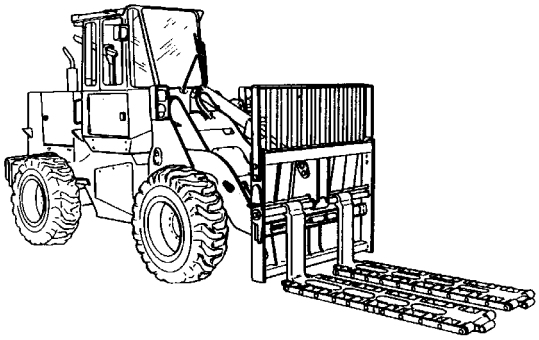
TECHNICAL MANUAL
DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL

FOR

TRUCK FORKLIFT:ADVERSE TERRAIN,
10,000 LB CAPACITY, M544E
(NSN 3930-01-301-8250)



Approved for public release; distribution is unlimited

HEADQUARTERS, DEPARTMENT OF THE ARMY DECEMBER 1993

FOR INFORMATION ON FIRST AID, REFER TO FM 21-11.

WARNING

CARBON MONOXIDE (EXHAUST GASES) CAN KILL!

Carbon monoxide is a colorless, odorless, deadly poisonous gas 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 forklift truck is operated for any purpose.

(1) DO NOT operate forklift truck engine in enclosed areas.

(2) DO NOT idle forklift truck engine with cab windows closed and without defroster fan operating.

(3) BE ALERT at all times for exhaust odors.

(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 artificial respiration, 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

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry contacts battery terminal, a direct short will result, causing instant heating of jewelry which will result in severe injury to personnel.

- Battery gases can explode. DO NOT smoke or allow sparks or open flames near batteries. Wear safety glasses or goggles when checking batteries. Failure to follow this warning may result in death or serious injury to personnel.

- Sulfuric acid contained in batteries can cause serious burns. If battery corrosion or electrolyte makes contact with skin, eyes, or clothing, take immediate action to stop the corrosive burning effects. Failure to follow these procedures may result in death or serious injury to personnel.

  a. Eyes. Flush with cold water for no less than 15 minutes and seek medical attention immediately.

  b. Skin. Flush with large amounts of cold water until all acid is removed. Seek medical attention as required.

  c. Internal. If corrosion or electrolyte is ingested, drink large amounts of water or milk. Follow with milk of magnesia, beaten egg, or vegetable oil. Seek medical attention immediately.

  d. Clothing/Equipment. Wash area with large amounts of cold water. Neutralize acid with baking soda or household ammonia.

WARNING

BRAKE SYSTEM

Pressure stored in accumulator is approximately 500 psi (3448 kPa). Ensure that accumulator pressure is relieved before removing service brake hoses or components. Failure to follow this warning may result in serious injury or death to personnel.

WARNING

CLEANING AGENTS

- Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-1380F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

- Cleaning compound, trichlorotrifluoroethane, for electrical parts is toxic and flammable, and reacts violently with aluminum, titanium, barium, lithium, samarium, sodium, and potassium. Always wear protective goggles and rubber gloves, and use only in a well-ventilated area. DO NOTwear jewelry while using cleaning compound. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. Cleaning compound fumes or vapors can take the place of air and may become a cancer producing agent. DO NOT use near open flame or excessive heat. The compound's boiling point is 11 4°F (46°C). If you become dizzy while using cleaning compound, immediately get fresh air and medical help. If compound contacts eyes, immediately wash your eyes with water and get medical aid.

WARNING

COMPRESSED AIR

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

WARNING

DIESEL FUEL HANDLING

- DO NOT smoke or permit any open flame in area of forklift truck 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 will result in injury to personnel or equipment damage.

- Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

WARNING

ELECTRICAL SYSTEM

When troubleshooting an electrical malfunction or performing electrical maintenance, ALWAYS place battery disconnect switch in OFF position. Failure to follow this warning may create a spark and explosion, resulting in serious injury or death to personnel.

WARNING

EXHAUST PIPE AND MUFFLER

DO NOT touch hot exhaust pipe or muffler with bare hands. Severe injury to personnel will result.

