begin to extend after first cylinder is connected.

10. Start engine. Use joystick to extend boom hoist cylinder (8) until cylinder rod eye is aligned with pivot pin hole of boom. Stop engine (TM 10-3930-660-10).

NOTE

Apply antiseize compound to pivot pin as installed.

11. Install and secure pivot pin (9) to outer boom (3) with capscrew (10) and new locknut (11).
12. Repeat steps 10 and 11 for other boom hoist cylinder (8).
13. Start engine and raise outer boom (3) as required for access to lines (4). Stop engine (TM 10-3930-660-10).



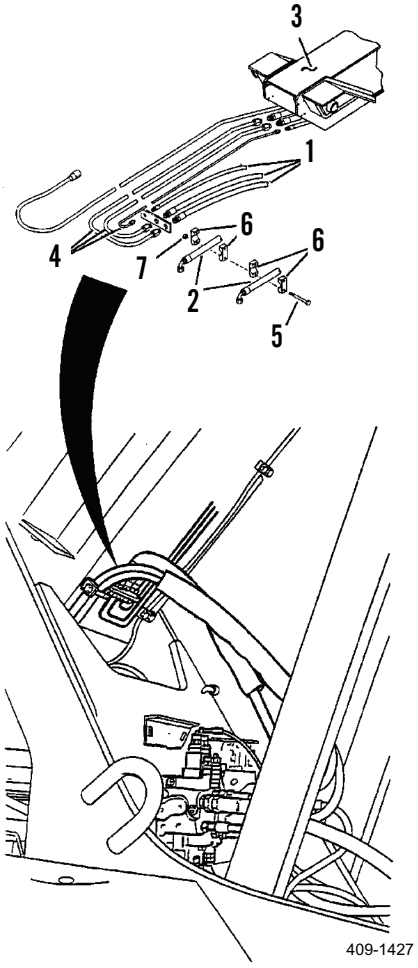
409-1428

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 3000 psi (20685 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 injury or death.
- Remove hose caps carefully prior to connecting lines in step 15. Hydraulic oil may be under pressure. Failure to follow this precaution will cause personal injury.

14. Connect three hoses (1) to three lines (4) at bulkhead as tagged.
15. Position hoses (2) on underside of outer boom (3) and secure with four clamp halves (6), nut (7) and capscrew (5).
16. Start engine and lower outer boom (3) until horizontal. Stop engine (TM 10-3930-660-10).
17. Install intermediate boom (WP 0263 00).
18. Lubricate boom pivot pins and boom hoist cylinder upper pivot pins.
19. Operate boom and check for proper operation (TM 10-3930-660-10).



END OF WORK PACKAGE

BOOM PIVOT PINS REPLACEMENT 0265 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance, (Item 21, WP 0324 00)

Lifting device, 5 ton capacity

Materials/Parts

Compound, anti-seize (Item 11, WP 0323 00)

Grease (Item 21, WP 0323 00)

Locknut (2)

References

WP 0316 00

WP 0317 00

Equipment Condition

Vehicle parked on level ground (TM 10-3930-660-10)

Boom retracted and level (TM 10-3930-660-10)

Forks leveled and resting on ground (WP 0186 00)

REMOVAL

NOTE

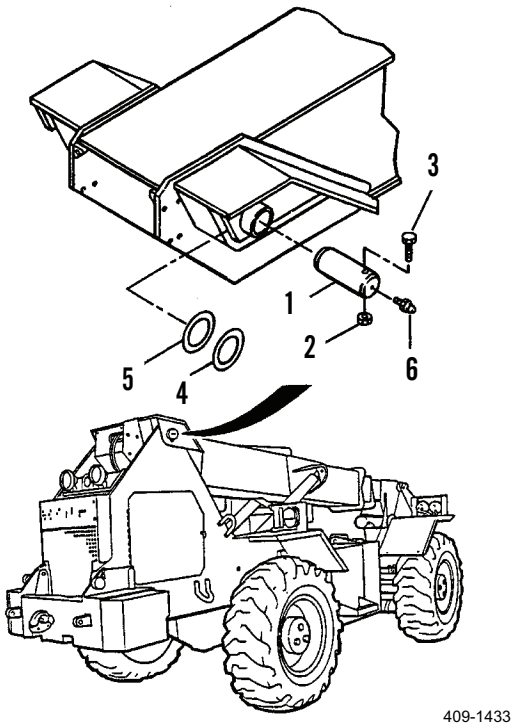
The procedure to remove left and right boom pivot pins are the same.

1. Use a hoist or other suitable lifting device to support back of boom and take weight of boom off pivot pins (1).
2. Remove locknut (2) and hex head capscrew (3). Discard locknut.

NOTE

The boom has washer spacers between boom and frame. Note position and quantity of washer spacers for assembly.

3. Use slide hammer or puller to remove pivot pin (1) and any washer spacers (4 or 5).
4. Remove grease fitting (6), if necessary.



409-1433

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

NOTE

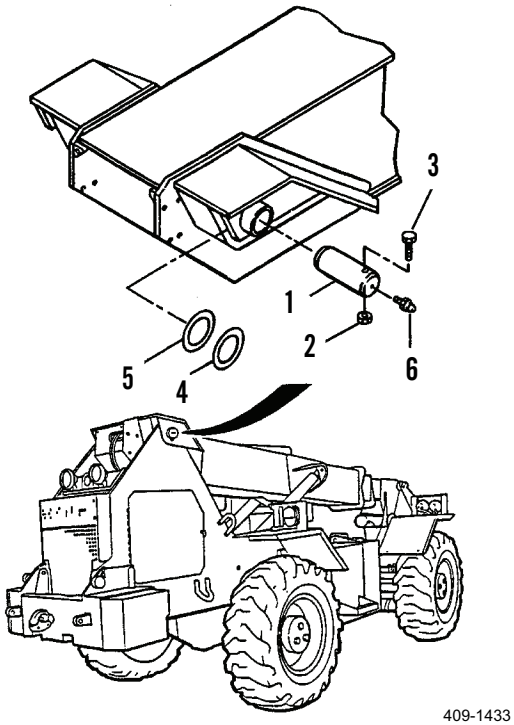
The procedure to install left and right boom pivots are the same.

1. If removal was necessary, install grease fitting (6).

NOTE

Apply anti-seize compound to pivot pin as installed.

2. Install pivot pin (1) and any washer spacers (4 or 5).
3. Install hex head capscrew (3) and new locknut (2).
4. Apply grease to fitting (6).



409-1433

END OF WORK PACKAGE

BOOM WEAR PADS REPLACEMENT 0266 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Sealant, Loctite (Item 43, WP 0323 00)

Insert (4)

Lockwasher (2)

References

WP 0262 00

WP 0263 00

WP 0316 00

Equipment Condition

Vehicle parked on level ground (TM 10-3930-660-10)

Boom retracted (TM 10-3930-660-10)

Inspect wear pads (WP 0190 00)

REMOVAL

NOTE

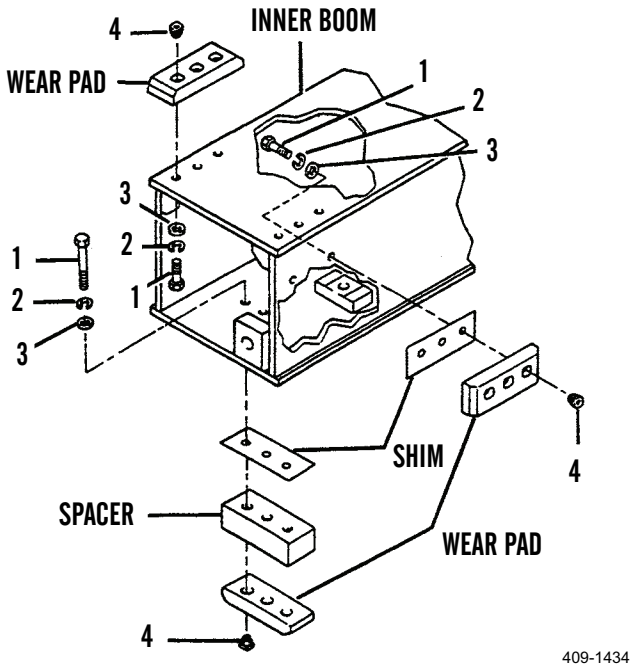
The amount of boom disassembly will depend upon location of wear pads being replaced.

1. Disassemble inner and intermediate booms as necessary for wear pad replacement (WP 0262 00 and WP 0263 00).

NOTE

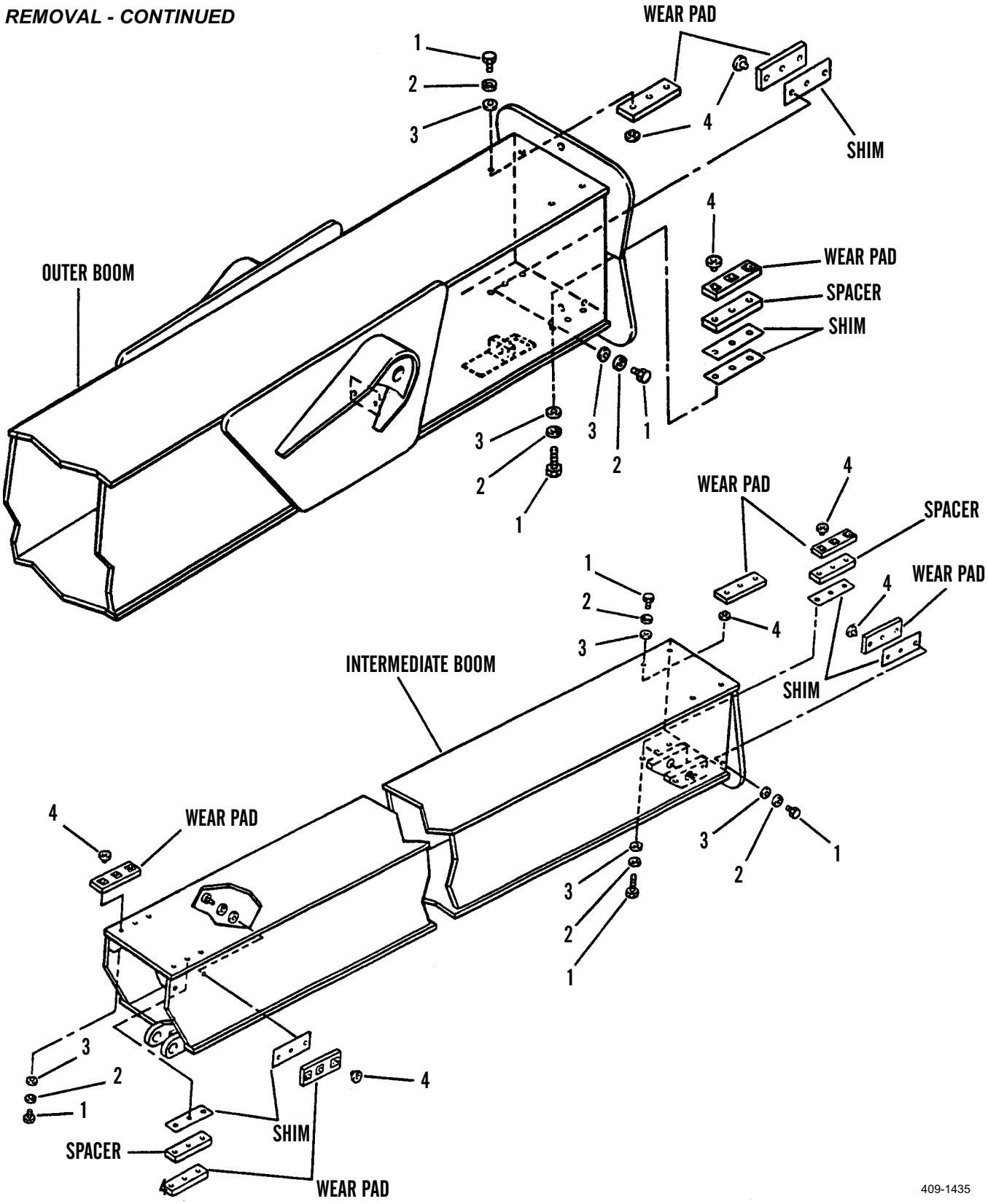
Most wear pads have off-center mounting holes. Note orientation of wear pads prior to removal.

2. Remove capscrews (1), lockwashers (2), flatwashers (3) and wear pads. Some pads have spacers and shims. Note quantity and locations of these items before removal. Discard lockwashers.
3. Remove and discard inserts (4) with worn wear pad(s).



BOOM WEAR PADS REPLACEMENT - CONTINUED **0266 00**

REMOVAL - CONTINUED



CLEANING

See *Cleaning* instructions (WP 0316 00).

IINSTALLATION

1. Install new inserts (4) in wear pads.
2. Apply loctite on threads of capscrews (1).
3. Install capscrews (1), flatwashers (3), shims, spacers, wear pads and new lockwashers (2). Torque capscrews to 30 lb-ft (40 Nm).

NOTE

Check for proper clearances between wear pads and boom sections during assembly. A total gap of 0.01 to 0.13 in. (0.25 to 3.3 mm) is allowed in both vertical and horizontal directions.

4. Assemble inner and intermediate booms as necessary (WP 0262 00 and WP 0263 00).
5. Operate boom and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

BOOM EXTEND AND RETRACT CHAINS REPLACEMENT 0267 00

THIS WORK PACKAGE COVERS

Extend and Retract Chain Removal, Extend and Retract Chain Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Materials/Parts

Sealant, Loctite (Item 43, WP 0323 00)

Cotter pin (15)

Lockwasher (2)

Rope

References

WP 0193 00

WP 0194 00

WP 0262 00

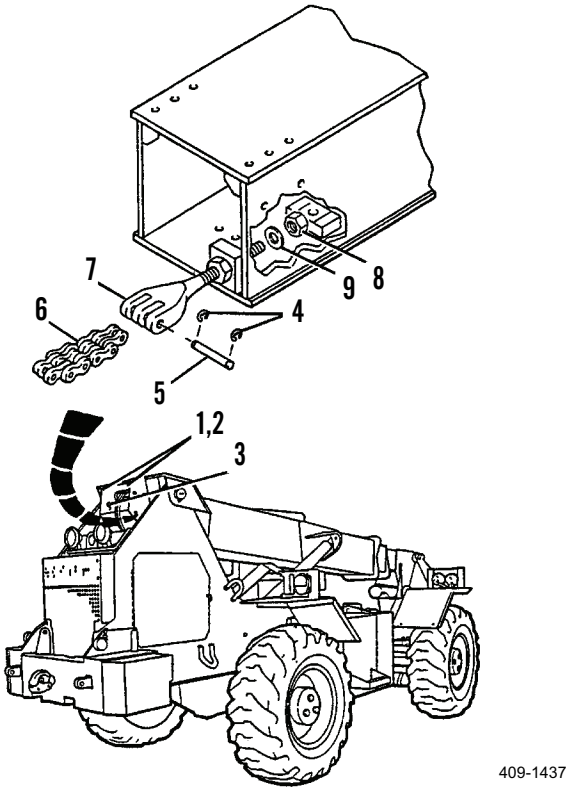
Equipment Condition

Vehicle parked on level ground (TM 10-3930-660-10)

Boom retracted (TM 10-3930-660-10)

EXTEND CHAIN REMOVAL

1. Remove four hex head capscrews (1), four lockwashers (2) and cover (3). Discard lockwashers.
2. Remove two retaining rings (4) and one pin (5). Disconnect extend chain (6) from clevis (7).
3. If clevis (7) is damaged, remove nut (8), flatwasher (9) and clevis (7).



409-1437

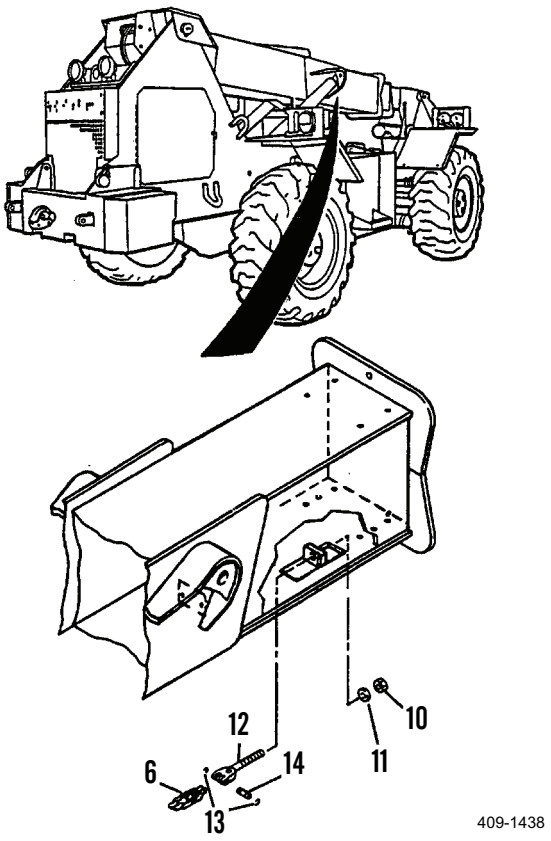
EXTEND CHAIN REMOVAL - CONTINUED

4. Remove nut (10) and flatwasher (11) from clevis (12). Remove clevis (12) from its mounting hole near hose tensioner.
5. Remove extend chain (6).
6. Tie a rope of suitable length to end of extend chain (6), just behind clevis (12).
7. Tie other end of rope to clevis (12) mounting hole.

NOTE

Leave rope inside boom after removing extend chain. The rope will be used to pull new extend chain through boom assembly.

8. Pull extend chain (6) out from back of boom. Remove rope from chain (6).
9. Remove two retaining rings (13), pin (14) and clevis (12). Separate extend chain (6) from clevis (12).



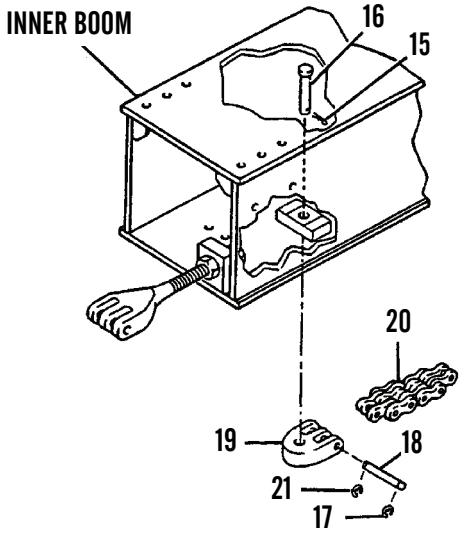
409-1438

NOTE

To retract chain, inner boom must be removed.

RETRACT CHAIN REMOVAL

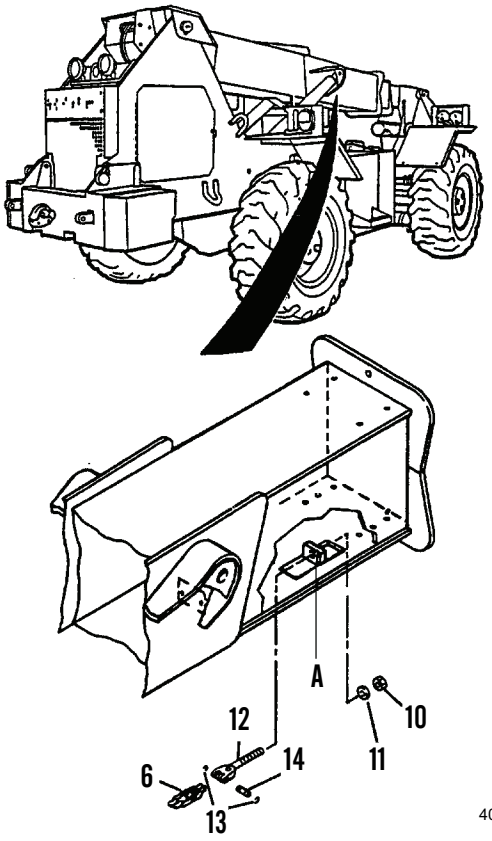
1. Remove inner boom (WP 0263 00).
2. Remove cotter pin (15) and clevis pin (16). Discard cotter pin.
3. Remove retaining ring (17), pin (18), clevis (19) to disconnect retract chain (20). Remove retaining ring (21) from pin (18), if necessary.



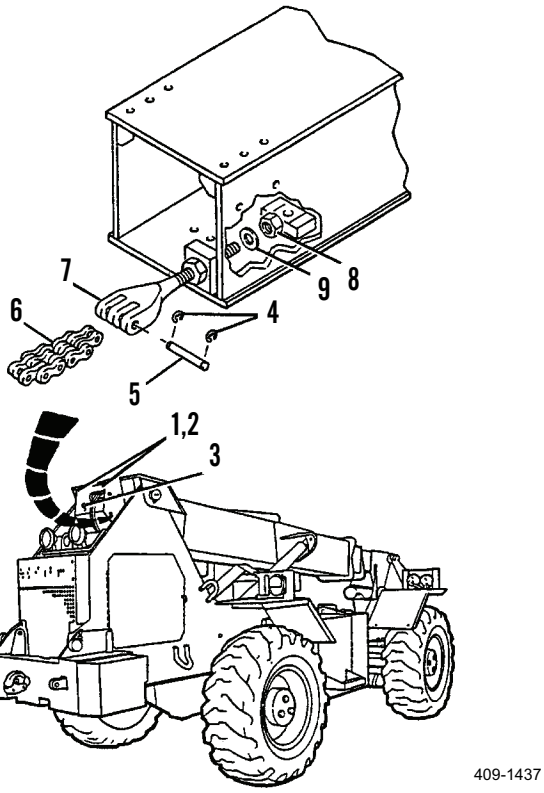
409-1439

EXTEND CHAIN INSTALLATION

1. Attach one end of extend chain (6) to clevis (12). Install pin (14) and two retaining rings (13).
2. Tie rope (that was used during removal and found inside boom) to end of extend chain (6) just behind clevis (12).
3. Pull rope with extend chain (6) through boom. Pull rope through opening (A) in boom near clevis (12) mounting hole. Remove rope from clevis (12) mounting hole and end of extend chain (6).
4. Install clevis (12) with extend chain (6) into mounting hole. Secure with flatwasher (11) and nut (10).
5. If removal was necessary, install clevis (7), flatwasher (9) and nut (8).
6. Attach extend chain (6) end to clevis (7). Install pin (5) and two retaining rings (4).
7. Install cover (3), four new lockwashers (2) and four hex head capscrews (1).
8. Adjust extend chain (6) (WP 0193 00).
9. Adjust hose and cable tension (WP 0194 00).



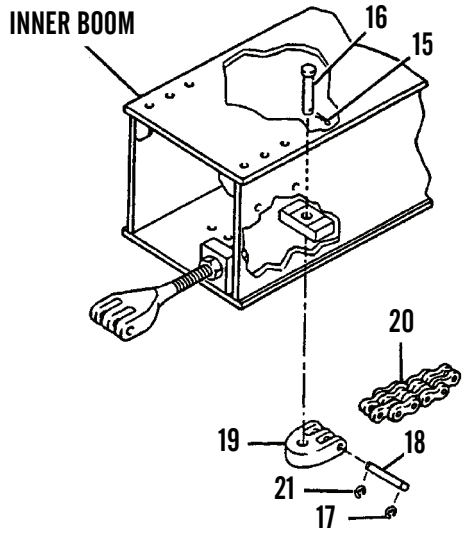
409-1440



409-1437

RETRACT CHAIN INSTALLATION

1. Position clevis (19) on end of retract chain (20). Install pin (18) and retaining ring (17).
2. If removal was necessary, install retaining ring (21) on pin (18).
3. Install clevis pin (16) through clevis (19) and secure with new cotter pin (15).



4. Install inner boom (WP 0262 00).
5. Adjust retract chain (TM 10-3930-660-20).

END OF WORK PACKAGE

HYDRAULIC HOSES REPAIR 0268 00

THIS WORK PACKAGE COVERS

Repair

INITIAL SETUP

Tools and Special Tools

Tool outfit, hydraulic system test and repair (HSTRU) (Item 41, WP 0324 00)

References

TM 9-4940-468-14

Equipment Condition

Hydraulic hose(s) removed from vehicle

REPAIR

For hydraulic hose repair/manufacture, refer to TM 9-4940-468-14.

END OF WORK PACKAGE

BOOM EXTEND CYLINDER REPLACEMENT 0269 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 500 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 8, WP 0323 00)

Compound, antiseize (Item 11, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Materials/Parts - Continued

Locknut (16)

Lockwasher (2 and 10)

Wood block

References

WP 0194 00

WP 0316 00

WP 0317 00

Personnel Required

Two

Equipment Condition

Vehicle parked on level ground

Boom retracted (TM 10-3930-660-10)

CAUTION

Wipe the area clean around all hydraulic connections to be opened during removal and disassembly. Cap oil lines and plug holes after removing lines. Contamination of the hydraulic system could result in premature failure.

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 5,000 psi (34475 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 injury or death.

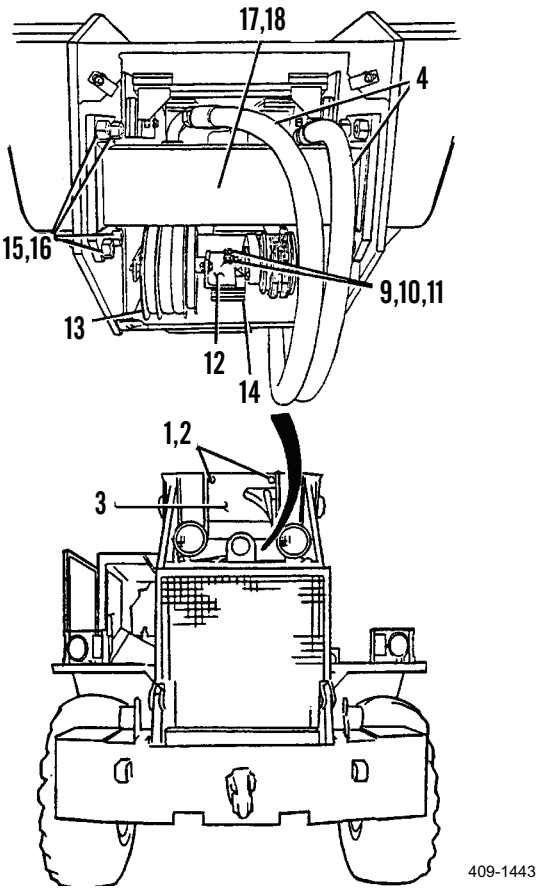
CAUTION

Retract cylinder before removal. Failure to follow this precaution will cause part damage.

NOTE

If more than one hydraulic line is removed, identify lines to assure proper installation. Use container to catch any hydraulic oil that may drain from system.

1. Remove four hex head capscrews (1), four lockwashers (2) and cover (3). Discard lockwashers.
2. Disconnect two hoses (4).
3. Remove snap ring (5), shaft (6), spacer (7) and two spacers (8).
4. Remove two hex head capscrews (9), two lockwashers (10), two flatwashers (11) and bracket (12) with pulley (13). Discard lockwashers.
5. Reinstall capscrews (9), lockwashers (10) and flatwashers (11) to secure boom wear pad (14) in place. Discard lockwashers.
6. Place wood blocks underneath boom extend cylinder and inner boom.
7. Remove eight hex head capscrews (15) and eight locknuts (16) from extend cylinder anchor (17). Discard locknuts.



REMOVAL - CONTINUED

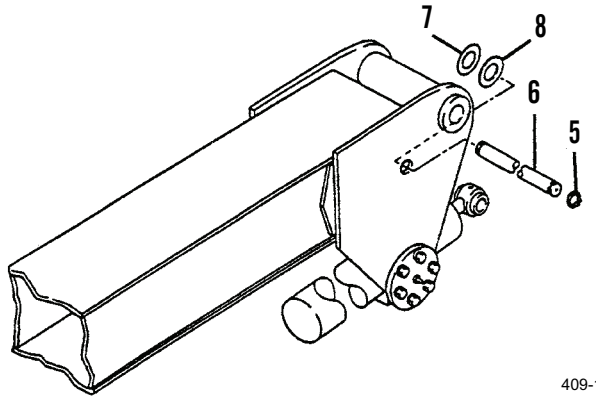
WARNING

Use 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 the outer boom is 1,600 lb (726 kg).
- Raise cylinder as needed with hoist and sling during removal to provide clearance over obstructions at rear of boom.

8. Use a hoist and sling to pull extend cylinder (18) out, with extend cylinder anchor (17). Reposition hoist and sling as needed during removal of cylinder (18).
9. Remove extend cylinder (18) with extend cylinder anchor (17) as a unit.

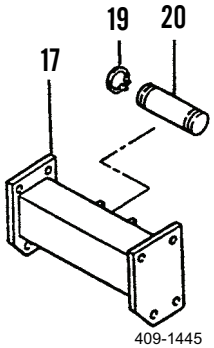


409-1444

CAUTION

Remove cylinder from sling with care to prevent part damage.

10. Remove two snap rings (19), one shaft (20) and extend cylinder anchor (17).
11. Remove two hex head capscrews (21), two nuts (22) and two buckling braces (23 and 24).
12. Remove two socket head capscrews (25) and wear pad (26).



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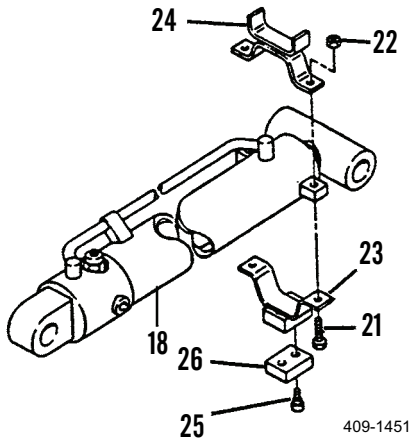


409-1451

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

NOTE

- Remove caps and plugs as hoses are installed. Wipe all sealing surfaces on valve and hoses clean and dry. Apply film of clean lubricating oil to all seals as they are installed.
- Apply antiseize compound to shaft as installed.

1. Install shaft (20), two snap rings (19) and extend cylinder anchor (17).
2. Install wear pad (26) and two socket head capscrews (25).
3. Install two buckling braces (23 and 24), two hex head capscrews (21) and two nuts (22).

WARNING

Use 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 the outer boom is 1,600 lb (726 kg).

4. Use a sling and hoist to install extend cylinder (18) at back of boom.
5. Have an assistant guide extend cylinder (18) and slide it into boom.

INSTALLATION - CONTINUED

NOTE

Apply anti-seize compound to shaft as installed.

6. Install two spacers (8), one spacer (7), shaft (6) and snap ring (5).
7. Place wood blocks underneath boom extend cylinder and inner boom.
8. Remove hoist and sling from back of extend cylinder.
9. Install eight hex head capscrews (15) and eight new locknuts (16) to secure extend cylinder anchor (17).

NOTE

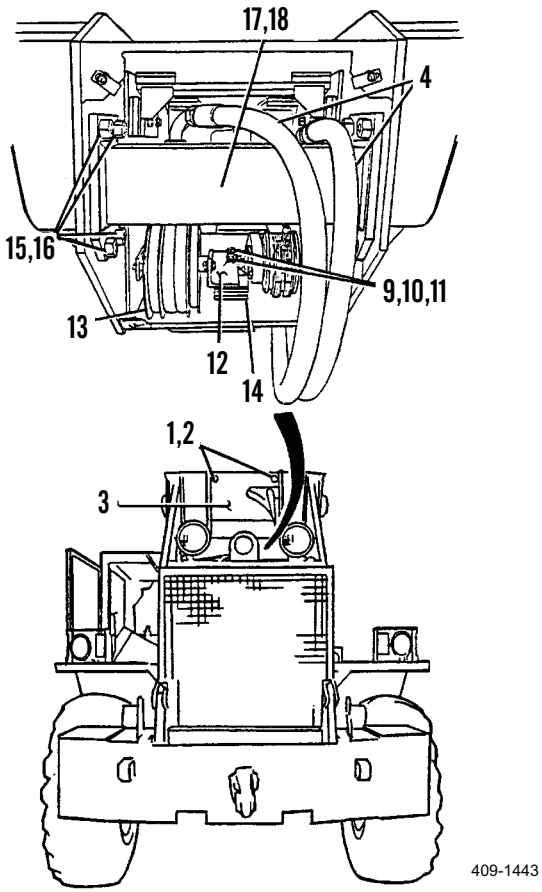
Attach a hoist with sling at front of inner boom if mounting holes between outer boom and extend cylinder anchor do not align. Move inner boom as needed to align mounting holes.

10. Remove wood blocks underneath boom extend cylinder and inner boom.

NOTE

When installing capscrews, apply loctite on threads.

11. Connect two hoses (4) to extend cylinder.
12. Install pulley (13) with bracket (12).
13. Remove two hex head capscrews (9), two flatwashers (11) and two new lockwashers (10) that held boom wear pad (14) in place.
14. Apply loctite on threads of capscrews (9) and reinstall them and flatwashers (11) to secure bracket (12).
15. Adjust host and cable tension (WP 0194 00).
16. Install cover (3), four new lockwashers (2) and four hex head capscrews (1).
17. Operate boom, check for proper operation and leaks (TM 10-3930-660-10).



END OF WORK PACKAGE

CHAPTER 5
GENERAL SUPPORT INSTRUCTIONS

CYLINDER HEAD ASSEMBLY REPAIR 0270 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Repair, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Tool kit, machinists: post, camp and station (Item 40, WP 0324 00)

Valve seat installation staking tool (Item 44, WP 0324 00)

Lifting device, 200 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Compound, valve lapping (Item 15, WP 0323 00)

Crocus, cloth (Item 16, WP 0323 00)

Oil, fuel diesel (Item 28, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Materials/Parts - Continued

Pads, Scotch Brite (Item 35, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Collets (11)

Seal (6)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

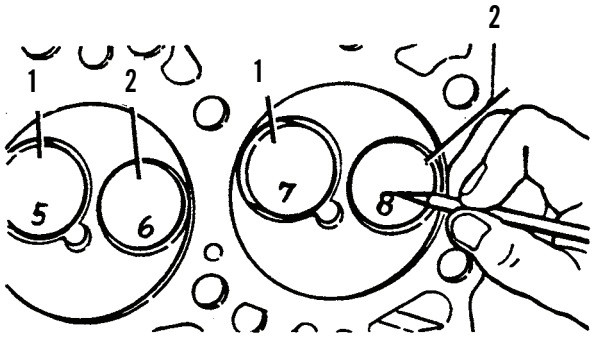
Equipment Condition

Cylinder head assembly removed (WP 0213 00)

Engine lifting bracket removed (WP 0212 00)

DISASSEMBLY

1. Identify intake and exhaust valves (1 and 2) in respect to their location in the cylinder head.
2. Mark the intake valves (1) and exhaust valves (2) to identify their location in the cylinder head.



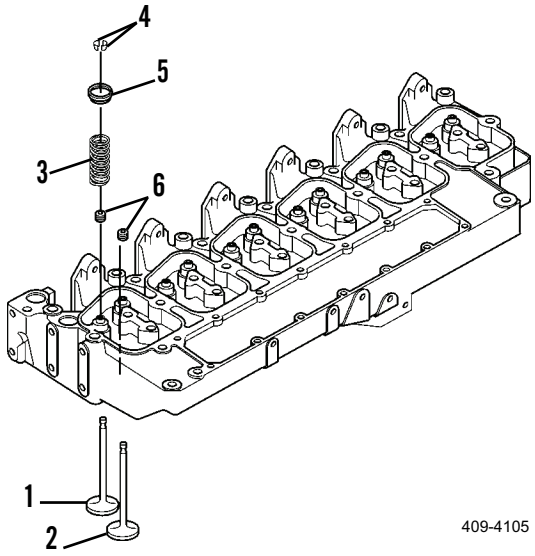
409-857

DISASSEMBLY - CONTINUED

NOTE

The following valve removal procedure is applicable to all 12 valves.

3. Compress valve spring (3) using a valve spring compressor.
4. Remove and discard collets (4).
5. Release spring pressure and remove compressor.
6. Remove spring retainer (5) and spring (3).
7. Remove intake and exhaust valves (1 and 2).
8. Remove and discard valve stem seals (6).



409-4105

CLEANING

- Cleaning compound, solvent 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.
- 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.

NOTE

If cylinder head and valve components are not to be assembled right away, lightly oil and wrap the parts after inspection and before storing.

1. See *Cleaning* instructions (WP 0316 00).
2. Polish cylinder head gasket surfaces with Scotch-brite pads.
3. Clean carbon from valves and remark according to location in head.
4. Clean valve heads with a soft wire wheel.
5. Clean valve stems with crocus cloth.
6. Wash valves with fuel oil and wipe dry with clean wiping rag.

CLEANING - CONTINUED

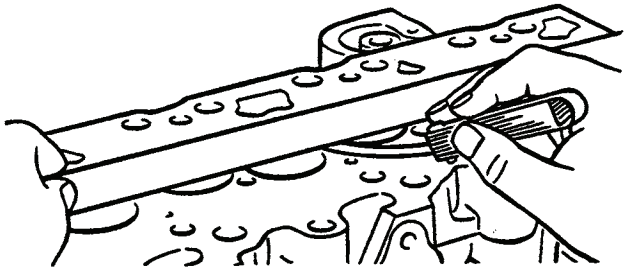
7. Remove valves according to their location in the cylinder head.
8. Clean valve springs with dry cleaning solvent and dry thoroughly with compressed air.

INSPECTION

1. To inspect cylinder head assembly (WP 0317 00), check for uneven surfaces and warpage of cylinder head.
2. Place a straightedge along length of cylinder head mating surface and check for distortion.
3. Measure gap under straightedge in areas indicated in chart.

NOTE

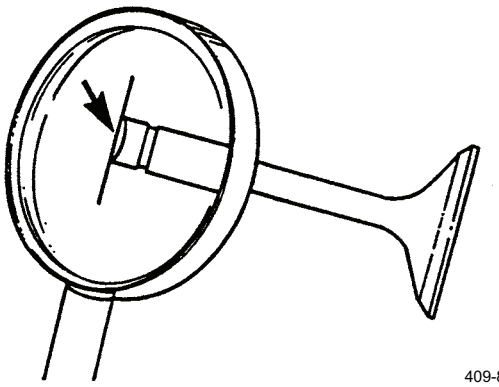
If warpage, uneven surfaces, or distortion are found, cylinder head assembly must be replaced.



409-858

Measured Area	Variation Limit
Any 2 in. (5 cm) dia. area	0.004 in. (0.1016 mm)
Overall end-to-end	0.003 in. (0.0762 mm)
Overall side-to-side	0.003 in. (0.0762 mm)

4. Inspect valves. Grind all reused valves. Mark new valves respective to their location in the cylinder head.
5. Inspect valve stems for scratches or scuff marks. Replace valve if scratches or scuffing is found.
6. Inspect valve faces for ridges, cracks, or pitting. Replace valve is ridges, cracks or pitting is found.
7. Check valve stem tip for flatness and replace valve if necessary.



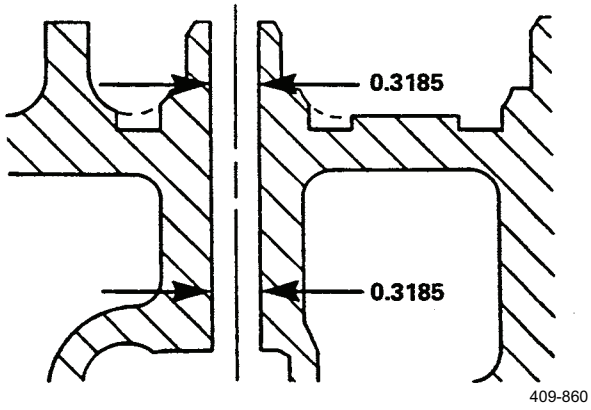
409-859

INSPECTION - CONTINUED

NOTE

- If a new valve is required, mark replacement location on the valve.
- The cylinder head has integral valve guides. Service valve guides can be installed to meet tolerance specifications after cylinder head is machined.

8. Measure valve stem diameter. Minimum allowable diameter is 0.3126 in. (7.9 mm). Mark new valves respective to their location in the cylinder head.
9. Inspect valve guide bores for scuffing or scoring. If guide bores are scuffed or scored, service valve guides must be installed.
10. Measure valve guide bore. Maximum allowable diameter is 0.3185 in. (8.1 mm).
11. If guide bores are worn, service valve guides must be installed. Refer to *Repair* in this work package.
12. Inspect valve seats for scoring, scratches or a burned condition.



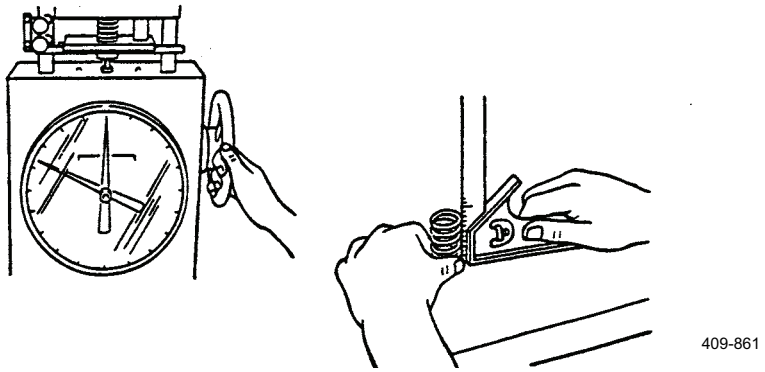
13. If a valve seat is scored, scratched or burned it must be ground or replaced. Refer to *Repair* in this work package.
14. Visually inspect valve springs for nicks, deep scratches, rust deposits, notches at the end of the spring, and for wear between coils. Replace valve springs if any of these conditions are found.

WARNING

- 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 caution when disassembling them, to avoid injury.

INSPECTION - CONTINUED

15. Check spring force using a valve spring tester.

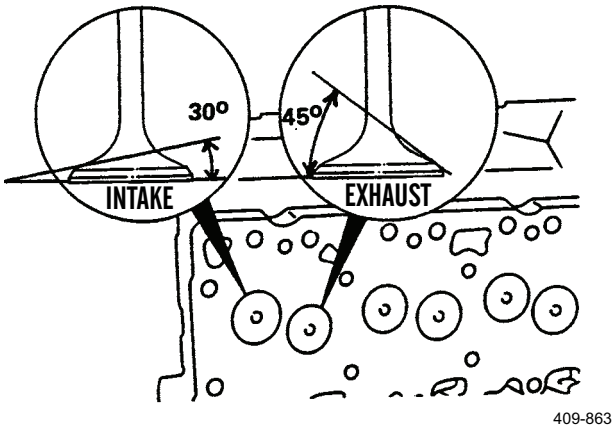


Description	Specification
Test force	65.0 to 72.2 lb (289 N to 321 N)
Length under test force	1.94 in. (49 mm)
Free length after test	2.19 in. (56 mm)
Spring must not be bent more than	0.039 in. (9.906 mm)

REPAIR

1. Grind valves to proper face angle.

Valve Face Angle

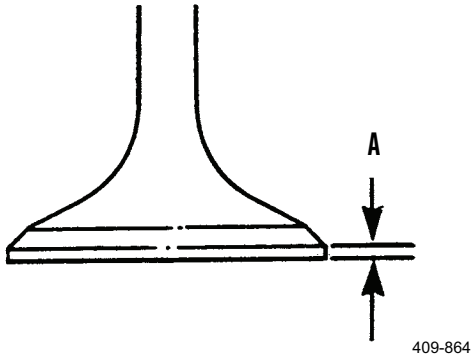


Intake	30 degrees
Exhaust	45 degrees

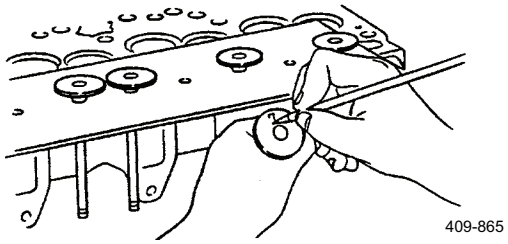
REPAIR - CONTINUED

2. Measure valve rim thickness.

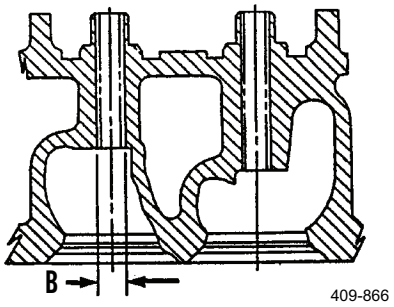
	Limit
Minimum (A)	0.031 in. (0.787 mm)



3. If rim thickness is less than 0.031 in. (0.0787 mm) after grinding, replace valve.
4. Mark valves again respective to their location in the cylinder head.
5. If valve guide bores are scratched, scored, burned or worn, the guide bores must be machined and service valve guides installed.

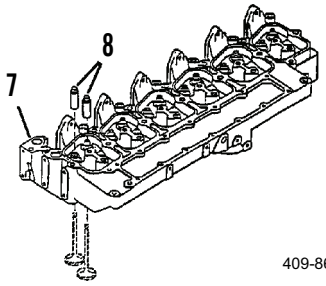


6. To install service valve guides (thin wall intake and exhaust guides), machine cylinder head parent metal valve guide bores (B) to 0.4375 to 0.4385 in. (11.11 to 11.13 mm) diameter.
7. To install service valve guides (thick wall intake) and 3904409 (thick wall exhaust), machine cylinder head base metal valve guide bores (B) to 0.5507 to 0.5517 in. (13.98 to 14.01 mm) diameter.

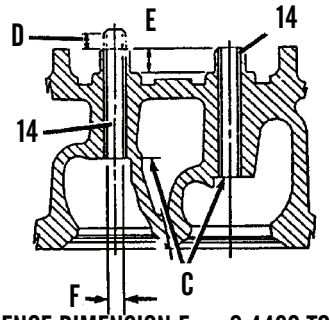


REPAIR - CONTINUED

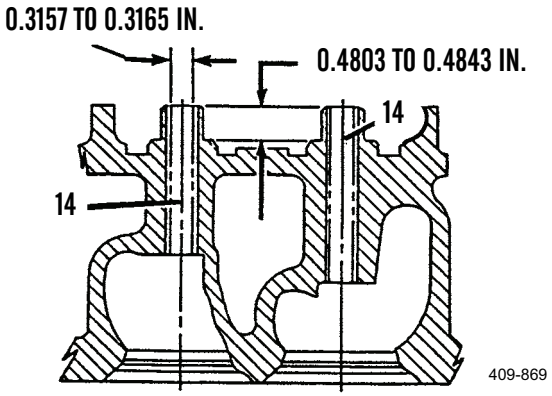
8. Lubricate valve guides with clean lubricating oil and press valve guides (8) into cylinder head (7) until they are flush with bottom of guide boss at (C).



9. If necessary, trim service guides (14) so they are flush with top of guide boss at (D). Note reference dimension (E).
10. Finish ream service valve guides (14) to a diameter (F) of 0.3157 to 0.3165 in. (8.0187 to 8.0391 mm).
11. Lubricate service guides with clean lubricating oil and press guides into cylinder head until guide is 0.4803 to 0.4843 in. (12.1996 to 12.3012 mm) above cylinder head.



12. Finish ream service valve guides to a diameter of 0.3157 to 0.3165 in. (8.0187 to 8.0391 mm).

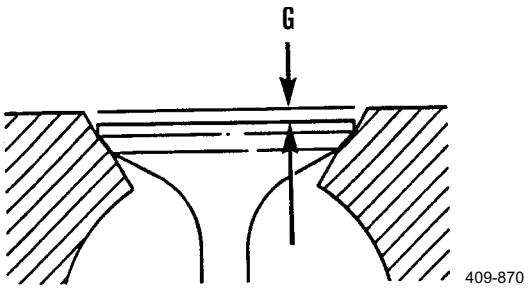


REPAIR - CONTINUED

NOTE

- Grind valve seats for a few seconds to avoid making the seats too wide.
- Integral (parent metal) valve seats can be ground once only. Valve seats that have been previously ground are marked with one X. If regrinding of X marked seats is necessary, service seats must be installed.

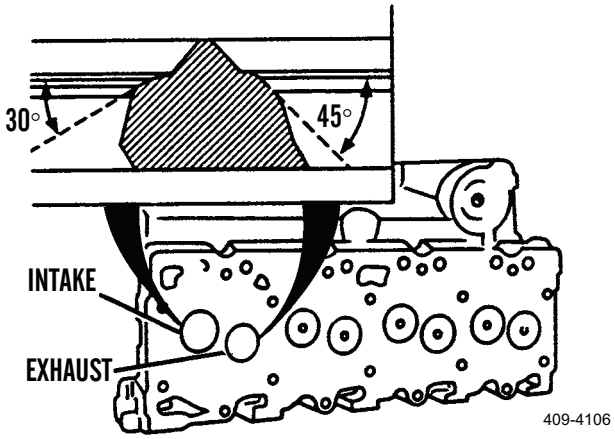
13. Install valves in their designated location and measure valve depth (G). Valve depth is the distance from the valve face to the cylinder head surface.
14. Record depth (G) for each valve.
15. Lightly grind the valve seats to proper angle. Be careful not to remove too much material and cause excessive seat width.



409-870

Seat Angle

Intake	30 degrees
Exhaust	45 degrees



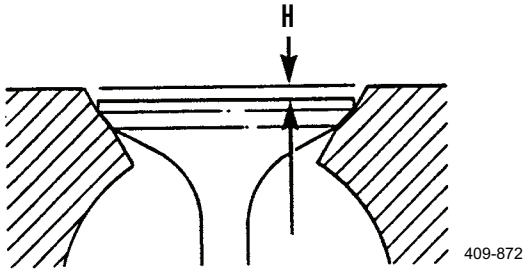
409-4106

REPAIR - CONTINUED

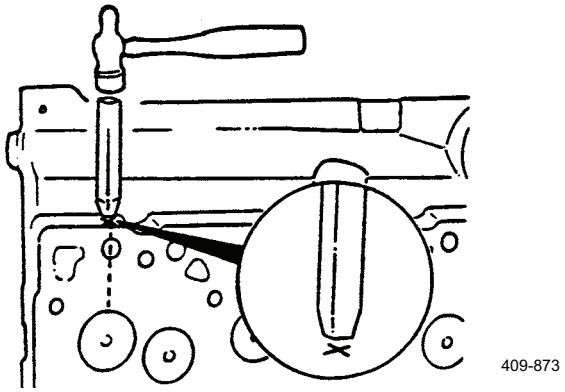
16. Reinstall valves in their designated bores. Measure and record depth H.
17. Calculate grinding depth (GD) from (G) and (H) measurements as follows: G = H-G

Maximum Limit

GD=0.010 in. (0.25 mm)



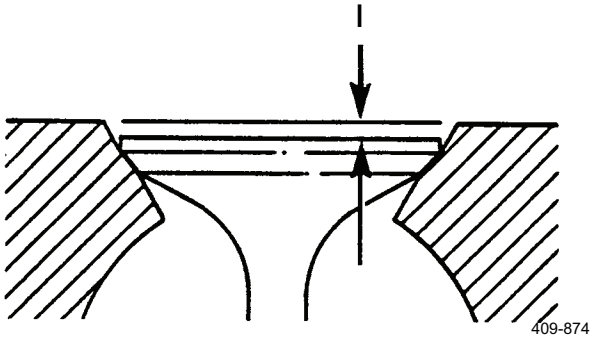
18. If (GD) is equal to or less than given tolerance, identify valve seat with an X.
19. If (GD) is greater than 0.010 in. (0.254 mm), a service valve seat must be installed.



20. With valves in their designated bores, measure and record depth (I).

Depth Limit

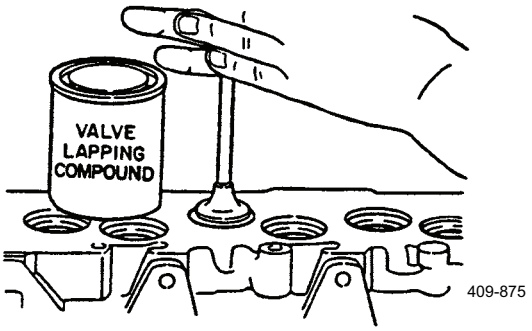
I Depth: 0.039 to 0.060 in. (0.9906 to 1.524 mm)



21. If depth (I) exceeds tolerance limits, replace the valve and check depth (I) again.

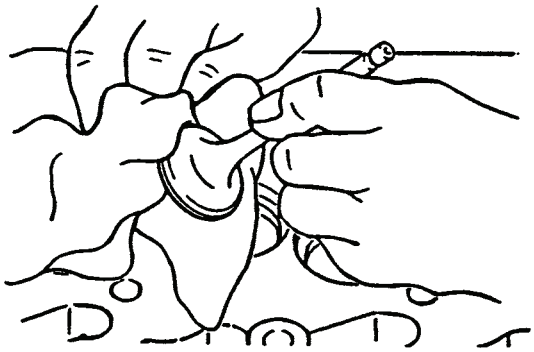
REPAIR - CONTINUED

22. Apply a light coat of valve lapping compound to each valve and lap each valve to its companion seat.



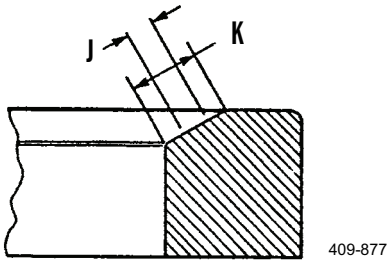
409-875

23. Remove valves and clean grinding compound from valves and seats.
24. Measure valve seat width.


409-876

Valve Seat Width Range Limits

Point J	0.060 in. (1.524 mm)
Point K	0.080 in. (2.032 mm)

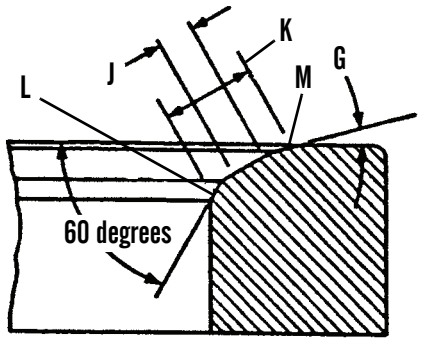


409-877

25. If valve seat is too wide after lapping, grind lower seat surface (L) using a 60 degree seat grinder, and upper seat surface (M) with a 15 degree seat grinder until seat width is centered and within specifications listed in step 31 above.

NOTE

If it was necessary to install service valve guides, install the service guides before installation the service seats.



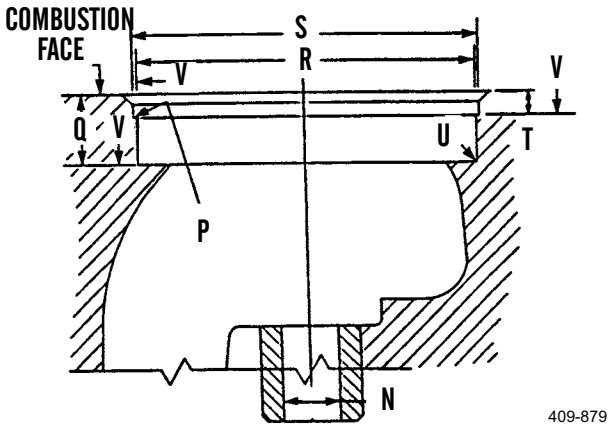
409-4107

REPAIR - CONTINUED

NOTE

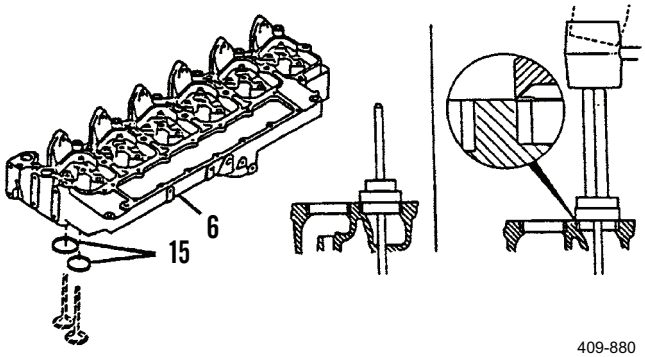
Valve seats marked with one X at side of cylinder head have been ground once and if regrinding is necessary, a service seat must be installed.

26. Machine base metal intake valve seat pocket to the dimensions shown.



N	0.3157 to 0.3165 in. (8.018 to 8.0391 mm)
P	0.015 in. (0.381 mm) radius max.
Q	0.4054 to 0.4134 in. (10.2743 to 10.5003 mm)
R	1.8499 to 1.8509 in. (46.9874 to 47.0128 mm) dia.
S	1.8848 to 1.8948 in. (47.8739 to 48.1279 mm) dia.
T	0.1454 to 0.1554 in. (3.6931 to 3.9471 mm)
U	0.0157 in. (0.3987 mm) radius max.
V	128 microinch surface finish

27. Install service seats (15) into machined pockets, in cylinder head (6).
28. Using a suitable staking tool, stake service seals into seal pockets.



REPAIR - CONTINUED

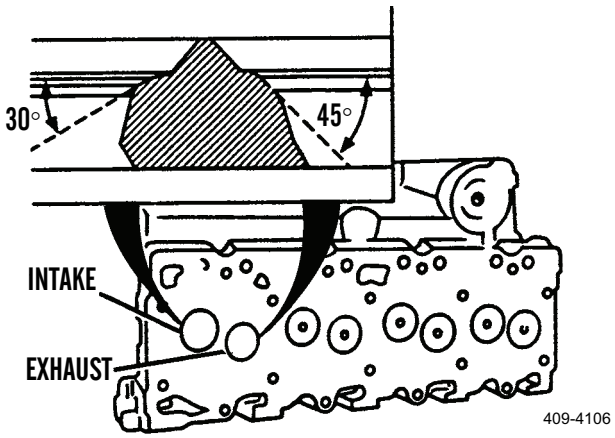
NOTE

Grind service seats for a few seconds only, to avoid making them too wide.

29. Grind service valve seats lightly to ensure proper seat angle.

Seat Angle

Intake	30 degrees
Exhaust	45 degrees

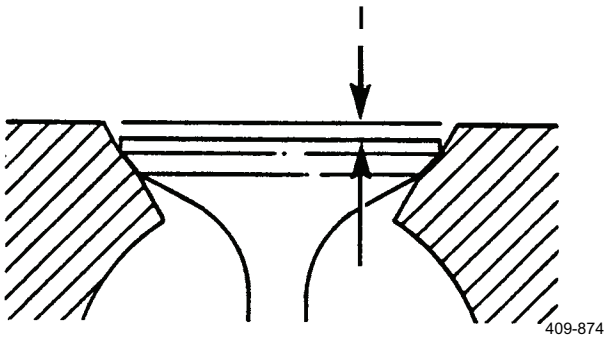


409-4106

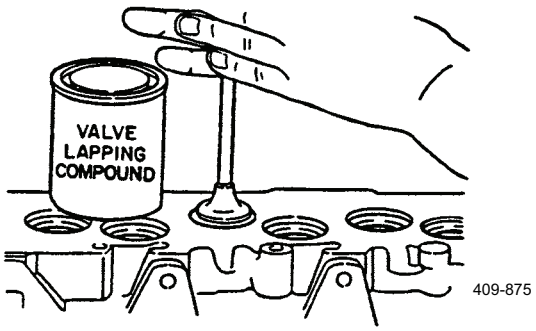
30. Install valves in their designated locations and measure depth (I).

Limit

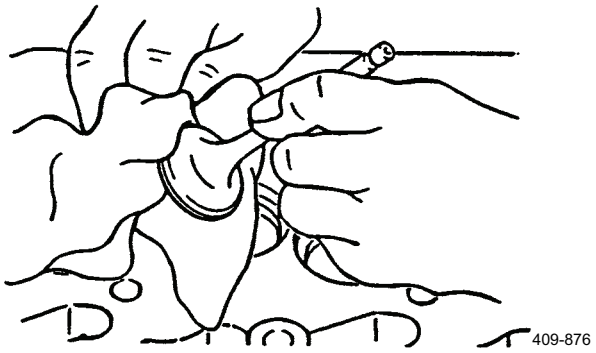
I Depth: 0.039 to 0.060 in. (0.099 to 1.524 mm)


409-874

31. Apply a light coat of valve lapping compound to each valve and lap valve to its companion service seat.
32. Remove valves from cylinder head and clean grinding compound from valves and service seats.



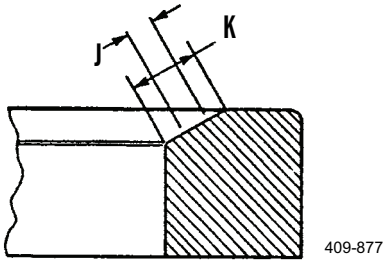
409-875


409-876

REPAIR - CONTINUED

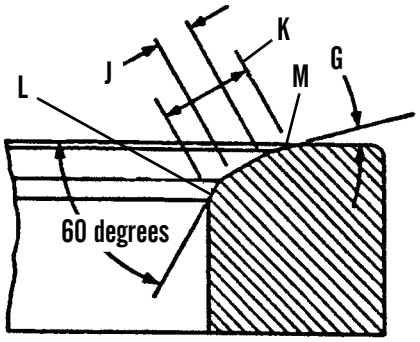
Valve Service Seat Width Range Limits

Minimum J	0.060 in. (1.524 mm)
Maximum K	0.080 in. (2.032 mm)



409-877

33. Measure width of service seats, and if service seat is too wide after lapping, grind lower seat surface (L) using a 60 degrees seat grinder, and upper seat surface (M) with a 15 degrees seat grinder until seat width is centered and within specifications listed above.

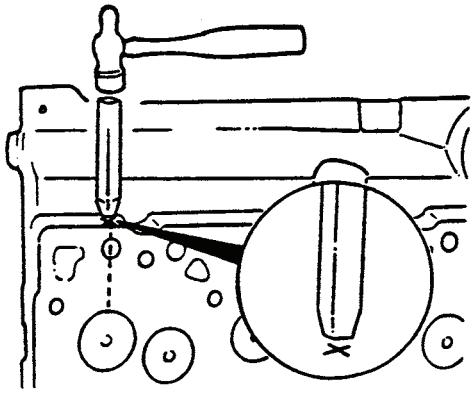


409-4107

34. Stamp two X's on side of cylinder head in line with pocket with service seat.

NOTE

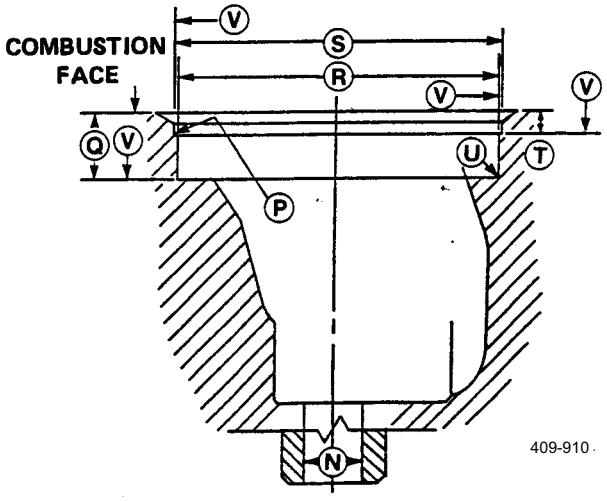
Valve seats marked with one X at side of cylinder head have been ground once and if regrinding is necessary, install service seat.


409-873

REPAIR - CONTINUED

35. Machine parent metal intake valve seat pocket to the dimensions shown.

N	0.3157 to 0.3165 in. (8.0187 to 8.0391 mm)
P	0.015 in. (0.381 mm) radius max.
Q	0.3795 to 0.4055 in. (9.6393 to 10.2997 mm)
R	1.7180 to 1.7190 in. (43.6372 to 43.6626 mm) dia
S	1.7489 to 1.7589 in. (44.422 to 44.676 mm) dia.
T	0.1379 to 0.1479 in. (3.5026 to 3.7566 mm)
U	0.0157 in. (0.3987 mm) radius max.
V	128 microinch surface finish

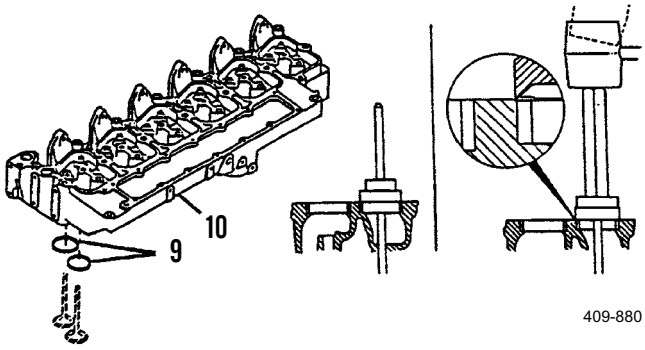


36. Install exhaust valve service seats (9) in cylinder head (10) in the same manner described for the intake service seats. See steps 27-35 above.

NOTE

- If it cannot be accurately determined that service valve seats have been ground only once after initial installation, replace the seat.
- Valve seats marked with two X's on the cylinder head have service seats installed. Service seats, like the parent metal seats, can only be ground once after initial installation.

37. Grind valve service seat(s). Grind service seats (15) for a few seconds only, to avoid making them too wide.
38. Grind service seats in the same manner, and to the same tolerances, as used for grinding the integral seat in steps 16 thru 31 above.



ASSEMBLY

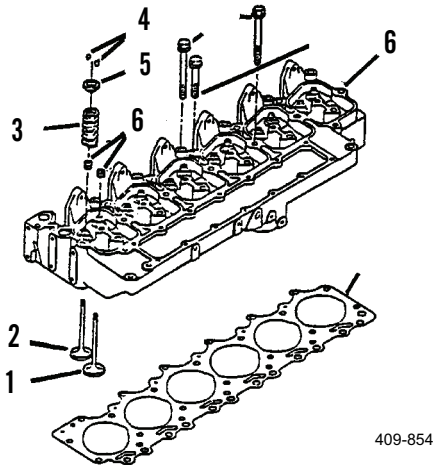
WARNING

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.

NOTE

The intake and exhaust valve stem seals are the same.

1. Install new valve stem seals (6).
2. Apply clean lubricating oil on the valve stems and install intake valve (1) and exhaust valve (2) in their designated locations.
3. Install springs (3) and spring retainers (5) over valve stems (1 and 2).

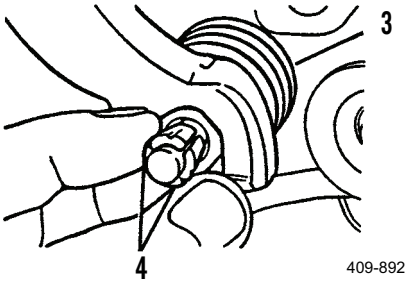


409-854

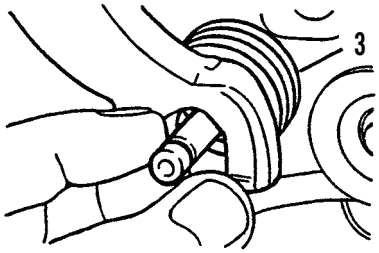
WARNING

If the collet is not currently installed on the valve system, it will unseat and be thrown with force when the spring compressor is released. The thrown collet could cause serious injury.

4. Compress valve springs (3) using a valve spring compressor and install new collets (4).
5. Slowly release valve spring compressor and remove it from the valve.
6. Tap valve stems lightly to seat new collets (4).
7. Repeat steps 1 thru 5 for the remainder of the valves.



409-892



409-893

ASSEMBLY - CONTINUED

8. Install engine lifting brackets (WP 0212 00).
9. Install cylinder head assembly (WP 0213 00).
10. Run engine, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

CRANKSHAFT MAINTENANCE 0271 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 200 lb capacity

Nylon straps, 200 lb capacity

Materials/Parts

Glove (Item 17, WP 0323 00)

Lubriplate (Item 26, WP 0323 00)

Plastigage (Item 38, WP 0323 00)

Capscrew (8)

Gasket (6)

Main bearing (10, 11, 15 and 17)

Roll pin (22)

Thrust bearing (18)

Wear seal (19 and 20)

References

WP 0272 00

WP 0277 00

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Engine removed (WP 0209 00)

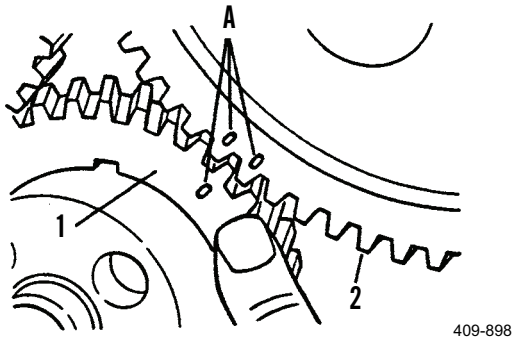
Flywheel housing and cover removed (WP 0215 00)

Front housing cover only removed (WP 0280 00)

Engine oil pan removed (WP 0219 00)

REMOVAL

1. Turn crankshaft until timing mark on crankshaft gear (1) is aligned with timing mark on the camshaft gear (2).



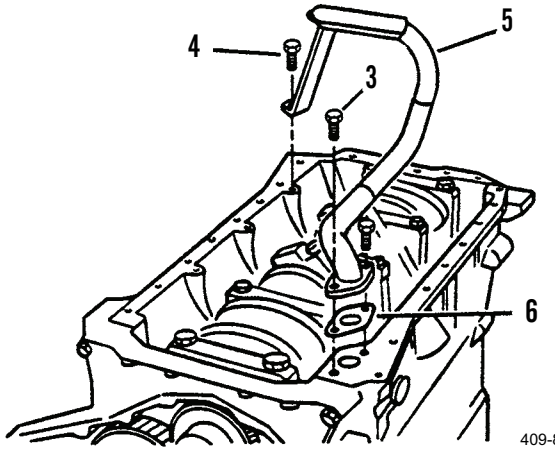
409-898

REMOVAL - CONTINUED

WARNING

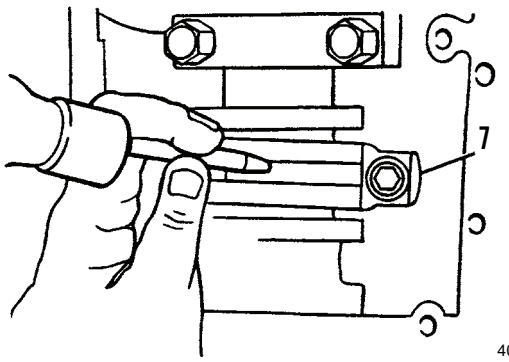
If engine falls from the stand, serious bodily injury could occur and the block and crankshaft could be damaged. Be sure engine is securely attached to the engine stand, then turn engine stand so that crankshaft is up.

2. Remove two capscrews (3) and capscrew (4).
3. Remove oil suction tube (5) and gasket (6). Discard gasket.



409-899

4. Turn crankshaft until two pistons are bottom center.
5. Mark cylinder number onto each connecting rod cap (7).



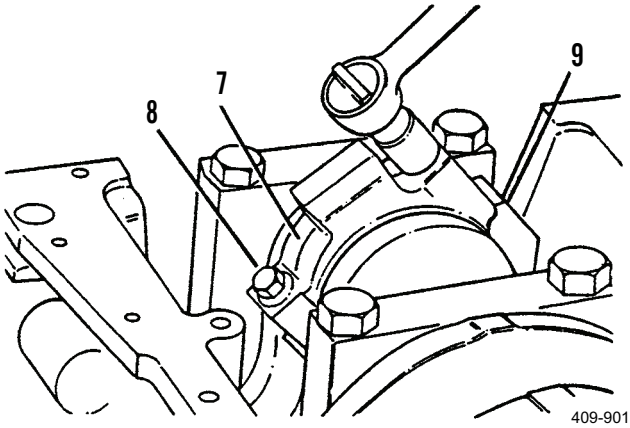
409-900

CAUTION

Be careful not to scratch or damage crankshaft when removing connecting rod caps and upper half of bearings. Any damage to the crankshaft could result in premature engine failure.

REMOVAL - CONTINUED

6. Remove two capscrews (8) and connecting rod caps (7) from connecting rods (9).
7. Push pistons and connecting rods away from crankshaft. Discard capscrews.



409-901

NOTE

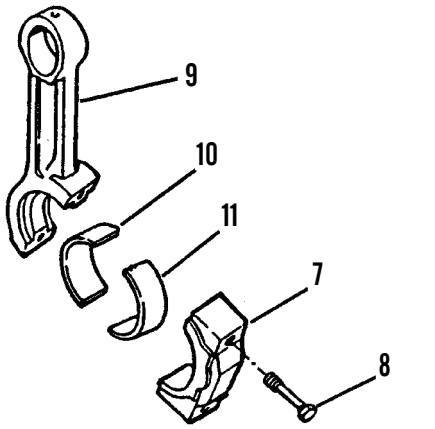
Do not reuse connecting rod capscrews.

8. Remove upper main bearing half (10) from connecting rods (9) and lower main bearing half (11) from connecting rod caps (7). Keep connecting rod caps and bearing halves together as a set. Discard main bearings.

NOTE

The four digit number stamped on the connecting rod and connecting rod cap are the same. Connecting rod and cap are machined as a set and must be kept that way.

9. Repeat steps 5 thru 9 for remaining connecting rod caps and bearings.



409-902

REMOVAL - CONTINUED

10. Remove fourteen capscrews (12), then remove seven main bearing caps (13) from crankshaft (14).
11. Remove and discard lower half of main bearings (15) from bearing caps (13).
12. If necessary, remove fourteen ring dowels (16).

CAUTION

Use only nylon straps, or equivalent, to remove crankshaft from cylinder block. Be sure that nothing hard contacts the machined surfaces of the crankshaft. A scratched or damaged crankshaft could cause premature engine failure.

WARNING

Use 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

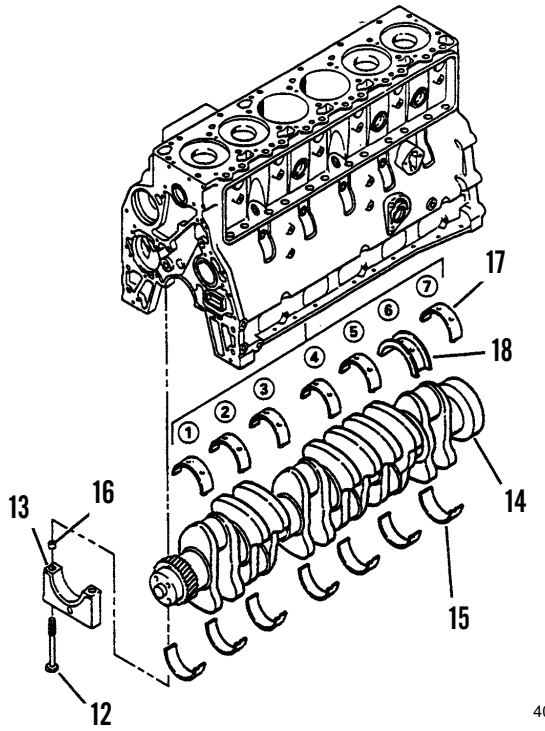
The crankshaft assembly weighs approximately 123 lb (56 kg).

13. Attach nylon or equivalent straps to the crankshaft (14).

CAUTION

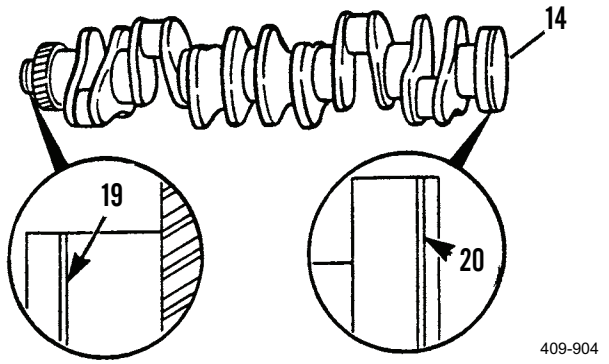
Be careful not to damage or scratch the crankshaft during removal.

14. Attach lifting straps to a suitable hoist. Slowly and carefully lift crankshaft (14) from the cylinder block.
15. Place crankshaft (14) in a clean, dry work area.
16. Remove and discard upper half of main bearings (17) from main bearing positions (1 thru 5 and 7).
17. Remove and discard thrust bearing (18) from no. 6 main bearing location in the block.

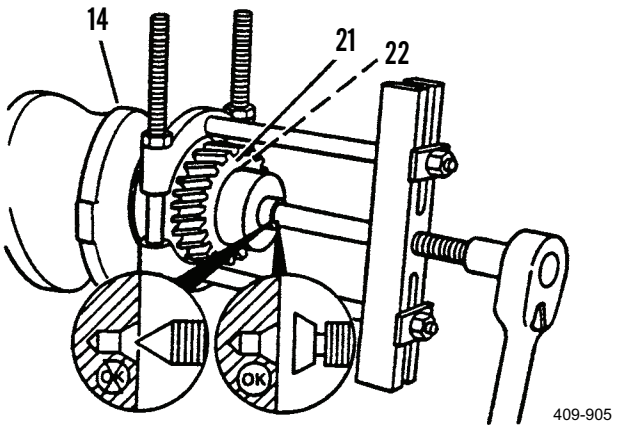


DISASSEMBLY

1. Remove and discard front wear seal (19) and rear wear seal (20) from crankshaft (14).



2. Using a suitable gear puller to remove crankshaft gear (21) and roll pin (22), if necessary, from crankshaft (14). Discard roller pin.



CLEANING

1. See *Cleaning Instructions* (WP 0316 00).

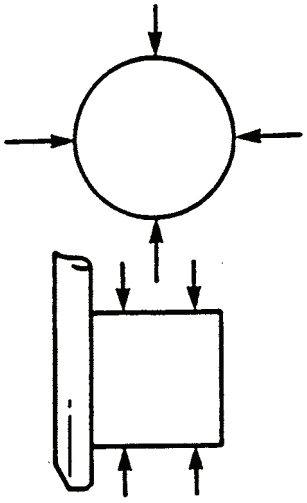
CAUTION

If crankshaft is not to be reinstalled within one hour after it is cleaned, apply clean lubricating oil on the bearing journals. Failure to comply with this recommendation will result in bearing journal corrosion.

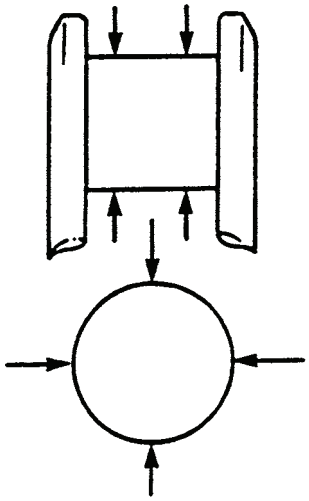
2. Apply clean lubricating oil to all crankshaft bearing journals if required.

INSPECTION

1. See *Inspection* instructions (WP 0317 00).
2. Inspect for large, deep cracks or broken material throughout the crankshaft, especially in the fillet and journal areas.
3. Inspect for a high concentration of depressions or pitting.
4. Inspect for burning or scoring in the journal areas.
5. If any of the conditions mentioned in steps 3 thru 5 above exists, replace the crankshaft.
6. Measure crankshaft main bearing journals. If any main bearing journal measures less than 3.2662 in. (82.9614 mm), replace the crankshaft or use oversize bearings. If any main bearing journal is out of round by more than 0.0020 in. (0.0508 mm), replace crankshaft or machine crankshaft and use oversize bearings.
7. Measure crankshaft connecting rod journals. If any connecting rod journal measures less than 2.7150 in. (69 mm), replace the crankshaft or use oversize bearing. If any connecting rod journal is out of round by more than 0.0020 in. (0.0508 mm), replace crankshaft or machine crankshaft and use oversize bearings.



409-906



409-907

8. Inspect main bearing bores for damage or abnormal wear (WP 0272 00).
9. Measure diameter of main bearing bores (WP 0272 00).
10. Inspect and measure connecting rod bearings (WP 0277 00).

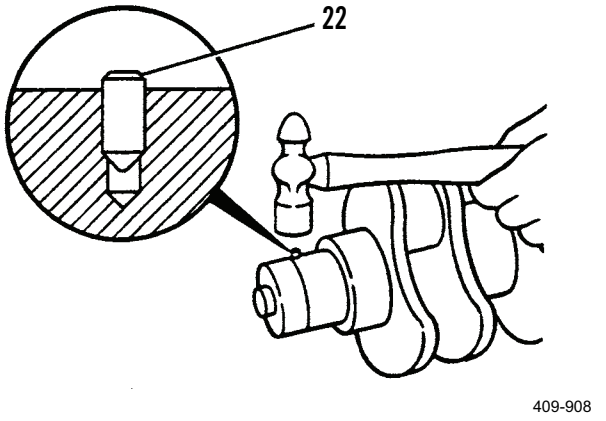
ASSEMBLY

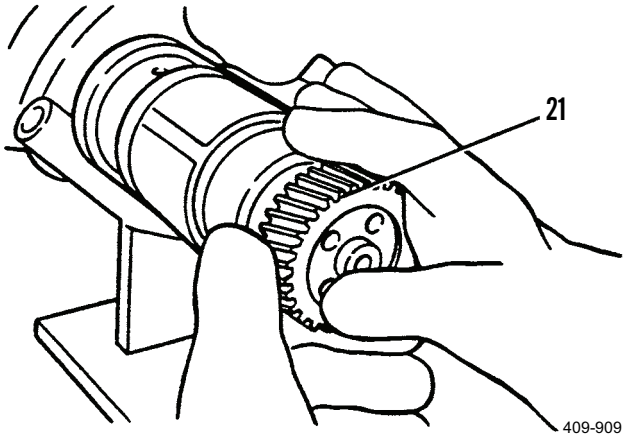
1. If a new crankshaft is being installed, a new roll pin (22) must be installed.

CAUTION

Do not heat crankshaft gear longer than 45 minutes. The gear will become permanently distorted if it is heated for longer than 45 minutes.

2. Heat crankshaft gear (21) in an oven for 45 minutes at 250°F (121°C).
3. Wearing insulating gloves, install crankshaft gear (21), with timing mark facing you, onto crankshaft until it is against the shaft shoulder.

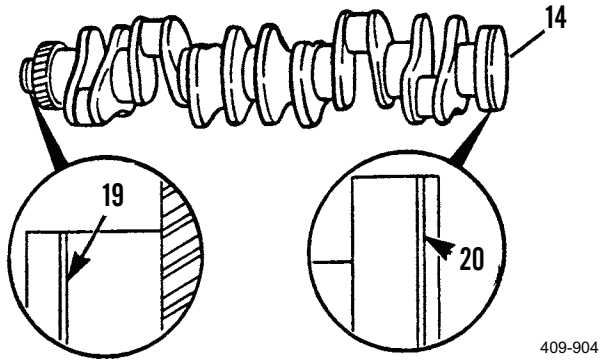




NOTE

Wear seals are used only if seal surfaces were damaged and the surface was machined to allow for seals installation.

4. Install new front wear seal (19) over end of crankshaft (14).
5. Install new rear wear seal (20) over end of crankshaft (14).



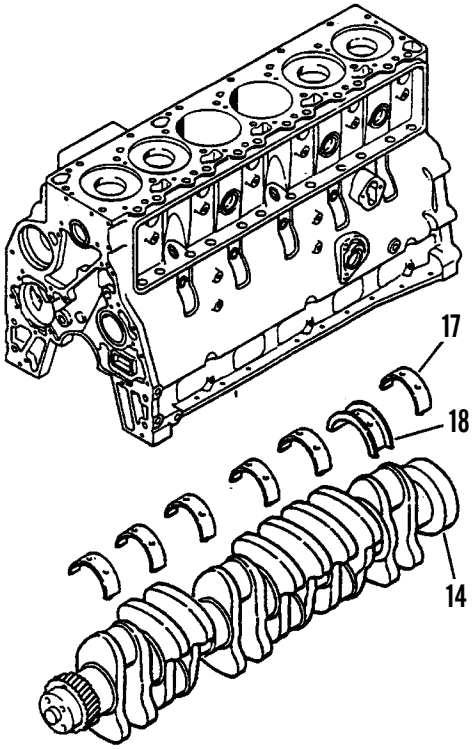
INSTALLATION

1. Clean main bearing surfaces in cylinder block (WP 0273 00).

NOTE

- If the crankshaft journals have been ground, appropriate oversize bearings will need to be installed.
- Install new main bearings dry at this time. Be sure cylinder block bearing bores, backsides of bearings, and inner surface of bearing caps are clean and dry.

2. Check main bearing and thrust bearing clearance by aligning tab of new upper main bearing half (17) with groove in crankshaft bearing bore (cylinder block), and press bearing half into place. Perform this procedure for main bearing positions (1 thru 5 and 7).
3. Install thrust bearing (18) in crankshaft bearing bore no. 6 with tab in bearing bore groove.



409-911

WARNING

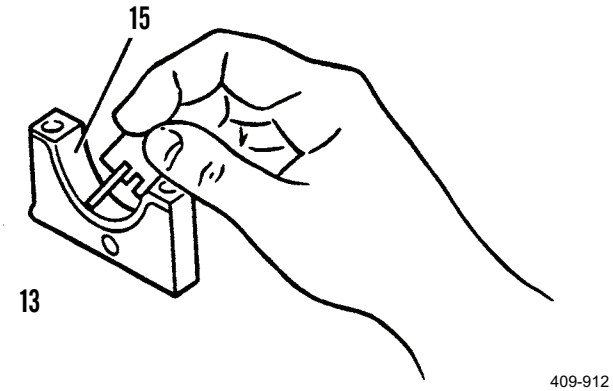
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

Use only nylon straps, or equivalent, to install crankshaft into cylinder block. Be sure that nothing metallic comes in contact with the machined surfaces of the crankshaft. A scratched or damaged crankshaft could cause premature engine failure.

INSTALLATION - CONTINUED

4. Attach nylon or equivalent straps to the crankshaft.
5. Attach lifting straps to hoist. Slowly and carefully move crankshaft to the cylinder block.
6. Slowly lower crankshaft into cylinder block. Be careful not to scratch the crankshaft journals.
7. Check that the crankshaft gear-to-camshaft gear timing marks are aligned. Allow crankshaft to firmly rest against the upper main bearing halves.
8. Place new lower main bearing halves (15) in bearing caps (13) with bearing tab in groove of cap.
9. Place a piece of plastigage on the surface of each new lower main bearing half (15).



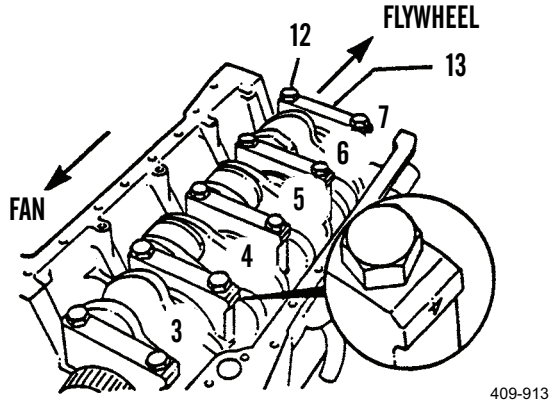
409-912

10. Apply clean lubricating oil to threads of capscrews (12), then install seven bearing caps (13) and fourteen capscrews (12).

NOTE

The number of the bearing cap must correspond to the number in the cylinder block and it must be facing towards the oil cooler side of the engine.

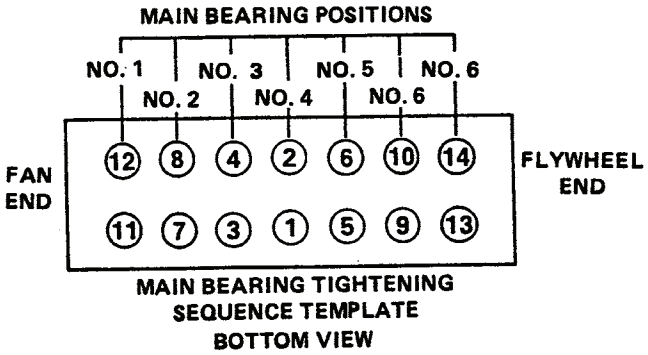
11. The main bearing capscrews (12) must be tightened evenly in a series of three steps, and in the sequence shown in this illustration. The torque values for each step are shown below.



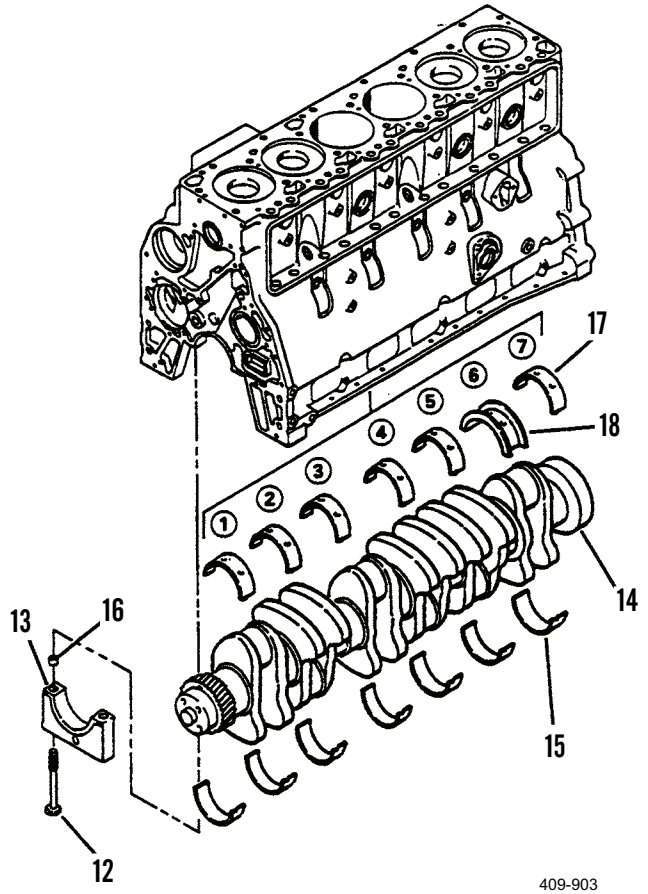
409-913

INSTALLATION - CONTINUED

Step	Torque Value
1	44 lb-ft (60 Nm)
2	88 lb-ft (119 Nm)
3	129 lb-ft (175 Nm)



12. Remove all capscrews (12) and bearing caps (13).
13. Remove and measure plastigage. Main bearing clearance must not exceed 0.00474 in (0.12039 mm). If bearing clearance exceeds clearance measurement, use appropriate oversize bearings.
14. Remove lower bearing halves (15) from bearing caps (13).
15. Lift crankshaft (14) from cylinder block far enough to remove upper bearing halves (17) and thrust bearing (18). Be careful that connecting rods do not scratch crankshaft.



INSTALLATION - CONTINUED

CAUTION

Be sure cylinder block bearing bores, backsides of bearings, and inner surface of bearing caps are clean and dry. Oil on these areas could cause less heat transfer between the bearings and the block which, in turn, could cause overheated bearings.

16. If removal was necessary, install fourteen ring dowels (16).

17. Place new lower bearing halves (15) in bearing caps (13) with tab inserted in cap groove.

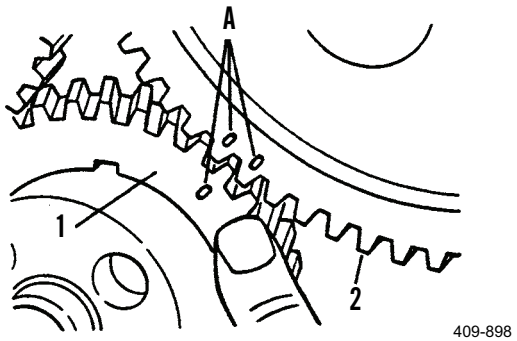
18. At main bearing positions (1 thru 5 and 7), align tab of upper bearing half (17) with groove in bearing bore (cylinder block), and press bearing half into place.

19. Align tab of thrust bearing (18) with groove in cylinder block at main bearing position 6, and press thrust bearing into place.

20. Apply lubriplate to the inside surfaces of the upper and lower bearing halves and thrust bearing.

21. Slowly lower crankshaft into cylinder block. Be careful not to scratch the crankshaft journals.

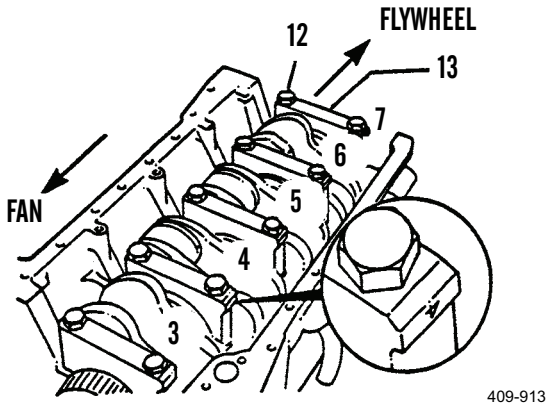
22. Check that the crankshaft gear (1)-to-camshaft gear (2) timing marks are aligned at point “A”, then allow crankshaft to firmly rest against the upper main bearing halves.



409-898

23. Install seven bearing caps (13) and fourteen capscrews (12). The number of the bearing caps must correspond to the numbers in the cylinder block and they must be towards the oil cooler side of the engine.

24. The main bearing capscrews (13) must be tightened evenly in a series of three steps, and in the sequence shown in this illustration. The torque value for each step is shown.



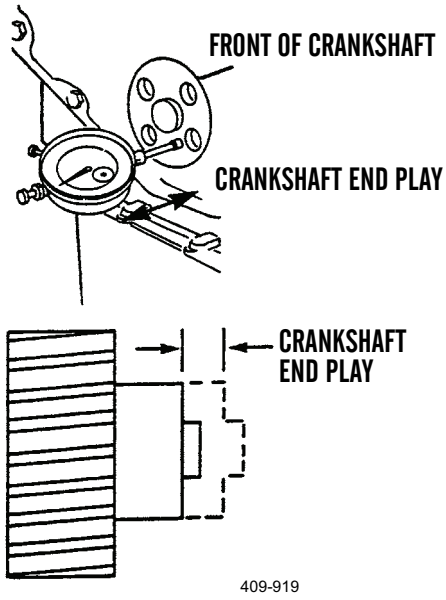
409-913

INSTALLATION - CONTINUED

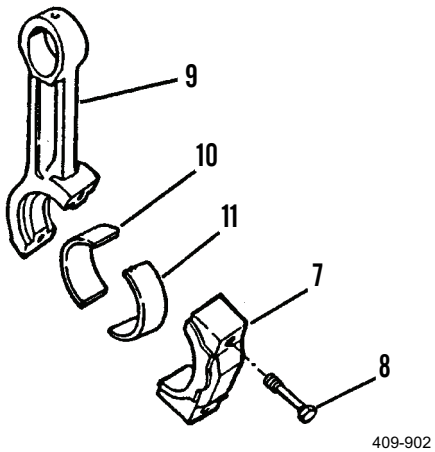
NOTE

End play is controlled by the dimensions of the thrust bearing and crankshaft journal at the no. 6 main bearing position.

25. Measure crankshaft end play using a dial indicator as shown in this illustration.
26. Push crankshaft forward, then toward rear of engine. With a new thrust bearing, end play limits must not exceed 0.005 to 0.010 in. (0.127 to 0.254 mm).
27. If end play measurement is greater than 0.010 in. (0.254 mm), install a larger size thrust bearing.



28. To determine connecting rod bearing clearance, turn crankshaft until two connecting rod bearing journals are bottom center.
29. Be sure crankshaft journals, bearing area on connecting rods, inner surface of connecting rod caps, and connecting rod bearings are dry and clean.
30. Put new upper main bearing half (10) on connecting rod (9) and pull piston and connecting rod assembly against crankshaft journal. Bearing tabs must be in the tab grooves of the connecting rod (9).

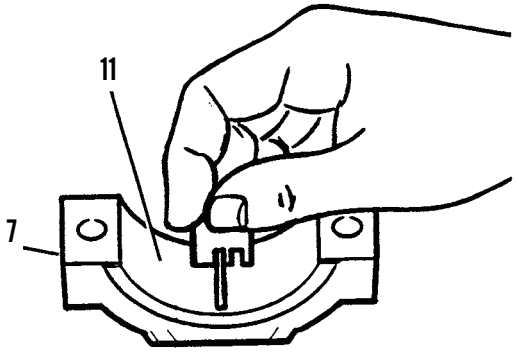


INSTALLATION - CONTINUED

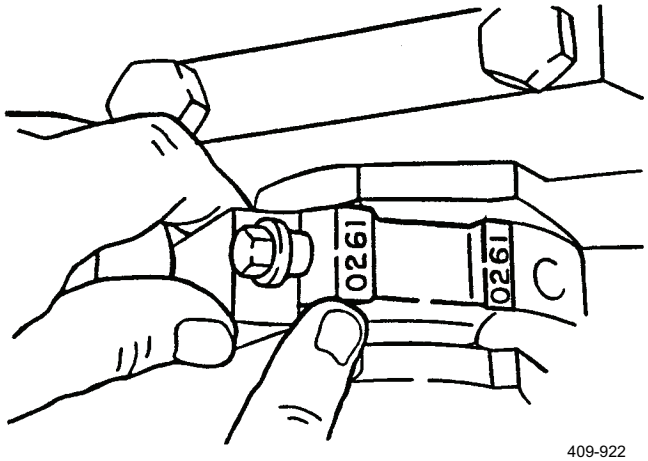
31. Put new lower main bearing half (11) in connecting rod cap (7). Bearing tabs must be in the tab grooves of the rod cap.
32. Put plastigage on the surface of the lower half of connecting rod bearing.

CAUTION

The four digit number stamped on the connecting rod and the rod cap must match and be facing the oil cooler side of the engine. Connecting rod and cap are machined as a set and must be kept that way. Failure to install matched sets could result in premature engine damage.



409-921



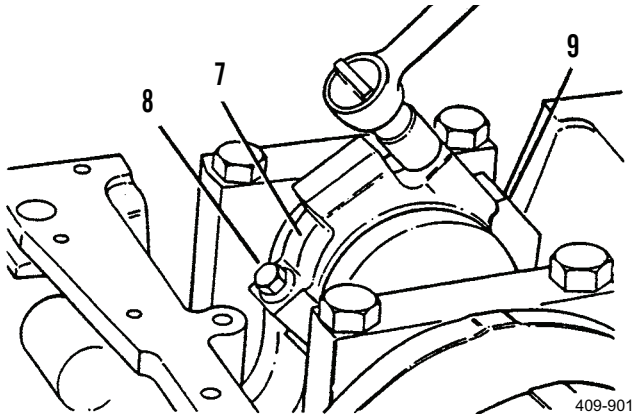
409-922

NOTE

Do not reuse connecting rod capscrews.

33. Apply clean lubricating oil to threads of new connecting rod capscrews, then install connecting rod cap (7) on connecting rod (9) with new capscrews (8).
34. The connecting rod capscrews (8) must be tightened evenly in a series of three steps. The torque value for each step is shown below.

Step	Torque Valve
1	26 lb-ft (35 Nm)
2	52 lb-ft (71 Nm)
3	73 lb-ft (99 Nm)



409-901

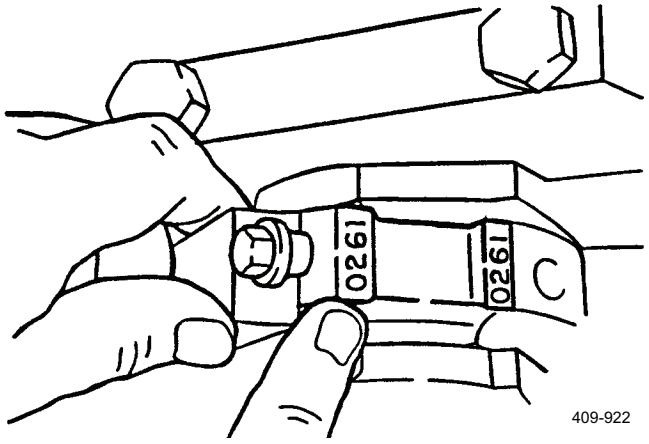
INSTALLATION - CONTINUED

35. Remove capscrews (8) and connecting rod caps (7).
36. Measure plastigage to determine what size connecting rod bearings to install.
37. Repeat steps 28 thru 36 for the other five connecting rods.
38. Turn crankshaft until two connecting rod bearing journals are bottom center.
39. Put upper bearing half (10) on connecting rod (9) with tab in the rod groove.
40. Put lower bearing half (11) in connecting rod cap (7) with tab in cap groove.
41. Apply lubriplate to inside surfaces of upper and lower bearing halves.

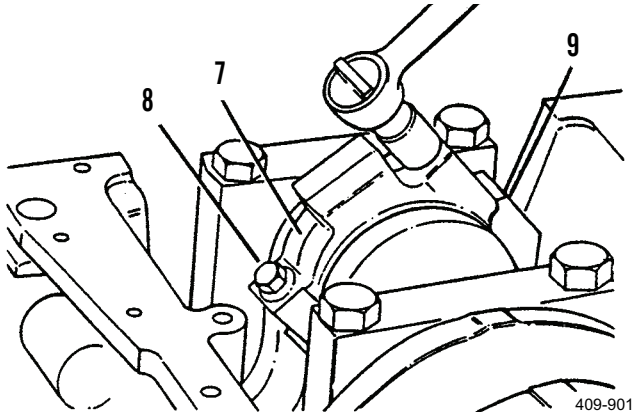
CAUTION

The four digit number stamped on the connecting rod and the rod cap must match and be facing the oil cooler side of the engine. Connecting rod and cap are machined as a set and must be kept that way. Failure to install matched sets could result in premature engine damage.

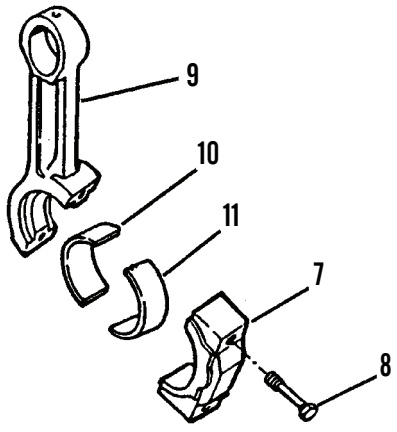
42. Pull piston and connecting rod assembly against crankshaft journal and install bearing cap (7) with new capscrews (8). Be sure the four digit number stamped on the bearing cap matches the number stamped on the connecting rod and that it is facing towards the oil cooler end of the engine.



409-922



409-901

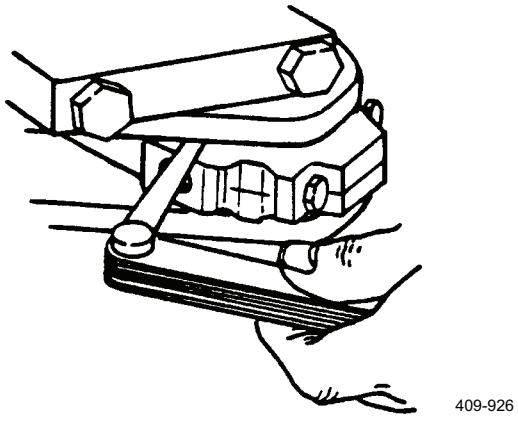


409-902

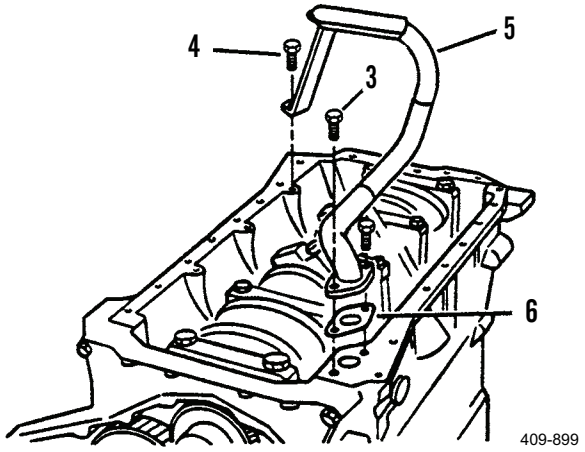
INSTALLATION - CONTINUED

43. The connecting rod capscrews (8) must be tightened evenly in a series of three steps. The torque value for each step is shown below.

Step	Torque Valve
1	26 lb-ft (35 Nm)
2	50 lb-ft (71 Nm)
3	73 lb-ft (99 Nm)


409-926

44. Repeat steps 39 thru 43 for the other five connecting rods.
45. Measure connecting rod side play at each connecting rod assembly.
46. Wear tolerance is 0.012 in. (0.304 mm) maximum.
47. If side play exceeds wear tolerance stated in previous step, replace connecting rod and connecting rod cap.
48. Install new gasket (6) on cylinder block.
49. Position oil suction tube (5) over new gasket (6) and install capscrews (3 and 4).
50. Torque capscrews (3 and 4) to 18 lb-ft (24 Nm).



409-899

51. Install oil pan (WP 0219 00).
52. Install front housing cover (WP 0280 00).
53. Install flywheel housing and cover (WP 0215 00).
54. Install engine (WP 0209 00).
55. Operate engine, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

CRANKSHAFT MAIN BEARINGS MAINTENANCE 0272 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Bearing inserter (Item 3 and 4, WP 0324 00)

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Lubriplate 105 (Item 26, WP 0323 00)

Plastigage (Item 38, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Materials/Parts - Continued

Thrust bearing (5)

References

WP 0271 00

WP 0316 00

Equipment Condition

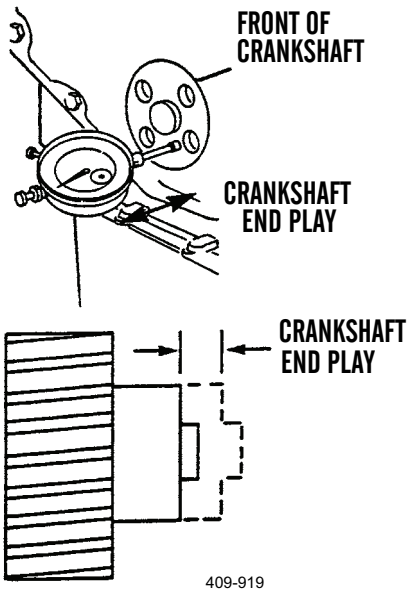
Vehicle parked on level ground (TM 10-3930-660-10)

Engine oil pan removed (WP 0219 00)

Engine oil pump inlet tube removed (WP 0220 00)

REMOVAL

1. End play is controlled by the dimensions of the thrust bearing and crankshaft journal at the no. 6 main bearing position.
2. Measure crankshaft end play using a dial indicator as shown.
3. Push crankshaft forward, then toward rear of engine. Record end play measurement. This data will be needed later during thrust bearing installation.



NOTE: BEARING REMOVAL INSTRUCTIONS FOR MAIN BEARINGS 1 AND 7 WILL BE COVERED IN THE INSTALLATION SECTION.

REMOVAL - CONTINUED

NOTE

- If main bearing position number on bearing cap is missing or hard to read, etch the correct number on the bearing cap so that it is facing the oil cooler side of the engine.
- Remove one main bearing set at a time.

4. Remove two capscrews (1) and bearing cap (2) from main bearings (2 thru 7) only. DO NOT remove bearing caps from main bearings 1 and 7 at this time.

CAUTION

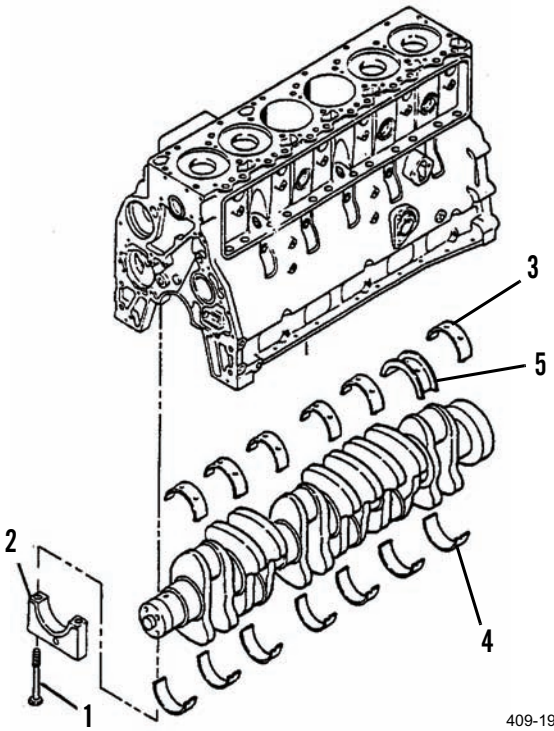
If crankshaft is turned in the wrong direction, the tab on the upper bearing half will be pushed between the crankshaft and main bearing bore in the block. This could cause damage to the block and the crankshaft.

5. Install bearing removal/installation tool into oil hole in crankshaft journal for main bearing being removed.
6. Slowly turn crankshaft so the bearing removal/installation tool pushes against the end of the bearing opposite the tab, and upper bearing half (3) is out of the cylinder block.
7. Remove bearing removal/installation tool from crankshaft oil hole.
8. Remove lower bearing half (4) from bearing cap (2). Keep bearing caps (2) and upper and lower bearings (i.e. 3 and 4) together as a set.

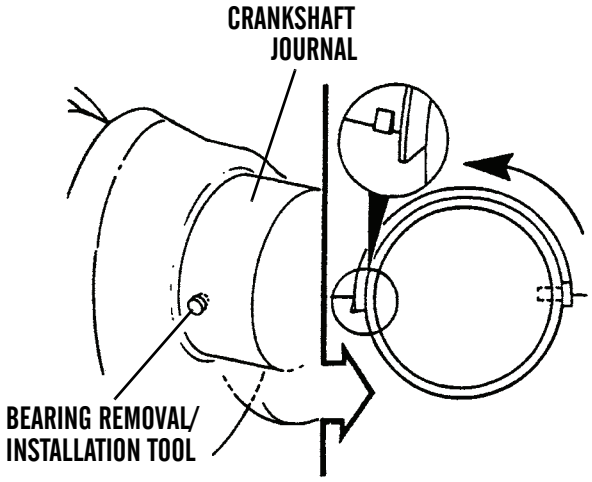
NOTE

When bearings are reused, each bearing must be installed in its original location because the bearing surfaces have a wear pattern matched to the crankshaft journals.

9. Repeat steps 6 thru 8 for remaining main bearings and thrust bearing (5) at main bearing position no. 6.



409-1930



409-4108

CLEANING

CAUTION

Never use any type of rough material or tools such as sandpaper, emery or crocus cloth, files, or glassbead cleaning equipment to clean bearings.

1. See *Cleaning* instructions (WP 0316 00).
2. Apply a light coat of oil over the bearings and the bearing surface in the bearing caps if the bearings are not going to be installed within one hour after cleaning.

INSPECTION

1. Inspect main bearings and thrust bearing. Replace bearing if:
   a. Back of bearing shows that fretting has taken place
   b. Back of bearing has a mirror-like (shiny) finish
   c. There are scratches in the bearing surface which do not disappear after cleaning
   d. Bearing surface has material damage such as cracks or flaking
   e. There is a hole in the bearing surface
   f. Bearing shows wear on the mating face
   g. Bearing oil hole is distorted
   h. There are hot spots in bearing surface
   i. Bearing has damage to the tab
2. Inspect thrust bearing flanges for damage. If damaged, replace thrust bearing.
3. Inspect main bearing bores in the block for cracks, chips, distortion, thread damage, or other damage. Replace cylinder block if there is bearing bore damage.
4. Inspect and measure crankshaft main bearing journals (refer to *Removal*).
5. Inspect main bearing caps for cracks, fretted or chipped mating surfaces, distortion or damaged ring dowels.
6. Replace a damaged bearing cap.
7. Replace both bearing cap ring dowels if one or both are damaged.

INSTALLATION

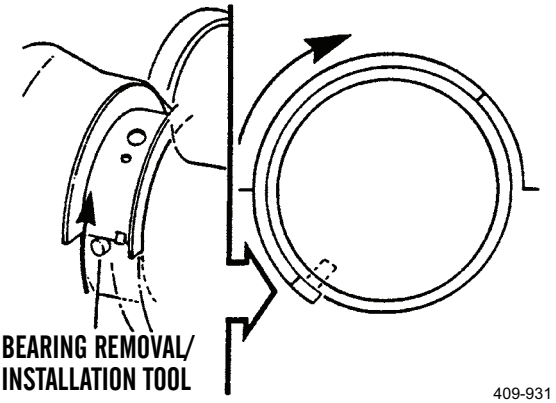
WARNING

- 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.
- To help prevent damage to the cylinder block during main bearing bore cleaning, compressed air shall not exceed 15 psi (103 kPa).
- Cleaning compound, solvent 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

If main bearings are coated with oil, remove oil with a clean wiping rag.

1. Clean main bearing surfaces in the cylinder block and bearing caps with cleaning solvent. Dry surfaces thoroughly with low pressure compressed air, 15 psi (103 kPa) maximum.



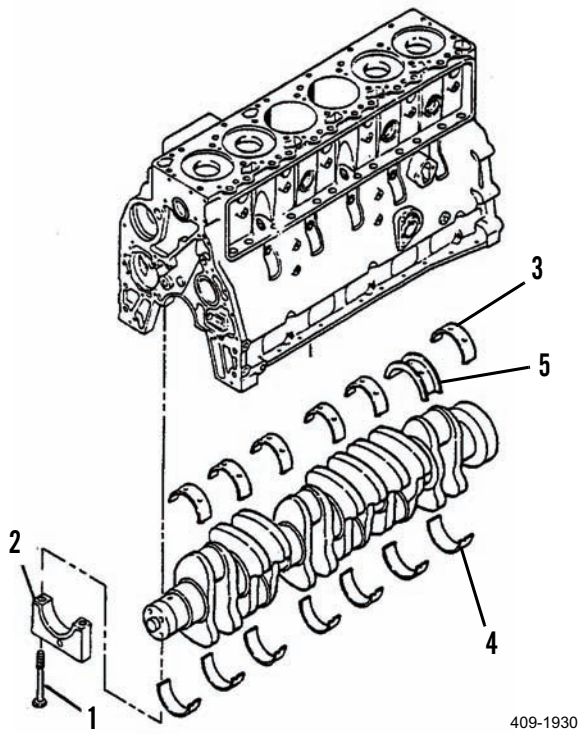
409-931

INSTALLATION - CONTINUED

NOTE

Install bearing halves dry for the following clearance checks.