WARNING

EYE PROTECTION

Wear eye protection when performing the following maintenance:

- Working under forklift truck
- Cleaning with wire brushes
- Striking metal parts with hammer or chisel
- Welding or heating forklift truck components
- Using chisel or drill
- Using compressed air

WARNING

HANDLING HEAVY COMPONENTS

Use extreme caution when handling heavy parts. Lifting device Is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

WARNING

HYDRAULIC FLUID

Fire resistant hydraulic fluid may contain Tricresyl Phosphate. If taken internally, paralysis may occur. Always wear protective goggles, face shield, rubber gloves, and long sleeves. Should hydraulic fluid make contact with skin or clothing, thoroughly wash with soap and water. Thoroughly wash hands prior to eating, drinking, or smoking. Failure to follow this warning may result in serious injury to personnel.

WARNING

HYDRAULIC LINES

DO NOT attempt to disconnect hydraulic lines and fittings while engine is running or before hydraulic system pressure has been released. When engine is running, hydraulic system is under pressure. Hydraulic system pressure should be 0 psi (0 kPa) before lines are disconnected. A line or fitting disconnected under pressure will explode with great force and can cause injury to personnel.

WARNING

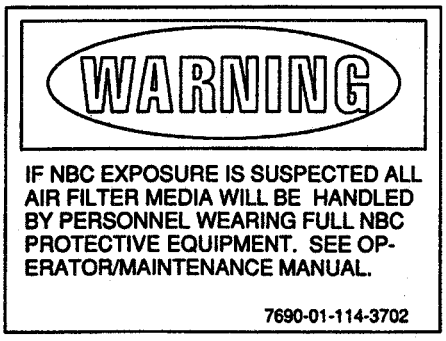
LIVE STEAM

Avoid contact with live steam. Live steam can burn skin, cause blindness, and cause other serious injury. Be sure to wear protective apron, gloves, and safety goggles when using live steam.

WARNING

NBC EXPOSURE

If NBC exposure is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.



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

ON-BOARD CRANE OPERATION

On-board crane is heavy. Assistant is required to raise or lower on-board crane to various operating positions. Assistant may be required to help raise or lower load. Failure to follow this warning may result in injury to personnel.

WARNING

PRESSURIZED COOLING SYSTEM

- DO NOT remove radiator fill cap unless engine Is cold. This is a pressurized cooling system and escaping steam, hot water, or coolant will cause serious burns.

- Servicing of engine cooling system should only be performed on a cool engine. NEVER remove clamps or hoses when engine is hot. Pressurized steam, hot water, or coolant will cause serious burns.

WARNING

PRUSSIAN BLUE DYE

Prussian blue dye is poisonous and can burn skin on contact. Always wear protective goggles and gloves, and use only in a well-ventilated area. Overexposure to prussian blue dye can cause serious heart and skin problems, dizziness, and unconsciousness if not handled properly.

WARNING

STARTING FLUID

Starting fluid is toxic and highly flammable. Container is pressurized to act as an expellent. DO NOT heat container and DO NOT discharge starting fluid in confined areas or near an open flame. Failure to follow this procedure may result in serious injury to personnel.

WARNING

UNAUTHORIZED CLEANING METHODS

Improper cleaning methods and use of unauthorized cleaning liquids or solvents can injure personnel and damage equipment. To prevent this, refer to TM 9-247 for further instructions.

WARNING

VEHICLE MOVEMENT

- Before moving forklift truck, ensure that all personnel are away from danger areas of forklift truck. Specifically, check to ensure that no one is between forward and rear sections of forklift truck. Failure to follow this warning may result in injury or death to personnel.

- DO NOT move forklift truck with frame locking bar installed. Forklift truck will be unsteerable and may result in injury to personnel.

TECHNICAL MANUAL

TM 10-3930-659-34

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 29 December 1993

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

TRUCK, FORKLIFT: ADVERSE TERRAIN, 10,000 LB CAPACITY, M544E (NSN 3930-01-301-8250)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual, direct to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

TABLE OF CONTENTS

TABLE OF CONTENTS (Con't)

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HOW TO USE THIS MANUAL

This manual is designed to help maintain the M544E Forklift Truck. It describes in detail the Direct Support Maintenance and the General Support Maintenance prescribed by the Maintenance Allocation Chart CTM 10-3930-659-20) and the Source, Maintenance, and Recoverability (SMR) Codes CTM 10-3930-659-24P).

FEATURES OF THIS MANUAL:

- Bleed-to-edge indicators on the cover and on the edge of the applicable manual pages provide quick access to chapters and sections most often used.
- A table of contents is provided at the beginning of most chapters and sections.
- WARNINGs, CAUTIONs, and NOTEs, subject headings, and other important information are highlighted in BOLD print as a visual aid.

WARNING

A WARNING indicates a hazard which can 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.

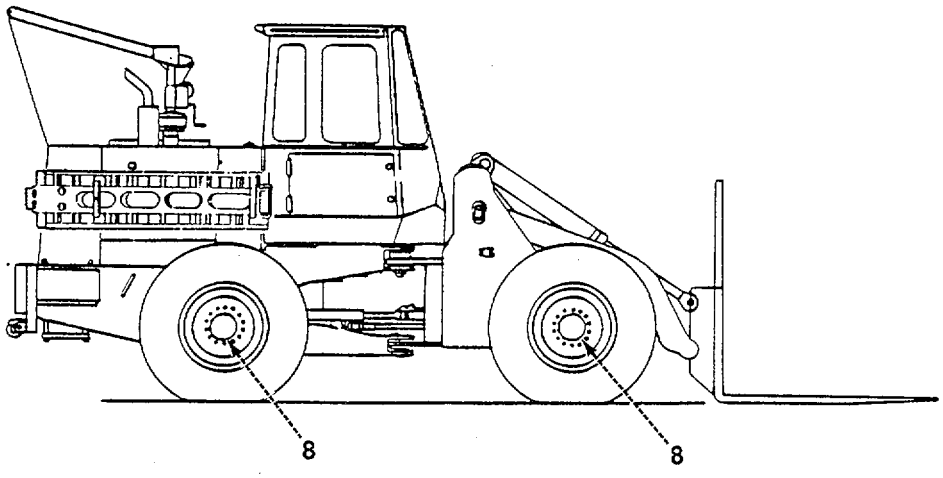
NOTE

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

- Statements and words of particular importance are printed in capital letters to create emphasis.
- Instructions are located together with illustrations that show the specific task on which the technician is working.
- Equipment locator illustrations are provided throughout the maintenance procedures. These illustrations are for use in locating components and assemblies of the overall equipment. It should be noted that the locator illustrations do not always reflect the equipment condition listed in the Initial Setup at the beginning of each task.

HOW TO USE THIS MANUAL (Con't)

• Dashed leader lines used in illustrations indicate that called out items are not visible (i.e., they are located within the structure). The example illustrates that the drive axles (8) are located within the axle.



Dashed Leader Line Example

• Technical instructions include metric in addition to standard units. A metric conversion chart is provided on the inside back cover.
• A standard torque chart is provided at Appendix D.
• An alphabetical index is provided at the end of the manual to assist in locating information not readily found in the table of contents.

FOLLOW THESE GUIDELINES WHEN YOU USE THIS MANUAL:

• Read through this manual and become familiar with its contents before proceeding to specific maintenance tasks.
• A warning summary is provided at the beginning of this manual and should be read before performing any maintenance tasks.
• In the actual maintenance tasks, follow all WARNINGs, CAUTIONs, and NOTEs. These are given immediately preceding the procedural steps to which they apply. If these instructions are not followed or care is not taken, injury to personnel or equipment damage may result.
• Within a chapter, section, or paragraph, headings are used to help group the material and assist you in quickly finding tasks. Read all preliminary information found at the beginning of each task. After completing a task, ALWAYS perform the follow-on maintenance at the end of the task.