2. Refer to end play data measured earlier in *Removal*. If crankshaft end play is not within 0.005 to 0.010 in. (0.127 to 0.254 mm), install a new, appropriate oversize thrust bearing (5).
3. Install a dry upper main bearing half (3) over the crankshaft journal such that the bearing tab will fit into the notch in cylinder block. If used main bearing is being installed, install upper bearing half in the same position it was removed from.



INSTALLATION - CONTINUED

4. Insert bearing removal/installation tool, into bearing journal oil hole so that it will push against tab end of bearing.

CAUTION

If the crankshaft is turned in the wrong direction, the bearing tab will be pushed between the crankshaft and bearing area in the block. This could cause damage to the block and the crankshaft.

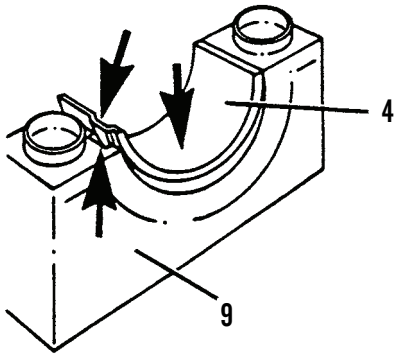
5. Slowly turn crankshaft in the correct direction until upper bearing tab is in the cylinder block notch.

6. Remove bearing removal/installation tool from crankshaft oil hole.

NOTE

After each upper bearing half is installed, install the respective lower bearing half and bearing cap as described in the following steps.

7. Install a new dry lower main bearing half (4) in bearing cap (2). Tab on bearing must be in the notch in bearing cap. If used main bearing is being installed, install bearing in the same bearing cap it was removed from.

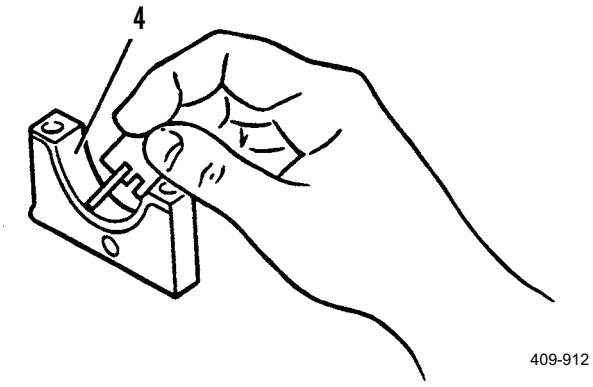


409-932

NOTE

Do not turn crankshaft after plastigage is in position. Plastigage will be distorted.

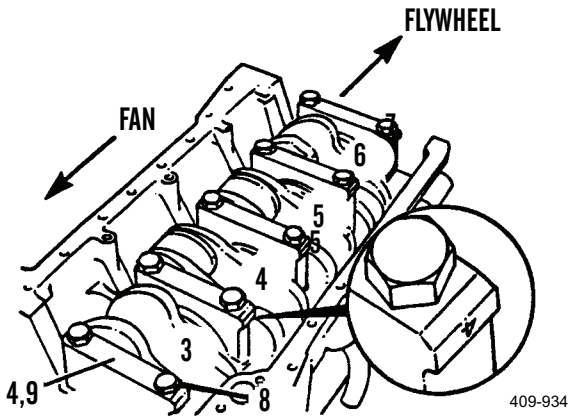
8. Place plastigage on the surface of new lower main bearing half (4).



409-912

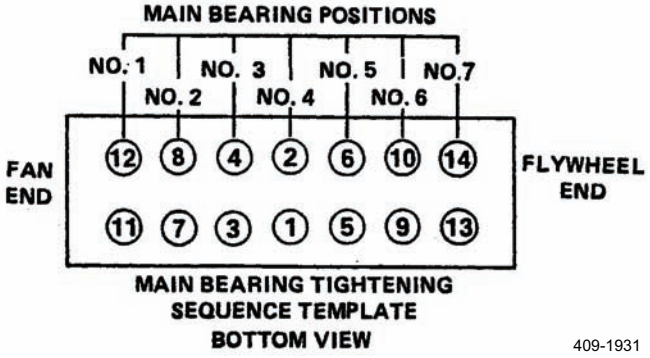
INSTALLATION - CONTINUED

9. Apply a light coat of lubricating oil on threads of capscrews (1). Install new upper main bearing (4), bearing cap (2), and two capscrews (1). The bearing cap must be installed in the same position it was removed from with number of bearing cap facing towards the oil cooler side of engine.
10. After each bearing and bearing cap is installed, torque capscrews (1) to 37 lb-ft (50 Nm). Do not tighten capscrews to final torque value at this time.



409-934

11. Repeat steps for the other main bearings (3 thru 5) and thrust bearing (6) at position no. 6.
12. Torque capscrews (1) evenly, in the sequence shown to 44 lb-ft (60 Nm).
13. Torque capscrews (1) evenly again in the sequence shown to 88 lb-ft (119 Nm).



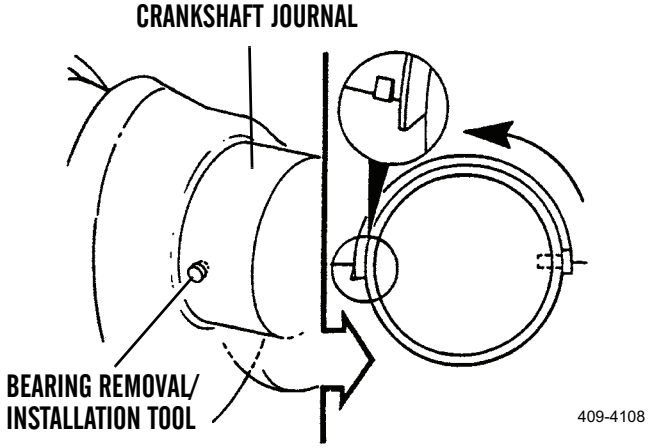
409-1931

14. Torque capscrews (8) evenly in the sequence shown to 129 lb-ft (175 Nm) final torque.
15. Check bearing clearance for positions no. 2 thru no. 6. Remove two capscrews (1) and bearing cap (2) from main bearings 2, 3, 4, 5 or 6. Remove one set of main bearings at a time.
16. Remove and measure plastigage. Main bearing clearance must not exceed 0.00474 in. (0.12039 mm). If bearing clearance exceeds the specified measurement, the appropriate oversize bearing set must be installed.

CAUTION

If crankshaft is turned in the wrong direction, the tab on the upper bearing half will be pushed between the crankshaft and main bearing bore in the block. This could cause damage to the block and the crankshaft.

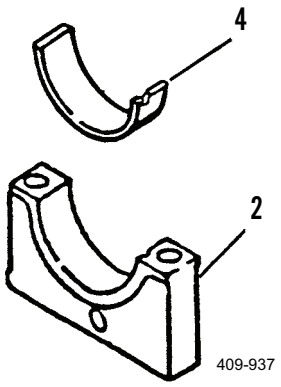
17. Install bearing removal/installation tool into oil hole in crankshaft journal for main bearing being removed.
18. Slowly turn crankshaft so the special pin pushes against the end of the bearing opposite the tab, and upper bearing half (3) is out of the cylinder block.



409-4108

INSTALLATION - CONTINUED

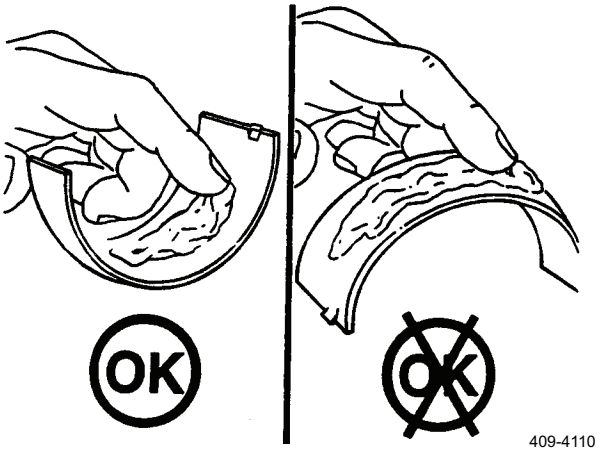
19. Remove bearing removal/installation tool from crankshaft oil hole.
20. Remove lower bearing half (4) from bearing cap (2). Keep main bearings and bearing caps together as a set.



NOTE

When bearings are reused, each bearing set must be installed in its original location because the bearing surfaces have worn to the crankshaft journals.

21. Repeat steps 15 thru 20 for remaining main bearings and thrust bearing (5) at main bearing position no. 6.
22. To install bearings, be sure bearing bore surfaces in the cylinder block are clean and dry.
23. Check that the backsides of main bearings are clean and dry.
24. Check that inside surfaces of bearing caps are clean and dry.
25. Apply lubriplate to the inside surface of upper bearing half (3). Do not lubricate the side that is against the cylinder block bearing bore.
26. Install one bearing set at a time. Install upper main bearing half (3) over the crankshaft journal such that the bearing tab will fit into the notch in cylinder block. If used main bearing is being installed, install main bearing half in the same position it was removed from. If a new bearing is being installed, use the correct size bearing as determined in steps 17 thru 19 above.



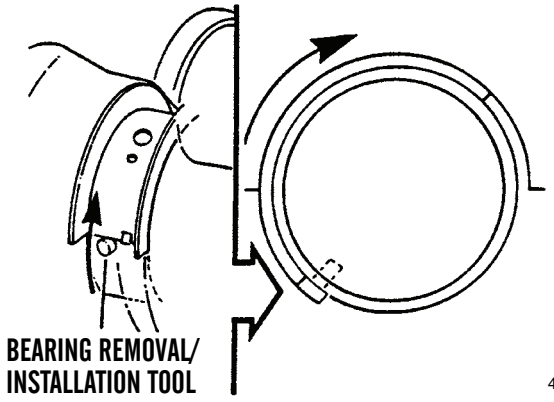
INSTALLATION - CONTINUED

27. Insert bearing removal/installation tool into bearing journal oil hole so that it will push against tab end of bearing.

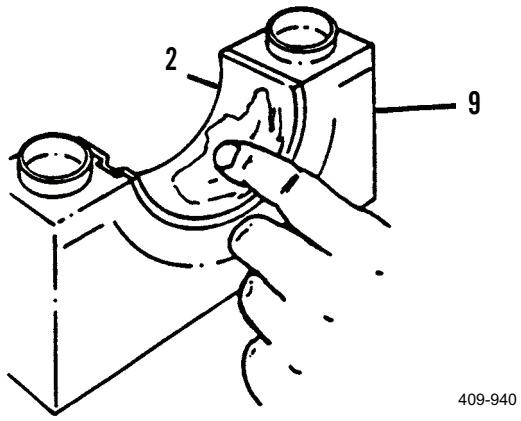
CAUTION

If the crankshaft is turned in the wrong direction, the bearing tab will be pushed between the crankshaft and bearing area in the block. This could cause damage to the block and the crankshaft.

28. Slowly turn crankshaft in the correct direction until upper bearing tab is in the cylinder block notch.
29. Remove bearing removal/installation tool from crankshaft oil hole.
30. Place lower bearing half (4) into bearing cap (2) that it was removed from. If a new bearing is being installed, use the correct size bearing as determined in above steps 17 thru 19 above. Apply lubriplate to inside surface of bearing half.

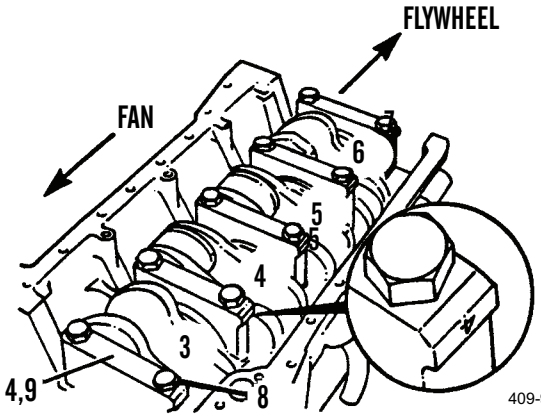


409-931

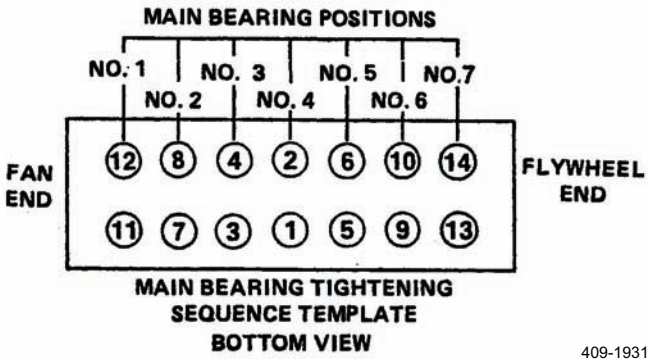


409-940

31. Install lower bearing (4), bearing cap (2) and two capscrews (1) on bearing bore with the same number as that stamped on cap, with number facing towards the oil cooler side of engine.
32. After installing each bearing and bearing cap, torque capscrews (1) to 37 lb-ft (50 Nm). Do not tighten capscrews to final torque value at this time.
33. Repeat steps 18 thru 32 for other main bearings and thrust bearing (5) at position no. 6.
34. Torque capscrews (1) evenly in the sequence shown to 44 lb-ft (60 Nm).
35. Torque capscrews (1) evenly again in the sequence shown to 88 lb-ft (119 Nm).
36. Torque capscrews (1) evenly in the sequence shown to 129 lb-ft (175 Nm) final torque.



409-934



409-1931

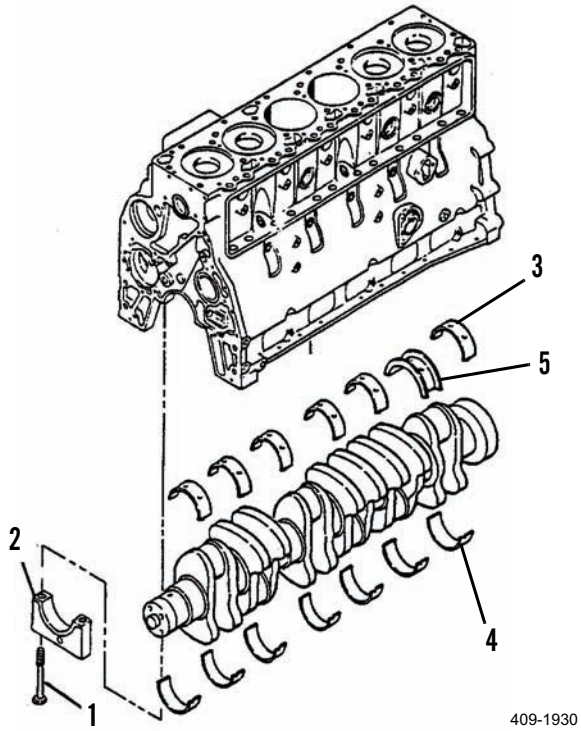
INSTALLATION - CONTINUED

37. If main bearing position number on bearing cap is missing or hard to read, etch the correct number on the bearing cap so that it is facing the oil cooler side of the engine.
38. Remove two capscrews (1) and bearing cap (2) from no. 1 main bearing. Remove lower bearing half (11) from bearing cap (9).

CAUTION

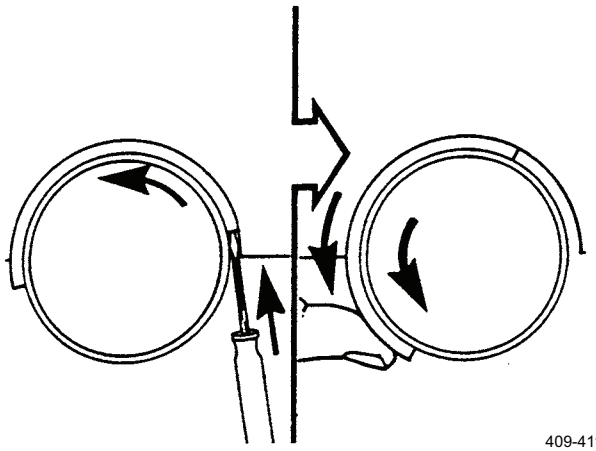
Be very careful not to scratch the crankshaft or the bearing bore during the removal of the upper bearing halves. A scratched or damaged crankshaft, or bearing bore could result in premature engine failure.

39. Use a flat blade screwdriver to remove the upper half of main bearing (3) at position no. 1 because the crankshaft journal for no. 1 main bearing does not have an oil hole.



409-1930

40. Gently push end of upper bearing half to loosen it from the cylinder block.
41. Press finger against bearing and turn crankshaft to roll the bearing from the cylinder block.


409-4111

CAUTION

If crankshaft is turned in the wrong direction, the tab on the upper bearing half will be pushed between the crankshaft and main bearing bore in the block. This could cause damage to the block and the crankshaft.

42. Remove no. 7 main bearing by using removal steps 4 thru 8.

INSTALLATION - CONTINUED

NOTE

When bearings are reused, each bearing must be installed in its original location because the bearing surfaces have worn to the crankshaft journals.

43. Check no. 1 main bearing clearance by using installation steps 15 thru 20.

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.
- To help prevent damage to the cylinder block during main bearing bore cleaning, compressed air shall not exceed 15 psi (103 kPa).
- Cleaning compound, solvent 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.

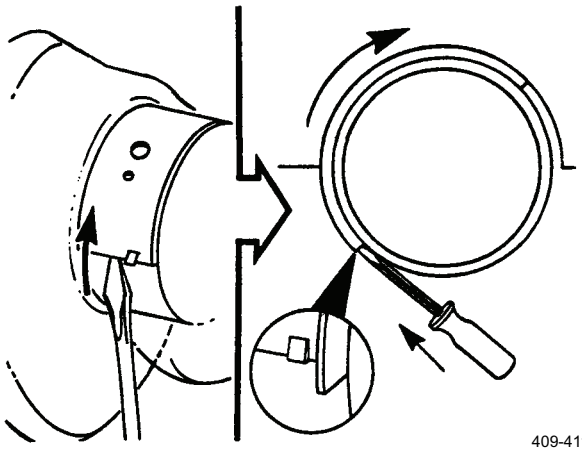
CAUTION

To help prevent damage to the cylinder block during main bearing bore cleaning, compressed air shall not exceed 15 psi. Use compressed air only with effective chip guarding and personal protective equipment.

NOTE

If main bearings are coated with oil, remove oil with a clean wiping rag.

44. Clean main bearing surfaces in the cylinder block and bearing caps with solvent cleaning compound. Dry surfaces thoroughly with low pressure compressed air 15 psi (103 kPa) maximum.



409-4112

INSTALLATION - CONTINUED

NOTE

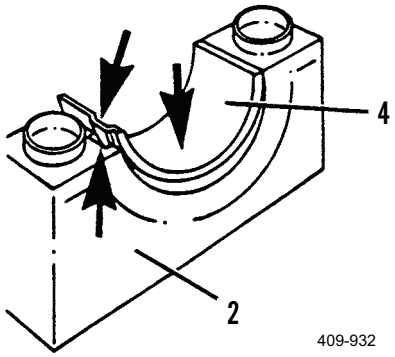
Install bearing halves dry for the following clearance checks.

45. Install a dry upper bearing half (3) over the crankshaft journal for main bearing (4) at position no. 1 such that the bearing tab will fit into the notch in cylinder block. If used main bearing is being installed, install main bearing half in the same position it was removed from.

CAUTION

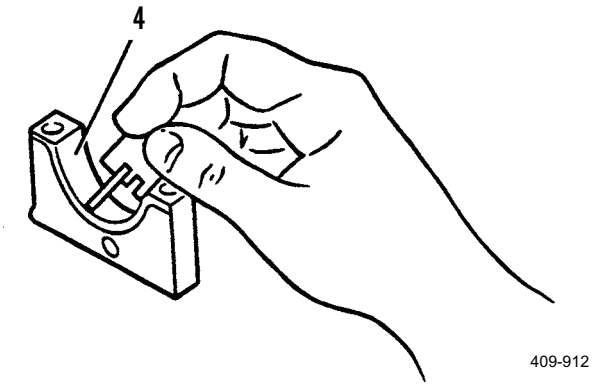
Be very careful not to scratch the crankshaft or the bearing bore during the installation of the upper bearing halves. A scratched or damaged crankshaft, or bearing bore, could result in premature engine failure.

46. Simultaneously push the upper bearing half, with a flat blade screwdriver, and turn the crankshaft until bearing tab is in notch in cylinder block.
47. Install a dry lower main bearing half (4) in no. 1 main bearing cap (2). Tab on bearing must be in the notch in bearing cap. If used main bearing is being installed, install bearing in the same bearing cap it was removed from.



409-932

48. Place plastigage on the surface of lower main bearing half (4).

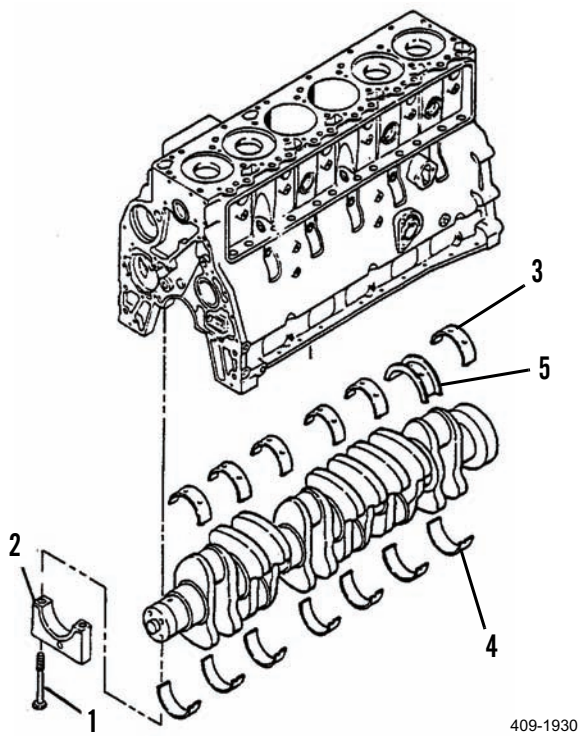


409-912

INSTALLATION - CONTINUED

49. Apply a light coat of lubricating oil on threads of capscrews (1).

50. Install bearing (4), bearing cap (2) and two capscrews (1) on the no. 1 bearing bore in the cylinder block.



51. Alternately tighten two capscrews (1) to final torque value in these three steps:

Step	Torque Value
1	44 lb-ft (60 Nm)
2	88 lb-ft (119 Nm)
3	129 lb-ft (175 Nm)

52. Check no. 1 main bearing clearance, steps 15 and 16.

53. Remove no. 1 main bearing, steps 38 thru 40.

54. Install no. 7 main bearing, steps 1 thru 7.

55. Alternately torque capscrews (8) to final torque value in these three steps:

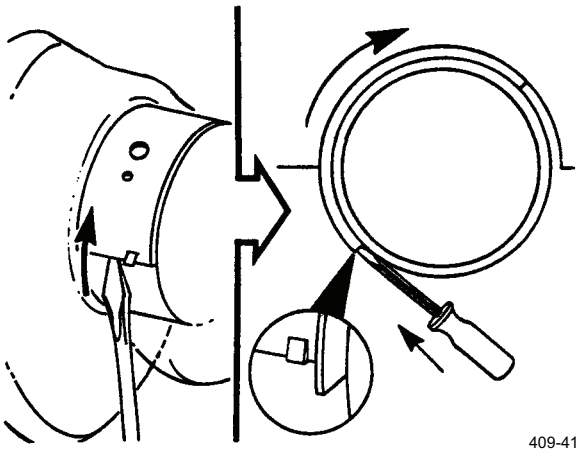
Step	Torque Value
1	44 lb-ft (60 Nm)
2	88 lb-ft (119 Nm)
3	129 lb-ft (175 Nm)

INSTALLATION - CONTINUED

56. Check bearing clearance using steps 15 thru 20.
57. Install no. 1 main bearing, steps 22 thru 26.

CAUTION

Be very careful not to scratch the crankshaft or the bearing bore during the installation of the upper bearing half. A scratched or damaged crankshaft, or bearing bore, could result in premature engine failure.


409-4112

58. To insert upper half of no. 1 main bearing into bearing bore, simultaneously push the upper bearing half with a flat blade screwdriver and turn the crankshaft until bearing tab is in notch in cylinder block.
59. Continue with no. 1 bearing installation, steps 31 and 34 thru 36.
60. Crankshaft must turn freely. If it does not turn with relative ease, check bearing installations and size of bearings.
61. Check crankshaft end play (WP 0271 00).
62. Install engine oil pump inlet tube (WP 0220 00).
63. Install oil pan (WP 0219 00).

END OF WORK PACKAGE

CRANKSHAFT FRONT SEAL REPLACEMENT 0273 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 46, WP 0323 00)

Materials/Parts - Continued

Front seal (1)

Sheet metal screw, no. 10

References

TM 10-3930-660-10

Equipment Condition

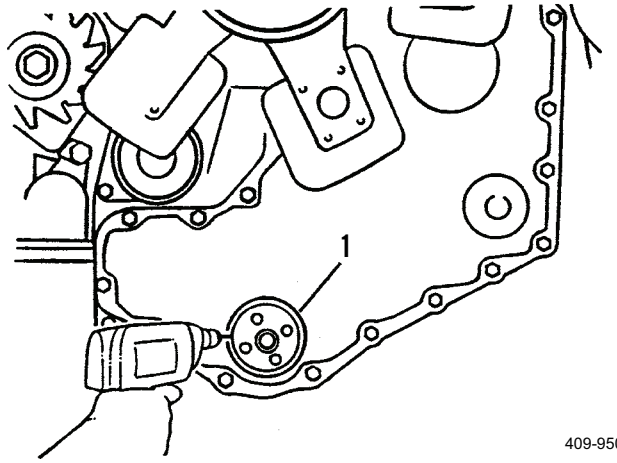
Crankshaft vibration damper removed (WP 0275 00)

WARNING

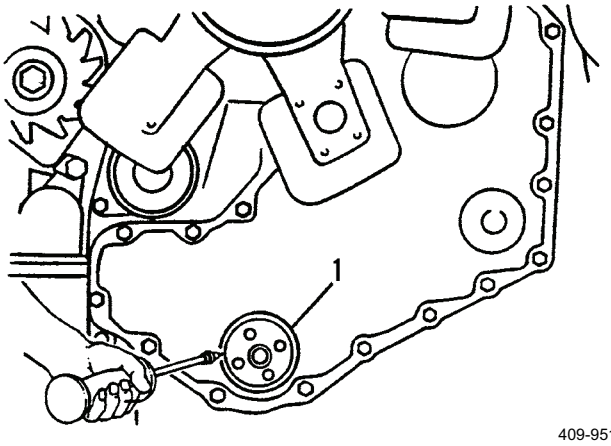
- Eye protection must be worn when performing maintenance where components or particles could fly out during procedure. Failure to take precautions could cause injury to personnel.
- Some components are under spring tension. Wear eye protection and use caution when disassembling them, to avoid injury.

REMOVAL

1. Drill two 1/8 in. (3.175 mm) holes 180 degrees apart in seal carrier.
2. Remove front seal (1) with slide hammer puller.
3. Insert a no. 10 sheet metal screw into end of slide hammer puller.
4. Alternately put slide hammer puller into the two 1/8 in. (3.175 mm) drilled holes and pull until front seal (1) is removed. Discard front seal.



409-950



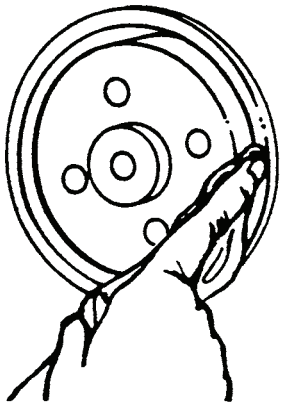
409-951

INSTALLATION

CAUTION

The seal lip and sealing surface on crankshaft must be clean to help prevent an oil leak around the seal.

1. Clean seal lip and sealing surface on crankshaft with clean wiping rags.

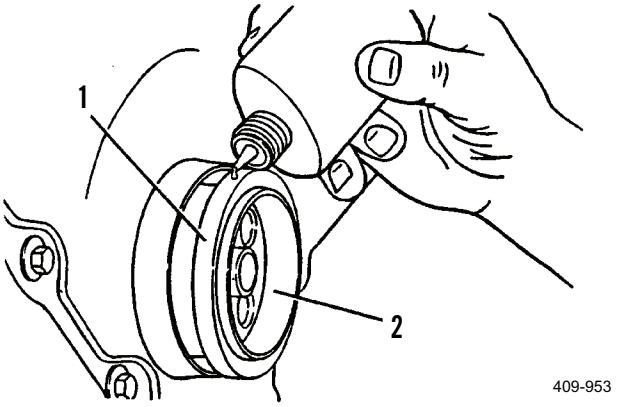

409-952

INSTALLATION - CONTINUED

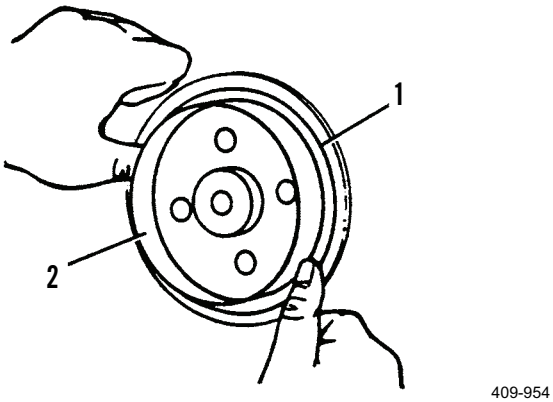
CAUTION

- The front seal and seal pilot used in step 3 are packaged as a single item. Do not separate these two components before seal installation. Failure to use the pilot could result in a damaged front seal.
- Drive the alignment/installation tool at the 12, 3, 6 and 9 o'clock positions only. Driving the tool at other positions could damage the seal carrier.

2. Apply a bead of loctite around outside surface of front seal (1).
3. Push on new front seal (1) until front seal is inside gear cover, then remove seal pilot (2).

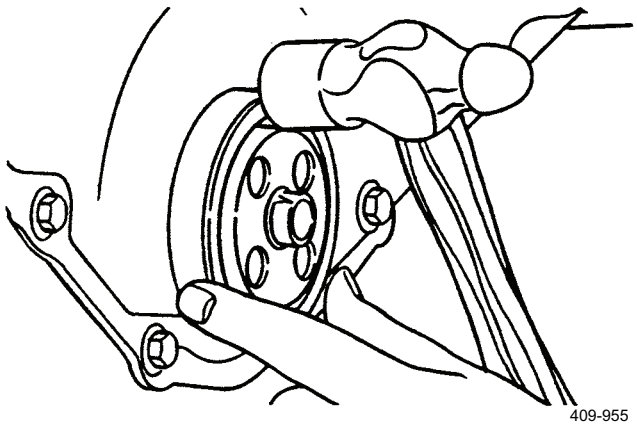


409-953



409-954

4. Position the alignment/installation tool over the crankshaft and against the seal carrier with the flange of the tool away from the front seal.
5. Use a hammer to tap front seal into front cover until flange of tool is against front cover.


409-955

6. Install crankshaft vibration damper (WP 0275 00).
7. Run engine and check for leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

CRANKSHAFT REAR SEAL REPLACEMENT 0274 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Rag, wiping (Item 40, WP 0323 00)

Rear oil seal (1)

Sheet metal screw, no. 10

References

TM 10-3930-660-10

Equipment Condition

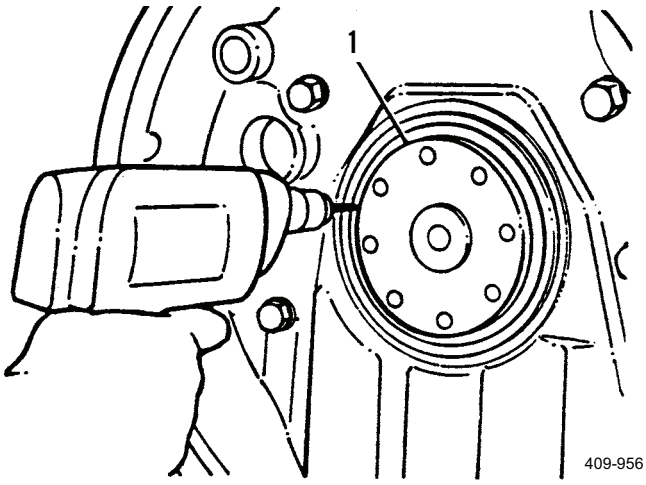
Flywheel removed (WP 0214 00)

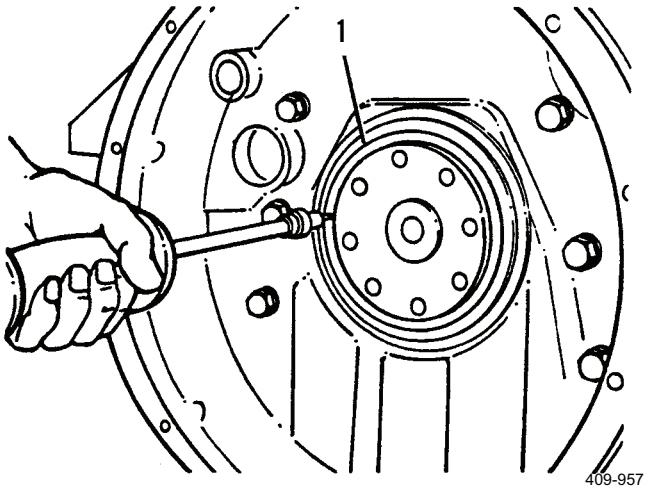
WARNING

- 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 caution when disassembling them, to avoid injury.

REMOVAL

1. Drill two 1/8 in. (3.175 mm) holes 180 degrees apart in seal carrier.
2. Remove rear crankshaft seal with slide hammer puller.
3. Insert a no. 10 sheet metal screw into end of slide hammer puller.
4. Alternately put slide hammer puller into the two 1/8 in. (3.175 mm) drilled holes and pull until oil seal (1) is removed. Discard rear oil seal.



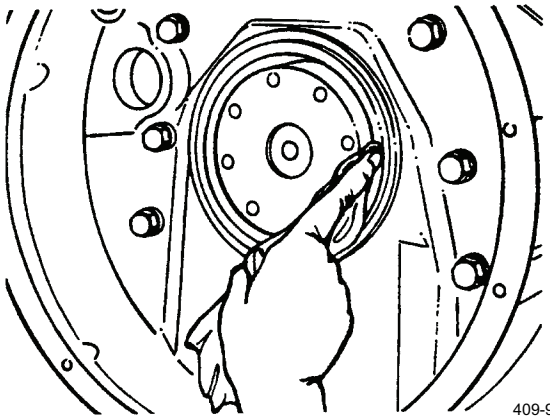


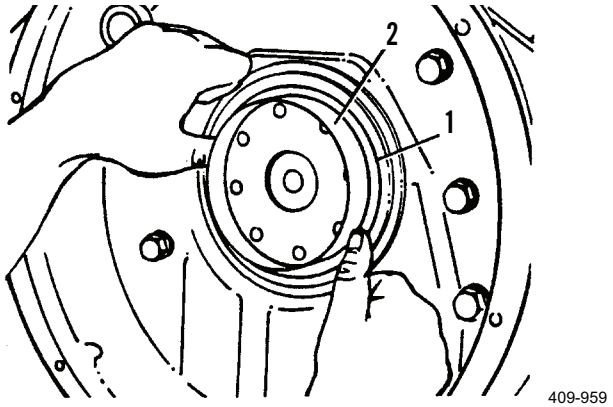
INSTALLATION

CAUTION

- The seal lip and sealing surface on crankshaft must be clean to help prevent an oil leak around the seal.
- Always use the seal pilot to install rear oil seal. Failure to do so could result in a damaged oil seal.

1. Install seal pilot (2) supplied with seal kit into crankshaft.
2. Install new oil seal (1) over seal pilot (2) and onto crankshaft.
3. Remove seal pilot (2) from crankshaft.



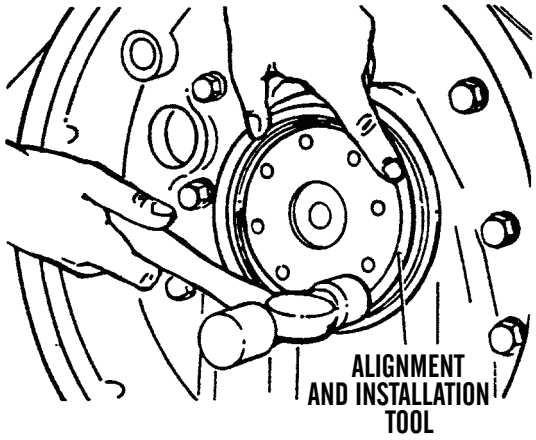


INSTALLATION - CONTINUED

CAUTION

Tap alignment/installation tool at the 12, 3, 6 and 9 o'clock positions only. Striking the tool at other locations could damage the seal carrier.

4. Place alignment/installation tool supplied with rear seal kit onto crankshaft and against seal carrier with the flange of the tool away from the seal.
5. Use a hammer to tap seal into seal retainer until flange of tool is against seal retainer.



409-960

6. Install flywheel (WP 0214 00).
7. Run engine and check for leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

CRANKSHAFT VIBRATION DAMPER MAINTENANCE 0275 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

References

WP 0316 00

WP 0317 00

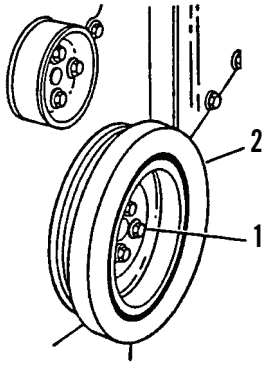
Equipment Condition

Radiator removed (WP 0053 00)

Drive belt removed (WP 0061 00)

REMOVAL

Remove four capscrews (1) and vibration damper (2).



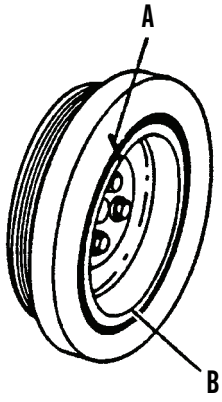
409-961

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Check that index lines (A) are aligned. If index lines are more than 1/16 in. (1.58 mm) apart, replace vibration damper.
2. Inspect rubber parts (B) of damper for deterioration and missing pieces. Replace damper if deterioration and/or missing pieces are evident.
3. See *Inspection* instructions (WP 0317 00).



409-962

INSTALLATION

1. Install vibration damper (2) and capscrews (1).
2. Tighten capscrews (1) to 101 lb-ft (137 Nm).
3. Install drive belt (WP 0061 00).
4. Install radiator (WP 0053 00).

END OF WORK PACKAGE

PISTONS, PISTON PINS AND RINGS MAINTENANCE 0276 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Tool kit, machinist's: post, camp and station (Item 40, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Materials/Parts - Continued

Detergent, laundry (Item 17, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Piston ring set

Equipment Condition

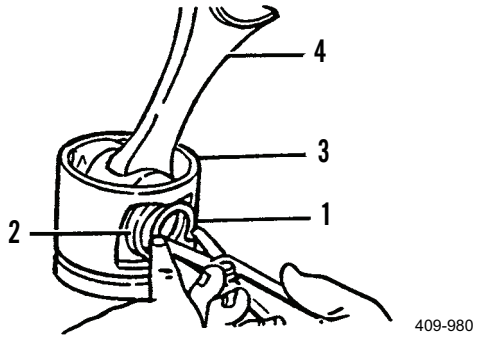
Connecting rod/piston assemblies removed from engine (WP 0277 00)

REMOVAL

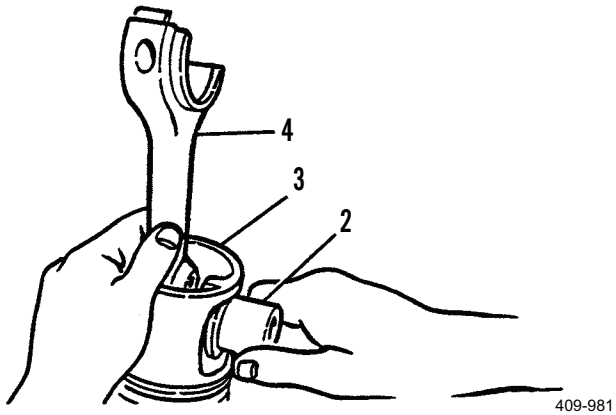
NOTE

Pistons do not have to be heated in order to remove piston pins.

1. Remove retaining ring (1).
2. Remove piston pin (2) from piston (3).
3. Separate piston (3) from connecting rod (4).



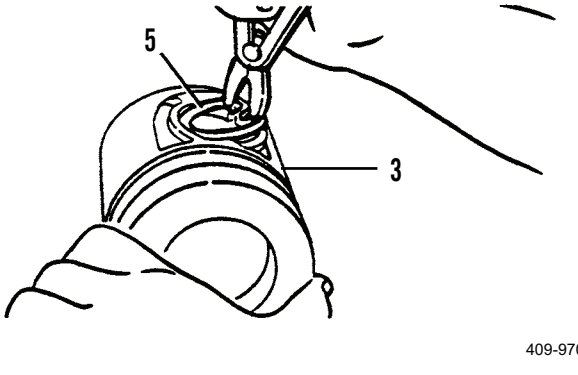
409-980



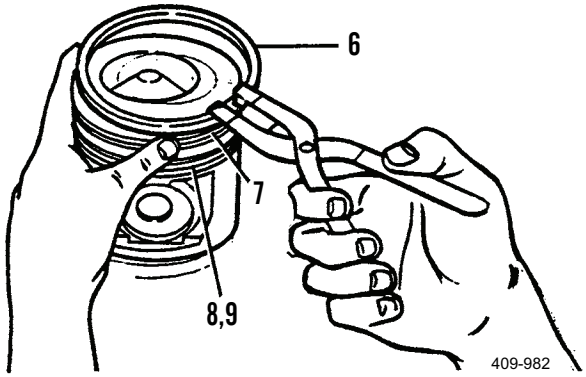
409-981

REMOVAL - CONTINUED

4. Remove second retaining ring (5), from side of piston (3).
5. Remove and discard piston rings (6 thru 8) and oil ring expander (9).

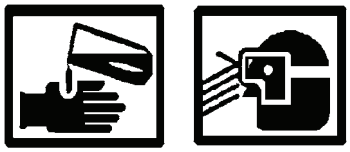
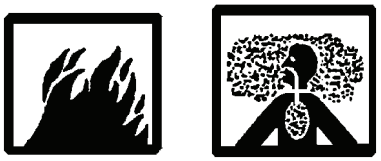


409-970



409-982

CLEANING

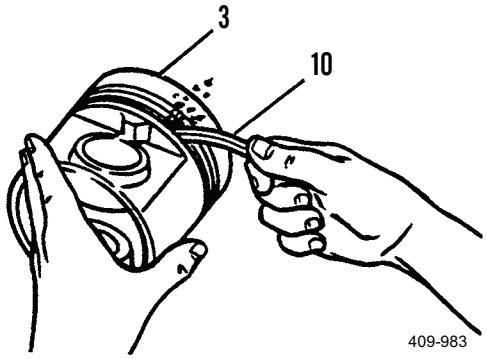
WARNING

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.

CAUTION

Do not use bead blast to clean pistons. Bead blasting may damage piston.

1. Soak pistons (3) in clean cleaning solvent compound to remove carbon deposits.
2. Wash pistons in a strong solution of laundry detergent and hot water, to remove carbon residue. Use a stiff bristle brush.
3. Clean ring grooves in piston (3) using square end of a broken piston ring (10). Use care to avoid scratching ring sealing surfaces in piston grooves.



409-983

CLEANING - CONTINUED

4. Clean pistons again in solution of laundry detergent and hot water.

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.

5. Rinse pistons in clean, fresh water and dry using compressed air.

INSPECTION

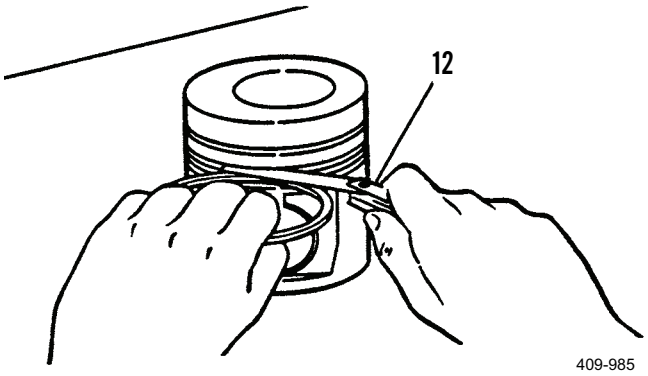
1. Visually inspect ring grooves, piston top, piston skirt and piston pin bore for cracks or other damage and for excessive wear.

2. Check piston skirt diameter using an inside micrometer at a point approximately 1/2 in. (13 mm) above bottom edge of piston. Minimum allowable skirt diameter is 4.0088 in. (101.8235 mm).

3. Check ring clearance for top, intermediate and oil control ring grooves using new rings and feeler gage (12) as shown. Maximum allowable clearances for these two grooves are:

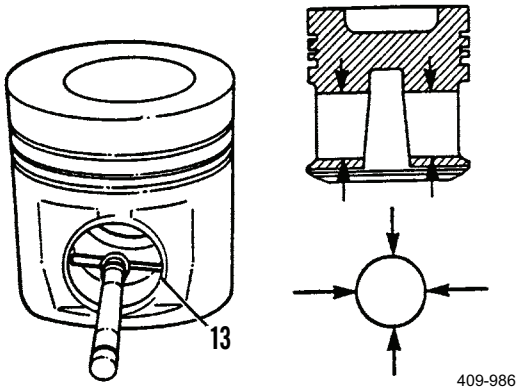
   a. Intermediate ring groove - 0.006 in. (0.152 mm).

   b. Oil control ring groove - 0.005 in. (0.127 mm).

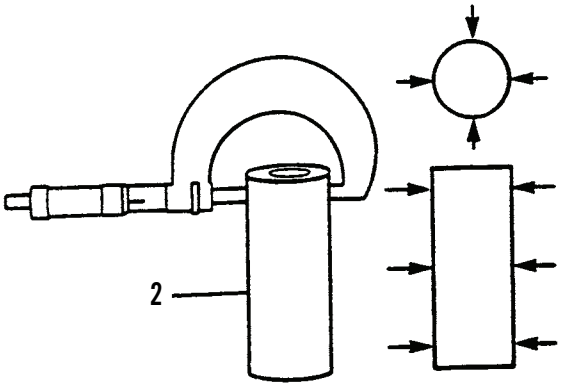


409-985

4. Check piston pin bore diameter (13) at four points noted. Maximum allowable bore diameter is 1.5758 in. (40.02 mm).
5. Check piston pin (2) diameter at six points as shown. Minimum allowable pin diameter is 1.5744 in. (39.98 mm).



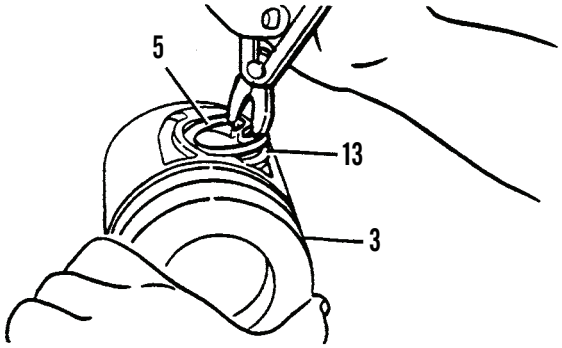
409-986



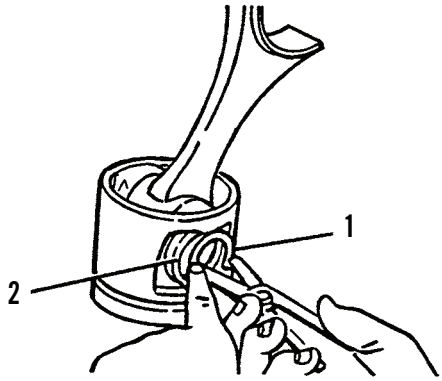
409-987

INSTALLATION

1. Install retaining ring (5) into groove on side of piston (3) marked front.
2. Lubricate piston pin (2) and pin bore (13) with clean lubricating oil.

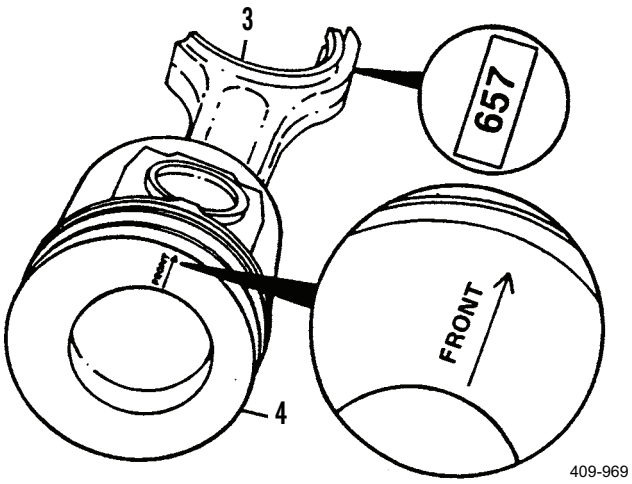


409-949

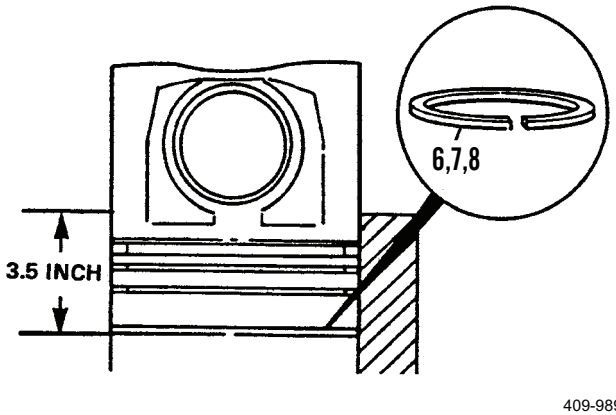


409-988

3. Position word “FRONT” on top of piston (3) and number on connecting rod (4) as shown, and then install piston pin (2).
4. Install second retaining ring (1).
5. Place each new piston ring (6 thru 8), individually, into cylinders to a depth of 3.5 in. (88.9 mm) and square ring in bore using piston as shown.



409-969

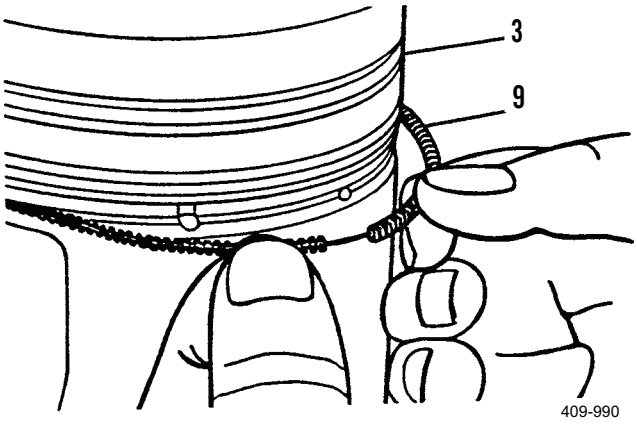


409-989

6. Measure and record new piston ring gaps while rings are in cylinders. Gaps should be as follows:
   a. Top ring gap - 0.0160 to 0.0275 in. (0.4064 mm to 0.6985 mm).
   b. Intermediate ring gap - 0.0100 to 0.0215 in. (0.254 to 0.5461 mm).
   c. Oil control ring gap - 0.0100 to 0.0215 in. (0.254 to 0.5461 mm).
7. If gaps are excessive, select next oversized piston ring set.
8. If gaps are too close, and new piston sleeves have been installed, bore out piston sleeves as necessary to allow gaps to open up to specification.

INSTALLATION - CONTINUED

9. Place oil control ring expander (9) in bottom groove in piston (3).
10. Install new oil control ring (8) over expander (9), with gap in oil control ring (8) positioned 180 degrees from gap in expander (9).
11. Install new intermediate ring (7), placing its gap at a point of 120 degrees from gap in oil control ring (8).
12. Install new top ring (6), placing its gap at a point of 120 degrees from gap in intermediate ring (7).



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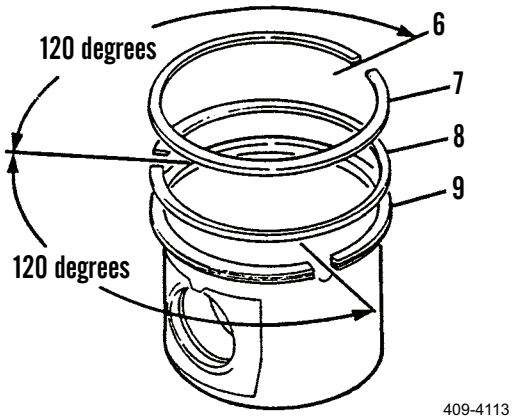


409-4113

13. Install rod/piston assemblies in engine (WP 0277 00).

END OF WORK PACKAGE

CONNECTING RODS AND BEARINGS MAINTENANCE 0277 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Tool kit, machinists: post, camp and station (Item 40, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Detergent, laundry (Item 17, WP 0323 00)

Lubriplate (Item 26, WP 032300)

Oil, lubricating (Item 30, WP 0323 00)

Capscrew (4)

Rod, bearing (5)

References

WP 0271 00

WP 0276 00

WP 0316 00

TM 10-3930-660-10

Equipment Condition

Cylinder head removed (WP 0213 00)

Oil pan removed (WP 0219 00)

Oil pump inlet tube removed (WP 0220 00)

REMOVAL

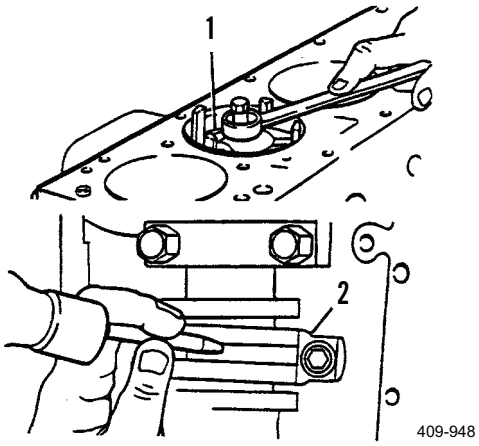
CAUTION

Maximum allowable cylinder bore diameter is 4.0203 in. (102.1156 mm). Make sure that ridge reamer does not gouge into cylinder bore or remove more metal than necessary.

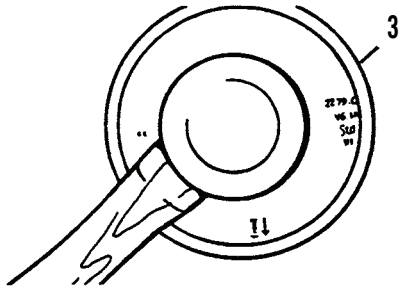
NOTE

If necessary, remove ridge from top of cylinders using ridge reamer.

1. Mark each rod bearing cap (2) and matched piston (3) with cylinder no. Use a hammer and steel no. stamps.

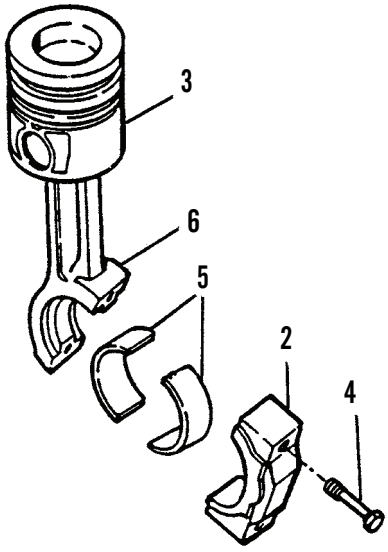


409-948



409-992

2. Remove capscrews (4), rod bearing cap (2) and rod bearings (5). Discard capscrews and rod bearings.



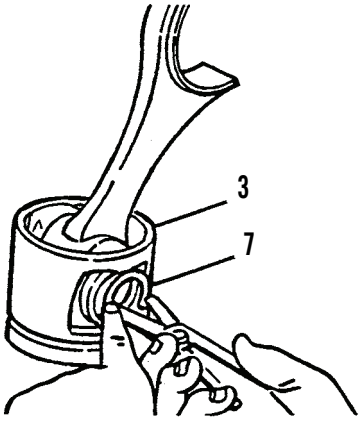
409-993

REMOVAL - CONTINUED

NOTE

Do not reuse connecting rod capscrews.

3. Remove piston (3) and connecting rod (6) assembly by pushing out through top of cylinder block.
4. Remove connecting rod (6) from piston (3).
5. Remove retaining ring (7) from front side of piston (3).
6. Remove piston pin (8) from piston (3) and connecting rod (6) to remove connecting rod (6).



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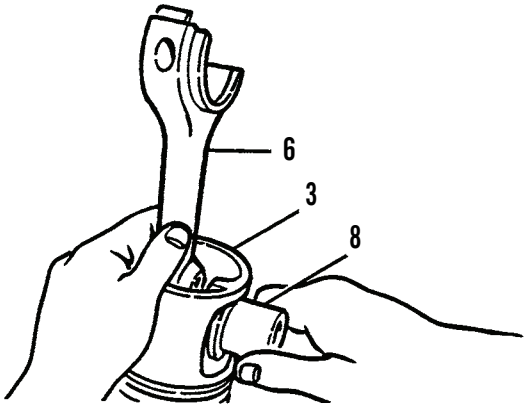


409-995

CLEANING

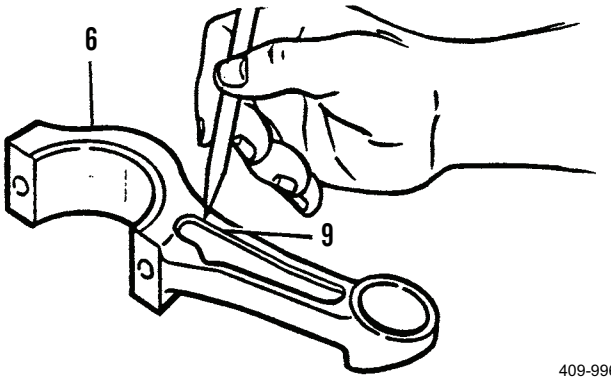
NOTE

Refer to *Cleaning* instructions (WP 0316 00) for general cleaning information and for appropriate warnings regarding use of solvents and compressed air.

1. Wash connecting rods (6) in a strong solution of laundry detergent and hot water.
2. Rinse connecting rods (6) in fresh, clean water and wipe dry using wiping rag.

INSPECTION

1. Visually inspect connecting rods (6) for damage or obvious wear.
2. Check I-beam section (9) of connecting rods (6) for dents or other damage. Any damage in this area can cause stress which will lead to breakage.
3. Measure I.D. of piston pin bore in connecting rod (6), at four points as shown, to check for wear. Take average of all readings. Average reading must not exceed range from 1.5769 to 1.5784 in. (40.0532 to 40.0913 mm).



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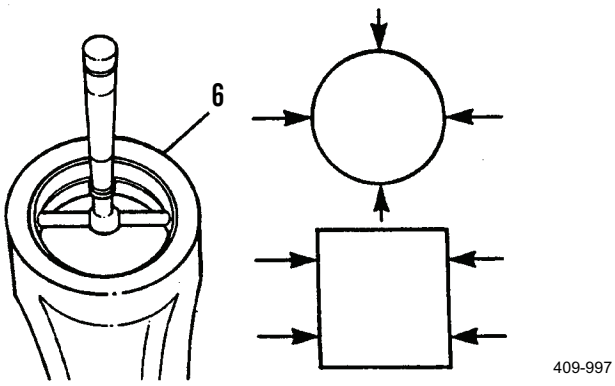
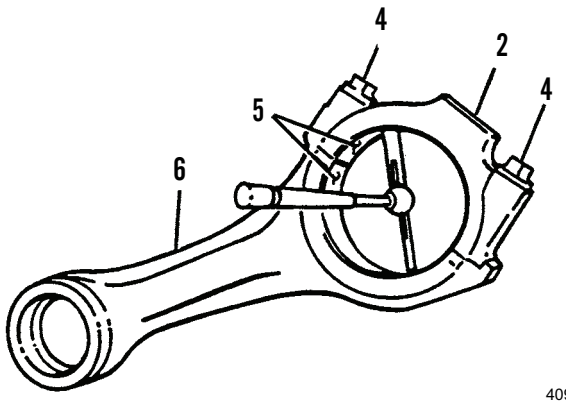


409-997

4. Assemble connecting rod (6), rod bearings (5) and rod bearing cap (2).
5. Install new capscrews (4) and tighten to 73 lb-ft (99 Nm).
6. Record smallest diameter measured at various points around bore.
7. Measure and record mean diameter of rod journal on crankshaft (10). Take four readings on each journal at points noted.
8. Subtract rod journal mean diameter, step 8, from smallest rod bearing diameter, step 6, to determine rod bearing clearance.

NOTE

Maximum allowable rod bearing clearance is 0.0035 in. (0.0889 mm). Select required undersized bearing set to compensate for excessive rod bearing clearance.



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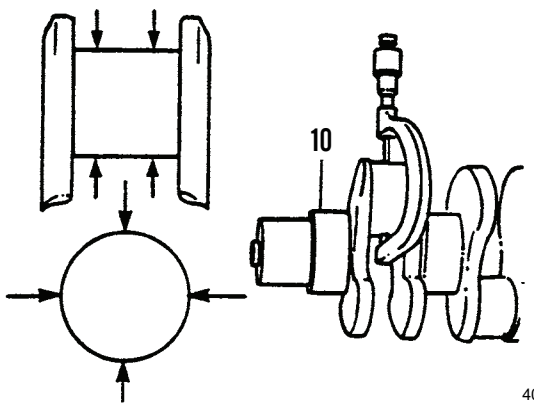


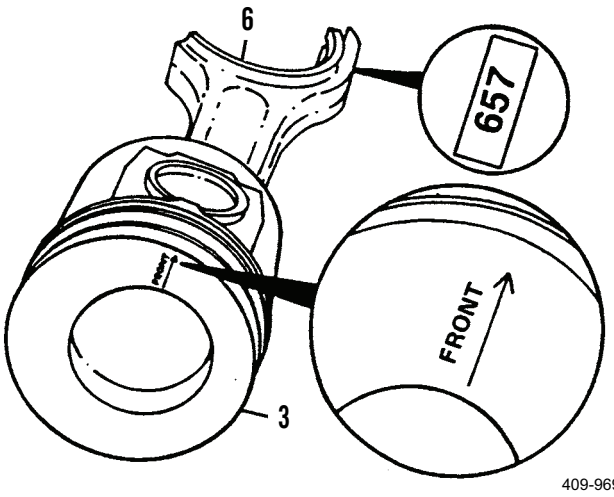
409-999

INSTALLATION

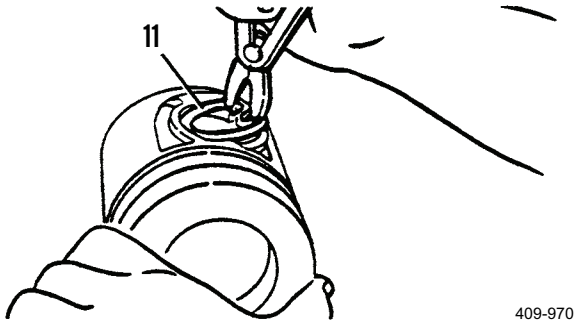
NOTE

If required, replace piston rings (WP 0276 00) before proceeding.

1. Assemble connecting rod (6) to piston (3).
2. Liberally apply clean lubricating oil to piston pin (8) and to piston pin bores in connecting rod (6) and in piston (3).
3. Install retaining ring (11) on side of piston marked FRONT.
4. Orient piston (3) and connecting rod (6) so word FRONT, on top of piston (3), and no. stamped on connecting rod, are positioned as shown.

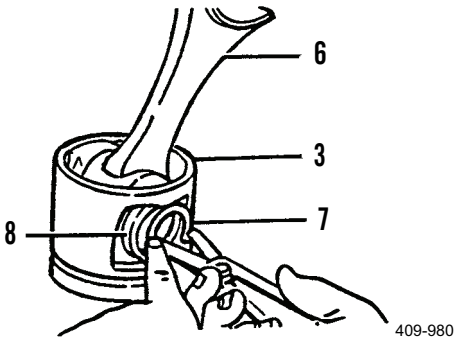


409-969



409-970

5. Install piston pin (8) through bores in piston (3) and in connecting rod (6).
6. Install retaining ring (7).
7. Install piston (3) and connecting rod (6) assembly.
8. Apply clean lubricating oil to cylinder bores, piston rings and piston skirts.



409-980

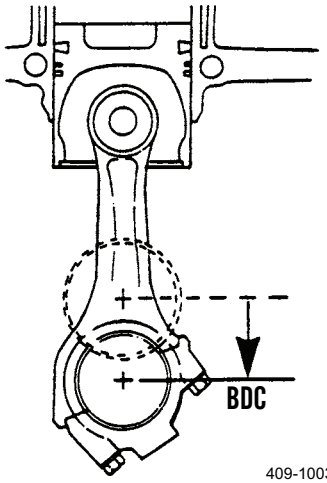
CAUTION

If a strap-type ring compressor is used, do not hook strap on gap of ring. This could cause piston ring to break.

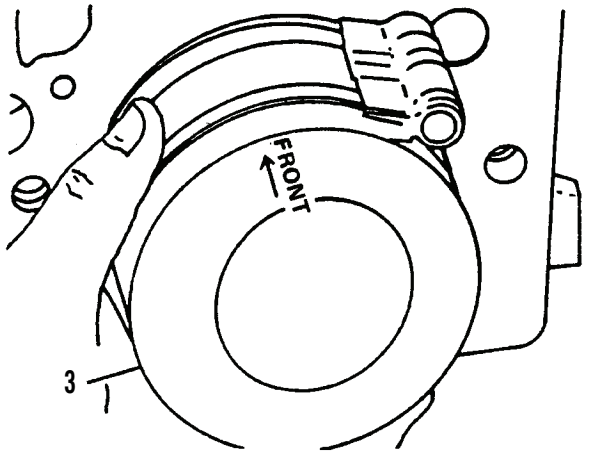
9. Compress piston rings using ring compressor (WP 0276 00).

INSTALLATION - CONTINUED

10. Bar crankshaft over so rod journal for piston and connecting rod assembly being installed is at bottom dead center (BDC).
11. Install piston (3) and connecting rod (6) assembly through top of cylinder bore, using care not to damage cylinder liner walls. Make sure that side of piston (3) with word FRONT faces front (fan end) of engine.
12. Continue to push piston (3) into cylinder bore until top of piston (3) is approximately 2 in. (50.8 mm) below top surface of cylinder block.



409-1003



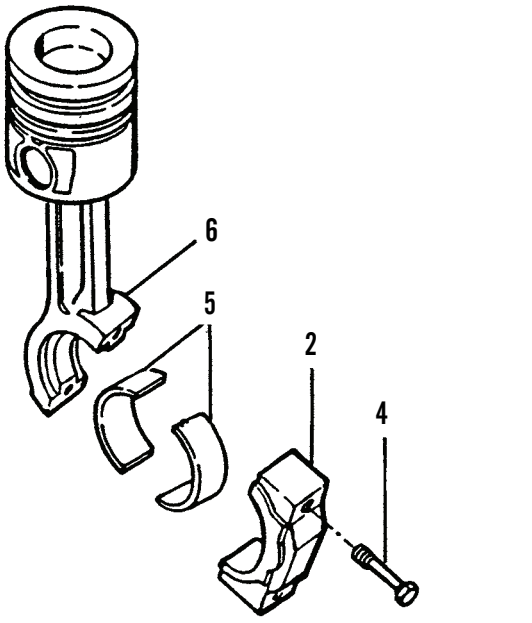
409-1004

13. Repeat above procedure until all six piston and connecting rod assemblies are installed.

NOTE

Obtain proper sized rod bearing set, according to rod bearing clearance measurement (WP 0271 00).

14. Install new rod bearings (5) in connecting rods (6) and caps (2).
15. Apply light coat of lubriplate to rod bearing (5) surfaces.

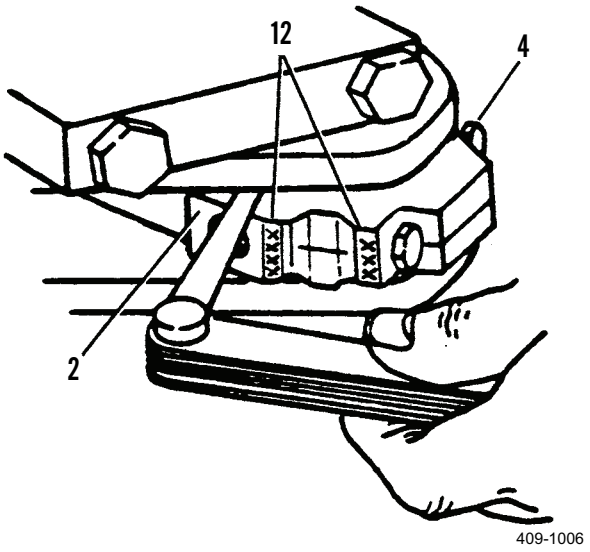


409-1005

16. Grasp bottom of connecting rod (6) and pull downward onto crankshaft rod journal.

INSTALLATION - CONTINUED

17. Install bearing caps (2) with four-digit no. (12) stamped on bearing caps (2) and on connecting rods (6), at parting line, towards oil cooler side of engine.
18. Apply clean lubricating oil to threads and under heads of capscrews (4).



NOTE

As bearing caps are installed, manually rotate crankshaft to ensure that crankshaft rotates freely. If crankshaft fails to rotate freely at some point, check for incorrect installation or incorrect size of rod bearings.

19. Torque capscrews (4) in three increments:
    a. First increment - 26 lb-ft (35 Nm).
    b. Second increment - 52 lb-ft (71 Nm).
    c. Third increment - 73 lb-ft (99 Nm).
20. Repeat until all six piston and connecting rod assemblies are installed.
21. Measure connecting rod side play at each connecting rod assembly. Wear tolerance is 0.012 in. (0.304 mm) maximum.
22. If side play exceeds wear tolerance, stated in step 21, replace connecting rod and connecting rod cap.
23. Install oil pump inlet tube (WP 0220 00).
24. Install oil pan (WP 0219 00).
25. Install cylinder head (WP 0213 00).
26. Run engine and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

CAMSHAFT, GEAR, AND BEARING MAINTENANCE 0278 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning and Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Crocus, cloth (Item 16, WP 0323 00)

Gloves, insulated (Item 19, WP 0323 00)

Lubriplate (Item 26, WP 0323 00)

References

WP 0316 00

TM 10-3930-660-10

Equipment Condition

Engine removed (WP 0209 00)

Rocker lever arms removed (WP 0216 00)

Fuel transfer pump removed (WP 0022 00 or WP 0023 00)

Front housing cover removed (WP 0280 00)

Oil pan removed (WP 0219 00)

REMOVAL

NOTE

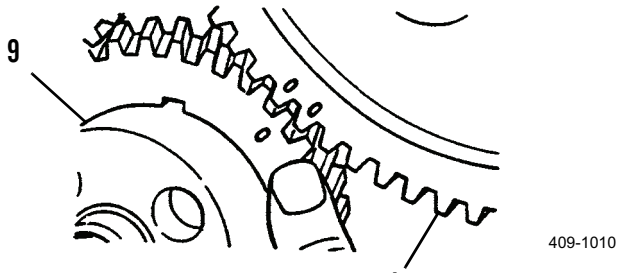
If new tappets were installed, the camshaft and camshaft bushing(s) must be replaced.

1. Turn crankshaft to align timing marks on camshaft gear (4) with timing marks on crankshaft gear (9).

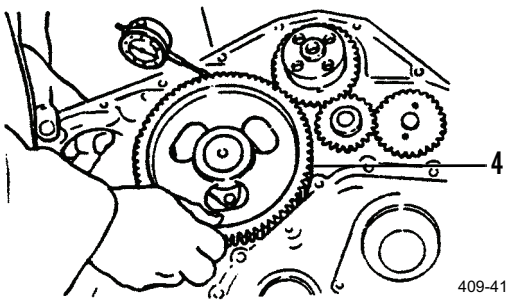
NOTE

When measuring camshaft gear backlash, hold the camshaft gear and the crankshaft gear to avoid getting a false backlash reading.

2. Measure camshaft gear (4) backlash using a dial indicator as shown.
3. Record measured backlash for reference.



409-1010



409-4114

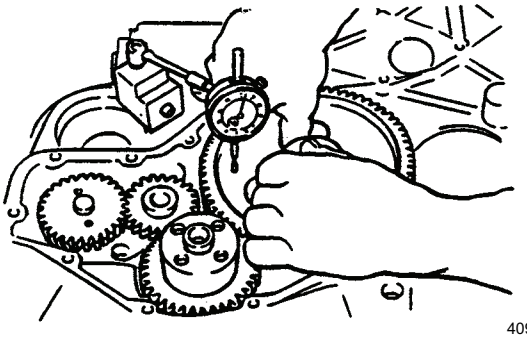
REMOVAL - CONTINUED

4. Measure camshaft end play using a dial indicator positioned on a machined surface of the camshaft gear. Record indicator reading for reference.

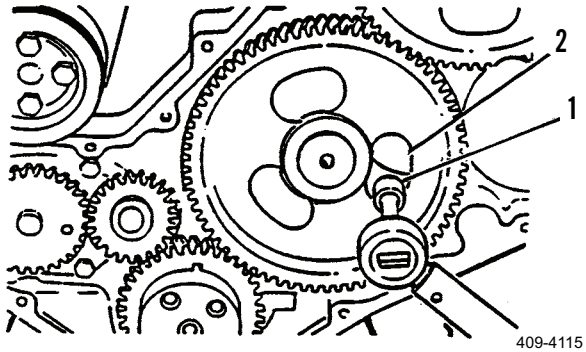
NOTE

To prevent tappets from dropping out of the cylinder block when camshaft is removed, turn engine stand so the crankshaft is facing up.

5. Remove two capscrews (1) from thrust plate (2) and remove thrust plate.



409-1016



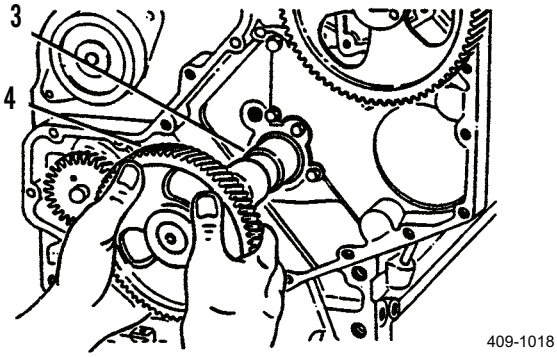
409-4115

6. Slowly and carefully remove camshaft (3) and gear (4), being careful not to damage the camshaft lobes and bearing journals, and camshaft bores in the cylinder block. It may be necessary to slowly turn the camshaft, during removal, to allow lobes to clear the tappets.

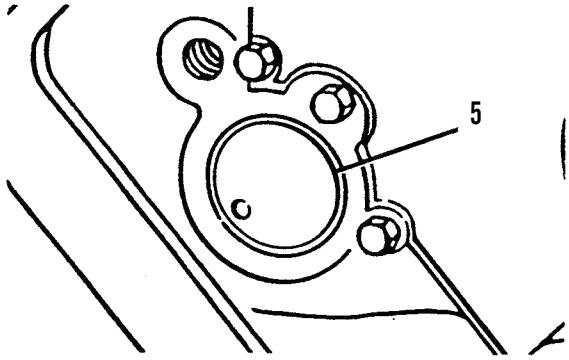
NOTE

If a new camshaft is to be installed, or if the camshaft bushing is damaged or dimensions exceed specified tolerance, refer to *Inspection*, the camshaft bushing, and all service bushings that may be installed in the other cam bores, must be replaced.

7. If necessary, remove camshaft bushing (5) and all cam service bushings.



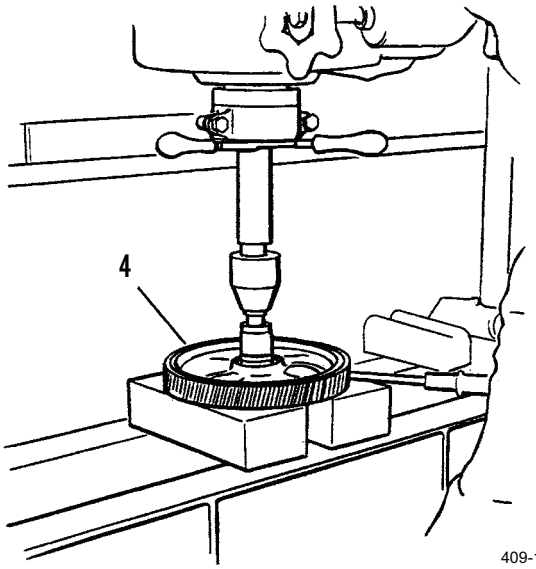
409-1018



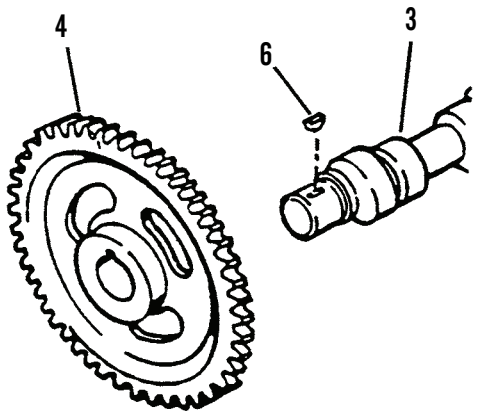
409-1019

DISASSEMBLY

1. Use a press to push gear (4) from camshaft (3).
2. Remove key (6) from camshaft.
3. Use crocus cloth to remove all burrs and smooth any rough surfaces on the camshaft that could have been caused by gear removal.



409-1020



409-1021

CLEANING

See cleaning instructions (WP 0316 00).

INSPECTION

1. Inspect camshaft bushing and camshaft bores in cylinder block.
2. Inspect camshaft bushing and camshaft bores for burrs, scoring, grooves and pitting.
3. Measure front camshaft bushing I.D. Acceptable range is 2.1295 to 2.1314 in. (54.0893 to 54.1375 mm).

NOTE

If intermediate and rear camshaft bores have service bushings installed, the I.D. dimension must be within the tolerance specified in step 3.

4. Measure intermediate and rear camshaft bores I.D. Acceptable bore I.D. range is 2.1295 to 2.1314 in. (54.0893 to 54.1375 mm). If bores are worn beyond this specification, the block must be machined and service bushings installed, or the block must be replaced. Refer to *Depot Level Maintenance*.

NOTE

If new valve tappets are being installed, the camshaft and camshaft bushing must be replaced.

5. Inspect camshaft by inspecting fuel lift pump lobe, valve lobes and camshaft bearing journal for cracking, pitting or other defects.
6. Measure bearing journal diameter. Minimum allowable diameter is 2.1245 in. (53.9623 mm).

INSPECTION - CONTINUED

7. Measure valve lobe diameters at peak of lobe. Minimum allowable intake valve lobe diameter at peak of lobe is 1.852 in. (47.04 mm). Minimum allowable exhaust valve lobe diameter at peak lobe is 1.841 in. (47.04 mm).
8. Measure fuel lift pump lobe diameter. Minimum allowable fuel lift pump lobe diameter is 1.398 in. (35.5 mm).
9. Inspect camshaft gear. If measured backlash is not 0.003 to 0.013 in. (0.076 to 0.33 mm).
10. Inspect gear teeth for damage or excessive wear.
11. Check for cracks at roots of gear teeth.
12. Examine thrust plate for damage, distortion or excessive wear.
13. Discard thrust plate if measured camshaft end play is not 0.007 to 0.011 in. (0.177 to 0.279 mm). Also check for enlarged thrust plate slot in camshaft if end play is excessive.

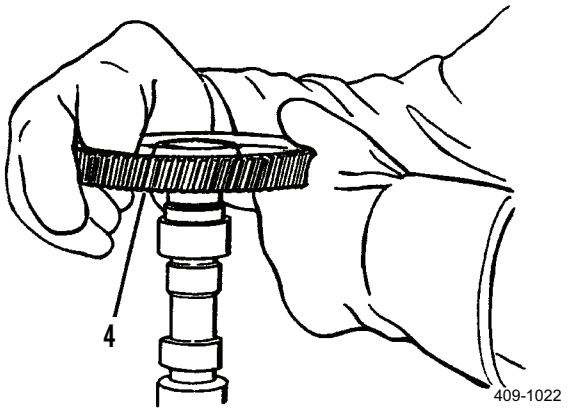
ASSEMBLY

1. Install key (6) in camshaft (3).
2. Install gear (4).
3. Apply lubriplate to gear mounting surface of camshaft (3).
4. Heat gear (4) in an oven to 250°F (121°C) for 45 minutes.

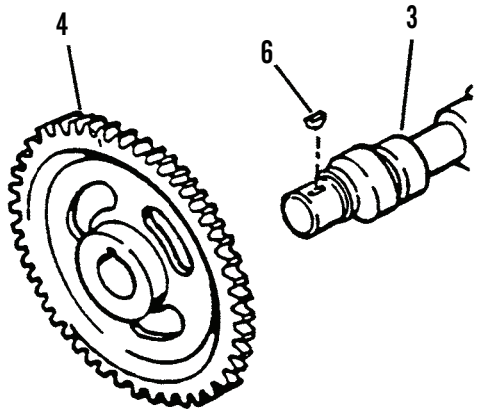
WARNING

Wear protective gloves to handle gear. Gear is hot and can cause severe burns.

5. Install gear (4) on camshaft (3) with timing marks away from camshaft and gear tight against shoulder of camshaft.



409-1022



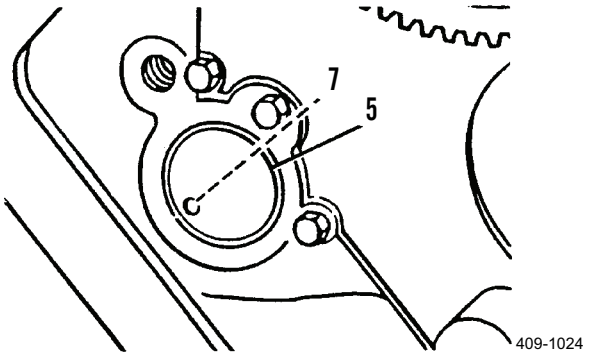
409-1021

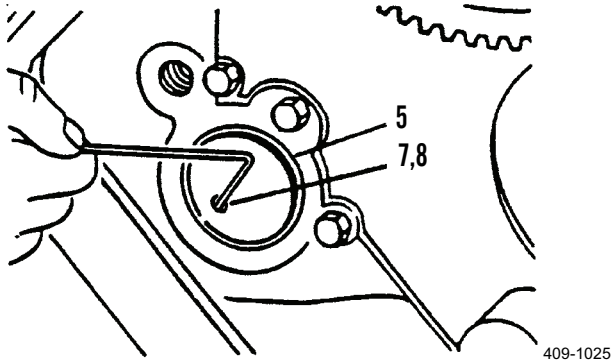
INSTALLATION

NOTE

If a new camshaft is being installed, a new camshaft bushing must be installed.

1. Mark location of oil hole (7) in camshaft bore using felt pen.
2. Place camshaft bushing (5) in its bore, taking care to align oil hole in bushing with oil hole (7) in camshaft bore.
3. Install camshaft bushing (5), using universal bushing installation tool, until bushing is flush with face of cylinder block.
4. Check oil hole alignments by inserting a 0.128 in. (0.325 mm) diameter rod into bushing oil hole (8) and insuring that rod can also enter oil hole (7) in camshaft bore. Remove and reinstall camshaft bushing (5) if oil hole alignment is unsatisfactory.

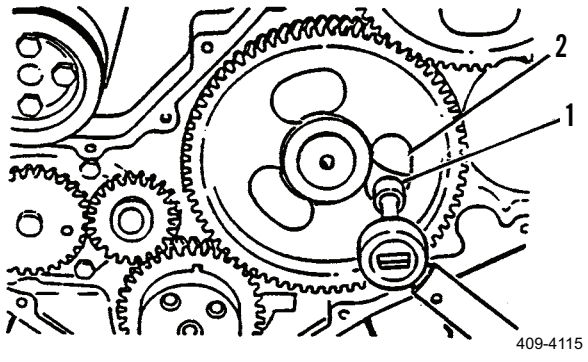




NOTE

The specified rod diameter represents the minimum sized oil passage required for adequate camshaft bushing lubrication.

5. Apply lubriplate to camshaft bores in cylinder block and to lobes of camshaft.
6. Position camshaft/gear/thrust plate in cylinder block.
7. Align timing marks on camshaft gear with timing mark on crankshaft gear.
8. Install capscrews (1) in thrust plate (2) and tighten to 6 lb-ft (8 Nm).
9. Install oil pan (WP 0219 00).



10. Install front housing cover (WP 0280 00).
11. Install fuel transfer pump (WP 0022 00 or WP 0023 00).
12. Install rocker arm levers (WP 0216 00).
13. Install engine (WP 0209 00).
14. Operate engine and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

VALVE TAPPETS MAINTENANCE 0279 00

THIS WORK PACKAGE COVERS

Inspection, Measurement

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 38, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Lubriplate (Item 25, WP 0323 00)

References

WP 0317 00

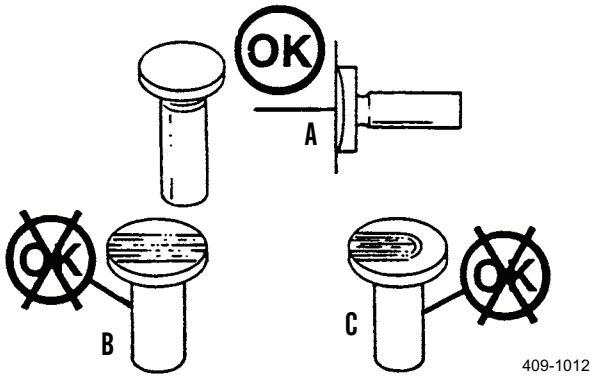
Equipment Condition

Valve tappets removed (WP 0217 00)

INSPECTION

1. See *Inspection* instructions (WP 0317 00).
2. Inspect socket, stem and face for excessive wear and other damage.

Inspection Point	Indication
A	Normal wear
B & C	Abnormal wear, do not reuse.

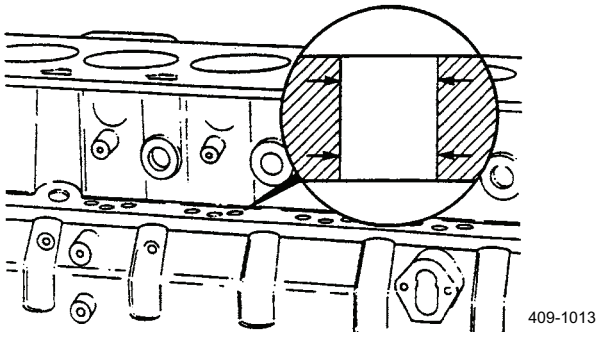


409-1012

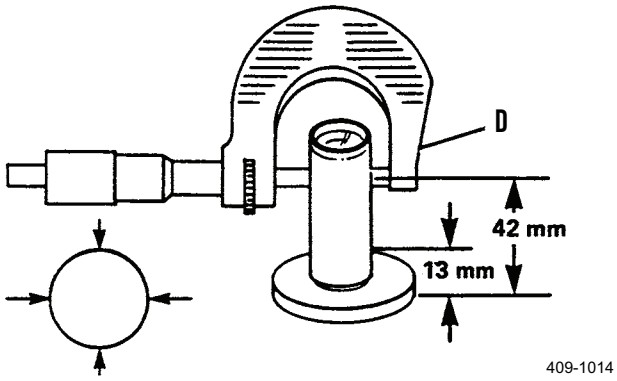
MEASUREMENT

1. Measure tappet bores. If tappet bores in cylinder block are not within specified tolerance, the engine must be rebuilt.

Wear Limit Tolerance
0.630 to 0.632 in. (16 to 16.05 mm)


409-1013

2. Check tappet dimensions (D) minimum diameter = 0.627 in. (16 mm).
3. Check tappet diameter in four places: 1.65 in. (42 mm) from face, 0.51 in. (13 mm) from face and 90 degrees to each measurement.



409-1014

4. Install valve tappets (WP 0217 00).

END OF WORK PACKAGE

FRONT HOUSING AND COVER MAINTENANCE 0280 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 38, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Sealant, Loctite 277 (Item 42, WP 0323 00)

Gasket (8, 10 and 22)

O-ring (18)

Oil seal (12)

Rectangular ring seal (16)

References

WP 0224 00

WP 0225 00

WP 0278 00

WP 0316 00

WP 0317 00

Equipment Condition

Engine removed (WP 0209 00)

STE/ICE-R pulse tachometer and drive assembly removed (WP 0089 00)

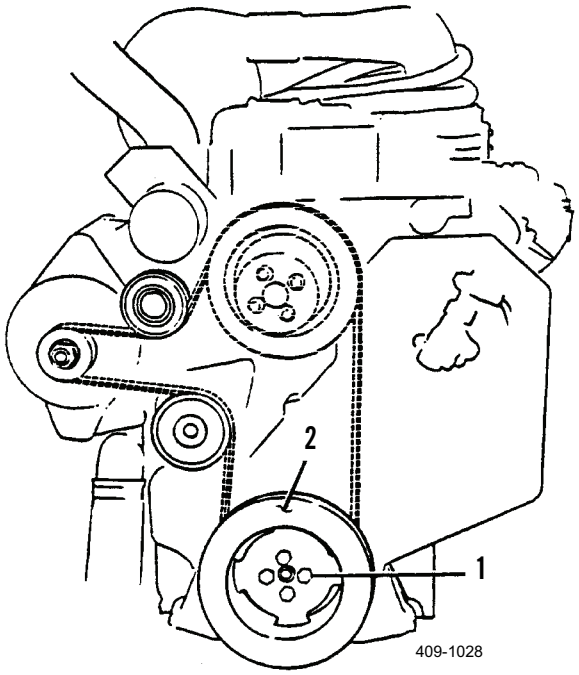
Fan and fan belt removed (WP 0059 00)

REMOVAL

1. Remove four capscrews (1) and vibration damper (2).

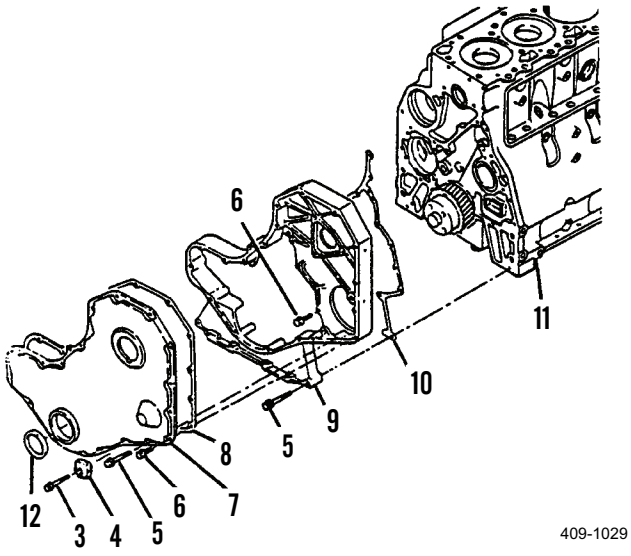
NOTE

Capscrews which retain the gear housing and cover are of three sizes. Note sizes and locations of capscrews during removal to ensure proper assembly.



REMOVAL - CONTINUED

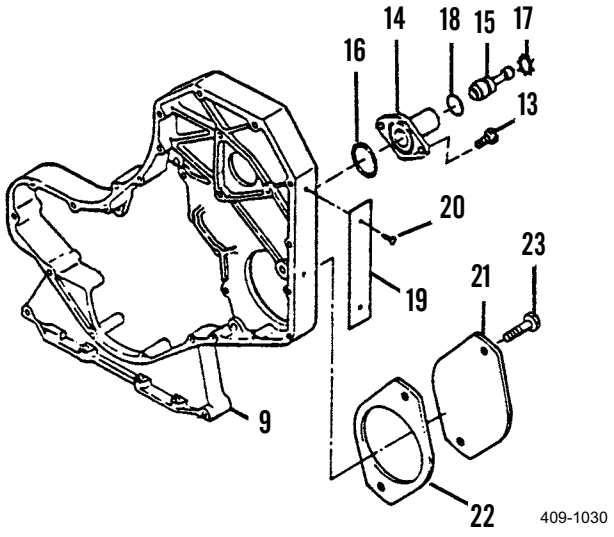
2. Remove long capscrew (3) and belt guide (4).
3. Remove eight capscrews (5) and eleven short capscrews (6) from gear cover (7).
4. Remove gear cover (7) and gasket (8). Discard gasket.
5. Remove camshaft and timing gear (WP 0278 00).
6. Remove fuel injector pump (WP 0224 00 or WP 0225 00).
7. Remove two capscrews (5) and five short capscrews (6) from gear housing (9).
8. Remove gear housing (9) and gasket (10). Discard gasket.
9. Use a gasket scraper to remove old gasket material from cylinder block (11) and gear housing (9).



409-1029

DISASSEMBLY

1. If necessary, remove oil seal (12) from gear cover (7). Discard oil seal.
2. Remove two capscrews (13) which retain the timing pin housing (14).
3. Remove timing pin (15) and housing (14) as an assembly.
4. Remove rectangular ring seal (16) from housing (14). Discard rectangular ring seal.
5. Remove retaining ring (17) from housing (14).
6. Remove timing pin (15) from housing (14).
7. Remove and discard O-ring (18).
8. If necessary, remove dataplate (19) from gear housing (9) by removing two drive screws (20).



409-1030

9. If necessary, remove cover plate (21) and gasket (22) from back of gear housing (9) by removing two capscrews (23). Discard gasket.

CLEANING

See cleaning instructions (WP 0316 00).

INSPECTION

See inspection instructions (WP 0317 00).

ASSEMBLY

CAUTION

If a new housing is installed, the timing pin assembly must be accurately located. Failure to do so could result in improper timing adjustment.

1. If removal was necessary, install cover plate (21) and new gasket (22) onto back of gear housing and retain with two capscrews (23).
2. If removal was necessary, install dataplate (19) onto gear housing (9) and retain with two drive screws (20).
3. Install new O-ring (18) into housing (14).
4. Install timing pin (15) into housing (14).
5. Install retaining ring (17) into housing (14).
6. Install new rectangular ring seal (16) into housing (14).

INSTALLATION

1. Install new gasket (10) and gear housing (9) into cylinder block (11). Install two capscrews (5) and five short capscrews (6). Torque capscrews to 6 lb-ft (8 Nm).
2. Install camshaft and timing gear (WP 0278 00).
3. Install timing pin (15) and housing (14) onto gear housing (9) as an assembly. Install two capscrews (13) finger tight.
4. Hold pin (15) in and engage hole in camshaft gear to ensure proper alignment. Torque capscrews (13) to 48 lb-in. (5 Nm).
5. Pull timing pin (15) out of camshaft gear.
6. Install fuel injection pump (WP 0224 00 or WP 0225 00).

CAUTION

Lips of seal and seal surface on crankshaft should be clean and free of oil prior to installation. Failure to clean surfaces could cause oil to leak at seal.

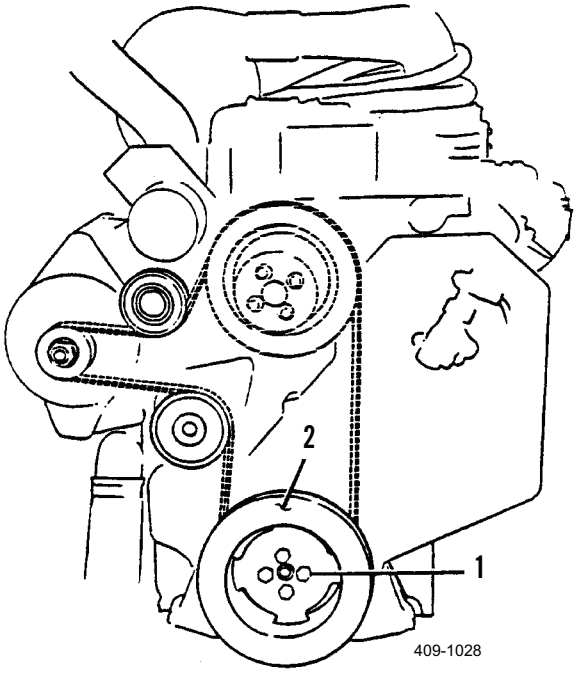
NOTE

- If new seal is installed, perform steps 7 thru 13.
- If old seal is re-used, perform step 14.

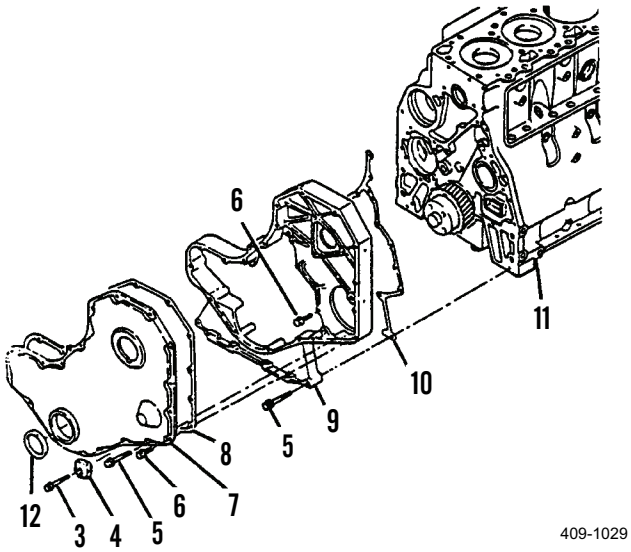
7. If new seal (12) is to be installed, install cover (7) and new gasket (8) onto housing (9) and retain with eight capscrews (5) and eleven short capscrews (6). Install capscrews in locations noted at disassembly. Do not tighten capscrews at this time.
8. Install alignment/installation tool from seal kit onto crankshaft end and into seal bore in gear cover (7) to align cover (7) with crankshaft end.
9. Torque capscrews (5 and 6) to 6 lb-ft (8 Nm).
10. Apply a bead of loctite to outside of new seal (12).
11. Press new seal (12) and seal pilot onto crankshaft end.
12. Remove seal pilot from new seal (12).
13. Use alignment/installation tool included in seal kit to drive seal to correct depth in cover (7) bore.
14. If old seal (12) is to be re-used, install seal pilot from seal kit into inside diameter of old seal (12) to protect lips of old seals (12) during installation.

INSTALLATION - CONTINUED

15. Install new gasket (8) onto housing (9).
16. Install new seal (12) and cover (7) onto housing (9) as an assembly.
17. Install eight capscrews (5) and eleven capscrews (6) through gear cover (7) and into gear housing (9). Torque capscrews to 6 lb-ft (8 Nm).
18. Install capscrews (3) and belt guide (4). Torque capscrews (4) to 6 lb-ft (8 Nm).
19. Install vibration damper (2) and retain with four capscrews (1). Torque capscrews (1) evenly to 101 lb-ft (137 Nm).



409-1028



409-1029

20. Install fan and drive belt (WP 0059 00).
21. Install STE/ICE-R pulse tachometer and drive assembly (WP 0089 00).
22. Install engine (WP 0209 00).
23. Run engine, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TURBOCHARGER ASSEMBLY REPAIR (152 HP) 0281 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Cloth, emery (Item 12, WP 0323 00)

Crocus cloth (Item 16, WP 0323 00)

Sealant, Loctite 59241 (Item 48, WP 0323 00)

Sealant, Loctite 767-41, (Item 49, WP 0323 00)

Oil, lubricating (Item 30, WP 0323 00)

Capscrew (18)

Locknut (9)

Lockplate (12 and 22)

Materials/Parts - Continued

Rectangular ring seal (6)

Retaining ring (27 and 29)

Seal (14, 16 and 26)

Thrust bearing (19)

References

WP 0316 00

WP 0317 00

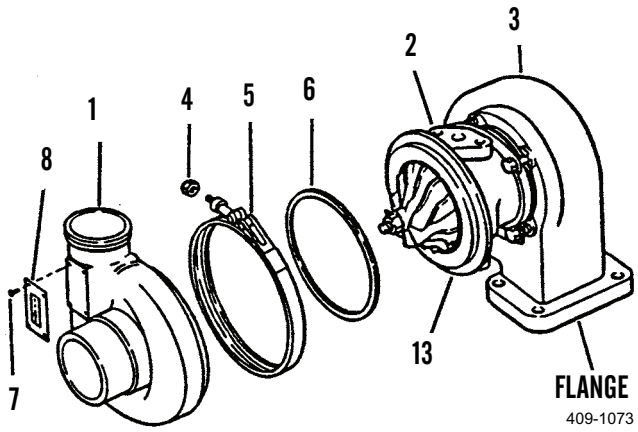
TM 10-3930-660-10

Equipment Condition

Turbocharger removed (WP 0026 00)

DISASSEMBLY

1. Mark compressor housing (1), bearing housing (2), turbine housing (3), and diffuser (13), for correct part orientation at assembly.
2. Place turbocharger in a vise and clamp by the turbine housing inlet flange. Place soft metal covers over vise jaws to prevent damage to turbine housing (3).
3. Loosen nut (4) on V-band clamp (5).
4. Remove compressor housing (1), V-band clamp (5) and rectangular ring seal (6). Discard rectangular ring seal.
5. If damaged, remove four drivescrews (7) and data plate (8).

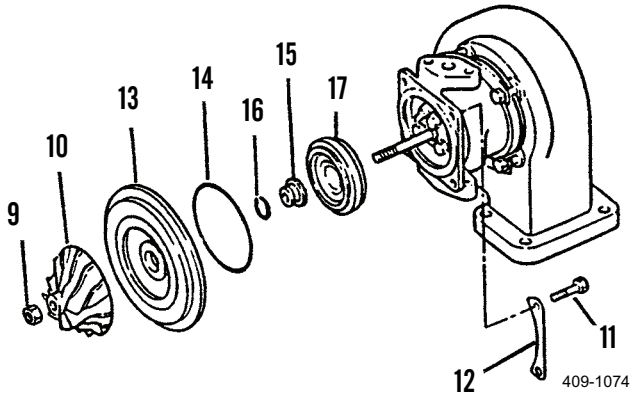


DISASSEMBLY - CONTINUED

NOTE

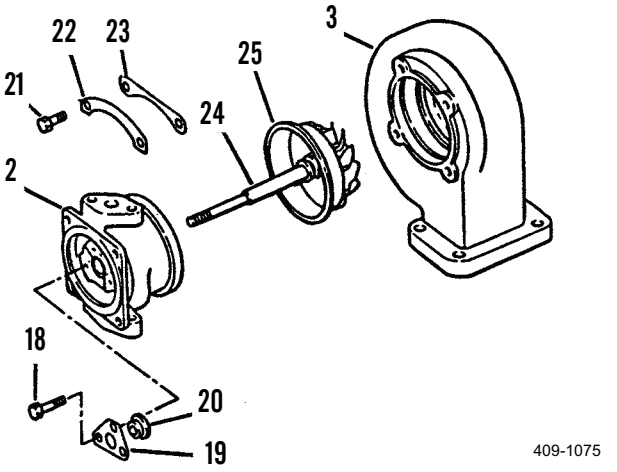
Threads on locknut are left-handed. Turn locknut clockwise to remove.

6. Remove locknut (9) and compressor impeller (10). Discard locknut.
7. Remove four capscrews (11) and two lock plates (12). Discard lock plates.
8. Remove diffuser (13) and diffuser seal (14). Discard seal.
9. Remove oil slinger (15) and split ring seal (16) as an assembly from the diffuser (13).
10. Remove split ring seal (16) from oil slinger (15). Discard split ring seal.



409-1074

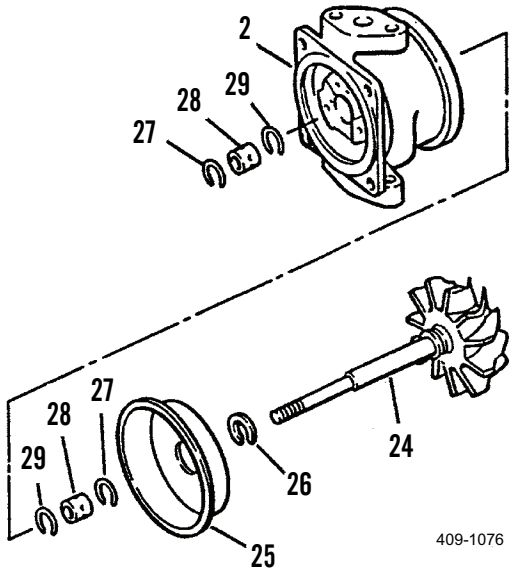
11. Remove oil baffle (17).
12. Remove three capscrews (18) and thrust bearing (19). Discard thrust bearing and capscrews.
13. Remove thrust collar (20).
14. Remove four capscrews (21), two lock plates (22) and clamping plate (23). Discard lock plates and capscrews.
15. Remove bearing housing (2) from turbine housing (3).
16. Remove shaft and wheel (24) and heat shield (25) from bearing housing (2) as an assembly.
17. Remove heat shield (25) from shaft and wheel (24).
18. Remove split ring seal (26) from shaft and wheel (24). Discard split ring seal.



409-1075

DISASSEMBLY - CONTINUED

19. Remove two outer retaining rings (27) from bore of bearing housing (2). Discard retaining rings.
20. Remove two bearings (28). Discard bearings.
21. Remove two inner retaining rings (29) from bore of bearing housing (2). Discard retaining rings.

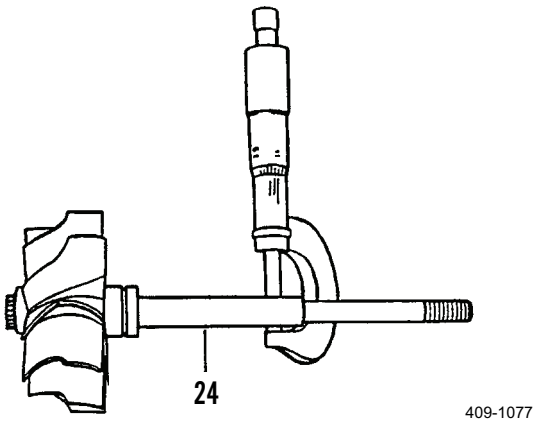


CLEANING

CAUTION

Do not use a wire brush on the compressor wheel. Use of a wire brush on compressor may cause premature component failure.

1. Use a scraper and medium grit emery cloth to remove carbon buildup from turbine housing (3).
2. Polish bearing surfaces on shaft (24) with crocus cloth.
3. For general cleaning instructions, refer to (WP 0316 00).



INSPECTION

1. Measure shaft (24) bearing diameter. Shaft bearing surface minimum diameter is 0.432 in (10.972 mm.)
2. For general inspection instructions, refer to (WP 0317 00).

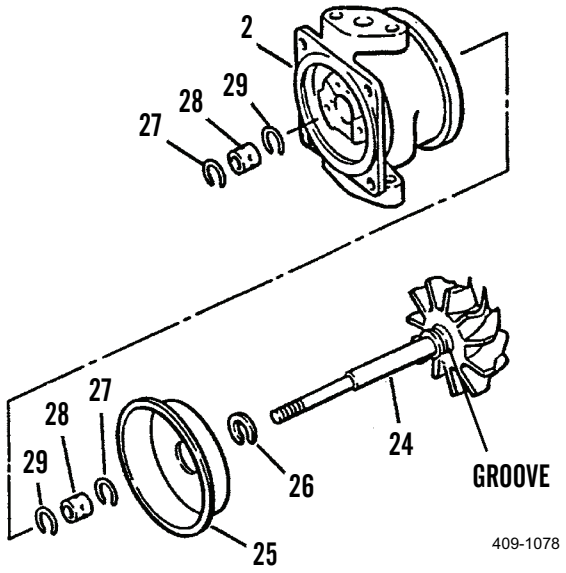
TURBOCHARGER ASSEMBLY REPAIR (152 HP) - CONTINUED

ASSEMBLY

NOTE

Balance marks on shaft, thrust collar and impeller must be aligned to make sure rotating parts of turbocharger are properly balanced.

1. Apply clean lubrication oil to groove on shaft (24).
2. Install new split ring seal (26) onto shaft (24) groove (B).
3. Install heat shield (25) onto shaft (24).
4. Clamp a socket in a vice and place shaft and wheel (24) nut end in socket.



NOTE

Beveled face of retaining rings must face bearings.

5. Install new inner retaining rings (29) into bearing housing (2).
6. Apply clean lubrication oil to new bearings (28).
7. Install new bearings (28) into bearing housing (2).

NOTE

Beveled face of retaining rings must face bearings.

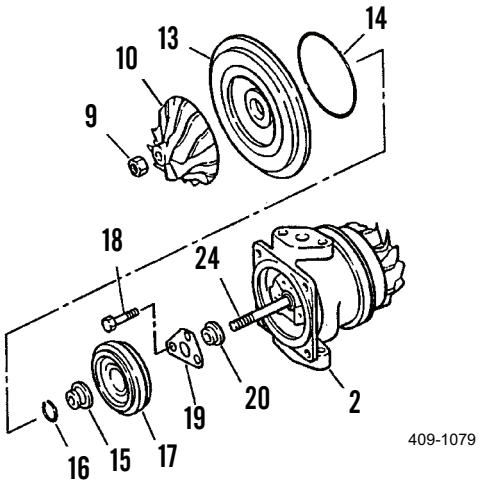
8. Install new outer retaining rings (27) into bearing housing (2).
9. Install bearing housing (2) onto shaft and wheel (24). Rotate housing (2) while pressing onto shaft (24) to seat bearings (28).

ASSEMBLY - CONTINUED

CAUTION

When installing thrust collar, be sure balance mark on collar is aligned with shaft balance mark. Mark top surface of thrust collar so alignment can be verified after installing thrust bearing. Failure to align balance marks could cause premature component failure.

10. Install thrust collar (20) onto shaft and wheel (24).
11. Apply clean lubrication oil to new thrust bearing (19).
12. Install new thrust bearing (19) and secure with three new capscrews (18). Torque capscrews to 40 lb-in. (54 Nm).
13. Install oil baffle (17) onto shaft (24).
14. Install new split ring oil seal (16) onto oil slinger (15).
15. Mark top surface of oil slinger (15) in line with balance mark.
16. Apply clean lubrication oil to outside of oil slinger (15).
17. Install oil slinger (15) and new split ring oil seal (16) into diffuser (13). Install new ring seal (14) into diffuser (13).
18. Align balance marks on shaft (24) and oil slinger (15).



19. Install oil slinger (15) and diffuser (13), as an assembly, onto shaft (24).

CAUTION

- When installing impeller, be sure to align balance marks on shaft and impeller. Failure to do so could cause premature component failure.
- Do not move bearing housing when installing impeller. Moving bearing housing during impeller installation will cause improper balance and premature component failure.

20. Install impeller (10) onto shaft (24).

ASSEMBLY - CONTINUED

CAUTION

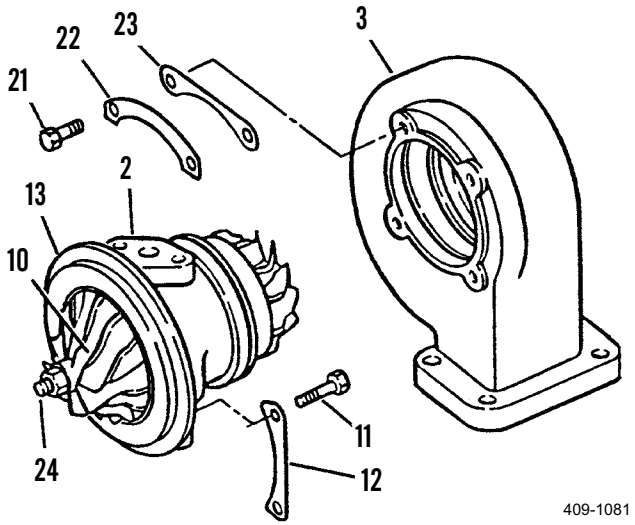
Do not allow impeller to turn when installing locknut. Failure to prevent impeller from turning will result in improper balance and premature component failure.

NOTE

Locknut has left-hand treads, be sure to turn locknut counterclockwise when installing.

21. Install new locknut (9) onto shaft. Torque locknut to 120 lb-in (163 Nm).

22. Install bearing housing (2), impeller (10) and shaft (24) into turbine housing (3) as an assembly.
23. Align match marks on bearing housing (2) and turbine housing (3) that were made at disassembly.
24. Apply Loctite 767-64 to new capscrew (21) threads.
25. Install two new lock plates (22), one clamping plate (23), and four new capscrews (21) into turbine housing.
26. Torque capscrews (21) to 100 lb-in. (136 Nm).
27. Bend lock plate (22) tabs up to secure capscrews (21).



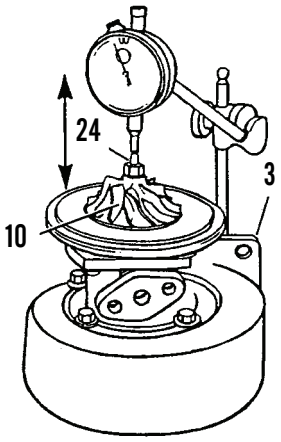
409-1081

28. Install two new lock plates (12) and four capscrews (11) through bearing housing (2) and into diffuser (13).
29. Torque capscrews (11) to 50 lb-in. (68 Nm).

CAUTION

Ensure scribe marks on diffuser, bearing housing and turbine housing are properly aligned during assembly. Failure to properly align components could result in premature component failure.

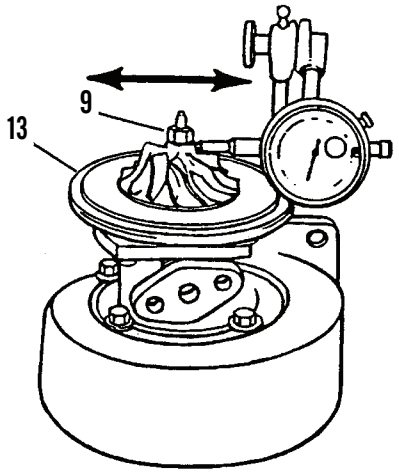
30. Bend lock plate (12) tabs up to secure capscrews (11).
31. Attach a dial indicator to the turbine housing (3). Adjust dial indicator so that plunger is against shaft (24) end.
32. Set dial indicator to zero.
33. Move shaft (24) and impeller (10) assembly back and forth and read end play on dial indicator. If end play is less than 0.001 in. (.0254 mm), or greater than 0.003 in. (.0762 mm), disassemble turbocharger and check for problem. Replace defective parts and assemble.
34. To measure radial clearance of shaft (24), attach a dial indicator to turbine housing. Adjust dial indicator plunger so that plunger is against end of impeller (13) between fins and jamnut (9).



409-1082

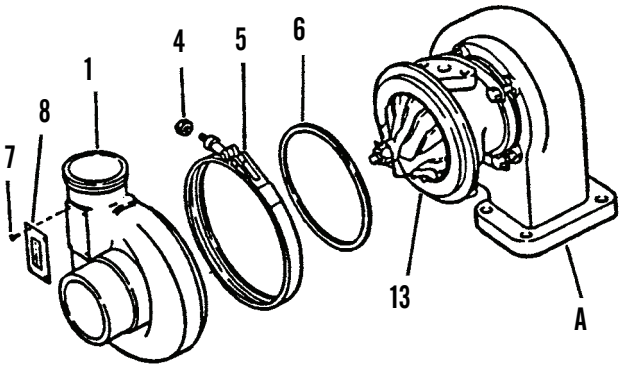
ASSEMBLY - CONTINUED

35. Set dial indicator to zero.
36. Move end of impeller (13) left and right and read radial clearance on dial indicator. If radial clearance is less than 0.012 in. (0.304 mm) or greater than 0.018 in. (0.457 mm), disassemble turbocharger and check for problem. Replace defective parts and assemble.



409-1083

37. If removal was necessary, install dataplate (8) and secure with four drivescrews (7).
38. Install ring seal (6) onto turbocharger diffuser (13).
39. Apply loctite 59241 to V-band clamp (5) bolt threads.
40. Install compressor housing (1) and V-band clamp onto diffuser (13). Torque nut (4) to 120 lb-in. (14 Nm).
41. Tap clamp (5) in four places, 90 degrees apart to seat clamp.



409-1084

42. Re-torque nut (4) to 120 lb-in. (14 Nm).
43. Install turbocharger (WP 0026 00).
44. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TURBOCHARGER ASSEMBLY REPAIR (165 HP) 0282 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 30, WP 0323 00)

Bearing (32)

Gasket (36)

Locknut (4 and 20)

Materials/Parts - Continued

Performed packing (28)

Retaining ring (31 and 33)

Seal ring (22 and 26)

References

WP 0316 00

WP 0317 00

Equipment Condition

Turbocharger removed (WP 0026 00)

DISASSEMBLY

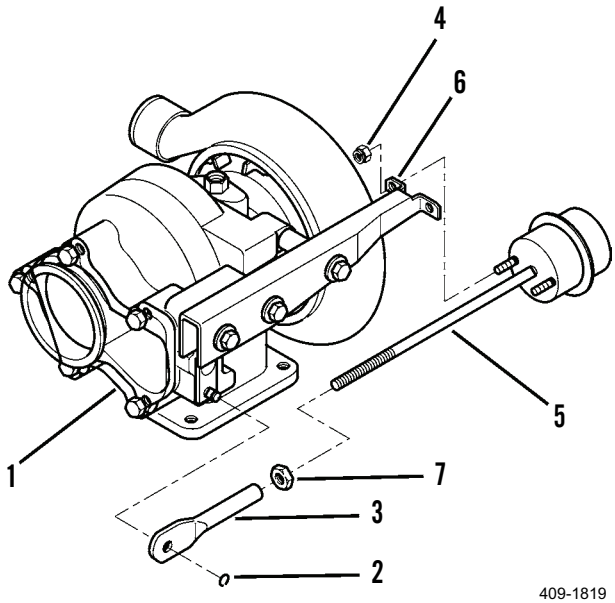
1. Place turbocharger in a vise with soft jaws and clamp by the turbine housing (1) inlet flange.

NOTE

Note position and length of control rod from boost capsule actuator for aid in installation.

WARNING

Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

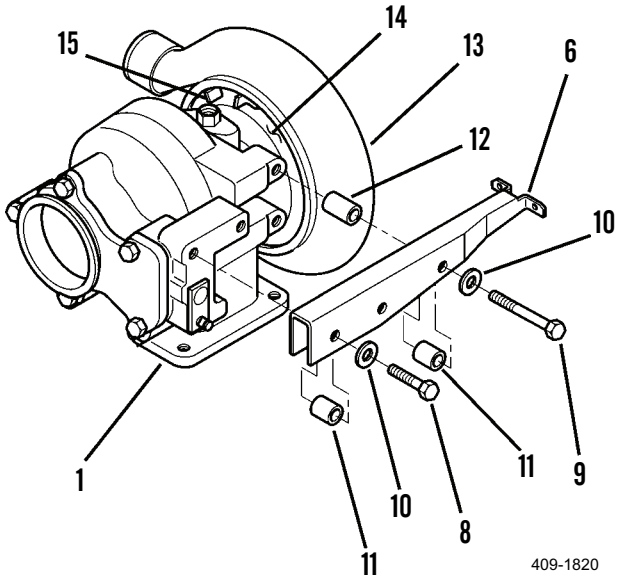


409-1819

2. Remove retaining ring (2) from turbine housing (1) control lever.
3. Remove adjusting link (3) from turbine housing (1) control lever.
4. Remove two locknuts (4), boost capsule actuator (5), and adjusting link (3) from bracket (6). Discard locknuts.
5. Loosen nut (7). Remove adjusting link (3) and nut from boost capsule actuator (5).

DISASSEMBLY - CONTINUED

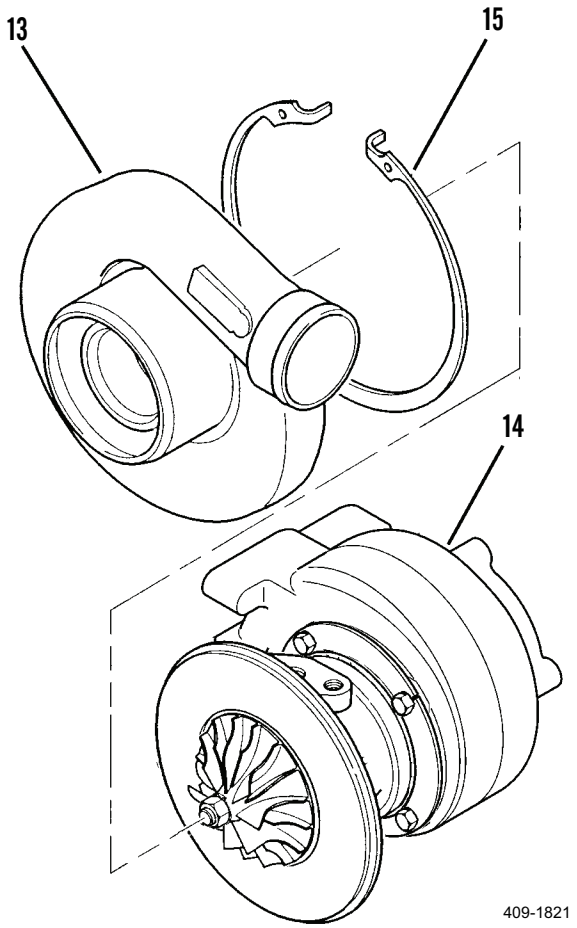
6. Remove three screws (8 and 9), washers (10), spacers (11), one spacer (12) and bracket (6) from turbine housing (1).
7. Mark compressor housing (13), turbine housing (1), bearing housing (14) and retaining ring (15) for aid in assembly.



WARNING

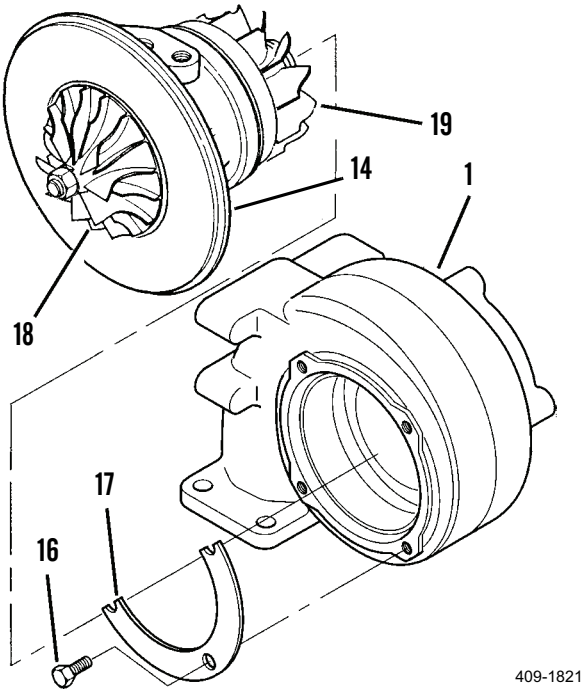
Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

8. Remove retaining ring (15) from compressor housing (13) and bearing housing (14).
9. Remove compressor housing (13) from bearing housing (14).



DISASSEMBLY - CONTINUED

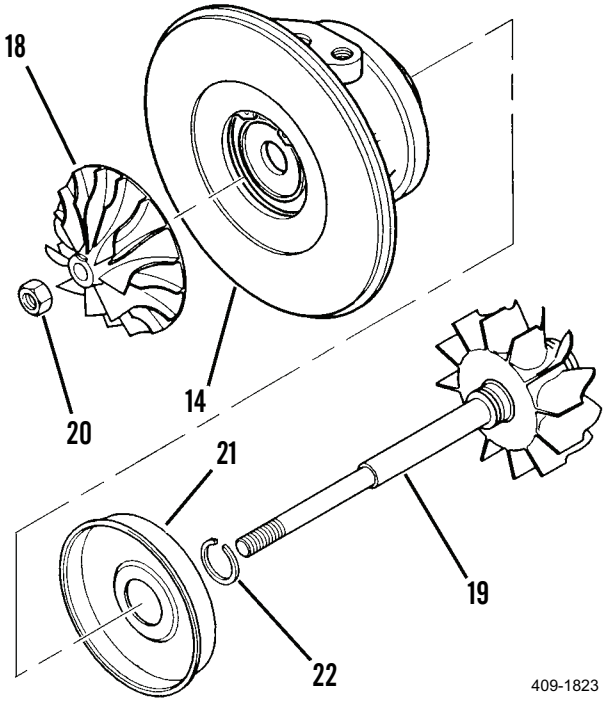
10. Remove four screws (16) and two clamp plates (17) from turbine housing (1).
11. Remove impeller (18), bearing housing (14), and shaft and wheel (19) as an assembly from turbine housing (1).
12. Place bearing housing (14) in a vise with soft jaws.



NOTE

Threads on locknut are left-handed. Turn locknut clockwise to remove.

13. Remove locknut (20) and impeller (18) from shaft and wheel (19). Discard locknut.
14. Remove turbocharger shaft and wheel (19) and heat shield (21) from bearing housing (14).
15. Remove seal ring (22) from turbocharger shaft and wheel (19). Discard seal ring.

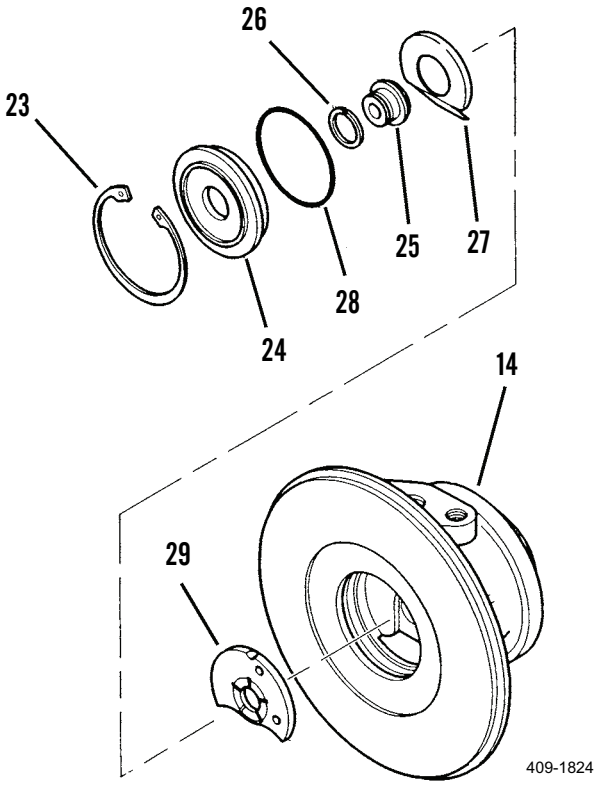


DISASSEMBLY - CONTINUED

WARNING

Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

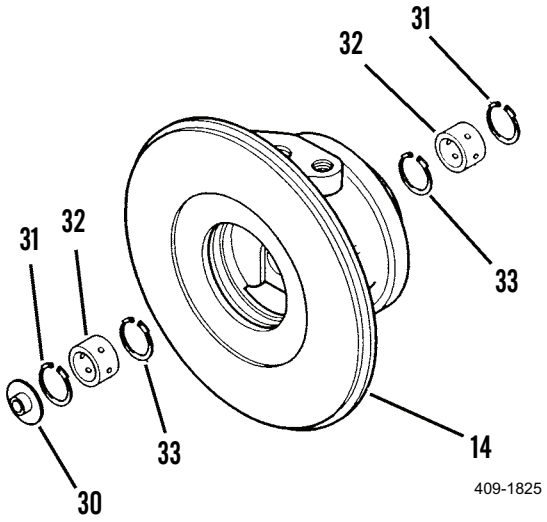
16. Remove retaining ring (23) from bearing housing (14).
17. Using two flat-nose pliers, remove oil seal plate (24) from bearing housing (14).
18. Remove oil slinger (25) and seal ring (26) from oil seal plate (24). Discard seal ring.
19. Remove oil baffle (27) from oil seal plate (24).
20. Remove and discard preformed packing (28) from bearing housing (14).
21. Remove thrust bearing (29) from bearing housing (14).
22. Remove thrust collar (30) from bearing housing (14).



WARNING

Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

23. Remove two outer retaining rings (31) from bore of bearing housing (14). Discard retaining rings.
24. Remove two bearings (32) from bearing housing (14). Discard bearings.

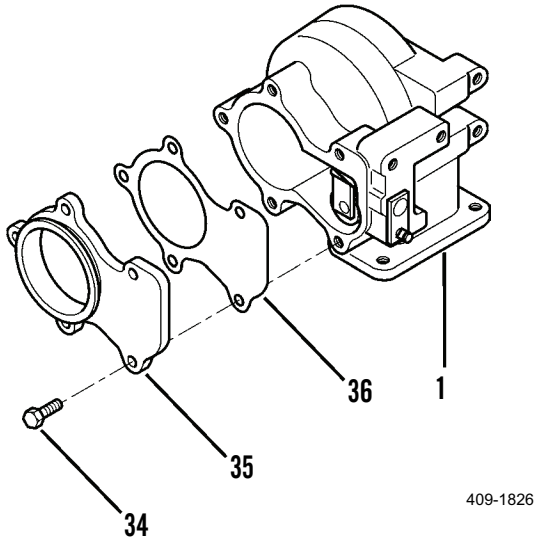


DISASSEMBLY - CONTINUED

WARNING

Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

25. Remove two inner retaining rings (33) from bore of bearing housing (14). Discard retaining rings.
26. If damaged, remove five screws (34), adapter (35) and gasket (36) from turbine housing (1). Discard gasket.



CLEANING

CAUTION

Do not use a wire brush on the compressor wheel. Use of a wire brush on compressor wheel may cause premature component failure.

1. Use a scraper and medium grit emery cloth to remove carbon buildup from turbine housing (1).
2. For general cleaning instructions, see *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Measure turbocharger shaft and wheel (19) bearing diameter. Shaft bearing surface minimum diameter is 0.432 in. (11 mm).
2. Measure bearing housing (14) bore diameter. Bearing housing bore minimum diameter is 0.6254 in. (16 mm).
3. For general inspection instructions, see *Inspection* (WP 0317 00).

ASSEMBLY

NOTE

Balance marks on shaft and wheel, impeller, thrust collar and oil slinger must be aligned to make sure rotating parts of turbocharger are properly balanced.

1. If removed, install new gasket (36), adapter (35) and five screws (34) on turbine housing (1).

ASSEMBLY - CONTINUED

WARNING

Use care when installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

NOTE

Beveled face of retaining rings must face bearings.

2. Install two inner retaining rings (33) in bearing housing (14) bore.
3. Apply engine oil to two bearings (32).
4. Install new bearings (32) in bearing housing (14).

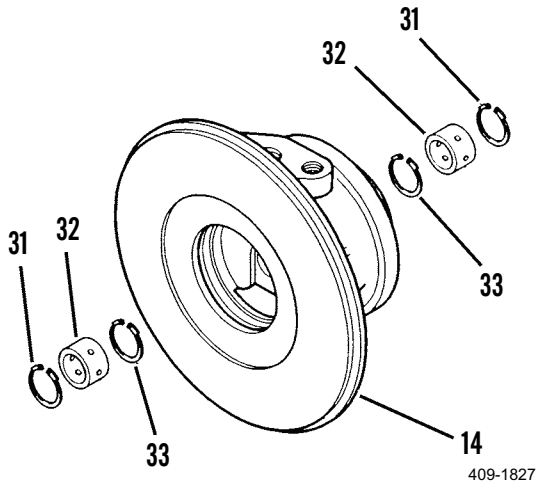
WARNING

Use care when installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

NOTE

Beveled face of retaining rings must face bearings.

5. Install two outer retaining rings (31) in bearing housing (14).



ASSEMBLY - CONTINUED

6. Position heat shield (21) on bearing housing (14).
7. Install seal ring (22) on shaft and wheel (19).

CAUTION

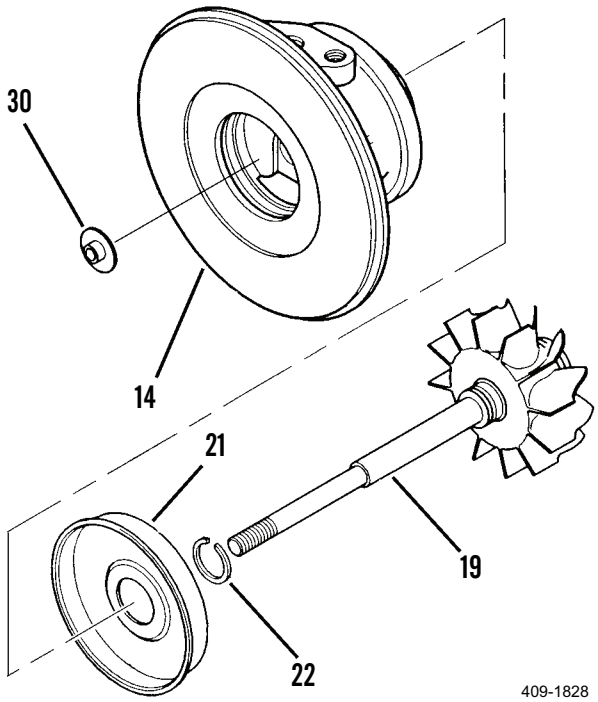
Ensure that seal ring gap is positioned 180 degrees from bearing housing drain hole to prevent damage to turbocharger assembly.

8. Install turbocharger shaft and wheel (19) and seal ring (22) as an assembly in bearing housing (14).
9. Apply engine oil on turbocharger shaft and wheel (19) shaft.
10. Support turbocharger shaft and wheel (19) and bearing housing (14) in a suitable fixture.

CAUTION

When installing thrust collar ensure balance mark on collar is aligned with shaft and wheel shaft balance mark. Mark top surface of thrust collar so alignment can be verified after installing thrust bearing. Failure to align balance marks could cause premature component failure.

11. Install thrust collar (30) on turbocharger shaft and wheel (19).



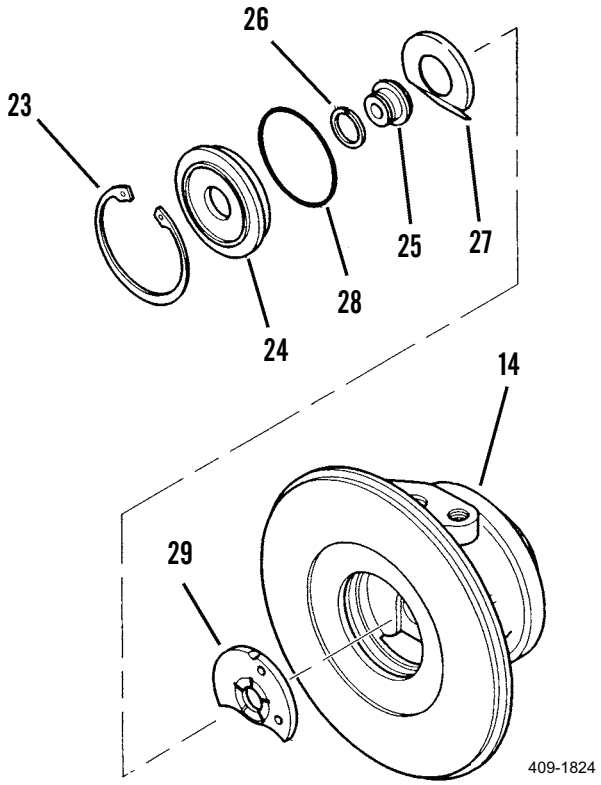
ASSEMBLY - CONTINUED

12. Apply engine oil to thrust bearing (29).
13. Install thrust bearing (29) in bearing housing (14).
14. Install seal ring (26) on oil slinger (25).
15. Apply engine oil to oil slinger (25).
16. Install oil slinger (25) in oil seal plate (24).
17. Install oil baffle (27) in oil seal plate (24).
18. Install preformed packing (28) on oil seal plate (24).

CAUTION

When installing oil slinger ensure balance mark on collar is aligned with shaft and wheel balance mark. Failure to align balance marks could cause premature component failure.

19. Install oil seal plate (24) in bearing housing (14).



WARNING

Use care when installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

20. Install retaining ring (23) in bearing housing (14).

ASSEMBLY - CONTINUED

CAUTION

- When installing impeller ensure balance marks on shaft and wheel and impeller. Failure to do so could cause premature component failure.
- Do not move bearing housing when installing impeller. Moving bearing housing during impeller installation will cause improper balance and premature component failure.

21. Install impeller (18) on turbocharger shaft and wheel (19).

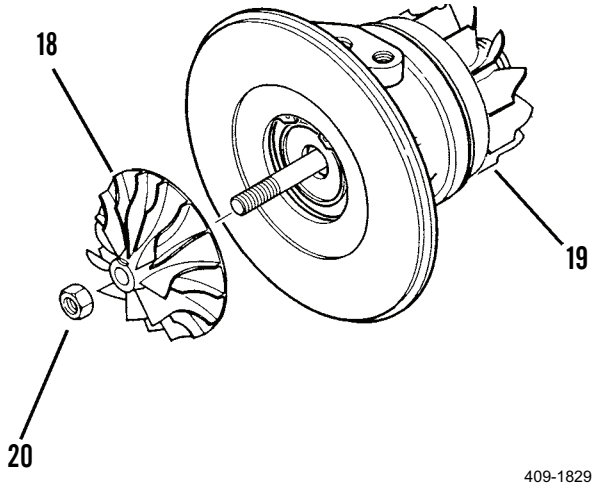
CAUTION

Do not allow impeller to turn when installing locknut. Failure to prevent impeller from turning will result in improper balance and premature component failure.

NOTE

Locknut has left-hand threads, be sure to turn locknut counterclockwise when installing.

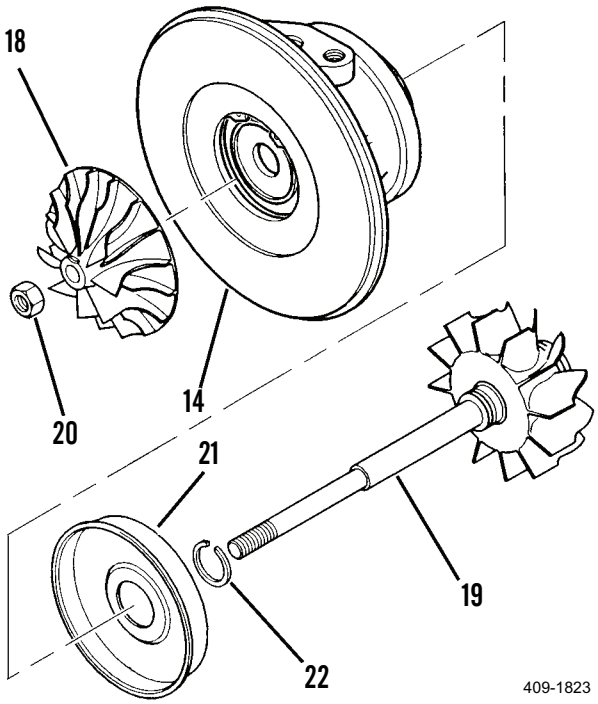
22. Install locknut (20) on turbocharger haft and wheel (19). Torque locknut to 150 lb-in. (203 Nm).



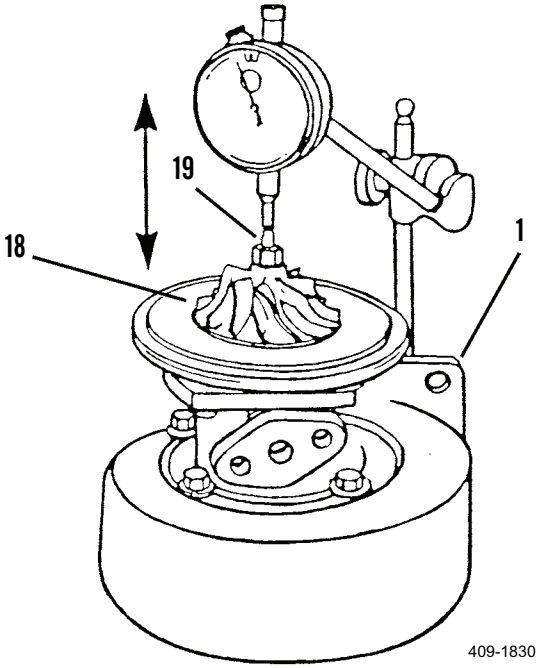
409-1829

ASSEMBLY - CONTINUED

23. Install impeller (18), bearing housing (14) and turbocharger shaft and wheel (19) into turbine housing (1) as an assembly.
24. Align match marks on bearing housing (14) and turbine housing (1) that were made at disassembly.
25. Install two clamp plates (17) and four screws (16) on turbine housing (1). Torque bolts to 120 lb-in. (163 Nm).

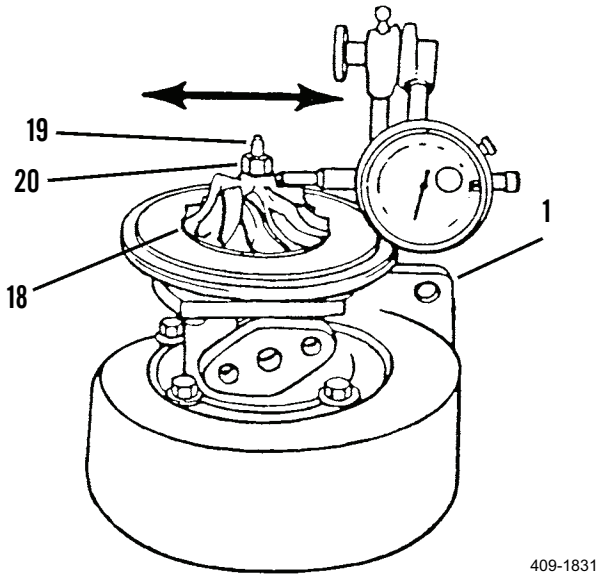


26. Measure turbocharger shaft and wheel (19) end play.
27. Attach a dial indicator to the turbine housing (1). Adjust dial indicator-so that plunger is against shaft and wheel (19) end.
28. Set dial indicator to zero.
29. Move turbocharger shaft and wheel (19) and impeller (18) assembly back and forth and read end play on dial indicator. If end play is less than 0.0015 in. (0.381 mm), or greater than 0.0037 in. (0.939 mm), disassemble turbocharger, steps 8-25 and check for problem. Replace defective parts and assemble, steps 2-26.



ASSEMBLY - CONTINUED

30. Measure radial clearance of turbocharger shaft and wheel (19).
31. Attach a dial indicator to turbine housing (1). Adjust dial indicator plunger so that plunger is against end of impeller (18) between fins and nut (20).
32. Set dial indicator to zero.
33. Move end of impeller (18) left and right and read radial clearance on dial indicator. If radial clearance is less than 0.0128 in. (0.3251 mm) or greater than 0.018 in. (0.4572 mm), disassemble turbocharger, Steps 8-25, and check for problem. Replace defective parts and assemble, steps 2-29.



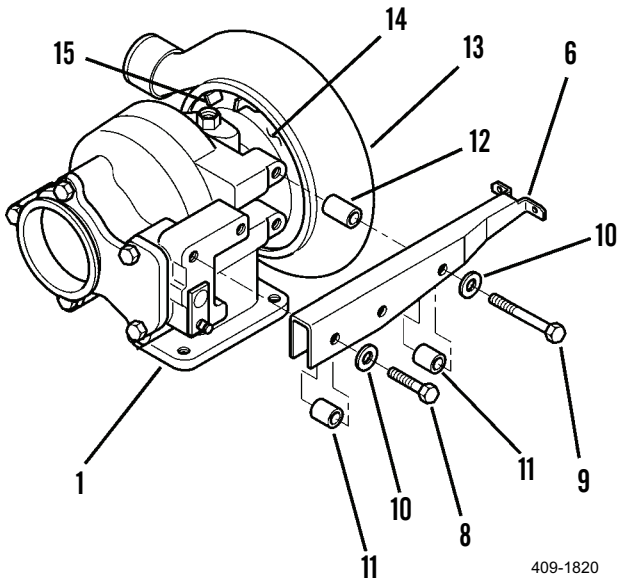
409-1831

34. Position compressor housing (13) on bearing housing (14).

WARNING

Use care when installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

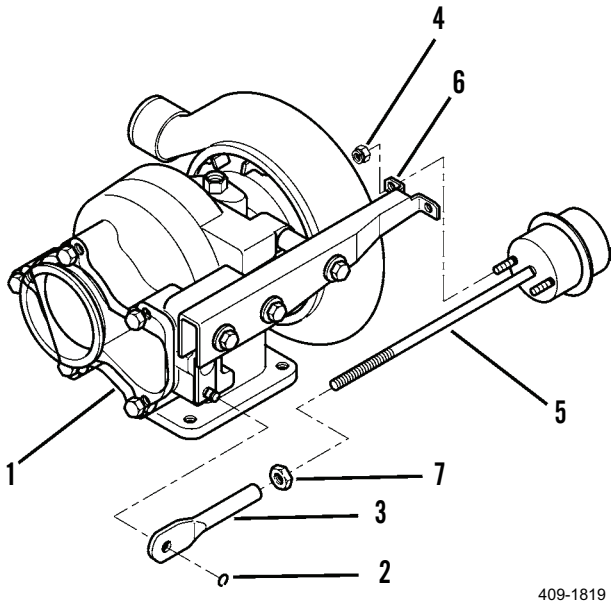
35. Install retaining ring (15) on compressor housing (13) and bearing housing (14).
36. Install bracket (6), spacer (12), three spacers (11), washers (10) and screws (8 and 9) on turbine housing (1).



409-1820

ASSEMBLY - CONTINUED

37. Install nut (7) and adjusting link (3) on boost capsule actuator (5).
38. Install boost capsule actuator (5) and two locknuts (4) on bracket (6). Torque locknuts to 40 lb-in. (54 Nm).
39. Install turbocharger (WP 0026 00).
40. Measure boost capsule actuator (5) travel. Specified travel should be 0.013 to 0.050 in. (0.33-1.27 mm).
41. Attach a dial indicator to the turbine housing (1).
42. Set dial indicator to zero.
43. Apply 27.7 psi (191 kPa) regulated air pressure to boost capsule actuator (5).
44. Measure boost capsule actuator (5) travel. If travel is less than 0.013 in. (0.33 mm) or greater than 0.050 in. (1.27 mm) replace boost capsule actuator.



45. Position turbine housing (1) lever towards boost capsule actuator (5).

CAUTION

Do not force alignment of boost capsule actuator or adjusting link to avoid causing component damage.

46. Adjust the adjusting link (3) length to where adjusting link aligns with turbine housing (1) lever.

WARNING

Use care when installing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

47. Install adjusting link (3) and retaining ring (2) on turbine housing (1) lever.
48. Disconnect regulated air pressure from boost capsule actuator (5).

END OF WORK PACKAGE

RADIATOR REPAIR 0283 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

References

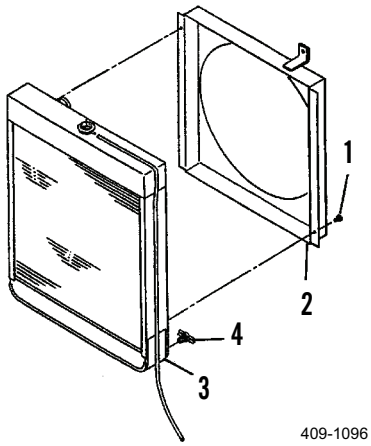
TM 10-3930-660-10

Equipment Condition

Radiator removed (WP 0053 00)

DISASSEMBLY

1. If necessary, remove eight screws (1) and shroud (2) from radiator (3).
2. Remove drain petcock (4).



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.

CAUTION

Do not attempt to clean radiator core fins with any sharp instrument. A sharp instrument may damage core, leading to leakage from core.

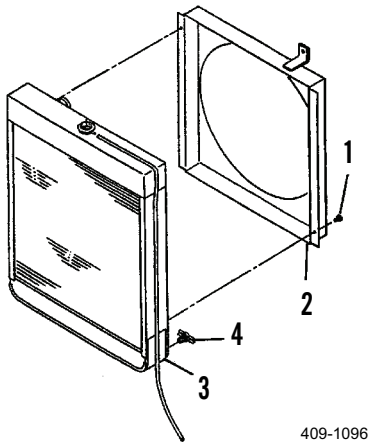
1. Remove dirt and other debris from core fins using compressed air.
2. Remove any surface corrosion from upper and lower tanks using a wire brush or sandpaper.

INSPECTION

1. Inspect core and upper and lower tanks for small holes, or for other evidence of minor leaks. Repair minor leaks by soldering or brazing.
2. Check filler cap opening pressure in a suitable tester. Opening pressure must be a minimum of 7 psi (48 kPa).
3. Check drain petcock (4) for damaged threads or signs of leakage.

ASSEMBLY

1. Install drain petcock (4).
2. Assemble shroud (2) to radiator (3) and secure with eight screws (1).



3. Install radiator (WP 0053 00).
4. Operate engine, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

ALTERNATOR ASSEMBLY MAINTENANCE (152 HP) 0284 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Testing, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, fuel and electrical (Item 22,WP 0324 00)

Materials/Parts

Lubricant, Delco-Remy (Item 24, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Sandpaper (Item 41, WP 0323 00)

Cleaning compound solvent (Item 10, WP 0323 00)

Bearing retainer (11)

Gasket (12)

Materials/Parts - Continued

Lockwasher (10 and 30)

Screw and lockwasher assembly (25)

Seal (41)

Springwasher (22)

References

TM 10-3930-660-10

WP 0316 00

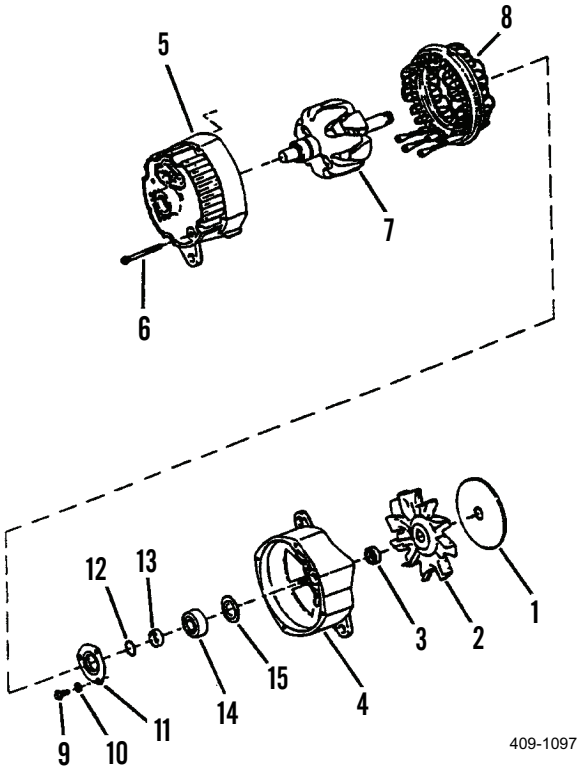
WP 0317 00

Equipment Condition

Alternator and pulley removed (WP 0062 00)

DISASSEMBLY

1. Remove baffle (1), fan (2) and collar (3).
2. Mark frames (4 and 5) to ensure correct orientation during assembly.
3. Remove four through bolts (6) and separate drive end frame (4) and rotor (7) from slip ring end frame (5) and stator (8).
4. Remove rotor (7) using a suitable press.
5. Remove three screws (9), three lockwashers (10), bearing retainer (11) and gasket (12). Discard lockwashers, bearing retainer and gasket.
6. Remove collar (13).
7. Remove ball bearing (14) by pressing towards inside of drive end frame (4). Apply pressure against ID of bearing (14).
8. Remove dust shield (15).



DISASSEMBLY - CONTINUED

9. Remove three nuts (16) that connect stator lead terminal clips (17) to diode trio (18).
10. Remove stator (8) from slip ring end frame (5).
11. Remove insulated screw (19) securing diode trio (18) to brush and holder assembly (20). Remove diode trio (18).

NOTE

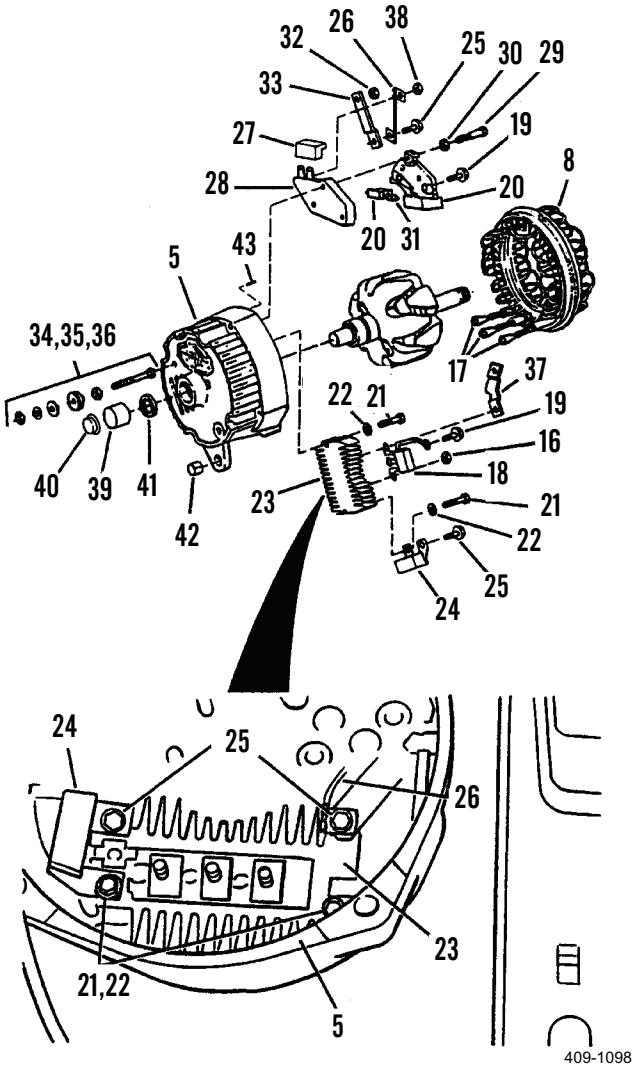
Screws and springwashers are located on the rectifier bridge, closest to outside of frame. One of the screws secures the lower contact of capacitor.

12. Remove two screws (21) and two springwashers (22) from rectifier bridge (23). Discard springwashers.

NOTE

Screw and lockwasher assemblies are located on the rectifier bridge, closest to center of frame. One assembly secures the upper contact of capacitor. The other assembly secures wire lead.

13. Remove two screw and lockwasher assemblies (25) from rectifier bridge (23). Remove capacitor (24) and rectifier bridge (23) from frame (5). Discard screw and lockwasher assemblies.
14. Remove rubber cover (27) from terminals of regulator (28).
15. Remove insulated screw (19), screw (29) and lockwasher (30), securing brush and holder assembly (20), brush springs (31) and regulator (28). Discard lockwasher. Remove parts (20, 28 and 31) from frame (5).



16. If necessary, remove nut (32), connector (33) and battery terminal assembly parts (34).
17. If necessary, remove relay terminal cap (35), relay terminal assembly parts (36) and connector (37).
18. If necessary, remove nut (38) and wire lead (26) from regulator (28).

NOTE

If roller bearing is not being removed, apply pressure sensitive tape over it for protection against dirt. Do not use friction tape or other tape that will leave a residue behind.

19. If necessary for replacement, push roller bearing (39) out of frame (5) and remove seal (41) and plug (40). Discard seal.
20. If necessary, remove bushing (42) and pin (43) from frame (5).

CLEANING

NOTE

For general cleaning instruction, see Cleaning (WP 0316 00).

1. Clean brushes using soft, dry cloth.
2. Clean slip rings on rotor (7).
3. Place rotor in a lathe, with slip ring of shaft free.
4. While rotor is spinning in lathe, hold no. 100 sandpaper or 400 grit silicon carbide paper against slip ring surface.

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.

5. After polishing slip rings, clean using low pressure (15 psi maximum) compressed air.

WARNING

- Cleaning compound, solvent 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.

6. Clean ball bearing (14) in cleaning solvent to remove lubricant.

INSPECTION

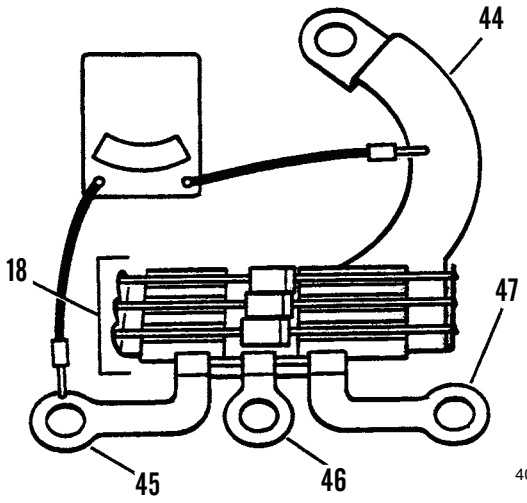
NOTE

For general inspection instructions, see *Inspection* (WP 0317 00).

1. Inspect bearings (14) for rough rotation or visible damage.
2. Inspect brushes for excessive wear.
3. Inspect brush springs for distortion or discoloration.

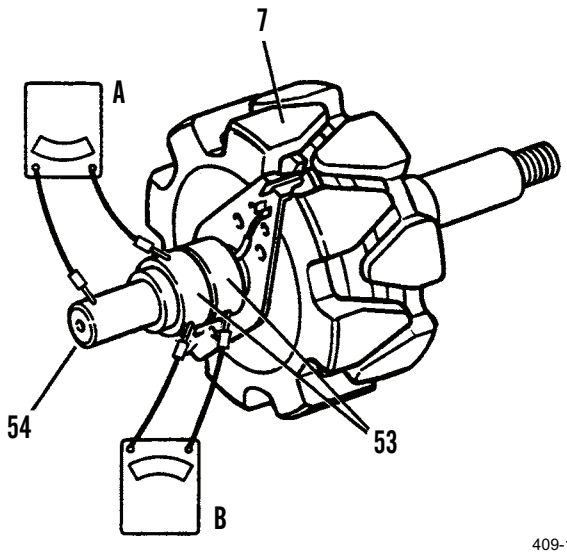
TESTING

1. To test diode trio (18), connect ohmmeter between diode trio single connector (44) and each of the other connectors (45 thru 47) in turn. Observe resistance reading on ohmmeter.
2. Reverse ohmmeter leads, or reverse meter polarity and repeat step 3 above.
3. At one polarity, resistance reading should be low and at the other polarity, resistance reading should be very high, if diodes are good.
4. If both readings on same set of connectors are either high or low, the associated diode is faulty and entire diode trio must be replaced.



409-1099

5. To test rectifier bridge (23), connect ohmmeter from grounded heat sink (48) to diode terminal (49) and note resistance reading.
6. Reverse ohmmeter leads or reverse meter polarity and again note resistance reading.
7. At one polarity, resistance reading should be low and at the other polarity, resistance reading should be very high, if diode is good. If diode if faulty, both readings will be either low or high.
8. Repeat above sequence between grounded heat sink (48) and diode terminals (50 and 51), and then between insulated heat sink (52) and each diode terminal (49 thru 51).
9. If any set of readings indicates a faulty diode, replace complete rectifier bridge (23).
10. To test rotor (7) for short or open circuits, connect ohmmeter between slip rings (53), in turn, and rotor shaft (54) (connection A). Observe resistance reading on ohmmeter.

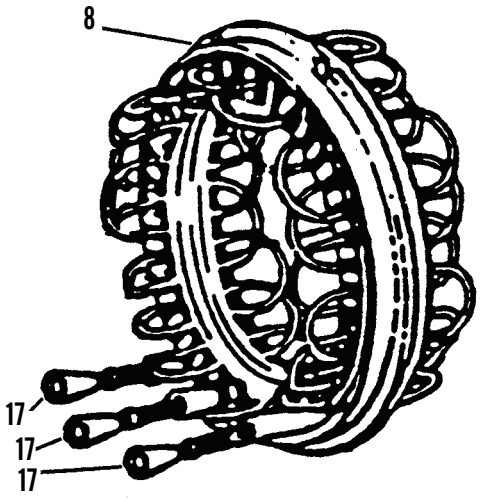


409-1101

11. Resistance reading should be high (infinite). If not, rotor (7) is defective and must be replaced.
12. Connect ohmmeter leads across slip rings (53) (connection B). Observe resistance reading on ohmmeter.
13. A high (infinite) resistance reading indicates an open rotor winding and rotor (7) must be replaced.

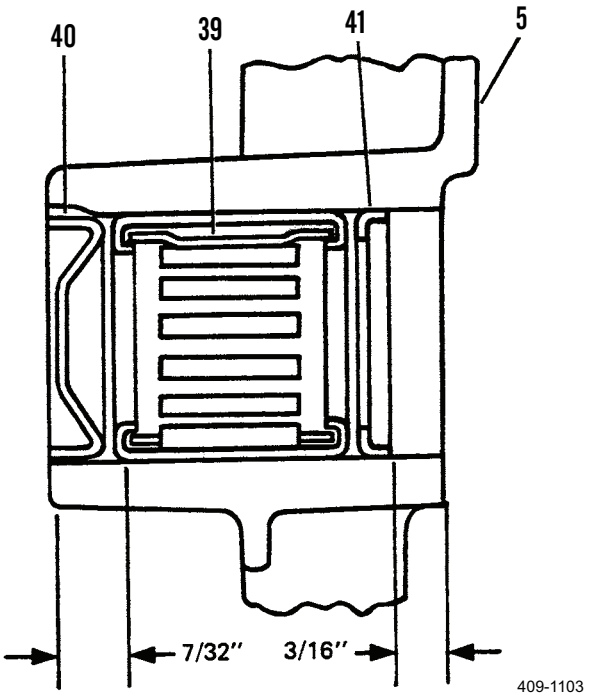
TESTING - CONTINUED

14. To test stator (8) for open or grounded windings, use an ohmmeter set to low scale, measure resistance through stator windings. Connect ohmmeter to terminal clips (17), from each outside clip to center clip and then between two outside clips.
15. Measure resistance from each terminal clip (17) to stator frame to check for grounded windings. A low resistance reading between any terminal clip (17) and stator frame indicates a grounded winding and stator (8) must be replaced as a unit.



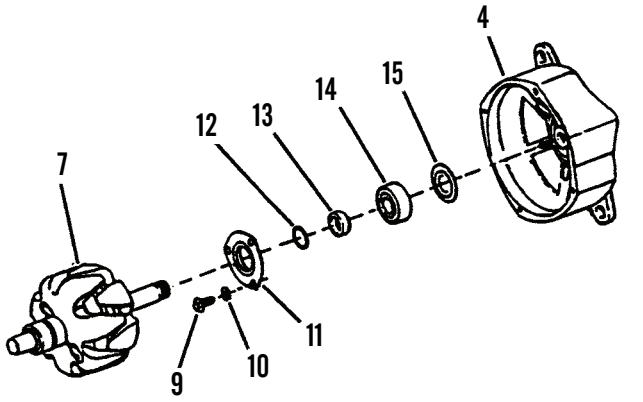
ASSEMBLY

1. Press roller bearing (39) into slip ring end frame (5) from outside to inside, to a depth of 7/32 in. (5.556 mm) as shown.
2. Fill plug (40) with Delco-Remy lubricant to a level sufficient to fill grease reservoir approximately one-half full.
3. Install plug (40), making sure that some lubricant touches roller bearing (39).
4. Press new seal (41) into slip ring end frame (5) bore to a depth of 3/16 in. (4.8 mm), as shown.



ASSEMBLY - CONTINUED

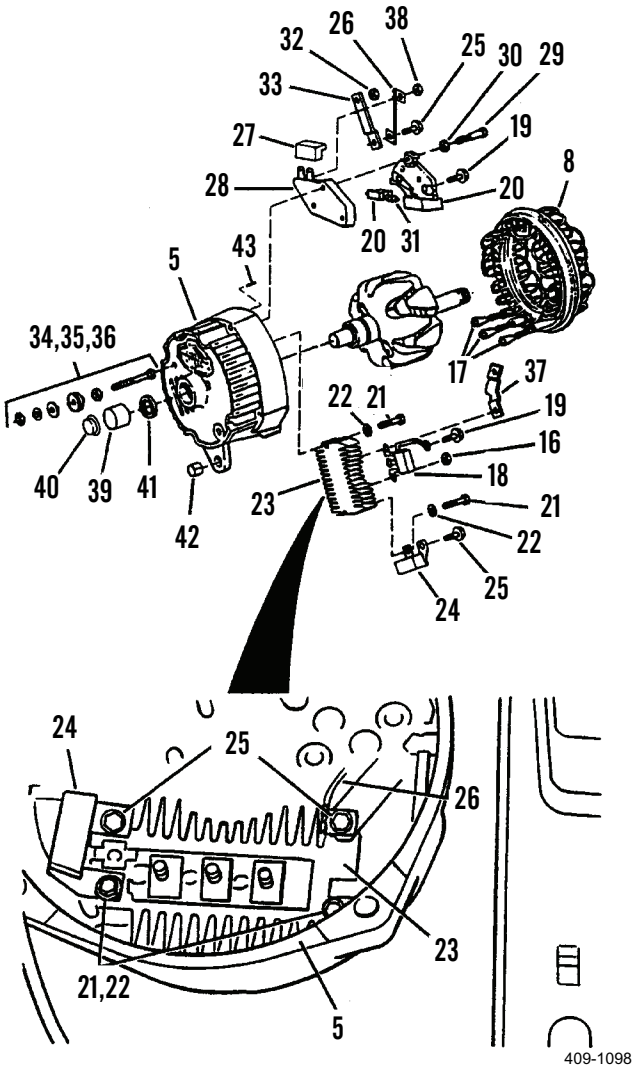
5. Install dust shield (15).
6. Apply small amount of Delco-Remy lubricant to ball bearing (14) race. Rotate bearing race to distribute lubricant.
7. Press ball bearing (14) into frame (4) from inside to outside. Sealed side of bearing must face out, away from new bearing retainer (11).
8. Fill grease cavity approximately one-half full of Delco-Remy lubricant. Arrange lubricant so some will touch ball bearing (14) after new bearing retainer (11) is installed.
9. Install new gasket (12), new bearing retainer (11), three new lockwashers (10) and three screws (9).



409-1104

ASSEMBLY - CONTINUED

10. Install collar (13) on rotor shaft and press rotor (7) through ball bearing (14) and bore in drive end frame (4) with a press.
11. If removed, install pin (43) and bushing (42) to frame (5).
12. If removed, secure wire lead (26) to regulator (28) with nut (38).
13. If removed, install connector (37), relay terminal assembly parts (36), and relay terminal cap (35).
14. If removed, install battery terminal assembly parts (34), connector (33) and nut (32).
15. Place regulator (28), brush springs (31), and brush and holder assembly (20) inside frame (5).
16. Install screw (29), new lockwasher (30) and insulated screw (19) to secure regulator (28), brush spring (31) and brush and holder assembly (20) and frame (5).
17. Install rubber cover (27) to terminals of regulator (28).
18. Place rectifier bridge (23) inside frame (5).



NOTE

Holes for screw and lockwasher assemblies are located on the rectifier bridge, closest to center of frame. One assembly secures the upper contact of capacitor. The other assembly secures wire lead.

19. Secure wire lead (26) and top contact of capacitor (24) to rectifier bridge (23) with two new screw and lockwasher assemblies (25).

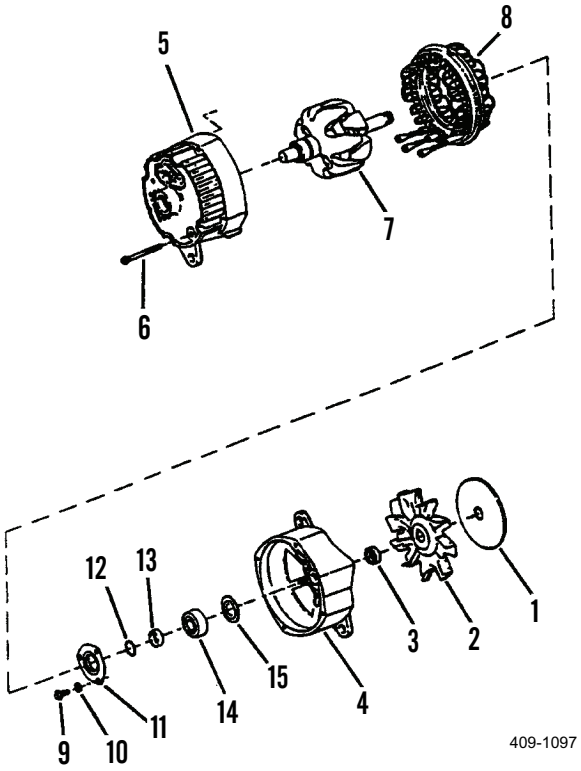
NOTE

Holes for screws and springwashers are located on the rectifier bridge, closest to outside of frame. One of the two screws secures the lower contact of capacitor.

20. Secure rectifier bridge (23) to frame (5) with two screws (21) and two new spring washers (22).
21. Secure diode trio (18) to brush and holder assembly (20) with insulated screw (19).
22. Connect stator terminal clips (17) to diode trio (18) and rectifier bridge (23) with three nuts (16).

ASSEMBLY - CONTINUED

23. Place stator (8) on slip ring end frame (5).



CAUTION

Be careful as rotor is placed in slip ring end frame not to damage brushes or seal.

NOTE

To secure brushes during rotor installation, push brushes into brush and holder assembly and insert a stiff piece of wire through hole provided in slip ring end frame.

24. Position drive end frame (4) with rotor (7) on slip ring end frame (5). Align match marks that were made during disassembly.
25. Remove wire used to hold brushes during rotor (7) installation.
26. Install and tighten four through bolts (6).
27. Install collar (3), fan (2) and baffle (1) on rotor shaft.
28. Install alternator pulley (WP 0062 00).
29. Install alternator to engine (WP 0062 00).
30. Run engine and check to ensure alternator is operating properly (TM 10-3930-660-10).

END OF WORK PACKAGE

ALTERNATOR ASSEMBLY MAINTENANCE (165 HP) 0285 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Testing, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39,WP 0324 00)

Shop equipment, fuel and electrical (Item 22, WP 0324 00)

Materials/Parts

Lubricant, Delco-Remy (Item 24, WP 0323 00)

Sandpaper (Item 41, WP 0323 00)

Materials/Parts - Continued

Bushing (49)

Locknut (1)

Roller bearing (45)

References

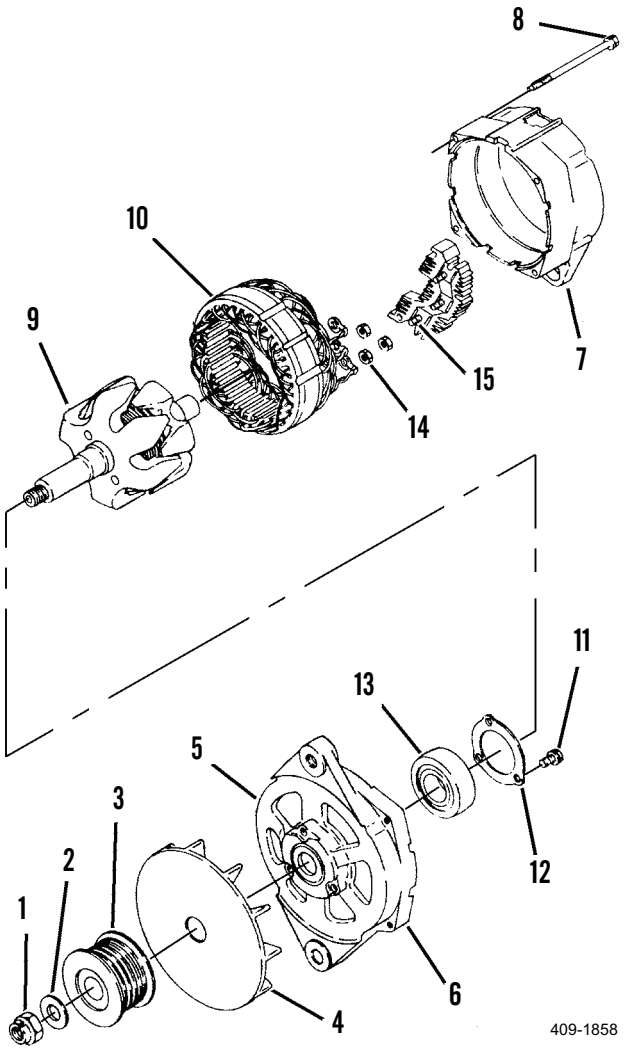
TM 10-3930-660-10

Equipment Condition

Alternator removed (WP 0063 00)

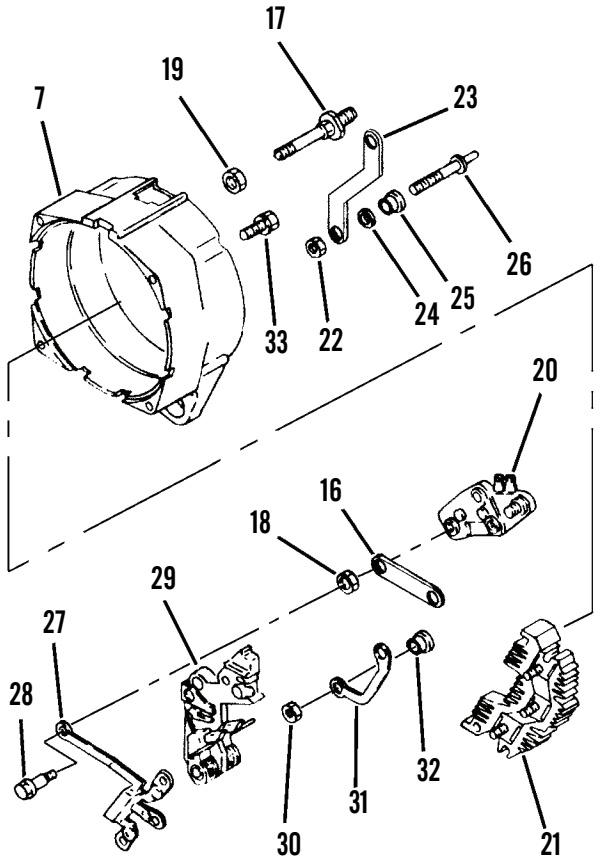
DISASSEMBLY

1. Remove locknut (1), washer (2), pulley (3), and fan (4) from alternator (5). Discard locknut.
2. Remove four screws (8) from alternator (5).
3. Separate front frame (6) and rotor assembly (9) from rear frame (7) and stator assembly (10).
4. Remove three screws (11), retainer plate (12), and with a suitable press, remove roller bearing (13) from front frame (6).
5. Remove three nuts (14) from studs (15).
6. Remove stator assembly (10) from rear frame (7).



DISASSEMBLY - CONTINUED

7. Remove nut (18), nut (19), and stud connector (16) from regulator (20) and rectifier bridge assembly (21).
8. Remove output terminal (17) from rear frame (7).
9. Remove nut (22), stud connector (23), washer (24), insulator (25), and indicator light terminal (26) from rear frame (7).
10. Remove diode trio (27) from rectifier bridge assembly (21).
11. Remove insulated screw (28) from brush holder assembly (29).
12. Remove nut (30), relay terminal connector (31), insulator (32), and relay terminal (33) from rear frame (7).



409-1859

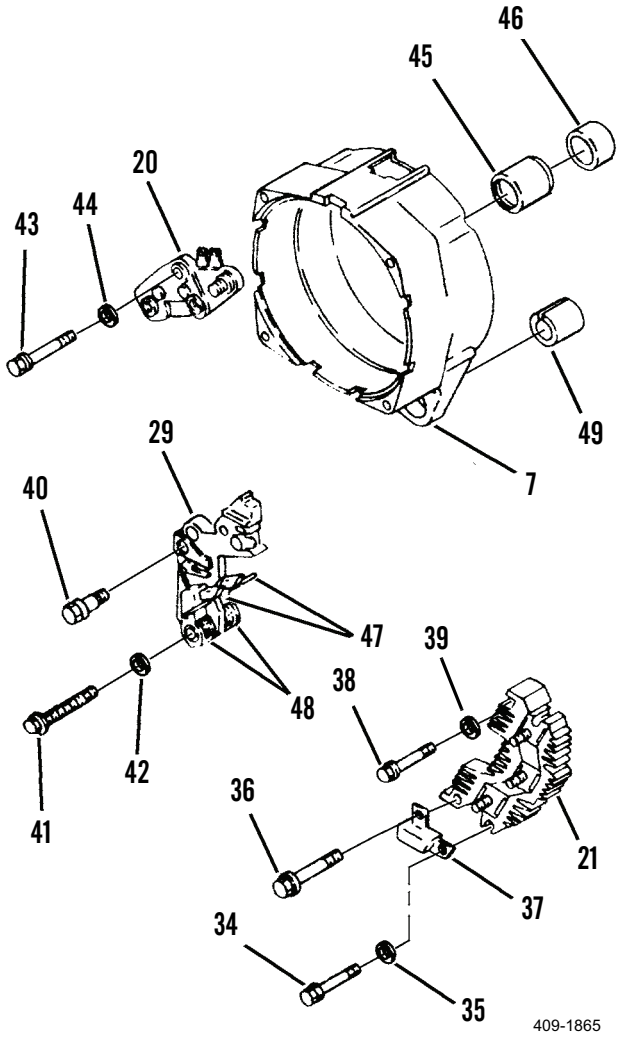
DISASSEMBLY - CONTINUED

13. Remove screw (34), washer (35), insulated screw (36), and capacitor (37) from rectifier bridge assembly (21).
14. Remove screw (38), washer (39), and rectifier bridge assembly (21) from rear frame (7).
15. Remove insulated screw (40), screw (41), washer (42), and brush holder assembly (29) from rear frame (7).
16. Remove screw (43), washer (44), and regulator (20) from rear frame (7).

NOTE

If roller bearing is not being removed, apply pressure sensitive tape over it for protection against dirt. Do not use friction tape or other tape that will leave a residue behind.

17. Use press to remove roller bearing (45) and cap (46) from rear frame (7). Discard roller bearing (45).
18. Remove two brushes (47), and two springs (48) from brush holder assembly (29).
19. Use press to remove bushing (49) from rear frame (7). Discard bushing.

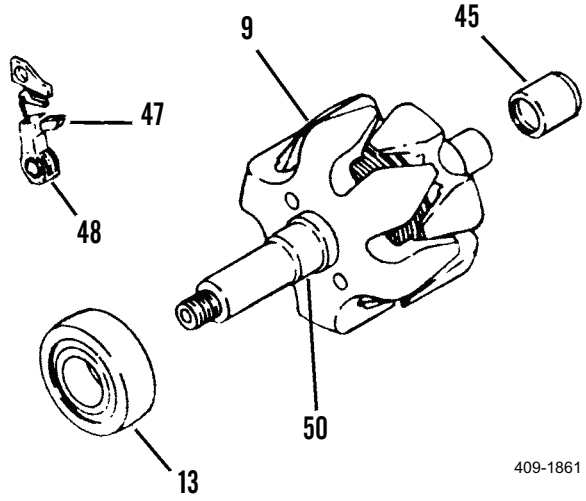


CLEANING

1. Clean brushes (47) using soft, dry cloth.
2. Clean slip rings on rotor assembly (9).
3. Place rotor assembly (9) in a lathe, with slip rings (50) of shaft free.
4. While rotor is spinning in lathe, hold sandpaper or 400 grit silicon carbide paper against slip ring (50) surface.

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 warming 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.



409-1861

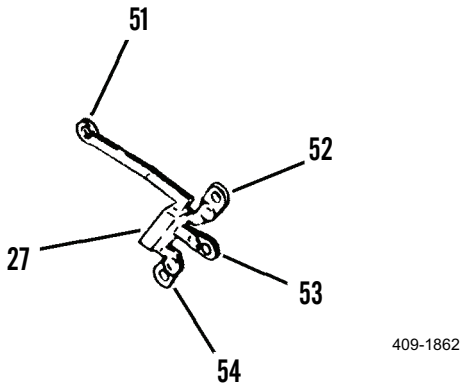
5. After polishing slip rings (50), clean using low pressure (15 psi (103 kPa) maximum) compressed air.

INSPECTION

1. Inspect roller bearings (13 and 45) for rough rotation or visible damage. Replace if damaged.
2. Inspect brushes (47) for excessive wear. Replace as needed.
3. Inspect brush springs (48) for distortion or discoloration. Replace as needed.

TESTING

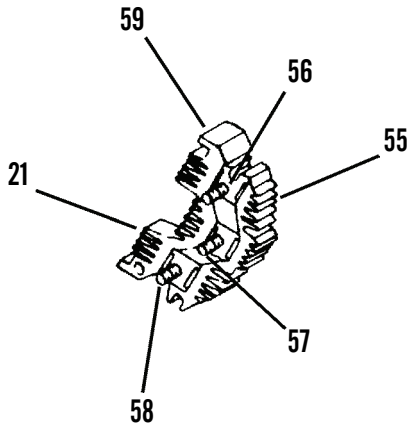
1. To test diode trio (27), connect multimeter between diode trio single connector (51) and each of the other connectors (52 thru 54) in turn. Observe resistance reading.
2. Reverse multimeter leads, or reverse meter polarity, and repeat step 1, above.
3. At one polarity, resistance reading should be low and at the other polarity, resistance reading should be very high, if diodes are good. If both readings on same set of connectors are either high or low, the associated diode is faulty and entire diode trio must be replaced.



409-1862

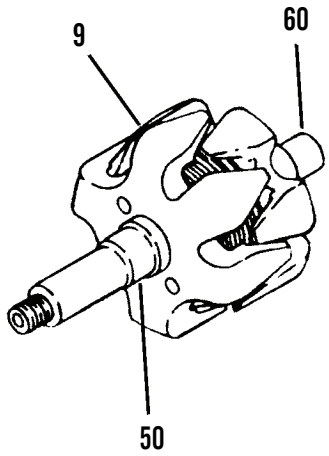
TESTING - CONTINUED

4. To test rectifier bridge assembly (21), connect multimeter from grounded heat sink (55) to diode terminal (56) and note resistance reading.
5. Reverse multimeter leads or reverse meter polarity and again note resistance reading.
6. At one polarity, resistance reading should be low and at the other polarity, resistance reading should be very high, if diode is good. If diode is faulty, both readings will be either low or high.
7. Repeat above sequence between grounded heat sink (55) and diode terminals (57 and 58), and then between insulated heat sink (59) and each diode terminal (56 thru 58).
8. If any set of readings indicates a faulty diode, replace complete rectifier bridge (21).



409-1863

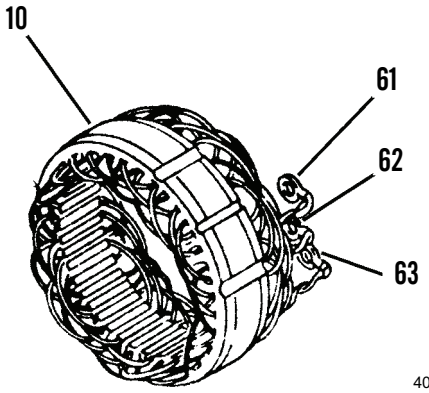
9. To test rotor assembly (9) for short of open circuits, connect multimeter between slip rings (50), in turn, and rotor shaft (60) (connection A). Observe resistance reading on ohmmeter.
10. Resistance reading should be high (infinite). If not, rotor (9) is defective and must be replaced.
11. Connect multimeter leads across slip rings (50) (connection B). Observe resistance reading on ohmmeter. A high (infinite) resistance reading indicates an open rotor winding and rotor (9) must be replaced.



409-1864

TESTING - CONTINUED

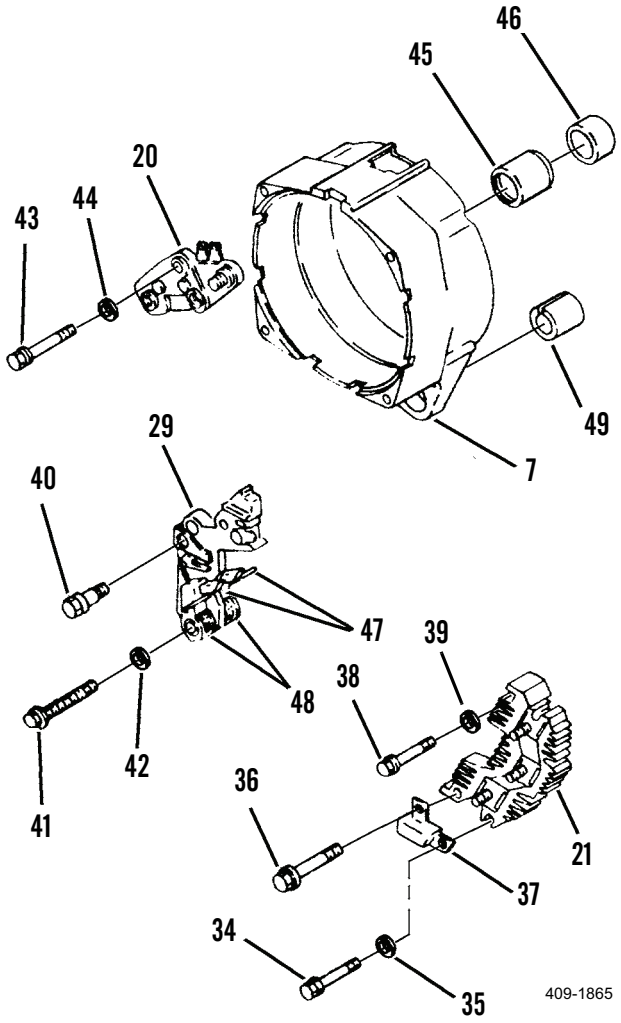
12. To test stator assembly (10) for open or grounded windings, use a multimeter set to ohms, low scale, measure resistance through stator windings. Connect multimeter to terminal clips (61 thru 63), from each outside clip to center clip and then between two outside clips.
13. Measure resistance from each terminal clip (61 thru 63) to stator frame to check for grounded windings. A low resistance reading between any terminal clip and stator frame indicates a grounded winding, and stator (10) must be replaced as a unit.



409-1866

ASSEMBLY

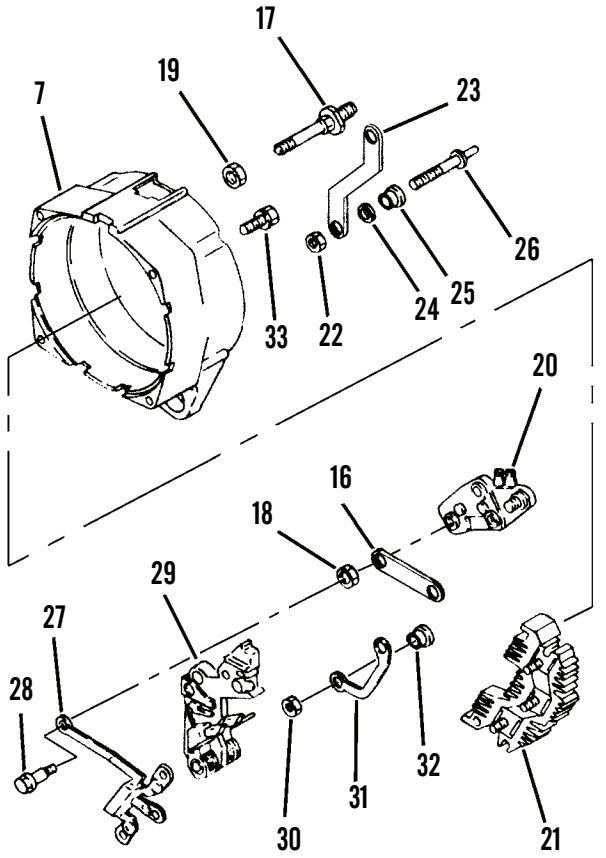
1. Use press to install bushing (49) on rear frame (7).
2. Position two springs (48) and brushes (47) on brush holder assembly (29).
3. Pack new roller bearing (45) with lubricant.
4. Use press to install new roller bearing (45) into rear frame (7). Bearing side should be flush with inside base of frame (7).
5. Install cap (46) in rear frame (7).
6. Install regulator (20) on rear frame (7) with washer (44) and screw (43).
7. Install brush holder assembly (29) on rear frame (7) and regulator (20) with washer (42) and screw (41) and insulated screw (40).
8. Install rectifier bridge assembly (21) on rear frame (7) with washer (39) and screw (38).
9. Install capacitor (37) on bridge rectifier assembly (21) with washer (35), screw (34), and insulated screw (36).



409-1865

ASSEMBLY - CONTINUED

10. Install relay terminal (33) and diode trio (27) on rear frame (7).
11. Position relay terminal (33) in rear frame (7).
12. Position insulator (32) and relay terminal connector (31) on relay terminal (33).
13. Start nut (30) on relay terminal (33).
14. Position opposite side of relay terminal connector on brush holder assembly (29).
15. Position diode trio (27) on rectifier bridge assembly (21).
16. Install insulated screw (28) on brush holder assembly (29).
17. Tighten nut (30).
18. Position indicator light terminal (26) on rear frame (7).
19. Position insulator (25) on indicator light terminal (26).
20. Position stud connector (23) and washer (24) on rectifier bridge assembly (21) and indicator light terminal (26).



409-1859

21. Install nut (22) on indicator light terminal (26).
22. Install output terminal (17) and stud connector (16) on rear frame (7).
23. Position stud connector (16) on output terminal (17) and regulator (20).
24. Install nut (18) and nut (19).

ASSEMBLY - CONTINUED

25. Position stator assembly (10) on rear frame (7) so that three stator terminal clips (65) are fitted on three studs (15).
26. Gently press stator assembly (10) into rear frame (7) so that it is properly seated.
27. Install three nuts (14) on protruding studs.
28. Install rotor assembly (9) on front frame (6).
29. Pack roller bearing (13) with Delco-Remy lubricant and position bearing in front frame (6).
30. Install retainer plate (12) and three screws (11) in front frame (6).
31. Use press to install bearing (13) in front frame (6) on rotor assembly (9).
32. Install front frame (6) and rotor assembly (9) on rear frame (7).

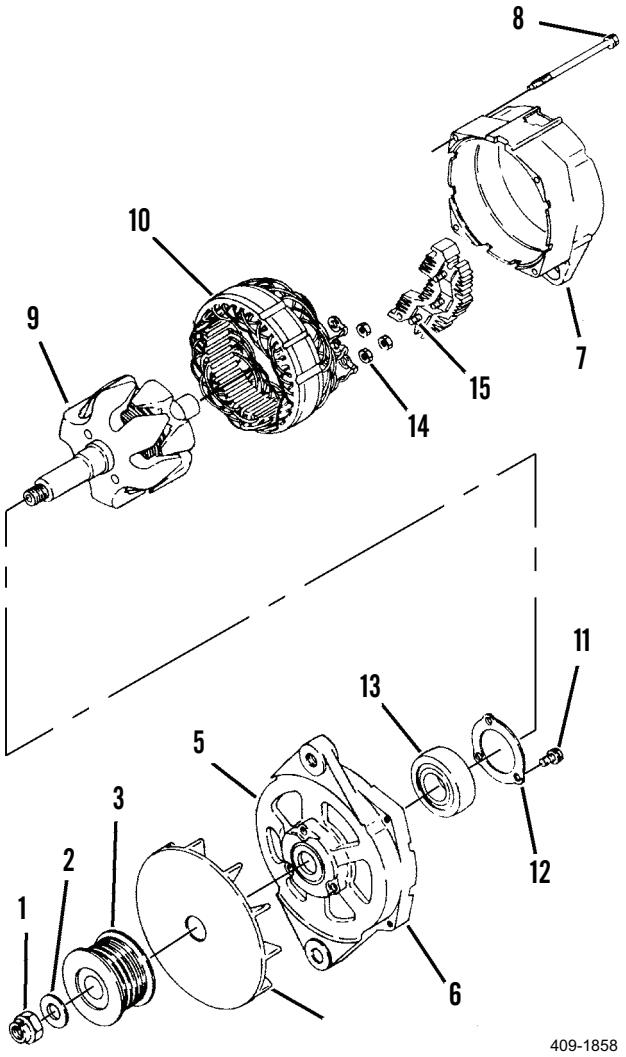
NOTE

Brushes must be retained before front and rear frame sections can be assembled.

33. Push brushes (49) into brush holder assembly (29) and insert a stiff piece of wire through hole provided in rear frame (7). Wire should then be inserted into retaining hole in brush holder assembly (29).

NOTE

Ensure bracket frame holes are correctly aligned when assembling frame halves. Two large bracket holes in alternator frame should be aligned.



34. Carefully position front frame (6) and rotor assembly (9) into rear frame (7).
35. Install four screws (8) into alternator (5).
36. Remove wire from rear frame (7).
37. Install fan (4) and pulley (3) with washer (2) and locknut (1). Torque locknut to 75 lb-ft (102 Nm).
38. Install alternator (WP 0063 00).
39. Run engine and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

STARTER ASSEMBLY MAINTENANCE (152 HP) 0286 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, fuel and electrical (Item 22, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 32, WP 0323 00)

Paper, emery (Item 36, WP 0323 00)

Bearing (5)

Gasket (27 and 32)

Grommet (11)

Materials/Parts - Continued

Lockwasher (31, 38 and 54)

Rivet (21)

References

WP 0316 00

TM 10-3930-660-10

Equipment Condition

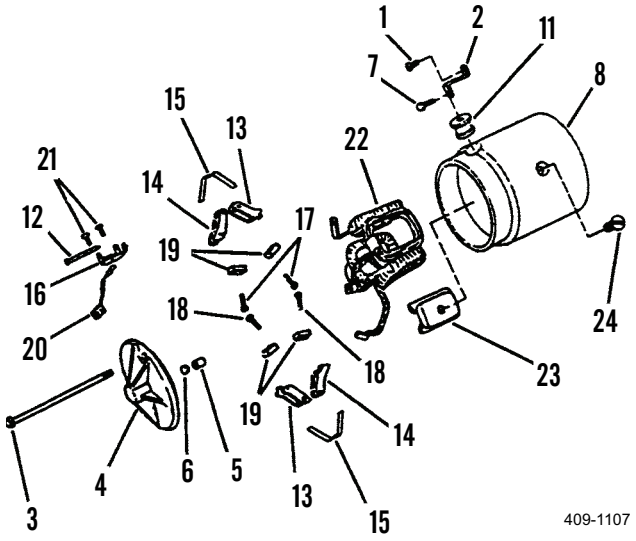
Starter removed (WP 0064 00)

DISASSEMBLY

NOTE

Clamp starter, drive end down, in a vise.

1. Remove screw (1) to disconnect connector (2) from solenoid switch terminal.
2. Remove two through bolts (3) and coil end frame (4).
3. If necessary for replacement, remove bearing (5) and wick (6). Discard bearing.
4. Remove screw (7) and carefully lift field frame (8) and associated parts off armature (9) and drive housing (10).
5. Remove connector (2) and grommet (11).
6. Remove two pins (12) to free holders (13 and 14) and springs (15) from supports (16).
7. Remove four screws (17 and 18) and four brushes (19). Two brush ground leads (20) are also attached with screws (17).
8. Remove brushes (19) from holders (13 and 14).
9. If necessary, remove four rivets (21) and two supports (16). Discard rivets.

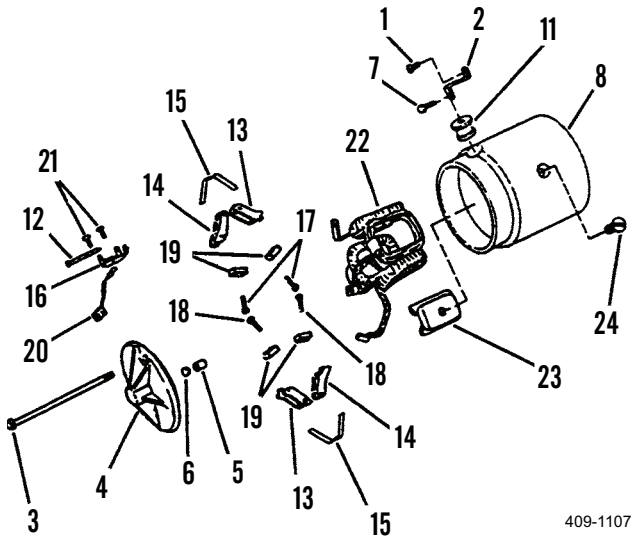


DISASSEMBLY - CONTINUED

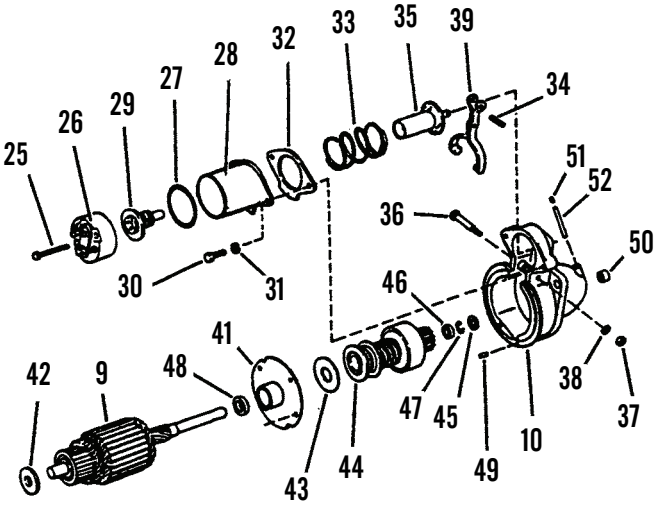
NOTE

Remove field winding coil only if known to be grounded or open. If it is being removed, use a pole spreader and a pole shoe screwdriver.

10. Match-mark all four shoes (23) and adjacent area of field frame (8), to ensure proper installation.
11. Remove eight screws (24), four shoes (23) and field winding coil (22).



12. Remove two capscrews (25) and separate cover (26) and gasket (27) from solenoid switch housing (28). Remove contact (29). Discard gasket.
13. Remove two screws (30) and lockwashers (31). Discard lockwashers.
14. Remove solenoid switch (28), gasket (32) and plunger return spring (33). Discard gasket.
15. Remove pin (34) and plunger (35).
16. Remove screw (36), nut (37), lockwasher (38) and shift lever (39). Discard lockwasher.
17. Remove brake washer (42) and armature (9), with washer (43), motor drive (44) and thrust washer (45).
18. Using a short pipe nipple, or other suitable metal cylinder, and a hammer, drive pinion stop (46) toward motor drive (44) until retaining ring (47) is exposed. Remove retaining ring (47).
19. Separate armature (9), center bearing plate (41), washer (43), motor drive (44) and pinion stop (46).



20. If required, remove center bearing (48) from center bearing retainer (41).
21. Remove parts (49 thru 52) from drive housing (10), as required, for replacement. Discard lockwasher.

CLEANING

NOTE

For general cleaning instructions, see WP 0316 00.

CAUTION

Do not clean starter parts in solvent cleaning compound, which may damage certain electrical parts.

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 starter parts in mineral spirits and dry using low pressure compressed air or clean lint-free cloth.

INSPECTION

1. Check brush (19) lengths against length of new brush. Brushes that are less than two-thirds the length of a new brush must be replaced.

NOTE

An oil-soaked brush must be replaced.

2. Check to ensure that brushes fit well in holders (13 and 14), but without binding.
3. Inspect brush springs (15) for distortion or discoloration.

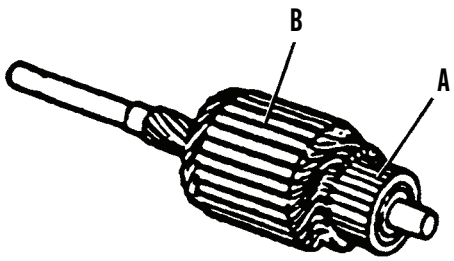
CAUTION

Do not turn commutator nor undercut insulation between commutator bars. Replace armature if commutator cannot be restored satisfactorily.

NOTE

- Check condition of commutator, and clean, if necessary, using emery paper.
- Check for short circuits in armature using a growler and steel strip.

4. Rotate armature in growler.
5. Hold steel strip (e.g., hacksaw blade) across armature slots as armature rotates. Steel strip will vibrate as slot between shorted bars passes under steel strip.
6. If short circuit is detected, check for build up of copper dust or other conductive material between commutator bars.
7. Check armature for grounds or open circuits, by measuring resistance between commutator (A) and one armature bar (B). Set ohmmeter on highest scale when taking measurement.
8. Switch ohmmeter to lowest scale, and place ohmmeter leads against two adjacent commutator bars (A) and observe ohmmeter. Ohmmeter needle should swing to zero and remain.



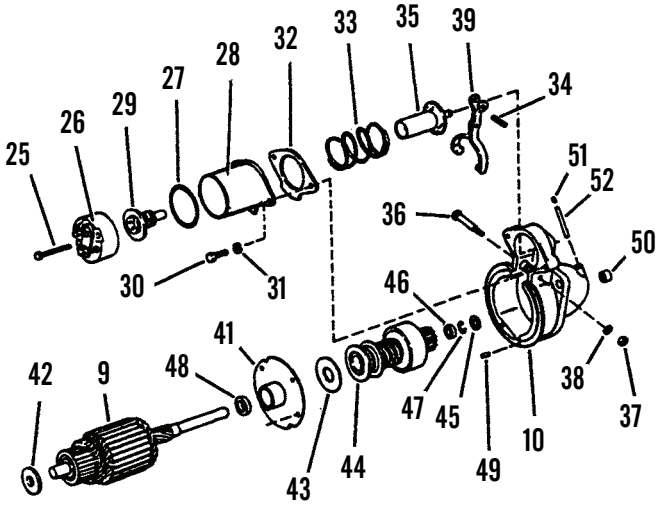
409-1110

INSPECTION - CONTINUED

9. Repeat check for all commutator bars (A) by moving one ohmmeter lead at a time. There must be continuity between each pair of bars.

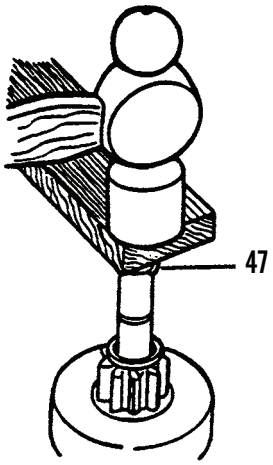
ASSEMBLY

1. If removed, install bearing (50), wick (52), plug (51) and pin (49).
2. Soak wick (52) and surface of bearing (50) in clean lubricating oil.
3. Press bearing (50) into bore until even with end of drive housing (10).
4. Install wick (52) and plug (51).
5. Install pin (49).
6. If removed, press center bearing (48) into center bearing retainer (41) until flush with front face of retainer.
7. Install center bearing retainer (41), washer (43) and motor drive (44) on armature shaft.

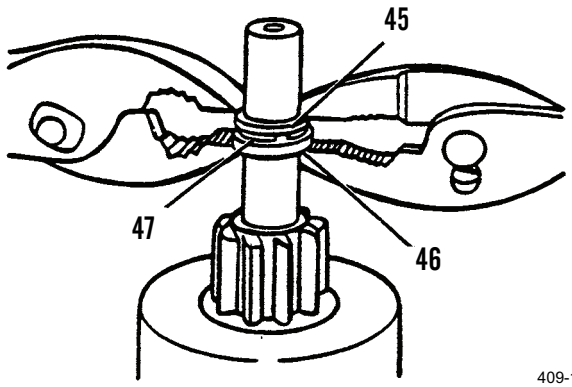


409-1108

8. Install pinion stop (46) (cupped side facing out) and retaining ring (47) on armature shaft. Retaining ring (47) may have to be forced over end of armature shaft using a hammer and piece of wood, as shown.
9. Place thrust collar (45) on retaining ring (47) and force pinion stop (46) over retaining ring (47), using two pliers as shown.



409-1112



409-1113

ASSEMBLY - CONTINUED

NOTE

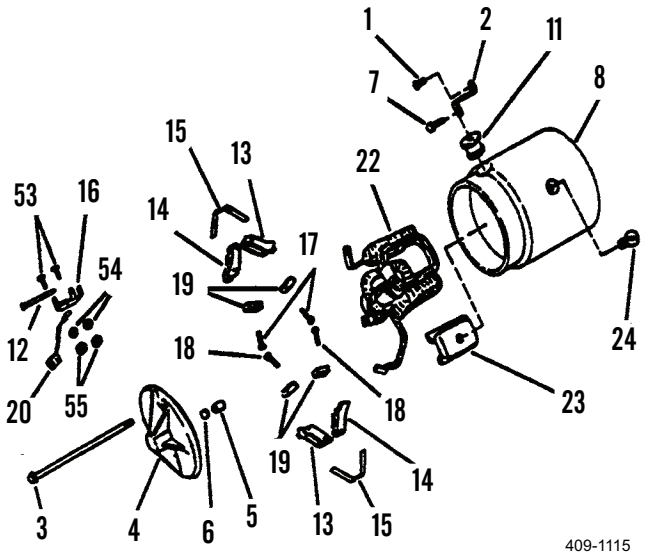
Clamp drive housing in a padded vise.

10. Position center bearing retainer (41) to drive housing (10).
11. Place shift lever (39) in drive housing (10) and secure with screw (36), nut (37) and new lockwasher (38).
12. Install plunger (35) and pin (34).
13. Install plunger return spring (33) and new gasket (32).
14. Install solenoid switch (28), two screws (30) and two new lockwashers (31).
15. Position contact (29) between cover (26) and solenoid switch housing (28). Align new gasket (27) and secure cover (26) to solenoid switch housing (28) with two capscrews (25).

NOTE

- If pole shoes have one long lip, install pole shoes so long lip points in direction of armature rotation. Also, observe match marks made before removal.
- If supports were removed, use service parts to secure supports during step 17, below.

16. If removed, install field coil (22) and pole shoes (23). Secure pole shoes (23) with eight screws (24). Use care to prevent grounding or shorting coils as pole shoes are secured.
17. If removed, secure two supports (16), and two brush ground leads (20) with four studs (53), four lockwashers (54) and four nuts (55).
18. Install two springs (15), two grounded brush holders (13), two insulated brush holders (14) and two pins (12).
19. Install two brushes (19) in grounded brush holders (14). Secure brushes (19) and brush ground leads (20) using two screws (17).
20. Install two brushes (19) in insulated brush holders (13) and secure with two screws (18).
21. Install new grommet (11) and connector (2).
22. Place brake washer (42) on armature (9).
23. Carefully lower field frame (8) onto armature (9), making certain that brushes (19) clear commutator bars and no interference occurs between pole shoes (23) and armature (9). Install screw (7) to secure connector (2) to field coil (22) terminal.
24. If removed, press new bearing (5) into bore in coil end frame (4). Soak wick (6) in lubricating oil, and install.



25. Check to be sure that brushes (19) are making proper contact with commutator, and that all internal electrical connections have been correctly made. Then, install coil end frame (4) and through bolts (3). Secure connector (2) to solenoid switch (28) terminal using screw (1).
26. Install starter (WP 0064 00).
27. Start engine and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

STARTER REPAIR (165 HP) 0287 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, fuel and electrical (Item 22, WP 0324 00)

Materials/Parts

Paper, emery (Item 36, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Bearing (16 and 17)

Bushing (40)

Locknut (24)

Materials/Parts - Continued

Lockwasher (25)

Nut and bolt with captive lockwasher (18, 19, 23 and 28)

O-ring (7, 8 and 10)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

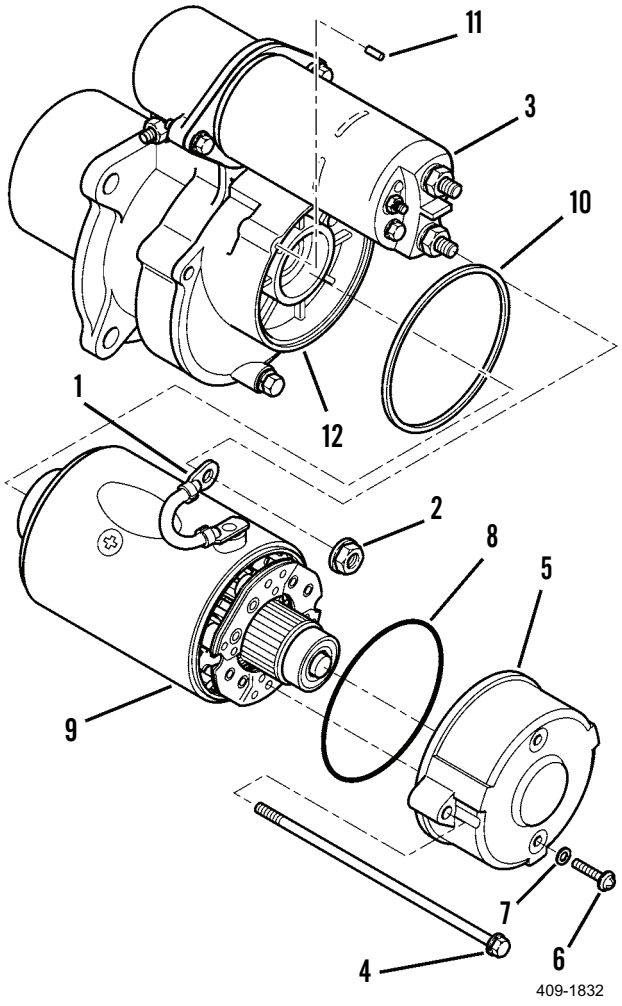
Starter removed (WP 0065 00)

DISASSEMBLY

NOTE

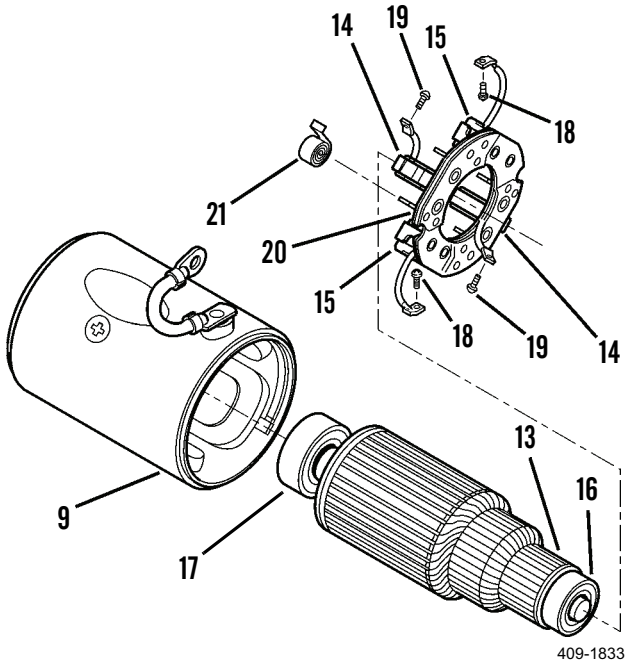
Clamp starter, drive end down, in a vise with soft jaws.

1. Tag and mark wire (1). Remove nut with captive washer (2) and wire from solenoid (3). Discard nut with captive washer.
2. Remove two bolts (4) from cover (5).
3. Remove two bolts (6), O-rings (7), cover (5) and O-rings (8) from frame and field coil assembly (9). Discard O-rings.
4. Remove frame and field coil assembly (9), O-ring (10) and pin (11) from bracket (12). Discard O-ring.



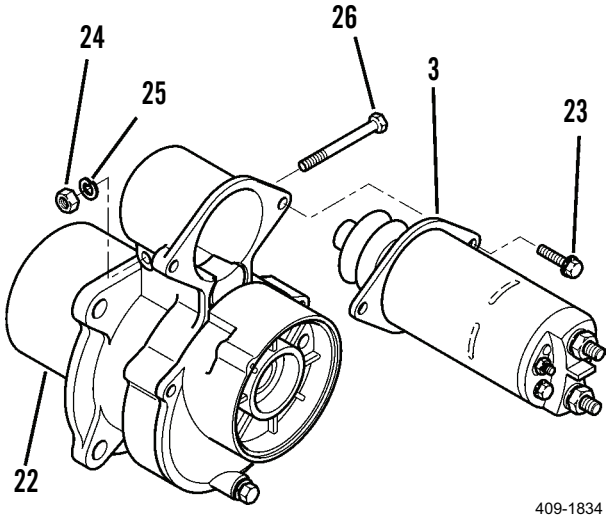
DISASSEMBLY - CONTINUED

5. Remove armature (13) from two ground brushes (14), coil brushes (15) and frame and field coil assembly (9).
6. If damaged, remove bearings (16 and 17) from armature (13). Discard bearings.
7. Remove two screws with captive lockwashers (18) and coil brushes (15) wire connectors from frame and field coil assembly (9). Discard screws with captive lockwashers.
8. Remove two screws with captive lockwashers (19) and ground brushes (14) wire connectors from brush holder (20). Discard screws with captive lockwashers.
9. Remove four springs (21) and two ground brushes (14) and coil brushes (15) from brush holder (20).



409-1833

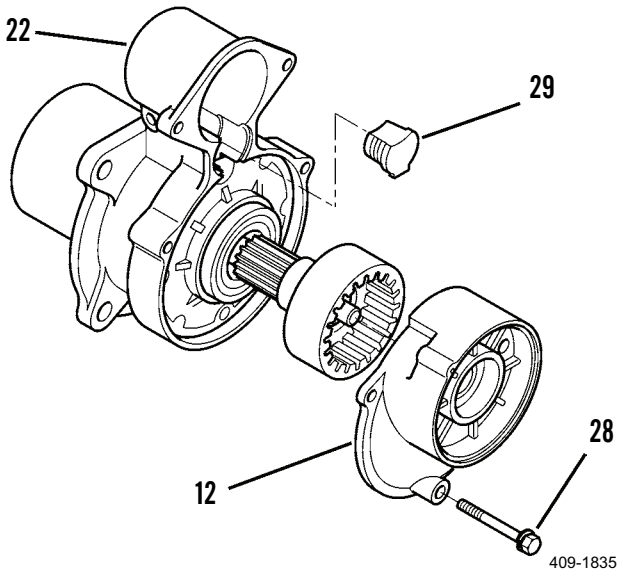
10. Remove two screws with captive lockwashers (23) from solenoid (3). Discard screws with captive lockwashers.
11. Remove locknut (24), lockwasher (25), and screw (26), from lever (27) and drive housing (22). Discard locknut and lockwasher.
12. Remove solenoid (3) from drive housing (22).



409-1834

DISASSEMBLY - CONTINUED

13. Remove two bolts with captive lockwashers and washers (28) and bracket (12) from drive housing (22). Discard bolts with captive lockwashers.
14. Remove plug (29) from drive housing (22).

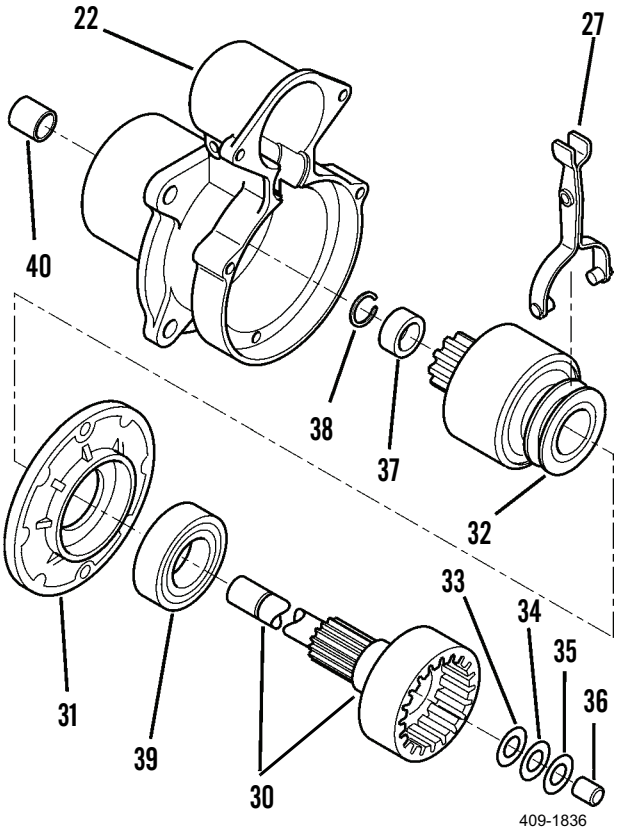


15. Remove driveshaft (30), shaft support (31), drive clutch assembly (32) and shifter fork (27) as an assembly from drive housing (22).
16. Remove washers (33 thru 35) and plug (36) from driveshaft (30).

WARNING

Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

17. Drive pinion stop (37) toward drive clutch assembly (32) and remove retaining ring (38) and pinion stop from driveshaft (30). Discard retaining ring.
18. Remove drive clutch assembly (32) and shaft support (31) from driveshaft (30).
19. Remove bearing (39) from driveshaft (30).
20. If damaged remove bushing (40) from drive housing (22). Discard bushing.



CLEANING

1. See *Cleaning* instructions (WP 0316 00).

WARNING

- Compressed air used for cleaning purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).
- Volatile mineral spirits burn easily and fumes can explode. Do not smoke or allow open flame nearby when using volatile mineral spirits. Failure to do so may cause serious injury or death to personnel.

CAUTION

Do not clean starter parts in dry cleaning solvent. Dry cleaning solvent may damage certain electrical parts.

2. Clean starter parts in mineral spirits and dry using low pressure compressed air or clean rag.

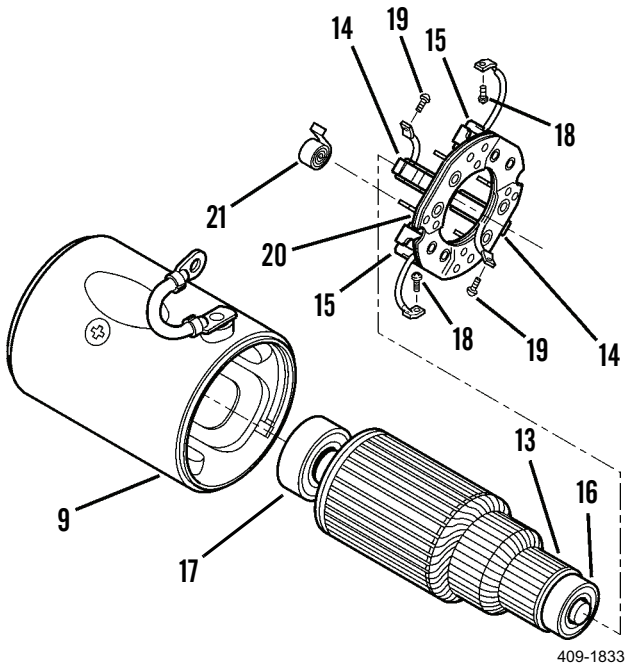
INSPECTION

1. See Inspection Instructions (WP 0317 00).
2. Check length of brushes (14 and 15) against length of new brush. Brushes that are less than two-thirds the length of a new brush must be replaced.
3. All oil-soaked brushes must also be replaced.
4. Check to ensure that brushes fit well in brush holder (20), without binding.
5. Inspect springs (21) for distortion or discoloration.

CAUTION

Do not turn down commutator or undercut insulation between commutator bars. Replace armature if commutator cannot be restored satisfactorily in Step 7 below.

6. Check condition of commutator, and clean, if necessary, using emery paper.



409-1833

INSPECTION - CONTINUED

7. Check for short circuits in armature (13) using a growler and steel strip.
8. Rotate armature (13) in growler.
9. Hold steel strip (e.g., hacksaw blade) across armature slots as armature rotates. Steel strip will vibrate as slot between shorted bars passes under steel strip.
10. If short circuit is detected, check for build up of copper dust or other conductive material between commutator bars. Clean out copper dust and check again for short circuits. If commutator bars are shorted, replace armature (13).
11. Check armature for grounds or open circuits.
12. Set multimeter to ohms, on highest scale. Check for grounds by measuring resistance between commutator and one armature bar.
13. Switch multimeter to lowest scale.
14. Place multimeter leads against two adjacent commutator bars and observe multimeter. Multimeter needle should swing to zero and remain.
15. Repeat check for all commutator bars by moving one multimeter lead at a time. There must be continuity between each pair of bars. If there is no continuity between one or more pairs of bars, replace armature (13).

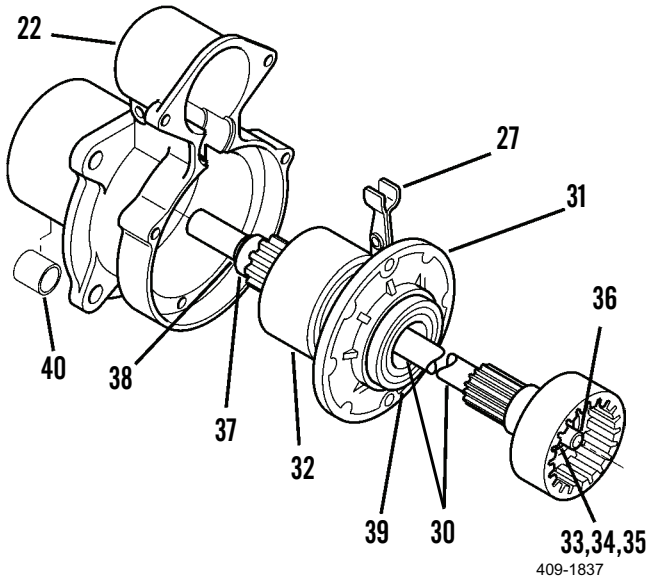
ASSEMBLY

1. If removed, install bushing (40) in drive housing (22).
2. Install bearing (39) on driveshaft (30).
3. Position shaft support (31) and drive clutch assembly (32) on drive shaft (30).

WARNING

Use care when removing snap and retaining rings. Snap and retaining rings are under spring tension and can act as projectiles when released and could cause severe eye injury.

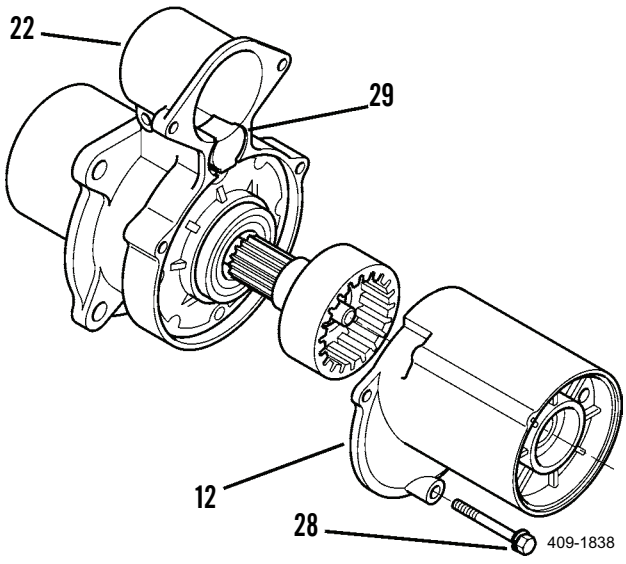
4. Install pinion stop (37) and new retaining ring (38) on drive shaft (30). Retaining ring may have to be forced over driveshaft using a block of wood.
5. Install plug (36) and washers (33 thru 35) on drive shaft (30).



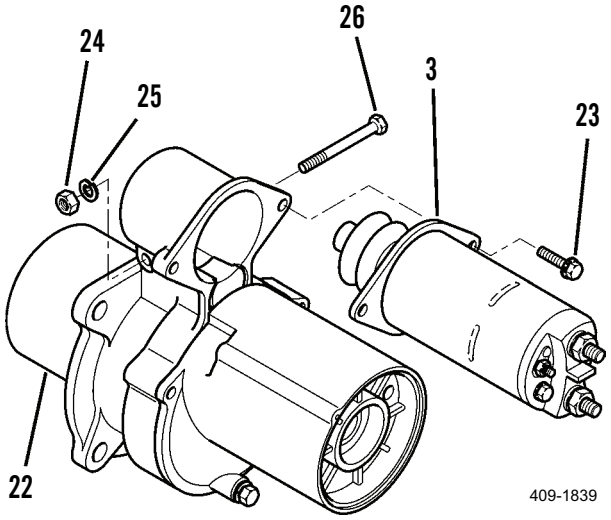
6. Install shifter fork (27), drive clutch assembly (32), shaft support (31), and driveshaft (30) as an assembly in drive housing (22).

ASSEMBLY - CONTINUED

7. Install plug (29) in drive housing (22).
8. Install bracket (12) and two bolts with captive lockwashers (28) on drive housing (22).

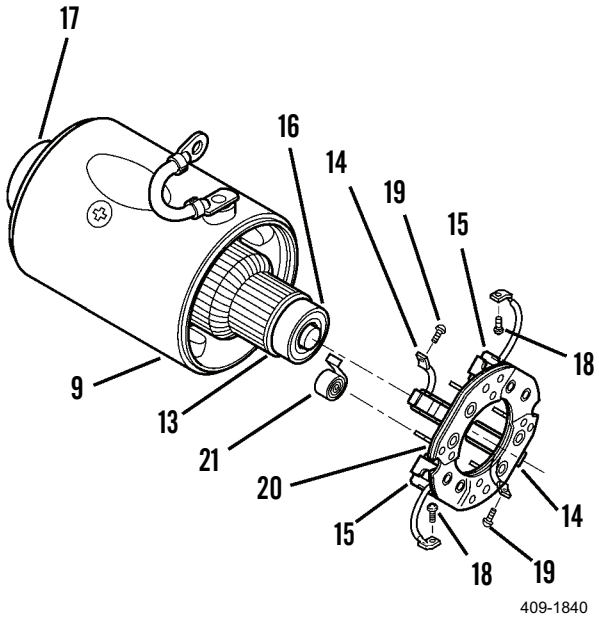


9. Install solenoid (3) on drive housing (22).
10. Install solenoid (3) on drive housing (22). Position solenoid so that solenoid engages lever (27).
11. Install screw (26), new lockwasher (25) and nut (24) in drive housing (22) and lever (27).
12. Install two screws with new captive lockwashers (23) in solenoid (3).



ASSEMBLY - CONTINUED

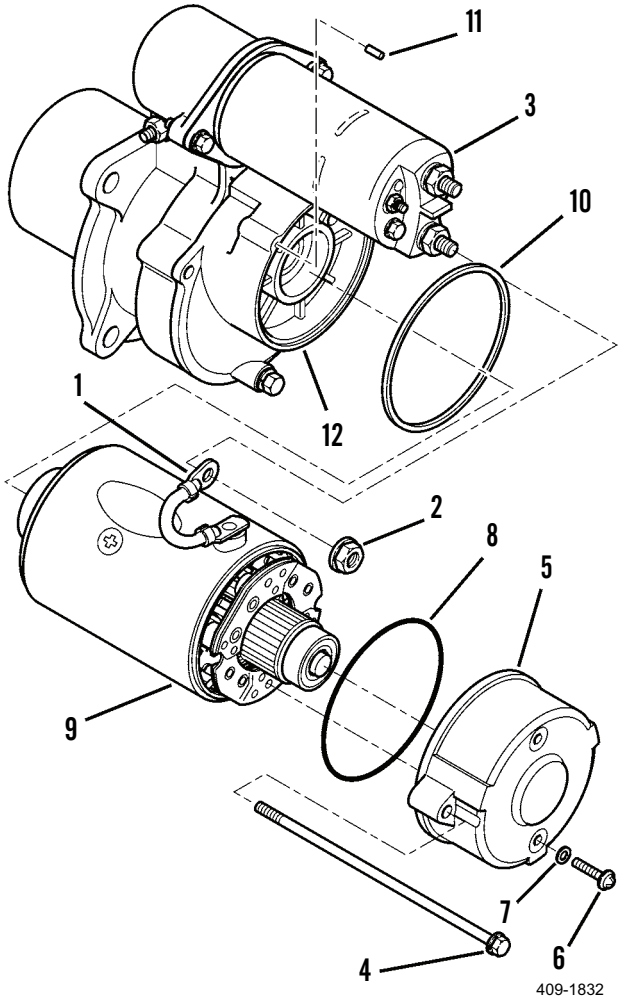
13. Install two coil brushes (15), ground brushes (14) and four springs (21) on brush holder (20).
14. Install two screws with captive lockwashers (19) on ground brushes (14), wire connectors, and brush holder (20).
15. Install two screws with captive lockwashers (18) and coil brushes (15) wire connectors on frame and field coil assembly (9).
16. If removed, install bearings (16 and 17) on armature (13).
17. Install armature (13) in frame and field coil assembly (9). Ensure that two ground brushes (14) and coil brushes (15) clear commutator bars.



409-1840

ASSEMBLY - CONTINUED

18. Install pin (11), new O-ring (10), frame and field coil assembly (9) on bracket (12).
19. Install new O-ring (8), cover (5), two new O-rings (7) and bolts (6) on frame and field coil assembly (9).
20. Install two bolts (4) in cover (5).
21. Install wire (1) and nut with captive washer (2) on solenoid (3).