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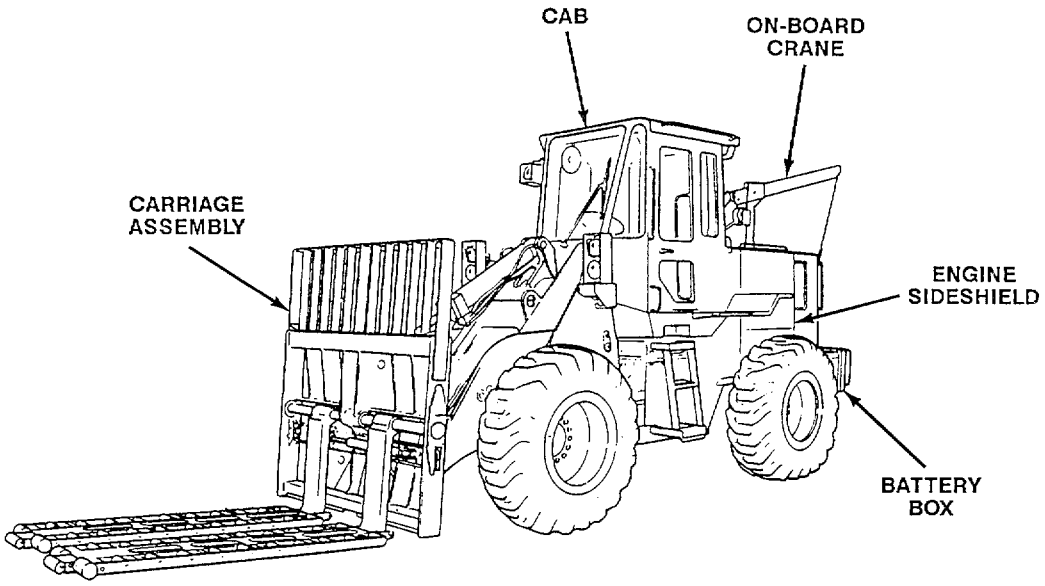
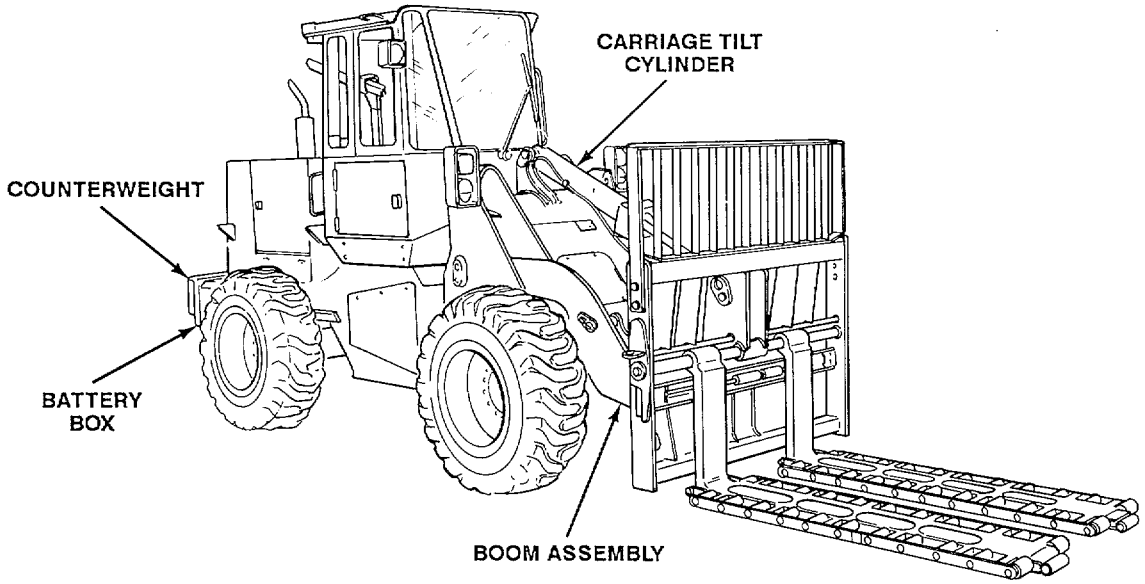

CAB
ON-BOARD CRANE
CARRIAGE ASSEMBLY
ENGINE SIDESHIELD
BATTERY BOX


CARRIAGE TILT CYLINDER
COUNTERWEIGHT
BATTERY BOX
BOOM ASSEMBLY

TA708020

CHAPTER 1
INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE.

a. Type of Manual. Direct Support and General Support Maintenance Manual.

b. Equipment Name and Model Number. Truck, Forklift: Adverse Terrain, 10,000 Lb Capacity, M544E.

c. Purpose of Equipment. The forklift truck is designed for conventional loading and unloading or stacking and unstacking of suitably packaged materiel.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS.