22. Install starter (WP 0065 00).
23. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TORQUE CONVERTER REPAIR 0288 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Sealant, Loctite (Item 43, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Materials/Parts - Continued

O-ring (10 and 28)

Seal ring (29)

References

WP 0316 00

WP 0317 00

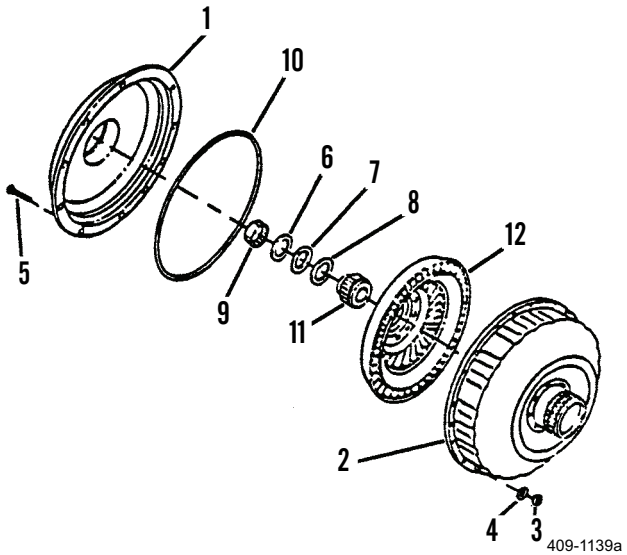
TM 10-3930-660-10

Equipment Condition

Torque converter removed (WP 0236 00)

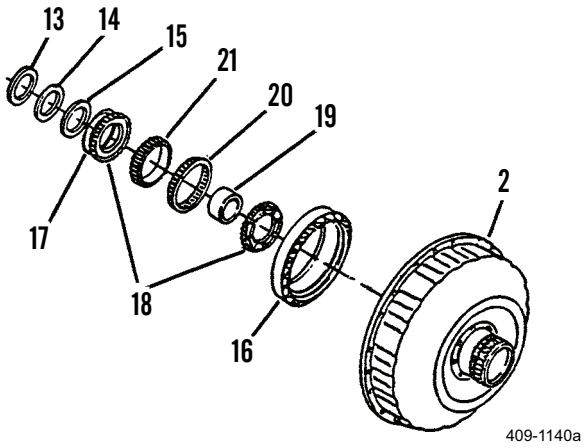
DISASSEMBLY

1. Mark front cover (1) and impeller (2) for assembly. Remove twenty hex nuts (3), twenty flatwashers (4), twenty capscrews (5) and front cover (1).
2. Remove outer thrust race (6), needle thrust bearing (7) and inner thrust race (8).
3. Use puller and remove bearing (9).
4. Remove and discard O-ring (10) from front cover (1).
5. Remove turbine hub (11) and turbine (12).



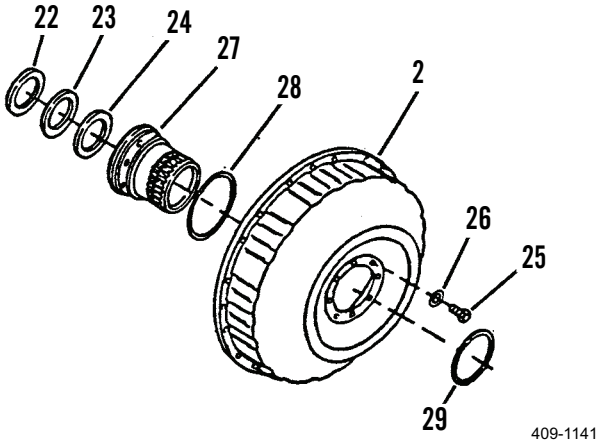
DISASSEMBLY - CONTINUED

6. Remove outer thrust washer (13), needle thrust bearing (14), inner thrust washer (15) and stator (16) from impeller (2).
7. Remove retaining ring (17), two clutch retainers (18), inner race (19), sprag clutch assembly (20) and outer race (21).



409-1140a

8. Remove outer thrust washer (22), needle thrust bearing (23) and inner thrust washer (24).
9. Remove eight capscrews (25), eight flatwashers (26) and impeller hub (27) from impeller (2).
10. Remove and discard O-ring (28) and seal ring (29).



409-1141

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

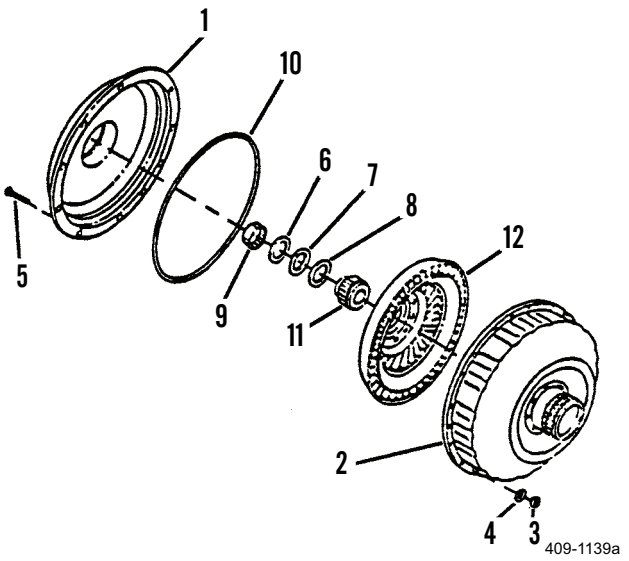
NOTE

Wipe all sealing surfaces clean and dry. Apply a thin film of clean lubricating oil to all seals and bearings as they are installed.

1. Install new O-ring (28) at base of impeller hub (27).
2. Install new seal ring (29) on impeller hub (27).
3. Install impeller hub (27), eight capscrews (25) and eight flatwashers (26). Torque capscrews (25) to 25 lb-ft (34 Nm).
4. Install inner thrust washer (24), needle thrust bearing (23) and outer thrust washer (22).

ASSEMBLY - CONTINUED

5. Install outer race (21), sprag clutch assembly (20) and inner race (19). Clutch assembly flange should be toward front of converter as shown. Stator will free-wheel counterclockwise viewed from output end.
6. Install sprag clutch assembly (20) with flanged edge of cage toward side of stator (16) marked “FRONT” or the letter “F”. The stator will free-wheel counterclockwise when viewed from output side.
7. Install two clutch retainers (18) and retaining ring (17).
8. Install stator (16) in impeller (2) so that the word “FRONT” faces away from impeller.
9. Install inner thrust washer (15), needle thrust bearing (14) and outer thrust washer (13).
10. Install turbine (12) and turbine hub (11).
11. Install inner thrust race (8), needle thrust bearing (7) and outer thrust race (6).
12. Install bearing (9) 0.040 in. (1.016 mm) below thrust race (6) surface.
13. Install new O-ring (10) on front cover (1).
14. Align marks made at disassembly between front cover (1) and impeller (2). Install front cover (1).



15. Apply loctite to threads of capscrews (5). Install twenty capscrews, twenty flatwashers (4) and twenty hex nuts (3). Torque capscrews to 25 lb-ft (34 Nm).
16. Install torque converter (WP 0236 00).
17. Operate equipment, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION ASSEMBLY REPAIR 0289 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Bearing driver insert (Item 3, WP 0324 00)

Tool kit, clutch aligning (Item 38, WP 0324 00)

Bearing driver (Item 4, WP 0324 00)

Lifting device, 10,000 lb capacity

Materials/Parts

Cap and plug set (Item 8, WP 0323 00)

Grease, GAA (Item 20, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Strap, tie down (Item 56, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Gasket (78)

Materials/Parts - Continued

O-ring (23, 46 and 65)

Seal (24, 47 and 66)

Wood block

References

WP 0316 00

WP 0317 00

Personnel Required

Two

Equipment Condition

Transmission control valve removed (WP 0239 00)

Transmission front cover assembly removed (WP 0238 00)

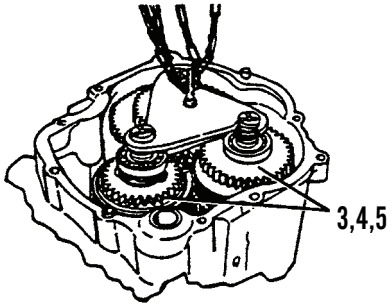
Transmission cover removed (WP 0150 00)

DISASSEMBLY

NOTE

All three clutch packs must be removed together because of gear meshing.

1. Install special lifting tool in bottom groove of all three shafts.
2. Attach a hoist with slings to special lifting tool and remove clutch packs (3 thru 5).
3. Place clutch packs (3 thru 5) on a clean bench. Place a wood block under first stage clutch pack (3). Remove special lifting tool from clutch packs.
4. Separate three clutch packs (3 thru 5).
5. Disassemble first stage clutch pack (3).

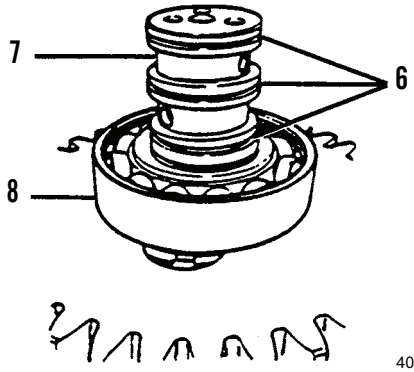


409-1154

CAUTION

Use care when removing seal rings to prevent clutch shaft damage.

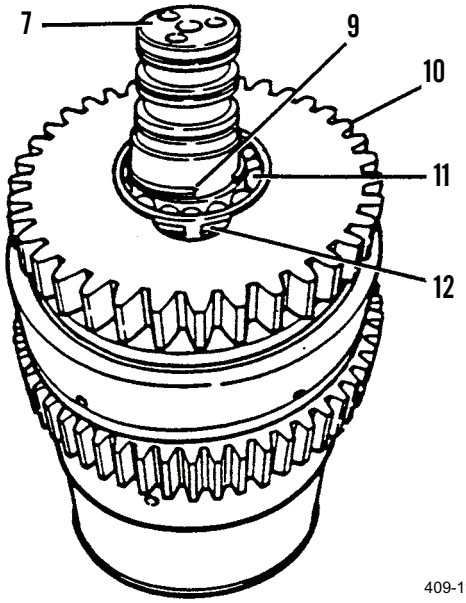
6. Remove three seal rings (6) from shaft assembly (7).
7. Use two pry bars 180 degrees apart to pry bearing (8) up and remove it from shaft assembly (7).



409-1155

DISASSEMBLY - CONTINUED

8. Remove snap ring (9) from shaft assembly (7).
9. Use a gear puller to remove weld gear (10) and bearing (11) as an assembly from shaft assembly (7).
10. Using an assistant to spread snap ring (12), use a driver to remove bearing (11) from weld gear (10).



409-1156

11. Remove snap ring (13).
12. Slide retainer (14) out of shaft assembly (7).

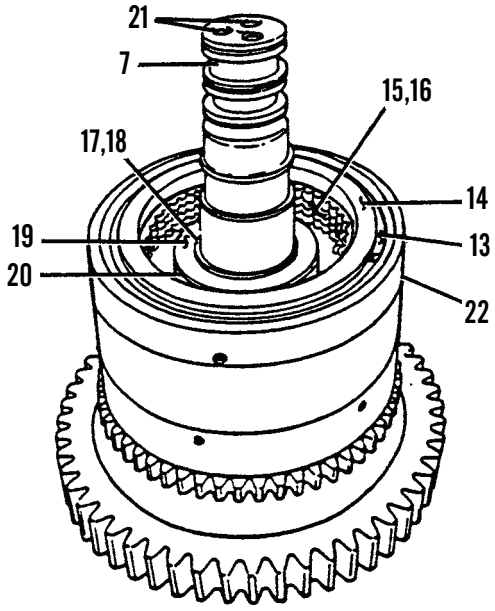
CAUTION

Carefully handle clutch plates so graphite coating does not flake off. Failure to follow this precaution could cause equipment damage.

13. Remove six clutch plates (15) and six separator plates (16).

NOTE

The first stage clutch pack contains twelve clutch plates and twelve separator plates.



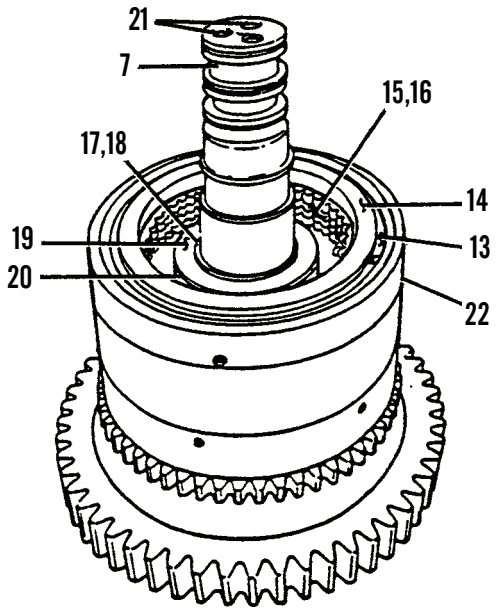
409-1157

DISASSEMBLY - CONTINUED

WARNING

Springs are under tension. Always wear face shield when working on compressed springs. Carefully handle spring in compressed form. Failure to follow this precaution could cause personal injury.

14. Place shaft assembly (7) in a press. Install a clutch spring compressor tool.
15. Press down on spring compressor tool and retainer (17) just enough to relieve pressure on retainer ring (18). Remove retainer ring (18). Slowly remove clutch spring compressor tool.
16. Remove retainer (17), four springs (19) and thrust washer (20).

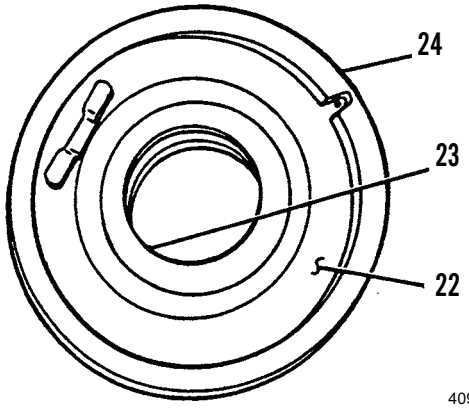


409-1157

WARNING

Do not exceed 30 psi (207 kPa) nozzle pressure when using compressed air. Do not direct compressed air against skin. Failure to follow this precaution could cause personal injury.

17. Insert air nozzle at pressure ports (21) located between three seal ring grooves on shaft assembly (7). Use compressed air to remove piston (22).
18. Remove and discard O-ring (23) and outer piston seal (24).
19. Turn shaft assembly (7) over and repeat steps 10 thru 20.



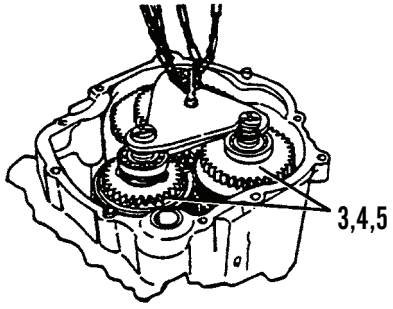
409-1158

DISASSEMBLY - CONTINUED

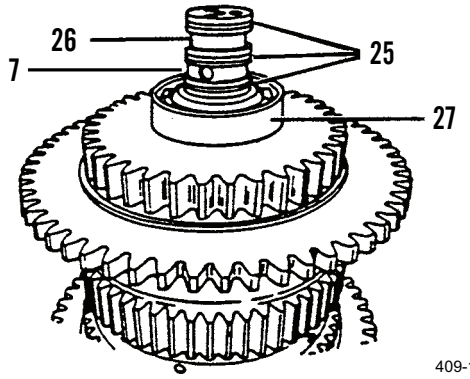
CAUTION

Use care when removing seal rings to prevent clutch shaft damage.

20. To disassemble second stage clutch pack (4), remove three seal rings (25) from shaft assembly (26).
21. Use two bars 180 degrees apart to pry bearing (27) up and remove it from shaft assembly (26).

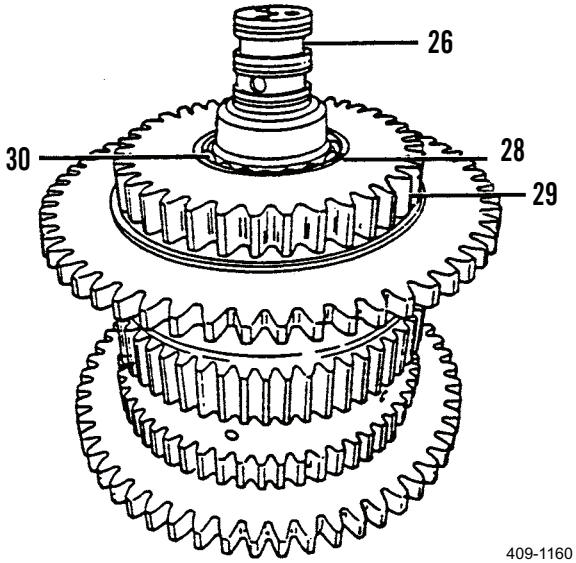


409-1154



409-1154

22. Remove snap ring (28) from shaft assembly (26).
23. Use a gear puller to remove weld gear (29) and bearing (30) as an assembly from shaft assembly (26).



409-1160

DISASSEMBLY - CONTINUED

24. Using an assistant to spread snap ring (31), use a driver to remove bearing (30) from weld gear (29).
25. Remove snap ring (32).
26. If necessary remove snap ring (31) from weld gear (29).
27. Slide retainer (33) out of shaft assembly (26).

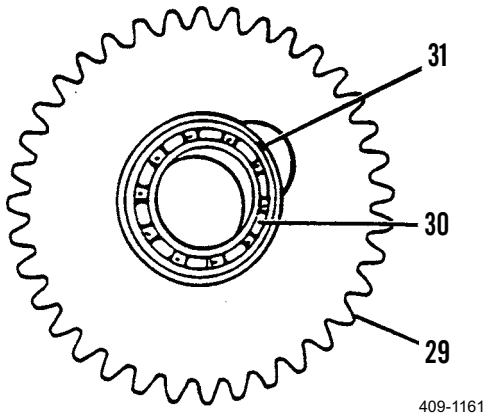
CAUTION

Carefully handle clutch plates so graphite coating does not flake off. Failure to follow this precaution could cause equipment damage.

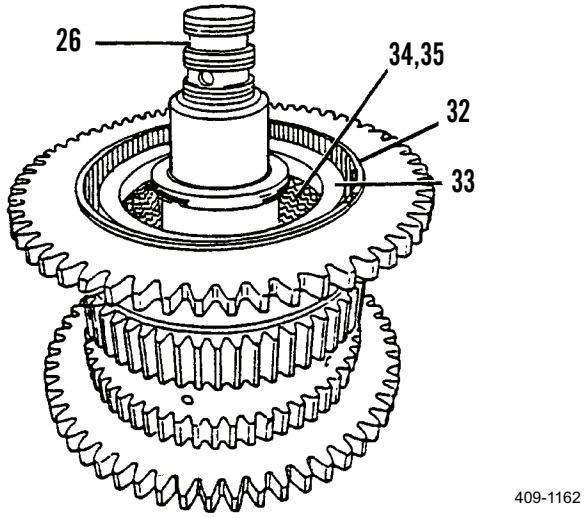
28. Remove six clutch plates (34) and six separator plates (35).

NOTE

The second stage clutch pack contains twelve clutch plates and twelve separator plates.

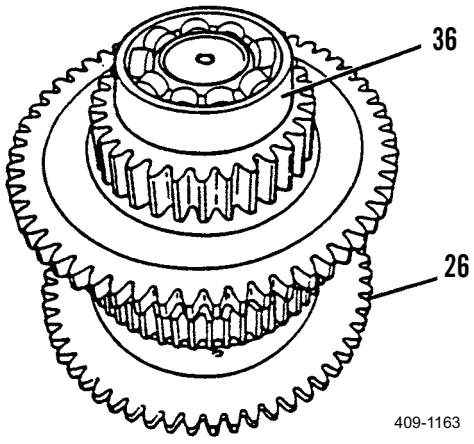


409-1161



409-1162

29. Turn shaft assembly (26) over.
30. Use two pry bars 180 degrees apart to pry bearing (36) up and remove it from shaft assembly (26).

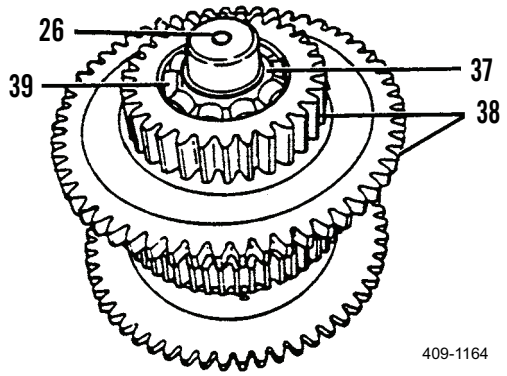


409-1163

DISASSEMBLY - CONTINUED

31. Remove snap ring (37).

32. Use a gear puller to remove weld gear (38) and two bearings (39) as an assembly from shaft assembly (26).



WARNING

Springs are under tension. Always wear face shield when working on compressed springs. Carefully handle spring in compressed form. Failure to follow this precaution could cause personal injury.

33. Place shaft assembly (26) in a press. Install a clutch spring compressor tool.

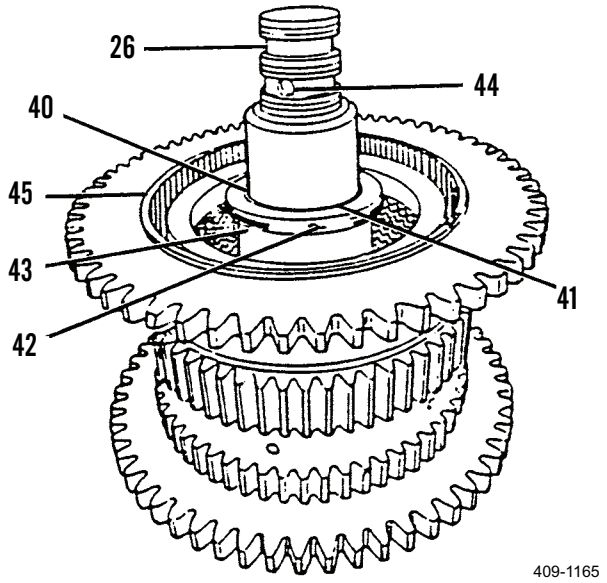
34. Press down on spring compressor tool and retainer (40) just enough to relieve pressure on retainer ring (41). Remove retainer ring (41). Slowly remove clutch spring compressor tool.

35. Remove retainer (40), four springs (42) and thrust washer (43).

WARNING

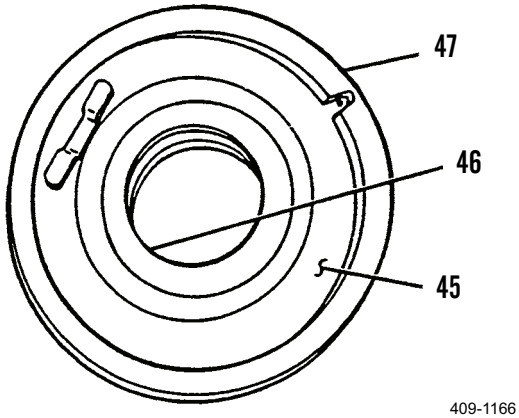
Do not exceed 15 psi (103 kPa) nozzle pressure when using compressed air. Do not direct compressed air against skin. Failure to follow this precaution could cause personal injury.

36. Insert air nozzle at pressure ports (44) located between three seal ring grooves on shaft assembly (26). Use compressed air to remove piston (45).

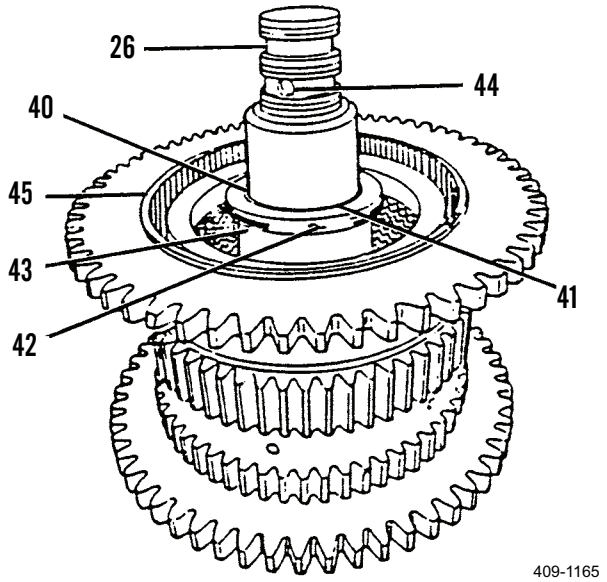


DISASSEMBLY - CONTINUED

37. Remove and discard O-ring (46) and outer piston seal (47).
38. Turn shaft assembly (26) over and repeat steps 27, 29, 30 and 35 thru 39.

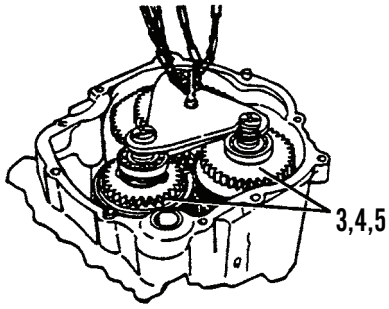


409-1166

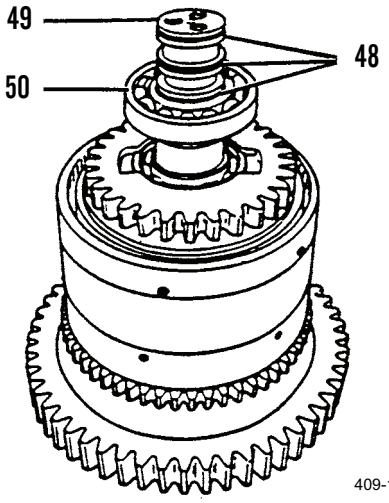


409-1165

39. Disassemble third stage clutch pack (5).
40. Remove three seal rings (48) from shaft assembly (49).
41. Use two pry bars 180 degrees apart to pry bearing (50) up and remove it from shaft assembly (49).



409-1154



409-1167

DISASSEMBLY - CONTINUED

42. Remove two snap rings (51).
43. Use a gear puller to remove weld gear (52) and bearing (53) as an assembly from shaft assembly (49).
44. Using an assistant to spread snap ring (54), use a driver to remove bearing (53) from weld gear (52).
45. Remove snap ring (55) and clutch plate retainer (56) from shaft assembly (49).
46. Remove four clutch plates (57) and four separator plates (58).

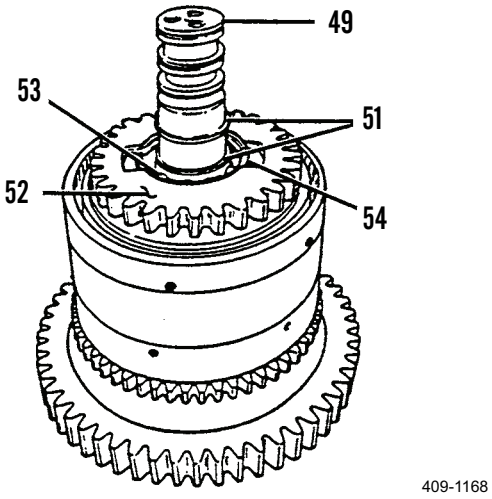
NOTE

The third stage clutch pack contains four clutch plates and four separator plates.

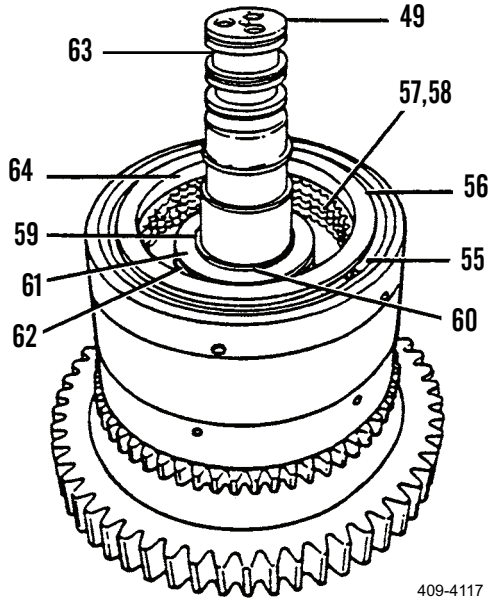
WARNING

Springs are under tension. Always wear face shield when working on compressed springs. Carefully handle spring in compressed form. Failure to follow this precaution could cause personal injury.

47. Place shaft assembly (49) in a press. Install a clutch spring compressor tool.
48. Press down on spring compressor tool and retainer (59) just enough to relieve pressure on retainer ring (60). Remove retainer ring (60). Slowly remove clutch spring compressor tool.
49. Remove retainer (59), four springs (61) and thrust washer (62).
50. Insert air nozzle at pressure ports (63) located between three seal ring grooves on shaft assembly (49). Use compressed air to remove piston (64).



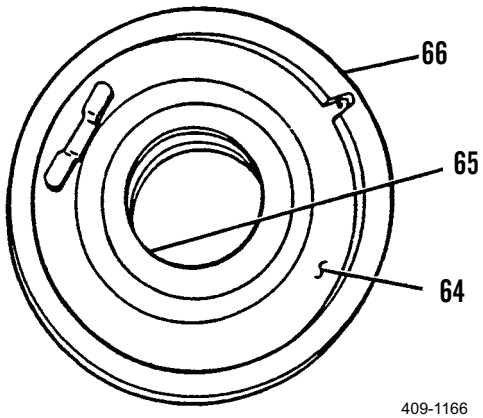
409-1168



409-4117

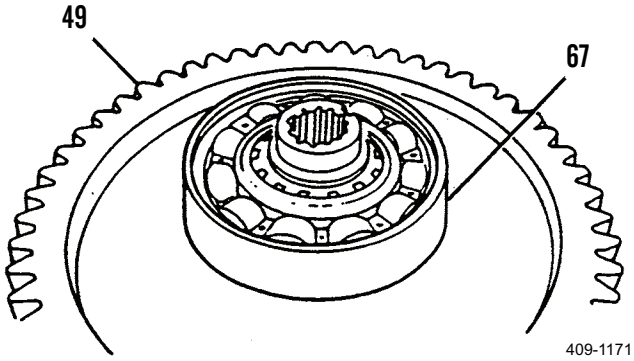
DISASSEMBLY - CONTINUED

51. Remove and discard O-ring (65) and outer piston seal (66) from piston (64).

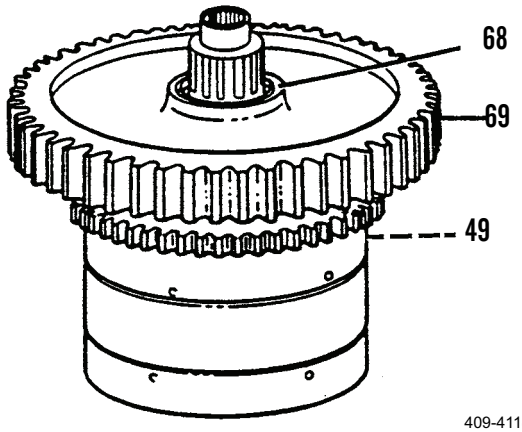


409-1166

52. Turn shaft assembly (49) over. Use a puller to remove bearing (67) from shaft assembly (49).
53. Remove snap ring (68) and gear (69) from shaft assembly (49).



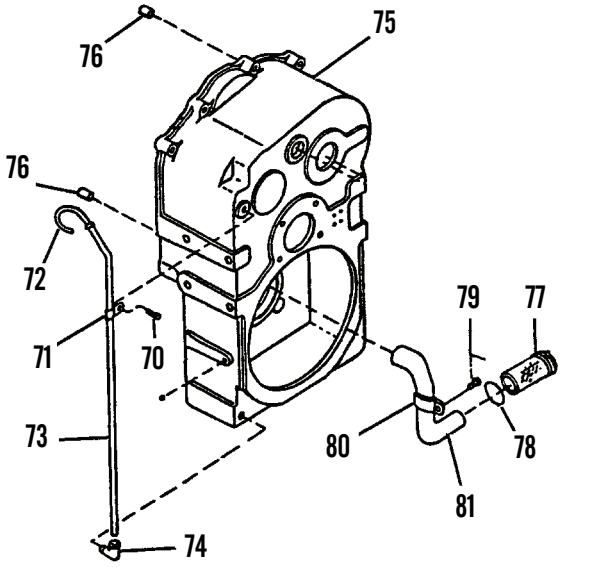
409-1171



409-4118

DISASSEMBLY - CONTINUED

54. Remove capscrew (70), clamp (71), dipstick (72), dipstick tube (73) and elbow (74) from transmission case (75).
55. Remove two locating bushings (76).
56. Remove suction screen (77) and gasket (78). Discard gasket.
57. Remove capscrew (79) from clamp (80) and remove suction tube (81).



409-1173

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

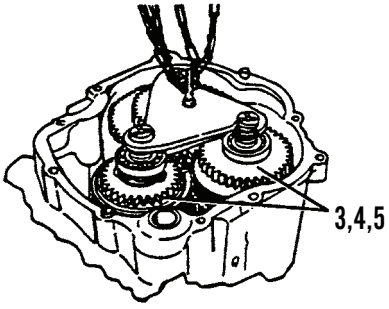
1. Install suction tube (81) and secure with clamp (80) and capscrew (79).
2. Install new gasket (78) and suction screen (77).
3. Install two locating bushings (76).
4. Install elbow (74), dipstick tube (73), dipstick (72), clamp (71) and capscrew (70) on transmission case (75).

ASSEMBLY - CONTINUED

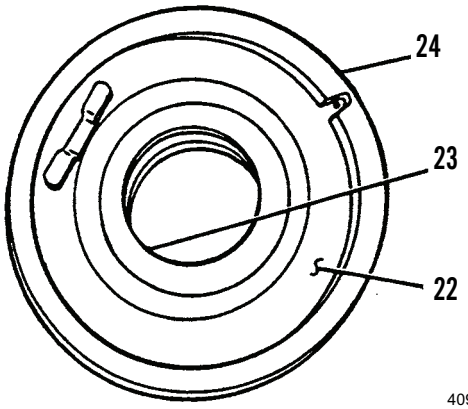
NOTE

Wipe all sealing surfaces clean and dry. Apply film of clean hydraulic oil to all parts as they are installed.

5. To assemble first stage clutch pack (3), install new outer piston seal (24) onto piston (22).



409-1154



409-1158

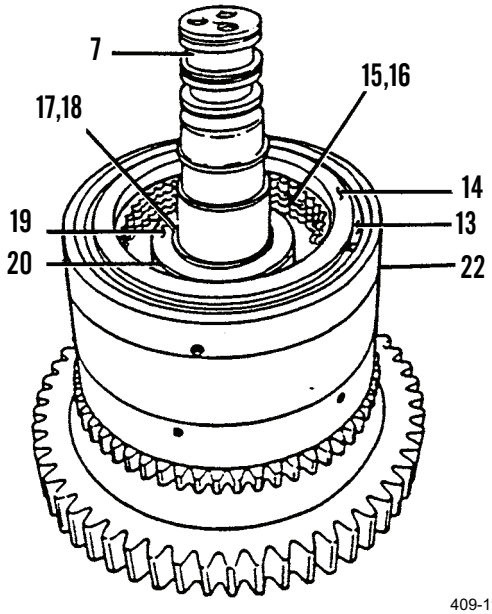
6. Install new O-ring (23) onto shaft assembly (7).

CAUTION

Use care when installing assembled piston to prevent damage to O-ring and outer piston seal.

7. Install assembled piston (22) into shaft assembly (7). Ensure that piston (22) aligns with locating pins in shaft assembly (17).

8. Install thrust washer (20), four springs (19) and retainer (17).



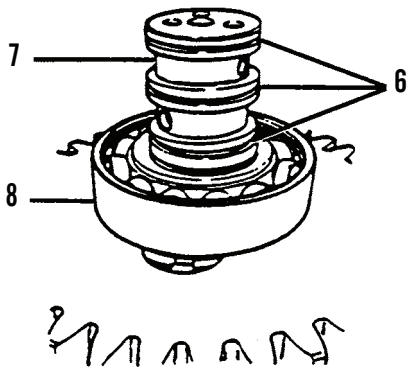
409-1175

ASSEMBLY - CONTINUED

WARNING

Springs are under tension. Always wear face shield when working on compressed springs. Carefully handle spring in compressed form. Failure to follow this precaution could cause personal injury.

9. Place shaft assembly (7) in a press. Install a spring compressor tool.



409-1155

WARNING

Ensure that retainer ring is secure in groove before spring compressor tool is removed from retainer to prevent springs from flying out. Failure to follow this precaution could cause personal injury.

10. Press down on spring compressor tool and retainer (17) to allow installation of retainer ring (18). Slowly remove spring compressor tool.

CAUTION

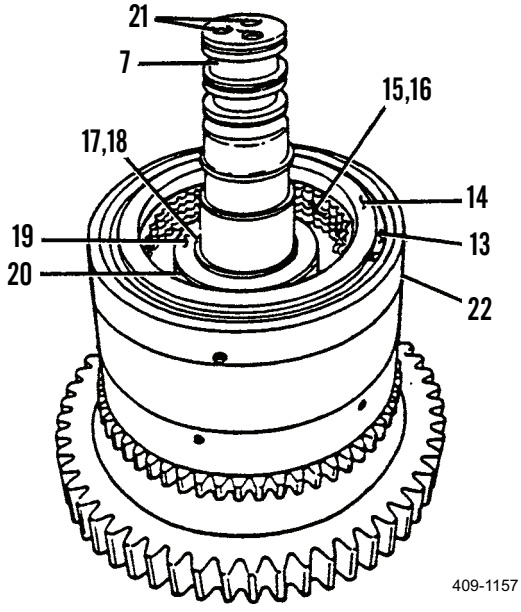
Carefully handle clutch plates so graphite coating does not flake off. Failure to follow this precaution could cause equipment damage.

11. Install six separator plates (16) and six clutch plates (15) into shaft assembly (7). Begin with separator plate (16) and then a clutch plate (15). Continue by alternating plates. The last plate must be a clutch plate (15).

NOTE

The separator plates have external teeth and clutch plates have internal teeth. The plates do not have a right or wrong side for installation.

12. Install retainer (14) and snap ring (13) on shaft assembly (7).



409-1157

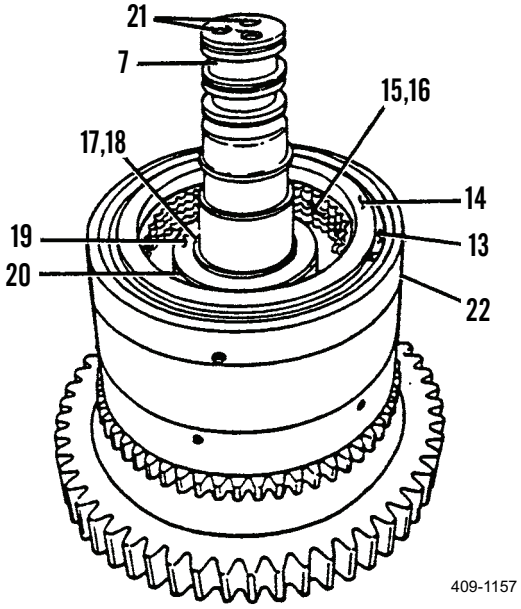
ASSEMBLY - CONTINUED

13. Install appropriate pair of alignment bars between weld gear (10) and piston (22), as required, to hold weld gear (10) off piston (22). Use either narrow or wide side of bars to ensure that weld gear (10) is held off piston (22) 5/8 in. (16 mm) and at the same time engages all clutch plates (15).

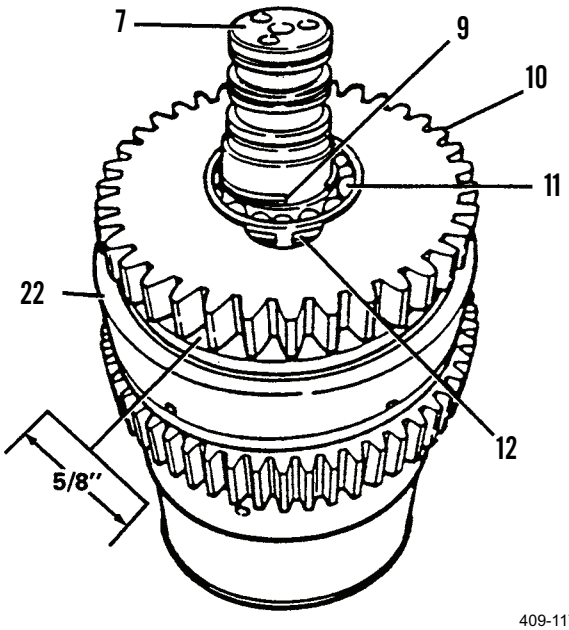
14. Install weld gear (10) on shaft assembly (7). Turn weld gear (10) so it meshes with clutch plates (15) and separator plates (16). Push weld gear (10) until it bottoms out. Weld gear (10) splines must be in full position with internal teeth of all clutch plates (15).

15. Using an assistant to spread snap ring (12), use a bearing driver to press bearing (11) onto shaft assembly (7) and into weld gear (10). Remove alignment bars to seat bearing (11) and weld gear (10) as an assembly.

16. Install snap ring (9). Ensure that snap ring (9) is fully in groove of shaft assembly (7).



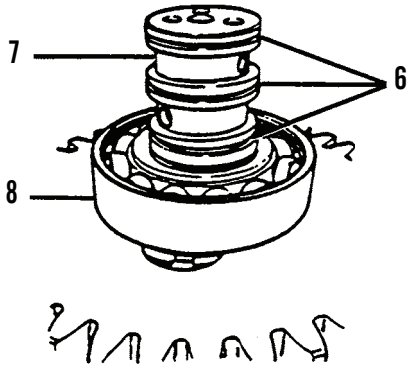
409-1157



409-1179

17. Use a bearing driver to press bearing (8) onto shaft assembly (7).

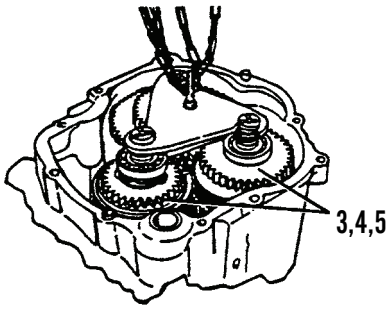
18. Apply grease to three seal rings (6) and install.



409-1155

ASSEMBLY - CONTINUED

19. Turn shaft assembly (7) over and repeat steps 8 thru 16.
20. To assemble second stage clutch pack (4), install new outer piston seal (47) onto piston (45).



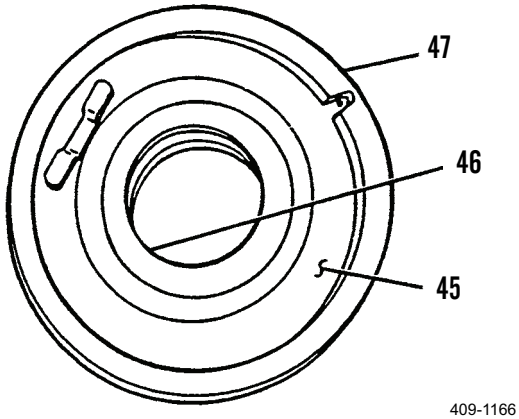
409-1154

21. Install new O-ring (46) onto shaft assembly (26).

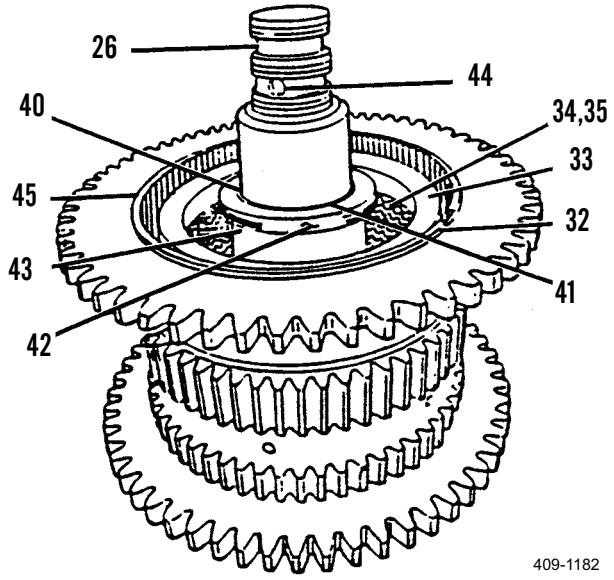
CAUTION

Use care when installing piston to prevent damage to O-ring and outer piston seal.

22. Install assembled piston (45) onto shaft assembly (26). Ensure that piston (45) aligns with locating pins in shaft assembly (26).
23. Install thrust washer (43), four springs (42) and retainer (40).



409-1166



409-1182

ASSEMBLY - CONTINUED

WARNING

Springs are under tension. Always wear face shield when working on compressed springs. Carefully handle spring in compressed form. Failure to follow this precaution could cause personal injury.

24. Place shaft assembly (26) in a press. Install a spring compressor tool.

WARNING

Ensure that retainer ring is secure in groove before spring compressor tool is removed from retainer to prevent springs from flying out. Failure to follow this precaution could cause personal injury.

25. Press down on spring compressor tool and retainer (40) to allow installation of retainer ring (41). Slowly remove spring compressor tool.

CAUTION

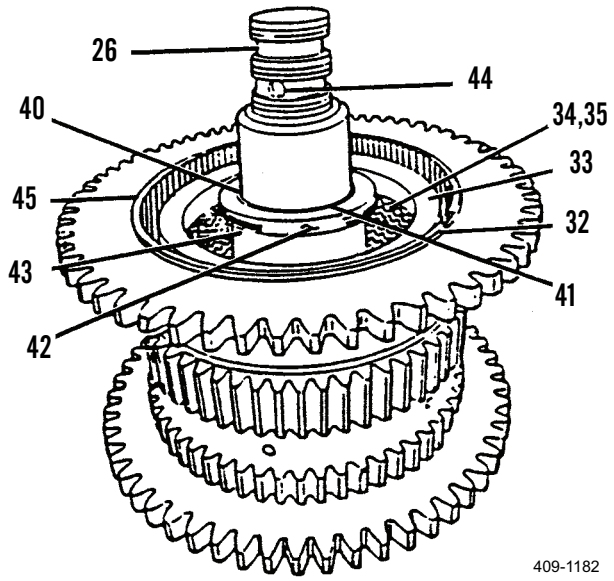
Carefully handle clutch plates so graphite coating does not flake off. Failure to follow this precaution could cause equipment damage.

26. Install six clutch plates (34) and six separator plates (35) into shaft assembly (26). Begin with a separator plate (35) and then a clutch plate (34). Continue by alternating plates. The last plate must be a clutch plate (34).

NOTE

The separator plates have external teeth and clutch plates have internal teeth. The plates do not have a right or wrong side for installation.

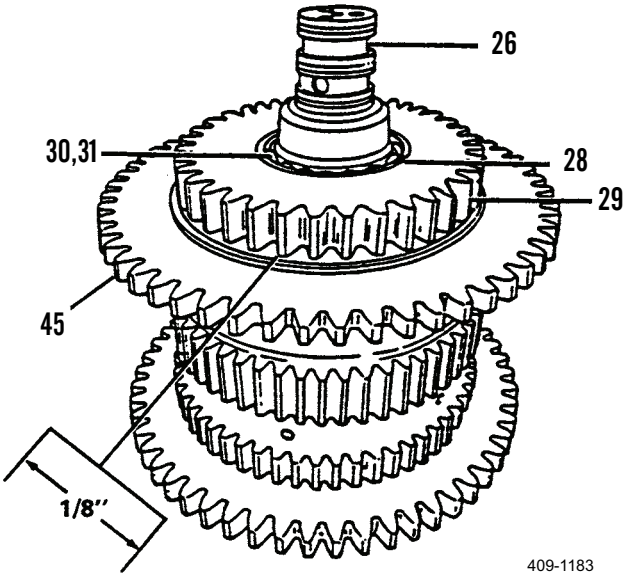
27. Install retainer (33) on shaft assembly (26).
28. Install snap ring (32).



ASSEMBLY - CONTINUED

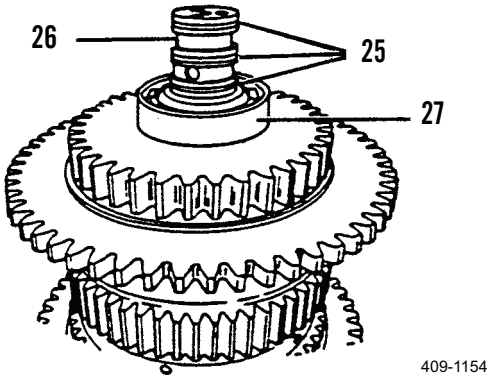
29. Install appropriate pair of alignment bars between weld gear (29) and piston (45) as required to hold weld gear (29) off piston (45). Use either narrow or wide side of bars to ensure that weld gear (29) is held off piston (45) 1/8 in. (0.3 mm), and at the same time engages all clutch plates (34).

30. If removed, install snap ring (31) in weld gear (29).
31. Install weld gear (29) on shaft assembly (26).
32. Use a bearing driver to press bearing (30) onto shaft assembly (26) and into weld gear (29). Remove alignment bars to seat bearing (30) and weld gear (29).
33. Install snap ring (28). Ensure that snap ring (28) is fully in groove of shaft assembly (26).

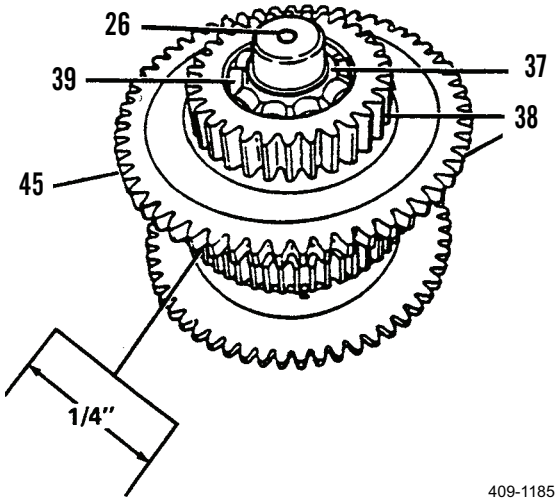


409-1183

34. Use a bearing driver to press bearing (27) onto shaft assembly (26).
35. Apply grease to three seal rings (25) and install.
36. Turn shaft assembly (26) over and repeat steps 23 thru 30.
37. Install weld gear (38) on shaft assembly (26). Turn weld gear (38) so it meshes with clutch plates (34) and separator plates (35). Push weld gear (38) until it bottoms out. Weld gear (38) splines must be in full position with internal teeth of all clutch plates (34).



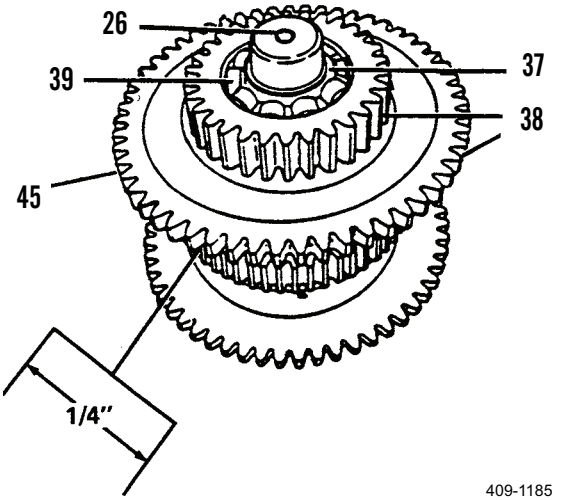
409-1154



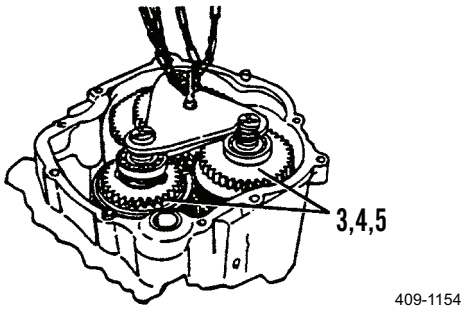
409-1185

ASSEMBLY - CONTINUED

38. Press one bearing (39) onto shaft assembly (26) until it is tight against snap ring.
39. Install appropriate pair of alignment bars between weld gear (38) and piston (45), as required, to hold weld gear (38) off piston. Use either narrow or wide bars to ensure that weld gear (38) is held off piston 1/4 in. (6.35 mm) and at the same time engages all clutch plates.
40. Install weld gear (38) on shaft assembly (26).
41. Press one bearing (39) onto shaft assembly (26) and into weld gear (38). Remove alignment bars to seat bearing (39) and weld gear (38).

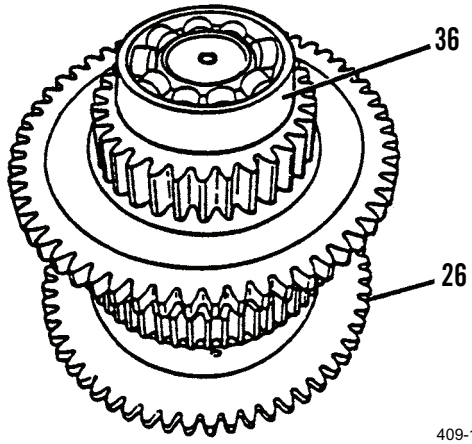


409-1185

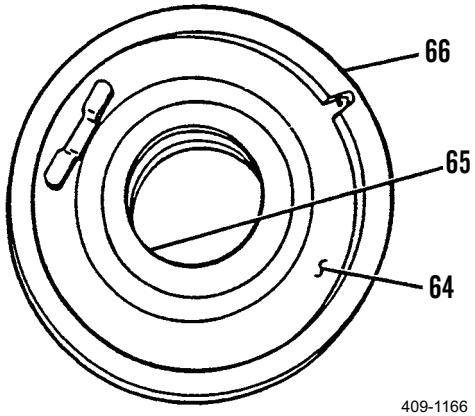


409-1154

42. Install snap ring (37) onto shaft assembly (26).
43. Press bearing (36) onto shaft assembly (26).
44. To assemble third stage clutch pack (5), install new outer piston seal (66) onto piston (64).
45. Install new O-ring (65) on piston (64).



409-1186



409-1166

ASSEMBLY - CONTINUED

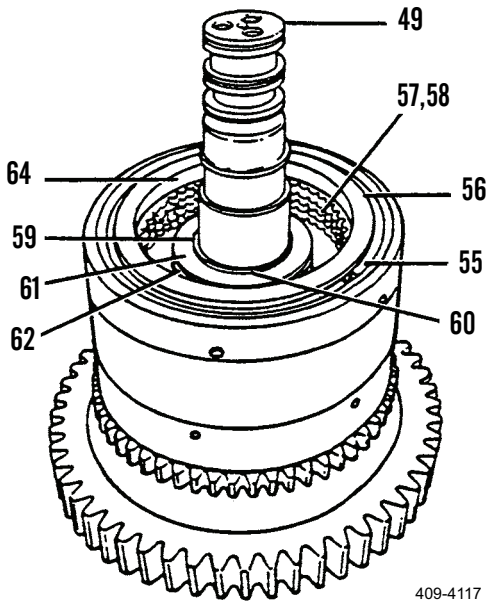
CAUTION

Use care when installing piston to prevent damage to O-ring and outer piston seal.

46. Install assembled piston (64) into shaft assembly (49). Ensure that piston (64) aligns with locating pins in shaft assembly (49).

47. Install thrust washer (62), four springs (61) and retainer (59).

48. Place shaft assembly (44) in a press. Install a spring compressor tool.



WARNING

Ensure that retainer ring is secure in groove before spring compressor tool is removed from retainer to prevent springs from flying out. Failure to follow this precaution could cause personal injury.

49. Press down on spring compressor tool and retainer (59) to allow installation of retainer ring (60). Slowly remove spring compressor tool.

CAUTION

Carefully handle clutch plates so graphite coating does not flake off. Failure to follow this precaution could cause equipment damage.

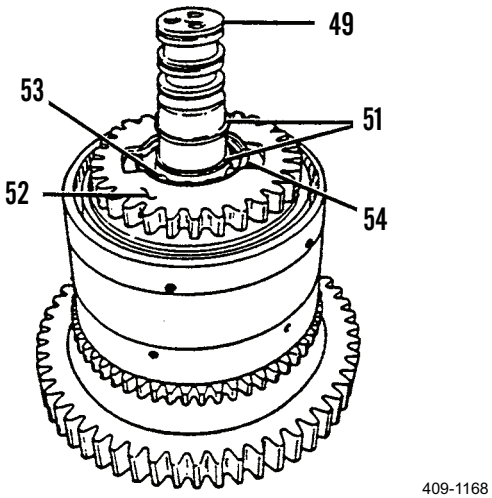
50. Install four clutch plates (57) and four separator plates (58) into shaft assembly (49). Begin with a separator plate (58) and then a clutch plate (57). Continue by alternating plates. The last plate must be a clutch plate (57).

NOTE

The separator plates have external teeth and clutch plates have internal teeth. The plates do not have a right or wrong side for installation.

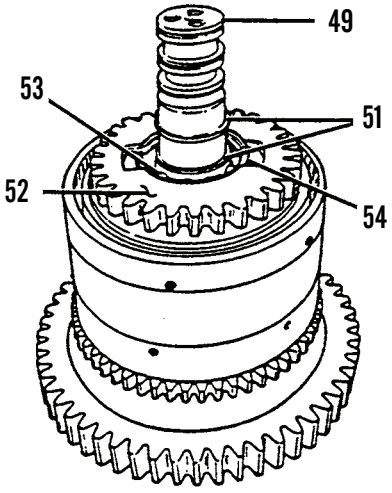
51. Install clutch plate retainer (56) and snap ring (55) on shaft assembly (49).

52. Install appropriate pair of alignment bars between weld gear (52) and piston (64), as required, to hold weld gear (52) off piston (64). Use either narrow or wide side of bars to ensure that weld gear (52) is held off piston (64) 1/16 in. (1.6 mm) and at the same time engages all clutch plates (57).

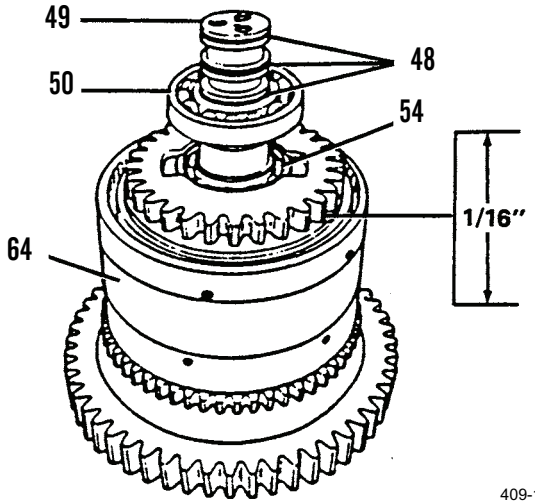


ASSEMBLY - CONTINUED

53. Install weld gear (52) on shaft assembly (49).
54. Using an assistant to spread snap ring (54), use a bearing driver to press bearing (50) onto shaft assembly (49) and into weld gear (52).
55. Install two snap rings (51). Ensure that snap rings (51) are fully in grooves of shaft assembly (49).

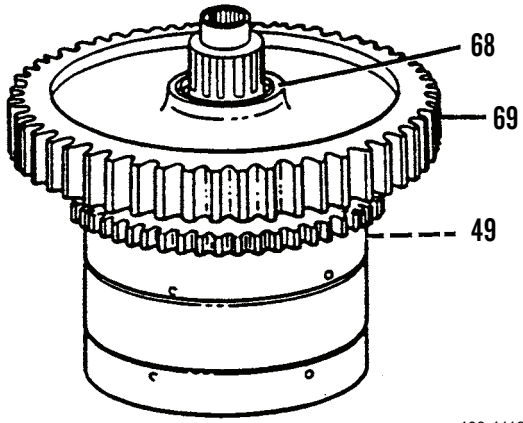


409-1168



409-1190

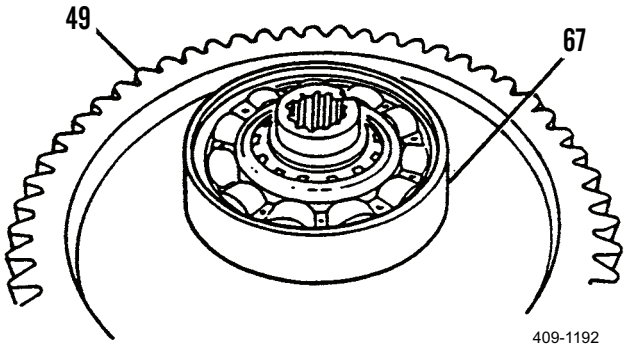
56. Use bearing driver to press bearing (50) onto shaft assembly (49).
57. Apply grease to three seal rings (48) and install.
58. Turn shaft assembly (49) over and press gear (69) onto shaft assembly (49).
59. Install snap ring (68) onto shaft assembly (49).



409-4118

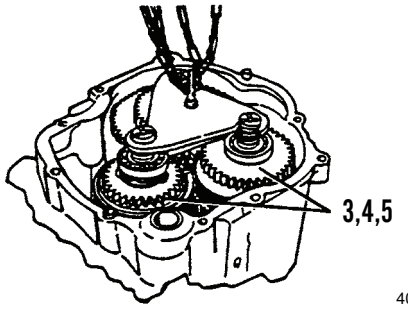
ASSEMBLY - CONTINUED

60. Tap or press bearing (67) onto shaft assembly (49).



409-1192

61. Place first stage clutch pack (3) on a wood block. Move the assembled three clutch packs (3 thru 5) together.
62. Install a special lifting tool in bottom groove of all three clutch pack (3 thru 5) shafts.
63. Attach a hoist with slings to special lifting tool and install clutch packs (3 thru 5) into main case.
64. Ensure that clutch packs (3 thru 5) are in proper position and sequence before removing special lifting tool. Ensure that bearings engage with seats in main case.



409-1154

65. Install transmission front cover assembly (WP 0238 00).
66. Install transmission control valve (WP 0239 00).

END OF WORK PACKAGE

TRANSMISSION FRONT COVER ASSEMBLY MAINTENANCE 0290 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 2,000 lb capacity

Materials/Parts

Grease, GAA (Item 20, WP 0323 00)

Sealant, Loctite (Item 43 and 48, WP 0323 00)

Sealant, permatex (Item 50, WP 0323 00)

Lockwasher (17)

O-ring (19 and 20)

Oil seal (3)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Transmission assembly removed (WP 0237 00)

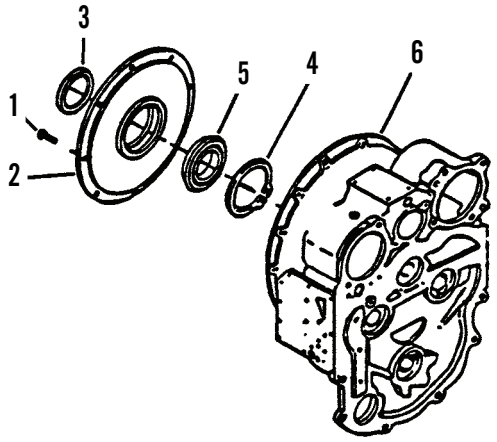
Transmission control valve removed (WP 0239 00)

Torque converter removed (WP 0236 00)

Transmission oil pump removed (WP 0240 00)

DISASSEMBLY

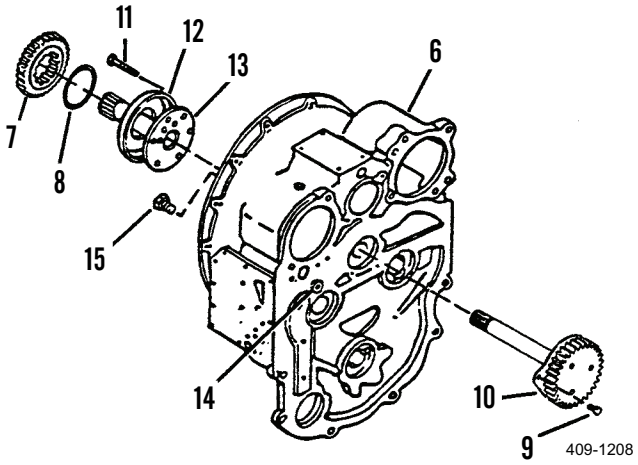
1. Remove seven capscrews (1) and bearing retainer (2).
2. Remove and discard oil seal (3).
3. Remove retaining ring (4) and bearing (5).
4. Remove permatex gasket material between bearing retainer (2) and transmission front cover (6).



409-1207

DISASSEMBLY - CONTINUED

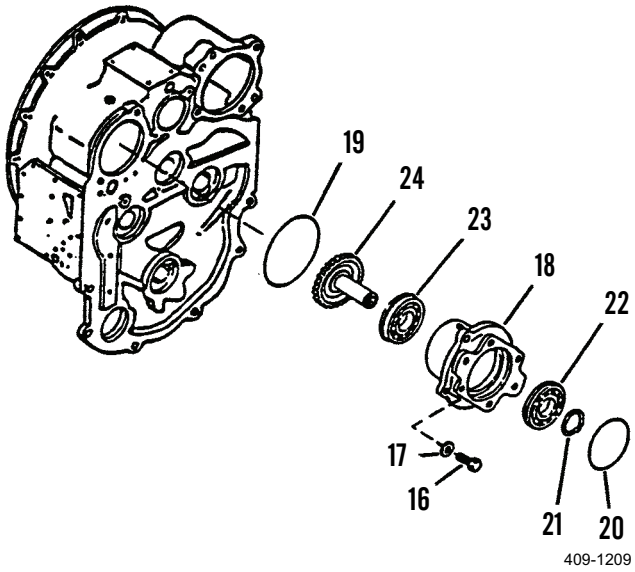
5. Remove hub impeller gear (7) and thrust washer (8).
6. Remove three capscrews (9) and transmission input shaft (10) as an assembly.
7. Remove six capscrews (11), cover plate (12) and stator support tube (13).



NOTE

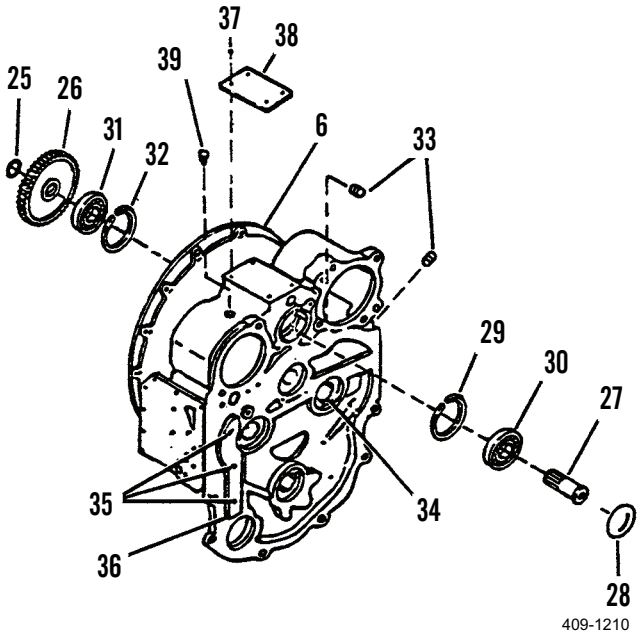
Do not remove high pressure line in front cover. The entire front cover assembly must be replaced if replacement of high pressure line is necessary. The high pressure line is not replaceable.

8. Remove allen head pipe plug (14).
9. Drive converter pressure relief valve (15) through pipe plug (14) opening in transmission front cover (6).
10. Remove four capscrews (16), four lockwashers (17) and hydraulic piston pump drive adapter (18) as an assembly. Discard lockwashers.
11. Remove and discard O-rings (19 and 20).
12. Remove snap ring (21), bearing (22) and bearing roller (23) from auxiliary pump gear (24).



DISASSEMBLY - CONTINUED

13. Remove snap ring (25) and auxiliary pump gear (26).
14. Use a punch to strike shaft (27) until cover (28) comes off and shaft (27) comes out.
15. Remove snap ring (29) from front cover (6).
16. Remove bearing (30) from shaft (27).
17. Remove bearing (31) and snap ring (32) from front cover (6).
18. Remove two pipe plugs (33).
19. Remove sleeve (34).
20. Remove three capscrews (35) and oil passage cover (36).
21. Remove four capscrews (37) and identification plate (38).
22. Remove breather (39).



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. Apply loctite 59241 and install breather (39).
2. Install identification plate (36) and four capscrews (37).
3. Install oil passage cover (36) and three capscrews (35).
4. Install sleeve (34). Align index mark on sleeve (34) to center of locating hole.
5. Apply loctite 59241 and install two pipe plugs (33).

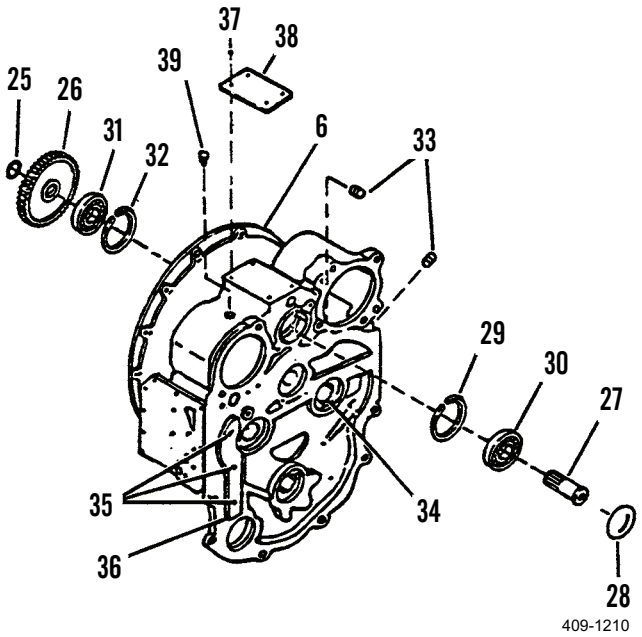
NOTE

When installing cover, apply loctite 242.

6. Install snap ring (32) and bearing (31) in transmission front cover (6).
7. Install snap ring (29) inside front cover (6).
8. Install bearing (30) on shaft (27).

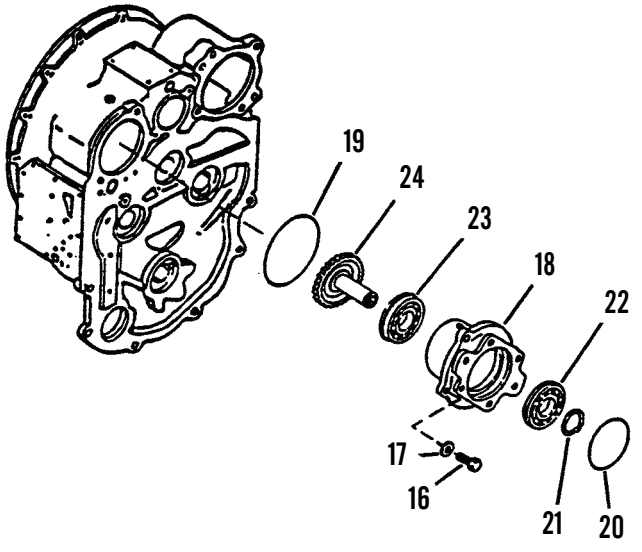
ASSEMBLY - CONTINUED

9. Install shaft (27) with bearing (30) in front cover (6).
10. Use a suitable puller to pull shaft (27) through front side of front door (6) and through auxiliary pump gear (26) until snap ring groove is seen.
11. Install snap ring (25).
12. Apply loctite 242 to cover (28) and press onto front cover (6).



409-1210

13. Install hydraulic piston pump drive adapter (18).
14. Install bearing roller (23) and bearing (22) on shaft of auxiliary pump gear (24).
15. Install snap ring (21).
16. Slide parts (21 thru 24) as an assembly into hydraulic piston pump drive adapter (18).
17. Install new O-rings (19 and 20) on hydraulic piston pump drive adapter (18).



409-1209

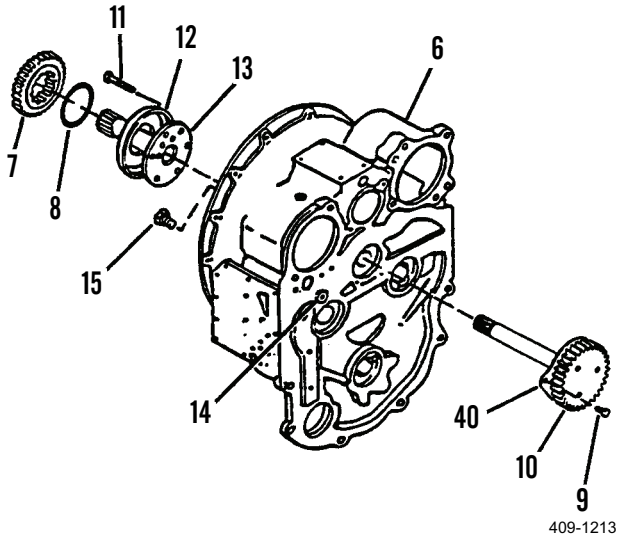
NOTE

Prior to installing capscrews, apply loctite 242.

18. Install hydraulic piston pump drive adapter (18), four new lockwashers (17) and four capscrews (16).

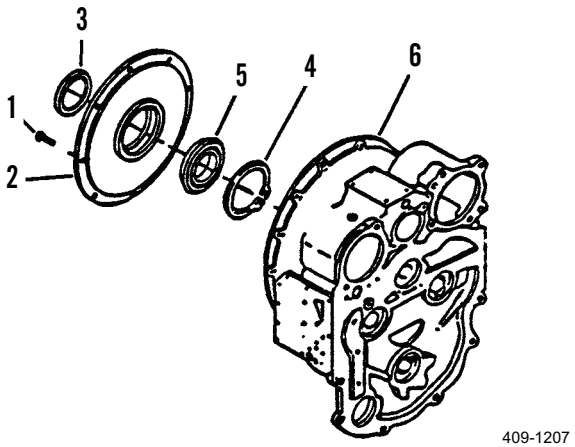
ASSEMBLY - CONTINUED

19. Apply loctite 242 to converter pressure relief valve (15) and drive into bore until valve seat shoulders against bottom of bore.
20. Apply loctite 59241 and install allen head pipe plug (14) to back side of front cover (6).
21. Install stator support tube (13), cover plate (12) and six capscrews (11).
22. Install transmission input shaft (10), as an assembly, through back of front cover (6). Ensure that flat side bearing retainer (40) is against front cover (6).
23. Apply loctite 242 on threads of three capscrews (9) and install.
24. Install thrust washer (8) against cover plate (12).
25. Install impeller gear (7) against thrust washer (8).



409-1213

26. Install bearing (5) with retaining ring (4) on bearing retainer (2).
27. Install new oil seal (3) in bearing retainer (2).
28. Apply permatex gasket material to bearing retainer (2). Ensure that new oil seal (3) is on the outside before installation bearing retainer (2). Install bearing retainer (2) and seven capscrews (1).



409-1207

29. Install transmission oil pump (WP 0240 00).
30. Install torque converter (WP 0236 00).
31. Install transmission control valve (WP 0239 00).
32. Install transmission assembly (WP 0237 00).
33. Operate transmission, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION OUTPUT SHAFT MAINTENANCE 0291 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

O-ring (3 and 19)

Oil seal (20 and 25)

Wood block

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

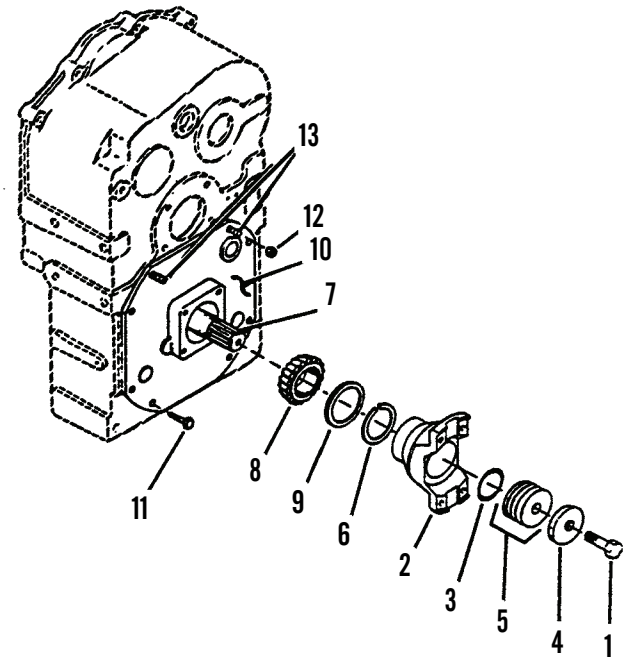
Equipment Condition

Front and rear propeller shafts removed (WP 0124 00)

Transmission oil drained (WP 0118 00)

REMOVAL

1. Remove capscrew (1), yoke (2), O-ring (3), washer (4) and shims (5). Discard O-ring.
2. Place transmission on blocks with converter side vertical.
3. Remove snap ring (6). Push output shaft (7) toward converter side of main case.
4. Use a gear puller to remove bearing cone (8) and thrust race (9).
5. Mark position of output cap (10) with relation to main case. Remove two capscrews (11) and two nuts (12). Two studs (13) should stay in main case.



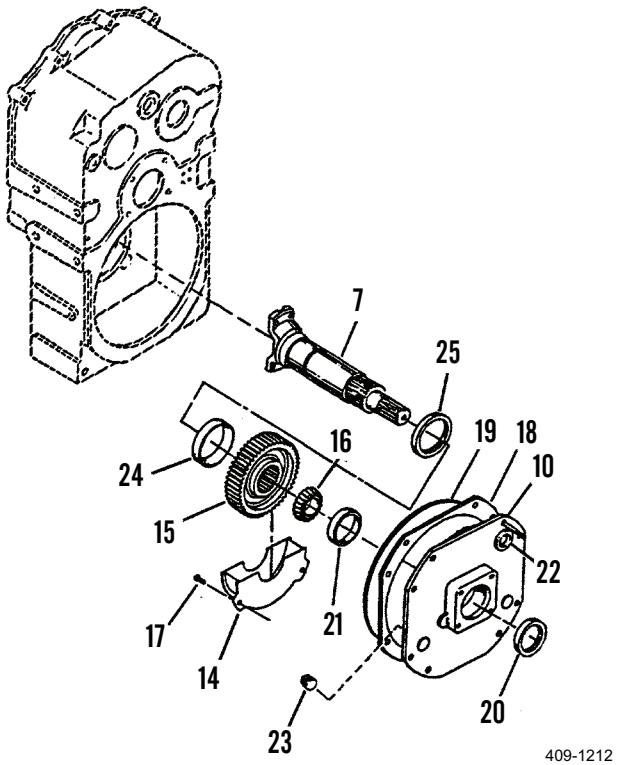
409-1211

REMOVAL - CONTINUED

CAUTION

Use care when removing baffle pan. Failure to follow this precaution will damage machine parts.

6. Remove the output cap (10). The baffle pan (14), gear (15) and bearing cone (16) will come off with output cap (10).
7. Remove two capscrews (17) and oil baffle pan (14).
8. Remove shims (18), O-ring (19), oil seal (20) and bearing cup (21) from output cap (10). Discard O-ring and oil seal.
9. Remove plug (22), if necessary.
10. Remove plug (23), if necessary.
11. Remove bearing cup (24) and oil seal (25) from main case. Discard oil seal.



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

INSTALLATION

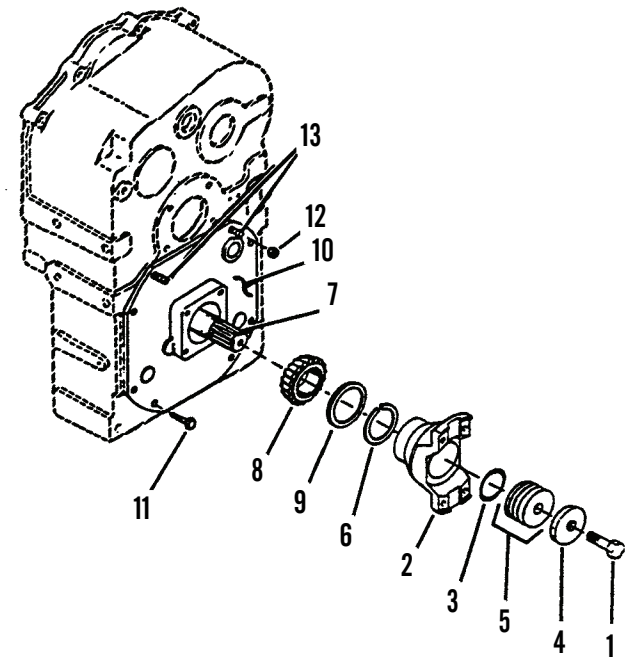
WARNING

- 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.
- Wear gloves and proper clothing while handling hot bearing cones. Failure to follow this warning could cause injury to personnel.

CAUTION

Bearing cones must not be heated above 300°F (149°C). Freezing bearing cups is acceptable to aid for installation.

1. Install new oil seal (25) and bearing cup (24) in main case.
2. If removal was necessary, install plug (23).
3. If removal was necessary, install plug (22).
4. Install bearing cup (21) and new oil seal (20) in output cap (10).
5. Place case in vertical position. Install output shaft (7) with spacer screws to locate it in main case. Ensure that output shaft (7) is installed straight and finished material of output shaft (7) yoke end is visible in front of seal.
6. Install bearing cone (8), thrust race (9) and snap ring (6) onto output shaft (7).
7. Lay case down with output shaft (7) up. Install a new O-ring (19) in groove of output cap (10).
8. Install bearing cone (16) in bearing cup (21).
9. Place gear (15) in baffle pan (14). Install baffle pan (14) and two capscrews (17) to output cap (10).
10. Install shims (18).
11. Use two studs (13) as guide and carefully install output cap (10) with shims (18) on main case. Use care to prevent damage to oil seal (20) and O-ring (19).
12. Install two nuts (12) and two capscrews (11). Ensure that output shaft (7) spins freely.



409-1211

NOTE

If a new yoke was installed, adjust shims to obtain 0.005 in. (0.127 mm) gap between yoke face and washer.

13. Install yoke (2), new O-ring (3), shims (5), washer (4) and capscrew (1).
14. Install a dial indicator to read shaft end play.
15. Pull up on output shaft (7) and read end play on dial indicator.
16. If end play is not within 0.000 to 0.004 in. (0.000 to 0.101 mm), adjust shims (5) as necessary to bring end play within specifications.
17. Remove indicator and base.

INSTALLATION - CONTINUED

18. Install front and rear propeller shafts (WP 0124 00).
19. Fill transmission with oil (WP 0118 00).
20. Operate transmission, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION INPUT SHAFT MAINTENANCE 0292 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Lifting device, 2,000 lb capacity

Materials/Parts

Grease, GAA (Item 20, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Gasket (9)

Seal ring (12)

Personnel Required

Two

References

WP 0316 00

WP 0317 00

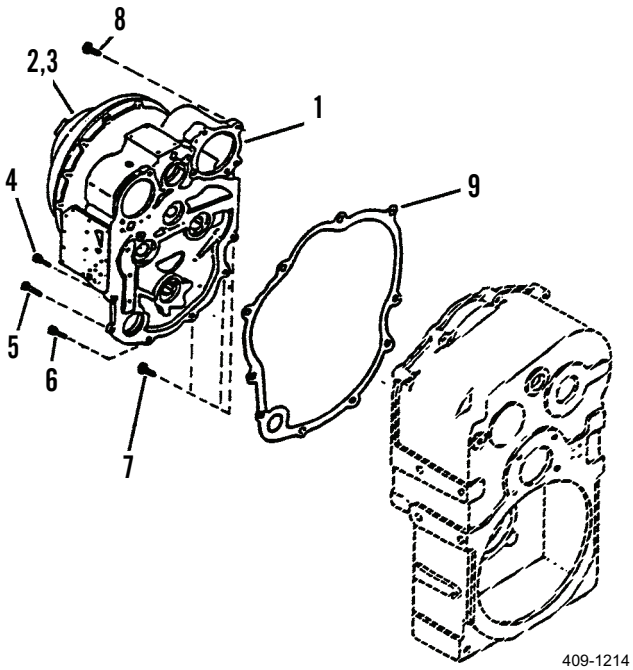
TM 10-3930-660-10

Equipment Condition

Transmission assembly removed (WP 0237 00)

REMOVAL

1. Remove transmission front cover assembly (1), torque converter (2) and front housing (3) as a unit from main case.
2. Attach a hoist with sling, or other suitable lifting device, to transmission front cover assembly (1), torque converter (2) and front housing (3) as a unit.
3. Remove capscrews (4 thru 6), three capscrews (7) and four capscrews (8) which secure transmission front cover assembly (1) to main case.

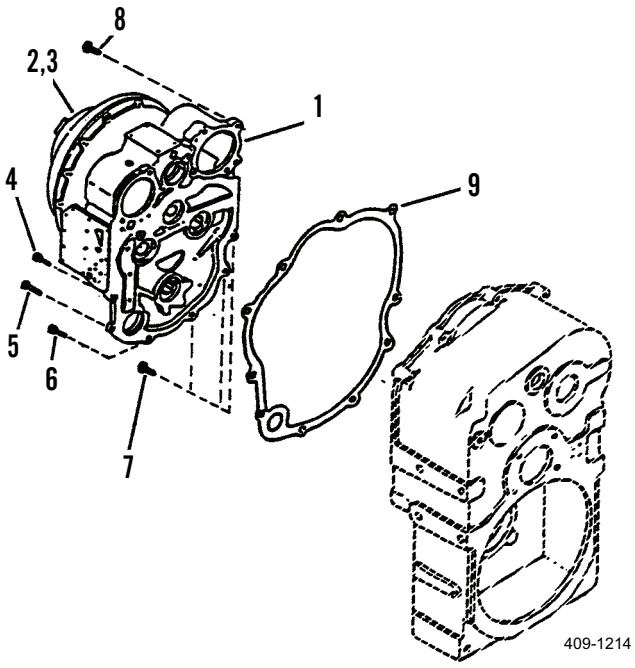


REMOVAL - CONTINUED

WARNING

Use 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. Use the hoist to lift unit off main case.
5. Remove and discard gasket (9).

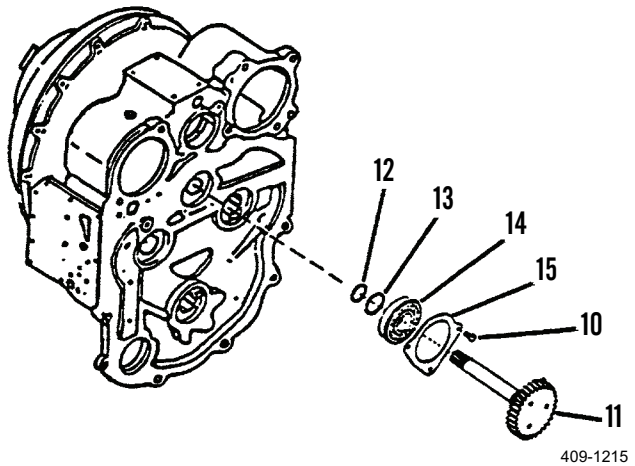


409-1214

6. Remove three capscrews (10) and transmission input shaft (11) as an assembly.

DISASSEMBLY

1. Remove and discard seal ring (12) from input shaft (11).
2. Remove snap ring (13) and ball bearing (14).
3. Remove bearing retainer (15).



409-1215

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. Install bearing retainer (15) on input shaft (11). Ensure that flat side of bearing retainer (15) faces away from input shaft (11) gear.
2. Install ball bearing (14) and snap ring (13).
3. Install new seal ring (12).

INSTALLATION

NOTE

- When installing capscrews, apply loctite.
- Install input shaft as an assembly.

1. Apply grease to new seal ring (12) to center it on input shaft (11).
2. Install input shaft (11) through bore in back of front cover assembly (1). Ensure that bearing retainer (15) is placed with flat side against front cover (1).
3. Apply loctite to threads of three capscrews (10) and install.

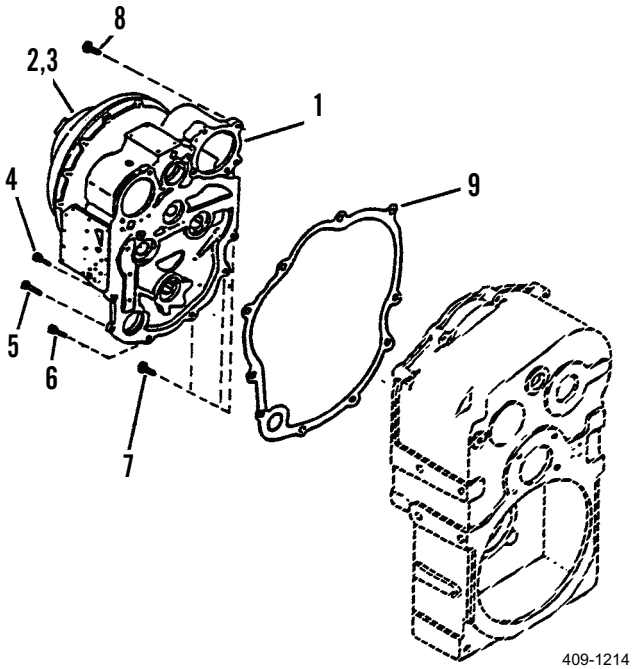
INSTALLATION - CONTINUED

4. Install transmission front cover assembly (1), torque converter (2) and front housing (3) as a unit to main case.
5. Position new gasket (9) on main case.

WARNING

Use 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.

6. Attach a hoist with sling, or other suitable lifting device, to front cover assembly (1), torque converter (2) and transmission front housing (3) as a unit. Lift unit into position on main case.
7. Install four capscrews (8), three capscrews (7) and capscrews (4 thru 6) which secure unit to main case.



409-1214

8. Install transmission assembly (WP 0237 00).
9. Operate transmission, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION CONTROL VALVE MAINTENANCE 0293 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Sealant, Loctite (Item 48, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Materials/Parts - Continued

Oil seal (16 and 23)

O-ring (3, 7, 11, 15, 19, 25 and 31)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Transmission removed (WP 0237 00)

DISASSEMBLY

1. Remove neutral start switch (1).

WARNING

Springs are under tension. Always wear face shield when working on compressed springs. Carefully handle spring in compressed form. Failure to follow this precaution could cause personal injury.

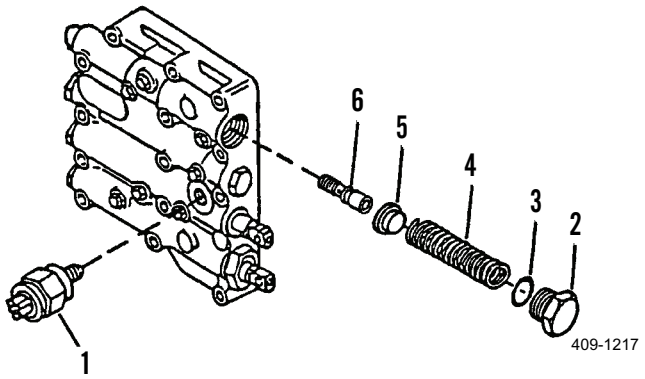
CAUTION

Do not overtighten vise jaws. Failure to follow this precaution will cause part damage.

NOTE

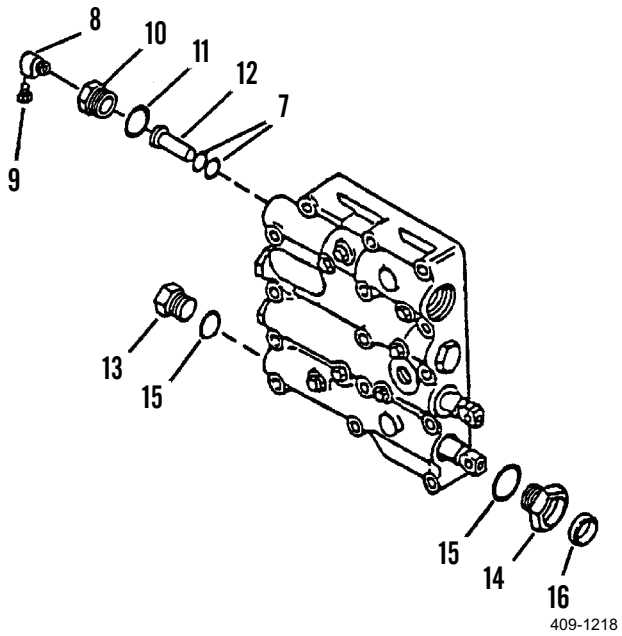
Line vise jaws with soft material to avoid damaging valve housing.

2. Remove plug (2). Remove and discard O-ring (3).
3. Remove return spring (4) and spring guide (5).
4. Remove pressure valve assembly (6).



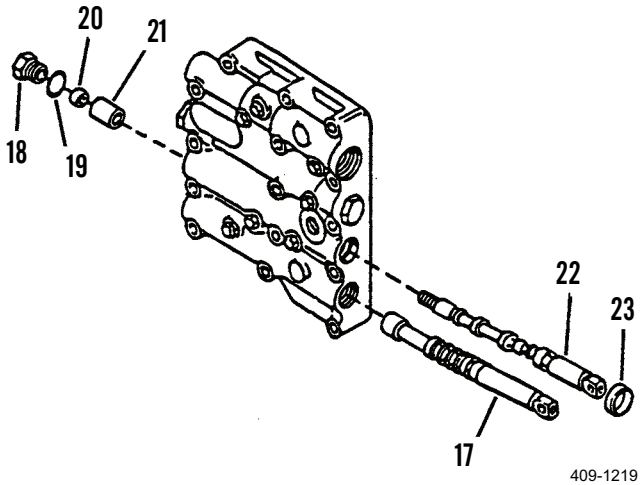
DISASSEMBLY - CONTINUED

5. Remove and discard two O-rings (7).
6. Remove elbow (8). Remove plug (9) if necessary.
7. Remove brake line plug (10). Remove and discard O-ring (11).
8. Remove brake cutoff piston (12).
9. Remove plugs (13 and 14). Remove and discard O-ring (15) from each plug (13 and 14).
10. Remove and discard oil seal (16) from plug (14).



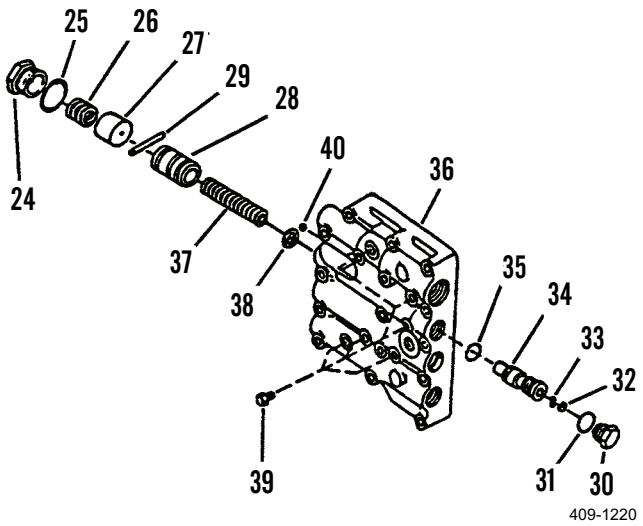
409-1218

11. Remove stem assembly (17) (range selector spool).
12. Remove cap (18). Remove and discard O-ring (19).
13. Remove nut (20) and spacer (21).
14. Remove stem (22) (directional spool). Remove and discard oil seal (23).



409-1219

DISASSEMBLY - CONTINUED



15. Remove plug (24). Remove and discard O-ring (25).
16. Remove dump valve spring (26) and dump valve (27).
17. Depress accumulator piston (28) and remove roller (29).
18. Remove plug (30). Remove and discard O-ring (31).
19. Remove snap ring (32), orifice plate, spool (34) and shims (35) from end of valve body (36).
20. Remove accumulator piston (28), accumulator spring (37) and washer (38) from other end of valve body.
21. Remove eight plugs (39) and one ball (40) if necessary.

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

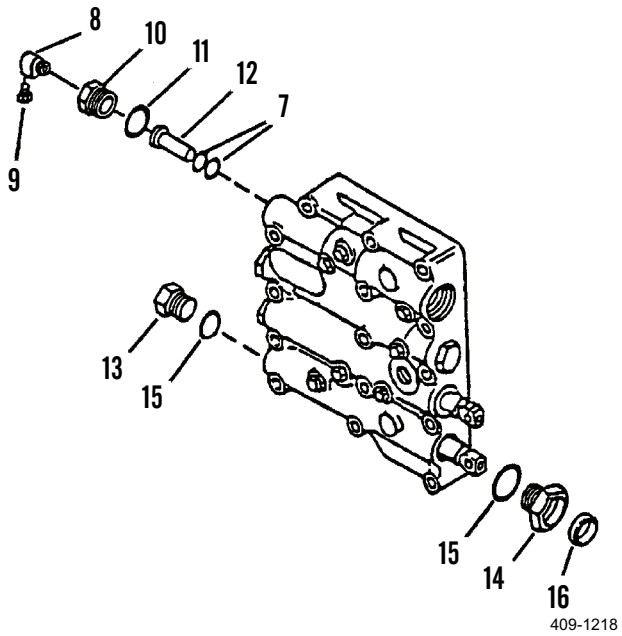
NOTE

- Wipe all sealing surfaces on cylinder clean and dry. Apply film of clean hydraulic oil to all parts, except neutral start switch, as they are installed.
- Apply loctite to all plugs prior to installation.

1. If removal was necessary, install one ball (40) and eight plugs (39). Ball (40) should be 0.03 in. (0.76 mm) below surface.
2. Install washer (38), accumulator spring (37) and accumulator piston (28) in one end of valve body (36). Depress accumulator piston (28) to compress spring (37) and install roller (29) in hole toward back of valve body (36).
3. Install dump valve (27) and dump valve spring (26).
4. Install new O-ring (25) on plug (24). Install plug (24).
5. Install shims (35), spool (34), orifice plate (33) and snap ring (32) on other side of valve body (36).
6. Install new O-ring (31) on plug (30). Install plug (30).
7. Install new oil seal (23) into valve body bore.
8. Install stem (22) (directional spool). Use care to prevent damage to new oil seal (23).
9. Install spacer (21) and nut (20) on stem (22) (directional spool).
10. Install new O-ring (19) on cap (18). Install cap (18).

ASSEMBLY - CONTINUED

11. Install new O-ring (15) on plug (13 and 14). Install plug (13).
12. Install stem assembly (17) (range selector spool).
13. Install plug (14).
14. Install new oil seal (16) in plug (14).
15. Install two new O-rings (7) into top bore grooves.
16. Install brake cut-off piston (12).
17. Install new O-ring (11) on brake line plug (10). Install brake line plug (10).
18. If removed, install plug (9) in elbow (8).
19. Install elbow (8).

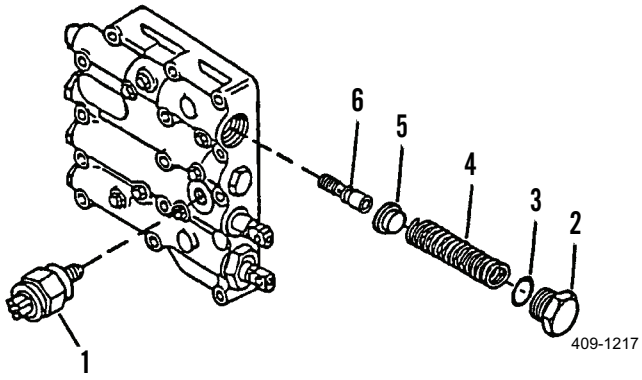


409-1218

20. Install pressure valve assembly (6), spring guide (5) and return spring (4).
21. Install new O-ring (3) on plug (2). Install plug (2).
22. Install neutral safety switch (1).

NOTE

Apply loctite to threads of neutral safety switch.



409-1217

23. Install transmission (WP 0237 00).
24. Operate transmission, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

TRANSMISSION OIL PUMP MAINTENANCE 0294 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Alumilastic (Item 3, WP 0323 00)

Gasket (6)

Lockwasher (10)

Materials/Parts - Continued

O-ring (11 and 12)

References

WP 0316 00

WP 0317 00

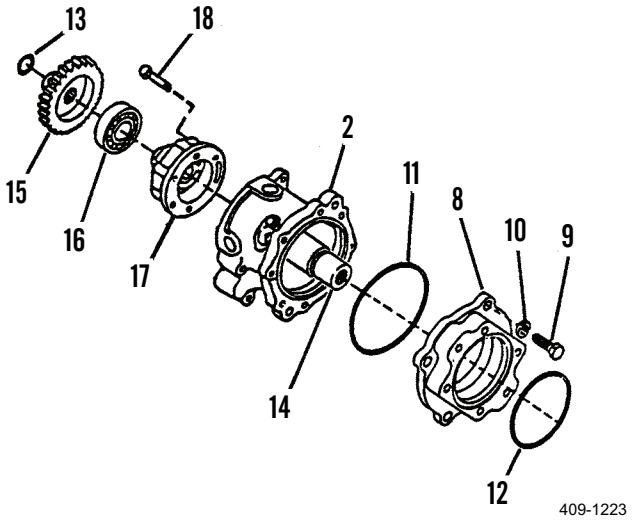
TM 10-3930-660-10

Equipment Condition

Tandem gear pump removed (WP 0173 00)

DISASSEMBLY

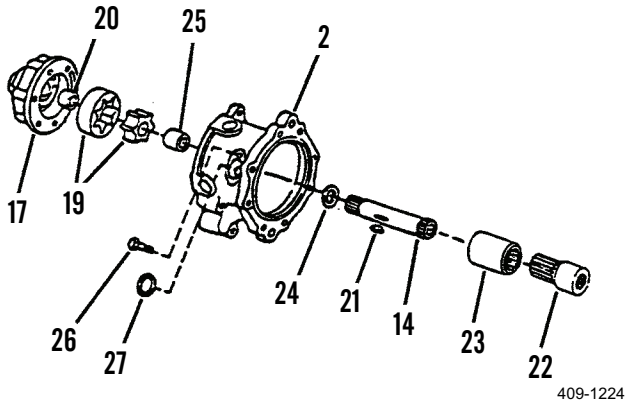
1. Scribe adapter (8) and transmission oil pump (2). These marks will be used for alignment during assembly.
2. Remove four capscrews (9), four lockwashers (10) and adapter (8). Discard lockwashers.
3. Remove and discard O-rings (11 and 12) from adapter (8).
4. Remove snap ring (13) from end of shaft (14).
5. Use a gear puller to pull gear (15) with bearing (16) from end of shaft (14).
6. Scribe retainer (17) and housing (2). These marks will be used during assembly.
7. Remove six capscrews (18) and retainer (17).



409-1223

DISASSEMBLY - CONTINUED

8. Remove two piece geroter (19).
9. Remove bearing (20) from retainer (17).
10. Remove woodruff key (21) from key way in shaft (14).
11. Remove sleeve adapter (22) and sleeve spacer (23).
12. Remove shaft (14) and thrust race (24).
13. Remove bearing (25) from housing (2).
14. Remove capscrew (26) and expansion plug (27) if necessary.



409-1224

CLEANING

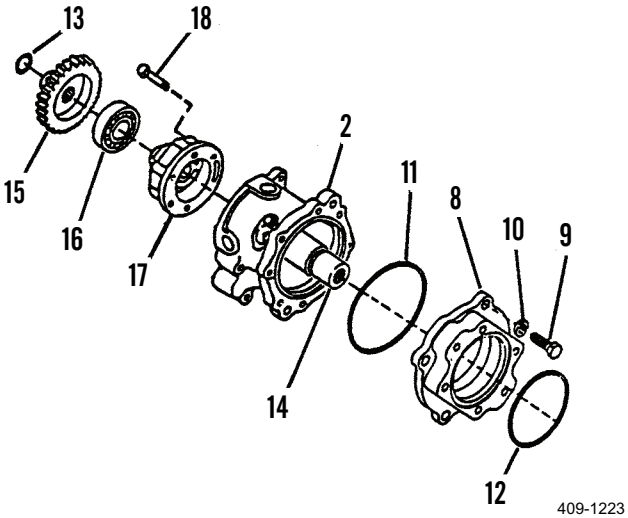
See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. If removal was necessary, install expansion plug (27) and capscrew (26).
2. Install bearing (25) 0.015 in. (0.381 mm) below surface in housing (2).
3. Install thrust race (24) and woodruff key (21) on shaft (14). Insert shaft (14) in housing (2).
4. Install bearing (20) in retainer (17).
5. Install two piece geroter (19) on shaft (14). The geroter must assemble freely over woodruff key (21) in shaft (14).
6. Install retainer (17) on housing (2). Ensure that scribe marks align.
7. Apply alumilastic to threads of capscrews (18) and install six capscrews (18). Torque capscrews (18) to 17 lb-ft (23 Nm).



409-1223

8. Install sleeve spacer (23) and sleeve adapter (22) on shaft (14).
9. Install bearing (16) and gear (15) on end of shaft (14).
10. Install snap ring (13).

ASSEMBLY - CONTINUED

11. Install new O-rings (11 and 12) on adapter (8).
12. Install adapter (8) on transmission oil pump (2). Ensure that scribe marks align.
13. Install four new lockwashers (10) and four capscrews (9).
14. Install tandem gear pump (WP 0173 00).
15. Operate transmission and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

FRONT AXLE ASSEMBLY MAINTENANCE 0295 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Oil seal (7)

References

WP 0316 00

WP 0317 00

Equipment Condition

Vehicle parked on level ground

Rear wheels chocked (TM 10-3930-660-10)

Steering cylinders removed (WP 0141 00)

Tie rods removed (WP 0251 00)

Parking brake assembly removed (WP 0127 00)

Front planetary wheel ends removed (WP 0244 00)

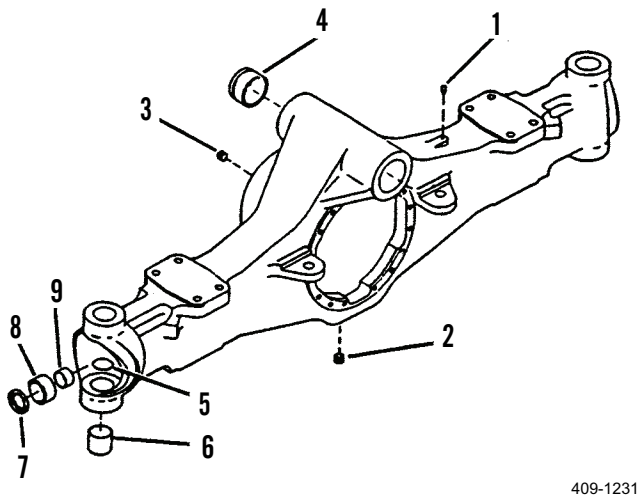
Front steering cylinder ball joint end cap assembly removed (WP 0142 00)

Front differential carrier assembly removed (WP 0243 00)

Front steering knuckles removed (WP 0250 00)

DISASSEMBLY

1. Remove breather (1).
2. Remove drain plug (2).
3. Remove oil filler plug (3).
4. Remove two bushings (4).
5. Remove four king pin plugs (5).
6. Remove four king pin bushings (6).
7. Remove and discard two oil seals (7).
8. Remove two sleeve assemblies (8).
9. Remove two bushings (9).



409-1231

CLEANING

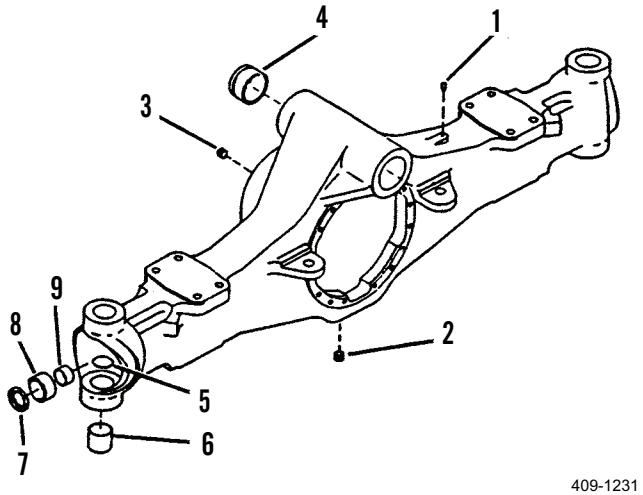
See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. Install two bushings (9).
2. Install two sleeve assemblies (8).
3. Install two new oil seals (7).
4. Install four king pin backings (6).
5. Install four kin pin plugs (5).
6. Install two bearings (4).
7. Install oil filler plug (3).
8. Install oil drain plug (2).
9. Install breather (1).



409-1231

10. Install front steering knuckles (WP 0250 00).
11. Install front differential carrier assembly (WP 0243 00).
12. Install front steering cylinder ball joint end cap assembly (WP 0142 00).
13. Install front planetary wheel ends (WP 0244 00).
14. Install parking brake assembly (WP 0127 00).
15. Install tie rods (WP 0251 00).
16. Install steering cylinders (WP 0141 00).
17. Operate vehicle, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

FRONT DIFFERENTIAL CARRIER ASSEMBLY MAINTENANCE 0296 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly, Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Differential resistance tool (Item 7, WP 0324 00)

Yoke nut tool (Item 47, WP 0324 00)

Lifting device, 4,000 lb capacity

Materials/Parts

Compound, marking (Item 13, WP 0323 00)

Compound, sealing (Item 14, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Oil, lubricating (Item 32, WP 0323 00)

Cotter pin (3)

Differential bolt, 1/4-20 X 7 in.

Materials/Parts - Continued

Differential washer, 1-3/4 O.D. (Two)

Differential wingnut, 1/4-20

Gasket (25)

Retaining hardware, no spin

Rivet (18)

Wood block

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Personnel Required

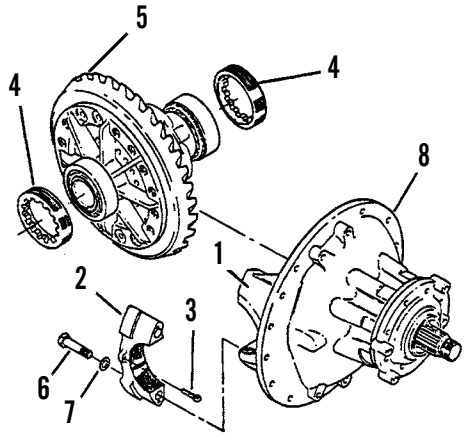
Two

Equipment Condition

Front differential carrier assembly removed (WP 0243 00)

DISASSEMBLY

1. Use a center punch and hammer to mark one carrier leg (1) and bearing cap (2) to enable correct matching at reassembly.
2. Remove cotter pins (3) holding two bearing adjusting rings (4) in position, main differential and ring gear assembly (5). Discard cotter pins.
3. Remove two capscrews (6) and two flatwashers (7) from each of two bearing caps (2).
4. Remove two bearing caps (2) from carrier (8).
5. Remove two bearing adjusting rings (4) from ring gear assembly (5).



409-1237

DISASSEMBLY

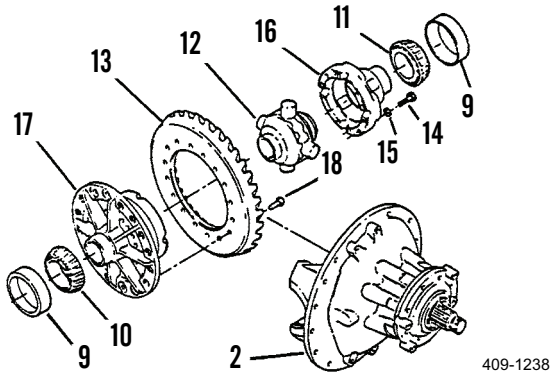
WARNING

Use 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.

6. Use a sling to lift the main differential and ring gear assembly (5) from the carrier. Place the assembly on a work bench.
7. Remove two bearing cups (9).
8. Remove flange case half bearing cone (10) and plain case half bearing cone (11) with puller.

NOTE

If matching marks on the case halves of the differential are not visible, mark each case half with a center punch and hammer. The match marks are to ensure proper part orientation at assembly.

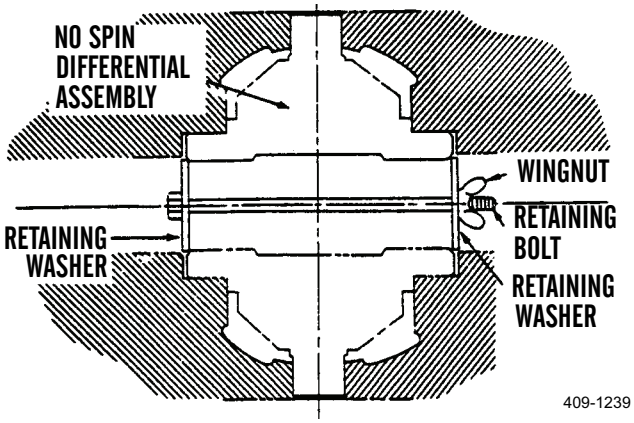


409-1238

WARNING

Failure to use a retaining bolt or other means of restraint can cause injury when removing the no-spin differential. The no-spin differential contains compression springs under pressure.

9. Secure the no-spin differential (12) with a bolt, a wing nut, and two flatwashers. See materials/parts heading in initial setup for retaining hardware dimensions.
10. Remove eight capscrews (14) and eight flatwashers (15) from plain case half (16).
11. Separate case halves (16 and 17) and remove no-spin differential (12).



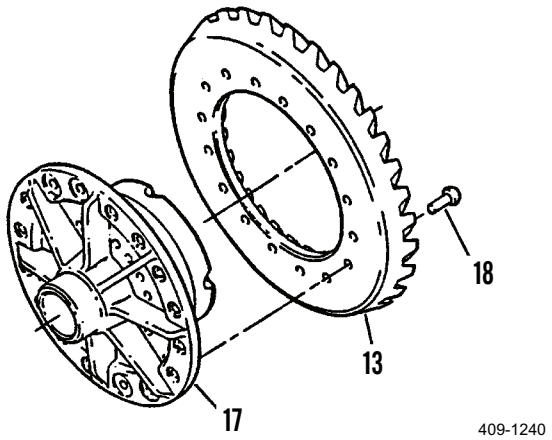
409-1239

DISASSEBMLY - CONTINUED

NOTE

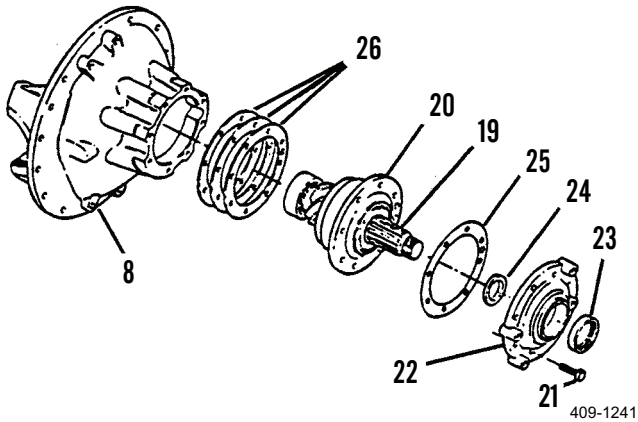
The no-spin differential is not serviceable and must not be disassembled. Do not remove the retaining bolt for inspection.

12. Inspect the no-spin differential (12) for visible damage. Replace if damaged.
13. Remove ring gear (13).
14. Inspect ring gear (13) for wear or damage. If ring gear (13) needs replacement, center punch twelve rivets (18) on side of ring gear (13).
15. Drill twelve rivets (18) on side of ring gear (13) to a depth equal to thickness of one rivet head. Use a drill bit 1/32 in. (0.793 mm) smaller than body diameter of rivet.
16. Press or drive twelve rivets (18) from drilled side through holes in ring gear (13) and flange case half (17). Discard rivets.
17. Support assembly under ring gear (13) with metal or wood blocks and use a press to remove case half (17) through gear (13). Separate flange case half (17) and ring gear (13).



409-1240

18. Remove bevel pinion (19) and bearing cage (20) from differential carrier (8).
19. Place differential carrier (8) on bench with bevel pinion (19) facing up. Clamp carrier securely.
20. Remove eight capscrews (21) and pinion bearing cage cover (22).
21. Use puller to remove bevel pinion bearing oil seal (23).
22. Remove pinion bearing cage thrust washer (24).
23. Remove pinion bearing cage cover gasket (25). Discard gasket.

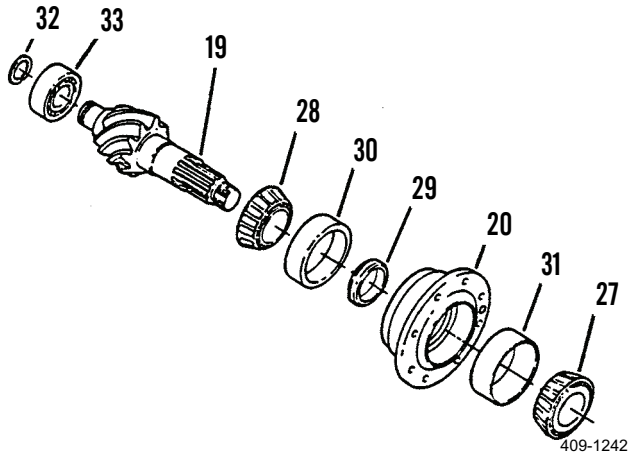


409-1241

24. Remove bevel pinion (19) with bearing cage (20) and shims (26) from the differential carrier (8). Keep shims together for use during assembly. If shims are damaged, measure total thickness of shim pack and note dimension; discard shims (26). Shim thickness dimension will be needed to calculate depth of bevel pinion in differential carrier when gear set is installed.

DISASSEMBLY - CONTINUED

25. Place bevel pinion (19) and bearing cage (20) in a press with splined end at the top of assembly.
26. Support bearing cage (20) under flange area with metal or wood blocks.
27. Use a press or leather mallet and driver to remove bevel pinion (19) from bearing cage (20).
28. Remove outer bearing (27) from bearing cage (20).
29. Use puller to remove inner bearing cone (28) and bearing spacer (29) from bevel pinion (19).
30. Use puller to remove inner bearing cup (30) and outer bearing cup (31) from bearing cage (20).
31. Install a soft metal cover over vise jaws to protect bevel pinion (19). Place bevel pinion (19) in a vise.
32. Use expanding snap ring pliers to remove snap ring (32) from end of bevel pinion (19).



33. Use a suitable puller to remove bearing (33) from spigot end of bevel pinion (19).

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

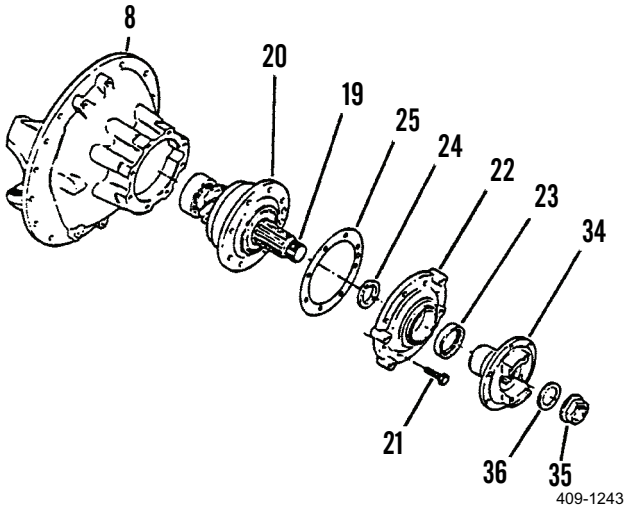
NOTE

Pinion and ring gears are a matched set. If replacement of ring gear or pinion gear is necessary, replace both gears as a set.

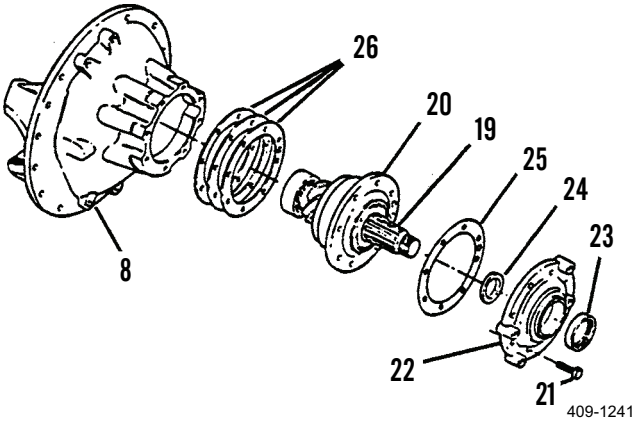
1. Use a press or sleeve and driver to install inner bearing cup (30) and outer bearing cup (31) into bearing cage (28). Be sure bearing cups are flat against bottom of cage bore.
2. Use a press or sleeve and driver to install inner bearing cone (28) on bevel pinion (19).
3. Use a press or sleeve and driver to install spigot bearing (33) onto spigot end of bevel pinion (19).
4. Use expanding snap ring pliers to install snap ring (32) into groove in end of bevel pinion (19).
5. Apply a thin film of clean lubricant to inner and outer bearing cups (30 and 31) and bearing cones (27 and 28).
6. Install bevel pinion (19) into bearing cage.
7. Install bearing spacer (32) on bevel pinion (19) against inner bearing cone (28).
8. Use press or sleeve and driver to install outer bearing cone (37) on bevel pinion against bearing spacer (29).

ASSEMBLY - CONTINUED

9. Apply a thin film of clean lubricant to inner surface of bevel pinion bearing oil seal (23).
10. Apply a thin film of clean lubricant to seal bore in pinion bearing cage cover (22).
11. Use a press or suitable sleeve and mallet to install bevel pinion bearing oil seal (23) into pinion bearing cage cover (22).
12. Use a feeler gauge to check gap between pinion bearing oil seal (23) flange and pinion bearing cage cover (22) at several points around the seal (23). Gap must be within 0.015 to 0.030 in. (0.381 to 0.762 mm). The difference between the largest and smallest gap measurements must not exceed 0.010 in. (0.254 mm).
13. Temporarily install bevel pinion (19) and bearing cage (20) assembly in differential carrier (8). Do not install shims (26) under bearing cage (20).
14. Install new gasket (25) on bearing cage (20).
15. Install pinion bearing cage thrust washer (24), bearing cage (20) and bearing cage cover (22), and secure with eight capscrews (21). Hand tighten capscrews (21).
16. To adjust bearings, install companion flange (34), nut (35) and washer (36) on bevel pinion (19). Companion flange (34) must be against outer bearing.
17. Fasten yoke nut tool to companion flange (34). Use fabricated yoke nut tool to hold bevel pinion (19) in position when nut (35) is tightened.



409-1243



409-1241

18. Torque nut (35) on bevel pinion (9) to 300-400 lb-ft (407-542 Nm).
19. Remove yoke nut tool from companion flange (34).
20. Attach a torque wrench on bevel pinion nut (35). Rotate bevel pinion (19) and read value indicated on torque wrench. New pinion bearings should be preloaded between 5 and 45 lb-in. (0.6 and 5.1 Nm) of torque. Reused pinion bearings should be preloaded between 10 and 30 lb-in. (1.1 and 3.4 Nm).

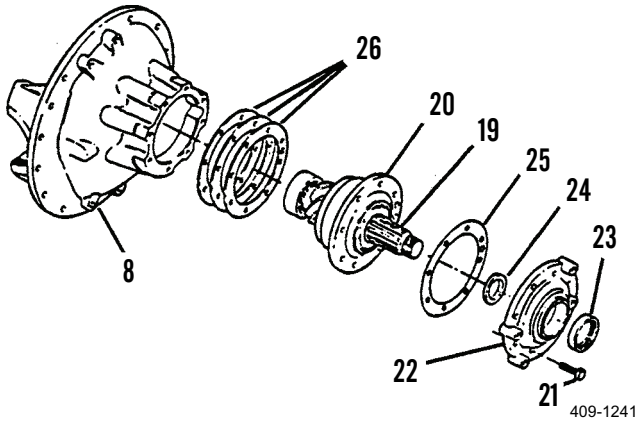
NOTE

Do not read starting torque. Read only torque value after bevel pinion starts to rotate. Starting torque will give a false reading.

21. Increase bearing preload by removing bevel pinion (19) and bearing cage (20) assembly from differential carrier (8) and installing a thinner bearing spacer (29). Repeat steps 14 thru 20.
22. Decrease bearing preload by removing bevel pinion (19) and bearing cage (20) assembly from differential carrier (8) and installing a thicker bearing spacer (29). Repeat steps 14 thru 20.
23. Remove nut (35), washer (36) and companion flange (34) from bevel pinion (19).

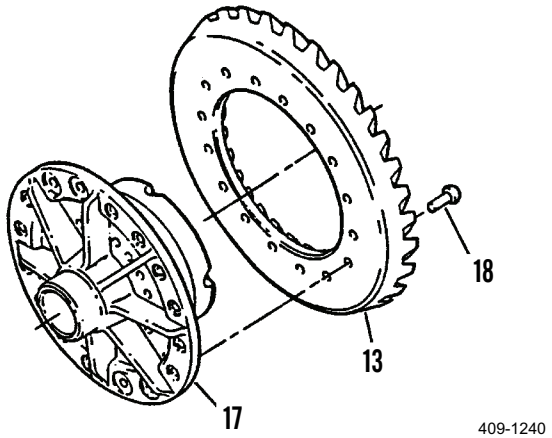
ASSEMBLY - CONTINUED

24. Remove eight capscrews (21) and bearing cage cover (22).



25. Remove bevel pinion (19) and bearing cage (20) as an assembly from differential carrier (8).

26. If replacement of bevel pinion (19) and ring gear (13) set is necessary, adjust thickness of shim pack for new bevel pinion (19) and ring gear (13) set.



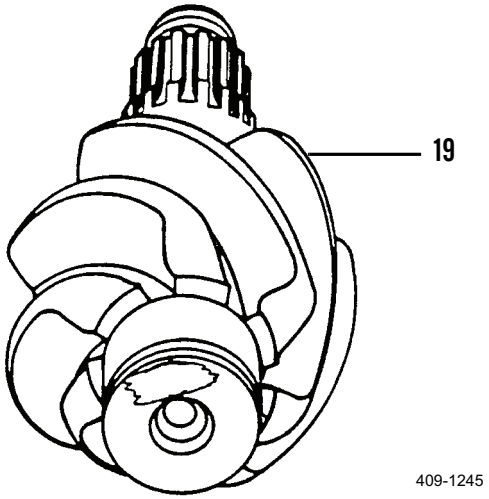
NOTE

If a new bevel pinion and ring gear set is installed, or if the depth of the bevel pinion has to be adjusted, calculate the needed thickness of the shim pack using the following procedure.

27. Use a micrometer to measure thickness of old shim pack (26) removed from under bearing cage (20). Record measurement.

ASSEMBLY - CONTINUED

28. Read variation number of spigot end of old bevel pinion (19). Record number.



NOTE

Bevel pinion spigot end number can be in 1000ths of an in. or 100ths of a millimeter. Example: +3 is 0.003 in., and +0.03 is 0.03 mm. Be sure to convert millimeters to in. by multiplying by 0.039 before performing the following procedure.

29. Subtract number from spigot bearing end of old bevel pinion (19) from shim pack (26) thickness measure in step 28. If old number is a plug (+) value. If old bevel pinion spigot number is a minus (-) value, add number from spigot end of old bevel pinion (19) to shim pack (26) thickness. This is the thickness of the standard shim pack, with a variation.

30. Read number on spigot end of new bevel pinion (19). Record number.

31. Add number from spigot end of new bevel pinion (19) to standard shim pack (26) thickness calculated in step 32, if number on spigot end of new bevel pinion (19) is a plus (+). If new pinion cone number is a minus (-), subtract new pinion cone number from standard shim pack (26) thickness calculated in step 30. This is the thickness of the new shim pack.

Example 1

Old shim pack thickness	0.030
Old bevel pinion spigot end number, PC+2	-0.002
Standard shim pack thickness	0.028
New bevel pinion spigot end number, PC+5	+0.005
New shim pack thickness	0.033

Example 2

Old shim pack thickness	0.030
Old bevel pinion spigot end number, PC-2	+0.002
Standard shim pack thickness	0.032
New bevel pinion spigot end number, PC+5	+0.005
New shim pack thickness	0.037

Example 3

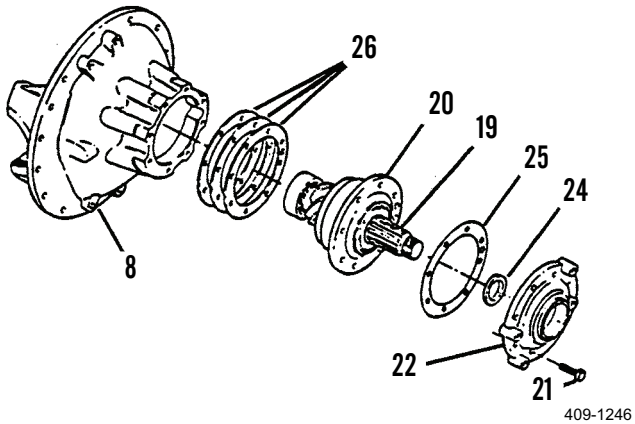
Old shim pack thickness	0.030
Old bevel pinion spigot end number, PC+2	-0.002
Standard shim pack thickness	0.028
New bevel pinion spigot end number, PC-5	-0.005
New shim pack thickness	0.023

Example 4

Old shim pack thickness	0.030
Old bevel pinion spigot end number PC-2	+0.002
Standard shim pack thickness	0.032
New pinion cone number, PC-5	-0.005
New shim pack thickness	0.027

ASSEMBLY - CONTINUED

32. Install pinion bearing cage thrust washer (24) on bevel pinion (19).
33. Place bearing cage cover (22) onto bearing cage (20) and secure with eight capscrews (21).
34. Torque capscrews (21) to 50-75 lb-ft (68-102 Nm).

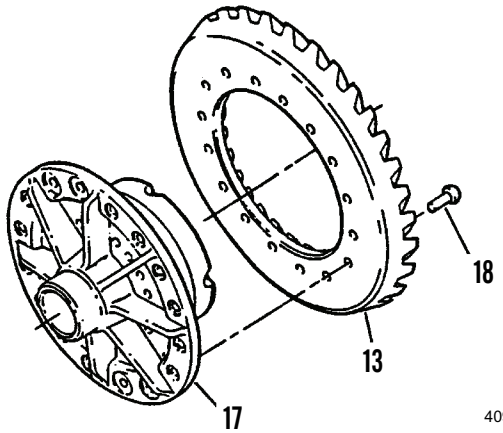


409-1246

WARNING

- Wear gloves and proper clothing while handling hot ring gear. Failure to follow this precaution could result in serious personal injury.
- Ring gear must be heated before installation. Failure to heat ring gear before installation could cause damage to differential case half because of tight fit.
- Use 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.

35. Expand ring gear (13) by heating in a tank of water to a temperature of 160° to 180°F (71° to 82°C) for 10 to 15 minutes.
36. Use a sling and hoist to lift the ring gear (13) from tank of water.
37. Install ring gear (13) on flange case half (17) immediately after heating. If ring gear (13) does not fit easily on flange case half (17), repeat step 41.
38. Align fastener holes of ring gear (13) and flange case half (17) by rotating ring gear (13) as needed.



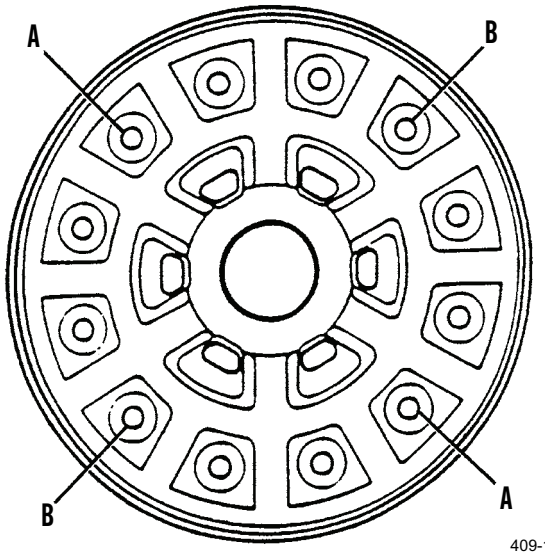
409-1240

ASSEMBLY - CONTINUED

CAUTION

Do not heat rivets before installation. Hot rivets could damage ring gear and flange case half.

39. Use a rivet machine to press rivets (18) into place from ring gear (13) side of the assembly. Press rivets (18) in pairs opposite each other (A and B). Apply 60,000 lb (413,685 kg) of pressure.



409-1248

CAUTION

Pressure on rivets must be held for approximately one minute so that rivet body will completely fill hole. Failure to do so could cause rivet failure.

40. Use a 0.003 in. (0.076 mm) feeler gage to check for gaps between back surface of ring gear (17) and flange case half (26). If gauge fits more than half way to rivets, remove ring gear (13), see *Disassembly*, steps 16 thru 19 and repeat steps 36 thru 40. If gap persists, inspect flange case half (17) and ring gear (13) for problem, replace defective parts.

ASSEMBLY - CONTINUED

41. Use a press and sleeve to install bearing cone (10) on flange case half (17).

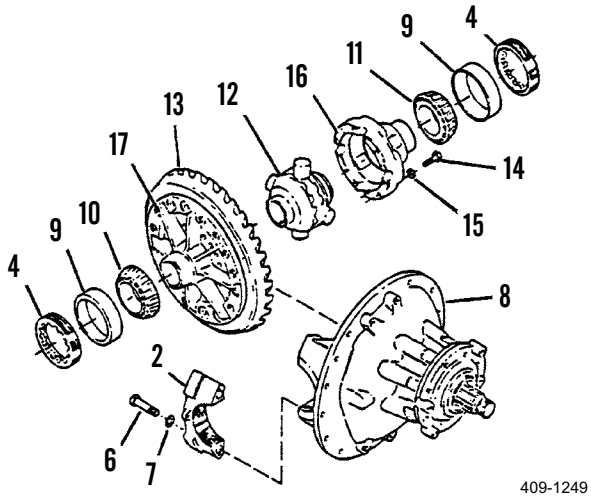
42. Use a press and sleeve to install bearing cone (11) on plain case half (16).

43. Apply clean lubricant to inside surfaces of both case halves (16 and 17) and no-spin differential (12).

44. Place flange case half (17) on bench, ring gear (13) teeth up.

45. Install no-spin differential (12) into flange case half (17).

46. Place plain case half (26) over flange case half (17) and no-spin differential (12). Rotate plain case half (16) as needed to align match marks.



409-1249

47. Apply loctite to eight capscrews (14). Install four of the eight capscrews (14) and four flatwashers (15) at opposing pairs (X and Y) into case halves (16 and 17).

CAUTION

Spacing between four initially installed capscrews must be even to prevent uneven pressure on case halves when torquing. Failure to do so could cause component failure.

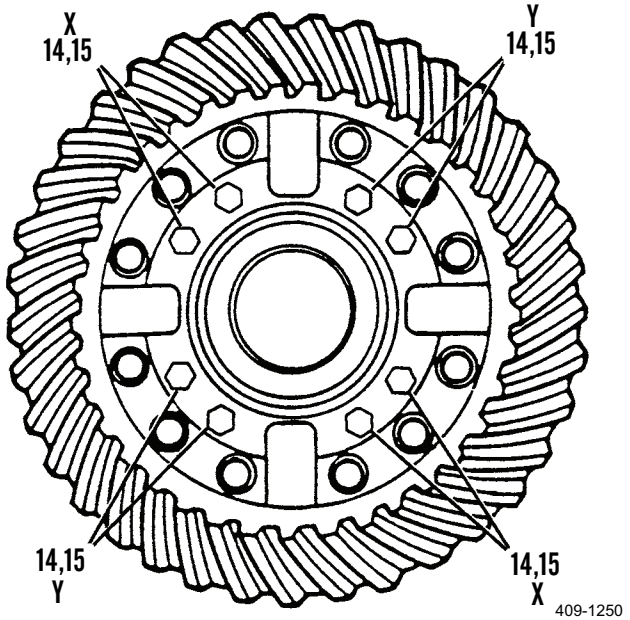
48. Torque four capscrews (14) to 60-75 lb-ft (81-102 Nm).

NOTE

Torque capscrews in pairs on opposing sides of ring gear.

49. Install remaining four capscrews (14) and four flat-washers (15). Torque capscrews to 60-75 lb-ft (81-102 Nm).

50. Remove no spin retaining bolt, flatwashers and wing nut.



409-1250

NOTE

- When installing bearing cups, apply loctite to bearing bores of differential carrier legs and bearing caps. Do not apply loctite to adjusting ring threads.
- Clean and dry bearing cups, bores of differential carrier, legs and bearing caps.

51. Apply thin film of gear oil to inner diameter of the bearing cups (9) and on both bearing cones (10 and 11).

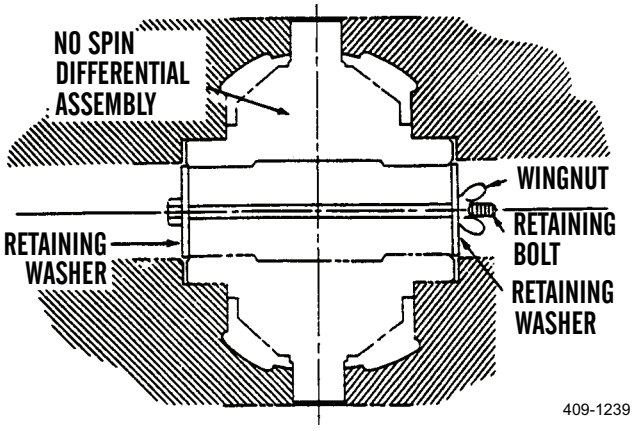
ASSEMBLY - CONTINUED

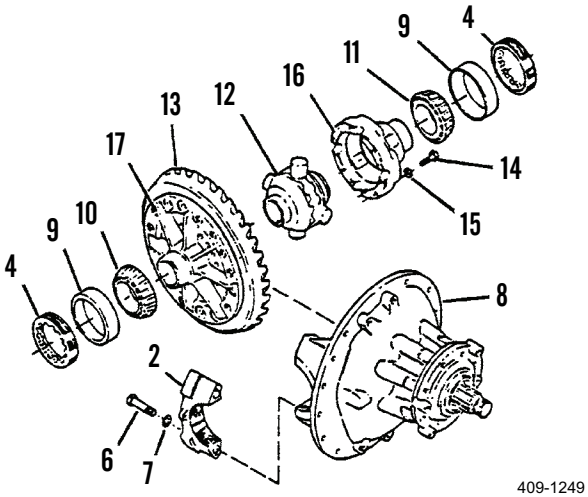
52. Apply thin bead of loctite to bearing bores of differential carrier (8) legs and bearing caps (2).
53. Install two bearing cups (9) over bearing cones (10 and 11) on case halves (16 and 17).

WARNING

Use 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.

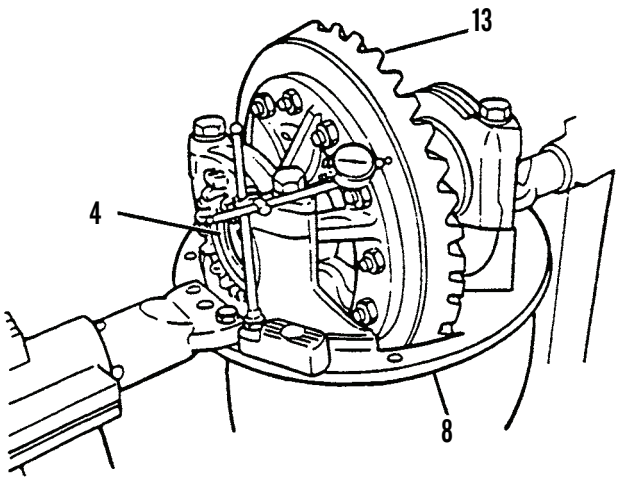
54. Use a sling and hoist to lift differential and ring gear (9 thru 17) as an assembly and install into differential carrier (8). Bearing cups (9) must be flat against bores between differential carrier (8) legs.
55. Install both bearing adjusting rings (4) into position between differential carrier (8) legs. Turn each adjusting ring (4) hand tight against bearing cup (9).
56. Install bearing caps (2) over the assembled bearing cups (9) and bearing cones (10 and 11), and adjusting rings (4). Use match marks made during disassembly to match original location of bearing caps.
57. Use a plastic or leather mallet to fit each bearing cap (2) tightly against the bearing cups (9), adjusting rings (4) and differential carrier (8) legs. If bearing caps (2) do not fit correctly, check alignment of match marks between bearing caps (2) and differential carrier (8) leg. If necessary, repeat steps 55 thru 56.
58. Install two capscrews (6) and two flatwashers (7) that hold bearing caps (2) to differential carrier (8) legs. Tighten capscrews (6) by hand four to six turns, then torque to 110-145 lb-ft (149-197 Nm).





ADJUSTMENT

1. Attach a dial indicator on the mounting flange of the differential carrier (8).
2. Adjust the dial indicator so that the plunger is against the back surface of the ring gear (13).

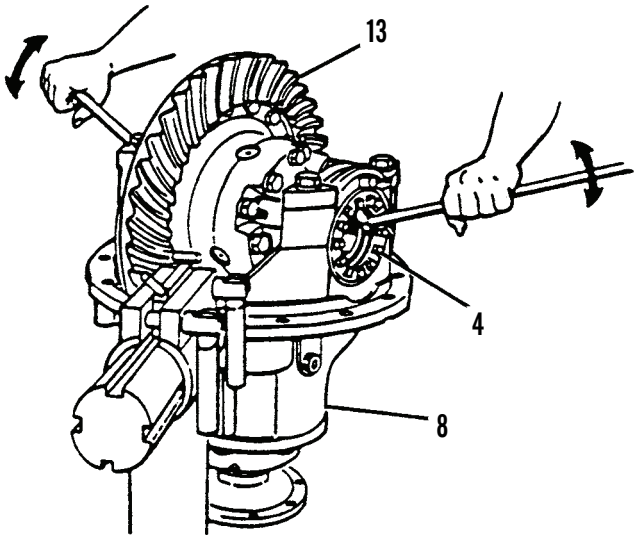


409-1253

CAUTION

When turning bearing adjusting rings, always use a tool that engages two or more opposite notches in the ring. A large screwdriver can be used for this purpose. Failure to do so could cause damage to adjusting ring lugs.

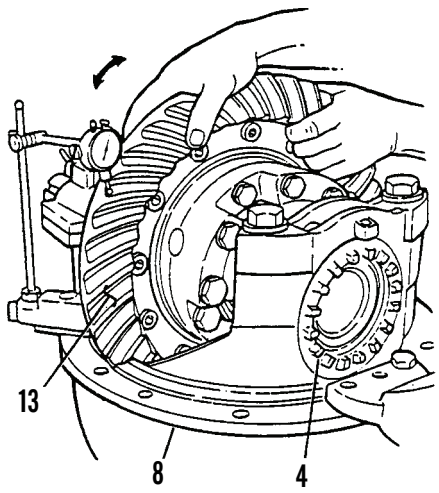
3. Loosen the bearing adjustment ring (4) opposite ring gear (13) so that a small amount of end play shows on dial indicator. Move differential assembly and ring gear (13) left and right with suitable pry bars while reading dial indicator. Do not allow pry bars to touch bearings (9 thru 11).
4. Tighten bearing adjustment ring (4) opposite ring gear (13) so that no end play shows on dial indicator. Move the differential assembly and ring gear (13) left and right as needed.
5. Tighten each bearing adjusting ring (4) one notch from zero end play.
6. To check runout of ring gear (13), attach dial indicator on mounting flange of differential carrier (8). Adjust dial indicator so that plunger is against back surface of ring gear (13).
7. Adjust dial of indicator to zero.



409-1254

ADJUSTMENT - CONTINUED

8. Rotate differential assembly and ring gear (13) and read dial indicator. If runout of ring gear (13) exceeds 0.008 in. (2.03 mm), remove differential assembly and ring gear (13) and inspect differential assembly for problem. Replace defective parts and reinstall differential assembly and ring gear (13) into differential carrier (8). Repeat preload adjustment of differential bearings.
9. To adjust backlash of ring gear (13), attach a dial indicator to the mounting flange on differential carrier (2).
10. Adjust dial indicator so that plunger is against the tooth surface on ring gear (13).
11. Adjust dial of indicator to zero.
12. Hold bevel pinion in position.
13. Read dial indicator while rotating ring gear (13) a small amount in both directions.
14. Adjust backlash of old gear set to setting measured before carrier was disassembled, 0.008 to 0.018 in. (2.032 to 0.457 mm).



409-1255

15. If new gear set is installed, adjust backlash to 0.012 in. (0.304 mm).

NOTE

When adjusting backlash, adjust only the ring gear; do not adjust the bevel pinion.

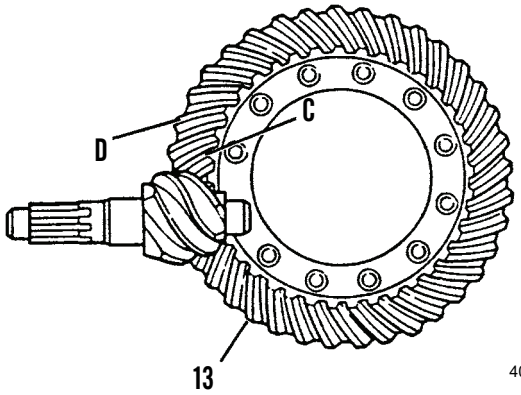
16. Increase backlash by loosening bearing adjusting ring (4) opposite teeth of ring gear (13), and tightening bearing adjusting ring (4) on ring gear (13) side of differential assembly. Make adjustments one notch at a time until backlash is within specifications.
17. Decrease backlash by tightening bearing adjusting ring (4) opposite teeth of ring gear (13), and loosening bearing adjusting ring (4) on ring gear (13) side of differential assembly. Make adjustments one notch at a time until backlash is within specifications.

ADJUSTMENT - CONTINUED

NOTE

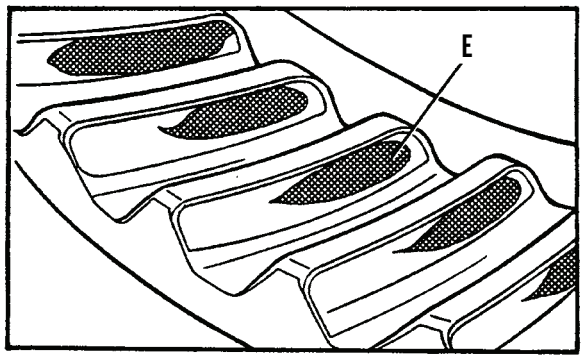
- In the following steps, movement of contact pattern in length of tooth is indicated as toward “toe” (C) or “heel” (D) of ring gear.
- Always check tooth contact patterns on drive side of gear teeth.

18. Apply marking compound (prussian blue, red lead) to 12 gear teeth of ring gear. Rotate ring gear so that 12 gear teeth are next to bevel pinion.
19. Rotate ring gear (13) forward and backward so that 12 marked teeth go past bevel pinion 6 times to get contact patterns. Repeat, if necessary, to get a more clear pattern.

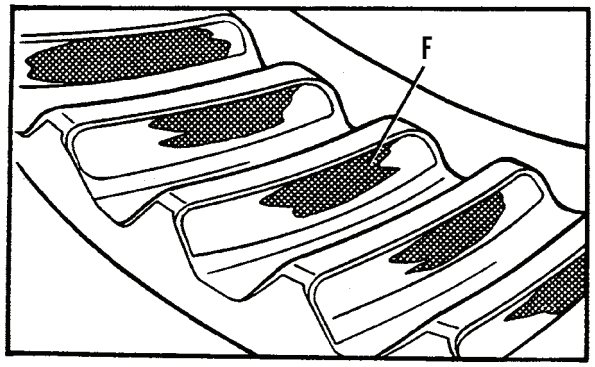


409-1256

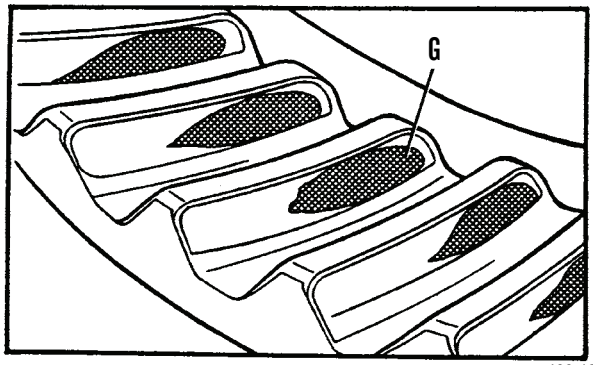
20. Inspect contact patterns on ring gear (13). Good hand rolled pattern (E) will show contact toward toe of gear tooth and in the center between top and bottom of tooth. A high pattern (F) will show contact closer to top of gear tooth. A low pattern (G) will show contact toward bottom of gear tooth. When in operation, pattern will extend to approximately full length of gear tooth.



409-1257



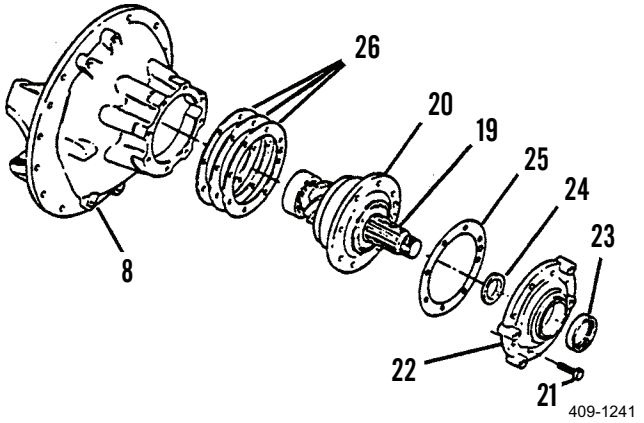
409-1258



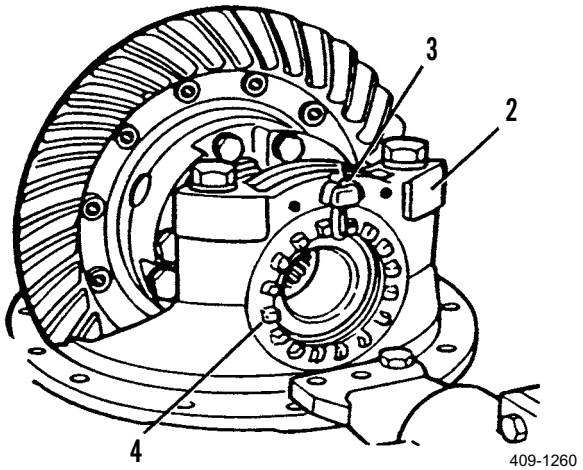
409-1259

ADJUSTMENT - CONTINUED

21. If necessary, install thinner shim pack (26) under pinion bearing cage (20) to correct high contact pattern.
22. If necessary, install thicker shim pack (26) under pinion bearing cage (20) to correct low contact pattern.
23. If necessary, decrease backlash to move contact patterns toward toe of ring gear teeth.
24. If necessary, increase backlash to move contact patterns toward heel of ring gear teeth.
25. Install two new cotter pins (3) that hold two bearing adjusting rings (4) in position. Install new cotter pins (3) through boss of bearing cap (2) and between lugs of adjusting ring (4).



409-1241



409-1260

26. Install front differential carrier assembly (WP 0243 00).

END OF WORK PACKAGE

REAR AXLE ASSEMBLY MAINTENANCE 0297 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Two jackstands, 7,000 lb capacity

Materials/Parts

Oil, lubricating (Item 32, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Seal (14)

Wood blocks

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Personnel Required

Two

Equipment Condition

Rear wheel assemblies removed (WP 0134 00)

Rear disc brake assemblies removed (WP 0249 00)

Steering cylinders removed (WP 0141 00)

Tie rod removed (WP 0251 00)

Rear propeller shaft removed (WP 0124 00)

Counterweight removed (WP 0145 00)

Rear planetary wheel ends removed (WP 0248 00)

Steering knuckles removed (WP 0250 00)

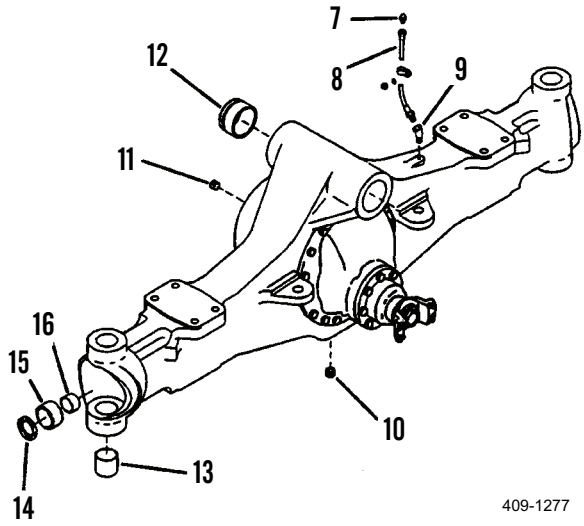
Rear differential carrier assembly removed (WP 0247 00)

DISASSEMBLY

NOTE

Repair of axle assembly at Direct Support is limited to replacement of axle seals, steering knuckle bushings and pivot bushings.

1. Remove breather (7), hose (8), elbow (9).
2. Remove drain plug (10).
3. Remove oil filler plug (11).
4. Remove two bearings (12).
5. Remove four king pin bushings (13).
6. Remove and discard two oil seals (14).
7. Remove two sleeves (15) and two bushings (16).



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. Install two bushings (16) and to sleeves (15).
2. Install two new oil seals (14).
3. Install four king pin bushings (13).
4. Install two bearings (12).
5. Install oil filler plug (11).
6. Install oil drain plug (10).
7. Install breather (7), hose (8) and elbow (9).
8. Install rear differential carrier assembly and rear universal (cardan) steering joints (WP 0247 00).
9. Install steering knuckles (WP 0250 00).
10. Install rear planetary wheel ends (WP 0248 00).
11. Install counterweight (WP 0145 00).

ASSEMBLY - CONTINUED

12. Install rear propeller shaft (WP 0124 00).
13. Install tie rods (WP 0251 00).
14. Install steering cylinders (WP 0141 00).
15. Install rear disc brake assemblies (WP 0249 00).
16. Install rear wheel assemblies (WP 0134 00).
17. Operate vehicle and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

REAR DIFFERENTIAL CARRIER ASSEMBLY MAINTENANCE 0298 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly, Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Differential resistance tool (Item 7, WP 0324 00)

Driver, group (Item 9, WP 0324 00)

Yoke nut tool (Item 47, WP 0324 00)

Lifting device, 4,000 lb capacity

Materials/Parts

Compound, marking (Item 13, WP 0323 00)

Compound, sealing (Item 14, WP 0323 00)

Sealant, Loctite (Item 46, WP 0323 00)

Oil, lubricating (Item 32, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Cotter pin (2)

Materials/Parts - Continued

Rivets (19)

Seal (29)

Shim pack (28)

Wood block

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

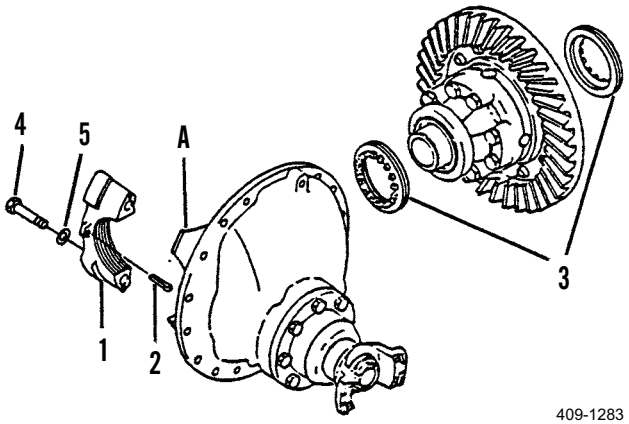
Rear axle assembly removed (WP 0245 00)

Axle housing lubricant drained (WP 0125 00)

Rear planetary wheel ends removed (WP 0248 00)

DISASSEMBLY

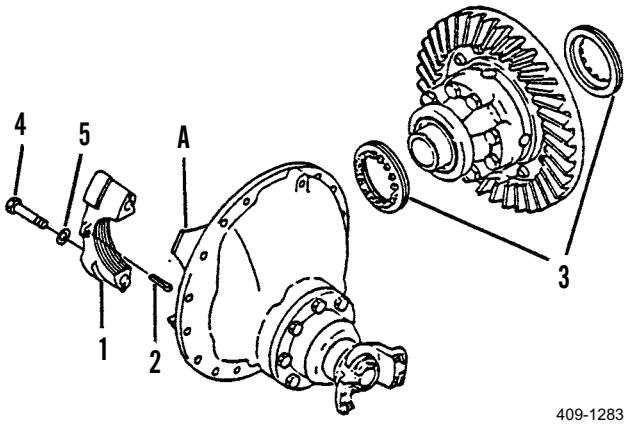
1. Use center punch and hammer to mark one carrier leg (A) and bearing cap (1) to enable correct matching at reassembly.
2. Remove cotter pins (2) holding two bearing adjusting rings (3) in position. Discard cotter pins.
3. Remove two capscrews (4) and two flatwashers (5) from each of two bearing caps (1).



409-1283

DISASSEMBLY - CONTINUED

4. Remove two bearing caps (1), two bearing adjusting rings (3) and two bearing cups (6).



409-1283

WARNING

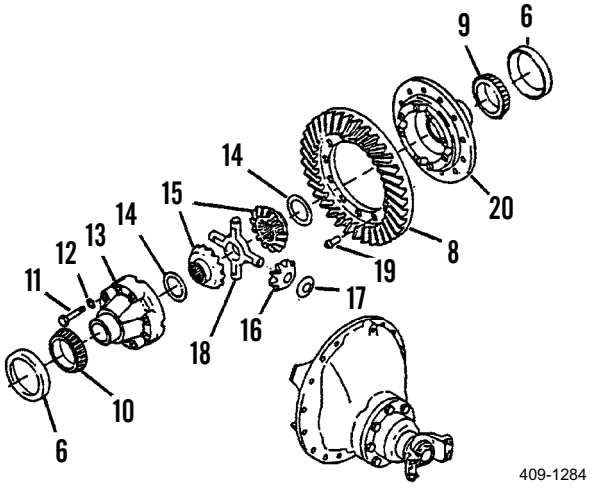
Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

5. Use a sling to lift differential carrier (7) and ring gear (8) as an assembly and place assembly on a work bench.

6. Remove flange case half bearing cone (9) and plain case half bearing cone (10) with a suitable puller.

NOTE

If matching marks on the case halves of the differential are not visible, mark each case half with a center punch and hammer. The match marks are to ensure proper case halves orientation at assembly.



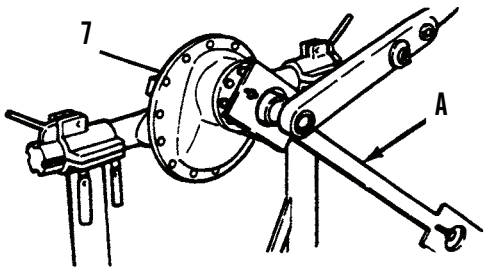
409-1284

7. Remove eight capscrews (11) and eight flatwashers (12) from plain case half (13) and separate the case halves.

8. Remove two side gear thrust washers (14), two side gears (15), four pinion gears (16), four pinion gear thrust washers (17) and differential spider (18).

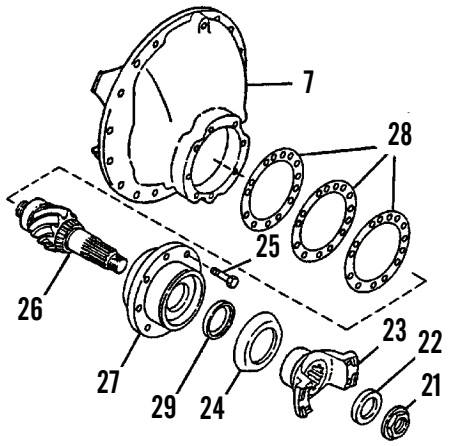
DISASSEMBLY - CONTINUED

9. Inspect ring gear (8) for wear or damage. If ring gear (8) needs replacement, center punch twelve rivets (19) on side of ring gear (8).
10. Drill twelve rivets (19) on ring gear (8) to a depth equal to thickness of one rivet head. Use a drill bit 1/32 of an inch (0.793 mm) smaller than rivet body diameter.
11. Press or drive twelve rivets (19) from drilled side through holes in ring gear (8) and flange case half (20). Discard rivets.
12. Support assembly under ring gear (8) with blocks and use a press to remove case half (20) through ring gear (8).
13. Place differential carrier (7) on bench and clamp carrier securely.



409-1285

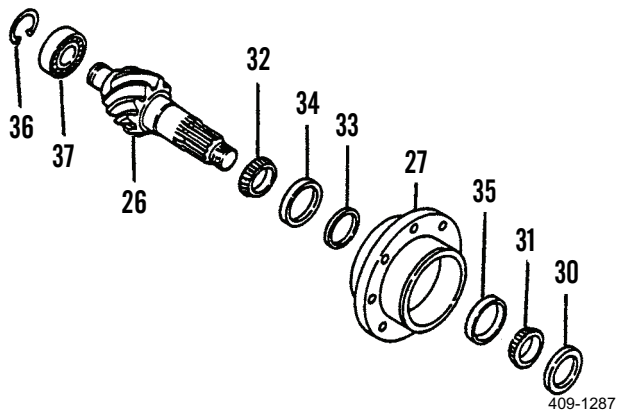
14. Fasten yoke nut tool to companion yoke. Hold yoke nut tool (A) to remove bevel pinion nut (21) and washer (22).
15. Remove companion yoke (23) with deflector (24). Use a puller if necessary.
16. Remove eight capscrews (25).
17. Remove bevel pinion (26), bearing cage (27), and shims (28), as an assembly, from the differential carrier (7). Keep shims together for use during assembly. If shims are damaged, measure total thickness of shim pack and record dimension. Discard shims. Shim thickness dimension will be needed to calculate depth of bevel pinion in differential carrier when gear set is installed.
18. Use a suitable puller to remove pinion oil seal (29) from bearing cage (27). Discard seal.



409-1286

DISASSEMBLY - CONTINUED

19. Remove pinion bearing cage thrust washer (30).
20. Place bevel pinion (26) and bearing cage (27) in a press with splined end of pinion at the top of assembly.
21. Support bearing cage (27) under flange area with blocks.
22. Use a press to remove bevel pinion (26) from bearing cage (27).
23. Remove outer bearing cone (31) from bearing cage (27).
24. Use puller and remove inner bearing cone (32) and bearing spacer (33) from bevel pinion (26).
25. Use puller to remove inner bearing cup (34) and outer bearing cup (35) from bearing cage (27).



26. Install a soft metal cover over vise jaws to protect bevel pinion (26). Place bevel pinion in a vise.
27. Remove snap ring (36) from end of bevel pinion (26).
28. Remove bearing (37) from spigot end of bevel pinion (26).

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Pinion and ring gears are a matched set. If replacement of ring gear or pinion gear is necessary, replace both gears as a set.

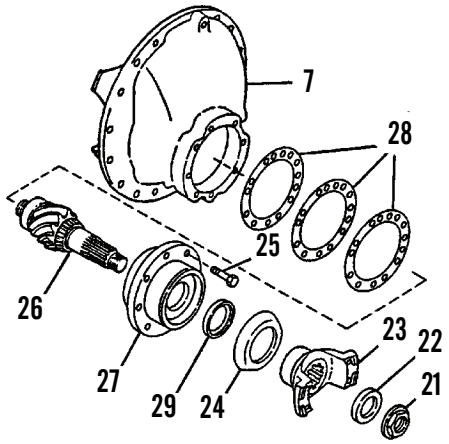
1. Use a press and suitable driver to install inner bearing cup (34) and outer bearing cup (35) into bearing cage (27). Be sure bearing cups are tight against bottom of cage bore.
2. Use a press and suitable sleeve driver to install inner bearing cone (34) on bevel pinion (26).
3. If necessary, use a press and suitable sleeve driver to install spigot bearing (37) onto spigot end of bevel pinion (26).
4. Install snap ring (36) into groove on end of bevel pinion (26).
5. Apply a thin film of clean lubricating oil to inner and outer bearing cups (34 and 35) and bearing cones (31 and 32).
6. Install bearing spacer (33) on bevel pinion against inner bearing cone (32).
7. Install bevel pinion (29) and bearing assembly into bearing cage.
8. Use a press and suitable sleeve driver and install outer bearing cone (31) on bevel pinion tight against bearing spacer (27).
9. Install pinion bearing thrust washer (30).
10. Install companion yoke (23), nut (21) and washer (22) on bevel pinion (26). If necessary, use a press to push yoke on pinion. Companion yoke (23) must be against thrust washer (30).

ASSEMBLY - CONTINUED

NOTE

Shims are not installed at this time.

11. Temporarily install bevel pinion (26) and bearing cage (27) assembly in differential carrier (7). DO NOT install shims (28) under bearing cage (27).
12. Install eight capscrews (25) finger-tight.
13. Fasten yoke nut tool to companion yoke (23). Use yoke nut tool (A) to hold bevel pinion (26) in position when nut (21) is tightened.
14. Torque nut (21) on bevel pinion (26) to 300 to 400 lb-ft (407 to 542 Nm).
15. Remove bar from companion yoke (23).

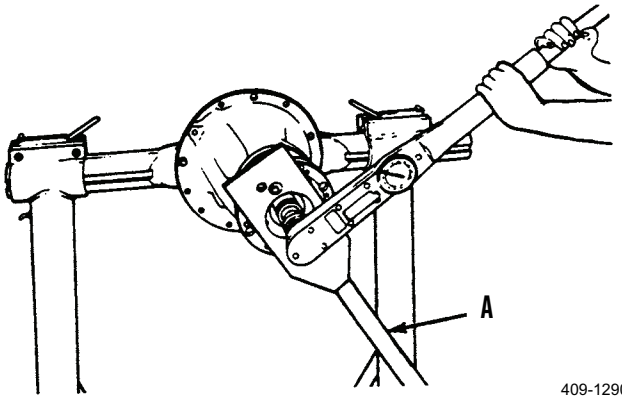


409-1286

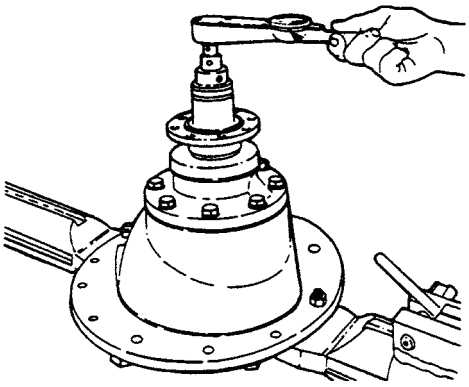
NOTE

Do not read starting torque. Read only torque value after bevel pinion starts to rotate. Starting torque will give a false reading.

16. Attach a torque wrench on bevel pinion nut (21). Rotate bevel pinion (26) and read value indicated on torque wrench. New pinion bearings should be preloaded between 5 and 45 lb-in. (7 and 61 Nm) of torque. Reused pinion bearings should be preloaded between 10 and 30 lb-in. (1.12 and 3.38 Nm).
17. Increase bearing preload by removing bevel pinion (26) from bearing cage (27) and installing a thinner bearing spacer (33). Repeat steps 10 thru 16.
18. Decrease bearing preload by removing bevel pinion (26) from bearing cage (27) and installing a thicker bearing spacer (33). Repeat steps 10 thru 16.



409-1290


409-1291

19. Remove nut (21), washer (22) and companion yoke (23) from bevel pinion (26).
20. Remove eight capscrews (25).
21. Remove bevel pinion (26) and bearing cage (27), as an assembly, from differential carrier (7).

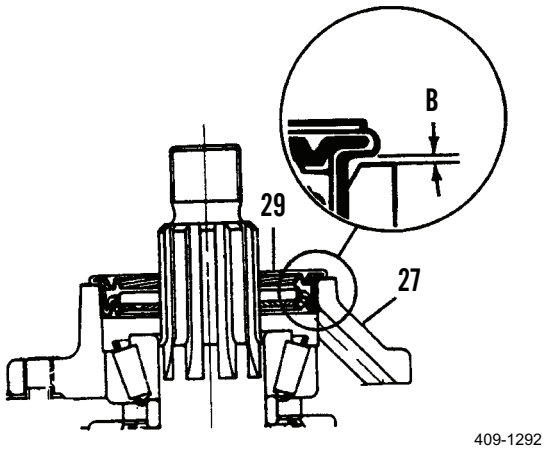
ASSEMBLY - CONTINUED

22. Apply a thin film of clean lubricating oil to inner surface of new pinion oil seal (29).

23. Apply thin film of clean lubricating oil to seal bore in pinion bearing cage (27).

24. Use a press or mallet and suitable sleeve to install bevel pinion bearing oil seal (29) into pinion bearing cage (27) until flange of seal is against bearing cage.

25. Gap (B) of 0.015 to 0.030 in. (0.381 to 0.762 mm) is normal between new seal (29) and bearing cage (27). Check gap at several points. The difference between the largest and smallest gap measurement must not exceed 0.010 in. (0.252 mm).



409-1292

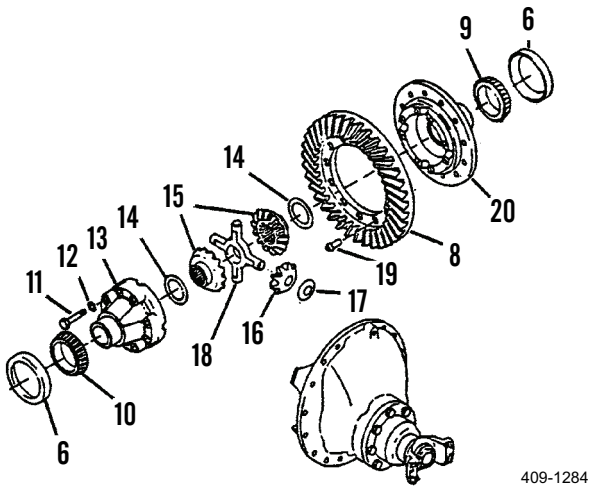
26. Install companion yoke (23) with deflector (24), washer (22) and nut (21).

27. Adjust thickness of shim pack for new bevel pinion (26) and ring gear (8) set. Use a micrometer to measure thickness of old shim pack (28) removed from under bearing cage (27). Record measurement.

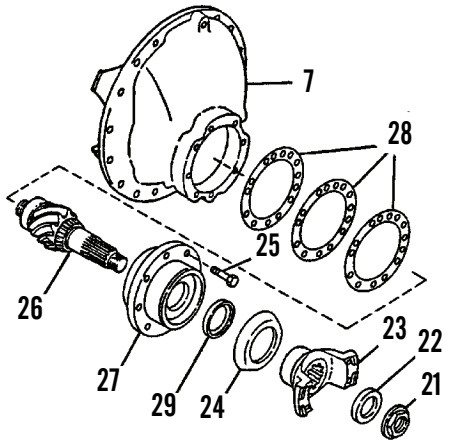
NOTE

If a new bevel pinion and ring gear set is installed, or if the depth of the bevel pinion has to be adjusted, calculate the needed thickness of the shim pack using the following procedure.

28. Read cone variation number on spigot end of old bevel pinion (26). Record number.



409-1284



409-1286

ASSEMBLY - CONTINUED

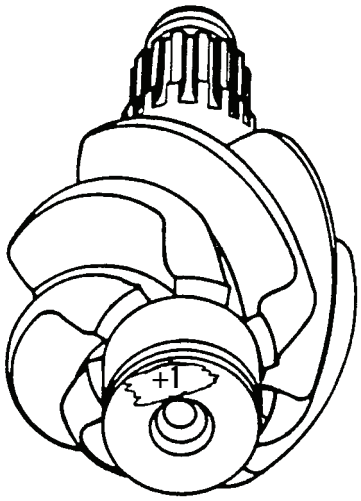
NOTE

Bevel pinion spigot end number can be in 1000ths of an in. or 100ths of a millimeter. Millimeters will be indicated with a decimal point. Example: +3 = 0.003 in., + 0.03 = 0.03 mm. Be sure to convert millimeters to inches by multiplying by 0.039 before performing the following calculations.

29. If old bevel pinion cone number is a plus (+) value, subtract number from old shim pack (28) thickness measured in step 27. If old bevel pinion cone number is a minus (-) value, add number from spigot end of old bevel pinion (26) to old shim pack (28) thickness. This is the thickness of the standard shim pack, without a cone variation.

30. Read number on spigot end of new bevel pinion (26). Record number.

31. If number on spigot end of new bevel pinion is a plus (+), add number to standard shim pack (28) thickness calculated in step 27. If new pinion cone number is a minus (-), subtract new pinion cone number from standard shim pack (28) thickness calculated in step 25. This is the thickness of the new shim pack with cone variation.



409-1245

Example 1	
Old shim pack thickness	0.030
Old bevel pinion spigot end number, PC+2	-0.002
Standard shim pack thickness	0.028
New bevel pinion spigot end number, PC+5	+0.005
New shim pack thickness	0.033

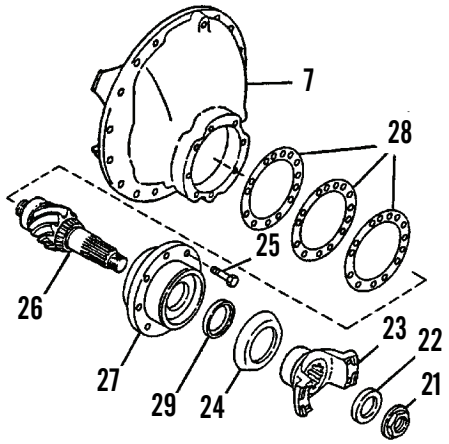
Example 2	
Old shim pack thickness,	0.030
Old bevel pinion spigot end number, PC-2	+0.002
Standard shim pack thickness	0.032
New bevel pinion spigot end number, PC+5	+0.005
New shim pack thickness	0.037

Example 3	
Old shim pack thickness	0.030
Old bevel pinion spigot end number, PC+2	-0.002
Standard shim pack thickness	0.028
New bevel pinion spigot end number, PC-5	-0.005
New shim pack thickness	0.023

Example 4	
Old shim pack thickness	0.030
Old bevel pinion spigot end number, PC-2	+0.002
Standard shim pack thickness	0.032
New bevel pinion spigot end number, PC-5	-0.005
New shim pack thickness	0.027

ASSEMBLY - CONTINUED

32. Install bevel pinion (26) and bearing cage (27), as an assembly, and new shim pack (28) into the carrier.



409-1286

NOTE

Use a minimum of three shims in a shim pack. Install the thinnest shims on both sides of the shim pack for maximum sealing.

33. Install new shim pack (28) and pinion bearing cage (27). Secure with eight capscrews (25).
34. Torque capscrews (25) to 50 to 75 lb-ft (68 to 102 Nm).
35. Torque nut (21) to 300 to 400 lb-ft (407 to 542 Nm).

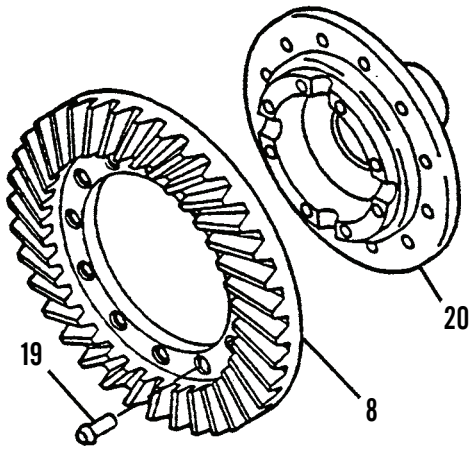
WARNING

Wear gloves and proper clothing while handling hot ring gear. Failure to follow this warning could result in serious personal injury.

CAUTION

Ring gear must be heated before installation. Failure to heat ring gear before installation could cause damage to differential case half because of tight fit.

36. Expand ring gear (8) by heating in a tank of water to a temperature of 160°F to 180°F (71 to 82°C) for 10 to 15 minutes.
37. Use a suitable sling and hoist to lift the ring gear (8) from tank of water.
38. Install ring gear (8) on flange case half (20) immediately after heating. If ring gear (8) does not fit easily on flange case half (20), repeat step 36.
39. Align fastener holes of ring gear (8) and flange case half (20) by rotating ring gear (8) as needed.



409-1295

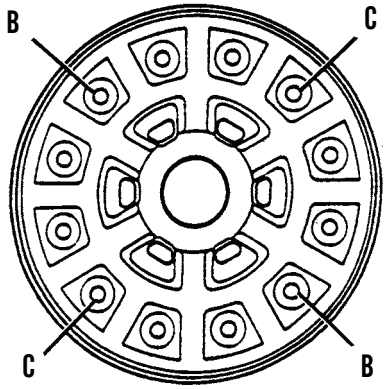
ASSEMBLY - CONTINUED

40. Properly install twelve new rivets (19) in pairs opposite each other (B and C) from the flange case half (20) side of the assembly (side opposite gear teeth) as shown. Rivet head must be against flange case half (20).

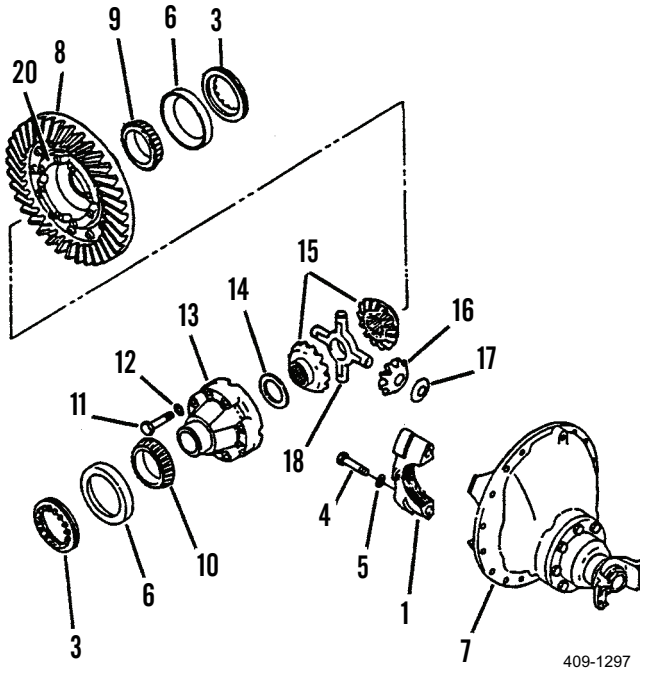
CAUTION

- Do not heat rivets before installation. Use only cold rivets for proper fastening.
- Pressure on rivets must be held for approximately one minute so that rivet body will completely fill hole. Failure to do so could cause rivet failure.

41. Use a riveting machine to press new rivets (19) into place from ring gear (8) side of the assembly. Press new rivets (19) in pairs opposite each other. Apply 60,000 lb (413685 kPa) of pressure.
42. Use a 0.003 in. (0.076 mm) feeler gauge to check for gaps between back surface of ring gear (8) and flange case half (20). If gauge fits more than half way to rivets, remove ring gear (8). If gap persists, inspect flange case half (20) and ring gear (8) for problem. Replace defective parts.
43. Use press sleeve driver to install bearing cone (9) on flange case half (20).
44. Use press sleeve driver to install bearing cone (10) on plain case half (13).
45. Apply clean lubricating oil to inside surfaces of both case halves (13 and 20), two thrust washers (14), two side gears (15) and four pinion gears (16).
46. Place flange case half (20) on bench, ring gear (8) teeth up.
47. Install one thrust washer (14) and side gear (15) into the flange case half (20).
48. Install four pinion gears (16) and four pinion gear thrust washers (17) on differential spider (18). Install differential spider assembly into flange case half (20).
49. Install second side gear (15) and thrust washer (14) over spider (18) and differential pinion gears (16).
50. Place plain case half (13) over flange case half (20) and gears (15 and 16). Rotate plain case half (13) as needed to align match marks.



409-1296



409-1297

ASSEMBLY - CONTINUED

CAUTION

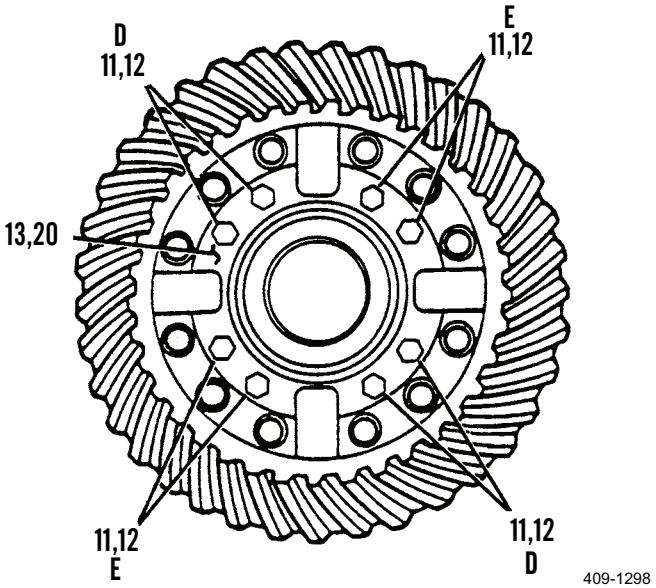
Spacing between first four installed capscrews must be even to prevent uneven pressure on case halves when torquing. Failure to do so could cause component failure.

51. Apply loctite to eight capscrews (11). Install four of the eight capscrews (11) and four flatwashers (12), as opposing pairs (D and E), into case halves (13 and 20).
52. Torque four capscrews (11) to 60 to 75 lb-ft (81 to 102 Nm).

NOTE

Torque capscrews in pairs opposite each other.

53. Install remaining four capscrews (11) and four flatwashers (12). Torque to 60 to 75 lb-ft (81 to 102 Nm).
54. Check rotating resistance of differential gears.

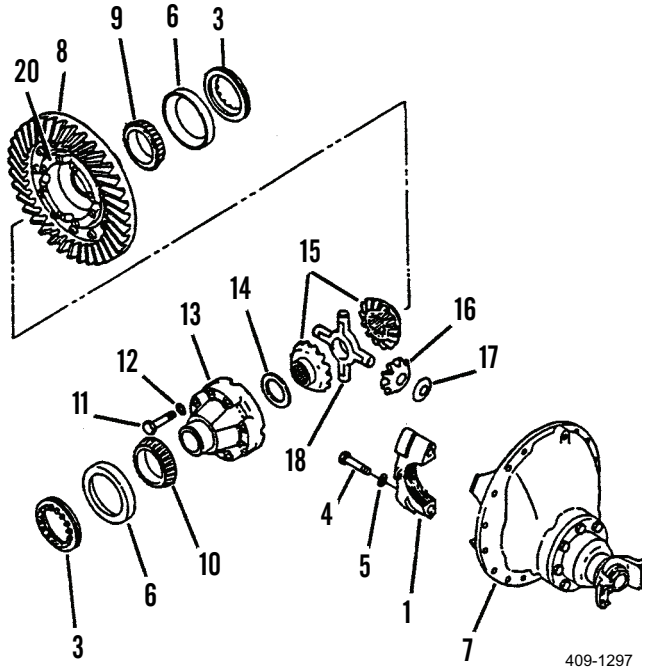


409-1298

NOTE

- Fabricate a tool from an axle's shaft that matches the spline of differential side gear.
- Put differential in a soft-jaw vise in the normal operating position.

55. Install differential resistance tool into spline of one side gear.
56. Apply torque wrench on end of differential resistance tool. Read the value of torque wrench as differential gears are rotated.
57. If torque value exceeds 50 lb-ft (68 Nm), disassemble differential. Inspect case halves (13 and 20), spider (18), gears (15 and 16) and washers (14 and 17) for cause of high torque reading. Replace parts as necessary.
58. Clean and dry bearing cups (6), bores of differential carrier (7) legs and bearing caps (1).
59. Apply thin film of clean lubricating oil to inner diameter of the bearing cups (6) and on both bearing cones (9 and 10).



409-1297

ASSEMBLY - CONTINUED

NOTE

When installing bearing cups into bearing bores of differential carrier, apply loctite to bearing bores of differential carrier and bearing caps. Do not allow loctite to get into adjusting ring threads.

60. Apply thin bead of loctite to bearing bores of differential carrier (7) legs and bearing caps (1). Do not apply loctite to adjusting ring (3) threads.
61. Install two bearing cups (6) over bearing cones (9 and 10) on case halves (13 and 20).

WARNING

- Use 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.

62. Use a suitable sling and hoist to carefully lift differential and ring gear (6 thru 18) as an assembly and install into differential carrier (7). Bearing cups (6) must be flat against bores between differential carrier (7) legs.

CAUTION

Install bearing caps in correct location to avoid thread damage by cross-threading adjusting rings, when installed, or mismatching bearing caps.

63. Install bearing caps (1) over the assembled bearing cups and bearing cones (9 and 10). Use match marks made during disassembly to match original location of bearing caps.
64. Install capscrews (4) and flatwashers (5) and hand-tighten.

CAUTION

Install adjusting rings, using care not to cross-thread the rings or the caps. A plastic or leather mallet can be used to align the rings and caps during installation. DO NOT force adjusting rings. Damage to threads may result.

65. Install adjusting rings (3) and tighten hand tight against each bearing cup (6).
66. Torque capscrews (4) to 110-145 lb-ft (149-197 Nm).

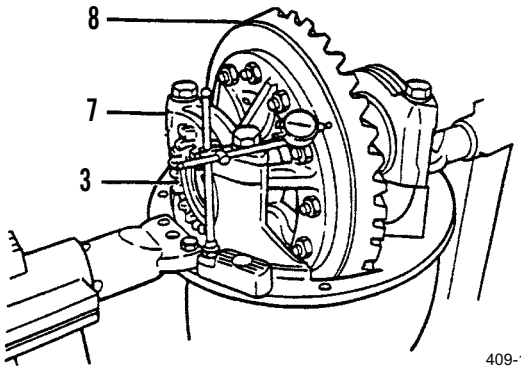
ADJUSTMENT

1. Attach a dial indicator on the mounting flange of the differential carrier (7).
2. Adjust the dial indicator so that the plunger is against the back surface of the ring gear (8). Adjust dial indicator to zero.

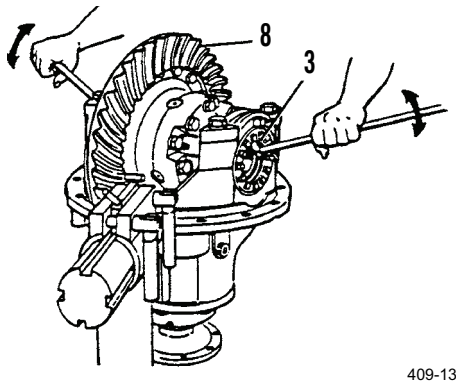
CAUTION

When turning bearing adjusting rings, use a large screwdriver that engages two or more opposite notches in the ring. Failure to engage at least two notches could cause damage to adjusting ring lugs.

3. Loosen the bearing adjusting ring (3) opposite ring gear (8) so that a small amount of end play shows on dial indicator. Move differential assembly with ring gear (8) left and right with suitable pry bars while reading dial indicator. DO NOT allow pry bars to touch bearing (9 thru 10).
4. Tighten bearing adjusting ring (3) opposite ring gear (8) so that no end play shows on dial indicator. Move the differential assembly and ring gear (8) left and right as needed to be sure no end play is present.
5. Tighten each bearing adjusting ring (3) one notch from the zero end play measured in step 4.

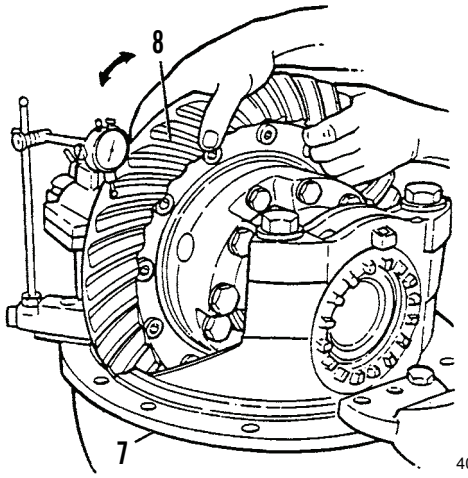


409-1302



409-1303

6. Check runout of ring gear (8). Attach dial indicator on mounting flange of differential carrier (7). Adjust dial indicator so that plunger is against back surface of ring gear (8).
7. Adjust dial indicator to zero and rotate differential assembly and ring gear (8) and read dial indicator. If runout of ring gear (8) exceeds 0.008 in. (0.20 mm), remove differential assembly and ring gear (8) and inspect differential assembly for problem. Replace defective parts and install differential assembly and ring gear (8) into differential carrier (7). Repeat preload adjustment of differential bearings.
8. To adjust backlash of ring gear (8), attach a dial indicator to the mounting flange on differential carrier (7).
9. Adjust dial indicator so that plunger is against the tooth surface on ring gear (8).



409-1304

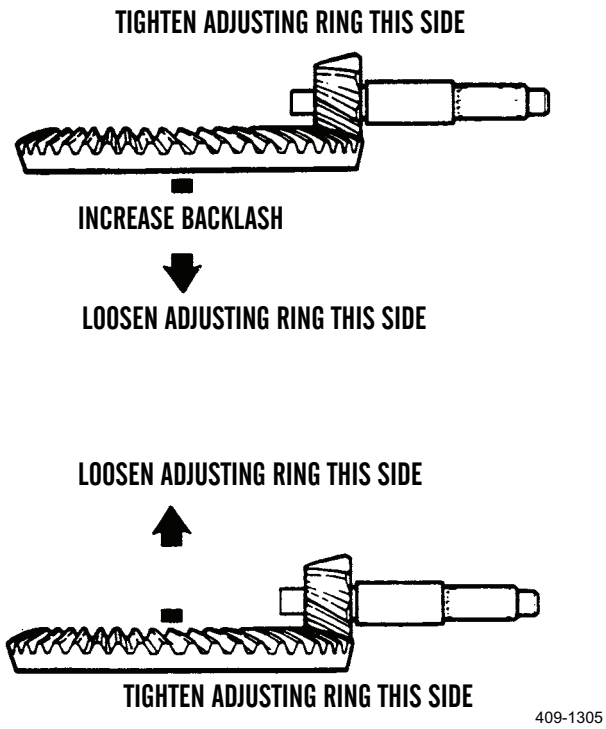
ADJUSTMENT - CONTINUED

10. Adjust dial of indicator to zero, and hold bevel pinion in position so it does not move.
11. Read dial indicator while rotating ring gear (8) in both directions against teeth of bevel pinion.
12. If old gear set is installed, backlash must be 0.008 to 0.018 in. (0.20 to 0.46 mm) or setting before carrier was disassembled.
13. If new gear set is installed, backlash must be 0.012 in. (0.30 mm).

NOTE

When adjusting backlash, only the ring gear and differential are adjusted. Do not adjust the bevel pinion.

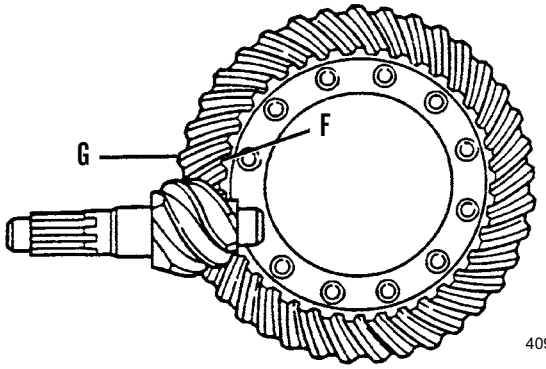
14. Increase backlash by loosening bearing adjusting ring (7) on gear (8) side, and tightening bearing adjusting ring (7) away from ring gear (8) side of differential assembly. Make adjustments one notch at a time until backlash is within specifications.
15. Decrease backlash by tightening bearing adjusting ring (7) on ring gear (8) side, and loosening bearing adjusting ring (7) away from ring gear (8) side of differential assembly. Make adjustments one notch at a time until backlash is within specifications.
16. Check tooth contact patterns of the gear set.



ADJUSTMENT - CONTINUED

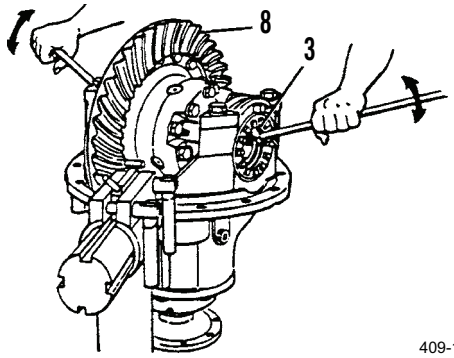
NOTE

In the following steps, movement of contact pattern in length of tooth is indicated as toward “toe” (F) or “heel” (G) of ring gear.

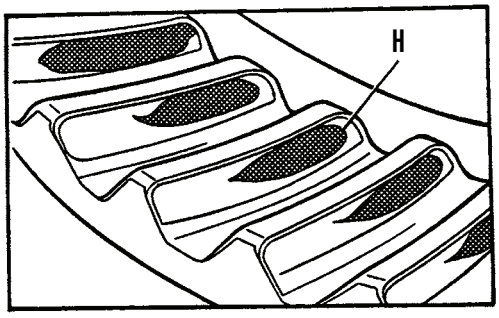


409-1306

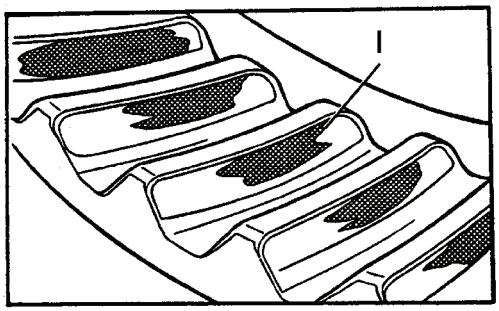
17. Apply marking compound to 12 gear teeth of ring gear. Rotate ring gear so that 12 gear teeth are next to bevel pinion.
18. Rotate ring gear (8) forward and backward so that 12 marked teeth go past bevel pinion six times to get contact patterns. Repeat, if necessary, to get a clearer pattern.
19. Inspect contact patterns on ring gear (8). Good hand rolled pattern (H) will show contact toward toe of gear tooth and in the center between top and bottom of tooth. A high pattern (I) will show contact closer to top of gear tooth. A low pattern (J) will show contact toward bottom of gear tooth. When in operation, pattern will extend to approximately full length of gear tooth.



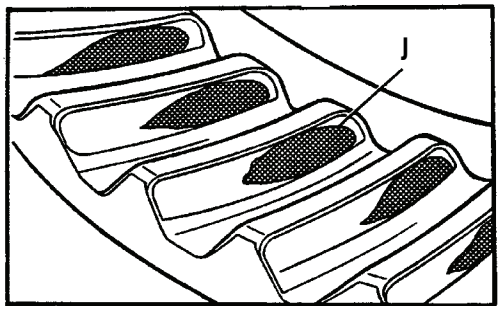
409-1303



409-1307



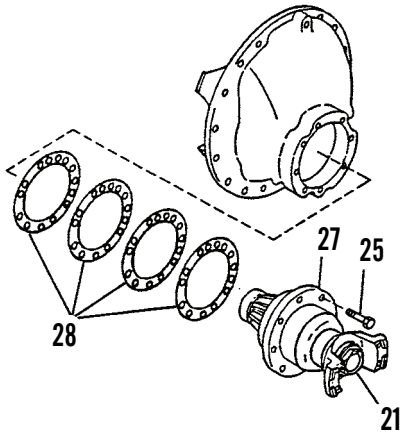
409-1308



409-1309

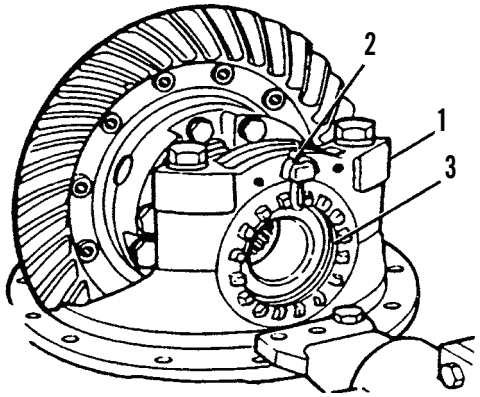
ADJUSTMENT - CONTINUED

20. If necessary, install new thinner shim pack (28) under pinion bearing cage (27) to correct high contact pattern.
21. If necessary, install new thicker shim pack (28) under pinion bearing cage (27) to correct low contact pattern.



409-1294

22. If necessary, decrease backlash to move contact patterns toward toe of ring gear teeth.
23. If necessary, increase backlash to move contact patterns toward heel of ring gear teeth.
24. Install two new cotter pins (2) that hold two bearing adjusting rings (3) in position. Install new cotter pins (2) through boss of bearing cap (1) and between lugs of adjusting ring (3).



409-1310

25. Install planetary wheel ends (WP 0248 00).
26. Fill axle housing (WP 0125 00).
27. Install rear axle assembly (WP 0245 00).
28. Operate equipment and check for proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

BRAKE CONTROL VALVE MAINTENANCE 0299 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 29, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Wooden dowel

Materials/Parts

Grease, GAA (Item 20, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Backup ring (19)

Boot (2)

Cup (12 and 18)

Materials/Parts - Continued

Filter (44)

Insert (33)

Lockwasher (56 and 58)

O-ring (7, 17, 21, 23, 28, 34, 35, 38, 42, 49, 52, 54, 61 and 62)

Poppet (40)

References

WP 0316 00

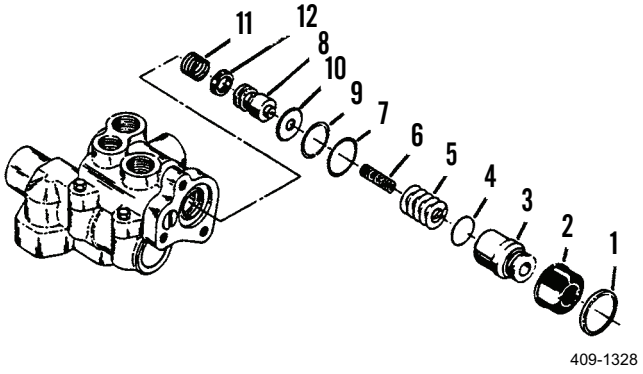
TM 10-3930-660-10

Equipment Condition

Brake control valve removed (WP 0131 00)

DISASSEMBLY

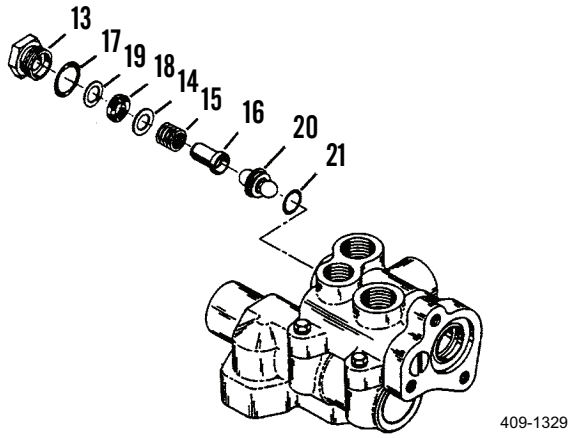
1. Remove ring (1) and boot (2). Discard boot.
2. Remove piston (3), shim or shims (4) and springs (5 and 6).
3. Remove and discard O-ring (7).
4. Depress piston (8) and remove retaining ring (9).
5. Remove washer (10) and piston (8).
6. Remove spring (11) from piston (8).
7. Remove and discard cup (12) from piston (8).



409-1328

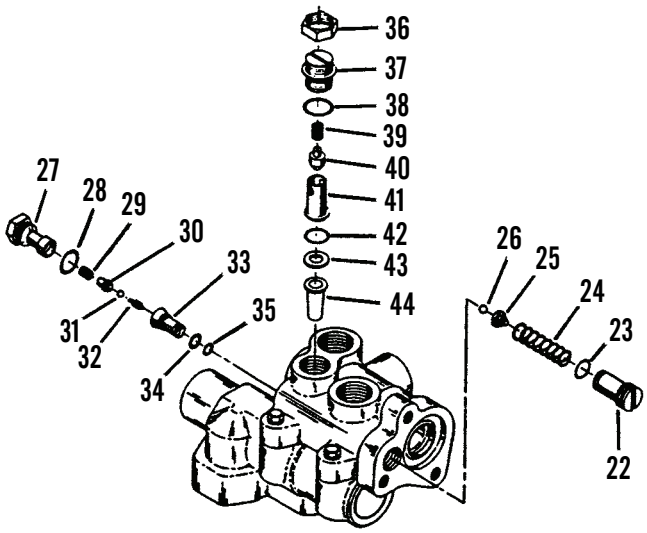
DISASSEMBLY - CONTINUED

8. Remove plug (13).
9. Remove washer (14), spring (15) and guide (16).
10. Remove and discard O-ring (17), cup (18) and back-up ring (19).
11. Remove valve and ball assembly (20).
12. Remove and discard O-ring (21) from valve and ball assembly (20).



409-1329

13. Count and record number of turns required to remove plug and locking pin assembly (22). Remove and discard O-ring (23) from plug (22).
14. Remove spring (24), seat (25) and ball (26).
15. Remove plug (27). Remove and discard O-ring (28) from plug (27).
16. Remove spring (29), stop (30), ball (31), spool (32) and insert (33). Discard insert.
17. Remove and discard O-rings (34 and 35) and insert (33).
18. Loosen nut (36) and remove adjusting screw (37).
19. Remove and discard O-ring (38) from adjusting screw (37).
20. Remove spring (39), poppet (40), seat (41), O-ring (42), washer (43) and filter (44). Discard poppet, O-ring and filter.



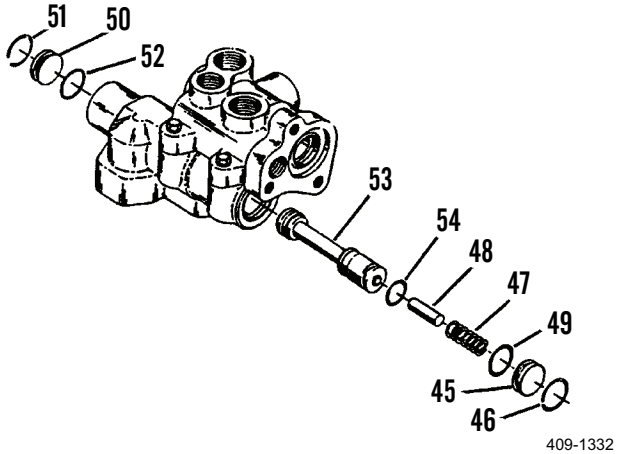
409-1331

DISASSEMBLY - CONTINUED

WARNING

Plug is under tension of spring. Use care when removing retaining ring to prevent personal injury.

21. Depress plug (45) and remove retaining ring (46).
22. Remove plug (45), spring (47) and stop (48).
23. Remove and discard O-ring (49) from plug (45).
24. Depress plug (50) and remove retaining ring (51).
25. Remove plug (50). Remove and discard O-ring (52).

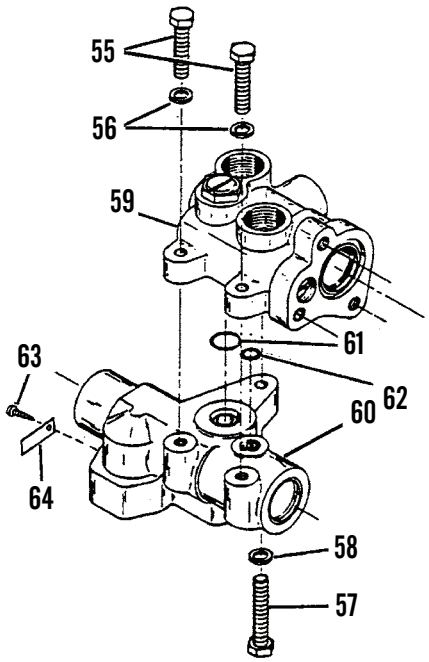


409-1332

CAUTION

Use extreme care when removing spool. Do not force spool at any time during removal. Failure to follow this precaution will result in part damage.

26. Remove spool (53). The spool (53) can be guided out of valve by reaching into either large port on bottom. Remove and discard O-ring (54) from spool (53).
27. Separate and disassemble control housing (59) from charging section (60).
28. Remove two screws (55) and two lockwashers (56). Discard lockwashers.
29. Remove screw (57) and lockwasher (58). Discard lockwasher.
30. Separate control housing (59) from charging section (60).
31. Remove and discard O-rings (61 and 62) from charging section (60).
32. Remove two screws (63) and one label (64), if necessary.



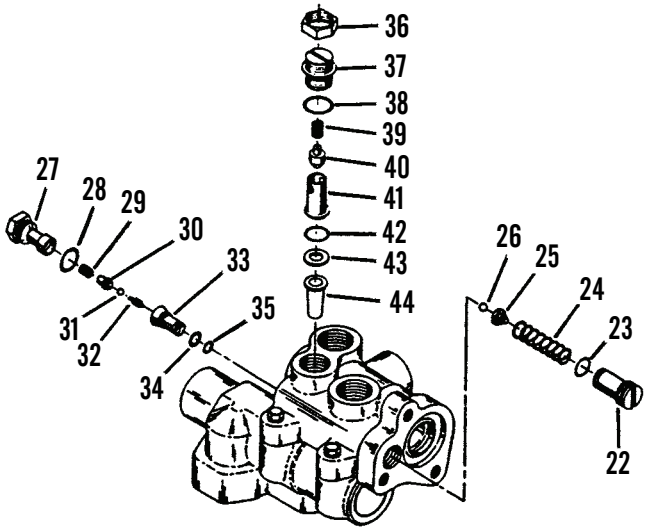
409-1334

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Measure spool (32) and balls (26 and 31).
2. Assemble spool (32) inside insert (33). Place balls (26 and 31) in respective seats. Measure across balls (26 and 31) with a micrometer. Record measurement.
3. Remove spool (32) and place balls (26 and 31) on their respective seats. Measure with a micrometer.
4. Subtract smaller dimension from larger dimension. If difference is less than 0.004 in. (0.10 mm), replace spool (32) with a new one.
5. Insert plug and locking pin assembly (22).
6. The plug (22) has a nylon pin through threaded end so that plug will hold adjusting to which it is set. Screw plug into control housing (59).
7. Check to see if nylon pin has sufficient friction with threads to keep plug (22) from vibrating loose.
8. If there is no increase in torque required to turn plug (22) when pin engages threads, replace pin.



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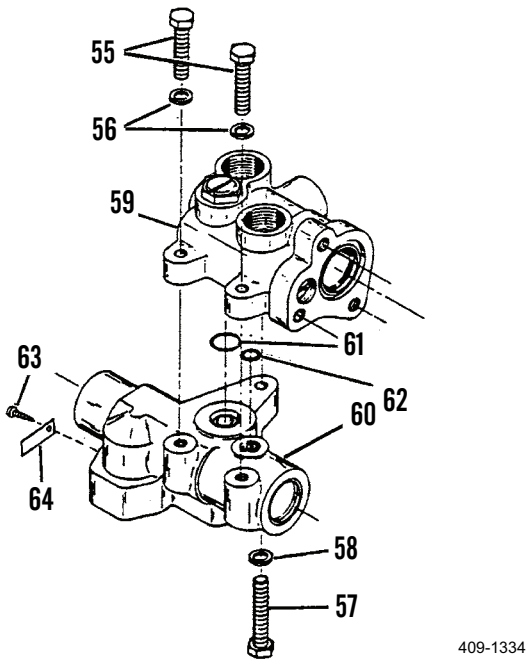


409-1334

ASSEMBLY

NOTE

Wipe all sealing surfaces on pump clean and dry. Apply film of clean lubricating oil to all seals as they are installed.

1. If removal was necessary, install one label (64) and two screws (63).
2. Install new O-rings (61 and 62) in charging section (60).
3. Assemble control housing (59) to charging section (60).

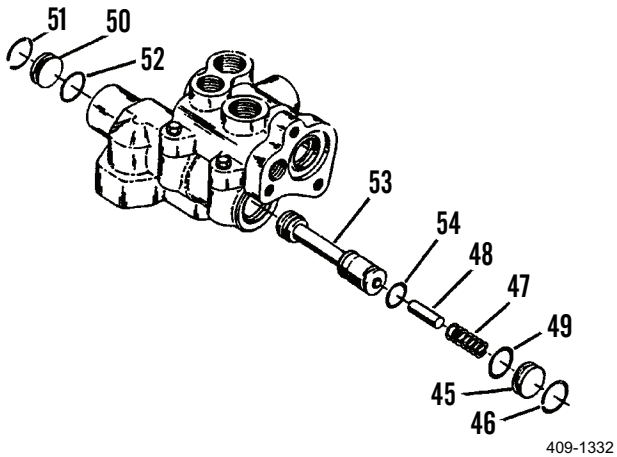
ASSEMBLY - CONTINUED

4. Install new lockwasher (58) and screw (57). Torque screw (57) to 22-27 lb-ft (30-37 Nm).
5. Install two new lockwashers (56) and two screws (55). Torque screws (55) to 22-27 lb-ft (30-37 Nm).
6. Install new O-ring (52) on plug (50). Install plug (52) with retaining ring (51).

CAUTION

Use care to prevent damage to lands on spool and inside bore. Do not force spool into valve. Failure to follow this precaution will cause part damage.

7. Install new O-ring (54) on spool (53). Insert spool (53) into valve bore. Ensure that spool (53) is oriented correctly. Ensure that spool (53) makes contact with plug (50) on opposite side of valve.
8. Install stop (48) and spring (47).
9. Install new O-ring (49) on plug (45). Install plug (45) with retaining ring (46).



409-1332

10. Install new filter (44), washer (43), new O-ring (42), seat (41), new poppet (40) and spring (39).
11. Install new O-ring (38) on adjusting screw (37). Install adjusting screws (37) and torque to 15-20 lb-ft (20-27 Nm).
12. Install nut (36) and torque to 15-20 lb-ft (20-27 Nm).
13. Install new O-rings (34 and 35) on new insert (33). Use a wooden dowel to push new insert (33) into valve.
14. Install spool (32) into new insert (33). Insert the short end of spool (32) first.
15. Install ball (31). Ensure that ball (31) rests on new insert (33).
16. Apply clean grease on end of spring (29) to hold stop (30) in place. Install stop (30) with spring (29).
17. Install new O-ring (28) on plug (27). Install and torque plug (27) to 40-50 lb-ft (54-68 Nm).

CAUTION

Ensure that ball is on seat before proceeding. Failure to do so could cause part damage.

18. Apply clean grease to hold ball (26) and seat (25) to spring (24). Install ball (26), seat (25) and spring (24).

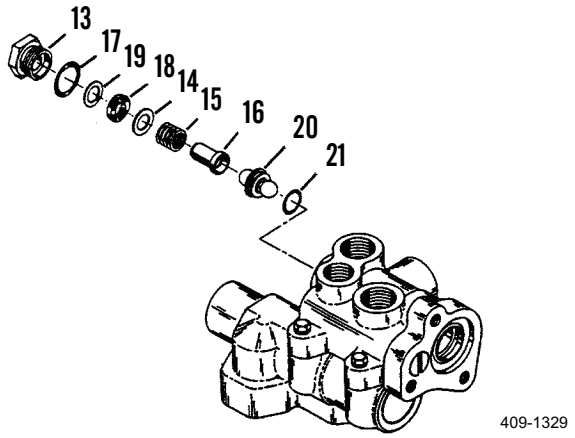
NOTE

The maximum accumulator pressure is adjusted by turning plug. The high pressure limit is increased by turning plug into valve. The low pressure limit is decreased by turning plug out from valve.

19. Install new O-ring (23) on plug (22). Install plug (22) and turn same number of times as recorded during disassembly.

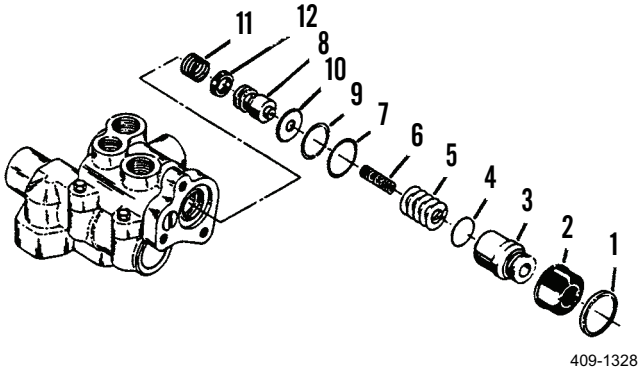
ASSEMBLY - CONTINUED

20. Install new O-ring (21) on valve and ball assembly (20). Insert valve and ball assembly (20) in valve.
21. Install new cup (18) and new back-up ring (19) in plug (13).
22. Install new O-ring (17) on plug (13).
23. Install guide (16), spring (15) and washer (14) in plug (13).



409-1329

24. Install plug assembly (13). Torque to 40-50 lb-ft (54-68 Nm).
25. Install new cup (12) and spring (11) on piston (8). Install piston (8).
26. Install washer (10).
27. Install retaining ring (9).
28. Install new O-ring (7), springs (5 and 6), shim or shims (4) and piston (3).



409-1328

29. Install new boot (2) and retaining ring (1).
30. Install brake control valve (WP 0131 00).
31. Operate brake, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

STEERING CONTROL VALVE MAINTENANCE 0300 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Quad ring seal (14 and 15)

Materials/Parts - Continued

Seal (3, 6, 10, 22, 24 and 26)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Steering control valve removed (WP 0143 00)

DISASSEMBLY

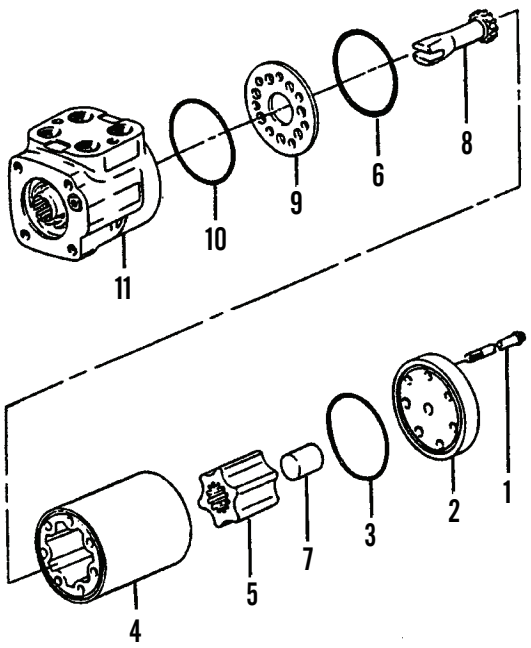
CAUTION

Care should be taken not to contaminate steering pump during disassembly. Dirt and other foreign substances should be removed from surrounding area and pump before disassembling. Failure to follow this precaution will cause part damage.

NOTE

- Place clean rags over jaws of vise to prevent damage to steering control valve.
- Place steering control valve in a vise, meter end up. Do not overtighten vise.

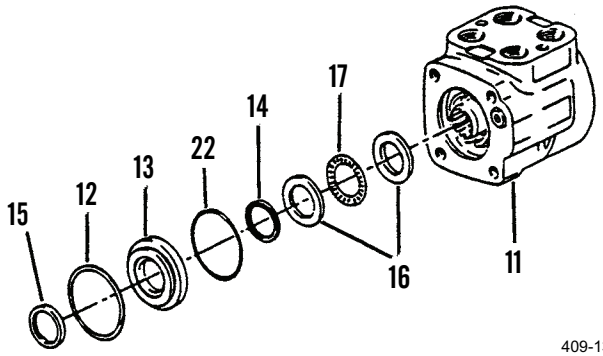
1. Remove seven capscrews (1).
2. Remove end cap (2).
3. Remove and discard seal (3) from end cap (2).
4. Remove gerotor housing (4) and star (5). Do not drop star (5).
5. Remove and discard seal (6) from gerotor housing (4).
6. Remove spacer (7).
7. Remove drive (8).
8. Remove spacer plate (9).
9. Remove and discard seal (10) from valve housing (11).



409-1342

DISASSEMBLY - CONTINUED

10. Reverse valve housing (11) by turning over in the vise. Remove retaining ring (12).
11. Remove seal gland bushing (13).
12. Remove and discard quad ring seals (14 and 15).
13. Remove two bearing races (16) and thrust bearing (17).



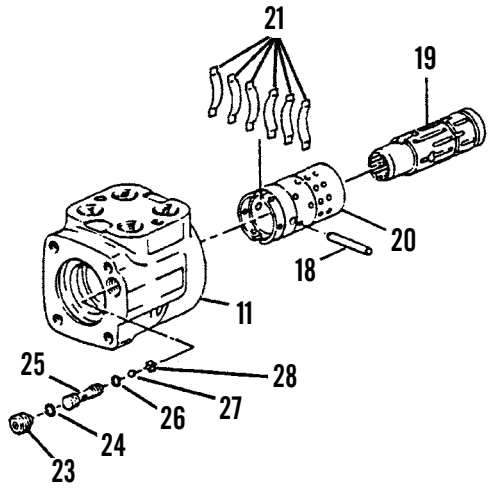
409-1343

14. Remove centering pin (18) from spool (19) and sleeve (20) assembly.

CAUTION

Do not bind spool and sleeve in valve housing. Failure to follow this precaution will cause port damage.

15. Push spool (19) out of sleeve (20). Rotate spool (19) slowly to remove it from housing (11).
16. Remove centering springs (21) if necessary.
17. Remove and discard seal (22).
18. Remove set screw (23), seal (24), seat (25), seal (26), check ball (27) and retainer (28). Discard seals.



409-1344

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Wipe all sealing surfaces on pump clean and dry. Apply film of clean hydraulic oil to all seals, except quad ring seal as they are installed.

1. Install retainer (28), check ball (27), new seal (26), seat (25), new seal (24) and setscrew (23).
2. Install centering springs (21) in sleeve (20).
3. Assemble spool (19) and sleeve (20) so that spring slots line up at same end. Rotate spool (19) when sliding parts together. Spool (19) should rotate smoothly in sleeve (20) with fingertip force applied at spline end.
4. Install pin (18) through spool (19) and sleeve (20) assembly until it is flush at both sides of sleeve (20).

CAUTION

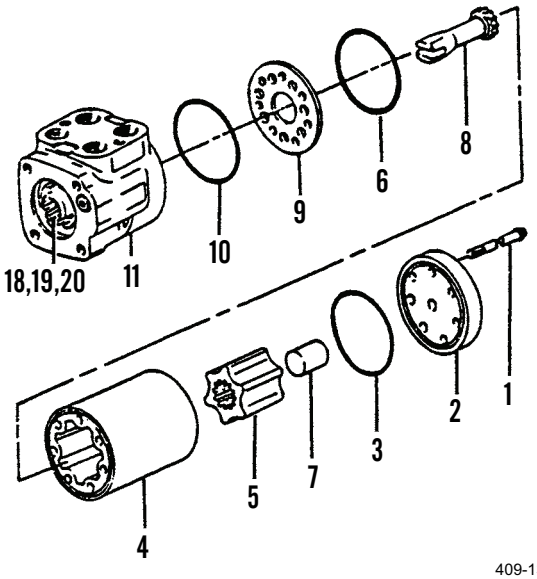
Use care when installing spool and sleeve assembly to prevent shifting of parts. Failure to follow this precaution will cause part damage.

5. Position spool (19) and sleeve (20) assembly so that spline end of spool (19) enters valve housing (11) end opposite steering column side. Push spool (19) and sleeve (20) assembly into valve housing (11) until flush at gerotor housing end. Do not pull assembly beyond this point to prevent pin (18) from dropping into discharge groove of housing (11).
6. Check for free rotation of the spool (19) and sleeve (20) assembly by turning with light fingertip force at spline end.
7. Install two bearing races (16) and thrust bearing (17) over spool (19).
8. Install new seal (22) into valve housing (11).

NOTE

Do not lubricate quad ring seal.

9. Install new quad ring seals (14 and 15) in seal gland bushing (13).
10. Install seal gland bushing (13) over spool (19) in valve housing (11).
11. Install retaining ring (12).
12. Turn valve housing (11) over.
13. Install new seal (10) in valve housing (11).
14. Install space plate (9). Align capscrew holes between spacer plate (9) and tapped holes in valve housing (11).
15. Rotate spool (19) and sleeve (20) assembly until pin (18) is parallel with port face.
16. Install drive (8). Ensure that drive (8) engages pin (18).
17. Install new seal (6) in gerotor housing (4).



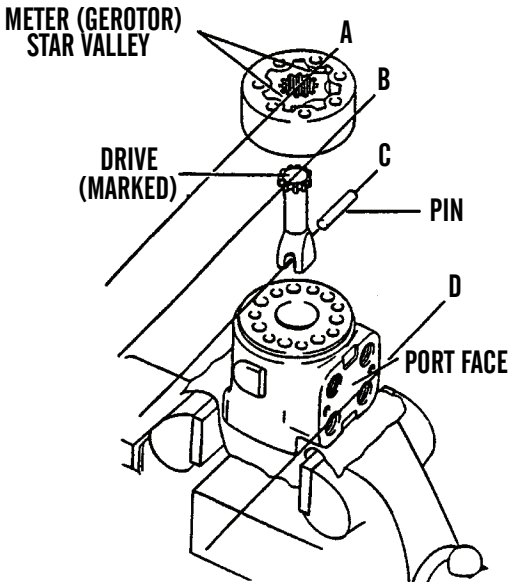
409-1337

ASSEMBLY - CONTINUED

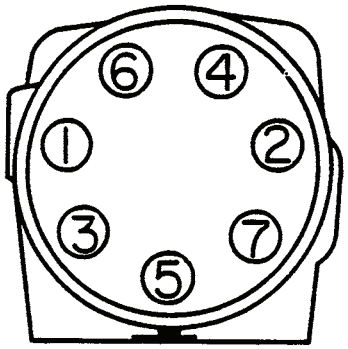
NOTE

Note parallel relationship between lines “A” thru “D”.

18. Install gerotor housing (4). Place gerotor housing (4) with new seal (6) mating to spacer plate (9). Align valleys between drive (8) and gerotor housing (4).

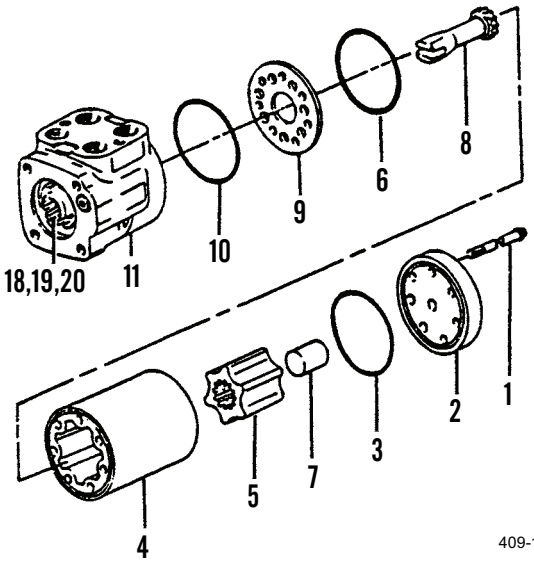


409-1346



409-1347

19. Install star (5). Engage star (5) and drive (8) without disturbing relationship of components.
20. Install spacer (7) in star (5).
21. Install new seal (3) in end cap (2).
22. Install end cap (2) on gerotor housing (4) and align holes.
23. Install seven capscrews (1) in end cap (2). Pretighten capscrews (2) to 150 lb-in. (17 Nm), then torque to 275 lb-in. (31 Nm), in sequence shown.



409-1337

24. Install steering control valve (WP 0143 00).
25. Operate equipment, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FRAME ASSEMBLY MAINTENANCE 0301 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Tool kit, body and fender repair (Item 37, WP 0324 00)

Materials/Parts

Sealant, Loctite (Item 45, WP 0323 00)

Bushing (8)

Conduit (5 and 6)

Hinge (7)

Lockwasher (3)

References

WP 0149 00

WP 0262 00

WP 0316 00

WP 0317 00

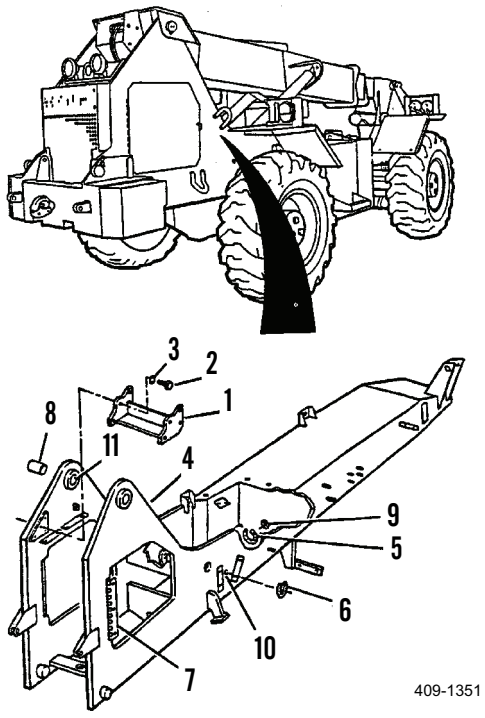
TM 9-237

Equipment Condition

Back-up alarm and rear service floodlights removed (WP 0103 00)

DISASSEMBLY

1. Remove eight capscrews (2) and eight lockwashers (3) from crossmember (1). Discard lockwasher.
2. Remove crossmember (1) from frame (4).
3. Remove conduit (5) from hole (9) in frame (4). Discard conduit.
4. Remove conduit (6) from hole (10) in frame (4). Discard conduit.
5. Remove hinge (7) from frame (4).
6. Remove engine access door (WP 0149 00).
7. Measure location of hinge (7) in frame cutout for door. Record location.



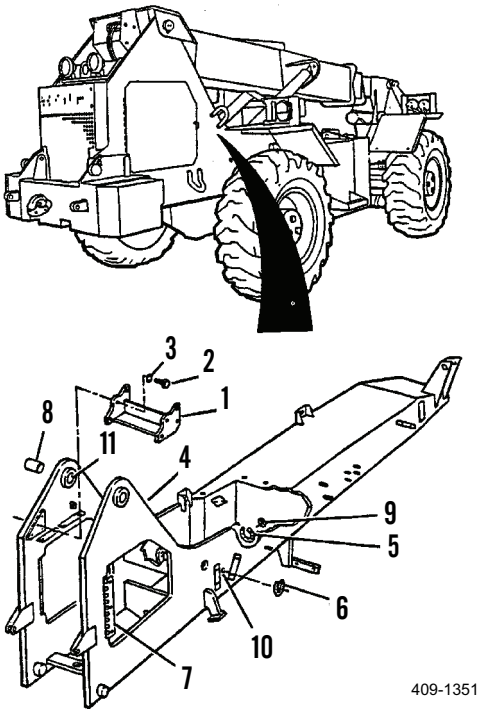
DISASSEMBLY - CONTINUED

8. Break welds attaching hinge (7) to frame (4).
9. Remove hinge (7) and discard.

WARNING

- 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 caution when disassembling them, to avoid injury.

10. Use a grinder or file to remove old weld material from frame (4).
11. Remove boom (WP 0262 00).
12. Use a hammer and suitable driver to remove bushing (8) from boom pivot pin hole (11).
13. Discard bushing (8).



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

1. Use a hammer and suitable driver to install new self-aligning bushing (8).
2. Install boom (WP 0262 00).

ASSEMBLY - CONTINUED

3. Position new hinge (7) on frame, using measurements taken at disassembly.
4. Hold new hinge (7) in position, using a suitable clamp.

CAUTION

Do not weld door side of hinge to frame. Welding incorrect half of hinge to frame will result in damage to frame and hinge.

5. Weld new hinge (7) to frame (4) at several points along pin side (TM 9-237).
6. Install new conduit (6) in hole (10) in frame (4).
7. Install new conduit (5) in hole (9) in frame (4).
8. IInstall crossmember (1) onto frame (4) and secure with eight capscrews (2) and eight new lockwashers (3).
9. Apply loctite to threads of capscrews (2).
10. Torque capscrews (2) to 210 lb-ft (285 Nm).

END OF WORK PACKAGE

TANDEM GEAR PUMP MAINTENANCE 0302 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Seal removal tool (Item 17, WP 0324 00)

Drive gear installation tool (Item 8, WP 0324 00)

Materials/Parts

Grease (Item 20, WP 0323 00)

Sealant, Loctite (Item 43, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Materials/Parts - Continued

Rag, wiping (Item 40, WP 0323 00)

Sealant, permatex (Item 50, WP 0323 00)

Seal (8, 9, 10, 14, 15, 16, 19, 24, 25, 26, 31, 33, 34 and 35)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Tandem gear pump removed (WP 0173 00)

DISASSEMBLY

CAUTION

Prying notches are provided between the pump sections. If prying off sections becomes necessary, take extreme care not to mar or damage machined surfaces. Excessive force while prying can result in misalignment and damaged parts.

NOTE

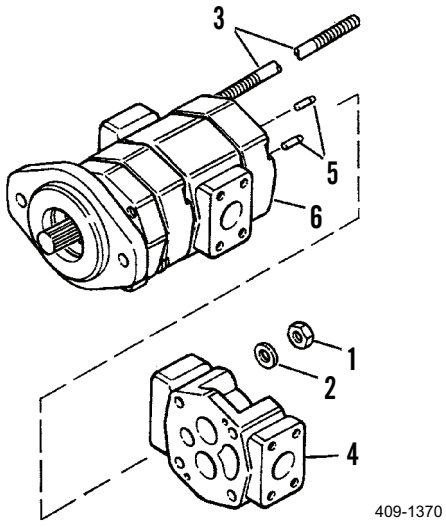
Place pump in a vise with driveshaft pointing down. Mark all sections to be used for alignment at assembly.

1. Remove four nuts (1) and washers (2) from studs (3).
2. Remove cover (4).

NOTE

Dowel pins (5) will remain in cover or housing.

3. Remove gear housing (6).



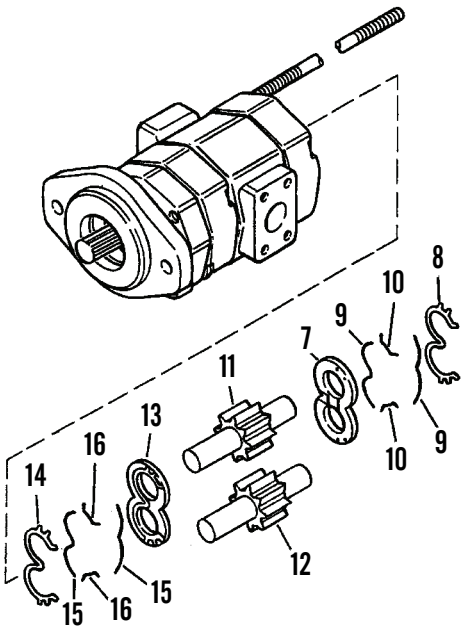
DISASSEMBLY - CONTINUED

4. Remove thrust plate (7). Remove and discard seal (8), two seals (9) and two seals (10).

CAUTION

Gears are closely machined; therefore, they must be kept together as sets when removed from a unit. Handle with care to avoid damage to the journals or teeth. Avoid touching gear journals.

5. Carefully remove drive gear (11) and driven gear (12). Keep these parts together as a matched set.
6. Remove thrust plate (13). Remove and discard seal (14), two seals (15) and two seals (16).



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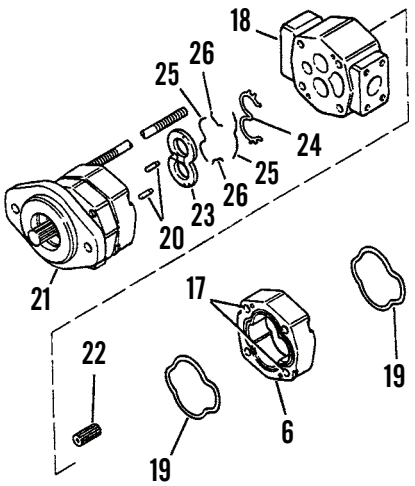
7. Remove gear housing (6). Dowel pins (17) will remain in gear housing (6) or bearing carrier (18). Do not remove dowel pins.
8. Remove and discard two seals (19) from gear housing (6).
9. Pry off bearing carrier (18). Dowel pins (20) will remain in either bearing carrier or gear housing (21). Do not remove dowel pins.
10. Remove connecting shaft (22).
11. Remove thrust plate (23). Remove and discard seal (24), two seals (25) and two seals (26).



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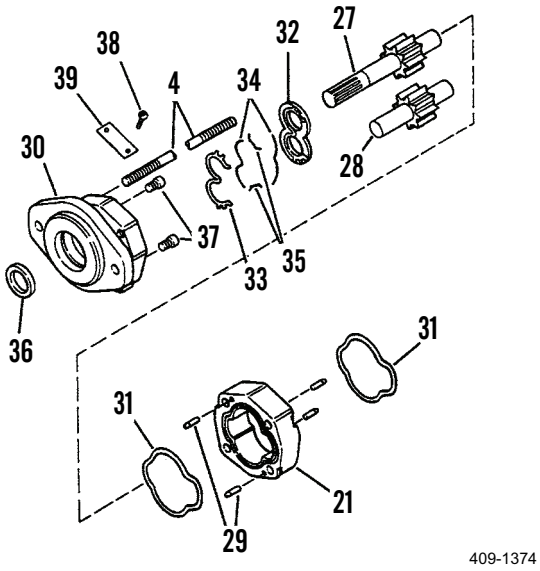
DISASSEMBLY - CONTINUED

CAUTION

Gears are closely machined, therefore they must be kept together as sets when removed from a unit. Handle with care to avoid damage to the journals or teeth. Avoid touching gear journals.

12. Remove drive gear (27) and driven gear (28).
13. Pry off gear housing (21). Dowel pins (29) will remain in either gear housing or end cover (30). Do not remove dowel pins.
14. Remove and discard two seals (31) from gear housing (21).
15. Remove thrust plate (32). Remove and discard seal (33), two seals (34) and two seals (35).



CAUTION

Do not grip on or near any machined surfaces during disassembly or assembly. Failure to follow this precaution will cause part damage.

16. Place end cover (30) in a vise with mounting side face down.
17. Insert fabricated seal removal tool into notch between double lip seal (36) and end cover (30). Tap seal out and discard.
18. Use a screwdriver to remove two plugs (37).
19. Remove two screws (38) and plate (39).
20. Remove four studs (4).

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Inspect gear housing (6 and 21). Replace gear housings if wear exceeds 0.007 in. (0.177 mm) cutout.
2. Place a straightedge across the bore. If a 0.007 in. (0.177 mm) feeler gauge can be slipped under the straightedge in cutout area, replace gear housing.
3. If cutouts are 0.007 in. (0.18 mm) or less, gear housing is in good condition and may be used.
4. Inspect thrust plates (7, 13, 23 and 32) for wear, scoring, pitting or eroding.
5. Erosion indicates oil contamination. Pitted thrust plates indicates cavitation or oil aeration. Discolored thrust plates indicate overheating, probably insufficient oil.
6. Replace thrust plates if wear exceeds 0.002 in. (0.05 mm).
7. See *Inspection* instructions (WP 0317 00).

ASSEMBLY

CAUTION

Do not grip on or near any machined surfaces during disassembly or assembly. Failure to follow this precaution will cause part damage.

NOTE

Wipe all sealing surfaces clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.

1. Secure plate (39) with two screws (38).

NOTE

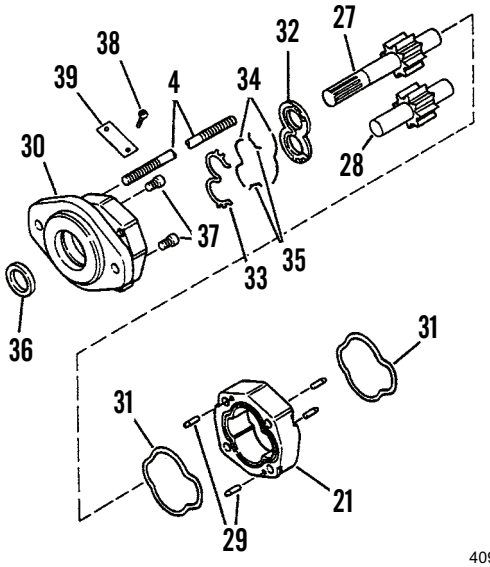
Place end cover in a vise with mounting face down.

2. If removal of two plugs (37) was necessary, apply on threads. Install them in end cover (30). Stake each plug with a punch at both ends of screwdriver slot and around edges. Peen edge of hole 1/32 to 1/16 in. (0.79 to 1.59 mm) with a 1-1/2 in. (38 mm) steel diameter ball.
3. Apply permatex aviation form-a-gasket no. 3 sealant on lip seal (36). With metal side of seal up, use an arbor press and a bar (1-3/4 in. [44.5 mm] diameter by 2 in. [51 mm] long bar), press seal (36) into end cover (30). Press seal flush with recess. Wipe off excess sealant.
4. Apply grease on two new seals (31). Install new seals into grooves on gear housing (21).

CAUTION

If parts are difficult to fit during assembly, tap gently with a soft hammer. Use care to prevent part damage.

5. Ensure that dowel pins (29) are in place. Install gear housing (21) onto end cover (30). Gently tap gear housing (21) tight against end cover (30). Use care to prevent damage to new seals (31).
6. Install new seals (33 thru 35) into grooves in thrust plate (32) with flat side of new seal (33) facing away from thrust plate.
7. Slip thrust plate (32) through gear housing (21) into end cover (30). The new seal (33) should face away from end cover (30). The relief groove in thrust plate (32) should face pump outlet side.
8. Slide driven gear (28) through gear housing (21) into end cover (30).
9. Apply grease on fabricated drive gear installation tool. Place shaft of greased drive gear (27) inside tool. Slide both through end cover (30) with a twisting motion. The integral gears should rest against thrust plate (32). Remove drive gear installation tool. Apply lubricating oil on gears (27 and 28).



409-1374

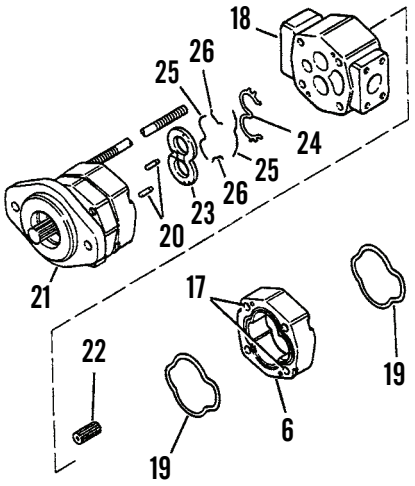
ASSEMBLY - CONTINUED

10. Install new seals (24 thru 26) in thrust plate (23) with flat side of new seal (24) facing away from thrust plate.
11. Slip thrust plate (23) over gears (27 and 28) and into gear housing bore (21). The flat side of seal should be facing outlet side.

CAUTION

If parts are difficult to fit during assembly, tap with a soft hammer. Use care to prevent part damage.

12. Ensure that dowel pins (20) are in place. Install bearing carrier (18) onto gear housing (21). Align dowel holes over dowel pins. Use a soft hammer to tap parts together.
13. Install connecting shaft (22) in spline of drive gear (27).



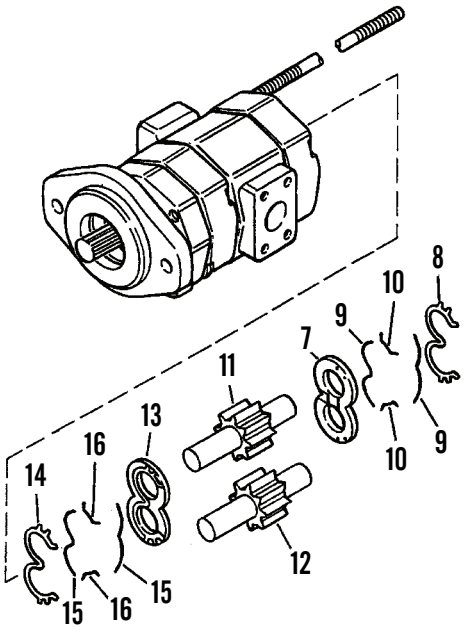
409-1373

14. Apply grease on two new seals (19). Install seals into grooves on gear housing (6).

CAUTION

If parts are difficult to fit during assembly, tap with a soft hammer. Use care to prevent part damage.

15. Ensure that dowel pins (17) are in place. Install gear housing (6) onto bearing carrier (18). Align dowel holes over dowel pins. Use a soft hammer to tap parts together. Use care to prevent damage to new seals (31).
16. Install new seals (14 thru 16) into grooves in thrust plate (13) with flat side of new seal (14) facing away from thrust plate.
17. Install drive gear (11) and driven gear (12) into bearing carrier (15). Ensure that gears are in contact with thrust plate (13) face.
18. Install new seals (8 thru 10) into grooves in thrust plate (7) with flat side of new seal facing away from thrust plate.
19. Install thrust plate (7) with new seals over gears (11 and 12). The flat side of new seal (8) should be facing up with relief groove facing outlet side.



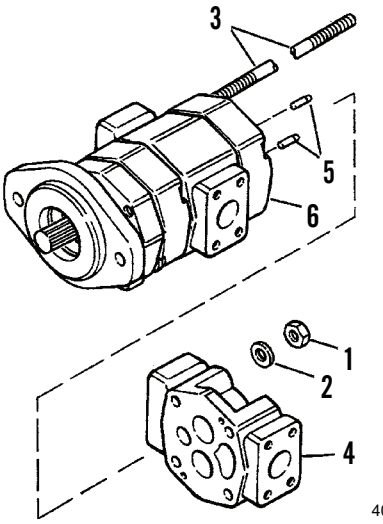
409-1372

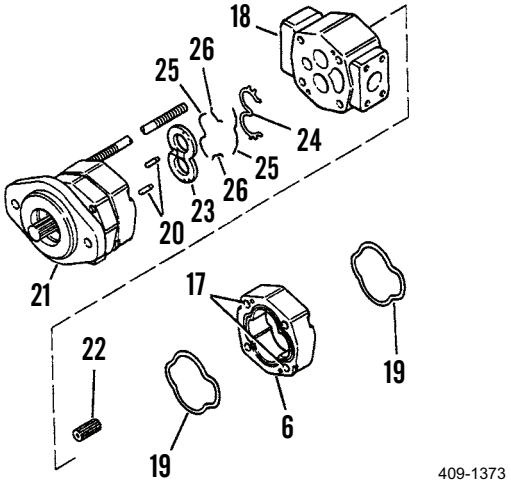
ASSEMBLY - CONTINUED

CAUTION

If parts are difficult to fit during assembly, tap with a soft hammer. Use care to prevent part damage.

20. Ensure that dowel pins (5) are in place. Install cover (4) onto gear housing (6). Align dowel holes over dowel pins (5). Use a soft hammer to tap parts together. Use care to prevent damage to new seals (19).





NOTE

Studs should be flush with shaft end of end cover.

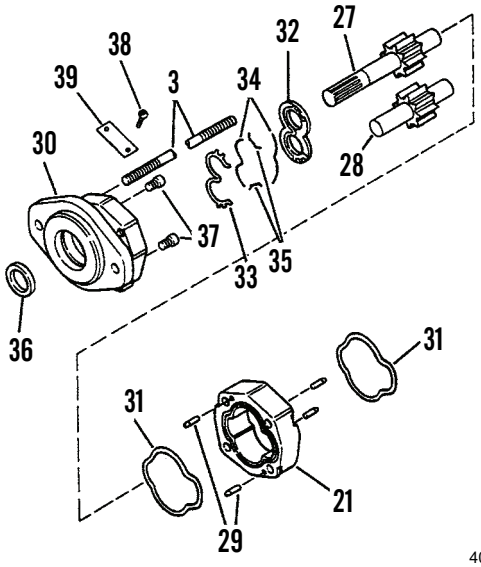
21. Install four studs (3) through all housings and into end cover (30).

22. Install four washers (2) and nuts (1). Finger-tighten alternately.

23. Rotate pump shaft to ensure there is no binding. After nuts (1) are tight and there is no binding, torque to 200 lb-ft (271 Nm).

24. Install tandem gear pump (WP 0173 00).

25. Operate engine, check for proper operation and leaks (TM 10-3930-660-10).



END OF WORK PACKAGE

MAIN CONTROL VALVE ASSEMBLY MAINTENANCE 0303 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Back-up ring (10, 29 and 34)

O-ring (9, 11, 14, 19, 28, 30, 33, 38, 46, 55, 65 and 66)

Seal (4 and 23)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Boom cylinder flow control valve removed (WP 0182 00)

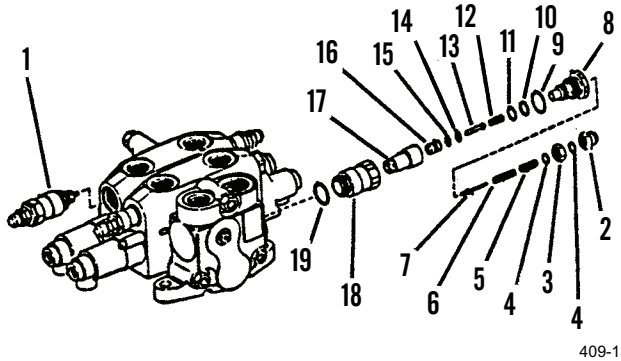
Main control valve assembly removed (WP 0175 00)

DISASSEMBLY

NOTE

Do not remove valves (1) unless they are being replaced.

1. Remove nuts (2 and 3). Remove and discard two seals (4) from nuts.
2. Remove adjusting screw (5), spring (6) and poppet (7).
3. Remove plug (8), O-ring (9), back-up ring (10) and O-ring (11). Discard O-rings and back-up ring.
4. Remove spring (12), piston (13), O-ring (14), back-up ring (15) and poppets (16 and 17). Discard O-ring.
5. Remove body (18) and O-ring (19). Discard O-ring.



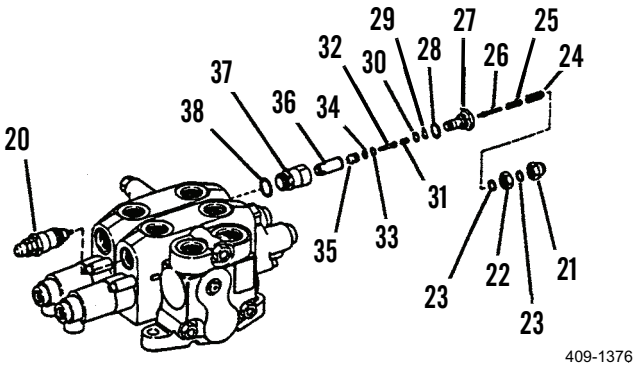
409-1375

DISASSEMBLY - CONTINUED

NOTE

Do not remove valves (20) unless they are being replaced.

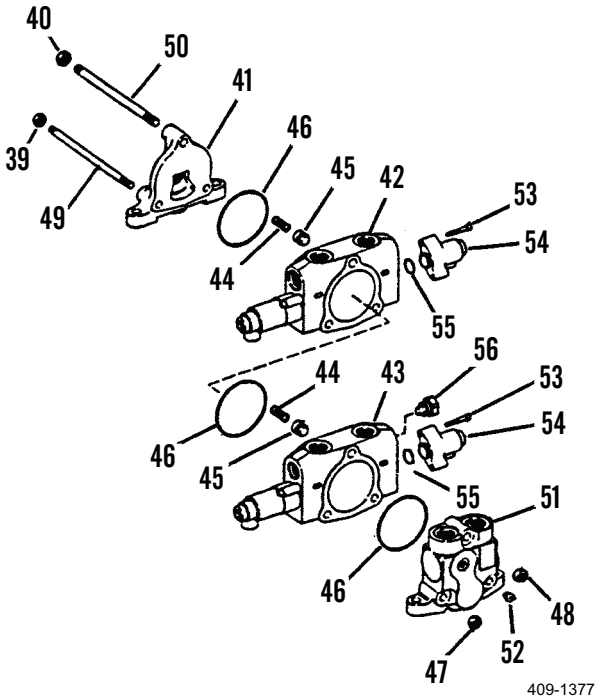
6. Remove nuts (21 and 22). Remove and discard two seals (23) from nuts.
7. Remove adjusting screw (24), spring (25) and poppet (26).
8. Remove plug (27), O-ring (28), back-up ring (29) and O-ring (30). Discard O-rings and back-up ring.
9. Remove spring (31), piston (32), O-ring (33), back-up ring (34) and poppets (35 and 36). Discard O-ring and back-up ring.
10. Remove body (37) and O-ring (38). Discard O-ring.



NOTE

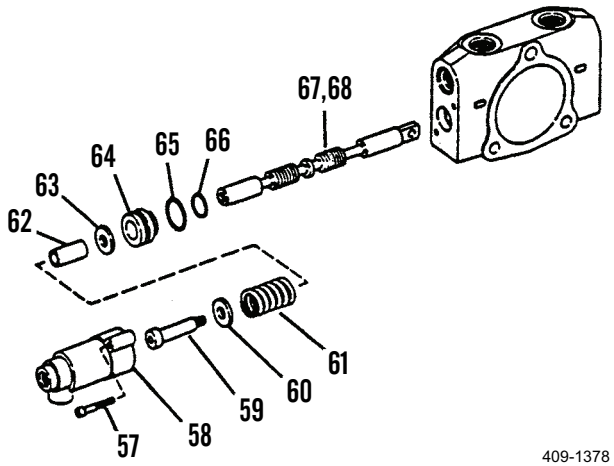
- Mark housing sections of main control housing valve for assembly.
- Use care not to lose springs and poppets when removing housing sections.

11. Remove two nuts (39), one nut (40) and outlet section (41).
12. Remove two springs (44) and two poppets (45).
13. Remove and discard three O-rings (46).
14. Remove two nuts (47), one nut (48), two tie rods (49), one tie rod (50) and inlet housing (51).
15. Remove plug (52) if necessary.
16. Remove two capscrews (53) from two spool caps (54).
17. Remove and discard two O-rings (55).
18. Remove plug assembly (56) if necessary.



DISASSEMBLY - CONTINUED

19. Remove two cap screws (57) from two spool caps (58).
20. Remove two socket head shoulder screws (59), flatwashers (60), springs (61), spacers (62) and flatwashers (63).
21. Remove two retainers (64) and O-rings (65 and 66). Discard O-rings.
22. Remove two spools (67 and 68).



409-1378

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

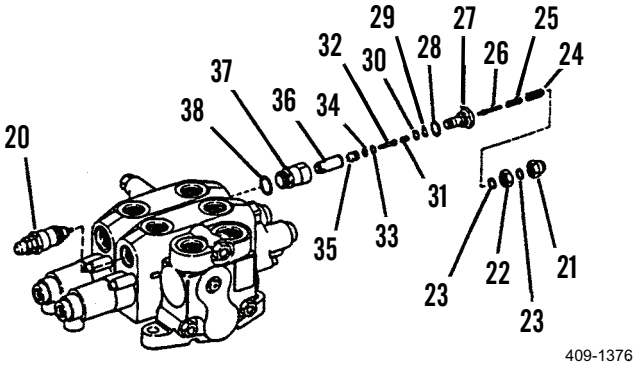
NOTE

Wipe all sealing surfaces on main control valve clean and dry. Apply film of clean lubricating oil to all seals as they are installed.

1. Install two spools (67 and 68).
2. Install new O-rings (65 and 66) on two retainers (64).
3. Install two retainers (64), flatwashers (63), spacers (62), springs (61), flatwashers (60) and socket head shoulder screws (59).
4. Install two spool caps (58) and cap screws (57).
5. If removal of plug assembly (56) was necessary, install it in housing section (43).
6. Install two new O-rings (55) on spool caps (54).
7. Install two spool caps (54) and capscrews (53).
8. If removal of plug (52) was necessary, install it in inlet housing (51).
9. Install three new O-rings (46) in housing sections (42, 43 and 51).
10. Install two poppets (45) and springs (44).
11. Use match lines on housing sections (41, 42, 43 and 51) and install them in proper order on tie rods (49 and 50).
12. Install two nuts (47), one nut (48), two nuts (39) and one nut (40) on tie rods (49 and 50).
13. Torque nuts (40 and 48) to 74 lb-ft (100 Nm) torque nuts (39 and 47) to 48 lb-ft (65 Nm).

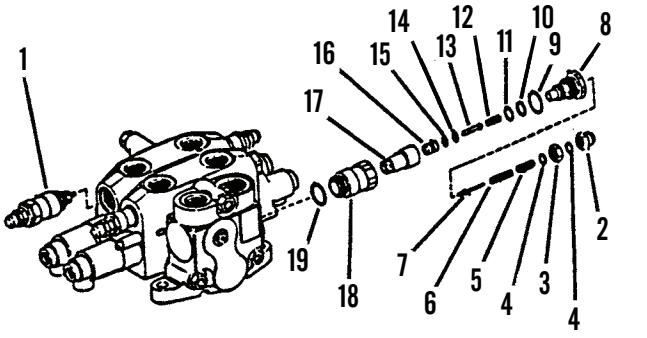
ASSEMBLY - CONTINUED

14. Install new O-ring (38) on body (37).
15. Install new O-ring (33) on poppet (35). Install new back-up ring (34).
16. Install poppet (36), poppet (35), piston (32) and spring (31) into body (37).
17. Install new O-rings (28 and 30) onto plug (27).
18. Install new back-up ring (29) onto plug (27). Install plug assembly (27) into body (37).
19. Install poppet (26), spring (25) and adjusting screw (24).
20. Install one new O-ring (23) into each nut (21 and 22).
21. Install nuts (21 and 22).
22. Install two relief valve assemblies (20) if removed.



409-1376

23. Install new O-ring (19) on body (18).
24. Install new O-ring (14) on poppet (13). Install back-up ring (15).
25. Install poppet (17), poppet (16), piston (13) and spring (12) into body (18).
26. Install new O-rings (9 and 11) onto plug (8).
27. Install new back-up ring (10) onto plug (8). Install plug assembly (8) into body (18).
28. Install poppet (7), spring (6) and adjusting screw (5).
29. Install one new O-ring (4) into each nut (2 and 3).
30. Install nuts (2 and 3).
31. Install two relief valve assemblies (1) if removed.



409-1375

32. Install main control valve assembly (WP 0175 00).
33. Install boom cylinder flow control valve (WP 0182 00).
34. Operate boom, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

MLRS ATTACHMENT CONTROL VALVE MAINTENANCE 0304 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, common no. 2 (Item 19, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Back-up ring (23 and 28)

Lockwasher (49)

Materials/Parts - Continued

O-ring (3, 4, 7, 14, 22, 24, 27, 42, 43, 51, 52, 60 and 62)

Seal (17)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

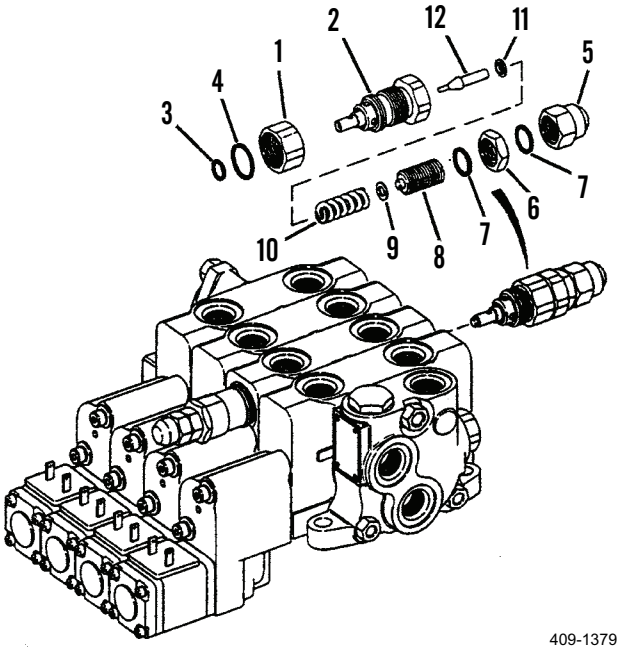
MLRS attachment control valve removed (WP 0176 00)

DISASSEMBLY

NOTE

Do not remove relief valves unless they are being disassembled.

1. Remove nut (1). Remove and discard O-rings (3 and 4).
2. If necessary, remove nuts (5 and 6). Remove and discard two O-rings (7).
3. Remove adjusting screw (8), shim (9), spring (10), spring retainer (11) and poppet (12) from body (2).



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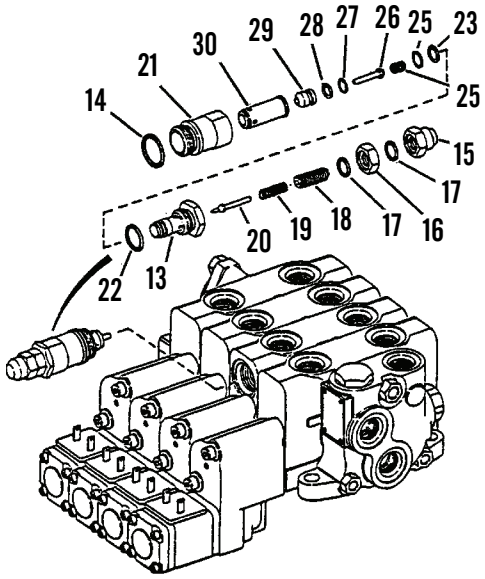
DISASSEMBLY - CONTINUED

NOTE

Do not remove relief valves unless they are being disassembled.

4. Remove plug (13) from body (21). Remove and discard O-ring (14).
5. Remove nuts (15 and 16). Remove and discard two seals (17) from nuts (15 and 16).
6. Remove adjusting screw (18), spring (19) and poppet (20).
7. Remove O-ring (22), back-up ring (23) and O-ring (24). Discard O-rings and back-up ring.
8. Remove spring (25), piston (26), O-ring (27), back-up ring (28) and poppets (29 and 30). Discard O-ring and back-up ring.



409-1380

NOTE

Mark housing sections. These marks will be used for assembly.

9. Place valve so it is resting on housing inlet (31).

NOTE

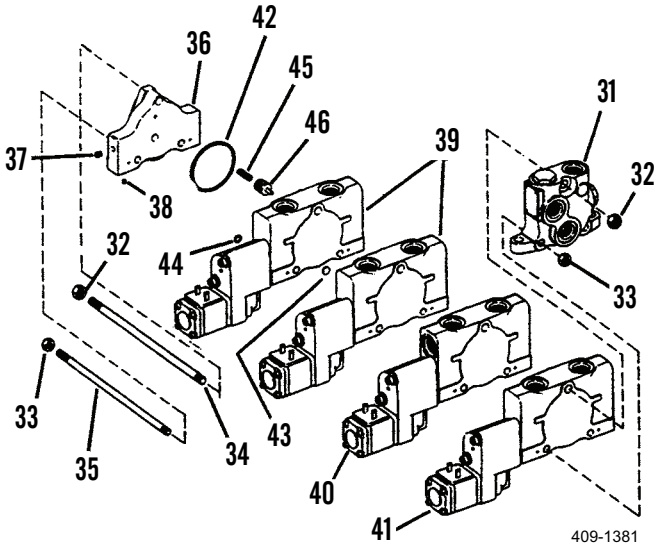
Use care when removing outlet and housing sections. Do not lose poppets and springs that may eject from housing sections.

10. Remove nuts (32 and 33), tie rod (34), two tie rods (35) and outlet housing (36).
11. Remove plugs (37 and 38), if necessary.
12. Separate housing (39 thru 41) and inlet housing (31).
13. Remove and discard one large O-ring (42) and two small O-rings (43) from each face of housing section.

NOTE

Valve section closest to outlet housing has no shuttle plate.

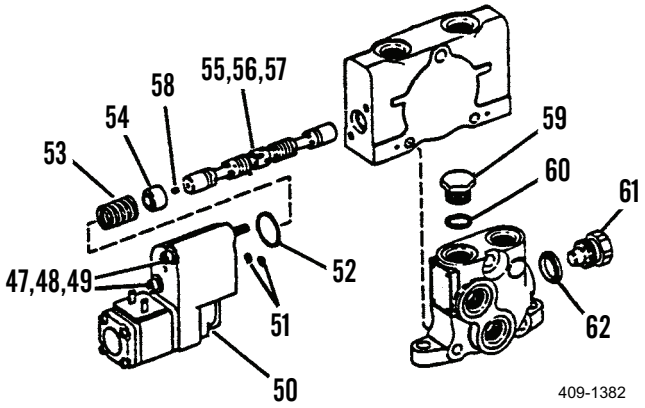
14. Remove three shuttle plates (44), four springs (45) and four compensator pistons (46).



409-1381

DISASSEMBLY - CONTINUED

15. Remove two bolts (47), flatwashers (48) and lockwashers (49) from each electric hydraulic proportioning (EHP) assembly (50). Remove eight EHP assemblies. Discard lockwashers.
16. Remove and discard two small O-rings (51) and one large O-ring (52) from each EHP assembly (50).
17. Remove spring (53) and spring seat (54) from each housing section.
18. Remove spools (55 and 56) and two spools (57) from housing sections.
19. Remove plug (58) from each spool.
20. Remove plug (59) and O-ring (60), if necessary. Discard O-ring.
21. Remove plug (61) and O-ring (62), if necessary. Discard O-ring.



CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Wipe all sealing surfaces on valve clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.

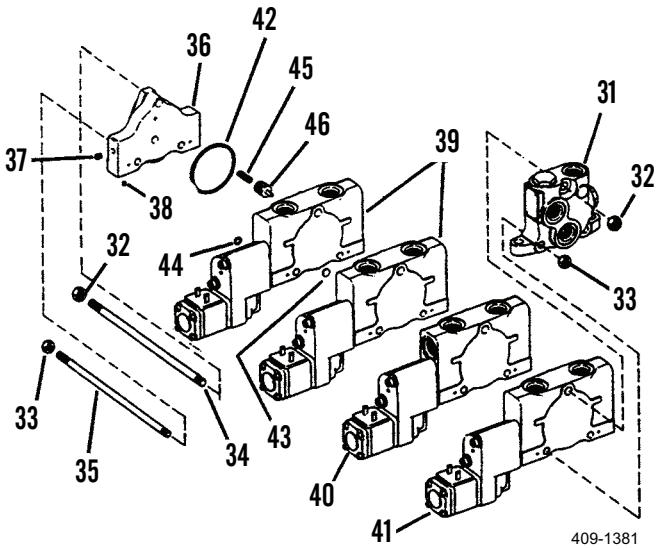
1. If removal of O-ring (62) and plug (61) was necessary, install plug (61) with new O-ring (62).
2. If removal of O-ring (60) and plug (59) was necessary, install plug (59) with new O-ring (60).
3. Install plug (58) into each spool (55 thru 57).
4. Install spools (55 and 56) and two spools (57).
5. Install spring seat (54) and spring (53) in each housing section.
6. Install two new small O-rings (51) and one new large O-ring (52) to each EHP assembly (50).
7. Install eight electric hydraulic proportioning (EHP) assemblies (50) with new lockwashers (49), flatwashers (48) and two bolts (47).

ASSEMBLY - CONTINUED

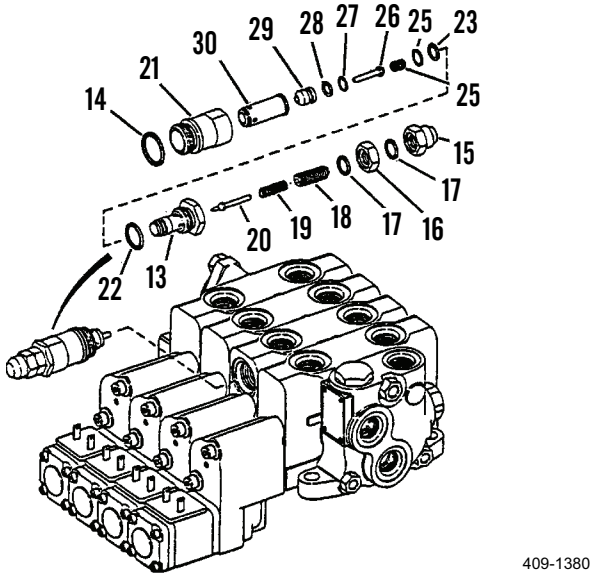
NOTE

Valve section closest to outlet housing has no shuttle plate.

8. Install four pistons (46), four springs (45) and three shuttle plates (44).
9. Install one new large O-ring (42) and two new small O-rings (43) in each face of housing sections.
10. If removal of plugs (37 and 38) was necessary, install them.
11. Use match lines on housing sections (39, 40 and 41), inlet housing (31) and outlet housing (36) and assemble them in proper order on tie rod (34) and two tie rods (35). Install nuts (32 and 33).
12. Torque four nuts (33) to 14 lb-ft (19 Nm). Torque two nuts (32) to 33 lb-ft (45 Nm).

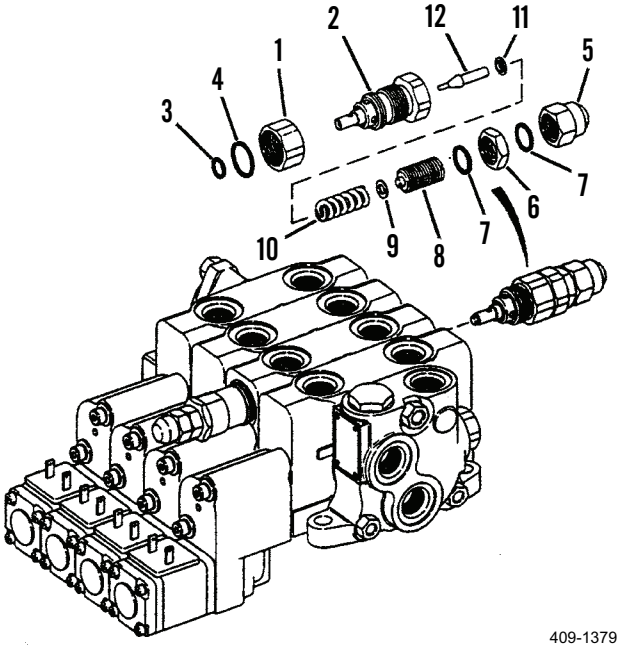


13. Install new O-ring (27) on poppet (29). Install new back-up ring (28).
14. Install poppets (29 and 30), piston (26) and spring (25) into body (21).
15. Install new O-rings (22 and 24) onto plug (13).
16. Install new back-up ring (23) onto plug (13). Install plug assembly (13) into body (21).
17. Install poppet (20), spring (19) and adjusting screw (18).
18. Install one new seal (17) into each nut (15 and 16).
19. Install nuts (15 and 16).
20. Install relief valve as an assembly. Torque relief valve to 30-50 lb-ft (41-68 Nm) at plug (13).



ASSEMBLY - CONTINUED

21. Install poppet (12), spring retainer (11), spring (10), shim (9) and adjusting screw (8) into body (2).
22. Install one new O-ring (7) in each nut (5 and 6).
23. Install nuts (5 and 6).
24. Install nut (1) onto body (2).
25. Install new O-rings (3 and 4) on nut (1).
26. Install relief valve as an assembly. Torque relief valve to 22-28 lb-ft (30-38 Nm).



409-1379

27. Install MLRS attachment control valve (WP 0176 00).
28. Operate equipment, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

HYDRAULIC JOYSTICK CONTROL VALVE MAINTENANCE 0305 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Materials/Parts

Grease (Item 20, WP 0323 00)

Sealant, Loctite (Item 46, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Back-up ring (25)

Materials/Parts - Continued

O-rings (11, 26 and 27)

Seal spool (12)

References

WP 0316 00

TM 10-3930-660-10

Equipment Condition

Hydraulic joystick control valve removed (WP 0181 00)

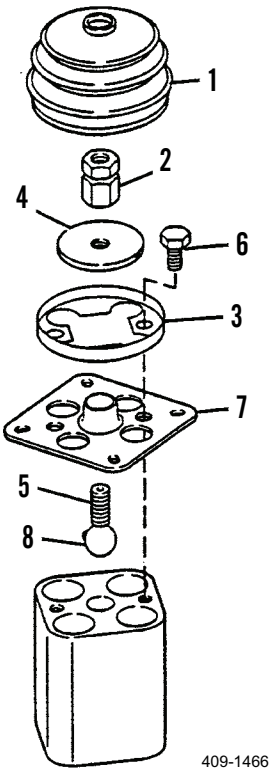
DISASSEMBLY

1. Remove boot (1) by carefully prying it from groove in nut (2) and out from under boot clamp (3).
2. Remove nut (2) and pivot plate (4) from pivot bolt (5).

NOTE

Plunger capsules are under spring compression. Hold mounting plate down and remove capscrews in even increments.

3. Remove two capscrews (6), boot clamp (3) and mounting plate (7).
4. Push pivot bolt (5) down out of mounting plate (7), using care not to lose ball (8).



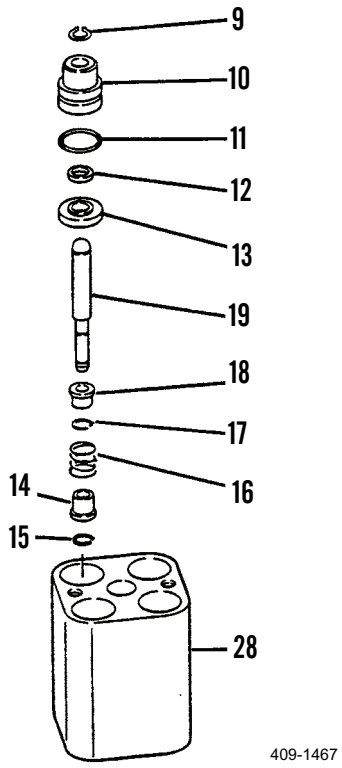
409-1466

DISASSEMBLY - CONTINUED

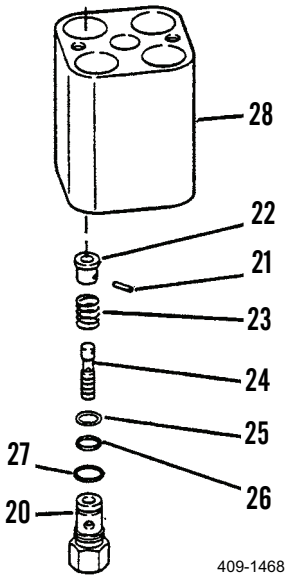
NOTE

There are four identical plunger capsule assemblies and four identical metering capsule assemblies. Steps 6 thru 14 apply to all four.

5. Remove retaining ring (9) and cap (10).
6. Remove O-ring (11) and seal spool (12) from cap (10). Discard O-ring and seal spool.
7. Remove retainer (13).
8. Push up on spring seat (14) and remove retaining ring (15).
9. Remove spring (16), retaining ring (17) and spring seat (18) from plunger (19).



10. Remove plug (20) from housing (28).
11. Remove pin (21), spring seat (22) and spring (23) from spool (24).
12. Remove back-up ring (25) and O-rings (26 and 27) from plug (20). Discard back-up ring and O-rings.

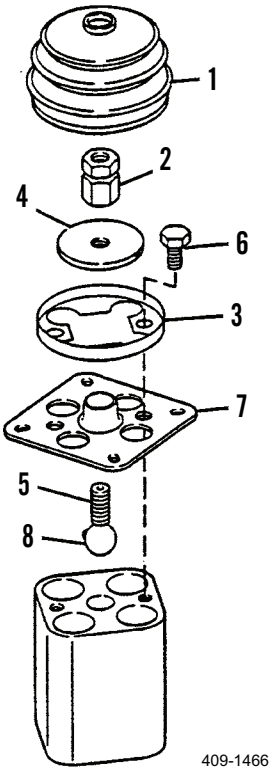


CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

1. Inspect boot (1) for tears, stretching or signs of deterioration.
2. Inspect springs (16 and 23) for signs of stretching or distortion.
3. Inspect plungers (19) and spools (24) for burrs, nicks or score marks.
4. Inspect bores in caps (10) and plugs (20) for burrs, nicks or score marks.
5. Inspect nut (2), pivot plate (4) and pivot bolt assembly (5) threads for damage.



ASSEMBLY

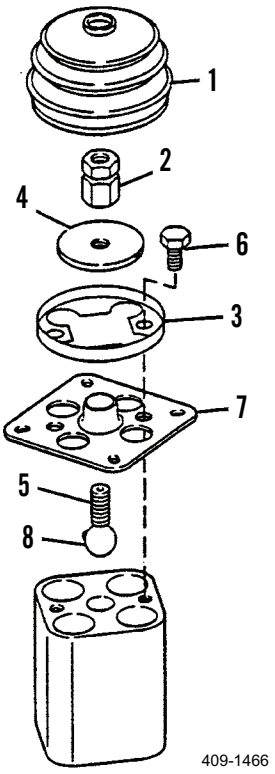
NOTE

Apply a coat of clean transmission oil to all internal sliding surfaces.

1. Assemble spool (24) to spring seat (22) using pin (21).
2. Install new O-rings (26 and 27) and new back-up ring (25) on plug (20).
3. Place spring (23) on spool (24) and insert spool (24) in top of plug (20).
4. Install plug (20) and associated parts in bottom of housing (28). Tighten plug to torque of 29 to 41 lb-ft (39 to 56 Nm).
5. Repeat steps 1 thru 4 for other four sets of metering capsule parts.
6. Install spring seat (18) and retaining ring (17) on plunger (19).
7. Install spring (16), spring seat (14) and retaining ring (15) on plunger (19).
8. Install retainer (13) and new seal spool (12) on plunger (19).
9. Install new O-ring (11) on cap (10) and install cap on plunger (19). Secure with retaining ring (9).
10. Install assembled parts (9 thru 19) in bore in housing (28).
11. Repeat steps 6 thru 10 for three other plunger capsule assemblies.

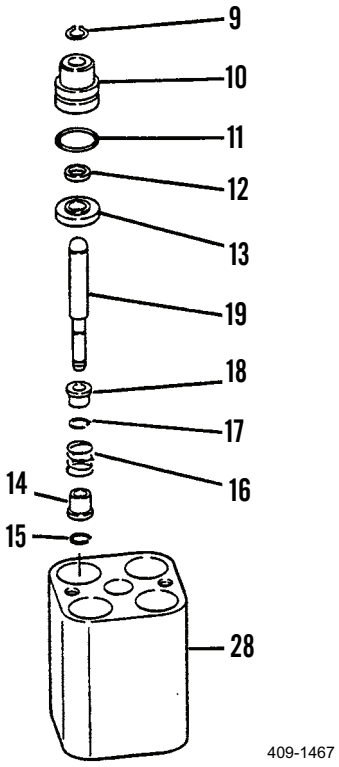
ASSEMBLY - CONTINUED

12. Apply grease to contact surfaces of pivot bolt (5) and mounting plate (7).
13. Install pivot bolt (5) and ball (8) in mounting plate (7) from bottom side. Use care not to dislodge ball (8).
14. Install boot clamp (3) on mounting plate (7). Use care not to tear or stretch it.
15. Apply loctite to threads of capscrews (6). Install capscrews (6) and torque to 15 lb-ft (20 Nm).



ASSEMBLY - CONTINUED

16. Thread pivot plate (4) onto pivot bolt (5) until bottom of pivot plate (4) just contacts tops of plungers (19). Lock pivot plate (4) in that position with nut (2). Torque nut (2) to 29-41 lb-ft (39-56 Nm).



17. Install hydraulic joystick control valve (WP 0181 00).
18. Operate equipment, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FRAME TILT CYLINDER MAINTENANCE 0306 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Spanner wrench, frame tilt cylinder (Item 29, WP 0324 00)

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 48, WP 0323 00)

Back-up ring (2, 3, 4 and 17)

Materials/Parts - Continued

Nut (14)

O-ring (5, 6, 7, 11 and 16)

Seal (13 and 18)

Wear ring (12)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Frame tilt cylinder removed (WP 0183 00)

DISASSEMBLY

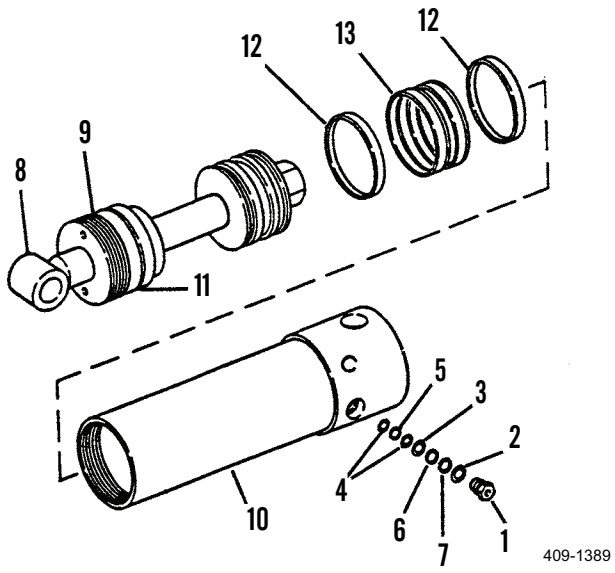
WARNING

Hydraulic oil, under pressure, can remain within cylinder after disconnecting hydraulic hoses. To avoid severe personal injury, slowly loosen counterbalance valve and allow pressure to escape before removing valve entirely.

NOTE

- Note and mark location of counterbalance valves for use during assembly. The valves are not interchangeable.
- Use a vise with soft jaws to secure cylinder in a horizontal position for disassembly.

1. Relieve pressure in cylinder by slowly removing two counterbalance valves (1). Drain residual oil through valve holes into a suitable container.
2. Remove and discard back-up rings (2 and 3), two back-up rings (4) and three O-rings (5 thru 7) from each counterbalance valve (1).



CAUTION

Do not scratch or damage the wear surface of rod, piston or gland. Follow this precaution to prevent failure of the cylinder.

3. Pull rod (8) out approximately 5 in. (12.7 cm) for removal of gland (9).
4. Place a container under gland (9) to catch oil contained in cylinder
5. Use a spanner wrench to remove gland (9) from cylinder tube (10). Pull gland (9) out of cylinder far enough to unseat O-ring (11). Allow oil to drain into container.

CAUTION

Use care when removing rod and piston assembly to prevent wear ring damage. Keep rod in line with cylinder tube to prevent binding.

6. Remove rod (8) and piston assembly from cylinder tube (10).

DISASSEMBLY - CONTINUED

NOTE

Place rod and piston assembly on suitable supports to prevent damage.

7. Remove and discard two wear rings (12).

NOTE

Do not nick or scratch seal groove during removal of seal. Failure to follow this precaution will cause part damage.

8. Cut and discard seal (13).

NOTE

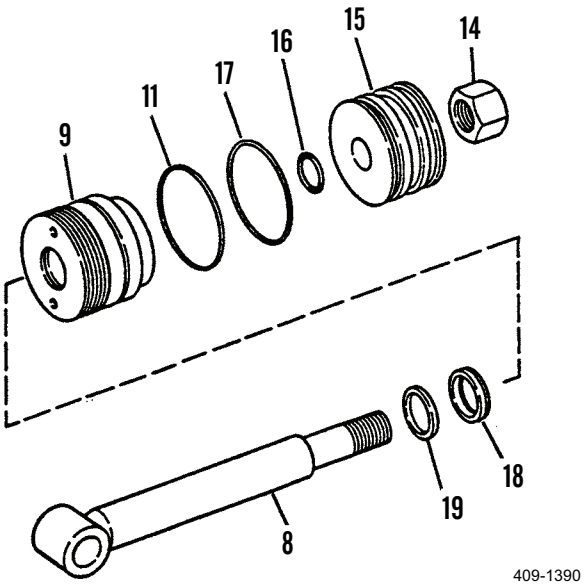
The nut may need to be heated with a torch for removal.

9. Remove nut (14) and piston (15). Discard nut.

10. Remove and discard O-ring (16) from piston (15) bore.

11. Slide gland (9) off rod (8).

12. Remove O-ring (11) and back-up ring (17) from gland (9). Discard O-ring and back-up ring.



409-1390

CAUTION

Do not nick or scratch seal groove during removal of seal and rod wiper. Failure to follow this precaution will cause part damage.

NOTE

Note direction that lip of seal is facing before removal.

13. Remove seal (18) and rod wiper (19) from inside of gland (9). Discard seal.

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

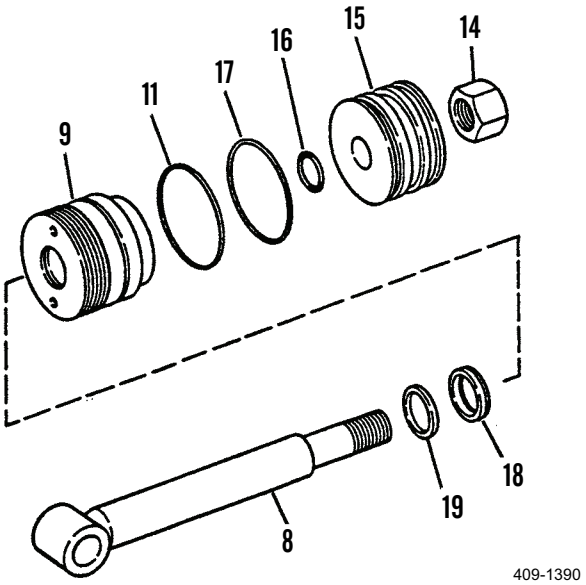
Wipe all sealing surfaces on cylinder clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.

1. Install new seal (18) and rod wiper (19) inside gland (9). Ensure that seal (18) lip is positioned the same way as it was before disassembly.
2. Install new back-up ring (17) and new O-ring (11) on outside diameter of gland (9).
3. Slide gland (9) onto rod (8).
4. Lubricate piston (15) inner diameter with clean lubricating oil. Install new O-ring (16) inside bore of piston (15).

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. Use cleaning solvent and clean rag to clean threads on rod (8) and new nut (14).
6. Slide piston (15) onto rod (8).
7. Apply loctite on threads of rod (8) and new nut (14). Install nut new (14) on rod (8).



409-1390

ASSEMBLY - CONTINUED

NOTE

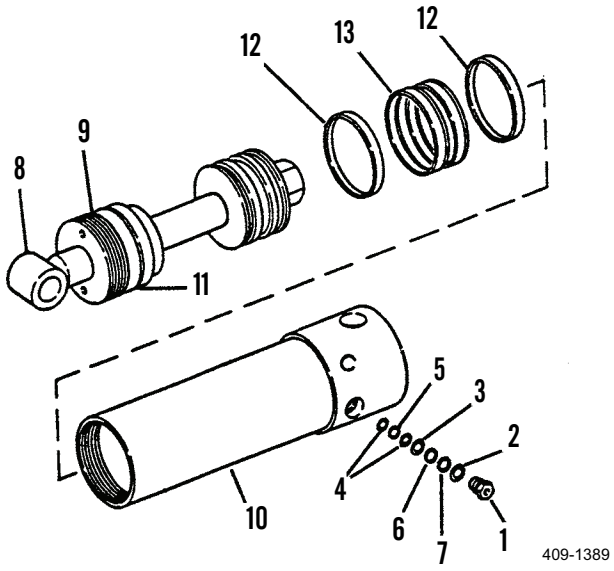
Place rod and piston assembly on suitable supports to prevent damage during assembly.

8. Install two new wear rings (12) and one new seal (13). Position new wear rings so that gaps are 180 degrees apart.

CAUTION

Use care when installing rod and piston assembly. Keep rod in line with cylinder tube to prevent binding. Failure to follow this precaution will cause part damage.

9. Lubricate cylinder tube (10) inner diameter, piston (15) outside diameter and gland (9) outside diameter with clean lubricating oil.
10. Position rod (8) and piston assembly in cylinder tube (10).



NOTE

Tighten gland so that it is flush with end of cylinder tube. Do not overtighten gland.

11. Tighten gland (9) onto cylinder tube (10).
12. Install new back-up rings (2 and 3), two new back-up rings (4) and three new O-rings (5 thru 7) on each counterbalance valve (1).
13. Install two counterbalance valves (1) in cylinder tube (10) as noted during *Disassembly*.
14. Install frame tilt cylinder (WP 0183 00).
15. Operate equipment, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

CARRIAGE TILT CYLINDER REPAIR 0307 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Spanner wrench, frame tilt cylinder (Item 29, WP 0324 00)

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 48, WP 0323 00)

Materials/Parts - Continued

Back-up ring (13)

Container

O-ring (5 and 11)

Seal (7 and 14)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Carriage tilt cylinder removed (WP 0184 00)

DISASSEMBLY

WARNING

Hydraulic oil, under pressure, can remain within cylinder after disconnecting hydraulic hoses. To avoid severe personal injury, slowly loosen counterbalance valve and allow pressure to escape before removing cylinder entirely.

CAUTION

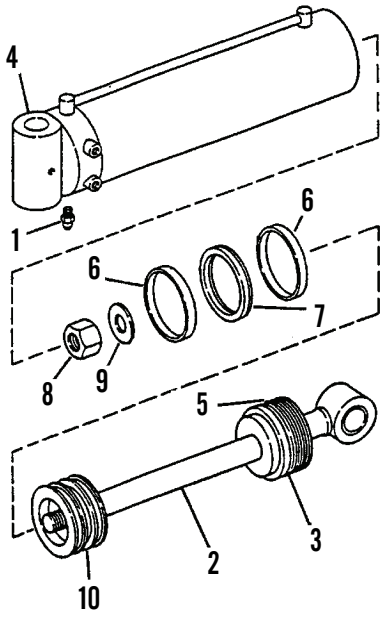
Do not scratch or damage the wear surface of rod, piston or gland. Follow this precaution to prevent failure of cylinder.

NOTE

- Use a vise with soft jaws to secure cylinder in a horizontal position for disassembly.
- Relieve pressure in cylinder by slowly loosening counterbalance valve. Drain residual oil through valve hole into a container.

DISASSEMBLY - CONTINUED

1. Use a suitable tool to pull rod (2) out approximately 5 in. (12.7 cm) for removal of gland (3).
2. Place a container under gland (3) to catch oil contained in cylinder.
3. Use a spanner wrench to unscrew gland (3) from cylinder tube (4). Pull gland (3) out of cylinder far enough to unseat O-ring (5). Allow oil to drain into container.



409-1391

CAUTION

Use care when removing rod and piston assembly to prevent wear ring damage. Keep rod in line with cylinder tube to prevent binding.

4. Remove rod (2) and piston assembly from cylinder tube (4).
5. Place rod (2) and piston assembly on suitable supports to prevent damage.
6. Remove two wear rings (6).

CAUTION

Do not nick or scratch seal groove during removal of seal. Failure to follow this precaution will cause part damage.

7. Cut seal (7) and discard.

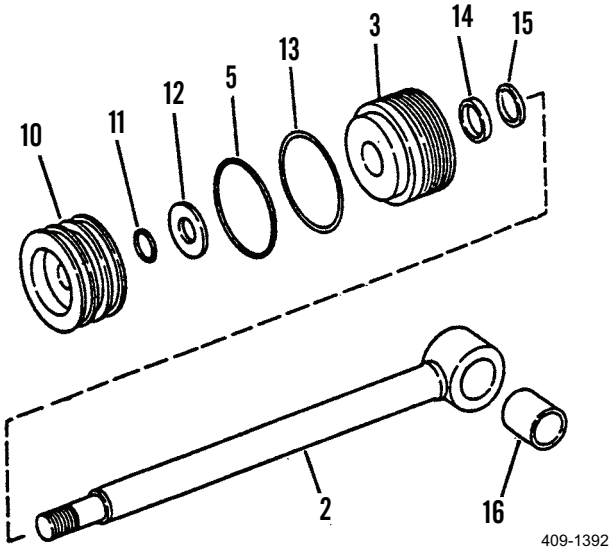
NOTE

The nut may need to be heated with a torch for removal.

8. Remove nut (8) and washer (9).

DISASSEMBLY - CONTINUED

9. Remove piston (10) and O-ring (11). Discard O-ring.
10. Remove washer (12) and slide gland (3) off rod (2).
11. Remove O-ring (5) and back-up ring (13) from gland (3). Discard O-ring and back-up ring.



CAUTION

Do not nick or scratch seal groove during removal of seal and rod wiper. Failure to follow this precaution will cause part damage.

NOTE

Note direction that lip of seal is facing before removal.

12. Remove seal (14) and rod wiper (15) from inside of gland (3). Discard seal.
13. Remove bushing (16).

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Wipe all sealing surfaces on cylinder clean and dry. Apply film of clean hydraulic oil to all seals as they are installed.

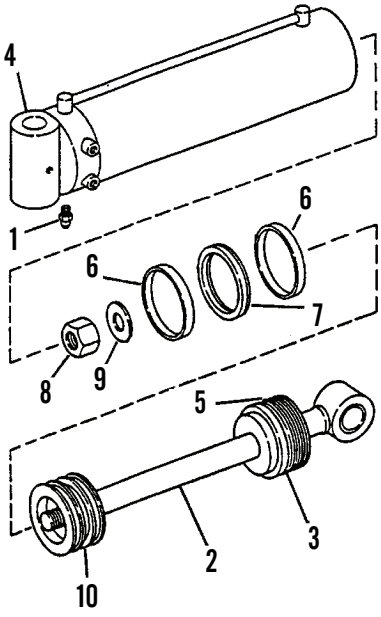
1. Install bushing (16).
2. Install new seal (14) and rod wiper (15) inside gland (3). Ensure that seal (14) lip is positioned the same way as it was before disassembly.
3. Install new back-up ring (13) and new O-ring (5) on outside diameter of gland (3).
4. Slide gland (3) and washer (12) onto rod (2).
5. Lubricate piston (10) inner diameter with clean lubricating oil. Install new O-ring (11) inside bore of piston (10).

ASSEMBLY - CONTINUED

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.

6. Use cleaning solvent and clean rag to clean threads on rod (2) and nut (8).
7. Slide piston (10) onto rod (2).
8. Apply loctite on threads of rod (2) and nut (8). Install nut (8) and washer (9) on rod (2).
9. Place rod (2) and piston assembly on suitable supports to prevent damage during assembly.
10. Install two wear rings (6) and one new seal (7) on piston (10). Position wear rings so that gaps are 180 degrees apart.



409-1391

CAUTION

Use care when installing rod and piston assembly. Keep rod in line with cylinder tube to prevent binding. Failure to follow this precaution will cause part damage.

11. Lubricate cylinder tube (4) inner diameter, piston (10) outside diameter and gland (3) outside diameter with clean hydraulic oil.
12. Position rod (2) and piston assembly in cylinder tube (4).

NOTE

Tighten gland so that it is flush with end of cylinder tube. Do not overtighten gland.

13. Tighten gland (3) onto cylinder tube (4).
14. Install counterbalance valve (1) in cylinder tube (4) as noted during disassembly.
15. Install carriage tilt cylinder (WP 0184 00).
16. Operate equipment, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

MLRS ATTACHMENT CYLINDER REPAIR 0308 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Spanner wrench, frame tilt cylinder (Item 29, WP 0324 00)

Spanner wrench, boom lift cylinder and boom extend cylinder (Item 24, WP 0324 00)

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 48, WP 0323 00)

Materials/Parts - Continued

Back-up ring (2, 3, 4 and 19)

Bushing (24)

O-ring (5, 6, 7, 11 and 17)

Seal (13 and 21)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

MLRS attachment cylinder removed (WP 0185 00)

DISASSEMBLY

WARNING

Hydraulic oil, under pressure, can remain within cylinder after disconnecting hydraulic hoses. To avoid severe personal injury, slowly loosen counterbalance valve and allow pressure to escape before removing valve entirely.

NOTE

Use a vise with soft jaws to secure cylinder in a horizontal position for disassembly.

1. Relieve pressure in cylinder by slowly removing counterbalance valve (1). Drain residual oil through valve holes into a suitable container.
2. Remove back-up rings (2 and 3), two back-up rings (4) and three O-rings (5 thru 7) from each counterbalance valve (1). Discard back-up rings and O-rings.

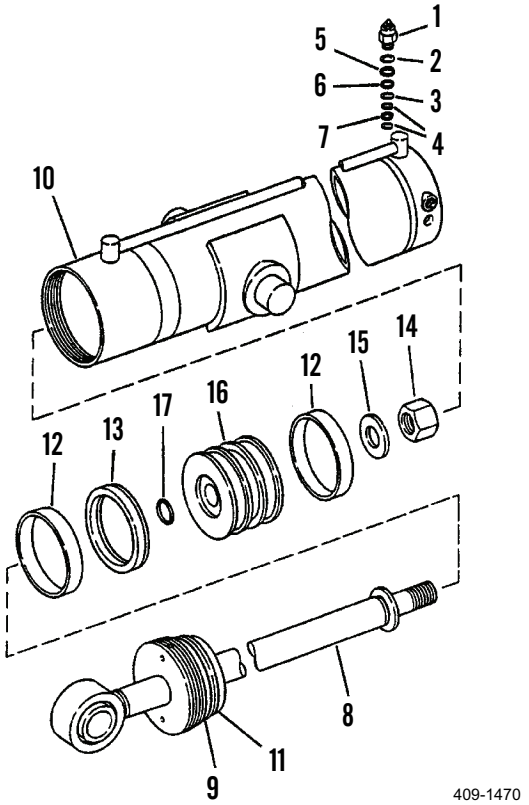
CAUTION

Do not scratch or damage the wear surface of rod, piston or gland. Follow this precaution to prevent failure of the cylinder.

3. Pull rod (8) out approximately 5 in. (12.7 cm) for removal of gland (9).
4. Place a container under gland (9) to catch oil contained in cylinder.
5. Use spanner wrench to unscrew gland (9) from cylinder tube (10). Pull gland (9) out of cylinder far enough to unseat O-ring (11). Allow oil to drain into container.

CAUTION

Use care when removing rod and piston assembly to prevent wear ring damage. Keep rod in line with cylinder tube to prevent binding.



6. Remove rod (8) and piston assembly from cylinder tube (10).
7. Place rod (8) and piston assembly on supports to prevent damage.
8. Remove two wear rings (12).

DISASSEMBLY - CONTINUED

CAUTION

Do not nick or scratch seal groove during removal of seal. Failure to follow this precaution will cause part damage.

9. Cut seal (13) and discard.

NOTE

Nut may need to be heated with a torch for removal.

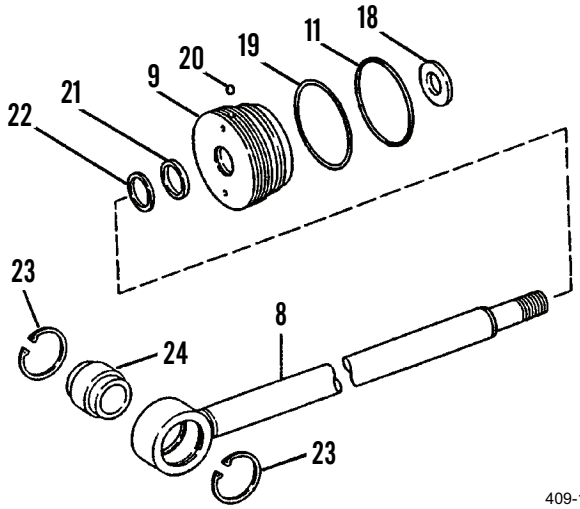
10. Remove nut (14), washer (15) and piston (16).
11. Remove and discard O-ring (17) from piston (16) bore.
12. Remove washer (18) and gland (9) off rod (8).
13. Remove O-ring (11) and back-up ring (19) from gland (9). Discard O-ring and back-up ring.
14. Remove lock pellet (20) if necessary.

CAUTION

Do not nick or scratch seal groove during removal of seal and rod wiper. Failure to follow this precaution will cause part damage.

NOTE

Note direction that lip seal is facing before removal.



409-1471

15. Remove seal (21) and rod wiper (22) from inside of gland (9). Discard seal.
16. Use snap ring pliers to remove one snap ring (23) from bushing (24).
17. Press out bushing (24) from rod (8). Remove other snap ring (23) from bushing (24). Discard bushing.

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

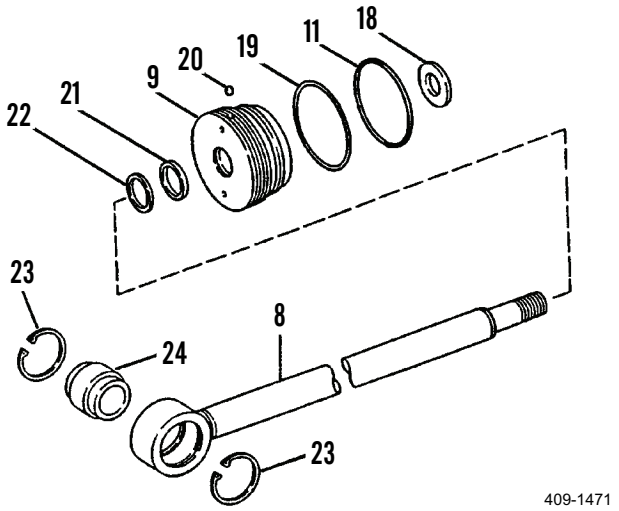
See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Wipe all sealing surfaces on cylinder clean and dry. Apply film of clean lubricating oil to all seals as they are installed.

1. Press new bushing (24) in rod (8).
2. Install two snap rings (23) on new bushing (24).
3. Install new seal (21) and rod wiper (22) inside gland (9).
4. If removal was necessary, install lock pellet (20).
5. Install new back-up ring (19) and new O-ring (11) on outside diameter of gland (9).
6. Slide gland (9) and washer (18) onto rod (8).



7. Lubricate piston (16) inner diameter with clean lubricating oil. Install new O-ring (17) inside bore of piston (16).

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.

8. Use cleaning solvent to clean threads on rod (8) and nut (14).
9. Slide piston (16) and washer (15) onto rod (8).
10. Apply loctite on threads of rod (8) and nut (14). Install nut (14) on rod (8).
11. Place rod (8) and piston (16) assembly on supports to prevent damage during assembly.
12. Install two new wear rings (12) and one new seal (13) on piston (16). Position new wear rings so that gaps are 180 degrees apart.

ASSEMBLY - CONTINUED

CAUTION

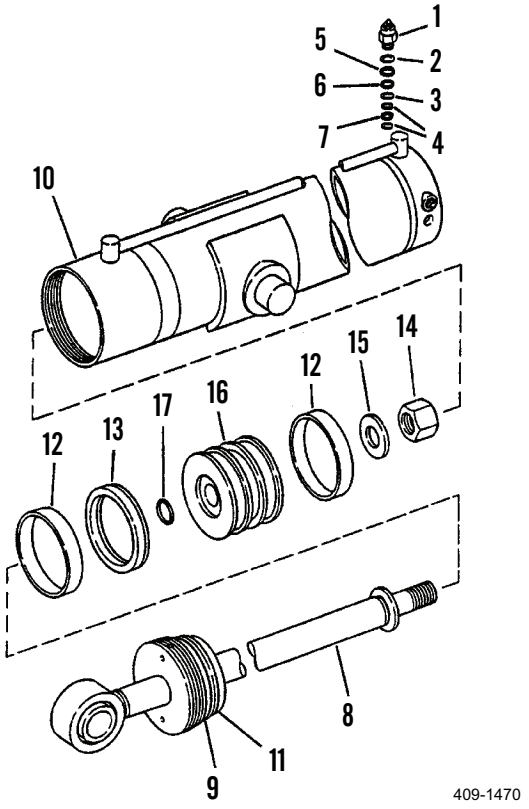
Use care when installing rod and piston assembly. Keep rod in line with cylinder tube to prevent binding.

13. Lubricate cylinder tube (10) inner diameter, piston (16) outside diameter and gland (9) outside diameter with clean hydraulic oil.
14. Position rod (8) and piston (16) assembly in cylinder tube (10).

NOTE

Tighten gland so that it is flush with end of cylinder tube. Do not overtighten gland.

15. Tighten gland (9) onto cylinder tube (10).
16. Install new back-up rings (2 and 3), two new back-up rings (4) and three new O-rings (5 thru 7) on counterbalance valve (1).
17. Install counterbalance valve (1).
18. Install MLRS attachment cylinder (WP 0185 00).
19. Operate equipment, check for proper operation and leaks (TM 10-3930-660-10).



END OF WORK PACKAGE

BOOM EXTEND CYLINDER MAINTENANCE 0309 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Spanner wrench, boom lift cylinder and boom extend cylinder (Item 24, WP 0324 00)

Lifting device, 500 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Compound, anti-seize (Item 11, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Sealant, Loctite (Item 45, WP 0323 00)

Tag, marker (Item 57, WP 0323 00)

Materials/Parts - Continued

Back-up ring (29, 30, 31, 35, 36, 37 and 53)

Nut (48)

O-ring (32, 33, 34, 38, 39, 40, 45, 50 and 52)

Seal (47 and 54)

Wear ring (46)

References

WP 0316 00

WP 0317 00

Personnel Required

Two

Equipment Condition

Vehicle parked on level ground

Boom retracted (TM 10-3930-660-10)

DISASSEMBLY

WARNING

Hydraulic oil, under pressure, can remain within cylinder after disconnecting hydraulic hoses. To avoid severe personal injury, slowly loosen counterbalance valve and allow pressure to escape before removing valve entirely.

NOTE

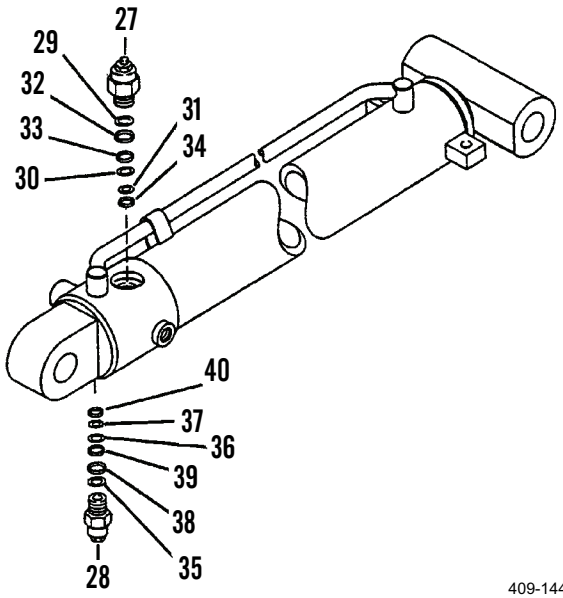
Use a vise with soft jaws to secure cylinder in a horizontal position for disassembly.

1. Remove two counterbalance valves (27 and 28).

NOTE

Note and mark location of counterbalance valves for use during assembly. The valves are not interchangeable.

2. Remove back-up rings (29 and 30), two back-up rings (31) and three O-rings (32 thru 34) from each counterbalance valve (27). Discard back-up rings and O-rings.
3. Remove three back-up rings (35 thru 37) and three O-rings (38 thru 40) from counterbalance valve (28). Discard back-up rings and O-rings.



409-1447

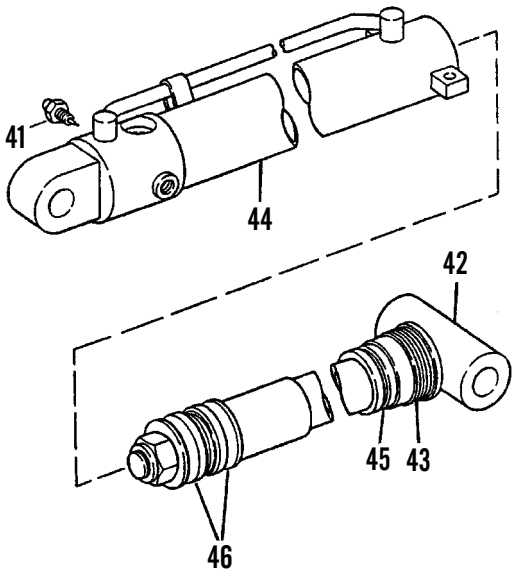
DISASSEMBLY - CONTINUED

4. Remove needle valve (41).

CAUTION

Do not scratch or damage the wear surface of rod, piston or gland.

5. Pull rod (42) out approximately 5 in. (12.7 cm) for removal of gland (43).
6. Place a container under gland (43) to catch oil contained in cylinder.
7. Use a spanner wrench to remove gland (43) from barrel (44). Pull gland (43) out of cylinder far enough to unseat O-ring (45). Allow oil to drain into container.



409-1448

CAUTION

Use care when removing rod and piston assembly to prevent wear ring damage. Keep rod in line with cylinder tube to prevent binding.

8. Remove rod (42) and piston assembly from barrel (44).
9. Place rod (42) and piston assembly on supports to prevent damage.
10. Remove and discard two wear rings (46).

DISASSEMBLY - CONTINUED

CAUTION

Do not nick or scratch seal groove on piston during removal of seal. Failure to follow this precaution will cause part damage.

11. Cut seal (47) and discard.

NOTE

The nut may need to be heated with a torch for removal.

12. Remove nut (48) and piston (49). Discard nut.
13. Remove and discard O-ring (50) from piston (49) bore.
14. Remove tube (51) and gland (43) off rod (42).
15. Remove O-rings (45 and 52) and back-up ring (53) from gland (43). Discard O-rings and back-up ring.

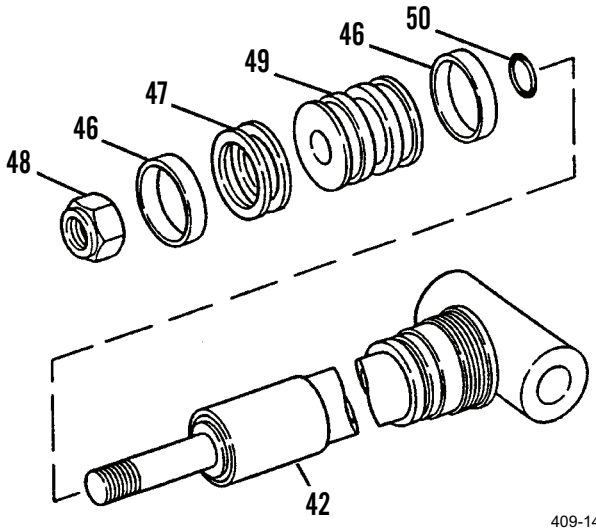
CAUTION

Do not nick or scratch seal groove inside gland during removal of seal and rod wiper. Failure to follow this precaution will cause part damage.

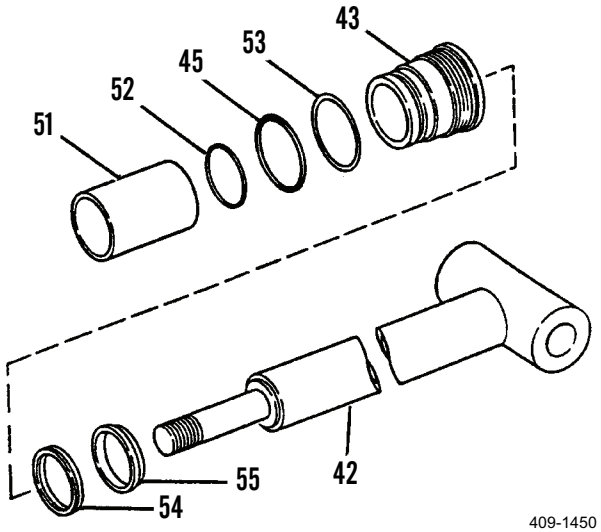
NOTE

Note direction that lip of seal is facing before removal.

16. Remove seal (54) and rod wiper (55) from inside of gland (43). Discard seal.



409-1449



409-1450

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

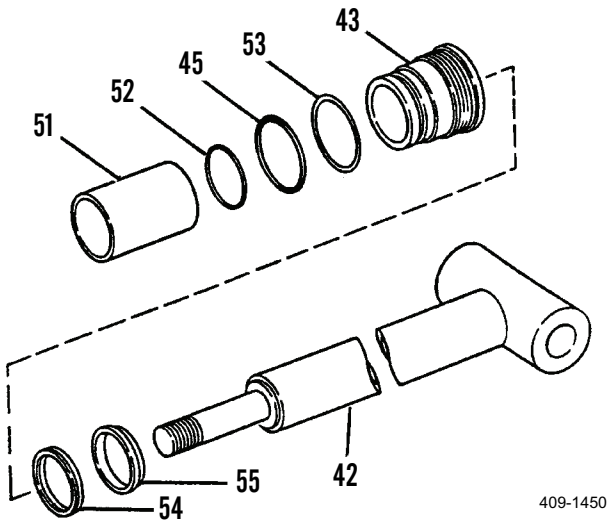
See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

- Wipe all sealing surfaces on cylinder clean and dry. Apply film of clean lubricating oil to all seals as they are installed.
- When installing rod and nut, apply loctite on threads.

1. Install new seal (54) and rod wiper (55) inside gland (43).
2. Install new back-up ring (53) and new O-rings (45 and 52) on outside diameter of gland (43).
3. Slide gland (43) and tube (51) onto rod (42).



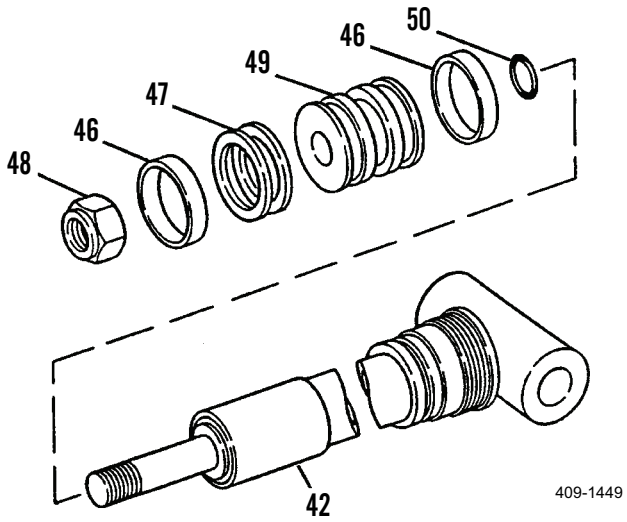
ASSEMBLY - CONTINUED

4. Lubricate piston (49) inner diameter with clean lubricating oil. Install new O-ring (50) inside bore of piston (49).

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. Using a cleaning solvent and clean rag to clean threads on rod (42) and new nut (48).
6. Slide piston (49) onto rod (42).
7. Apply loctite on threads of rod (42) and new nut (48). Install new nut (48) on rod (42).
8. Place rod (42) and piston (49) assembly on suitable supports to prevent damage during assembly.
9. Install two new wear rings (46) and one new seal (47) on piston (49). Position wear rings so that gaps are 180 degrees apart.



CAUTION

Use care when installing rod and piston assembly. Keep rod in line with barrel to prevent binding. Failure to follow this precaution will cause part damage.

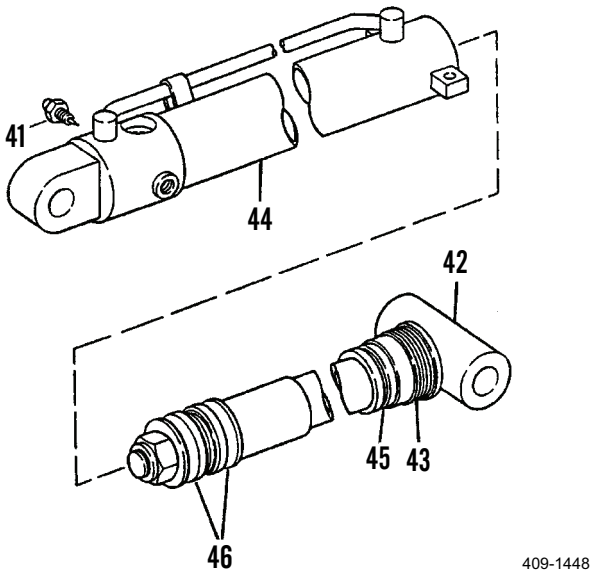
10. Lubricate barrel (44) inner diameter, piston (49) outside diameter and gland (43) outside diameter with clean hydraulic oil.
11. Position rod (42) and piston (49) assembly in barrel (44).

ASSEMBLY - CONTINUED

NOTE

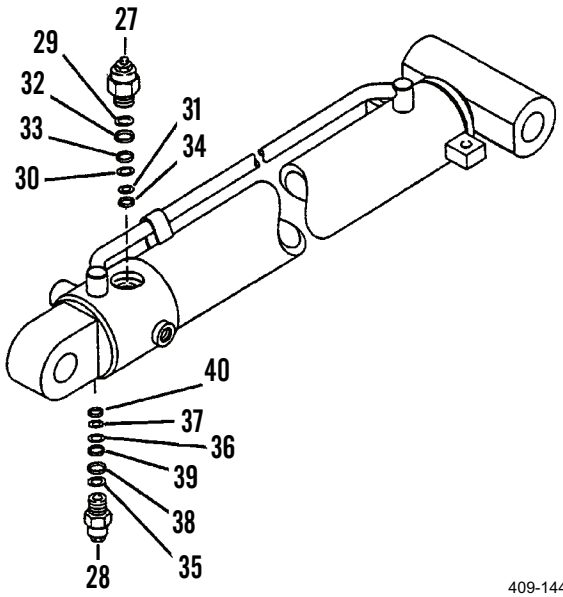
Tighten gland so that it is flush with end of barrel. Do not overtighten gland.

12. Tighten gland (43) on barrel (44).
13. Install needle valve (41).



409-1448

14. Install counterbalance valves (27 and 28).
15. Install three new O-rings (38 thru 40) and three new back-up rings (35 thru 37) on counterbalance valve (28).
16. Install new back-up rings (29 and 30), two new back-up rings (31) and three new O-rings (32 thru 34) on counterbalance valve (27).
17. Install two assembled counterbalance valves (27 and 28) in cylinder tube (44) as noted during disassembly.



409-1447

18. Operate boom, check for proper operation and leaks (TM 10-3930-660-10).

END OF WORK PACKAGE

FORK SIDESHIFT CYLINDERS MAINTENANCE 0310 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Spanner wrench, fork sideshift cylinder, outer gland (Item 27, WP 0324 00)

Materials/Parts

Oil, lubricating (Item 33, WP 0323 00)

Rag, wiping (Item 40, WP 0323 00)

Back-up ring (11 and 17)

Materials/Parts - Continued

O-ring (10 and 16)

Seal (12, 13, 15 and 19)

Wear ring (18)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Fork sideshift cylinder removed (WP 0200 00)

DISASSEMBLY

CAUTION

Do not scratch or damage the wear surface of rod, piston or inner gland. Follow this precaution to prevent failure of the cylinder.

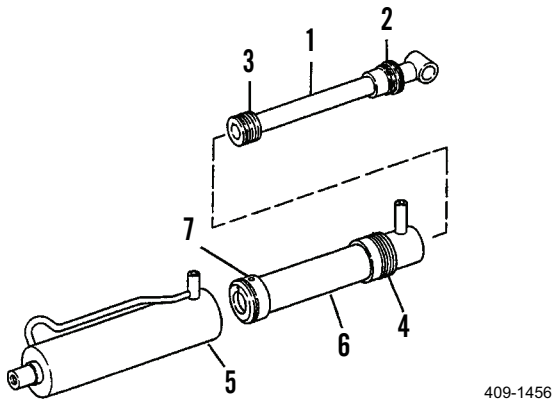
NOTE

Use a vise with soft jaws to secure cylinder in a horizontal position for disassembly.

1. Pull rod (1) out approximately 5 in. (12.7 cm) for removal of inner gland (2).
2. Place a container under inner gland (2) to catch oil contained in cylinder.

CAUTION

Use care when removing rod and piston assembly to prevent seal damage. Keep rod in line with barrel to prevent binding.

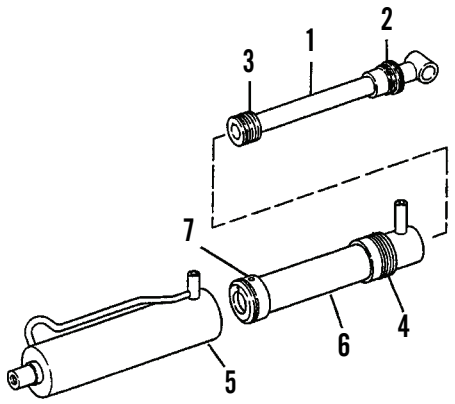


409-1456

3. Use a spanner wrench to unscrew inner gland (2) from rod (1). Remove rod (1), inner gland (2) and inner piston (3) as an assembly. Clamp assembly in a holding device.

DISASSEMBLY - CONTINUED

4. Use a spanner wrench to remove outer gland (4) from barrel (5). Remove outer gland (4), cylinder tube (6) and outer piston (7) as an assembly.
5. Remove setscrew (8) from inner piston (3) face.
6. Remove three piston rings (9).
7. Heat inner piston (3) with acetylene torch to approximately 300°F to 400°F (149°C to 204°C). Use a strap wrench to remove inner piston (3) from rod (1).
8. Remove inner gland (2).



409-1456

CAUTION

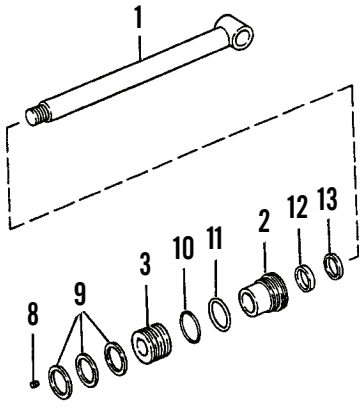
Do not nick or scratch seal groove of gland during removal of seal. Failure to follow this precaution will cause part damage.

9. Remove O-ring (10) and back-up ring (11) from outer diameter of inner gland (2). Discard O-ring and back-up ring.

NOTE

Note direction that lip of seal is facing before removal.

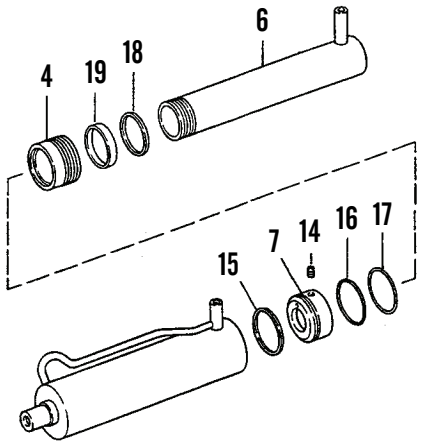
10. Remove and discard seals (12 and 13) from inner diameter of inner gland (2).



409-1457

DISASSEMBLY - CONTINUED

11. Remove setscrew (14) from outer diameter of outer piston (7).
12. Cut and discard seal (15) to remove it from outer piston (7).
13. Heat outer piston (7) with acetylene torch to approximately 300°F to 400°F (149°C to 204°C). Use a spanner wrench to remove outer piston (7) from cylinder tube (6).
14. Remove outer gland (4) from cylinder tube (6).
15. Remove O-ring (16) and back-up ring (17) from outer diameter of outer gland (4). Discard O-ring and back-up ring.



409-1458

NOTE

Note direction that seal is facing before removal.

16. Remove wear ring (18) and seal (19) from inner diameter of outer gland (4). Discard seal.

CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

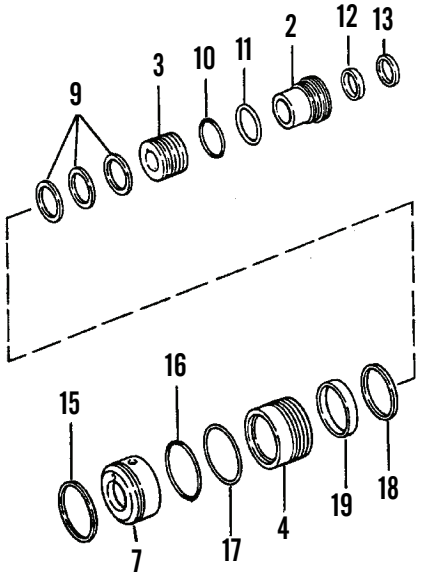
See *Inspection* instructions (WP 0317 00).

ASSEMBLY

NOTE

Wipe all sealing surfaces on cylinder clean and dry. Apply film of clean lubricating oil to all seals as they are installed.

1. Install new seals (12 and 13) in inner diameter of inner gland (2). Ensure that new seals are positioned in same direction as was noted before removal.
2. Install new back-up ring (11) and new O-ring (10) on outer diameter of inner gland (2).
3. Install new seal (19) and wear ring (18) in inner diameter of outer gland (4). Ensure that new seal is positioned in same direction as noted before removal.
4. Install new back-up ring (17) and new O-ring (16) on outer diameter of outer gland (4).
5. Install three piston rings (9) on inner piston (3). Stagger piston gaps to provide 90-degree relationship between all gaps.



409-1459

ASSEMBLY - CONTINUED

NOTE

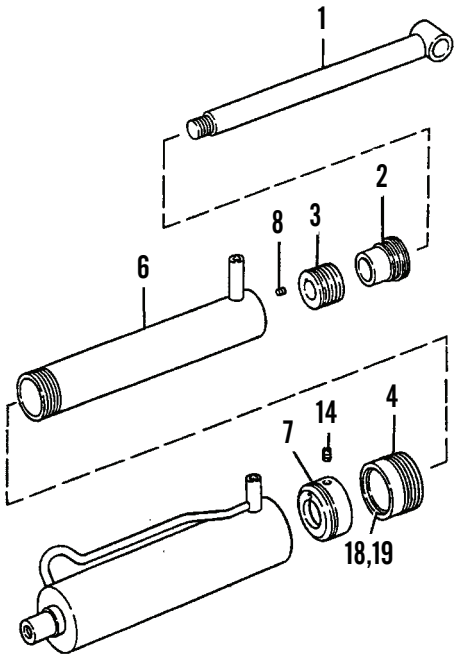
Excessive piston ring bypass may occur if gaps are aligned.

6. Install new seal (15) on outer piston (7).
7. Lubricate inner diameter of inner gland (2) and new seals (12 and 13) with clean lubricating oil. Slide inner gland (2) onto rod (1).

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.

8. Use cleaning solvent to clean threads of rod (1) and apply loctite. Install inner piston (3) onto rod (1). Use a strap wrench to tighten piston (3) and install setscrew (8). Tighten setscrew and stake.
9. Lubricate inner diameter of outer gland (4), new seal (19) and wear ring (18) as an assembly, with clean lubricating oil. Slide outer gland (4) onto cylinder tube (6).
10. Use solvent to clean threads of cylinder tube (6) and apply loctite. Install outer piston (7) onto cylinder tube (6) and tighten. Install setscrew (14) into outer piston (7) and tighten. Stake setscrew.



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ASSEMBLY - CONTINUED

WARNING

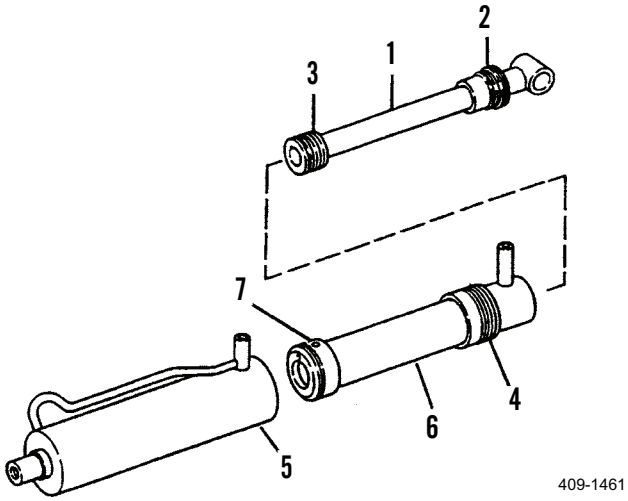
Solvent cleaning compound, MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

11. Use cleaning solvent to clean threads of inner gland (2) and outer gland (4). Apply loctite.
12. Clean threads inside barrel (5). Slide outer piston (7) with cylinder (6) as an assembly, into barrel (5).
13. Install outer gland (4) into barrel (5). Tighten outer gland (4) until it is flush with end of barrel. Do not overtighten outer gland (4).

CAUTION

Use care when installing rod and piston assembly. Keep rod in line with barrel to prevent binding.

14. Slide inner piston (3) on rod (1) into barrel (5). Use a spanner wrench to tighten inner gland (2) until it is flush with end of barrel (5).



409-1461

15. Install fork sideshift cylinder (WP 0200 00).
16. Operate forks, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

BOOM HOIST CYLINDERS MAINTENANCE 0311 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning, Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)

Shop equipment, automotive maintenance (Item 21, WP 0324 00)

Spanner wrench, boom lift cylinder and boom extend cylinder (Item 24, WP 0324 00)

Materials/Parts

Cleaning compound, solvent (Item 10, WP 0323 00)

Oil, lubricating (Item 33, WP 0323 00)

Sealant, Loctite (Item 45, WP 0323 00)

Back-up ring (2, 3, 4 and 19)

Materials/Parts - Continued

Bushing (24)

O-ring (5, 6, 7, 11, 16 and 18)

Seal (13 and 20)

References

WP 0316 00

WP 0317 00

TM 10-3930-660-10

Equipment Condition

Boom hoist cylinder removed (WP 0201 00)

DISASSEMBLY

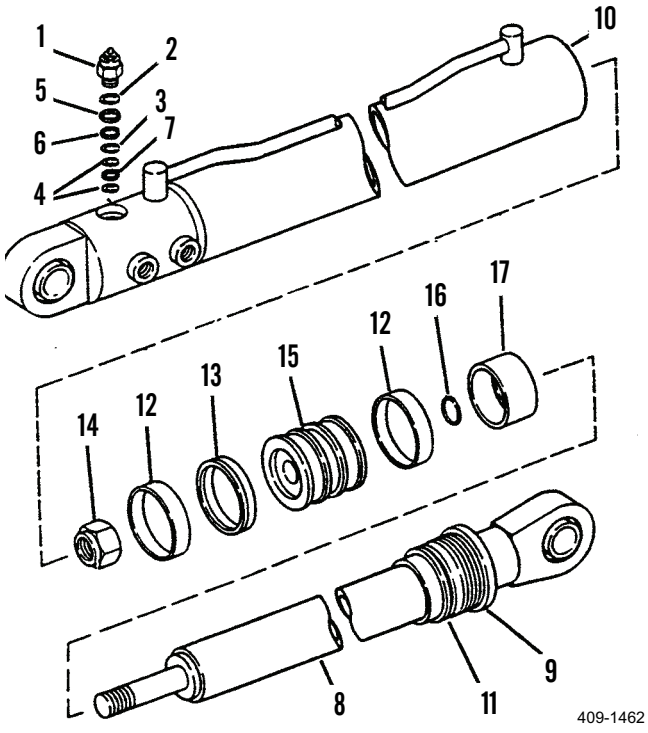
WARNING

Hydraulic oil, under pressure, can remain within cylinder after disconnecting hydraulic hoses. To avoid severe personal injury, slowly loosen counterbalance valve and allow pressure to escape before removing valve entirely.

NOTE

Use a vise with soft jaws to secure cylinder in a horizontal position for disassembly.

1. Relieve pressure in cylinder by slowly removing counterbalance valve (1). Drain residual oil through valve holes into a suitable container.
2. Remove back-up rings (2 and 3), two back-up rings (4) and three O-rings (5 thru 7) from each counterbalance valve (1). Discard back-up rings and O-rings.



CAUTION

Do not scratch or damage the wear surface of rod, piston or gland. Follow this precaution to prevent failure of the cylinder.

3. Pull rod (8) out approximately 5 in. (12.7 cm) for removal of gland (9).
4. Place a container under gland (9) to catch oil contained in cylinder.
5. Use a spanner wrench to unscrew gland (9) from cylinder tube (10). Pull gland (9) out of cylinder far enough to unseat O-ring (11). Allow oil to drain into container.

CAUTION

Use care when removing rod and piston assembly to prevent wear ring damage. Keep rod in line with cylinder tube to prevent binding.

6. Remove rod (8) and piston assembly from cylinder tube (10).

NOTE

Place rod and piston assembly on suitable supports to prevent damage.

7. Remove two wear rings (12).

DISASSEMBLY - CONTINUED

CAUTION

Do not nick or scratch seal groove during removal of seal. Failure to follow this precaution will cause part damage.

8. Cut seal (13) and discard.

NOTE

The nut may need to be heated with a torch for removal.

9. Remove nut (14) and piston (15).
10. Remove and discard O-ring (16) from piston (15) bore.
11. Remove tube (17).
12. Slide gland (9) off rod (8).
13. Remove O-rings (11 and 18) and back-up ring (19) from gland (9). Discard O-rings and back-up ring.

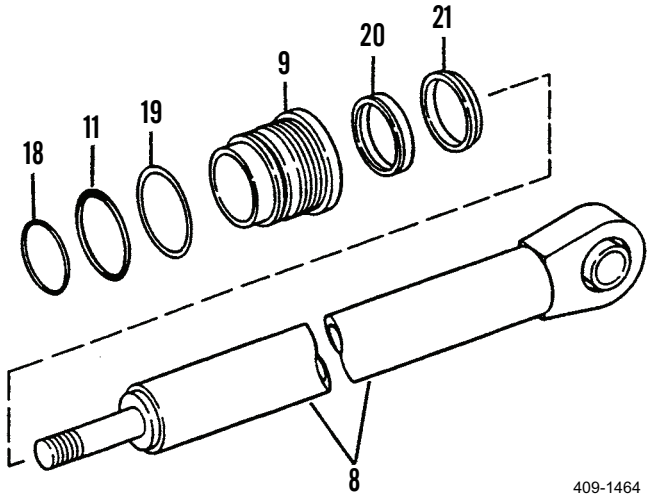
CAUTION

Do not nick or scratch seal groove during removal of seal and rod wiper. Failure to follow this precaution will cause part damage.

NOTE

Note direction that lip of seal is facing before removal.

14. Remove seal (20) and rod wiper (21) from inside of gland (9). Discard seal.
15. Remove needle valve (22).
16. Use snap ring pliers to remove one snap ring (23) from cylinder tube (10) and rod (8).
17. Press out one bushing (24) from cylinder tube (10) and rod (8). Remove one snap ring (23) from each bushing (24). Discard bushing.



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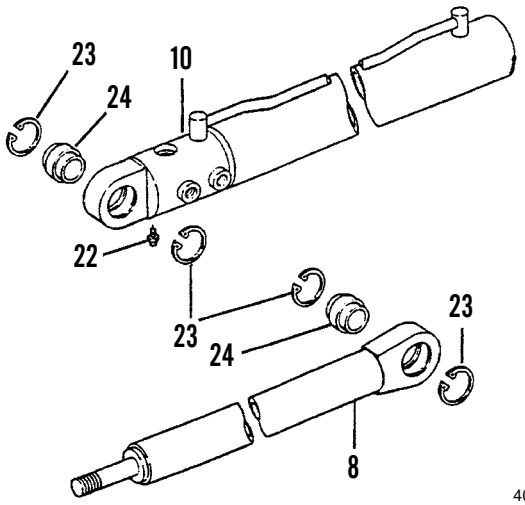

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CLEANING

See *Cleaning* instructions (WP 0316 00).

INSPECTION

See *Inspection* instructions (WP 0317 00).

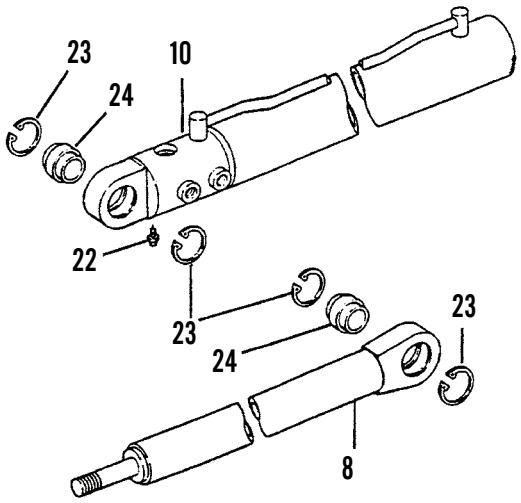
ASSEMBLY

1. Install needle valve (22).
2. Press one new bushing (24) in cylinder tube (10) and rod (8).
3. Install two snap ring (23) on each new bushing (24).

NOTE

Wipe all sealing surfaces on cylinder clean and dry. Apply film of clean lubricating oil to all seals as they are installed.

4. Install new seal (20) and rod wiper (21) inside gland (9). Ensure that new seal (20) lip is positioned the same way as it was before disassembly.
5. Install new back-up ring (19) and new O-rings (11 and 18) on outside diameter of gland (9).
6. Slide gland (9) onto rod (8).
7. Lubricate piston (15) inner diameter with clean lubricating oil. Install new O-ring (16) inside bore of piston (15).
8. Install tube (17).



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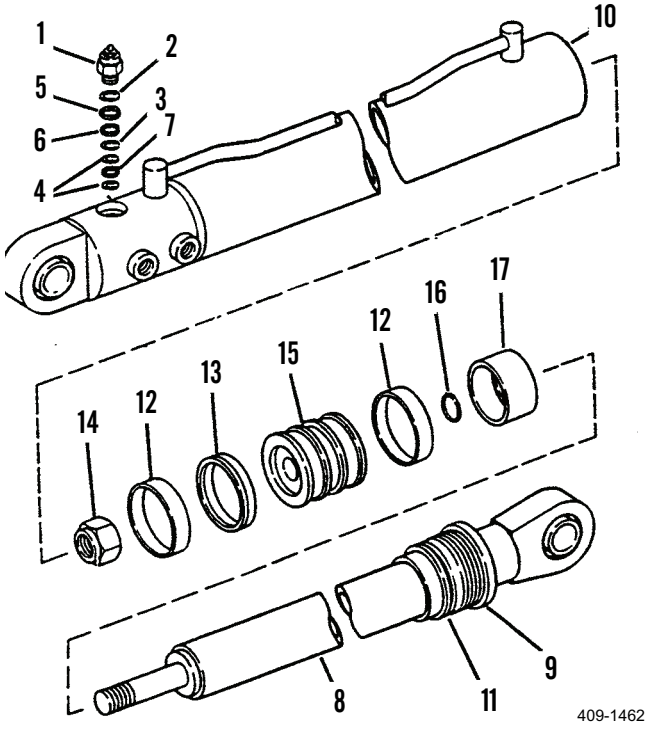
ASSEMBLY - CONTINUED

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.

9. Use cleaning solvent and clean rag to clean threads on rod (8) and nut (14).
10. Slide piston (15) onto rod (8).
11. Apply loctite on threads of rod (8) and nut (14). Install nut (14) on rod (8).
12. Place rod (8) and piston (15) assembly on suitable supports to prevent damage during assembly.
13. Install two wear rings (12) and one new seal (13) on piston (15). Position wear rings so that gaps are 180 degrees apart.



CAUTION

Use care when installing rod and piston assembly. Keep rod in line with cylinder tube to prevent binding. Failure to follow this precaution will cause part damage.

14. Lubricate cylinder tube (10) inner diameter, piston (15) outside diameter and gland (9) outside diameter with clean lubricating oil.
15. Position rod (8) and piston (15) assembly in cylinder tube (10).

NOTE

Tighten gland so that it is flush with end of cylinder tube. Do not overtighten gland.

16. Tighten gland (9) onto cylinder tube (10).
17. Install new back-up rings (2 and 3), two new back-up rings (4) and three new O-rings (5 thru 7) on counterbalance valve (1).
18. Install counterbalance valve (1).
19. Install boom hoist cylinder (WP 0201 00).
20. Operate boom hoist, check for leaks and proper operation (TM 10-3930-660-10).

END OF WORK PACKAGE

CHAPTER 6
GENERAL MAINTENANCE INSTRUCTIONS

GENERAL MAINTENANCE INSTRUCTIONS 0312 00

SCOPE

These general maintenance instructions contain general shop practices and specific methods you must be familiar with to properly maintain the Track, Forklift; 6,000 lb Variable Reach Rough Terrain. You should read and understand these practices and methods before starting maintenance tasks on the forklift.

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. Forklift must be parked on level ground with wheels chocked.
   b. Engine must be OFF (TM 10-3930-660-10).
   c. Components which are hot at operating temperatures (i.e., cooling, exhaust and hydraulic systems) must cool down before they are removed.
   d. Components must, however, be at operating temperature to be tested.
   e. Battery disconnect switch must be in OFF position or batteries disconnected when performing electrical system maintenance.
   f. Hydraulic system pressure must be relieved before disconnecting any hydraulic system line or fitting.

GENERAL INFORMATION

1. Before beginning a task, find out how much repair, modification or replacement is needed to fix the forklift as described in this manual. Sometimes the reason for forklift failure can be seen right away and complete teardown is not necessary. Disassemble the forklift only as far as necessary to repair or replace damaged or broken parts.
2. All tags and forms attached to the forklift 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.
3. 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, O-rings, preformed packings, cotter pins, spring pins, locknuts, and lockwashers.

CLEANING INSTRUCTIONS

- 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 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 to personnel.
- 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. **General.**
   a. Cleaning instructions will be the same for the majority of parts and components that make up the forklifts.
   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) 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.
2. **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 30, WP 0323 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.

CLEANING INSTRUCTIONS - CONTINUED

4. **Castings.**
   a. Clean inner and outer surfaces of castings and all areas subject to grease and oil with solvent cleaning compound (Item 10, WP 0323 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 10, WP 0323 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 damage or destroy the material.

   a. Wash electrical cables and flexible hoses with a mild solution of detergent (Item 17, WP 0323 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. **Machined Surfaces.**
   a. Clean machined surfaces with solvent cleaning compound (Item 10, WP 0323 00).
   b. Dry surfaces with compressed air.
8. **Mated Surfaces.**
   a. Remove old gasket and/or sealing compound using a wire brush and solvent cleaning compound (Item 9, WP 0321 00).
   b. Lightly coat with lubricating oil (Item 30, WP 0323 00) and wrap all parts subject to rust before storing.
9. **Rusted Surfaces.** Clean all rusted surfaces using wire brush and crocus cloth.
10. **Oil-Bathed Internal Parts.** Wipe oil-bathed internal parts clean with a lint-free cloth.
11. **Air-Actuated Internal Parts.** Wash air-actuated internal parts clean with a lint-free cloth.
12. **Externally Exposed Parts.** Wash externally exposed parts with detergent (Item 17, WP 0323 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.

INSPECTION INSTRUCTIONS - CONTINUED

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. **Studs, Bolts and Screws.** Replace if threads are damaged, bent, loose or stretched.
6. **Gears.**

NOTE

When gear teeth wear limits are not established, good judgment 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.
7. **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.
8. **Oil Seals.** Oil seals are mandatory replacement items.
9. **Core Hole Expansion Plugs.** Inspect for leakage. Replace plugs when leakage is present.
10. **Machine Tooled Parts.** Inspect for cracks, breaks, elongated holes, wear and chips. Replace any damaged parts.
11. **Machined Surfaces.** Inspect for cracks, evidence of wear, galled or pitted surface, burrs, nicks and scratches.
12. **Mated Surfaces.** Inspect for remains of old gasket, seal, secure fit, pitting and evidence of leakage.
13. **Rusted Surfaces.** Inspect for pitting, holes and severe damage.
14. **Oil-Bathed Internal Parts.** Inspect for cracks, nicks, burrs, evidence of overheating and wear.
15. **Air-Actuated Internal Parts.** Inspect for cracks, nicks, burrs, evidence of overheating and wear.
16. **Externally Exposed Parts.** Inspect for breaks, cracks, rust damage and wear.
17. **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 forklift.

   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.

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 TM 9-233 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 (Item 16, WP 0323 00) dipped in solvent cleaning compound (Item 10, WP 0323 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.

LUBRICATION INSTRUCTIONS

NOTE

Refer to WP 0010 00 and WP 0011 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 prior to 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.
   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.

TAGGING WIRES AND HOSES

1. Use marker tags (Item 57, WP 0323 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 or tape lines and ports after disconnecting lines. When these are not available, use plastic bags and rubber bands, clean rags (Item 40, WP 0323 00), duct tape or other similar materials to prevent dirt from entering system.
c. Ensure that new and used parts are clean before installing.
d. Replace all clamps and tiedown straps.
e. Wait to remove cover, cap, plug or tape from lines and ports until just before installing lines.

FLUID DISPOSAL

NOTE

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

ELECTRICAL GENERAL MAINTENANCE INSTRUCTIONS 0313 00

THIS WORK PACKAGE COVERS

Connector Repair
Sealed Connector Repair
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

Maintenance Level

Unit

Tools and Special Tools

Tool kit, general mechanic's (Item 39, WP 0324 00)
Shop equipment, common no. 1 (Item 20, WP 0324 00)
Heat gun, electric (Item 12, WP 0324 00)

Materials/Parts

Cloth, crocus (Item 16, WP 0323 00)
Detergent (Item 17, WP 0323 00)
Tag, marker (Item 57, WP 0323 00)

NOTE

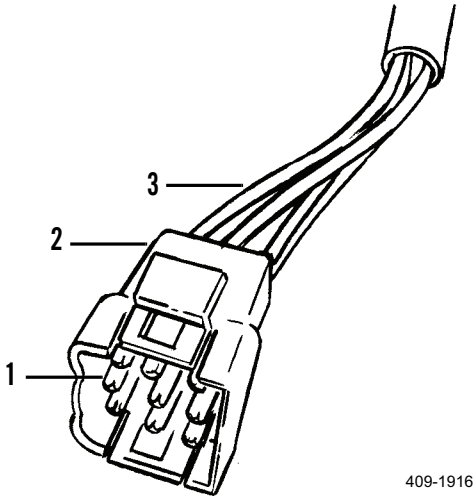
Use electrical insulating varnish on all electrical connections that are mounted outside of vehicle and are exposed to harsh weather and/or road spray.

CONNECTOR REPAIR

NOTE

- Perform the following steps for each wire of connector.
- Tag wires to aid in installation.

1. Using pin removal tool, position tool over pin (1) and push inward to retract two barbs of pin.
2. Remove wire (3) with pin (1) attached, from rear of connector (2).
3. If defective, remove pin (1) from wire (3) by cutting through wire just behind pin.



409-1916

NOTE

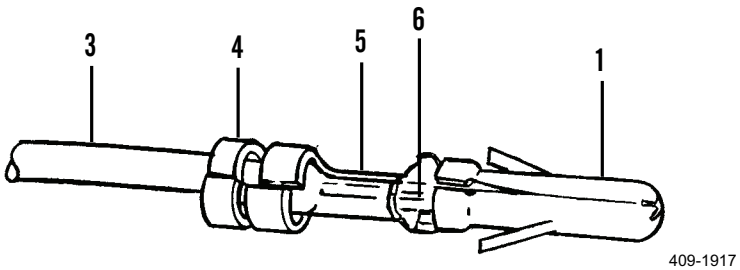
Perform steps 4 thru 6 only if pin was removed.

4. Using wire stripping tool, strip insulation of wire (3) to expose proper length of metal strands (6).
5. Using crimping tool, securely crimp tabs (5) of pin (1) over metal strands (6) of wire (3).

NOTE

The other two tabs of pin may need to be crimped slightly in order to enter connector.

6. Using crimping tool, crimp tabs (4) at rear of pin (1) over insulation of wire (3).



409-1917

7. Push pin (1) into rear of connector (2) until fully seated.

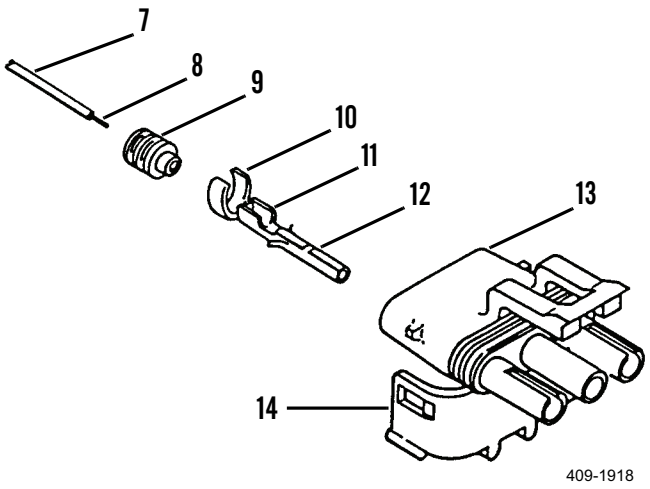
SEALED CONNECTOR REPAIR

1. Open hinged cover (14) of connector (13) for access to rear of connector.

NOTE

- Perform the following steps for each wire of connector.
- Tag wires to aid in installation.

2. Using pin removal tool, position tool over pin (12) and push inward to retract two barbs of pin.
3. Remove wire (7), with pin (12) and seal (9) attached, from rear of connector (13).
4. If defective, remove pin (12) and seal (9) from wire (7) by cutting through wire just behind seal.



NOTE

Perform steps 5 thru 8 only if pin and seal were removed.

5. Position new seal (9) on wire (7).
6. Using wiring stripping tool, strip insulation of wire (7) to expose 1/8 in (3 mm) length of metal strands (8).
7. Using crimping tool, securely crimp tabs (11) of pin (12) over metal strands (8) of wire (7).
8. Slide seal (9) next to pin (12) and crimp tabs (10) of pin over end of seal.
9. Push pin (12) into rear of connector (13) until fully seated.
10. Close hinged cover (14) of connector (13).

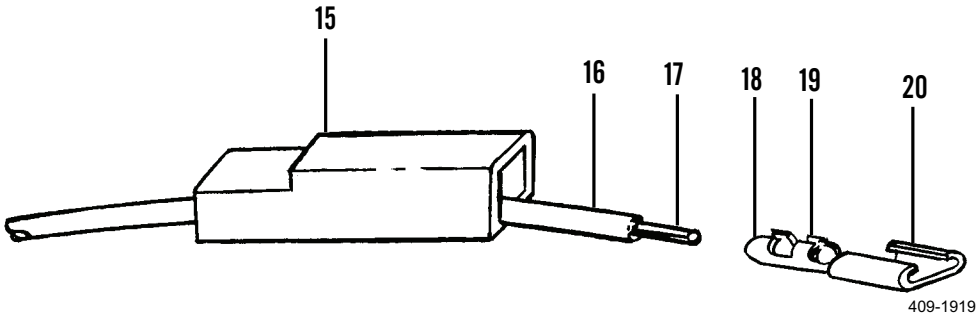
RECEPTACLE CONNECTOR REPAIR

1. Using removal tool, insert tool into front of connector (15) and depress locking tab of receptacle (20).
2. Push wire (16), with receptacle (20) attached, thru front of connector (15).
3. If defective, remove receptacle (20) from wire (16) by cutting through wire just behind receptacle.

NOTE

Perform steps 4 thru 7 only if receptacle was removed.

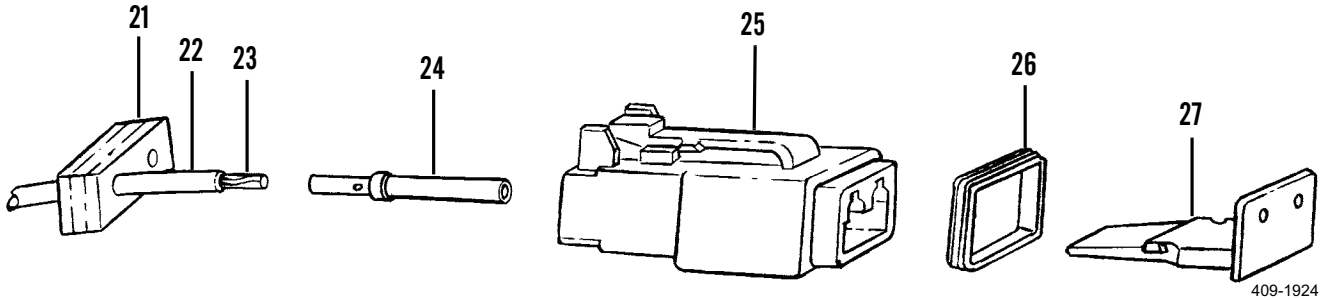
4. Slide connector (15) back on wire (16).
5. Using wire stripping tool, strip insulation of wire (16) to expose 1/4 in. (6 mm) length of metal strands (17).
6. Using crimping tool, securely crimp tabs (19) of receptacle (20) over metal strands (17).
7. Using crimping tool, crimp tabs (18) of receptacle (20) over insulation of wire (16).
8. Slide connector (15) forward over receptacle (20) until locking tab of receptacle snaps into place.



409-1919

WATERPROOF CONNECTOR REPAIR

1. Remove end cover (27) and gasket (26) from front of connector (25).
2. Remove seal (21) from rear of connector (25) and slide seal back on wire (22).



409-1924

NOTE

- Perform the following steps for each wire of connector.
- Tag wires to aid in installation.

3. Using pin removal tool, insert tool into front of connector (25) and depress locking tab of connector.
4. Remove wire (22) with pin (24) from rear of connector (25).
5. If defective, remove pin (24) from wire (22) by cutting through wire just behind pin.

WATERPROOF CONNECTOR REPAIR - CONTINUED

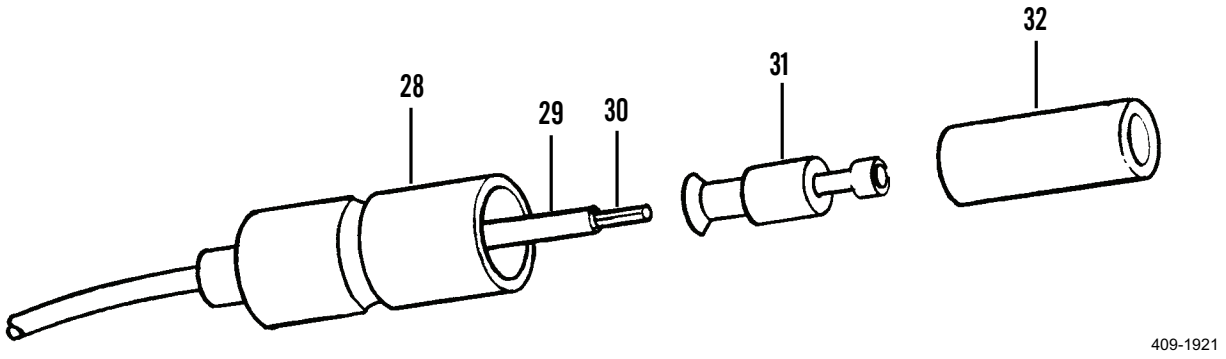
NOTE

Perform steps 6 thru 9 only if pin was removed.

6. Using wire stripping tool, strip insulation of wire (22) to expose 1/4 in. (6 mm) length of metal strands (23).
7. Insert metal strands (23) of wire (22) fully into rear of pin (24).
8. Using crimping tool, securely crimp pin (24) to metal strands (23) of wire (22).
9. Push pin (24) into rear of connector (25) until fully seated.
10. Install seal (21) on rear of connector (25).
11. Install gasket (26) and end cover (27) on front of connector (25).

MILITARY CONNECTOR REPAIR

1. Slide shell (28) back on wire (29) to expose sleeve (32).
2. Remove sleeve (32) from terminal (31) by pulling sleeve forward.
3. If defective, remove terminal (31) from wire (29) by cutting through wire just behind terminal.



409-1921

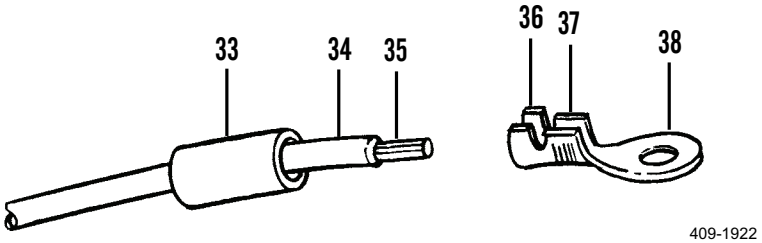
NOTE

Perform steps 4 thru 6 only if terminal was removed.

4. Using wire stripping tool, strip insulation of wire (29) to expose length of metal strands (30) equal to depth of terminal (31).
5. Using crimping tool, securely crimp terminal (31) to metal strands (30) of wire (29).
6. Install sleeve (32) to terminal (31) by pushing sleeve over front of terminal until fully seated.
7. Slide shell (28) up wire (29) and over sleeve (32).

RING TERMINAL REPAIR

1. Remove ring terminal (38) from wire (34) by cutting through wire just behind heat shrink tubing (33).
2. Cut heat shrink tubing (33) to length sufficient to cover tabs (36 and 37) of ring terminal (38) and 1/4 in. (6 mm) of wire (34).
3. Slide heat shrink tubing (33) back on wire (34).
4. Using wire stripping tool, strip insulation of wire (34) to expose proper length of metal strands (35).
5. Using crimping tool, securely crimp tabs (37) of ring terminal (38) over metal strands (35).
6. Using crimping tool, crimp tabs (36) of ring terminal (38) over insulation of wire (34).
7. Slide heat shrink tubing (33) over tabs (36 and 37) of ring terminal (38).
8. Using heat gun, apply heat to heat shrink tubing (33) until tubing snugly conforms to ring terminal (38) and insulation of wire (34).



409-1922

SPLICING WIRES

NOTE

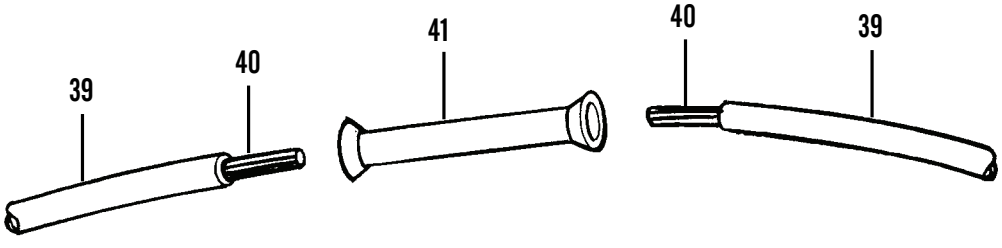
The selection of crimping tool and type of splice connectors is optional. High quality splice connectors can be expected to last the life of the vehicle.

1. Inspect each end of wire (39). Trim insulation and metal strands (40) of wire back, as necessary, to ensure integrity of wire.
2. Using wire stripping tool, strip each end of wire (39) to expose length of metal strands (40) to suit type of splice connector (41) used.

NOTE

Perform steps 3 and 4 at each end of splice connector.

3. Insert metal strands (40) of wire (39) fully into splice connector (41).
4. Using crimping tool, securely crimp splice connector (41) to metal strands (40) of wire (39).



409-1923

ELECTRICAL GROUND POINTS

Many electrical problems are the result of poor ground connections. Ensure that ground connections are good by performing the following steps:

> 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.

1. Remove screw, lockwasher, nut, etc. connecting ground wire terminal to vehicle ground point.
2. If necessary, clean mounting hardware, wire terminal, and ground point with detergent and a scrub brush.
3. Remove any rust or corrosion from ground point with a wire brush and abrasive cloth.
4. Replace defective mounting hardware and wire terminal as necessary.
5. 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 forklift. The multimeter ohms scale is used to test for continuity, shorts and resistance. The multimeter voltmeter scale is used to test voltage levels at any point 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).

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 (TM 10-3930-660-10) 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.

MULTIMETER USAGE - CONTINUED

CAUTION

Before performing a continuity test, always place battery disconnect switch in OFF position (TM 10-3930-660-10) 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 (TM 10-3930-660-10) 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.

(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.

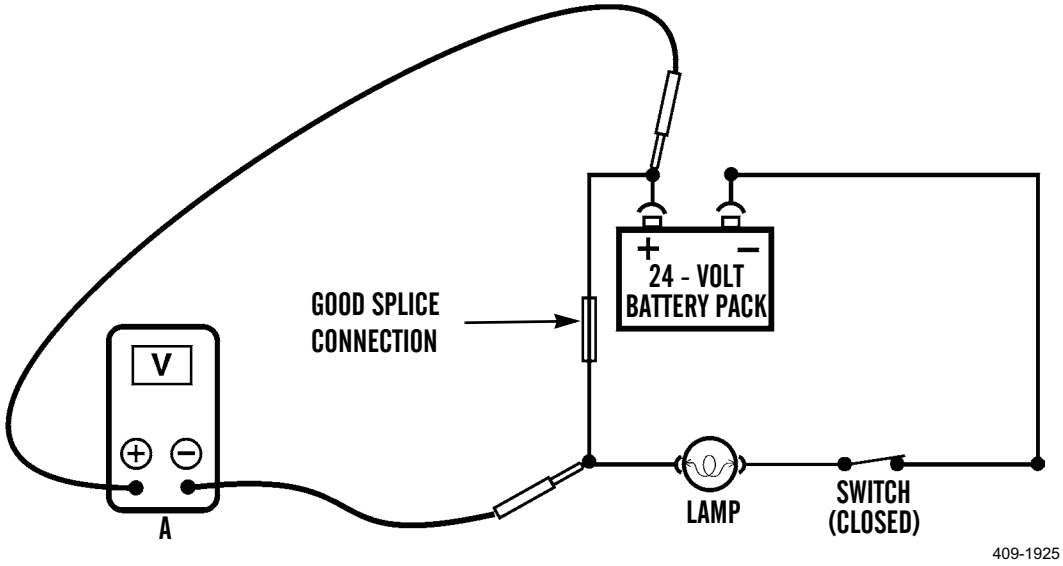
(4) Observe readout and interpret results as DC voltage in circuit being tested.

MULTIMETER USAGE - CONTINUED

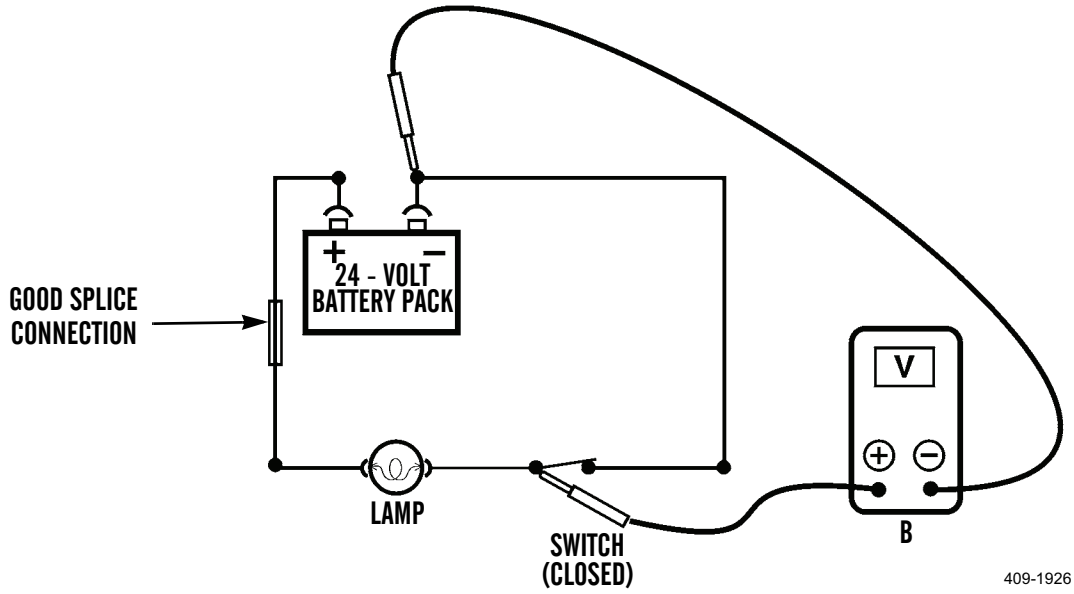
c. **DC Voltage Drop Examples.**

(1) Good Voltage Drop.

(a) Multimeter (A) is used to measure voltage drop across a good splice connection. Voltage reading at multimeter (A) should be low (about 0.1 volt). This means that resistance across this splice is low, resulting in low voltage drop.

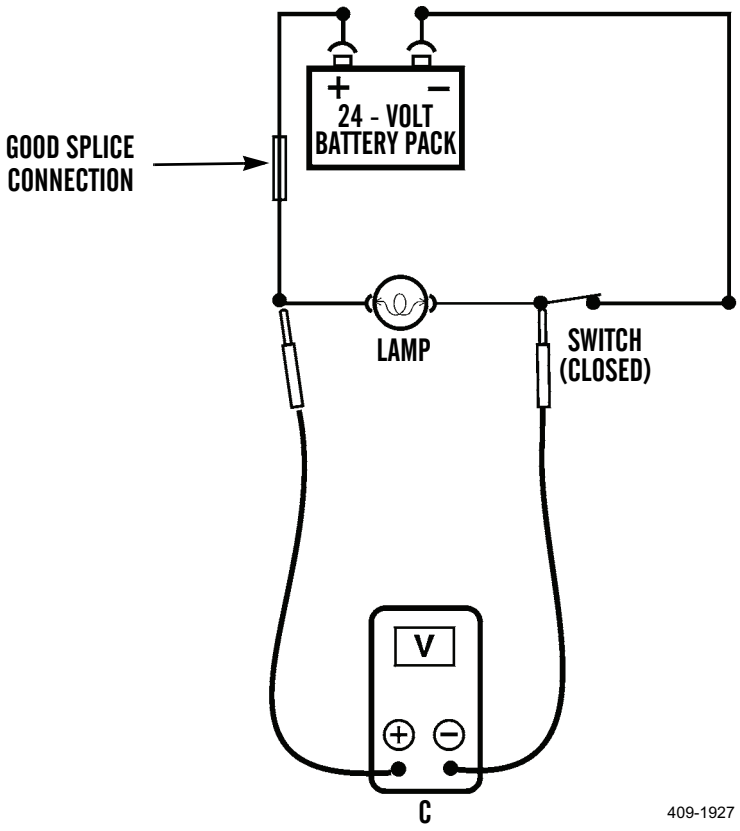


(b) Multimeter (B) is used to measure voltage drop across a closed switch. Voltage reading at multimeter (B) also should be low (about 0.1 volt). This means that resistance across this switch is low, resulting in low voltage drop.



MULTIMETER USAGE - CONTINUED

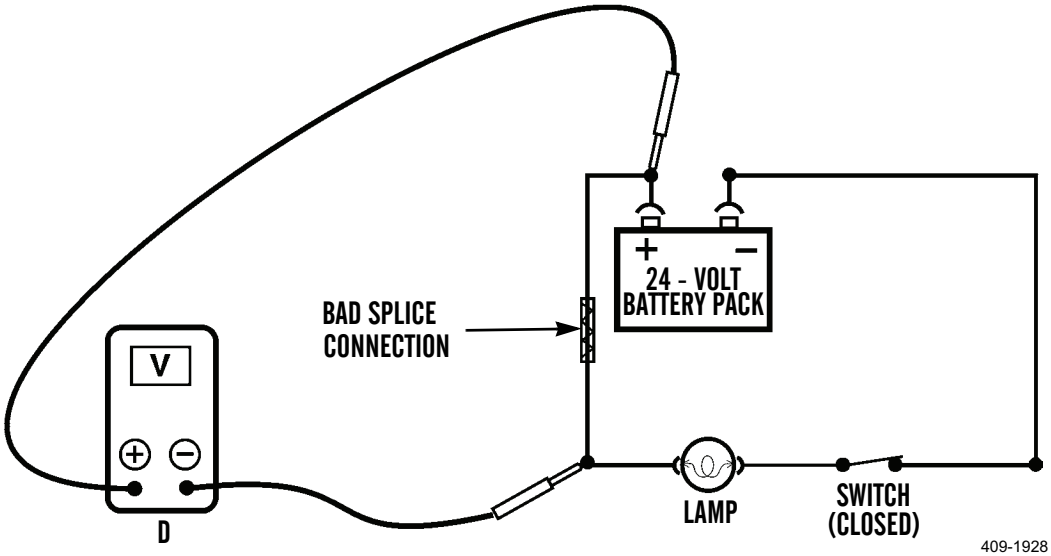
(c) Multimeter (C) is used to measure voltage drop across a load, in this case a lamp. If voltages at multimeters (A and B) are 0.1 volt each, voltage reading at multimeter (C) will equal 23.8 volts. This is because the sum of all voltage drops in a circuit is equal to the source voltage.



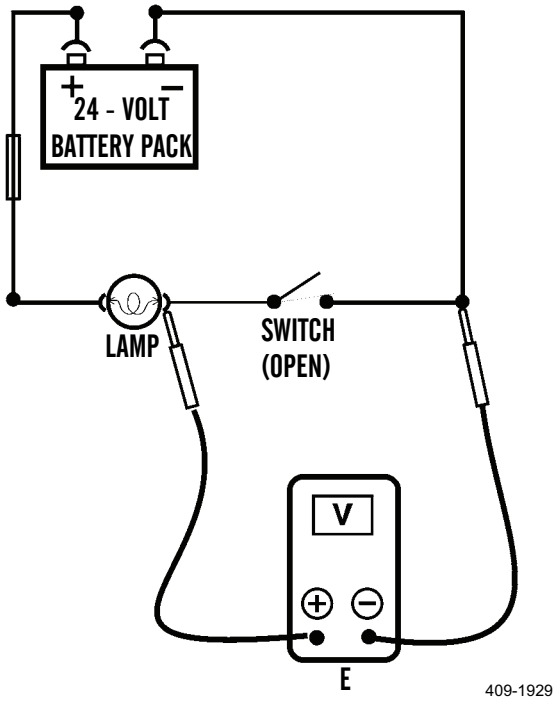
MULTIMETER USAGE - CONTINUED

(2) Bad Voltage Drop.

(a) Multimeter (D) is used to measure voltage drop across a bad splice connection. The voltage reading at multimeter (D) 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) Multimeter (E) is used 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 (E) 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

PREPARATION FOR STORAGE AND SHIPMENT 0314 00

SECURITY PROCEDURES

For security procedures involved in storage and shipment of the forklift, refer to AR 190-13.

STORAGE INSTRUCTIONS

1. **Short Term Storage (90 Days or Less).**

CAUTION

If short term storage is to occur during times when air temperature may fall below 0°F (-18°C), long term storage procedures must be used.

a. Fill fuel tank completely (TM 10-3930-660-10).

b. Perform After Operation Vital Preventive Maintenance Checks and Services (PMCS) (WP 0011 00).

c. Park forklift.

(1) Park forklift on a level surface;

(2) Block forklift to prevent movement; and

(3) Ensure that forklift is parked in a position to allow periodic movement and allow forklift to be driven away after storage.

d. Perform final walk-around inspection to ensure that all panels, access doors, container caps and fasteners are firmly secured.

e. Every 45 to 60 days forklift must be exercised.

(1) Perform *Before* operation PMCS (WP 0011 00).

f. Ensure all fluid levels are correct (WP 0011 00).

g. Start engine (TM 10-3930-660-10). Allow engine to warm at idle speed for approximately 10 minutes.

h. Observe warning and indicator lights (TM 10-3930-660-10).

i. When engine is warm, throttle up the forklift to operating RPM (TM 10-3930-660-10).

j. Operate all forklift controls (TM 10-3930-660-10). Steering, brakes, boom hoist, lift tool, lights, and horn systems must be operated. Stop forklift movement often and restart. Operation should last a minimum of 30 minutes.

k. Park forklift (TM 10-3930-660-10). Repeat steps a thru d.

STORAGE INSTRUCTIONS - CONTINUED

2. **Long Term Storage (Greater Than 90 Days).**

a. Perform a complete operational check (TM 10-3930-660-10).

b. If any system is found to be faulty, troubleshoot (WP 0006 00).

c. Thoroughly clean forklift. Remove all grease, dirt, rocks, tar and other foreign debris.

d. Visually inspect all metal components to locate areas to be repainted. Repaint as required (TM 43-0139).

e. With the exception of procedures involving fuel tank and engine crankcase, perform all Operator PMCS (TM 10-3930-660-10) and Field Maintenance PMCS (WP 0011 00).

f. Prepare engine.

(1) Drain fuel tank (WP 0032 00).

(2) Spray inside of fuel tank with preservative oil (Item 34, WP 0323 00).

(3) Coat threaded surface of fuel tank drain plug with preservative oil (Item 34, WP 0323 00).

(4) Remove and clean fuel filler cap.

(5) Coat inside of fuel filler cap with preservative oil (Item 34, WP 0323 00).

(6) Install fuel tank drain plug and fuel filler cap.

NOTE

A two compartment portable container with a three position valve is required when preserving forklift fuel system for long term storage. The container is needed to supply fuel and preservative oil to engine during preservation procedures. One side of container must contain diesel fuel (Item 28, WP 0323 00) and other side must contain preservative oil (Item 34, WP 0323 00).

(7) Disconnect fuel line from fuel/water separator on the “in from fuel tank” side (WP 0040 00).

(8) Connect fuel/preservative hose to fuel/water separator (WP 0040 00).

(9) Disconnect fuel return hose from fuel filter (WP 0042 00) and place in container for collecting fuel and preservative oil with a 55 gal. (200 liter) capacity.

(10) Open valve on fuel/preservative container to FUEL position.

(11) Start engine (TM 10-3930-660-10) and allow to operate at fast idle until engine is warm.

(12) Set throttle to run engine at 2100 rpm (TM 10-3930-660-10).

(13) Turn fuel/preservative valve to PRESERVATIVE position.

(14) Visually inspect fluid flowing from return line. When fluid is undiluted preservative oil, turn engine off (TM 10-3930-660-10).

(15) Turn fuel/preservative valve to OFF position.

(16) Disconnect fuel/preservative hose from fuel/water separator (WP 0040 00).

(17) Connect fuel supply line to fuel/water separator (WP 0040 00).

(18) Connect fuel return line to fuel filter (WP 0042 00).

(19) Discard fuel/preservative mixture collected from fuel return line in accordance with local regulations.

(20) Drain oil from crankcase (WP 0012 00).

(21) Fill crankcase with preservative oil (Item 34, WP 0323 00).

(22) Attach tag to engine oil fill tube stating “THIS CRANKCASE IS FILLED TO CAPACITY WITH PRESERVATIVE OIL. DRAIN AND REFILL CRANKCASE WITH ENGINE OIL BEFORE OPERATION OF ENGINE.”

STORAGE INSTRUCTIONS - CONTINUED

g. Apply insulating varnish or equivalent to all exposed electrical wires, cables and connectors.

h. Coat steering cylinder rod with preservative oil and then cover with barrier material.

i. Prepare air intake assembly:

(1) Disassemble air cleaner assembly (WP 0024 00).

(2) Fog inside of air cleaner canister with preservative oil (Item 34, WP 0323 00).

CAUTION

Preservative oil will damage non-metallic air filter parts. Care should be used when applying preservative oil to air filter non-metallic parts.

(3) Dip removed air cleaner components in preservative oil (Item 34, WP 0323 00).

(4) Install air cleaner elements and components (WP 0024 00).

(5) Wrap air intake restriction indicator in barrier material.

(6) Loosen hose clamp at turbo air inlet and pull off air inlet hose (WP 0026 00).

(7) Spray inside of air inlet hose and turbocharger inlet impeller with preservative oil (Item 34, WP 0323 00).

(8) Attach air inlet hose and tighten clamp (WP 0026 00).

j. Prepare exhaust system:

(1) Remove muffler (WP 0051 00).

(2) Clean and paint any unpainted area on muffler and exhaust pipe (TM 43-0209).

(3) Spray inside of exhaust pipe leading from engine with preservative oil (Item 34, WP 0323 00).

(4) Install muffler (WP 0051 00).

(5) Place barrier material over exhaust exit. Secure with tape (Item 58, WP 0323 00).

CAUTION

To prevent damage to alternator ensure that plug-in lead to alternator is disconnected.

k. Disconnect plug-in lead to alternator (WP 0062 00) and tape (Item 58, WP 0323 00).

CAUTION

Discharged batteries will be damaged if stored in below freezing temperatures.

l. Remove batteries (WP 0106 00) and tape (Item 58, WP 0323 00) battery cable ends. Store batteries where they can be checked periodically and recharged.

m. Cover seat with barrier material.

n. Tag forklift as “STORED LONG TERM.” List all work done on forklift on the tag.

o. Check forklift every 45 to 60 days for signs of damage or deterioration. Repeat procedures if damage is detected.

3. **Removing Forklift from Long Term Storage.**

a. Remove all coverings and tape.

b. Install fully charged batteries or new batteries (WP 0106 00).

c. Connect plug-in lead to alternator (WP 0062 00).

d. Perform all Operator PMCS (TM 10-3930-660-10) and Unit Maintenance PMCS (WP 0011 00).

e. On first day of operation, check forklift periodically for leaks and proper operation. Troubleshoot as required (WP 0006 00).

SHIPMENT INSTRUCTIONS

1. Perform Operator PMCS procedures (TM 10-3930-660-10).
2. Prepare forklift to point required by distance and duration of shipment. If duration of shipment will last more than three months, forklift should be prepared for storage.

END OF WORK PACKAGE

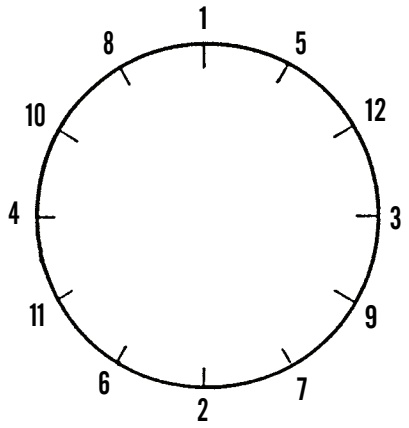
TORQUE LIMITS **0315 00**

SCOPE

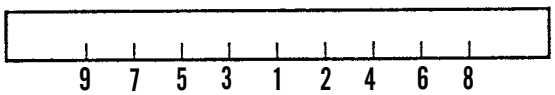
This work package lists standard torque values and provides general information for applying torque. Special torque values and tightening sequences are indicated in the maintenance procedures for applicable components.

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 ±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 (OEA-10).
   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.



CIRCULAR 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.

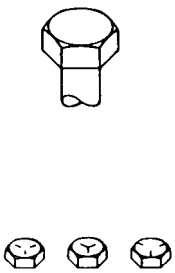
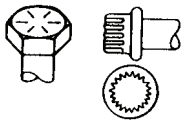
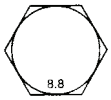
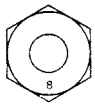
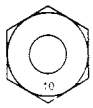
Current Usage	Much Used	Much Used	Used at Times	Used at Times
QUALITY OF MATERIAL	INDETERMINATE	MINIMUM COMMERCIAL	MEDIUM COMMERCIAL	BEST COMMERCIAL
SAE Grade Number	1 or 2	5	6 or 7	8
Cap Screw Head Markings Manufacturer's marks may vary These are all SAE Grade 5 (3 line)				
CAP SCREW BODY SIZE IN. - THREAD	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)
1/4 20	5 (7)	8 (11)	10 (14)	12 (16)
28	6 (8)	10 (14)		14 (19)
5/16 18	11 (15)	17 (23)	19 (26)	24 (33)
24	13 (18)	19 (26)		27 (37)
3/8 16	18 (24)	31 (42)	34 (46)	44 (60)
24	20 (27)	35 (47)		49 (66)
7/16 14	28 (38)	49 (66)	55 (75)	70 (95)
20	30 (41)	55 (75)		78 (106)
1/2 13	39 (53)	75 (102)	85 (115)	105 (142)
20	41 (56)	85 (115)		120 (163)
9/16 12	51 (69)	110 (149)	120 (163)	155 (210)
18	55 (75)	120 (163)		170 (231)
5/8 11	83 (113)	150 (203)	167 (226)	210 (285)
18	95 (129)	170 (231)		240 (325)
3/4 10	105 (142)	270 (366)	280 (380)	375 (508)
16	115 (156)	295 (400)		420 (569)
7/8 9	160 (217)	395 (536)	440 (597)	605 (820)
14	175 (237)	435 (590)		675 (915)
1 8	235 (319)	590 (800)	660 (895)	910 (1234)
14	250 (339)	660 (895)		990 (1342)

Table 2. 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

CLEANING INSTRUCTIONS 0316 00

1. **General.**

   a. The cleaning instructions will be the same for the majority of parts and components that make up the 6K Forklift.

   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) Hands should be kept free of any 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.

   c. Observe the following precautions during all cleaning operations:

- 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 (TM 9-247).
- Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury to personnel.
- Particles blown by compressed air are hazardous. Make certain the air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield when using compressed air.

2. **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 to all parts subject to rust.

   d. Blow out all tapped (threaded) holes with compressed air to remove dirt and cleaning fluids.

3. **Disassembled parts cleaning.**

   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 cleaning solvents (TM 9-247).

   b. Use a stiff brush to remove sludge and gum deposits.

   c. Blow out all tapped (threaded) holes with compressed air to remove dirt and cleaning fluids.

5. **Oil passages.** Particular attention must be given to all oil passages in castings and machined parts. Oil passages must be clean and free to any obstructions.

   a. Clean passages with wire probes to break up any sludge or gum deposits.

   b. Wash passages by flushing with solvents (TM 9-247).

   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 hose with water and mild soap solution and wipe dry.

   b. Oil seals are generally damaged during removal, so cleaning will not be necessary since new seals will be used in assembly.

7. **Bearings.**

   a. Bearings require special cleaning. After removing surface oil and gum deposits, place bearings in hot oil, 140°F (60°C), to loosen congealed oil and grease. Wipe bearings dry. Do not use compressed air. After cleaning, coat bearings with oil, wrap in paper, and hold for inspection.

   b. Refer to TM 9-247 for information and care of bearings.

8. **Machine tooled parts.**

   a. Clean machine tooled parts with dry cleaning solvent (P-D-680).

   b. Dry parts with compressed air.

9. **Machined surfaces.**

   a. Clean machined surfaces with dry cleaning solvent (P-D-680).

   b. Dry surfaces with compressed air.

10. **Mated surfaces.**

   a. Remove old gasket and/or sealing compound using wire brush and dry cleaning solvent (P-D-680).

   b. Lightly oil and wrap all parts subject to rust before storing.

11. **Rusted surfaces.** Clean all rusted surfaces using wire brush and crocus cloth.

12. **Oil bathed internal parts.** Wipe oil bather internal parts clean with lint free cloth.

13. **Air actuated internal parts.** Wipe air actuated internal parts clean with lint free cloth.

14. **Externally exposed parts.** Wash externally exposed parts with soap and water. Rinse thoroughly and air dry.

END OF WORK PACKAGE

INSPECTION INSTRUCTIONS 0317 00

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. Refer to MIL-I-6866, Inspection, Liquid Penetrant Methods, and MIL-I-6868, Inspection Process, Magnetic Particles.
   c. Particularly check areas around studs, pipe plugs, threaded inserts and sharp corners. Replace all cracked castings.
   d. Inspect machine surfaces for nicks, burrs, or raised metal. Mark damaged areas for repair or replacement.
   e. Inspect all pipe plugs, pipe plug openings, screws and screw openings for damaged or stripped threads.
   f. Check all gasket mating surfaces, flanges on housings, and supports for warpage with a straightedge or surface plate. Inspect mating flanges for discolorations that may indicate persistent oil leakage.
   g. Check all castings for conformance to applicable repair standards.
5. **Bearings.** Refer to TM 9-214 for inspection of bearings. Check all bearings for conformance to applicable repair standards.
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 judgment 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.
8. **Bushings 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. **Mated 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. **Air actuated 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.

END OF WORK PACKAGE

GENERAL DISASSEMBLY AND ASSEMBLY INSTRUCTIONS 0318 00

GENERAL

1. Always put together or take apart one part at a time. Do not work on two parts at the same time. Be sure to make all adjustments. Always check your work when you are finished. Make sure everything is done.
2. Check the adjustments for the last time by operating the vehicle. If all adjustments are correct, the vehicle is ready to go back to work.

END OF WORK PACKAGE

1. **General.** Any repair procedure peculiar to a specific part or component is covered in the section or paragraph relating to that item. After repair, clean all parts thoroughly to prevent dirt, metal chips or other foreign material from entering any working parts.

CAUTION

Repaired items must be thoroughly cleaned to remove metal chips and abrasives to prevent them from entering working parts of the 6K Forklift.

2. **Casings.**

   a. All cracked castings will be replaced.

   b. 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.

   c. Remachining of machined surfaces to repair damage, warpage or uneven surfaces is not permitted. Replace castings.

   d. Repair damaged threaded pipe plug or screw threads with a tap. Repair oversize holes with threaded inserts.

3. **Bearings.** Refer to TM 9-214 for repair of bearings.

4. **Studs.** Replace all bent and stretched studs. Repair minor thread damage with a thread die. Replace studs having stripped or damage threads as outlined below:

   a. Remove using a stud remover. Back studs out slowly to avoid heat buildup and seizure that can cause stud to break off.

   b. If studs break off too short to use a stud remover, use a stud extractor to remove or use “welding method.”

CAUTION

Refer to TM 9-237, Welding Instructions, to avoid damage to castings if welding method is used.

   c. Broken studs can be removed by welding bar stock or a nut to stud and removing with wrench.

   d. Install replacement stud slowly to prevent heat buildup and snapping off.

5. **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 cleaning solvent.

   c. If keyways are worn or enlarged, replace gear.

6. **Bushings and bushing type bearings.** When bushings and bushing type bearings seize to a shaft and spin in the bore, the associated part must also be replaced.
7. **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 replacing tool.

END OF WORK PACKAGE

CHAPTER 7
SUPPORTING INFORMATION

REFERENCES 0320 00

SCOPE

This work package lists forms, field manuals, technical manuals and other publications that are referenced in this manual and which apply to unit maintenance, intermediate direct support and general support maintenance of the 6K Forklift.

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 738-751

FORMS

Refer to DA PAM 738-751, Functional User's Manual for *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

Maintenance Request . . . . . DA Form 2407

Organizational Control Record for Equipment . . . . . DA Form 2401

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

Basic Cold Weather Manual . . . . . .FM 31-70

Camouflage, Concealment and Decoys . . . . . .FM 20-3

Desert Operations . . . . . .FM 90-3

First Aid. . . . . FM 4-25.11

Metal Body Repair and Related Operations . . . . . TC 9-510

Mountain Operations. . . . . FM 3-97.6

Northern Operations . . . . . .FM 31-71

TECHNICAL BULLETINS

Equipment Improvement Report and Maintenance Digest (US Army Tank-Automotive Command) Tank-Automotive Equipment. . . . . TB 430001-39 series

Use of Anti-Freeze Solutions and Cleaning Compounds in Engine Cooling System . . . . . TB 750-651

TECHNICAL MANUALS

Operator's Manual for All Terrain Lifter Army System (ATLAS) Clean Burn Diesel 10,000 lb (4536 kg) Capacity Model Skytrak 10000M . . . . . TM 10-3930-673-10

Maintenance Manual for All Terrain Lifter Army System (ATLAS) Clean Burn Diesel 10,000 lb (4536 kg) Capacity Model Skytrak 10000M. . . . . TM 10-3930-673-20

Unit Maintenance, Intermediate Direct Support and Intermediate General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for All Terrain Lifter Army System (ATLAS) Clean Burn Diesel 1,0000 lb (4536 kg) Capacity Model Skytrak 10000M . . . . . TM 10-3930-673-24P

Inspection Care and Maintenance of Antifriction Bearings . . . . . TM 9-214

Operator's Circular Welding Theory and Application . . . . . TC 9-237

TECHNICAL MANUALS - CONTINUED

Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Materiel and Related Materials Including Chemicals . . . . . TM 9-247

Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tools List for Simplified Test Equipment for Internal Combustion Engines (STE/ICE-R) (NSN 4910-01-124-2554) . . . . . TM 9-4910-571-12&P

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

Operator's, Unit and Direct Support Maintenance Manual for Tool Outfit, Hydraulic Systems Test and Repair Unit (HSTRU) (NSN 4940-01-036-5784) . . . . . TM 9-4940-468-13

SPECIFICATIONS AND STANDARDS

Dry Cleaning Solvent . . . . . Fed Spec P-D-680

Methyl Ethyl Ketone, Technical TT-M-261

Human Engineering Design Criteria for Military Systems, Equipment and Facilities MIL-STD-1472

OTHER PUBLICATIONS

Expendable/Durable Items (Except Medical, Class V, Repair Parts and Heraldic Items) . . . . . CTA 50-970

Army Medical Department Expendable/Durable Items . . . . . CTA 8-100

END OF WORK PACKAGE

MAINTENANCE ALLOCATION CHART (MAC) INTRODUCTION 0321 00

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 0322 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

Table 1. MAC for the 6K Forklift.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
01	**ENGINE**								A
0100	Engine Assembly	Inspect	0.1						
		Test	0.1	1.5				19,22,36	C,I
		Service		1.0				19,36	B
		Replace			7.0			20,36	
		Repair			10.0				
		Overhaul					40.0	12,20,31, 37,16	
	Engine Mounts	Inspect		0.1					
		Replace			2.0			20,36	
	Lifting Brackets	Replace			1.0			20,36,37,16	
0101	Crankcase, Cylinder Block, and Head Assembly								
	Cylinder Block	Replace				30.0		1	
		Repair				8.0		5,6	
	Cylinder Head Assembly with Valves	Adjust		2.0				19,36	D
		Replace			2.0			20,36	
		Repair				8.0		37,39,40,41	
0102	Crankshaft:								
	Crankshaft	Replace				8.0		1	
		Repair					8.0	20,37	
	Crankshaft Main Bearings	Replace				8.0		20,37	E
	Oil Seals	Replace				4.0		17,20,36,16	
	Vibration Damper	Replace				4.0		19,36	
0103	Flywheel Assembly:								
	Flywheel	Replace			4.0			20,32,36	
	Housing Flywheel and Cover	Replace			4.0			1,2,9,20,36	
0104	Pistons, Connecting Rods:								
	Pistons, Piston Pins and Rings	Replace				10.0		20,37	
	Connecting Rods and Bearings	Replace				10.0		20,37	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
01	**ENGINE - Continued**								A
0105	Valves, Camshaft and Timing System:								
	Rocker Lever Covers	Replace		1.0				18,36	
	Rocker Lever Assembly	Replace			4.0			20,36	
		Repair			2.0			20,37	
	Tappet, Valve	Replace			4.0			20,36	
	Gear and Bearing	Replace				24.0		20,36	
	Front Housing and Cover	Replace				8.0		3,4,20,36	
	Push Rod Cover	Replace			1.0			36	
0106	Engine Lubrication System:								
	Oil Pan	Inspect	0.1						F
		Replace			4.0			19,36	
	Oil Pump Inlet Tube	Replace			1.0			20,36	
	Oil Pump	Replace			1.0			20,36	
	Oil Filter	Replace		0.2				19,36	
	Oil Filter Base	Replace			0.5			20,36	
	Oil Level Gage	Replace		0.1				36	
	Oil Sampling Valve	Service	0.1						
		Replace		0.1				36	
	Oil Cooler	Replace			1.0			20,36	
0108	Manifolds								
	Exhaust Manifold	Replace		1.0				19,36	
	Intake Manifold Cover	Replace		1.0				36	
03	**FUEL SYSTEM**								
0301	Fuel Injector								
	Injector, Nozzle	Test			0.5			20,36,37	
		Replace			1.0			20,36	
0302	Fuel Pump								
	Fuel Injection Pump	Test			0.5			21,31,36	
		Adjust			2.0			36	G
		Replace			4.0			20,36	
		Overhaul					8.0	20,21,37	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
03	**FUEL SYSTEM - Continued**								
	Fuel Shutoff Valve	Replace			0.5			36	
		Testing			0.2			19,36	
	Fuel Transfer Pump	Test		0.5				22,36	
		Replace		1.0				18,36	
0304	Air Cleaner								
	Air Cleaner Assembly	Replace		0.7				36	
		Repair		1.0				18,36	
	Air Cleaner Elements	Service	0.2	0.2				36	H
		Replace		0.2				18,36	
	Air Inlet Cap	Replace		0.2				36	
	Air Inlet Tubing	Replace		0.5				18,36	
0305	Turbocharger								
	Turbocharger Assembly	Replace		2.0				19,36	
		Repair				4.0		20,37	
	Turbocharger Air Lines	Replace		1.0				36	
	Turbocharger Oil Line	Replace		0.2				18,36	
0306	Tanks, Lines and Fittings								
	Fuel/Hydraulic Tank	Inspect	0.1						
		Service	0.2	1.5				19,36	J
		Replace			2.0			36	
		Repair			2.0			34,37	
	Fuel Strainer	Inspect	0.1						
		Service		0.5				36	
		Replace		0.5				36	
	Fuel Lines Fittings and Manifold	Inspect	0.1						F
		Replace		1.0				18,36	
	Water Separator Assembly	Service	0.1						
		Replace		0.5				36	
0309	Fuel Filter and Head Assemblies	Service		0.5				36	
		Replace		0.5				19,36	
0311	Engine Starting Aids								
	Ether Start Kit	Replace		0.7				36	
		Repair		1.0				36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
03	**FUEL SYSTEM - Continued**								
	Ether Cartridge	Replace		0.2				36	
	Thermostat, Ether Start	Test		1.0				18,36	
		Replace		1.0				36	
	Bracket, Mounting	Replace		0.3				36	
0312	Accelerator Controls								
	Accelerator Cable	Adjust		0.5				36	K
		Replace		2.0				36	
	Accelerator Pedal and Linkage	Inspect	0.1						
		Replace		2.0				36	
		Repair		1.0				36	
04	**EXHAUST SYSTEM**							36	
	Muffler	Replace		0.7				36	
	Tail Pipe	Replace		0.5				36	
	Exhaust Pipe	Replace		0.3				36	
05	**COOLING SYSTEM**								
0501	Radiator								
	Radiator Assembly	Inspect	0.1						F
		Test				0.5		36	
		Service		0.5				36	
		Replace		2.0				36	
		Repair				2.0		20	
	Coolant Overflow Tank	Replace		0.5				36	
0503	Water Manifold, Headers, Thermostats, Housing Gasket								
	Thermostat	Replace		0.5				18,36	
	Housing	Replace		1.0				36	
	Radiator Hoses	Inspect	0.1						
		Replace		0.5				36	
	Water Inlet	Replace		0.5				18,36	
0504	Water Pump	Replace		2.0				18,36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
Group Number	Component/ Assembly	Maintenance Function	Unit C	Unit O	DS F	GS H	DEPOT D	Tools and Equipment	Remarks
05	**COOLING SYSTEM - Continued**								
0505	Fan Assembly								
	Fan Blade and Spacer	Inspect	0.1						
		Replace		1.5				36	
	Fan Guard	Inspect	0.1						
		Replace		1.0				36	
	Drive Belt	Inspect	0.1					36	
		Replace		1.0				18,36	
06	**ELECTRICAL SYSTEM**								
0601	Alternator								
	Alternator and Alternator Connections	Replace		0.4				18,36	
		Repair				4.0		37	
	Pulley	Replace		0.5				36	
0603	Starter								
	Starting Motor and Switch	Replace		0.4				18,36	
		Repair				4.0		36,37	
	Neutral Safety Switch	Inspect		0.2					
		Replace		0.5				36	
0607	Instrument Panel								
	Instrument Panel	Replace		4.0				36	
	Gauges, Switches, Lights	Inspect	0.1						
		Replace		0.5				36	
	Hour Meter	Replace		0.5				36	
	Circuit Breakers	Replace		0.2				36	
	Turn Signal Flasher	Replace		0.5				36	
	Relays	Replace		0.5				36	
0608	Miscellaneous Electrical Components								
	Blackout/Service Light Switch	Inspect	0.1						
		Replace		0.5				36	
	Temperature and Pressure Switches	Test		0.5				36	
		Replace		0.2				36	

Table 1. MAC for the 6K Forklift - Continued.

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment	(6) Remarks
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
			C	O	F	H	D		
06	**ELECTRICAL SYSTEM - Continued**								
	Hydraulic Bypass Switch	Test		0.5				22,36	
		Replace		0.2				18,36	
	Electrical Joystick Assembly	Adjust			0.5			18,36	
		Test		0.3	0.5			22,36	R
		Inspect	0.1		0.3				
		Replace		1.0				36	
		Repair			2.0			20,36	
	Fork Auto Leveler Switch	Inspect	0.1						
		Adjust		1.0				15,36	
		Test		1.0				15,30,36	
		Replace		1.0				36	
	Fork Auto Leveler Circuit Board	Test		0.3				15,30,36	
		Replace		0.5				36	
	Relays	Test		0.5				22,36	
		Replace		0.2				36	
	Boom Electrical Box Assembly	Inspect	0.1						
		Replace		2.0				36	
		Repair		2.0				36	
	STE/ICE-R Electrical Components	Test		0.5				19,22,36	B
		Replace		0.2				36	
0609	Lights								
	Headlights/Floodlights	Inspect	0.1						
		Replace		0.5				36	
		Repair		1.0				36	
	Blackout Drive	Inspect	0.1						
		Replace		0.5				36	
		Repair		1.0				36	
	Brake and Blackout Taillights	Inspect	0.1						
		Replace		0.5				36	
		Repair		0.5				36	
	Blackout Marker Lights	Inspect	0.1						
		Replace		0.5				36	
		Repair		0.5				36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
06	**ELECTRICAL SYSTEM - Continued**								
	Turn Signal Lights	Inspect	0.1						
		Replace		0.5				36	
		Repair		0.5				36	
0610	Sending Units and Warning Switches								
	Oil Pressure Sender	Test		0.5				19,36	
		Replace		0.1				36	
	Water Temperature Sender	Replace		0.1				36	
	Transmission Temperature Sender	Replace		0.1				36	
	Fuel Level Sender	Test		0.5				19,36	
		Replace		0.7				19,36	
0611	Horn, Siren								
	Back-up Alarm	Inspect	0.1						
		Replace		0.1				19,36	
	Back-up Switch	Adjust	0.1						
		Replace		1.0				36	
	Horn	Inspect	0.1						
		Replace		0.1				36	
0612	Batteries								
	Batteries	Inspect	0.1						
		Test		0.5				19,36	
		Service		0.5				36	
		Replace		0.5				36	
	Battery Cables	Service		0.1				36	
		Inspect	0.1						
		Replace		0.2				36	
	Battery Boxes	Replace		0.5				36	
		Repair			0.5			20,36	
	NATO Receptacle	Replace		0.3				36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
06	**ELECTRICAL SYSTEM - Continued**								
0613	Wiring Harnesses								
	Cab Wiring Harness	Test		0.5				22,36	
		Replace			8.0			19,36	
		Repair		1.0	2.5			20,36	
	Main Wiring Harness	Inspect	0.1						
		Test		0.5				18,22,36	
		Replace			8.0			18,36	
		Repair		2.0				20,36	
	Boom Electrical Cable	Test		0.5				22,36	
		Adjust		0.1				1	
		Replace		4.0				20,36	
		Repair		4.0				20,36	
	STE/ICE-R Harness	Test		0.5				19,22,36	
		Replace		4.0				19,36	
		Repair		4.0				1	
	Electric Joystick Harness	Test		0.5				22,36	
		Replace		1.0				36	
		Repair		0.5				20,36	
07	**TRANSMISSION**								
0705	Transmission Shifting Components								
	Transmission Shifter	Adjust		1.0				36	
		Replace		2.5				36	
		Repair		2.5					
	Transmission Cables	Replace		2.5				36	
	Transmission Disconnect Pedal	Adjust		1.0				36	
		Replace		2.0				36	
	Transmission Disconnect Master Cylinder	Replace		2.0				36	
0708	Torque Converter	Replace			8.0			18,36	
		Repair				8.0		20,36	
		Overhaul					8.0		
0710	Transmission								

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
07	**TRANSMISSION - Continued**								
	Transmission Assembly	Inspect	0.1						F
		Service	0.1	0.5				36	C, J
		Test		0.5				19,36	
		Replace			8.0			20,36	
		Repair				8.0		20,35,36	
		Overhaul					40.0	20,35,36	
	Mounting Brackets	Replace			2.0			19,36	
	Front Cover Assembly	Replace			2.0			20,36	
		Repair				1.0		20	
	Clutch Packs	Replace				4.0		20,35	
		Repair				3.0		20,37	
	Output Shaft	Replace				4.0		36	
		Repair				3.0		20,37	
	Front Housing	Replace				2.0		37	
		Repair				2.0		37	
	Input Shaft	Replace				4.0		36	
		Repair				1.0		20,37	
	Case and Covers	Replace				6.0		20	
		Repair				4.0		20,36	
0714	Servo Unit								
	Control Valve	Replace			2.0			36	
		Repair				4.0		36,37	
0721	Coolers, Pumps, Motors								
	Transmission Oil Pump	Replace			4.0			1	
		Repair				1.5		4, 26	
	Breather	Replace		0.5				36	
	Oil Filter and Head Assembly	Replace		0.5				19,36	
	Valve, Oil Sampling	Service	0.1						
		Replace		0.1				36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
09	**PROPELLER AND PROPELLER SHAFTS**								
0900	Front and Rear Propeller Shafts	Service		0.1				36	
		Replace		0.3				18,36	
		Repair		0.3				18,36	
	Transmission Propeller Shaft	Service		0.1				3	
		Replace		1.0				18,36	
		Repair		1.0				18,36	
10	**FRONT AXLE**								
1000	Front Axle Assembly	Inspect		0.1					
		Service		0.1				19,36	
		Replace			2.0			20,36	
		Repair				8.0		7,8,16,20, 36	
		Overhaul					14.0	7,8,12,16, 20,37	
	Pin, Axle Carrier	Service		0.1				36	
		Replace			0.7			18,36	
1002	Front Differential Carrier Assembly	Service		0.3				36	
		Replace			4.0			18,36	M
		Repair				2.0		20,37	
1003	Front Planetary Wheel Ends	Service		0.3				19,36	
		Replace			1.0			20,37	
		Repair				4.0		37	
11	**REAR AXLE**								
1100	Rear Axle Assembly	Inspect	0.1						
		Service		0.1				36	
		Replace			2.0			18,36	
		Repair				8.0		20,36	
		Overhaul					14.0	37	
	Pin, Axle Carrier	Service		0.1				36	
		Replace			0.7			20,36	
1102	Rear Differential Carrier Assembly	Service		0.3				36	
		Replace			4.0			20,36	M
		Repair				2.0		7,20,37	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
11	**REAR AXLE - Continued**								
1103	Rear Planetary Wheel Ends	Service		0.3				36	
		Replace			1.0			20,36	M
		Repair				4.0		7,20,37	
12	**BRAKES**								
1201	Hand Brakes								
	Parking Brake Assembly	Inspect	0.1						
		Adjust		1.0				36	
		Replace		1.0				19,36	
		Repair			2.0			37	S
	Lever and Cable	Inspect	0.1						
		Adjust		1.0				36	
		Replace		1.0				36	
1202	Service Brakes:								
	Disc Brake Assembly	Service		0.5				36	
		Replace			1.0			20,36	
		Repair			1.5			20,36	
	Brake Pads	Inspect		0.5					
		Replace		1.0				36	
1204	Hydraulic Brake System								
	Brake Control Valve	Replace		1.0				36	
		Repair				1.5		20,37	
	Accumulator	Test		0.2					
		Replace		0.5				19,36	
		Repair		0.5				19,36	
	Lines and Fittings	Inspect	0.1						
		Replace		1.0					
13	**WHEELS AND TRACKS**								
1311	Wheel Assembly	Inspect	0.1						
		Replace		1.0				18,36	
		Repair		1.0				18,36	
1313	Tire	Inspect	0.1						
		Service	0.1					19,36	
		Replace		1.0				19,36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
14	**STEERING**								
1401	Steering Gear Assembly								
	Steering Wheel	Replace		0.5				18,36	
	Steering Column	Replace		1.0				18,36	
	Steering Knuckle	Service		0.2				36	
		Adjust			1.0			20,36	P
		Replace			2.0			20,36	
	Tie Rod	Service		0.2				19,36	
		Adjust		0.5				36	
		Replace		1.5				20,36	
	Universal (Cardan) Steering Joints	Replace		1.5				19,36	
1410	Hydraulic Pump								
	Emergency Steering Pump	Test	0.1	0.2				19,36	
		Replace		1.0				19,36	
		Repair			2.0			3	
1411	Hoses, Lines, Fittings	Inspect	0.1						
		Replace		0.5				19,36	
		Repair		0.5				20,36,38	
1412	Hydraulic Cylinders								
	Steering Cylinders	Inspect	0.2						
		Service		0.1				36	
		Replace		1.0				19,36	
1414	Steering System Valves								
	Steering Valve, Control	Replace		1.0				19,36	
		Repair				1.5		37	
	Valve, Steering Select, Solenoid	Replace		1.0				18,36	
15	**FRAME, TOWING ATTACHMENTS AND DRAWBARS**								
1501	Frame Assembly	Repair				2.0		20,34,36	
1502	Counterweight	Replace		0.3				18,36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
15	**FRAME, TOWING ATTACHMENTS AND DRAWBARS - Continued**								
1503	Pintle Hook	Inspect	0.1						
		Service		0.1				19,36	
		Replace		0.3				36	
		Repair		0.5				36	
18	**BODY, CAB, HOOD AND HULL**								
1801	Body, Cab, Hood and Hull Assemblies								
	Engine Covers	Replace		0.3				36	
	Radiator Cover	Replace		0.5				36	
	Engine Door Panel	Replace		0.1				36	
	Transmission Cover	Replace		0.1				36	
	Cab Assembly with ROPS/ FOPS	Inspect	0.2						
		Replace			8.0			20,36	N
		Repair			1.5			20,34,36	L
	Sound Suppression Panels	Replace			1.0			36	
	Doors	Service		0.1				36	
		Replace		0.2				36	
		Repair		1.0				34	L
	Accessories Storage Box	Replace		0.1				36	
	Fire Extinguisher Bracket	Replace		0.1				36	
	Tool Box Door Latch	Replace		0.1				36	
	Cab Floor Mat	Replace		1.0				36	
1802	Fenders, Running Boards, Windshield Glass								
	Fenders	Replace		0.2				19,36	
	Fender Braces	Replace		0.6				19,36	
	Cab Windows	Replace		2.0				36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
18	**BODY, CAB, HOOD AND HULL - Continued**								
1806	Seat								
	Seat Assembly	Inspect	0.1						
		Replace		1.0				36	
		Repair		1.0				20,36	
	Seat Belts	Inspect	0.1						
		Replace		0.2				36	
22	**BODY, CHASSIS AND HULL, AND ACCESSORY ITEMS**								
2202	Accessory Items								
	Wiper Assemblies	Inspect	0.1						
		Replace		1.0				36	
		Repair		0.5				36	
	Windshield Washer Assembly	Inspect	0.1						
		Service		0.2				36	
		Replace		0.5				36	
		Repair		0.5				36	
	Mirror	Inspect	0.1						
		Replace		0.5				36	
	Fans, Ventilation	Inspect	0.1						
		Replace		0.5				36	
2207	Winterization Equipment								
	24V Heater Assembly	Inspect	0.1						
		Replace		1.0				36	
		Repair		1.5	1.5			20,36	
	Temperature Control Valve	Inspect	0.1						
		Replace		1.0				36	
	Heater hose, Lines and Fittings	Inspect	0.1						
		Replace		1.0				36	
2210	Data Plates	Replace		0.2				36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
24	**HYDRAULIC FLUID SYSTEMS**								
2401	Drive Pump Assemblies								
	Tandem Gear Pump	Service		0.5				36	
		Test		0.5				18,22,36,38	
		Replace		1.5				36	
		Repair			2.0			16,20,36	
	Piston Pump	Service		0.5				36	
		Test		0.5				19,36	
		Replace		1.0				20,36	
2402	Control Valves								
	Main Control Valve Assembly	Adjust		0.5				19,36	
		Replace		2.0				19,36	
		Repair			2.0	2.0		37	
	MLRS Attachment Control Valve Assembly	Replace		1.0				19,36	
		Repair			2.0			37	
	Priority Valve	Replace		0.5				19,36	
		Repair			1.0			36	
	Relief Valve, Frame Tilt/ Brakes	Test		0.5				36	
		Replace		0.5				19,36	
		Repair			1.0			37	
	Shuttle Valve	Replace		0.5				19,36	
	Frame Tilt Valve	Replace		0.5				19,36	
		Repair			1.5			20,24,36	
	Boom Cylinder Flow Control Valve	Replace		0.4				19,36	
	Hydraulic Joystick	Replace		1.0				36	
		Repair				1.5		37	
2404	Tilt Cylinder								
	Frame Tilt Cylinder	Service		0.3				36	
		Replace		0.7				20,36	
		Repair			1.0	1.0		20,23,36,37	
	Carriage Tilt Cylinder	Service		0.3				36	
		Replace		1.0				20,36	
		Repair			1.0	1.0		20,24,36,37	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
24	**HYDRAULIC FLUID SYSTEMS - Continued**								
2405	Attachment								
	Carriage Assembly	Inspect	0.1						
		Service		0.3				36	
		Replace			1.5			20,36	
		Repair				2.0		37	
	Forks	Inspect	0.1						
		Replace		1.0				19,36	
	Fork Bushings	Inspect	0.1						
		Replace		0.5				19,36	
	MLRS Lifting Tool	Inspect	0.1						
		Replace	0.2	0.2				36	Q
	MLRS Attachment	Inspect	0.1						
		Service		0.3				36	
		Replace		0.5				19,36	
		Repair				2.0		34	L
	Backrest	Inspect	0.1						
		Replace	0.1	0.1				36	Q
		Repair			1.0			34	L
	Boom Assembly	Inspect		0.5					
		Service		0.2				36	
		Replace			5.0			20,36	
		Repair			8.0			37	
	Boom Pivot Pins	Inspect	0.1						
		Service		0.1				36	
		Replace			1.0			20,36	
	Wear Pads	Inspect		0.5				36	
		Replace			8.0			20,36	O
	Pulley	Replace		1.0				19,36	
	Sheave	Replace		1.0				19,36	
	Extend and Retract Chains	Inspect		0.1					
		Adjust		0.5				36	
		Replace			4.0			20,36,38	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
24	**HYDRAULIC FLUID SYSTEMS - Continued**								
2406	Strainers, Filters, Lines and Fittings								
	Hoses, Lines and Fittings	Inspect	0.1						F
		Adjust		1.0				1	
		Replace		1.0				20,36	
		Repair			0.5			20,36,38	
	Tubing	Inspect	0.1						
		Replace		0.5				18,36	
	Oil Sampling Valve	Service	0.1						
		Replace		0.1				36	
	Strainer	Service		0.2				36	
		Replace		0.5				36	
	Oil Filter	Replace		0.2				19,36	
2407	Hydraulic Cylinders								
	Boom Extend Cylinder	Inspect	0.2						
		Replace			3.0			20,36	
		Repair			1.5	1.5		20,23,36	
	Fork Sideshift Cylinders	Inspect	0.2						
		Replace		1.0				20,36	
		Repair			1.0	1.0		20,25,36	
	Boom Hoist Cylinders	Inspect	0.2						
		Service		0.1				36	
		Replace		1.0				20,36	
		Repair			1.5	1.5		20,23,36	
	MLRS Attachment Cylinder	Inspect	0.2						
		Service		0.1				36	
		Replace		1.5				20,36	
		Repair			1.5	1.5		20,24,35,36	
31	**BASIC ISSUE ITEMS, MANUFACTURED INSTALLED**								
3100	Basic Issue Items								
	Emergency Boom Lift Kit	Replace		0.2				36	

Table 1. MAC for the 6K Forklift - Continued.

(1)	(2)	(3)	(4) Maintenance Level					(5)	(6)
			Field			Sustainment			
			Unit		DS	GS	DEPOT		
Group Number	Component/ Assembly	Maintenance Function	C	O	F	H	D	Tools and Equipment	Remarks
47	**GAUGES (NON-ELECTRICAL)**								
4702	Gauges, Mountings, Lines and Fittings								
	Sight Gauges	Inspect	0.1						
		Replace		0.5				36	
	Air Cleaner Restrictions Indicator	Inspect	0.1						
		Replace		0.5				36	

Table 2. Tools and Test Equipment Requirements for The 6K Forklift.

(1) Tools or Test Equipment Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
1	F	Adapter, (1/2 to 3/4 in. drive)		
2	F	Alignment, Tool		
3		Bearing Driver, Insert	5120-01-311-7242	8801803
4		Bearing Driver, Insert	5120-01-311-7243	8801804
5	O	Charging Kit, Pressure	4940-01-046-7109	8762813
6		Clutch Pack, Lift	5120-01-311-9161	8801802
7		Differential Resistance Tool		
8		Drive Gear Installation Tool		
9	F	Driver, Group		
10	F	Drivershaft/Pump Housing Bearing Installation Tool		
11	F	Driveshaft/Pump Housing Bearing Removal Tool		
12	F	Housing Bearing Race Installation Tool		
13		Housing Bearing Race Removal Tool		
14	F	Planetary Hub Drag Tool		
15	O	Protractor, Circular	6675-00-599-8859	1931A6
16	F	Seal Removal Tool		
17	O,F	Shaft Seal Driver		
18	O	Shop Equipment, Automotive Maintenance, Common No. 2 Less Power SC 4910-95-CL-A72	4910-00-754-0650	W32730
19	O	Shop Equipment, Automotive Maintenance and Repair, Common No. 1 Less Power SC4910-95-CL-A74	4910-00-754-0654	W32593
20	F	Shop Equipment, Automotive Maintenance and Repair, Field Maintenance, Basic, Less Power SC4910-95-CL-A31	4910-00-754-0705	T24660

Table 2. Tools and Test Equipment Requirements for The 6K Forklift - Continued.

(1) Tools or Test Equipment Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
21	F	Shop Equipment, Fuel and Electrical System Engine: Field Maintenance Basic, Less Power SC4910-95-CL-A01	4910-00-754-0714	T30414
22	O,F	Simplified Test Equipment for Internal Combustion Engines (STE/ICE-R) TM 9-4910-571-34&P	4910-00-124-2554	
23	H	Spanner Wrench, Boom Lift Cylinder and Boom Extend Cylinder	5120-01-368-1826	34-307
24	H	Spanner Wrench, Carriage Tilt and Attachment Hoist Cylinder	5935-00-478-0129	608862
25	H	Spanner Wrench, Fork Sideshift Cylinder - Inner Gland	5120-01-309-2047	6608872
26	H	Spanner Wrench, Fork Sideshift Cylinder - Outer Gland	5999-00-572-8870	608882
27	H	Spanner Wrench, Fork Sideshift Cylinder - Outer Piston	5120-01-309-2045	6608892
28		Spanner Wrench, Frame Tilt Cylinder		608852
29	O	Template, Fuel Pump	4910-01-074-0020	
30	O	Template, Level		
31	F	Test Set, Diesel Injector	4910-00-317-8265	5910359
32	F	Tool Barring		
33	F	Tool, Engine Barring, Bore Adapter	5120-01-285-5195	377371
34	F	Tool Kit, Body and Fender Repair SC5180-90-CL-N34	5180-00-754-0643	W33689
35	H	Tool Kit, Clutch Aligning	5180-01-307-9395	8801801
36	O	Tool Kit, General Mechanic's, SC5180-95-CL-N26	5180-00-177-7033	W33004
37	F,H	Tool Kit, Machinists: Post, Camp and Station SC5280-95-CL-A02	5280-00-511-1950	W44512

Table 2. Tools and Test Equipment Requirements for The 6K Forklift - Continued.

(1) Tools or Test Equipment Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
38	O	Tool Outfit, Hydraulic System Test and Repair (HSTRU) SC4940-95-CL-B07	4940-01-036-5784	13221E6850
39	H	Valve Block Bearing Race Installation Tool		
40	H	Valve Block Bearing Race Removal Tool		
41	H	Valve Seat Installation Staking Tool		
42	O	Wrench, Pipe	5120-00-776-1840	W18-36
43	F	Wrench Set, Spanner		609911
44	F	Yoke Nut Tool		

Table 3. Remarks for the 6K Forklift.

(1) REFERENCE CODE	(2) REMARKS
A	Engine assembly is manufactured to metric measure.
B	STE/ICE-R tests.
C	Service by changing oil and filter.
D	Consists of valve clearance adjustment.
E	Oversize/undersize replacement bearings are available.
F	Inspect for leakage.
G	Includes timing the injection pump using a timing pin method.
H	Consists of cleaning element with compressed air, if appropriate. Crew can remove and clean inner element.
I	Fuel and hydraulic tanks are incorporated in one assembly.
J	Crew adds oil or fuel; Organizational drains, cleans and refills the tank/reservoir.
K	Fuel control lever travel adjustment.
L	May be repaired by welding.
M	Front and rear differential carriers and planetaries are identical, except No-Spin differential is used on front axle.
N	Includes replacement of instrument panels, seat, etc.
O	Only inspect wear pads that are visible at boom ends.
P	End play adjustment.
Q	Crew can remove and install only.
R	Organizational uses built-in indicator lights to test joystick functions. Direct support tests joystick functions with ammeter.
S	Repair by replacement of down parts.

EXPENDABLE AND DURABLE ITEMS LIST 0323 00

SCOPE

This work package lists expendable and durable items you will need to maintain the 6K Forklift. This listing is for information only and is not authorized 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 Adhesive, 3-M, (Item 1, WP 0323 00)].
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	O	8010-01-260-5915	ADHESIVE, 3-M, No. 80 (04963) (TRAK 8526038) 1 Can	 OZ
2	O	6810-00-543-7415	ALCOHOL, Denatured (OMU53) 27 CFR 21,35	GAL
3	F	6810-00-543-7415	ALUMILASTIC	OZ
4	O	6810-00-527-2476	AMMONIA	QT
5	O		ANTIFREEZE, Permanent Arctic, MIL-A-11755 (81349)	
		6850-00-174-1806	55 Gallon Drum	GAL
6	O		ANTIFREEZE: Permanent, Ethylene Glycol, Inhibited (81349) MIL-A-46153	
		6850-00-181-7929	1 Gallon Can	GAL
		6850-00-181-7933	5 Gallon Can	GAL
		6850-00-181-7940	55 Gallon Drum	GAL
7	O		BARRIER MATERIAL: Grade A (81349) MIL-B-121 300 Foot Roll	 EA
8	O	5340-00-450-5718	CAP and PLUG Set (19207) 10935405	
9	O	6850-01-080-2387	CAULK, Silicone, Clear	TU
10	C		CLEANING COMPOUND: Solvent, Type III (81349) MIL-PRF-680	
		6850-01-474-2318	1 Gallon Can	CN
		6850-01-474-2320	5 Gallon Can	CN
		6850-01-474-2321	55 Gallon Drum	DR
11	O		COMPOUND, Anti-seize MIL-T-83483 (81349)	
		8030-00-293-3285	1 Can	LB
12	F	5350-00-584-4654	CLOTH, Medium Grit, Emery	OZ
13	F	8010-00-664-1414	COMPOUND, Prussian Blue Marking (58536) AA3108-2A-001Q 1 Quart Can	QT
14		8040-00-851-0211	COMPOUND, Sealing RTV-732 Black (71794)	TU

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
15	F	5350-01-010-7007	COMPOUND, Valve Lapping (1PQB8) 80037 Box of 12; 3 Ounce Tubes	OZ
16	F	5330-01-221-0872	CROCUS, Cloth	
17	F		DETERGENT, Laundry (81346) ASTM D 496 (81346) 7930-00-634-3935 200 Pound Drum	LB
18	O	6850-00-926-2276	FLUID, Windshield Washer	QT
19	F		GLOVES, Insulated	PR
20			GREASE, Automotive and Artillery GAA, MIL-G-10924 (81349) (SAE-J-310)	
	O	9150-00-935-1017	14 oz. Cartridge	OZ
	O	9150-00-190-0905	6 Pound Can	LB
	O	9150-00-190-0907	35 Pound Can	LB
21	O	9150-00-735-1800	GREASE, Silicone	TU
22	O	9150-00-250-0933	JELLY, Petroleum	LB
23	F	8040-00-264-3860	K & W Copper Coat 1504	OZ
24	F		LUBRICANT, Delco-Remy 1948791, AMOCO 1272	OZ
25	O	2640-00-256-5526	LUBRICANT, Ru-Glide Rubber	LB
26	F	7050-00-961-7663	LUBRIPLATE No. 105 ST40334 (90536)	CN
27			OIL, Fuel, Diesel, DF-1 Winter VVF800 (81349)	
	O	9140-00-286-5287	5 Gallon Can	GAL
	O	9140-00-286-5288	55 Gallon Drum	GAL
	O	9140-00-286-5286	Bulk	GAL
28			OIL, Fuel, Diesel, DF-2 Regular VVF800 (81349)	
	O	9140-00-286-5295	5 Gallon Can	GAL
	O	9140-00-286-5296	55 Gallon Drum	GAL
	O	9140-00-286-5294	Bulk	GAL
29			OIL, Fuel, Diesel, DF-A Arctic WF800 (81349)	
	O	9140-00-286-5282	5 Gallon Can	GAL
	O	9140-00-286-5284	55 Gallon Drum	GAL
	O	9140-00-286-5283	Bulk	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
30			OIL, Lubricating OE/HDO-15/40, MIL-PRF-2104 (81349)	
		9150-01-152-4117	1 Quart Can	QT
		9150-01-152-4118	5 Gallon Can	GAL
		9150-01-152-4119	55 Gallon Drum	GAL
31			OIL, Lubricating, Engine Arctic OEA, MIL-L-46167 (81349)	
	O	9150-00-402-4478	1 Quart Can	QT
	O	9150-00-402-2372	5 Gallon Can	GAL
	O	9150-00-491-7197	55 Gallon Drum	GAL
32			OIL, Lubricating, Gear Multipurpose GO 80/90 MIL-L-2105D (81349)	
	O	9150-01-035-5392	1 Quart Can	QT
	O	9150-01-035-5393	5 Gallon Can	GAL
	O	9150-01-035-5394	55 Gallon Drum	GAL
33			OIL, Lubricating, Transmission/Hydraulic OE/HDO-10 MIL-L-2140D (81349)	
	O	9150-00-189-6727	1 Quart Can	QT
	O	9150-00-191-2772	55 Gallon Drum	GAL
34	O		OIL, Preservative (MIL-P-46093)	
		9150-00-889-3523	1 Quart Can	QT
		9150-00-985-7293	5 Gallon Can	GAL
		9150-00-407-0973	55 Gallon Drum	GAL
35	F		PADS, Scotch Brite	
36	O	5350-00-619-9167	PAPER, Emery, Grit #80	PCS
37	O		PETROLATUM - Technical 82146 (14P1)	
		9150-00-250-0926	1.75 Pound Can	LB
38			PLASTIGAGE	
		5210-00-640-6176	0.004-0.009 Inch Clearance Range (74069) HPB1 Blue Color, Box of 12	BX
		5210-00-640-6177	0.001-0.003 Inch Clearance Range (74069) HPG1 Green Color, Box of 12	BX
		5210-00-640-6178	0.002-0.006 Inch Clearance Range (74069) HPR1 Red Color, Box of 12	BX

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
39	O	8010-00-159-4518	PRIMER, Metal	QT
40	O	7920-00-205-3570	RAG, Wiping A-A-531 (58536)	LB
41	F	5350-00-619-9166	SANDPAPER No. 100	
42	F	8030-01-126-9460	SEALANT, Loctite 222 (05972) 222	OZ
43	O	8030-01-014-5869	SEALANT, Loctite 242 MIL-S-46163 Type II Grade N (80244)	OZ
44	F	8030-01-142-3131	SEALANT, Loctite 262 (05972) 26241 250 Cubic Centimeter Bottle	CC
45	O	8030-01-158-6070	SEALANT, Loctite 271 MIL-S-46163 Type I Grade L (80244)	OZ
46	O	8030-01-063-7510	SEALANT, Loctite 277 MIL-S-46163 Type I Grade L (80244)	OZ
47	O	8030-00-180-6150	SEALANT, Loctite 609 MIL-R-46082B Type I (05962)	OZ
48	O	8030-00-204-9149	SEALANT, Loctite 59241	OZ
49	F	8030-00-251-3980	SEALANT, Loctite 767-64	OZ
50	F	8030-00-656-1426	SEALANT, Permatex, Aviation Form A Gasket No. 3, MIL-S-45180C (77247), 1 Tube	TU
51	O	8030-00-111-2762	SEALER, Ribbon (05972) 29031 50 Cubic Centimeter Bottle	CC
52	O	7930-00-282-9699	SOAP, Liquid (83421) 7930-00-282-9699 1 Gallon Can	GAL
53	O	6810-00-264-6618	SODA, Baking	OZ
54	O		SOLVENT, Chlorinated	QT
55	F		SOLVENT, Rust Penetrating	

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
56			STRAP, Tie Down	
	O	5975-00-903-2284	(96906) MS3367-4-0 4 Inch Length, Black Package of 100	EA
	O	5975-00-984-6582	(96906) MS3367-1-0 6 Inch Length, Black Package of 100	EA
	O	5975-00-935-5946	(96906) MS3367-2-1 13.35 Inch Minimum Length, Brown Package of 100	EA
57			TAG: Marker (64067) 9905-00-537-8954	
	O	9905-00-989-1485	Package of 50	EA
58			TAPE, Electrical	
	O	5970-00-989-1485	(75037) 33 260 Inch Roll	IN
59	O	8010-00-180-6343	VARNISH, Anti-Fungus	QT
60	O	6810-00-356-4936	WATER, Distilled	GAL

END OF WORK PACKAGE

TOOL IDENTIFICATION LIST 0324 00

SCOPE

This work package lists all common tools and supplements and special tools/fixtures needed to maintain the 6K Forklift.

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 39, WP 0324 00).
2. **Column (2) - Item Name.** This column lists the item by noun nomenclature and other descriptive features (e.g., Cutter, tube).
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

Table 1. Tool Identifications List Requirements for the 6K Forklift.

(1) Tools or Test Equipment Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
1	F	Adapter, (1/2 to 3/4 in. drive)		
2	F	Alignment, Tool		
3		Bearing Driver, Insert	5120-01-311-7242	8801803
4		Bearing Driver, Insert	5120-01-311-7243	8801804
5	O	Charging Kit, Pressure	4940-01-046-7109	8762813
6		Clutch Pack, Lift	5120-01-311-9161	8801802
7		Differential Resistance Tool		
8		Drive Gear Installation Tool		
9	F	Driver, Group		
10	F	Drivershaft/Pump Housing Bearing Installation Tool		
11	F	Driveshaft/Pump Housing Bearing Removal Tool		
12		Heat Gun, Electric		
13	F	Housing Bearing Race Installation Tool		
14		Housing Bearing Race Removal Tool		
15	F	Planetary Hub Drag Tool		
16	O	Protractor, Circular	6675-00-599-8859	1931A6
17	F	Seal Removal Tool		
18	O,F	Shaft Seal Driver		
19	O	Shop Equipment, Automotive Maintenance, Common No. 2 Less Power SC 4910-95-CL-A72	4910-00-754-0650	W32730
20	O	Shop Equipment, Automotive Maintenance and Repair, Common No. 1 Less Power SC4910-95-CL-A74	4910-00-754-0654	W32593
21	F	Shop Equipment, Automotive Maintenance and Repair, Field Maintenance, Basic, Less Power SC4910-95-CL-A31	4910-00-754-0705	T24660

Table 1. Tool Identification List for the 6K Forklift - Continued.

(1) Tools or Test Equipment Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
22	F	Shop Equipment, Fuel and Electrical System Engine: Field Maintenance Basic, Less Power SC4910-95-CL-A01	4910-00-754-0714	T30414
23	O,F	Simplified Test Equipment for Internal Combustion Engines (STE/ICE-R) TM 9-4910-571-34&P	4910-00-124-2554	
24	H	Spanner Wrench, Boom Lift Cylinder and Boom Extend Cylinder	5120-01-368-1826	34-307
25	H	Spanner Wrench, Carriage Tilt and Attachment Hoist Cylinder	5935-00-478-0129	608862
26	H	Spanner Wrench, Fork Sideshift Cylinder - Inner Gland	5120-01-309-2047	6608872
27	H	Spanner Wrench, Fork Sideshift Cylinder - Outer Gland	5999-00-572-8870	608882
28	H	Spanner Wrench, Fork Sideshift Cylinder - Outer Piston	5120-01-309-2045	6608892
29		Spanner Wrench, Frame Tilt Cylinder		608852
30	O	Template, Fuel Pump	4910-01-074-0020	
31	O	Template, Level		
32	F	Test Set, Diesel Injector (Use with Item 33)	4910-00-317-8265	5910359
33		Oil, Preservative MIL-P-46093 1-Quart Can	9150-00-889-3523	QT
34	F	Tool Barring		
35	F	Tool, Engine Barring, Bore Adapter	5120-01-285-5195	377371
36	H	Tool, Special Lifting		
37	F	Tool Kit, Body and Fender Repair SC5180-90-CL-N34	5180-00-754-0643	W33689
38	H	Tool Kit, Clutch Aligning	5180-01-307-9395	8801801
39	O	Tool Kit, General Mechanic's, SC5180-95-CL-N26	5180-00-177-7033	W33004

Table 1. Tool Identification List for the 6K Forklift - Continued.

(1) Tools or Test Equipment Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
40	F,H	Tool Kit, Machinist's: Post, Camp and Station SC5280-95-CL-A02	5280-00-511-1950	W44512
41	O	Tool Outfit, Hydraulic System Test and Repair (HSTRU) SC4940-95-CL-B07	4940-01-036-5784	13221E6850
42	H	Valve Block Bearing Race Installation Tool		
43	H	Valve Block Bearing Race Removal Tool		
44	H	Valve Seat Installation Staking Tool		
45	O	Wrench, Pipe	5120-00-776-1840	W18-36
46	F	Wrench Set, Spanner		609911
47	F	Yoke Nut Tool		

END OF WORK PACKAGE

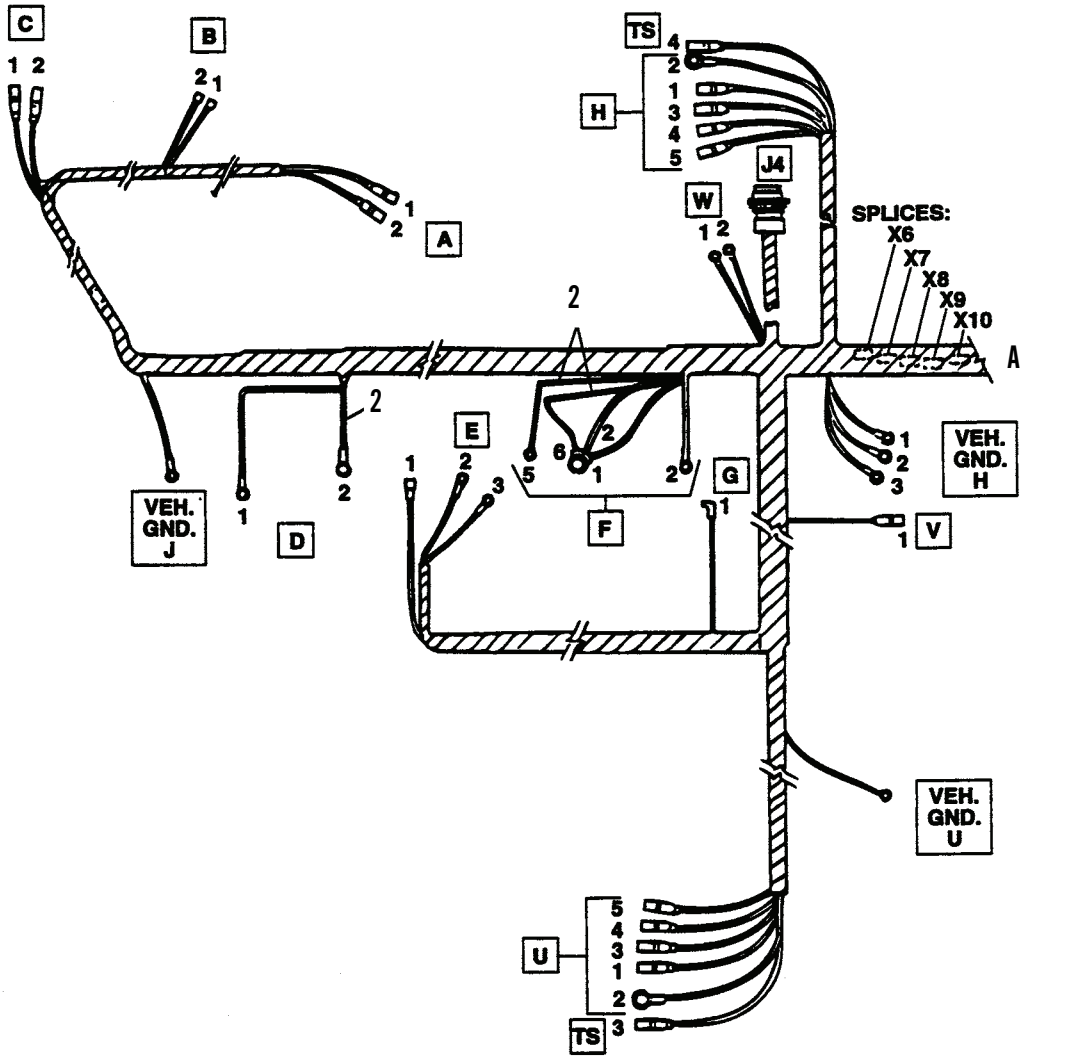
ILLUSTRATED LIST OF MANUFACTURED ITEMS 0325 00

INTRODUCTION

1. This work package includes complete instructions for making items authorized to be manufactured or fabricated at the Unit, Direct Support and General Support Maintenance levels.
2. A part number index (Table 1. Manufactured Items Part Number Index) in alphanumeric order is provided for cross-referencing part number of manufactured item to figure where fabrication criteria is covered.
3. All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustration.

MAIN WIRING HARNESS

Main Wiring Harness.



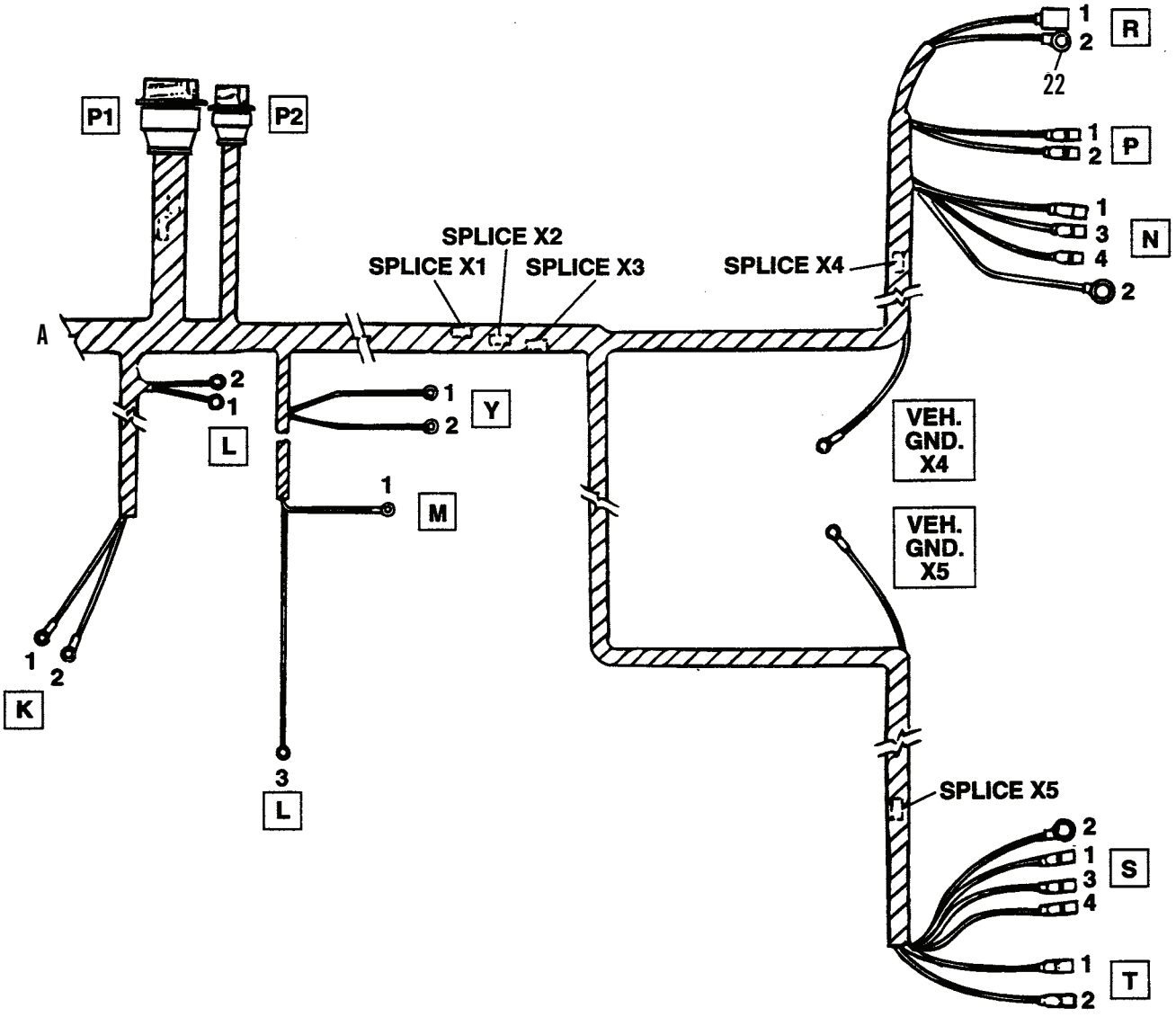
NOTE

All wires are 16 AWG (Item 1) unless otherwise indicated.

Item	Cage	Part No.	Description	QTY
--	3Y949	6602745	Frame Wiring Harness	1
1	64488	81163S	Wire, 16 AWG	AR
2	64488	81103S	Wire, 10 AWG	AR

MAIN WIRING HARNESS - CONTINUED

Main Wiring Harness.



409-126

NOTE

All wires are 16 AWG (Item 1) unless otherwise indicated.

MAIN WIRING HARNESS - CONTINUED

Component Identification

A . . . . Left Rear Floodlight
B . . . . Backup Alarm
C . . . . Right Rear Floodlight
D-1 . . Water Temperature Sender
D-2 . . Alternator
E-1 . . Fuel ON/OFF Switch (Injector Pump)
E-2 . . Oil Pressure Sender
E-3 . . Low Oil Pressure Switch
F . . . . Starter . S
G . . . . Water Temperature Switch
H . . . . Left Rear Blackout/Tail/Stop Light Assembly
J4 . . . Boom Receptacle
K . . . . Neutral Safety Switch
L-1 Transmission Temperature Sender
L-2 Transmission Temperature Switch
L-3 Fuel Level Sender
M Emergency Steering Motor
N Left Front Blackout/Turn Signal/Parking Light Assembly
P Left Headlight
R Blackout Headlight
S Right Front Blackout/Turn Signal/Parking Light Assembly
T Right Headlight
U Right Rear Blackout/Tail/Stop Light Assembly
V Cold Start Circuit
W Start Relay
Y Hydraulic Pressure Switch

Table 1. Wire List.

Connection Points	Wire No.	Length: in. (cm)
A-1 to X10	73	AR
A-2 to X13	2	AR
B-1 to P1-19	21	177.0 (150.0)
B-2 to X13	2	AR
C-1 to X10	73	AR
C-2 to X13	2	AR
D-1 to P1-10	15	143.0 (363.5)
D-2 to F-3	9	53.0 (135.0)
E-1 to P1-17	7	151.0 (383.5)
E-2 to P1-12	17	151.0 (383.5)
E-3 to P1-13	16	151.0 (383.5)
F-1 to P2-1	9	112.0 (284.5)
F-2 to K-1	4A	124.0 (315.0)
F-3 to D-2	9	53.0 (135.0)
F-5 to W-1	38	29.0 (74.0)

MAIN WIRING HARNESS - CONTINUED

Table 1. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
F-6 to W-2	39	AR
G-1 to P1-11	14	128.0 (325.5)
H-1 to X6	45	AR
H-2 to VEH. GND H-2	2	73.0 (185.5)
H-3 to X7	43	AR
H-4 to X8	44	AR
H-5 to X9	46	AR
J4		
-A to P1-30	54	141.0 (358.5)
-C to VEH. GND H-3	2	86.0 (218.5)
-H to P1-28	52	141.0 (358.5)
-J to P1-29	53	141.0 (358.5)
-K to P1-27	51	141.0 (358.5)
-L to P1-32	56	141.0 (358.5)
-M to P1-33	57	141.0 (358.5)
-N to P1-37	50	141.0 (358.5)
-P to P1-35	65	141.0 (358.5)
-R to P1-36	64	141.0 (358.5)
-S to P1-34	58	141.0 (358.5)
-W to P1-25	71	141.0 (358.5)
-X to P1-31	55	141.0 (358.5)
K-1 to F-2	4A	124.0 (315.0)
K-2 to P1-18	4	87.0 (221.0)
L-1 to P1-14	19	67.0 (170.5)
L-2 to P1-15	18	67.0 (170.5)
L-3 to P1-16	12	96.0 (244.0)
M-1 to P1-21	92	57.0 (145.0)
N-1 to X2	48	AR
N-2 to X4	2	AR
N-3 to X1	45	AR
N-4 to X11	27	AR
P-1 to X3	49	AR

MAIN WIRING HARNESS - CONTINUED

Table 1. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
P-2 to X4	2	AR
P1		
-1 Blank		
-2 to X3	49	AR
-3 to R-1	47	285.0 (724.0)
-4 to X2	48	AR
-5 to X1	45	AR
-6 to X7	43	AR
-7 to X8	44	AR
-8 to X9	46	AR
-9 to X11	27	AR
-10 to D-1	15	143.0 (363.5)
-11 to G-1	14	128.0 (325.5)
-12 to E-2	17	151.0 (383.5)
-13 to E-3	16	151.0 (383.5)
-14 to L-1	19	67.0 (170.5)
-15 to L-2	18	67.0 (170.5)
-16 to L-3	12	96.0 (244.0)
-17 to E-1	7	151.0 (383.5)
-18 to K-2	4	87.0 (221.0)
-19 to B-1	21	177.0 (450.0)
-20 to V-1	8	111.0 (282.0)
-21 to M-1	92	57.0 (145.0)
-22 to Y-2	91	31.0 (79.0)
-23 to Y-1	10	31.0 (79.0)
-24 to X10	73	AR
-25 to J4-W	71	141.0 (358.5)
-26 to X12	28	AR
-27 to J4-K	51	141.0 (358.5)
-28 to J4-H	52	141.0 (358.5)
-29 to J4-J	53	141.0 (358.5)
-30 to J4-A	54	141.0 (358.5)

MAIN WIRING HARNESS - CONTINUED

Table 1. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
-31 to J4-X	55	141.0 (358.5)
-32 to J4-L	56	141.0 (358.5)
-33 to J4-M	57	141.0 (358.5)
-34 to J4-S	58	141.0 (358.5)
-35 to J4-P	65	141.0 (358.5)
-36 to J4-R	64	141.0 (358.5)
-37 to J4-N	50	141.0 (358.5)
PS		
-1 to F-1	9	112.0 (284.5)
-2 to VEH. GND. H-1	2	84.0 (213.5)
-3 Blank		
R-1 to P1-3	47	285.0 (724.0)
R-2 to X4	2	AR
S-1 to X2	48	AR
S-2 to X5	2	AR
S-3 to X1	45	AR
S-4 to X12	28	AR
T-1 to X3	49	AR
T-2 to X5	2	AR
TS-3 to X12	28	AR
TS-4 to X11	27	AR
U-1 to X6	45	AR
U-2 to VEH. GND. U	2	63.0 (160.0)
U-3 to X7	43	AR
U-4 to X8	44	AR
U-5 to X9	46	AR
V-1 to P1-20	8	111.0 (282.0)
W-1 to F-5	38	29.0 (74.0)
W-2 to F-6	39	
Y-1 to P1-23	10	31.0 (79.0)
Y-2 to P1-22	91	31.0 (79.0

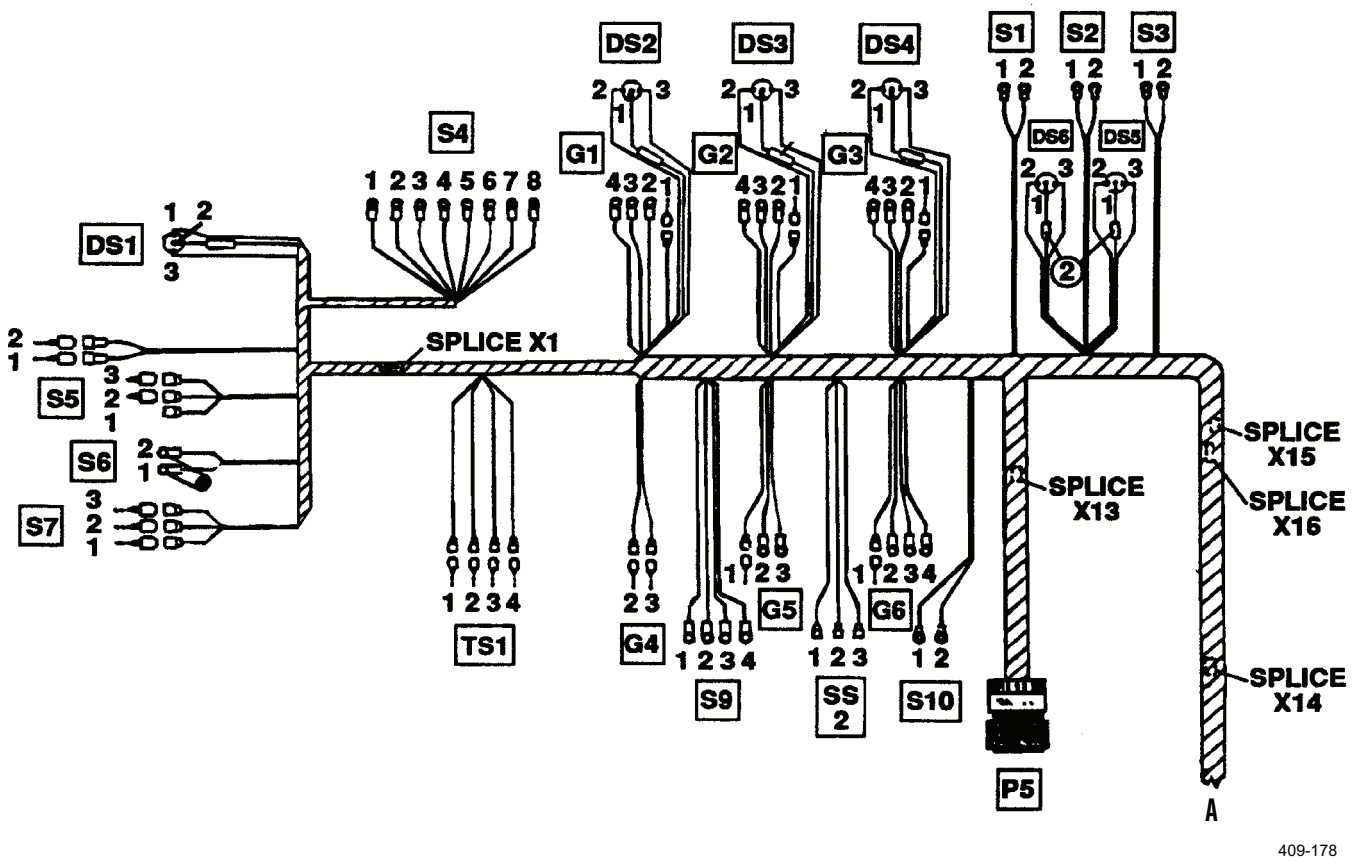
MAIN WIRING HARNESS - CONTINUED

Table 1. Wire List - Continued.

Connection Points	Wire No.	Length (Inches)
Splice-to-Splice Connections		
X1 to X6	45	AR
Splice-to-Vehicle Ground Connections		
X4 to VEH. GND. X4	2	AR
X5 to VEH. GND. X5	2	AR
X13 to VEH. GND. J	2	AR

CAB WIRING HARNESS

Cab Wiring Harness.



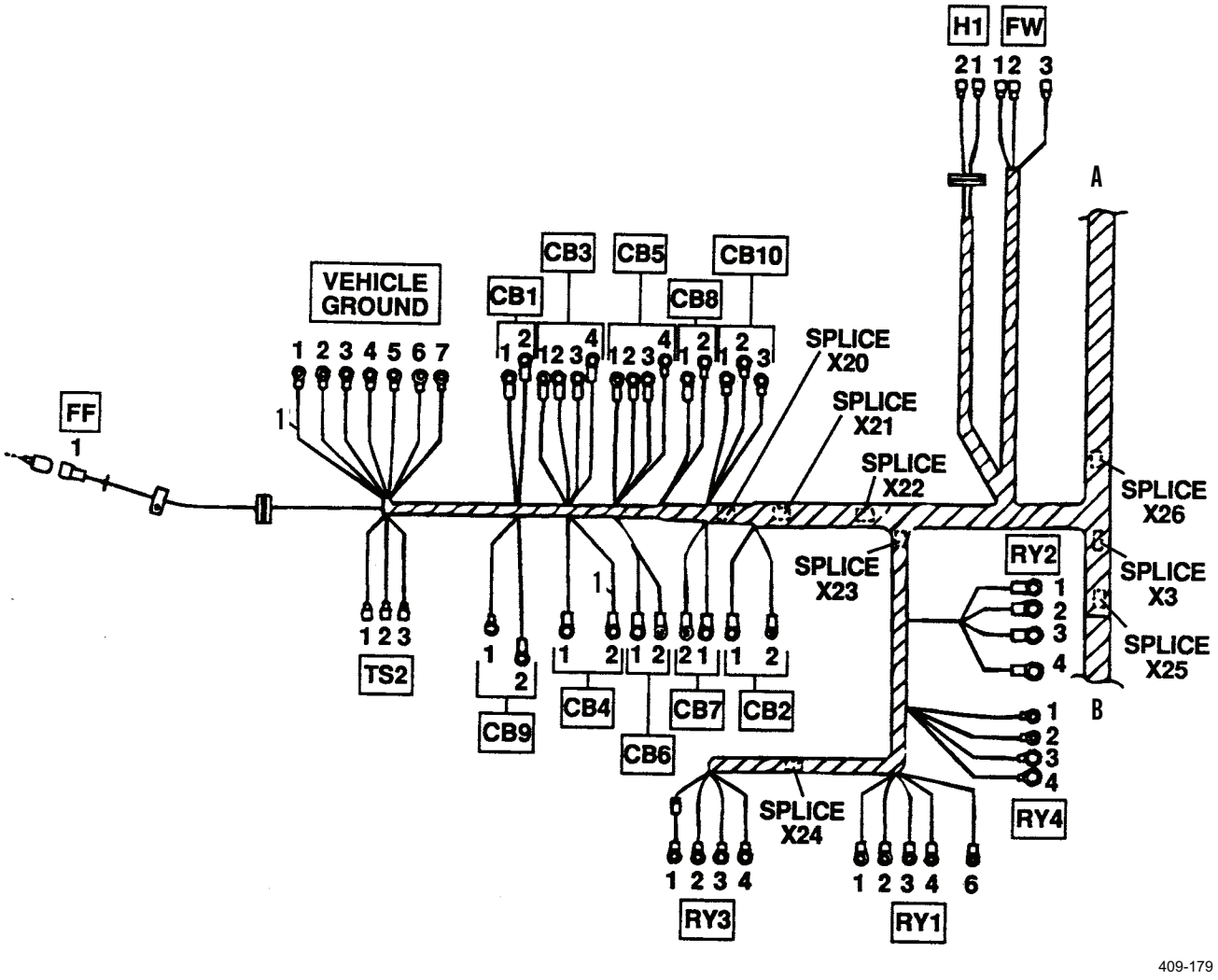
NOTE

All wires are 16 AWG, single conductor (item 3) unless otherwise noted.

Item	Cage	Part No.	Description	QTY
--	3Y949	6602765	Cab Wiring Harness	1
1	64488	81083S	Wire, 8 AWG	AR
2	64488	81143S	Wire, 14 AWG	AR
3	64488	81163S	Wire, 16 AWG	AR

CAB WIRING HARNESS - CONTINUED

Cab Wiring Harness - Continued.

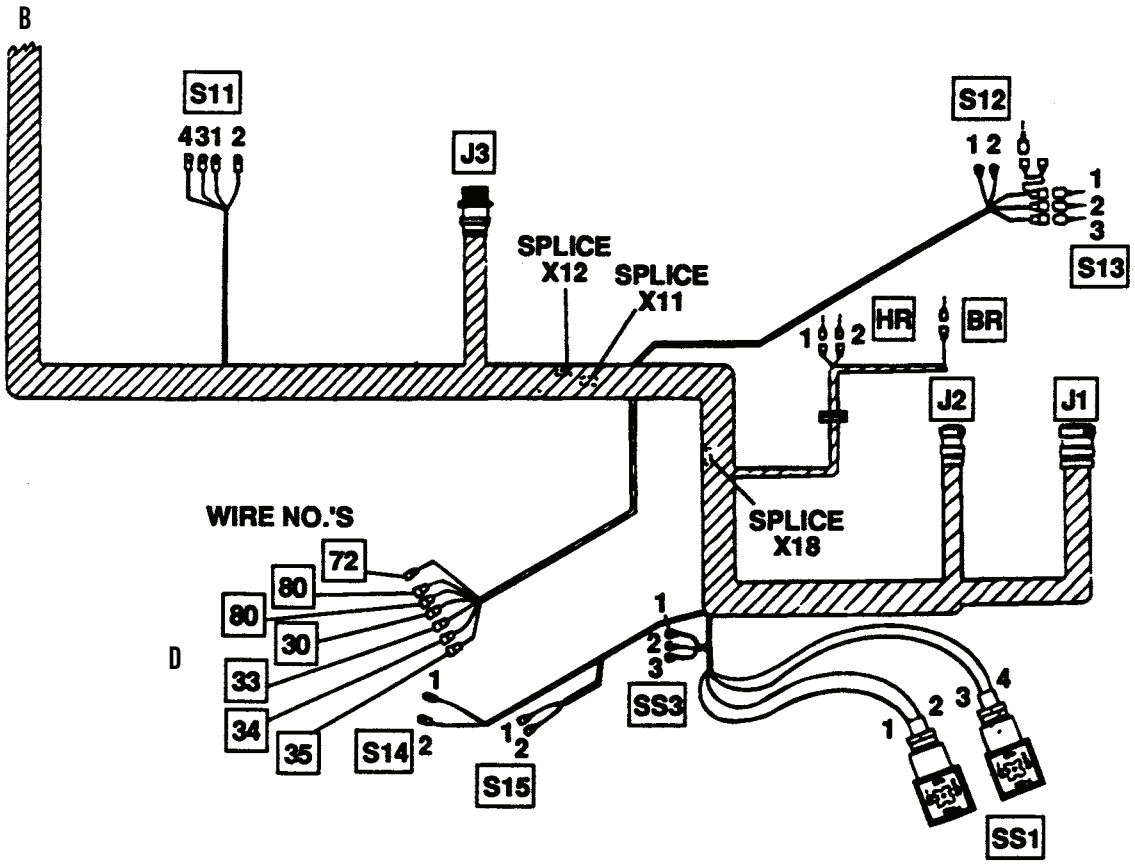


NOTE

All wires are 16 AWG (item 3) unless otherwise indicated.

CAB WIRING HARNESS - CONTINUED

Cab Wiring Harness - Continued.



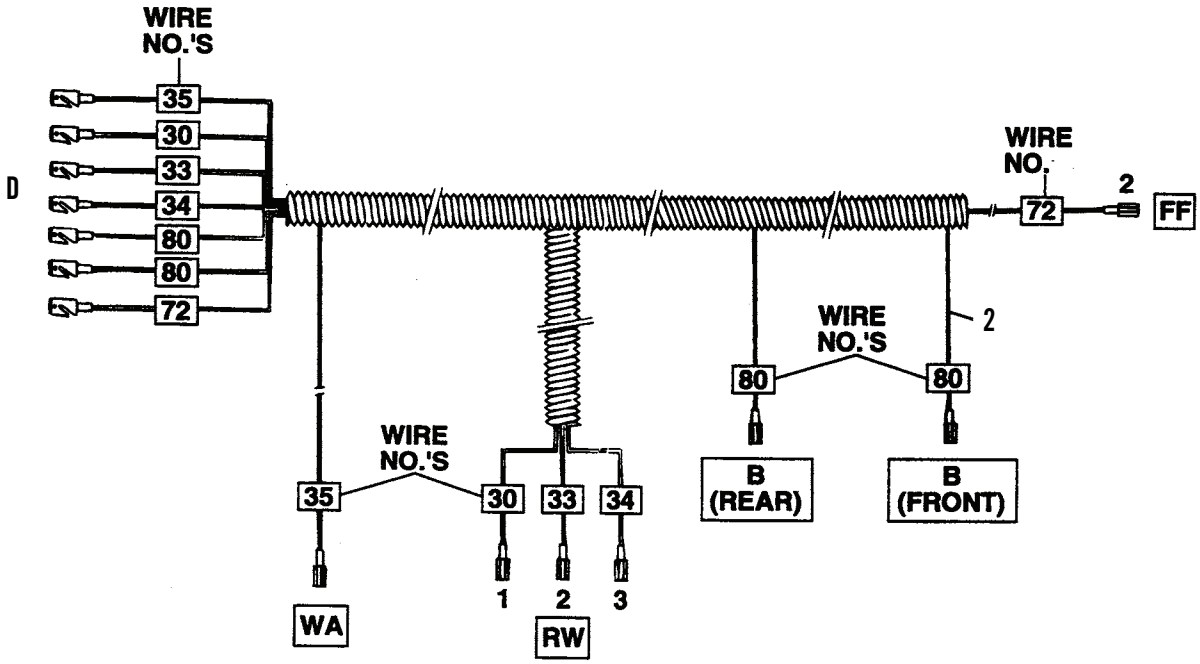
409-193

NOTE

All wires are 16 AWG (item 3) unless otherwise indicated.

CAB WIRING HARNESS - CONTINUED

Cab Wiring Harness - Continued.



409-194

NOTE

All wires are 16 AWG (item 3) unless otherwise indicated.

CAB WIRING HARNESS - CONTINUED

Component Identification

B . . . . Cab Fans
BR Brake On Switch

Circuit Breakers

CB1. . Gauges.
RW Rear Windshield Wiper
CB2. . Backup Alarm
RY1 Run Relay
CB3. . Wiper/Washer
RY2 Blackout Relay
CB4 . Blackout/Service/Panel Lights
RY3 Emergency Steering Relay
CB5. . Auto Leveler
RY4 Blackout Relay
CB6. . Main . .
S1 Front Floodlight Switch
CB7. . Floodlights
S2 Boom Floodlight Switch
CB8. . Heater Fans
S3 Boom Floodlight Switch
CB9. . Steer Select
S4 Fork Leveler Switch
CB10. Turn Signals/Horn
S5 Front Windshield Wiper Switch
DS1. . Fork Auto Level On Indictor
S6 Windshield Washer Switch
DS2. . High Water Temperature Indicator
S7 Rear Windshield Wiper Switch
DS3. . Low Oil Pressure Indicator
S8 Backup Alarm Switch
DS4. . Low Transmission Oil Pressure Indicator
S9 Ignition Switch
DS5. . Low Brake Fluid Indicator
S10 Horn Switch
DS6. . Brake On Indicator
S11 Fuel Shutoff/Emergency Steering Switch
FF . . . Front Floodlight
S12 Cold Start Switch
FW . . Front Windshield Wiper
S13 Heater Switch
G1 . . . Water Temperature Gauge
S14 Brake Switch
G2 . . . Engine Oil Pressure Gauge
S15 Low Brake Pressure Switch
G3 . . . Transmission Oil Pressure Gauge
SS1 and SS3 Steering Select Circuit
G4 . . . Hourmeter
SS2 Steering Select Circuit
G5 . . . Voltmeter
TS1 Turn Signal Switch
G6 . . . Fuel Gauge
TS2 Flasher
H1 . . . Horn . .
WA Windshield Washer
HR . . Heater

Table 2. Wire List.

Connection Points	Wire No.	Length: in. (cm)
B-1 to X18	80	AR
B-2 to X18	80	AR
BR to DS6-2	23	131.5 (334.0)
CB1-1 to X14	10	AR

CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
CB1-2 to X20	3	9.0 (23.0)
CB2-1 to S8-1	20	59.5 (151.5)
CB2-3 to X21	5	5.0 (13.0)
CB3-1 to X1	30	AR
CB3-2 to RW-1	30	80.0 (203.5)
CB3-3 to FW-1	30	27.0 (69.0)
CB3-4 to X20	3	8.0 (20.5)
CB4-1 to P5-F	40	44.0 (112.0)
CB4-2 to X20	3	AR
CB5-1 to J3-1	50	70.0 (178.0)
CB5-2 to DS1-1	50	58.0 (147.5)
CB5-3 to J1-37	50	107.5 (273.5)
CB5-4 to X20	3	7.0 (18.0)
CB6-1 to J2-1	9	105.0 (267.0)
CB6-2 to X22	1	9.0 (23.0)
CB7-1 to X16	70	AR
CB7-2 to X21	5	6.0 (15.5)
CB8-1 to X18	80	AR
CB8-2 to X20	3	6.0 (15.5)
CB9-1 to SS2-2	83	49.5 (126.0)
CB9-2 to X20	3	4.0 (10.5)
CB10-1 to TS2-1	24	16.0 (41.0)
CB10-2 to RY4-4	29	20.5 (52.5)
CB10-3 to S10-1	20	42.5 (108.0)
DS1-1 to CB5-2	50	58.0 (147.5)
DS1-2 to S4-8	59	9.5 (24.5)
DS1-3 to X15	2	21.0 (53.5)
DS2-1 to X14	10	AR
DS2-2 to J1-11	14	125.5 (319.0)
DS2-3 to X15	2	21.0 (53.5)
DS3-1 to X14	10	AR
DS3-2 to J1-13	16	114.5 (291.0)

CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
DS3-3 to X15	2	12.0 (30.5)
DS4-1 to X14	10	AR
DS4-2 to J1-15	18	121.5 (309.0)
DS4-3 to X15	2	9.0 (23.0)
DS5-1 to X14	10	AR
DS5-2 to S15-1	11	106.5 (270.5)
DS5-3 to X15	2	11.0 (28.0)
DS6-1 to X14	10	AR
DS6-2 to BR	23	131.5 (334.0)
DS6-3 to X15	2	AR
FF-1 to X26	72	AR
FF-2 to X26	72	AR
FW-1 to CB3-3	30	27.0 (69.0)
FW-2 to FW-4	31	6.5 (16.5)
FW-2 to S5-2	31	53.5 (136.0)
FW-3 to FW-5	32	6.5 (16.5)
FW-3 to S5-3	32	53.5 (136.0)
G1-1 to X13	13	AR
G1-2 to X14	10	AR
G1-3 to X15	2	AR
G1-4 to J1-10	15	123.5 (314.0)
G2-1 to X13	13	AR
G2-2 to X14	10	AR
G2-3 to X15	2	AR
G2-4 to J1-12	17	122.5 (311.0)
G3-1 to X13	13	AR
G3-2 to X14	10	AR
G3-3 to X15	2	AR
G3-4 to J1-14	19	119.5 (303.5)
G4-2 to X14	10	AR
G4-3 to X15	2	AR
G5-1 to X13	13	AR

CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
G5-2 to X14	10	AR
G5-3 to X15	2	AR
G6-1 to X13	13	AR
G6-2 to X14	10	AR
G6-3 to X15	2	AR
G6-4 to J1-16	12	119.5 (303.5)
H1-1 to S10-2	22	45.5 (116.0)
H1-2 to VEH. GND. -5	2	32.0 (81.5)
HR-1 to S13-3	82	61.0 (155.0)
HR-2 to S13-2	81	61.0 (155.0)
J1		
-1 Blank		
-2 to P5-M	49	118.5 (301.0)
-3 to P5-D	47	118.5 (301.0)
-4 to P5-L	48	118.5 (301.0)
-5 to X3	45	AR
-6 to P5-C	43	118.5 (301.0)
-7 to P5-N	44	118.5 (301.0)
-8 to P5-H	46	118.5 (301.0)
-9 to TS1-3	27	129.5 (329.0)
-10 to G1-4	15	123.5 (314.0)
-11 to DS2-2	14	125.5 (319.0)
-12 to G2-4	17	122.5 (311.5)
-13 to X25	16	AR
-14 to G3-4	19	118.5 (301.0)
-15 to DS4-2	18	121.5 (309.0)
-16 to G6-9	12	119.5 (303.5)
-17 to S11-1	7	84.5 (215.0)
-18 to S9-3	9	126 (320.0)
-19 to S8-2	21	137.5 (349.5)
-20 to S12-1	8	70.5 (179.5)
-21 to S11-4	92	84.5 (215.0)

CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
-22 to X24	91	AR
-23 to X14	10	AR
-24 to S2-1	73	117.0 (297.5)
-25 to S3-1	71	115.5 (293.5)
-26 to TS1-4	28	129.5 (329.0)
-27 to J3-8	51	61.5 (156.5)
-28 to J3-5	52	61.5 (156.5)
-29 to X12	53	AR
-30 to X11	54	AR
-31 to J3-9	55	61.5 (156.5)
-32 to J3-6	56	61.5 (156.5)
-33 to S4-5	57	135.5 (344.5)
-34 to S4-2	58	135.5 (344.5)
-35 to S4-3	65	135.5 (344.5)
-36 to S4-6	64	135.5 (344.5)
-37 to CB5-3	50	107.5 (273.5)
J2		
-1 to CB6-1	9	105.0 (267.0)
-2 to VEH. GND-1	2	111.0 (282.0)
J3		
-1 to CB5-1	50	60.0 (152.5)
-2 Blank		
-3 to VEH. GND.-2	2	60.0 (152.5)
-4 to X11	54	AR
-5 to J1-28	52	61.5 (156.5)
-6 to J1-32	56	61.5 (156.5)
-7 to X12	53	AR
-8 to J1-27	51	61.5 (156.5)
-9 to J1-31	55	61.5 (156.5)
P5		
-A to S14-1	41	117.0 (297.5)
-B to X13	13	AR

CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
-C to J1-6	43	118.5 (301.0)
-D to J1-3	47	118.5 (301.0)
-E to X3	45	AR
-F to CB4-1	40	44.0 (112.0)
-H to J1-8	46	118.5 (301.0)
-J Blank		
-K S14-2	42	117.0 (297.5)
-L J1-4	48	118.5 (301.0)
-M J1-2	49	118.5 (301.0)
-N J1-7	44	118.5 (301.0)
RW-1 to CB3-2	30	80.0 (203.5)
RW-2 to S7-2	33	105.5 (268.0)
RW-3 to S7-3	34	105.5 (268.0)
RY1-1 to X22	1	11.0 (28.0)
RY1-2 to X20	3	15.0 (38.5)
RY1-3 to S9-2	6	49.5 (126.0)
RY1-4 to S12-2	6	44.0 (112.0)
RY1-6 to X23	2	12.0 (30.5)
RY2-1 to X20	3	11.0 (28.0)
RY2-2 to X21	5	11.0 (28.0)
RY2-3 to X3	45	AR
RY2-4 to X23	2	9.0 (23.0)
RY3-1 to X25‘	16	23.5 (60.0)
RY3-2 to X24	91	12.0 (30.5)
RY3-3 to X14	10	36.0 (91.5)
RY3-4 to X24	91	12.0 (30.5)
RY4-1 to VEH. GND.-7	2	27.5 (70.0)
RY4-2 to X3	45	AR
RY4-3 to X22	1	AR
RY4-4 to CB10-2	29	20.5 (52.5)
S1-1 to X26	72	AR
S1-2 to X16	70	AR

CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
S2-1 to J1-24	73	117.0 (297.5)
S2-2 to X16	70	AR
S3-1 to J1-25	71	115.5 (293.5)
S3-2 to X16	70	AR
S4-1 to X11	54	AR
S4-2 to J1-34	58	135.5 (344.5)
S4-3 to J1-35	65	135.5 (344.5)
S4-4 to X12	53	AR
S4-5 to J1-33	57	135.5 (344.5)
S4-6 to J1-36	64	135.5 (344.5)
S4-7 to VEH. GND.-4	2	64.5 (164.0)
S4-8 to DS1-2	59	9.5 (24.5)
S5-1 to X1	30	AR
S5-2 to FW-2	31	53.5 (136.0)
S5-3 to FW-3	32	53.5 (136.0)
S6-1 to X1	30	AR
S6-2 to WA	35	104.0 (264.5)
S7-1 to X1	30	AR
S7-2 to RW-2	33	105.5 (268.0)
S7-3 to RW-3	34	105.5 (268.0)
S8-1 to CB2-1	20	59.5 (151.5)
S8-2 to J1-19	21	137.5 (349.5)
S9-1 to X22	1	40.0 (102.0)
S9-2 to RY1-3	6	49.5 (126.0)
S9-3 to J1-18	4	126.0 (320.0)
S9-4 to S11-2	36	75.5 (192.0)
S10-1 to CB10-3	20	42.5 (108.0)
S10-2 to H1-1	22	45.5 (116.0)
S11-1 to J1-17	7	84.5 (215.0)
S11-2 to S9-4	36	75.5 (192.0)
S11-3 to X24	91	60.0 (152.5)
S11-4 to J1-21	92	84.5 (215.0)

CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
S12-1 to J1-20	8	70.5 (179.5)
S12-2 to RY1-4	6	44.0 (112.0)
S13-1 to X18	80	AR
S13-2 to HR-2	81	61.0 (155.0)
S13-3 to HR-1	82	61.0 (155.0)
S14-1 to P5-A	41	117.0 (297.5)
S14-2 to P5-K	42	117.0 (297.5)
S15-1 to DS5-2	11	106.5 (271.0)
S15-2 to SS3-1	2	40.0 (102.0)
SS1-1 to SS2-1	84	110.5 (281.0)
SS1-2 to SS3-2	2	16.0 (41.0)
SS1-3 to SS2-3	85	110.5 (281.0)
SS1-4 to SS3-3	2	16.0 (41.0)
SS2-1 to SS1-1	84	110.5 (281.0)
SS2-2 to CB9-1	83	49.5 (126.0)
SS2-3 to SS1-3	85	110.5 (281.0)
SS3-1 to S15-2	2	40.0 (102.0)
SS3-2 to SS1-2	2	16.0 (41.0)
SS3-3 to SS1-4	2	16.0 (41.0)
TS1-1 to TS2-2	25	60.0 (152.5)
TS1-2 to TS2-3	26	60.0 (152.5)
TS1-3 to J1-9	27	129.5 (329.0)
TS1-4 to J1-26	28	129.5 (329.0)
TS2-1 to CB10-1	24	16.0 (41.0)
TS2-2 to TS1-1	25	60.0 (152.5)
TS2-3 to TS1-2	26	60.0 (152.5)
Vehicle Ground (VEH. GND.)		
-1 to J2-2	2	111.0 (282.0)
-2 to J3-3	2	60.0 (152.5)
-3 to X15	2	AR
-4 to S4-7	2	64.5 (164.0)
-5 to H1-2	2	32.0 (81.5)

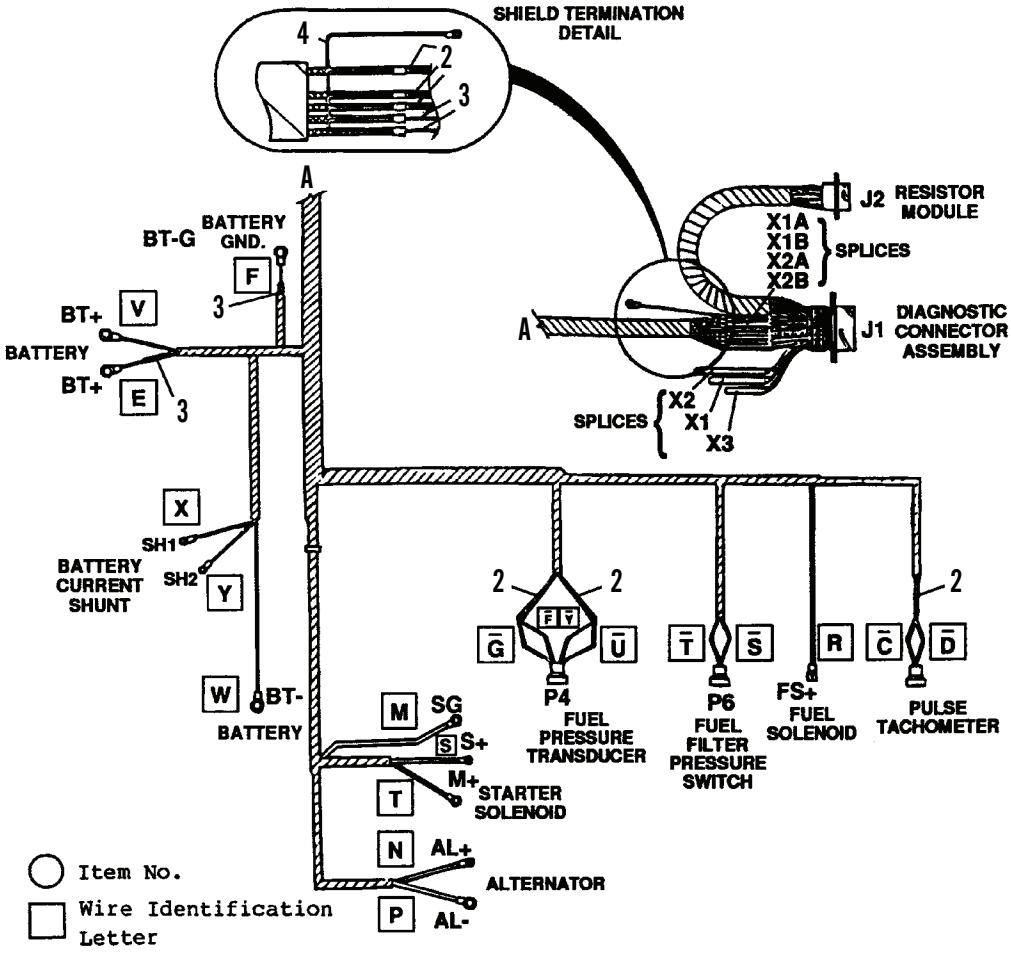
CAB WIRING HARNESS - CONTINUED

Table 2. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
-6 to X23	2	AR
-7 to RY4-1	2	27.5 (70.0)
WA to S6-2	35	104.0 (264.5)

STE/ICE-R WIRING HARNESS

STE/ICE-R Wiring Harness.



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NOTE

- All wire letters with a bar over them are lower case letters; i.e., A = a.
- All wires are 16 AWG, single conductor, (item 1) unless otherwise noted.

Item	Cage	Part No.	Description	QTY
--	3Y949	6602045	STE/ICE-R Wire Harness	1
1	64488	81163S	Wire, 1-Conductor, 16 AWG	AR
2			Wire, 2-Conductor Shielded, 16 AWG	AR
2			Wire, 1-Conductor Shielded, 16 AWG	AR
4	64488	81203S	Wire, 1-Conductor, 20 AWG	AR

STE/ICE WIRING HARNESS- CONTINUED

NOTE

All wire numbers (letters) with a bar over them are lower case letters; i.e., A = a.

Table 3. Wire List.

Connection Points	Wire No.	Length: in. (cm)
Alternator		
ALT+ to J1-N	N	162.0 (411.5)
ALT- to J1-P	P	162.0 (411.5)
Battery		
BT+ to J1-V	V	114.0 (290.0)
BT+ to J1-E	E	114.0 (290.0)
BT- to J1-W	W	99.0 (251.5)
BT-G to J1-F	F	91.0 (231.5)
Battery Current Shunt		
SH1 to J1-X	X	95.0 (241.5)
SH2 to J1-Y	Y	95.5 (243.0)
Fuel Solenoid		
FS+ to J1-R	R	176.0 (447.5)
Starter Solenoid		
M+ to J1-T	T	144.0 (366.0)
S+ to J1-s	S	144.0 (366.0)
SG to J1-M	M	144.0 (366.0)
J1		
-a to X3	a	6.0 (15.5)
-AA to X1	AA	7.0 (18.0)
-AB to X2	AB	8.0 (20.5)
-AC to X1	AC	7.0 (18.0)
-AD to X2	AD	8.0 (20.5)
-b to X3	b	6.0 (15.5)
-c to P5-1	c	182.0 (462.5)
-D to J2-H	D-H	18.0 (46.0)
-d to P5-2	d	182.0 (462.5)
-E to BT+	E	114.0 (290.0)
-F to BT-G	F	91.0 (231.5)
-f to X1B	f	3.0 (8.0)

STE/ICE WIRING HARNESS - CONTINUED

Table 3. Wire List - Continued.

Connection Points	Wire No.	Length (Inches)
J1 - Continued		
-g to X1	g	7.0 (18.0)
-h to J2-d	h-D	12.0 (30.5)
-j to J2-E	j-E	12.0 (30.5)
-k to X1	k	7.0 (18.0)
-M to SG	M	144.0 (366.0)
-m to X2	m	8.0 (20.5)
-N to ALT+	N	162.0 (411.5)
-n to X1	n	7.0 (18.0)
-O to X3	O	6.0 (15.5)
-P to ALT-	P	162.0 (411.5)
-p to X2	p	8.0 (20.5)
R to FS+	R	176.0 (447.5)
-S to S+	S	144.0 (366.0)
-s to X2A	s	3.0 (8.0)
-T to M+	T	144.0 (366.0)
-t to X2B	t	3.0 (8.0)
-U to X3	U	6.0 (15.5)
-u to P4-3	u	160.0 (406.5)
-V to BT+	V	114.0 (290.0)
-v to P4-4	v	160.0 (406.5)
-W to BT-	W	99.0 (251.5)
-w to X1	w	7.0 (18.0)
-X to SH-1	X	95.0 (241.5)
-s to X2	x	8.0 (20.5)
-Y to SH-2	Y	95.0 (241.5)
-y to X1	y	7.0 (18.0)
-Z to X3	Z	6.0 (15.5)
-z to X2	z	8.0 (20.5)
J2		
-A to X1B	A	12.0 (30.5)
-C to X2	C	17.0 (43.5)

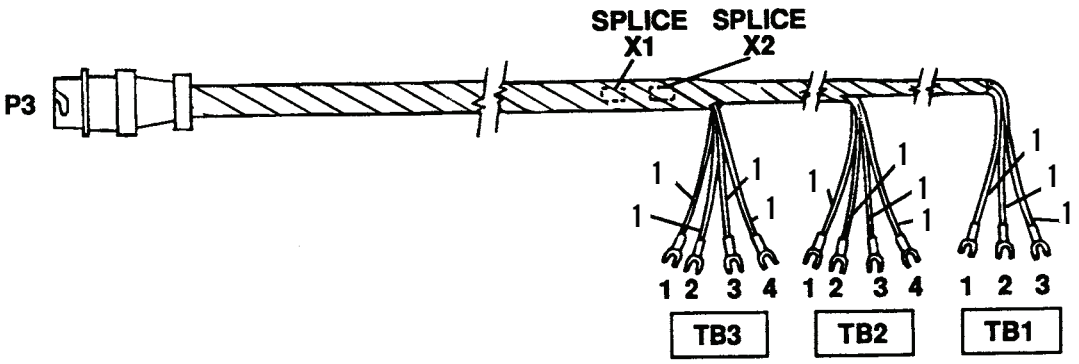
STE/ICE WIRING HARNESS - CONTINUED

Table 3. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
J2 - Continued		
-D to J1-h	h-D	12.0 (30.5)
-E to J1-j	j-E	12.0 (30.5)
-F to X2B	F	12.0 (30.5)
-G to X2A	G	12.0 (30.5)
-H to J1-D	D-H	18.0 (46.0)
-J to X1	J	16.0 (41.0)
P4		
-1 to X1B	f	155.0 (394.0)
-2 to X1A	g	155.0 (394.0)
-3 to J1-u	u	160.0 (406.5)
-4 to J1-v	v	160.0 (406.5)
P5		
-1 to J1-c	c	182.0 (462.5)
-2 to J1-D	d	182.0 (462.5)
P6		
-1 to X2B	t	165.0 (419.5)
-2 to X2A	s	165.0 (419.5)
Splice to Splice Connections		
X1 to X1A	X1	6.0 (15.5)

ELECTRIC JOYSTICK

Electric Joystick.



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Item No.	Cage	Part No.	Description	QTY
--	3Y949	6602583	Joystick Wire Harness	1
1	64488	81163S	Wire, 1-Conductor, 16 AWG	AR

Table 4. Wire List.

Connection Points	Wire No.	Length: in. (cm)
P3		
-1 to X2	50	11.0 (28.0)
-2 (Not Used)		
-3 to X1	2	9.0 (23.0)
-4 to TB2-2	54	16.0 (41.0)
-5 to TB1-3	52	17.0 (43.5)
-6 to TB3-2	56	15.0 (38.5)
-7 to TB2-3	53	16.0 (41.0)
-8 to TB1-2	51	17.0 (43.5)
-9 to TB3-3	55	15.0 (38.5)
TB1		
-1 to X1	2	8.0 (20.5)
-2 to P3-8	51	17.0 (43.5)
-3 to P3-5	52	17.0 (43.5)

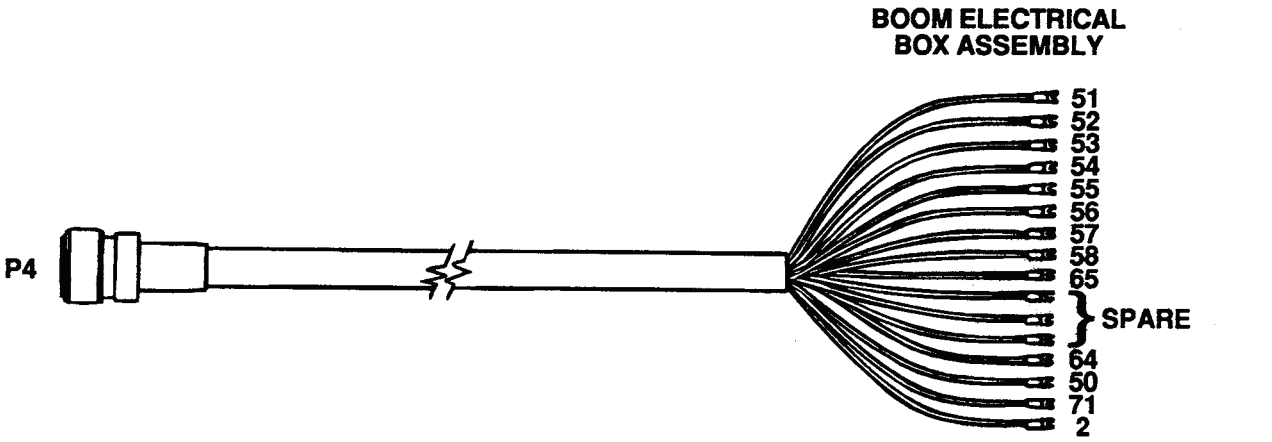
ELECTRIC JOYSTICK - CONTINUED

Table 4. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
TB2		
-1 to X1	2	7.0 (18.0)
-2 to P3-4	54	16.0 (41.0)
-3 to P3-7	53	16.0 (41.0)
-4 to X2	50	5.0 (13.0)
TB3		
-1 to X1	2	6.0 (15.5)
-2 to P3-6	56	15.0 (38.5)
-3 to P3-9F	55	15.0 (38.5)
-4 to X2	50	4.0 (10.5)

BOOM ELECTRICAL CABLE

Boom Electrical Cable.



NOTE

All wires are 18 AWG.

Item No.	Cage	Part No.	Description	QTY
--	3Y949	6602733	Boom Cable Wiring Harness	1
--	64488	81183S	Wire, 18 AWG, 16 X 0.010 strand	AR

Table 5. Wire List.

Connection Points	Wire No.	Length: in. (cm)
P4		
-A to Boom Electrical Box Assy.	54	483 (1227.0)
-C to Boom Electrical Box Assy.	2	483 (1227.0)
-F to Boom Electrical Box Assy.	Spare	483 (1227.0)
-H to Boom Electrical Box Assy.	52	483 (1227.0)
-J to Boom Electrical Box Assy.	53	483 (1227.0)
-K to Boom Electrical Box Assy.	51	483 (1227.0)
-L to Boom Electrical Box Assy.	56	483 (1227.0)
-M to Boom Electrical Box Assy.	57	483 (1227.0)
-N to Boom Electrical Box Assy.	50	483 (1227.0)
-P to Boom Electrical Box Assy.	65	483 (1227.0)
-R to Boom Electrical Box Assy.	64	483 (1227.0)
-S to Boom Electrical Box Assy.	58	483 (1227.0)
-T to Boom Electrical Box Assy.	Spare	483 (1227.0)

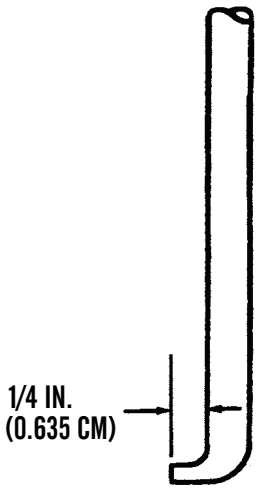
BOOM ELECTRICAL CABLE - CONTINUED

Table 5. Wire List - Continued.

Connection Points	Wire No.	Length: in. (cm)
P4 - Continued		
-U to Boom Electrical Box Assy.	Spare	483 (1227.0)
-W to Boom Electrical Box Assy.	71	483 (1227.0)
-X to Boom Electrical Box Assy.	55	483 (1227.0)

TANDEM GEAR PUMP

Tandem Gear Pump Seal Removal Tool.

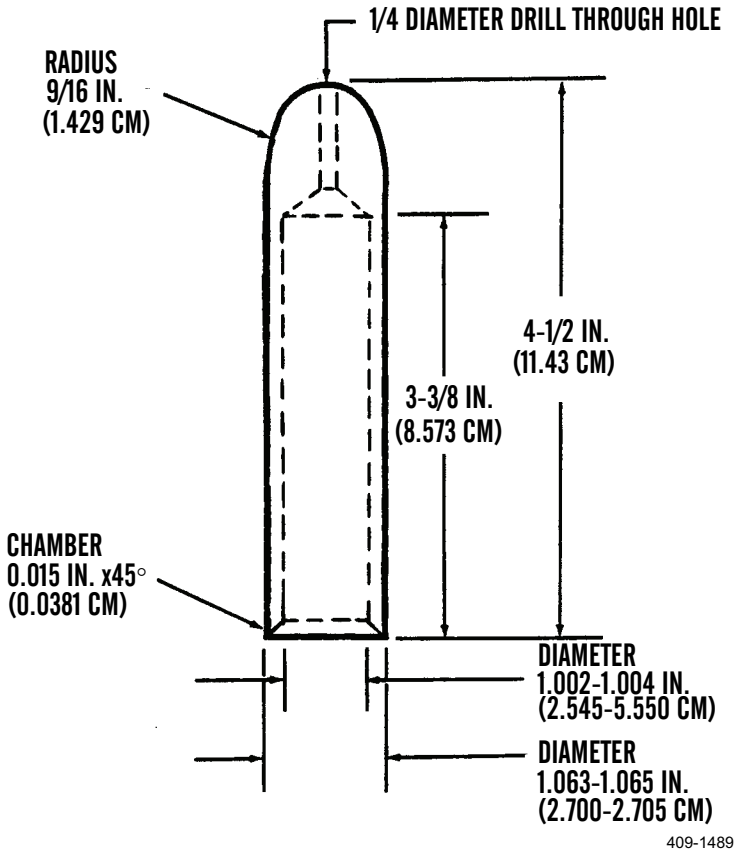


409-1488

1. Fabricated from a screwdriver.
2. Heat screwdriver tip and bend as shown.
3. Grind tip to fit notch behind shaft seal.

TANDEM GEAR PUMP - CONTINUED

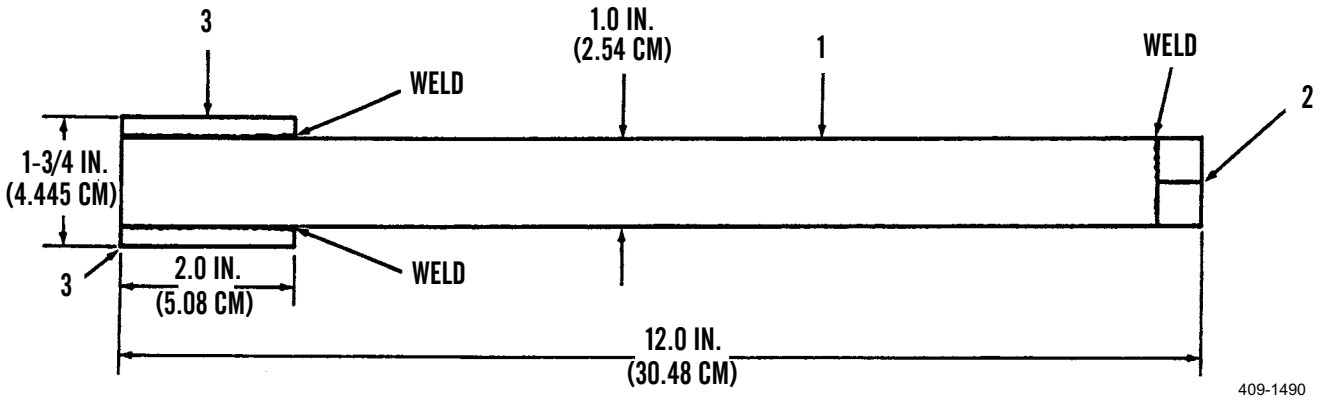
Tandem Gear Pump Drive Gear Installation Tool.

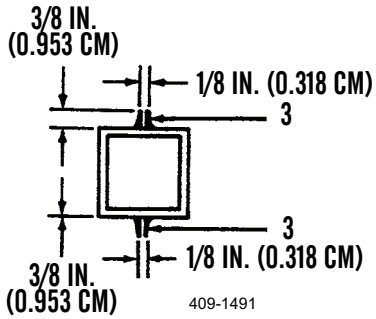


1. Fabricate from steel bar stock, 1-1/8 or 1-1/4 in. dia x 4-5/8 in. long (2.86 or 3.18 cm dia x 11.75 cm long).
2. All dimensions shown are in inches.
3. All external surfaces must be free of scratches and burrs.

DIFFERENTIAL RESISTANCE

Differential Resistance Tool.





Item	Description
1	Round Steel Stock, NSN 9150-00-199-1084
2	Hexagon Nut, NSN 5310-00-763-8920
3	Flat Bar Stock, NSN 9515-00-204-3972 (2)

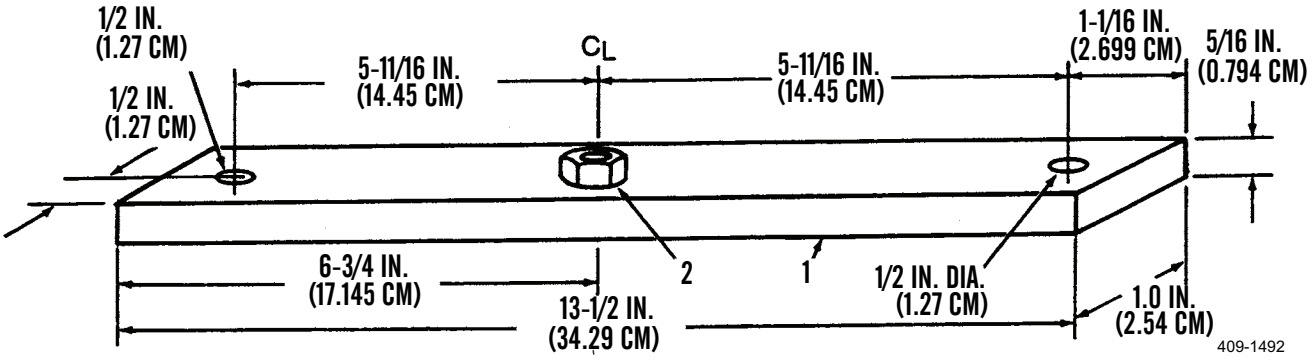
WARNING

Wear eye shields and protective gloves when fabricating this tool. Failure to do so may result in serious personal injury.

1. Fabricate as shown in illustration.
2. All dimensions are in inches.

PLANETARY HUB DRAG

Planetary Hub Drag Tool.



Item	Description
1	Steel Bar Stock, 5/16 in. (0.794 cm) x 1 in. (2.54 cm) x 13-1/2 in. (34.29 cm)
2	Hexagon Nut, 1/2-16, NSN 5310-01-270-173

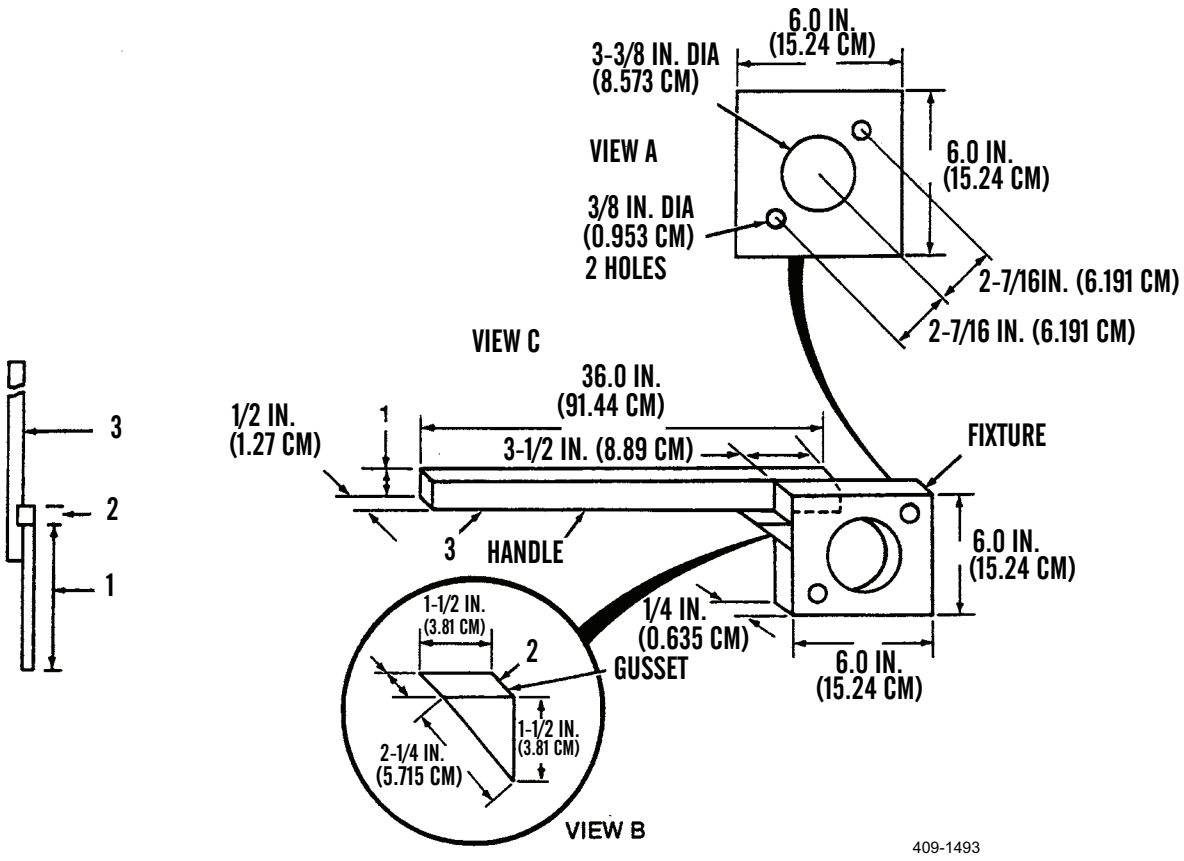
WARNING

Wear eye shields and protective gloves when drilling holes in the bar stock. Heated and flying metal parts may cause serious personal injury.

1. Drill two 1/2 in. (1.27 cm) diameter holes in the bar stock at the locations shown in the above illustration.
2. Remove burrs with a hand file.
3. Center hexagon nut (2) on bar stock (1) at location shown in above illustration.
4. Hold nut in place with a C-clamp and weld a single layer bead around the circumference of the nut.

YOKE

Yoke Tool Nut.



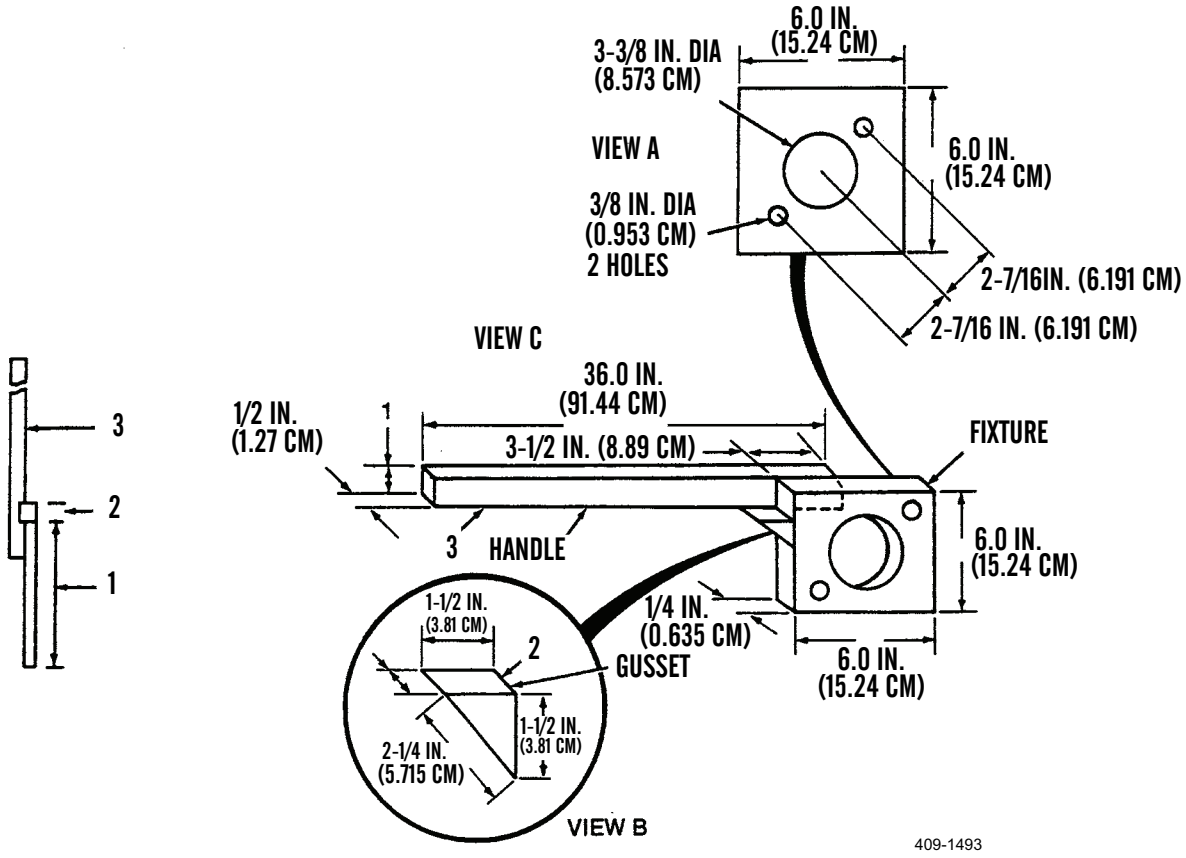
Item	Description
1	Steel Plate, 1/4 in. (0.635 cm) x 6 in. (15.24 cm) x 6 in. (15.24 cm)
2	Steel Bar Stock, 1-1/2 in. (3.81 cm) x 1-1/2 in.(3.81 cm) x 3/8 in. (0.953 cm)
3	Steel Bar Stock, 1/2 in. (1.27 cm) x 1 in. (2.54 cm) x 36 in. (91.44 cm)

WARNING

Wear eye shields and protective gloves when fabricating the yoke nut tool. Flying metal particles and heated metal may cause serious personal injury.

1. Cut steel plate (1) to size 6 in. x 6 in. square as shown in view A. Remove all burrs and sharp edges with a hand file.
2. Drill two 3/8 in. holes in plate as shown in view A.
3. Cut out a 3-3/8 in. diameter hole in plate as shown in view A.

YOKE - CONTINUED



4. Build a gusset, as shown in view B, from steel bar stock (2).
5. Hold bar stock (2) to steel plate (1), as shown in view C, with a C-clamp, and spot weld the two parts together.
6. Place gusset (view B) in the area shown in view C.
7. Weld a single bead over all adjoining metal.

TRANSMISSION ALIGNMENT BARS

Transmission Alignment Bars.

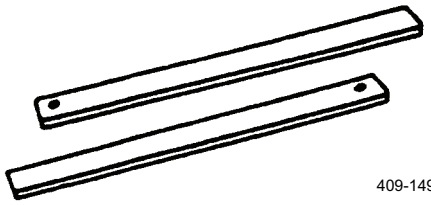


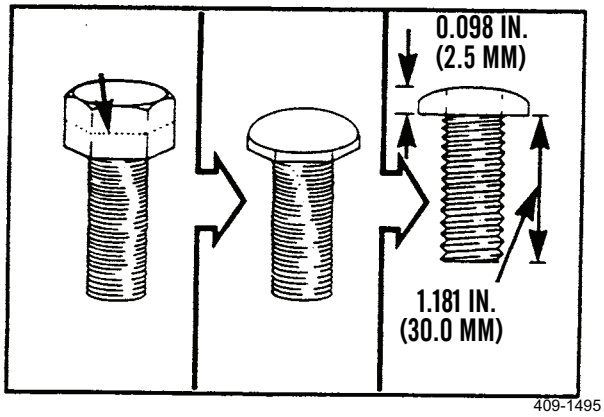
Table 6. Alignment Bars Dimension Data.

Bars Used* At	Bar Size			Number of Bars Required
	Width: in. (cm)	Length: in. (cm)	Height: in. (cm)	
First Stage Clutch Pack, Engine Side	2 (5.08)	12 (30.48)	5/8 (1.59)	2
First Stage Clutch Pack, Non-Engine Side	2 (5.08)	12 (30.48)	1/8 (0.32)	2
Second Stage Clutch Pack, Engine Side	2 (5.08)	12 (30.48)	1/8 (0.32)	2
Second Stage Clutch Pack, Non-Engine Side	2 (5.08)	12 (30.48)	1/4 (0.64)	2
Third Stage Clutch Pack, Engine Side Only	2 (5.08)	12 (30.48)	1/16 (0.16)	2
*Engine and non-engine side designations refer to clutch pack orientation when transmission is installed in vehicle.				

1. Fabricate bars from steel bar stock to the dimensions shown above.

BEARING

Bearing Removal/Installation Tool.



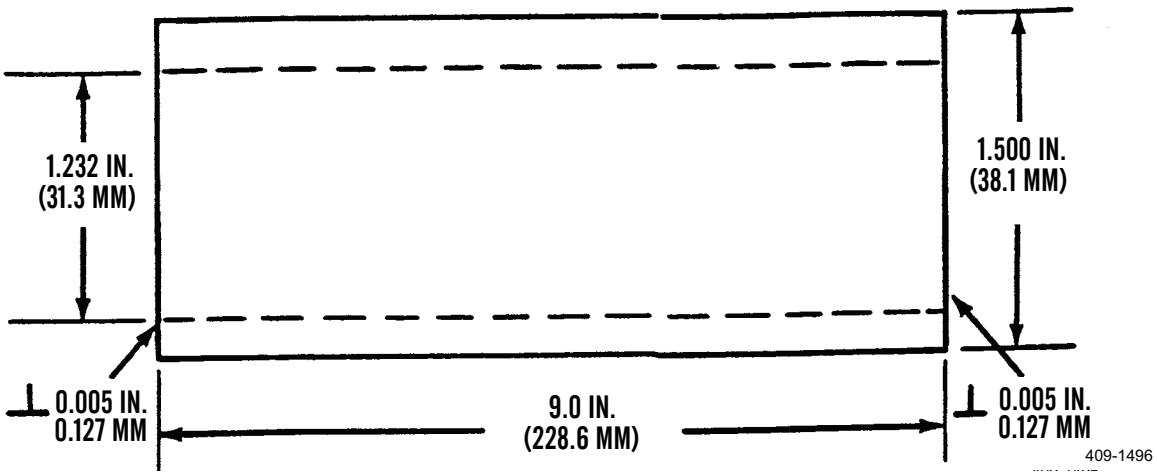
WARNING

Wear eye shields and protective gloves when fabricating the bearing removal/installation tool. Flying metal particles and heated metal may cause serious personal injury.

1. Fabricated from 0.236 in. (6 mm) capscrew.
2. All external surfaces must be free of scratches and burrs.

HYDRAULIC PISTON PUMP

Driveshaft/Pump Housing Bearing Removal Tool.



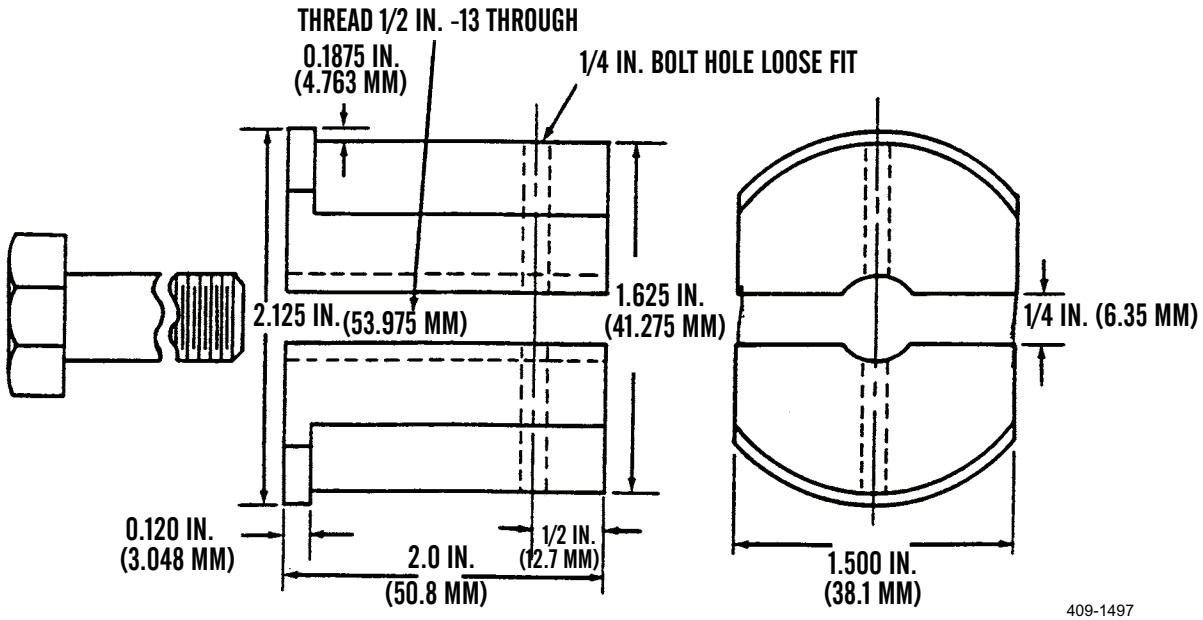
HYDRAULIC PISTON PUMP - CONTINUED

WARNING

Wear eye shields and protective gloves when fabricating this tool. Flying metal particles and heated metal may cause serious personal injury.

Machine removal tool from 1-1/2 in. (38.1 mm) steel pipe per the dimensions on sketch. All surfaces are to be smooth and flat. Radius or chamfer all sharp edges.

Housing Bearing Race Removal Tool.



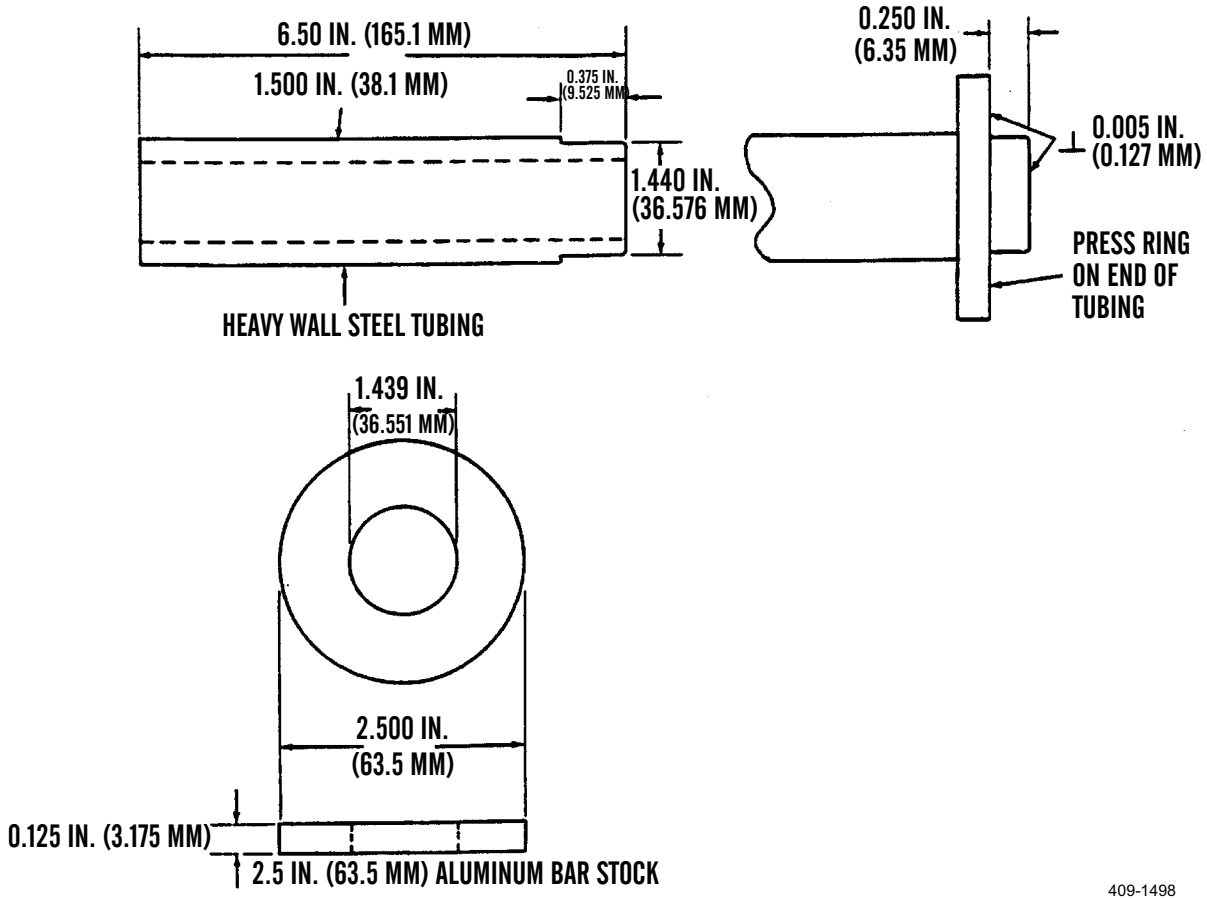
WARNING

Wear eye shields and protective gloves when fabricating this tool. Flying metal particles and heated metal may cause serious personal injury.

Machine removal tool from 2 in. (50.8 mm) long steel bar stock per the dimensions on sketch. All surfaces are to be smooth and flat. Radius or chamfer all sharp edges. Use a 5 in. (127.0 cm) long 1/2-13 hex head screw with this tool.

HYDRAULIC PISTON PUMP - CONTINUED

Shaft Seal Driver.



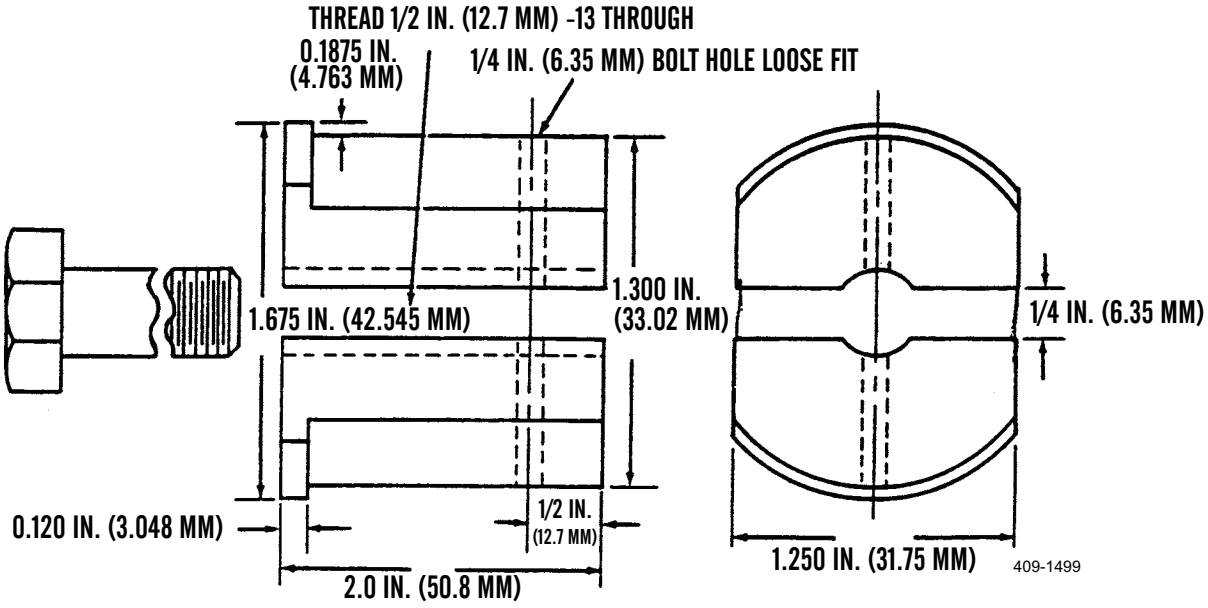
WARNING

Wear eye shields and protective gloves when fabricating this tool. Flying metal particles and heated metal may cause serious personal injury.

Machine installation tool from heavy wall steel tubing and aluminum bar stock per the dimensions on sketch. All surfaces are to be smooth and flat. Radius or chamfer all sharp edges.

HYDRAULIC PISTON PUMP - CONTINUED

Valve Block Bearing Race Removal Tool.

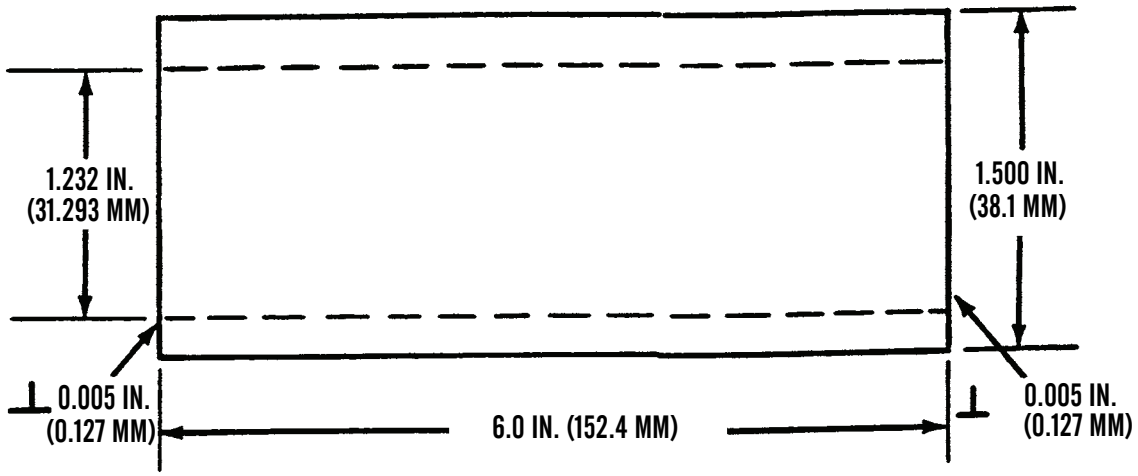


WARNING

Wear eye shields and protective gloves when fabricating this tool. Flying metal particles and heated metal may cause serious personal injury.

Machine removal tool from 2 in. (50.8 mm) long steel bar stock per the dimensions on sketch. All surfaces are to be smooth and flat. Radius or chamfer all sharp edges. Use a 5 in. (127 mm) long 1/3-13 hex head screw with this tool.

Driveshaft/Pump Housing Bearing Installation Tool.



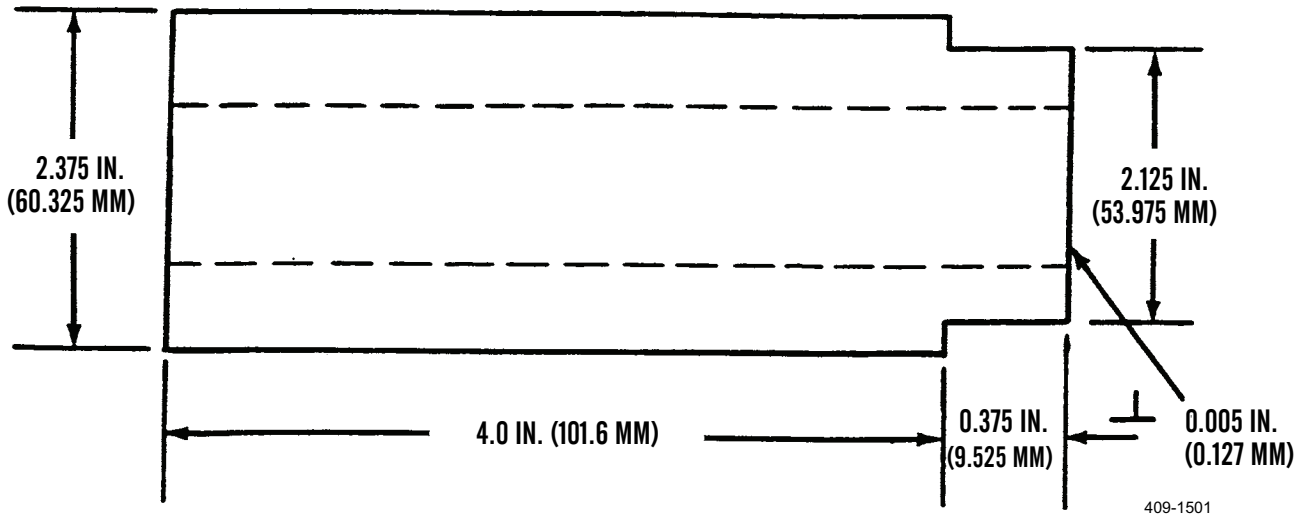
HYDRAULIC PISTON PUMP - CONTINUED

WARNING

Wear eye shields and protective gloves when fabricating this tool. Flying metal particles and heated metal may cause serious personal injury.

Machine installation tool from 1-1/2 in. (38.1 mm) steel pipe per the dimensions on sketch. All surfaces are to be smooth and flat. Radius or chamfer all sharp edges.

Housing Bearing Race Installation Tool.



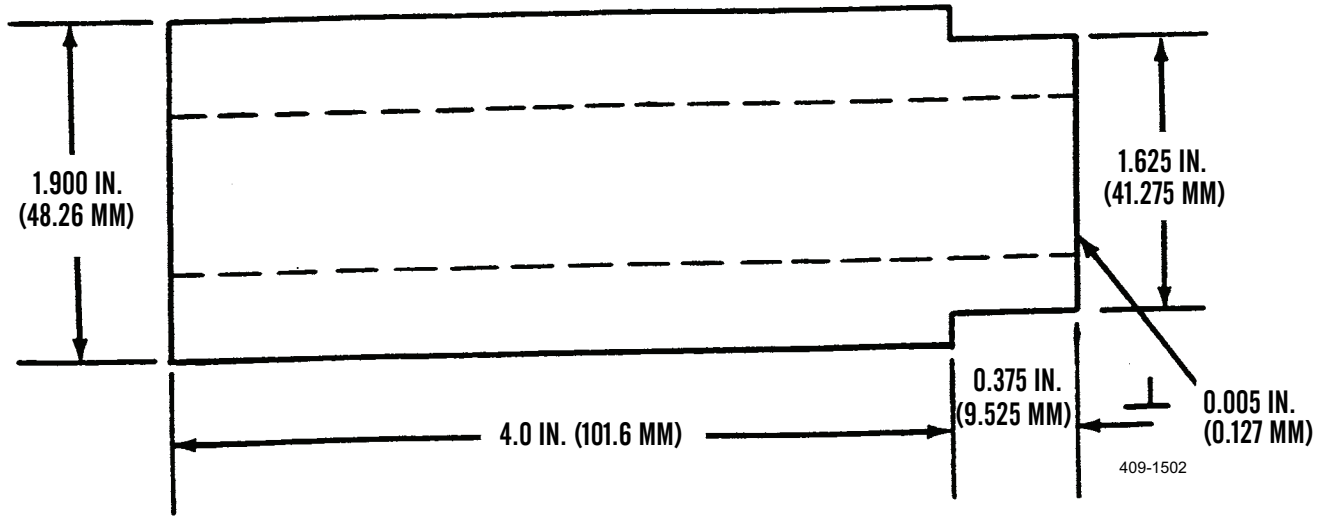
WARNING

Wear eye shields and protective gloves when fabricating this tool. Flying metal particles and heated metal may cause serious personal injury.

Machine installation tool from schedule 80 steel pipe per the dimensions on sketch. All surfaces are to be smooth and flat. Radius or chamfer all sharp edges.

HYDRAULIC PISTON PUMP - CONTINUED

Valve Block Bearing Race Installation Tool.



WARNING

Wear eye shields and protective gloves when fabricating this tool. Flying metal particles and heated metal may cause serious personal injury.

Machine installation tool from schedule 80 steel pipe per the dimensions on sketch. All surfaces are to be smooth and flat. Radius or chamfer all sharp edges.

END OF WORK PACKAGE

6000M EPA ENGINE RETROFIT INSTALLATION INSTRUCTIONS

FOR KIT 6623292

6000M EPA Engine Retrofit Installation Instructions

For Kit #6623292

B SER 1/04

6623293

JLG

1. ENGINE OIL PRESSURE SENDER REPLACEMENT (new engine)

REMOVAL (Figure 1)

a. Tag, mark and disconnect hose (1) from tee (2) on new engine block.

b. Remove tee (2) and bushing (3) from new engine block. Discard tee and bushing.

INSTALLATION (Figure 2)

a. (From the kit) install adapter # 8770065 (2) in new engine.

b. (From the kit) apply sealing compound on threads of nipple # 8530027 (3) and install nipple in adapter (2).

c. (From the kit) Apply sealing compound on threads of adapter # 8760011 (4) and tee # 8530028 (5).

d. Install tee (5) on nipple (3) and adapter (4) on tee (5).

e. Apply sealing compound to threads of old engine oil pressure sender (6) and install sender in tee (5).

f. Connect hose (1) from new engine block on adapter (4).

AFTER INSTALLATION OF NEW ENGINE (Figure 2)

a. Install electrical wire No. “17” (7) on old engine oil pressure sender with lockwasher and nut.

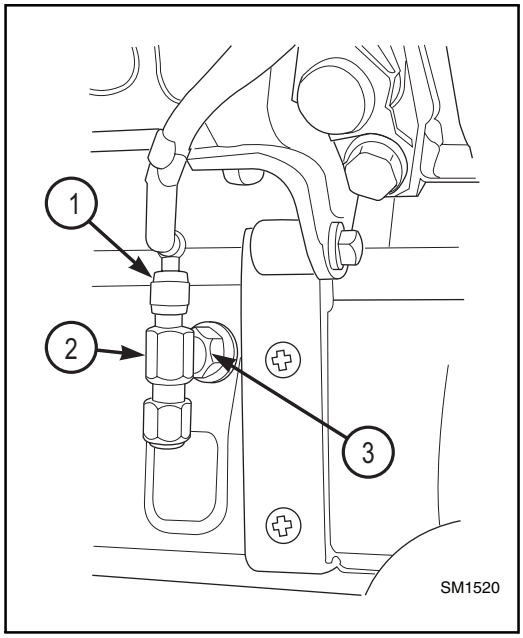


Figure 1

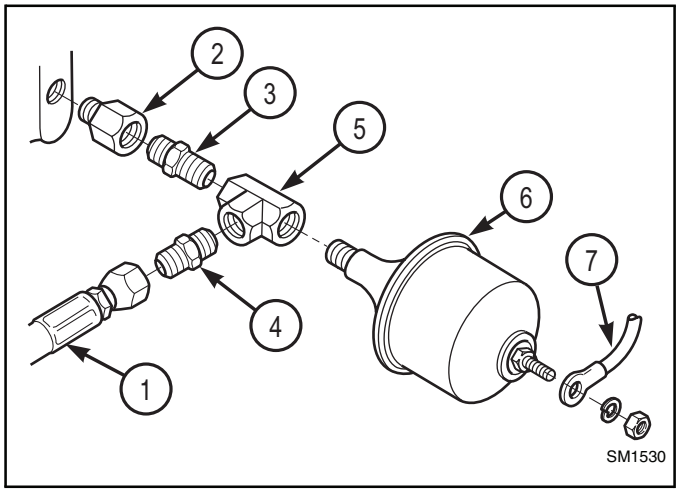


Figure 2

2. ENGINE OIL PRESSURE SWITCH REPLACEMENT (new engine)

REMOVAL (Figure 3)

a. Remove plug (1) from new engine block. Discard plug.

INSTALLATION (Figure 4)

a. (From the kit) apply sealing compound on threads of adapter # 8770065 (1) nipple # 8530027 (2) and tee # 8530028 (3).

b. Install adapter (1) nipple (2) and tee (3) in new engine block.

c. Apply sealing compound to threads of old engine oil pressure switch and old valve.

d. Install old engine oil pressure switch (4) and old valve (5) on tee (3).

AFTER INSTALLATION OF NEW ENGINE (Figure 4)

a. Install starwasher, electrical wire No."16" (6), on old engine oil pressure switch (4) with starwasher and nut.

b. Remove oil sampling decal plate from old engine and install decal plate on new engine.

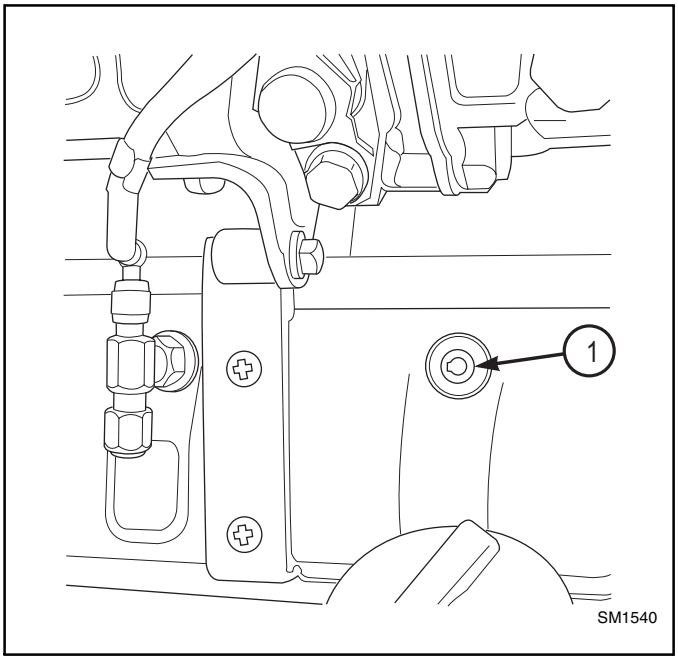


Figure 3

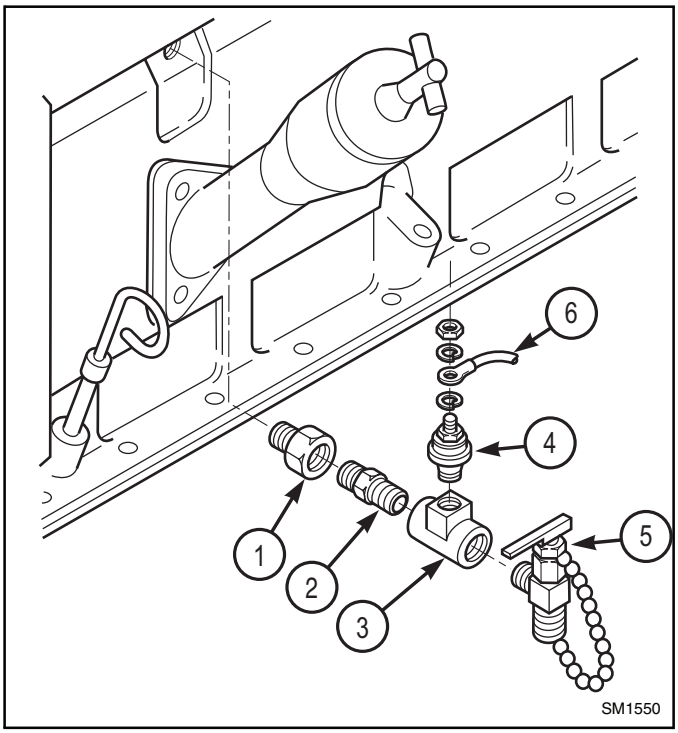


Figure 4

3. STE/ICE FUEL PRESSURE SENDER AND STE/ICE FUEL FILTER DIFFERENTIAL PRESSURE SWITCH REPLACEMENT. (new engine)

REMOVAL (Figure 5)

a. Remove capscrew (1) banjo inlet screw (2) and washer (3) from fuel filter system of the new engine block. Discard capscrew and banjo inlet screw.

b. Remove capscrew (4) and washer (5) from fuel filter system of the new engine block. Discard capscrew.

INSTALLATION

a. Install washer (3) see removal (Figure 5) and (from the kit) the banjo inlet screw #6618322 (1) in the fuel filter system (5) of the new engine block. (Figure 6).

b. (From the kit) apply sealing compound to threads on elbow #8760220 (2) and install on banjo inlet screw (1). (Figure 6).

c. Install washer (5) see removal and old engine banjo inlet screw (4) in the fuel filter system (5) of the new engine block. (Figure 7).

d. Apply sealing compound to tee (6), fuel pressure sender (7) and adapter (8) of the old engine. (Figure 7).

e. Install tee (6), fuel pressure sender (7) and adapter (8) on old engine banjo inlet screw (4). (Figure 7).

f. Install two starwasher (9), bracket (10), lockwashers (11) and screws (12) on new engine block. Tighten to 50 lb-ft. (Figure 7).

g. Apply sealing compound to threads of elbow (14) (Figure 6) and adapter (13). (Figure 6)

h. Install elbow (14) and adapter (13) on fuel differential pressure switch (15). (Figure 6).

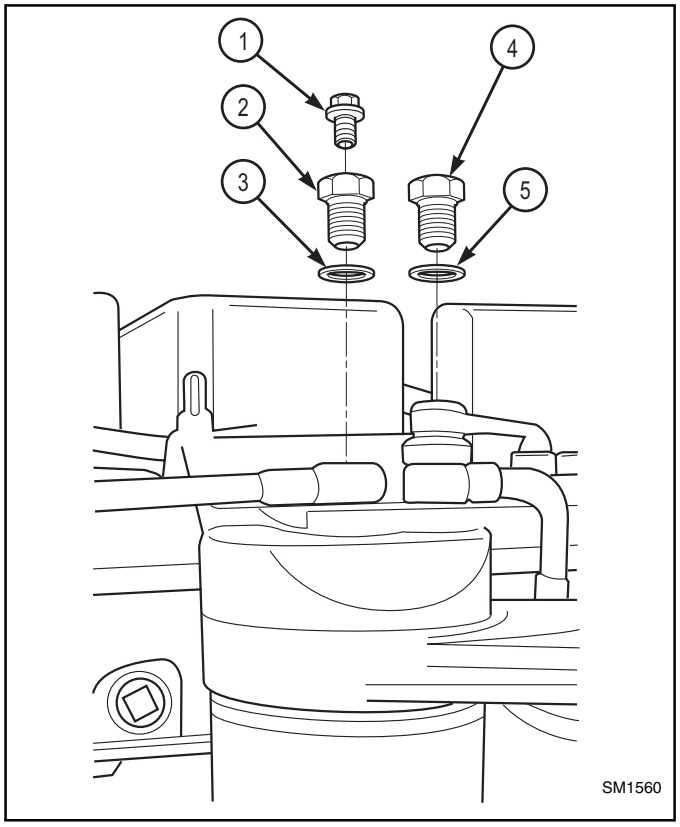


Figure 5

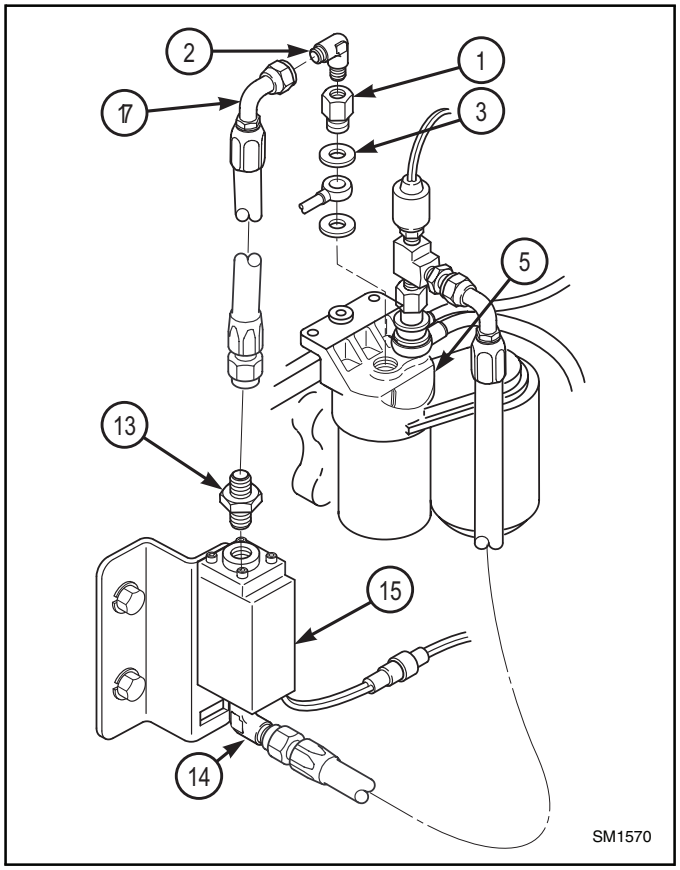


Figure 6

3. STE/ICE FUEL PRESSURE SENDER AND STE/ICE FUEL FILTER DIFFERENTIAL PRESSURE SWITCH REPLACEMENT. (new engine) (cont.)

i. Install fuel differential pressure switch (15) on bracket (10) with (from the kit) two tie straps #8584001 (16). (Figure 7).

j. Install (from the kit) hose #2714342 (17) on elbow (2) and adapter (13). (Figure 6).

k. Install (from the kit) hose #2714352 (18) on elbow (14) and adapter (8). (Figure 7).

AFTER INSTALLATION OF NEW ENGINE (Figure 7)

a. Connect switch connector (19) on vehicle wire harnesses connector (20) of old vehicle.

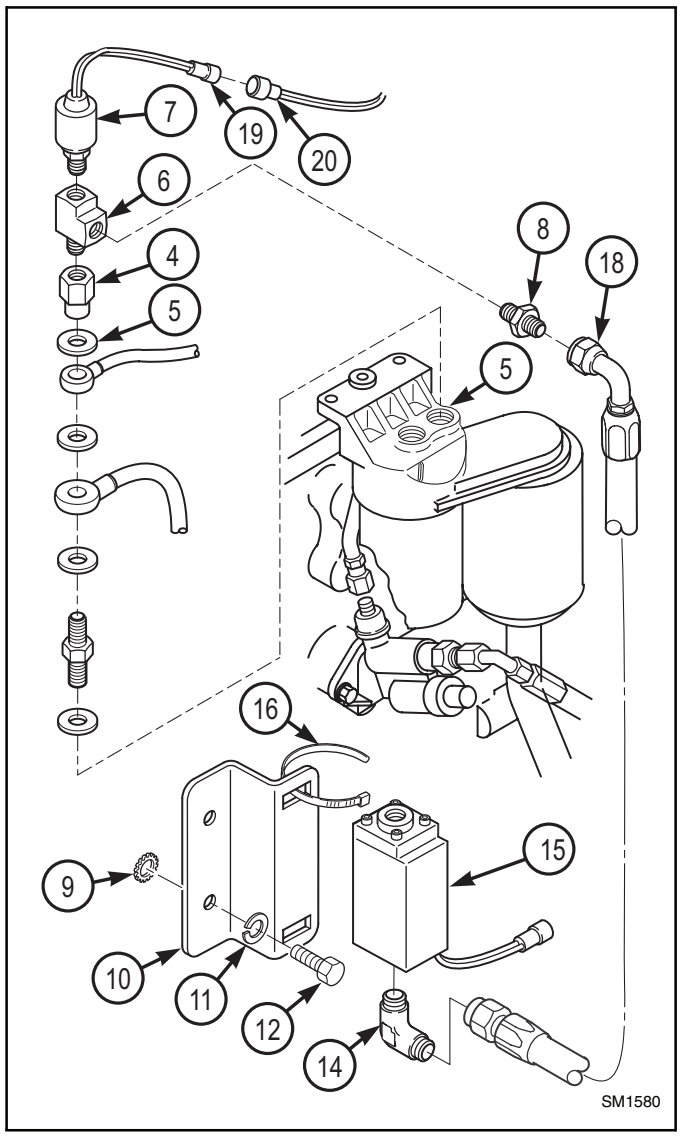


Figure 7

4. FUEL DRAIN TUBE REPLACEMENT (new engine)

AFTER INSTALLATION OF NEW ENGINE

REMOVAL

a. Remove plastic cap (1) from banjo fitting (2) on new engine block. Discard plastic cap. (Figure 8).

b. Loosen banjo fitting (2) and position it at 45 degree angle. Tighten fitting. (Figure 8).

c. Remove and discard one hose clamp (3) and fuel drain line (4) from vehicle. (Figure 9).

d. Remove and discard elbow (5) from vehicle fuel tank. (Figure 9).

INSTALLATION (Figure 10)

a. Apply sealing compound on threads of elbow # 8430039 (1) (From the kit) and install on vehicle fuel tank.

b. (From the kit) position fuel drain line # 6620181(2) on vehicle.

c. Install fuel drain line (2) (Figure 10) on banjo fitting (2) see removal (Figure 8) and elbow (1) with 2 clamp # 8405009 (3) (From the kit). (Figure 10).

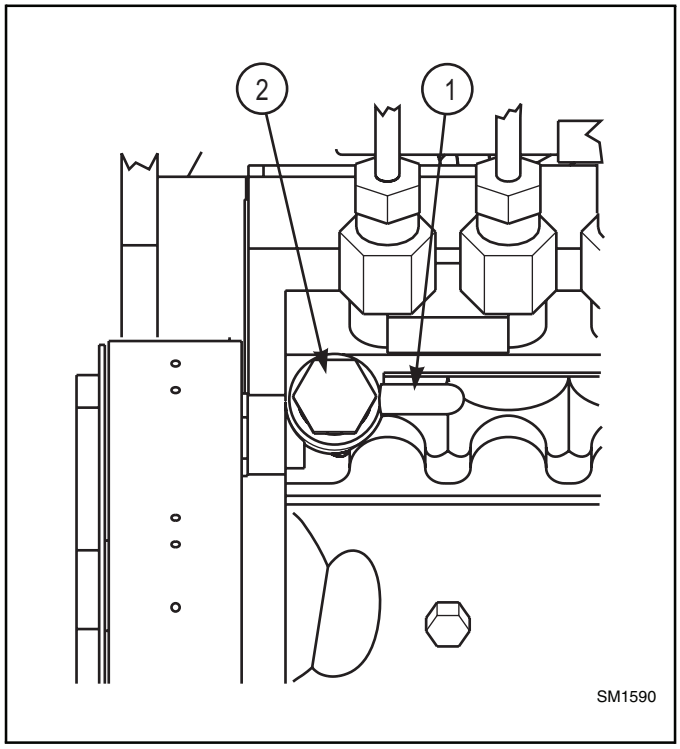


Figure 8

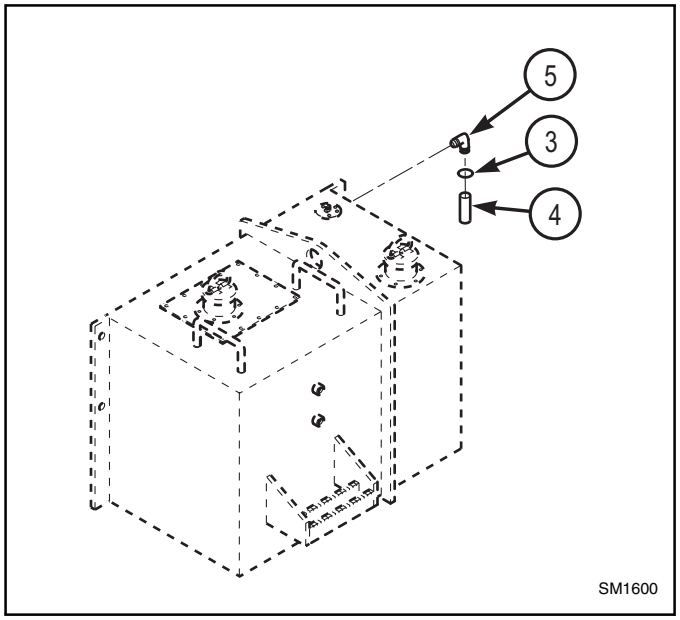


Figure 9

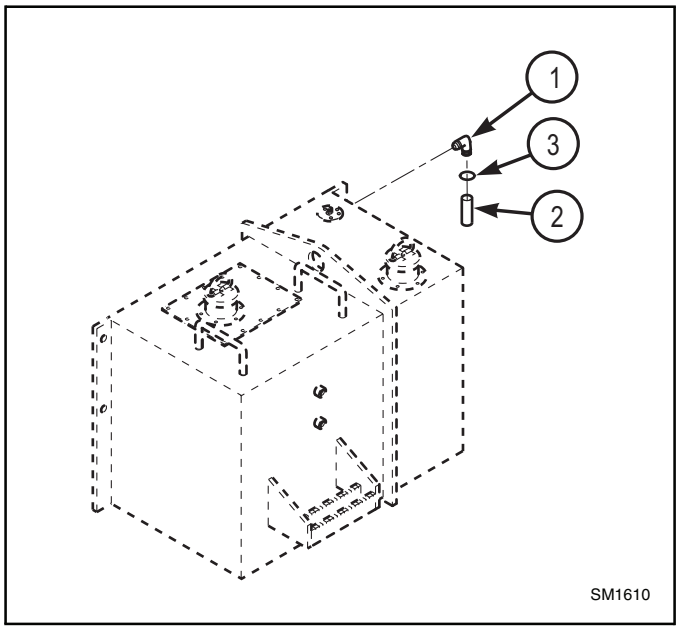


Figure 10

5. AIR CLEANER REPLACEMENT/REPAIR (new engine)

AFTER INSTALLATION OF NEW ENGINE

INSTALLATION (Figure 11)

a. (From the kit) position hose # 8273124 (1) and hose # 6618383 (2) on sleeve # 6618462 (3).

b. Position two hoses (1 and 2) on turbocharger (5) and housing (6).

c. (From the kit) install 2 clamps #8410010 (4).

d. (From the kit) install clamp #8405404 (7) and clamp (8) from the removal procedure. Tighten clamps to 216 lb-in.

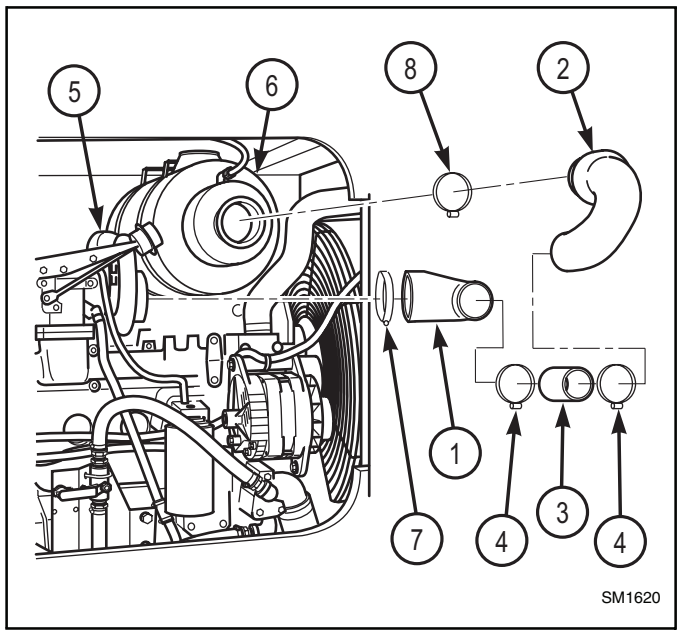


Figure 11

6. ENGINE WATER TEMPERATURE SWITCH REPLACEMENT (new engine)

REMOVAL (Figure 12)

a. Remove plug (1) from new engine block. Discard plug.

INSTALLATION (Figure 13)

a. (From the kit) apply sealant compound 592 to the threads of bushing #6618362 (1) and install into the new engine block.

b. Apply sealing compound to threads of the old engine water temperature switch (2) and install on bushing (1).

AFTER INSTALLATION OF NEW ENGINE

a. Install electrical wire No. “14” (3) on old engine water temperature switch and secure with lockwasher and nut.

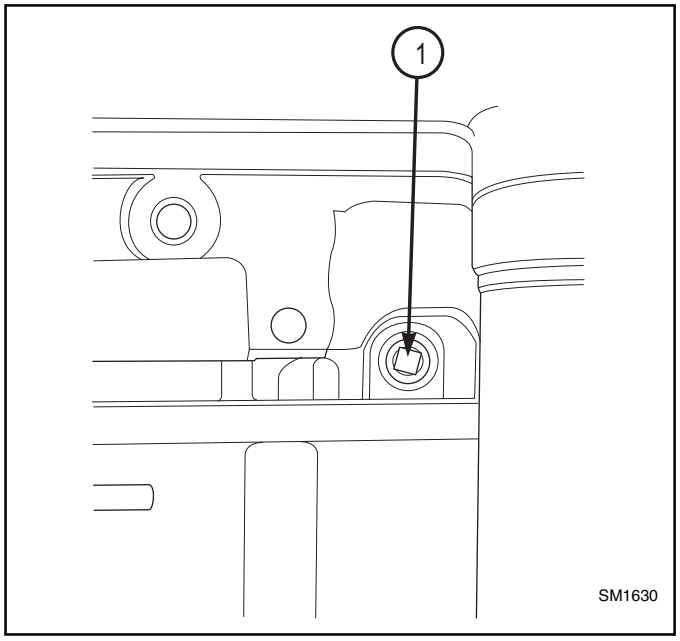


Figure 12

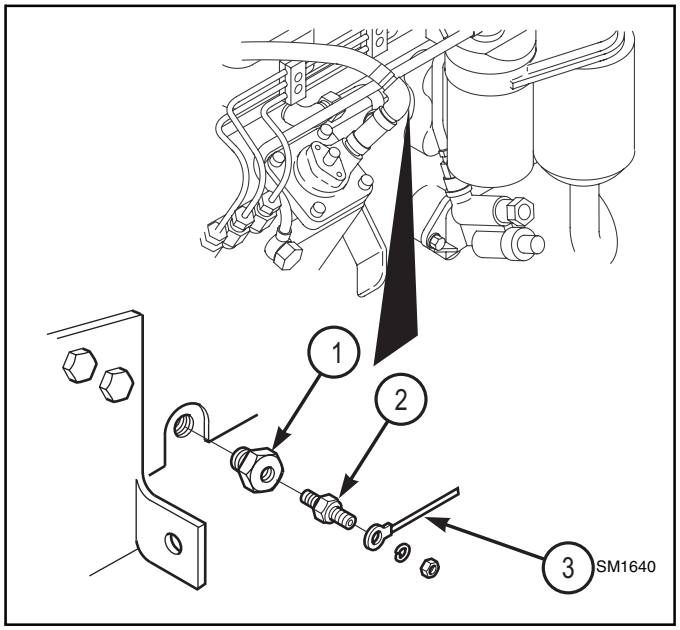


Figure 13

7. FUEL TRANSFER PUMP REPLACEMENT (new engine)

REMOVAL (Figure 14)

a. Remove plug (1) from fuel transfer pump (2) on new engine block. Discard plug.

INSTALLATION (Figure 15)

a. (From the kit) apply sealant compound 592 on the threads of reducer # 8540023 (1) and connector # 8760030 (2) and install on fuel transfer pump (3) of the new engine block.

AFTER INSTALLATION OF NEW ENGINE (Figure 15)

a. Connect fuel hose (4) from old engine on adapter (2).

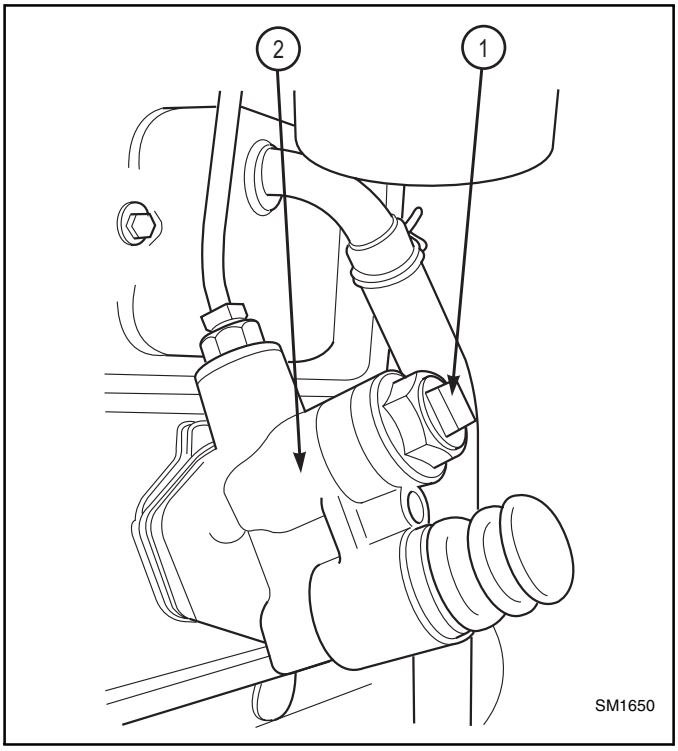


Figure 14

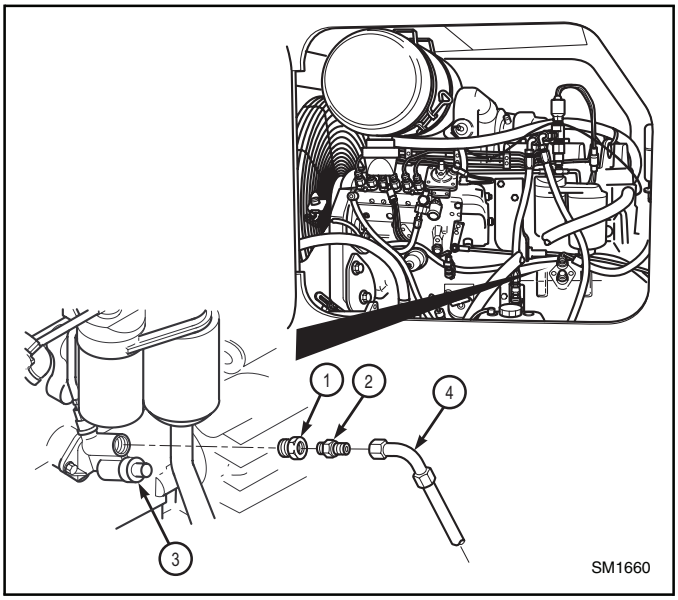


Figure 15

8. TURBOCHARGER AIR HOSE AND TUBES REPLACEMENT (new engine)

INSTALLATION (Figure 16)

a. (From the kit) install conduit # 7125811 (1) and two ties wraps # 8584001 (2) on hose (3).

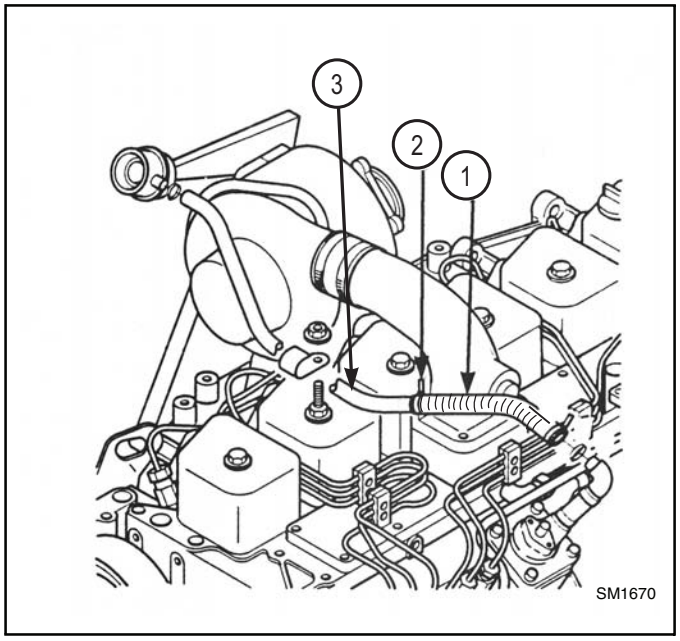


Figure 16

9. ACCELERATOR BRACKET AND CABLE REPLACEMENT (new engine)

INSTALLATION

a. (From the kit) position the relay # 8225114 (1) on the throttle plate # 6617802 (2) and secure with screw # 8310016 (3) washer # 8307111 (4) lockwasher # 8307003 (5) and nut # 8305002 (6). (Figure 17).

b. Position throttle plate (2) on new engine block and (From the kit) install with two lockwashers # 8307025 (7) and screws # 8310304 (8). (Figure 17).

c. (From the kit) install throttle strip bracket #6617792 (9) on fuel injection pump linkage (10) of new engine block with two lockwashers # 8307024 (11) and screws # 8310034 (12). (Figure 18).

d. (From the kit) temporarily install rod end # 8340034 (13) on throttle strip bracket (9) with locknut # 8305650 (14). (Figure 18).

AFTER INSTALLATION OF ENGINE

REMOVAL

a. Remove old engine securing clevis from accelerator cable. Discard securing clevis.

INSTALLATION (Figure 18)

a. Position accelerator (15) on throttle plate (2).

b. Remove rod end (13) and nut (14) from throttle strip bracket (9) and install rod end (13) on accelerator cable (15).

c. Reinstall rod end (13) and nut (14) on throttle strip bracket (9). Tighten nut.

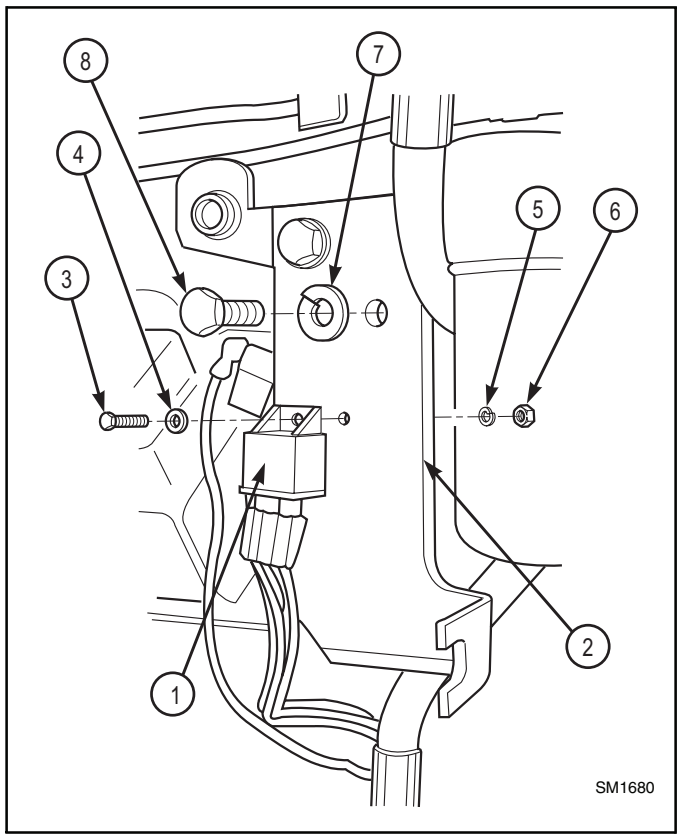


Figure 17

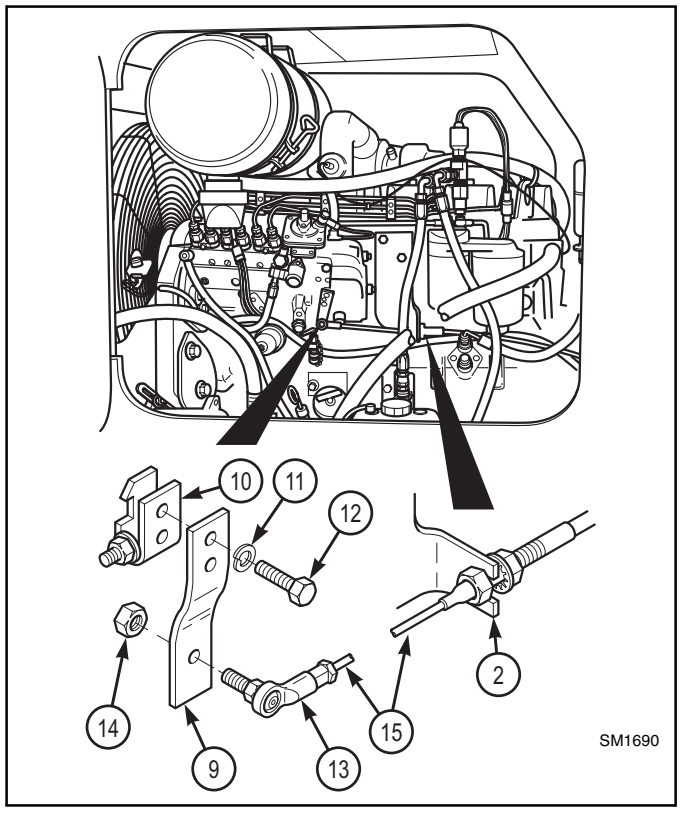


Figure 18

10. EPA ENGINE STARTER REPLACEMENT (new engine is not supplied with a starter)

REMOVAL

a. Remove all wires from the starter motor and the starter solenoid from the original engine.

b. Remove the three capscrews securing the starter motor assembly to the original engine bell housing. Discard the capscrews.

c. Remove the starter motor assembly from the original engine bell housing.

INSTALLATION

a. Install the starter to the bell housing on the new engine.

b. Line up the mounting holes of the starter with the mounting holes in the bell housing.

c. Secure in place with new capscrews (from the kit). DO NOT install the lower left side mounting capscrew at this time. Torque the other two mounting capscrews to 32 lb-ft (43,4 Nm).

11. EPA ENGINE HARNESS RETROFIT REPLACEMENT (new engine)

INSTALLATION

Note: *Install tie wraps as necessary*

a. Route wiring EPA Engine Harness (1) on new engine block. (Figure 19).

b. Connect electrical connector (2) to new fuel shut off connector (3). (Figure 19).

c. Connect electrical connector (4) to relay (5). (Figure 20).

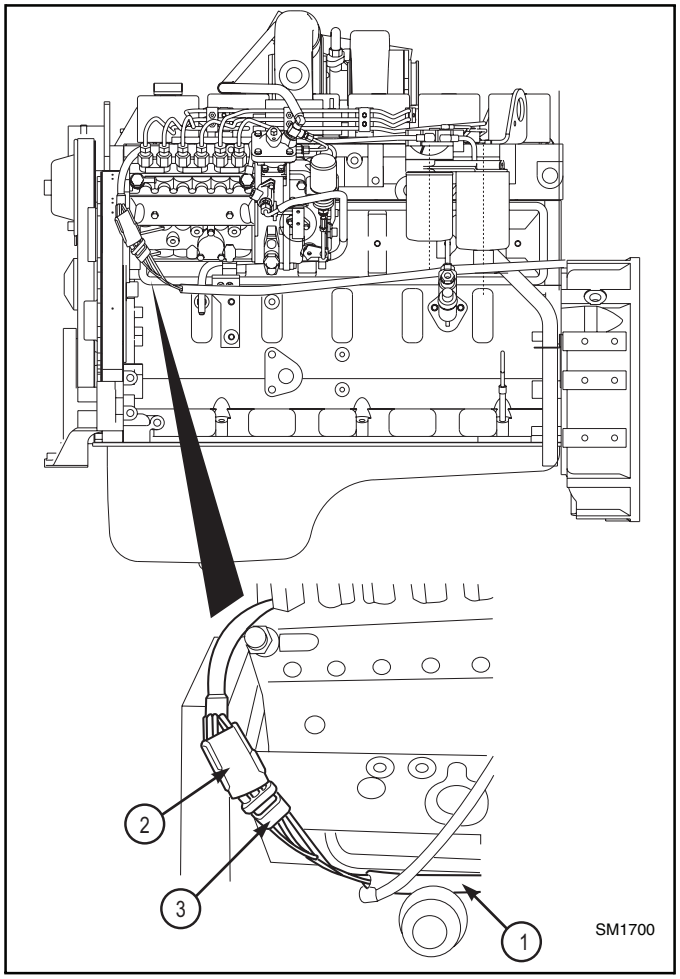


Figure 19

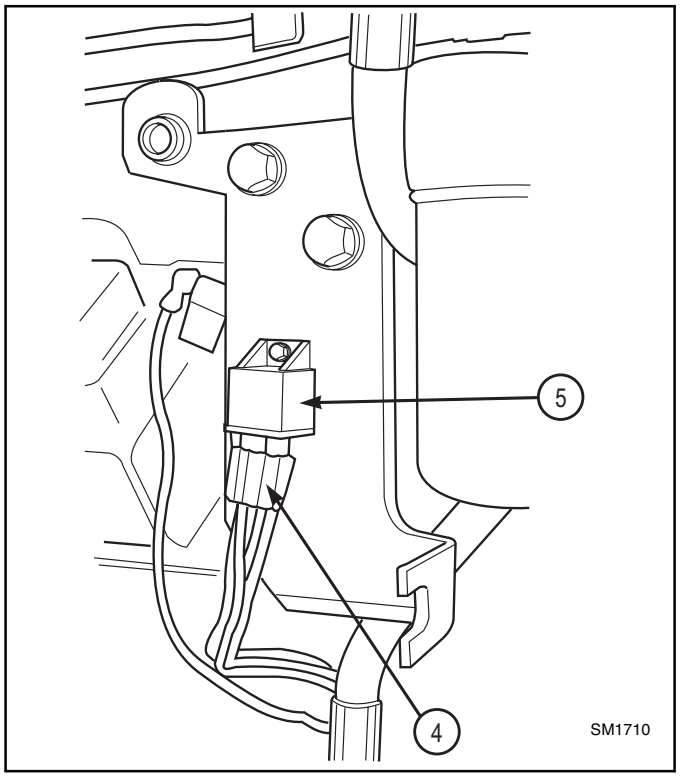


Figure 20

11. EPA ENGINE HARNESS RETROFIT REPLACEMENT (new engine) (cont)

d. (From the kit) install lockwasher #8310016 (6), terminal strap #6621412 (7), wires “9,” “9,” “T” & “39” to the starter solenoid (+) stud (8) with lockwasher #8310046 (6) and nut #8305438 (10). Tighten to 12 lb-ft. (Figure 21).

e. Attach positive battery cable “POS” with (from the kit) screw #8303620 (11), lockwashers #8307026 (12), on terminal strap (7) and nut #8305008 (13). (Figure 21).

f. Attach wires ”38” and “S” onto the starter solenoid stud (14) with (from the kit) lockwasher #8307052 (15) and nut #8310077 (16). Tighten to 25 lb-in. (Figure 21).

g. Attach wire “9A’” and white ground cable “WHT,” from the starter case housing, to the starter solenoid ground (-) stud (17). Tighten to 6 lb-ft. (Figure 21).

AFTER INSTALLATION OF ENGINE

a. Connect new harness fuel shut off electrical wire “7” to original fuel shut off electrical wire “7,” that was connected to the old engines fuel shut off solenoid (Not shown).

b. Attach wire “M” along with the frame ground cable “GND” to the lower left starter mount capscrew (18). (Figure 21). Torque the lower left capscrew to 32 lb-ft (43,4 Nm).

c. Connect new electrical wire “2” to any frame engine mount capscrew; for grounding the new EPA wire harness (Not shown).

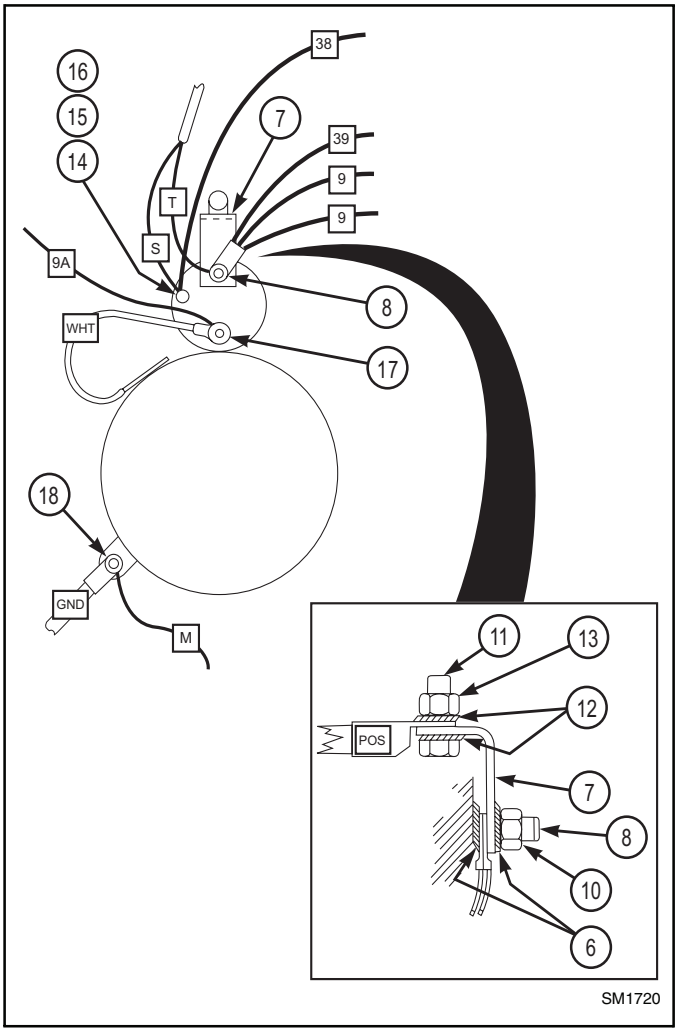


Figure 21

12. ETHER START ATOMIZER REPLACEMENT (new engine)

AFTER INSTALLATION OF NEW ENGINE REMOVAL (Figure 22)

a. Remove plug (1) from new engine block.

INSTALLATION (Figure 23)

Note: *Install tie wraps as necessary.*

a. Apply sealing compound to threads of (From the kit) Bushing #8530024 (2) and install on new engine block.

Note: *Punch mark on hex must be located on the bottom side of atomizer when tight.*

b. Apply sealing compound to threads of (from the kit) atomizer #8277101 (3) and install into bushing (2) on new engine block. Tighten to 25 lb-in.

c. Connect hose (4) to atomizer (3).

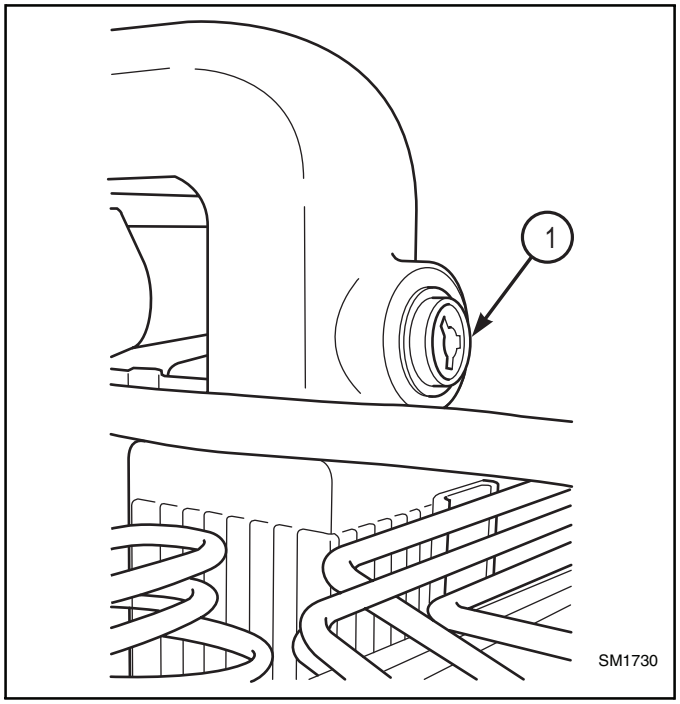


Figure 22

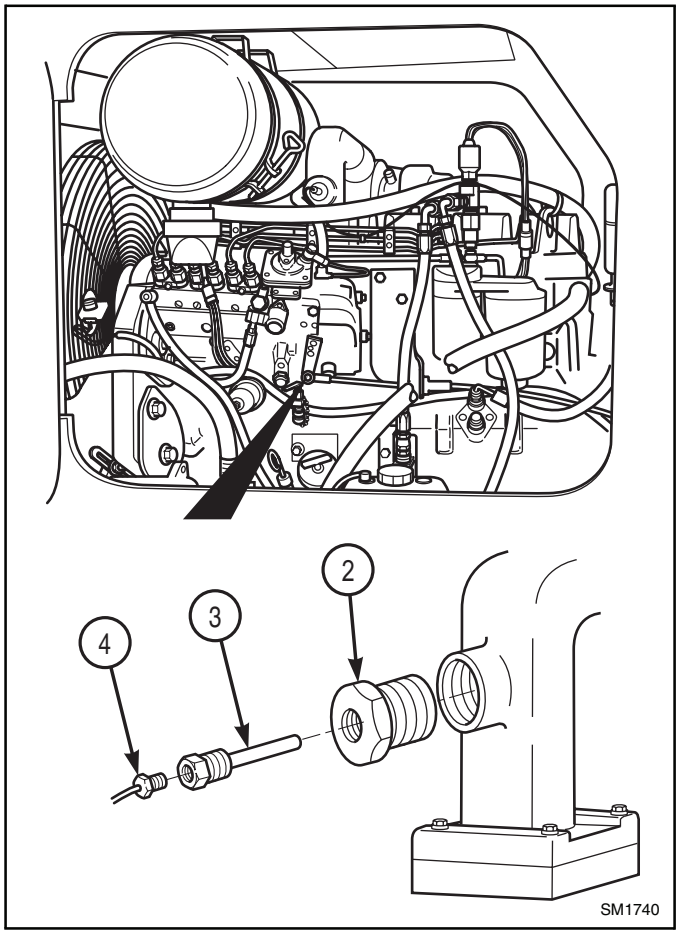
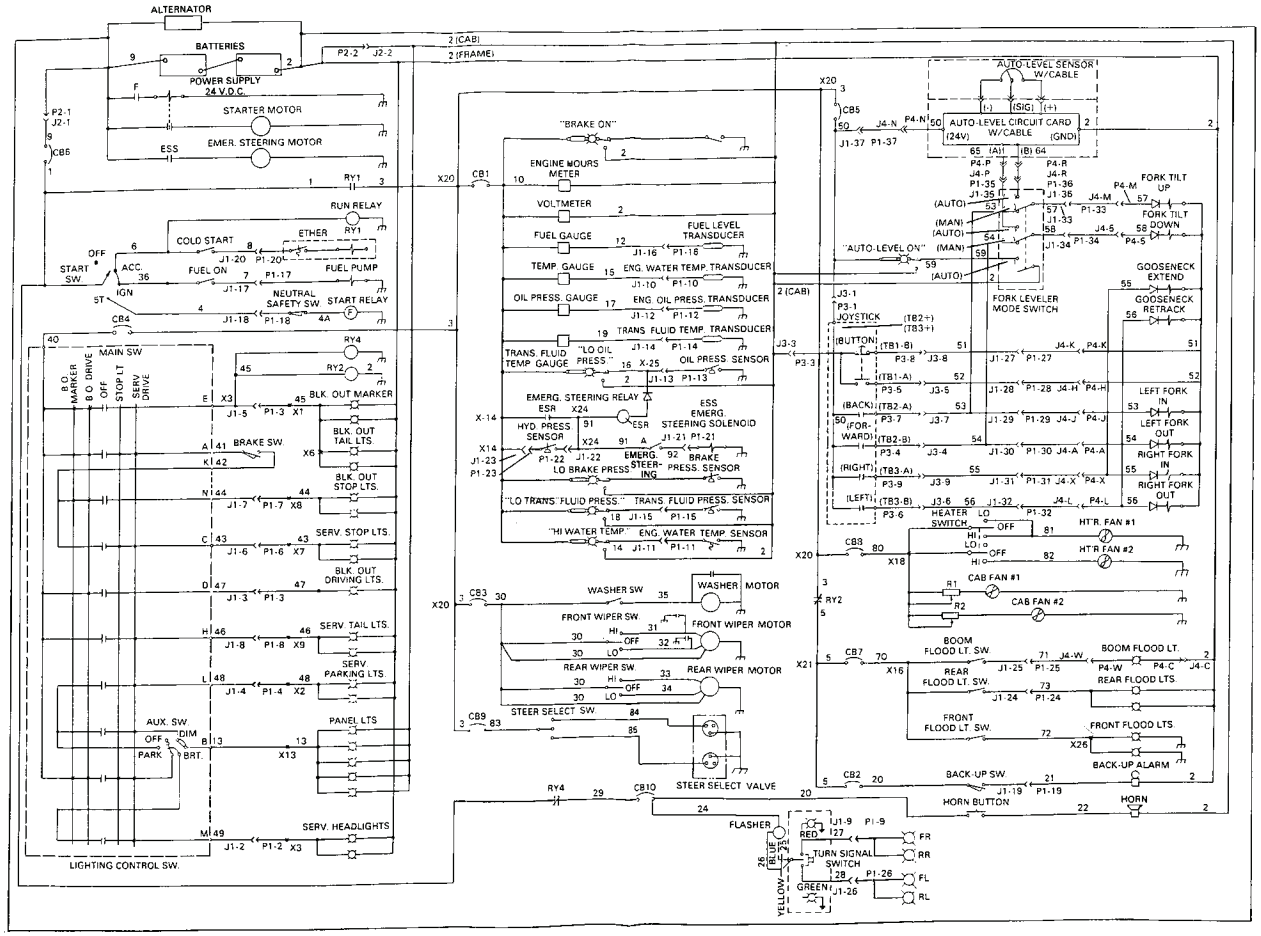


Figure 23



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By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0609312

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE 1 July 2006
TO: *(Forward to proponent of publication or form) (Include ZIP Code)* AMSTA-LC-LMIT/TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	FROM: *(Activity and location) (Include ZIP Code)* 125th Transportation Company ATTN: Motor SGT (SGT Wilson) Ft. Riley, KA 78665-4000	

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

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 10-3930-660-24-2	1 May 2006	Field Maintenance Manual (Unit and DS) for Truck, Forklift; 6,000 lb Variable Reach, Rough Terrain

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON
	0017 00-2					Part number supplied for item 2 is incorrect.

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

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Johnny Wilson, E-5, MOTOR SGT	DSN 867-7967	

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

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

PART III - REMAR[illegible] *ge*[illegible]*rks* [illegible] *enda*[illegible]*s, or sug*[illegible] *f*[illegible]*ement of publications and* [illegible]*k fo*[illegible] *Au*[illegible]*ona*[illegible] *la*[illegible] *s*[illegible]*ets* [illegible] *be used* [illegible] *spa*[illegible]*eded.)*

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AMSTA-LC-LMIT/TECH PUBS, TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630	

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DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. APD V4.00

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

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

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

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THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

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

Weights

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

Liquid Measure

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

Square Measure

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 = 0.0386 Sq Miles

Cubic Measure

1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

Temperature

5/9 (°F - 32) = °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 C° +32 = F°

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