Department of the Army forms and procedures used for the equipment will be those prescribed by DA Pam 738-750, The Army Maintenance Management System (TAMMS).

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.

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

1-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs).

If your forklift truck needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF Form 368 (Product Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MP, Warren, MI 48397-5000. We'll send you a reply.

1-5. WARRANTY INFORMATION.

The forklift truck is under warranty by the John Deere Company in accordance with TB 10-3930-659-14.

1-6. SAFETY, CARE, AND HANDLING.

a. General. Refer to FM 21-11, First Aid for Soldiers, for first aid treatments of injured personnel. IMMEDIATELY seek medical attention for any injury. The following first aid procedures should be used to prevent further injury until medical attention is available.

(1) Exhaust Gases or Toxic Fumes. Expose person to fresh air and keep warm. DO NOT permit person to move. If necessary, administer artificial respiration and immediately seek medical attention.

(2) Chemical Burns.

(a) Eyes. Flush eyes with cold water for no less than 15 minutes. Immediately seek medical attention.

(b) Skin. Flush area with large amounts of cold water until all acid is removed. Seek medical attention as required.

(c) Internal. Drink large amounts of water or milk followed by milk of magnesia, beaten egg, or vegetable oil. Immediately seek medical attention.

(d) Clothing or Equipment. Immediately wash area with large amounts of cold water. Neutralize acid with baking soda or household ammonia.

(3) Foreign Object in Eye. DO NOT attempt to remove foreign object from eye as object may cause cuts and abrasions. Close eye, cover with gauze and tape, and immediately seek medical attention.

b. Personnel Precautions.

(1) Read and become familiar with all WARNINGs in the warning summary at the front of this manual.

(2) Throughout this manual, WARNINGs are given immediately preceding the procedural steps to which they apply. Read these WARNINGs and follow them exactly.

(3) WARNING decals may be found on the forklift truck (see TM 10-3930-659-10) to provide safety instructions and identify specific hazards which if not followed may result in serious injury or death to personnel.

(4) Protect yourself against injury. Wear protective gear such as safety goggles or lenses, safety shoes, rubber apron, gloves, etc.

(5) Stay clear of moving parts. Remove watches, rings, and other jewelry which could catch on moving parts and cause injury. Keep hands, feet, and clothing away from all moving parts.

(6) Notify others in the area if you are handling flammable materiels. Know location of fire extinguishers and emergency procedures in case of accident or fire.

(7) Never operate engine or heater in a closed area unless area is properly ventilated. If symptoms of carbon monoxide poisoning are noticed, immediately evacuate and ventilate area.

(8) When lifting heavy parts, have someone help you. Ensure that lifting or jacking equipment is properly working, is suitable for the assigned task, and is secure against slipping.

(9) Never leave forklift truck unattended while engine is running. Observe all equipment conditions before performing maintenance.

(10) DO NOT climb on tires. Use mounted steps and ladders when climbing onto forklift truck. If needed, use a sturdy stepladder to perform maintenance on equipment not safely within your reach.

1-6. SAFETY, CARE, AND HANDLING (Con't).

c. Forklift Truck Precautions.

(1) Throughout this manual, CAUTIONs are placed as they pertain to specific maintenance procedures. Read these CAUTIONs and follow them exactly.

(2) Ensure that the battery disconnect switch is turned to the OFF position when performing any maintenance on the forklift truck.

(3) Disconnect battery as required.

(4) Use lifting equipment of sufficient capacity to remove and support heavy items.

1-7. CORROSION PREVENTION AND CONTROL.

a. Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with the forklift truck be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

b. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

c. If a corrosion problem is identified, it can be reported using SF Form 368 (Product Quality Deficiency Report). Use of keywords such as "corrosion," "rust," "deterioration," or "cracking" will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA Pam 738-750.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-8. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

a. The forklift truck is a commercial adverse terrain vehicle designed for loading and unloading or stacking and unstacking of suitably packaged materiel.

b. The forklift truck has a lifting capacity of 10,000 pounds (4540 kg) for raising, lowering, and transporting loads.

c. Features of the forklift truck:

(1) Turbocharged six-cylinder diesel engine.

(2) Power shift transmission with four forward and three reverse speeds.

(3) Full-time four-wheel drive.

(4) Articulating frame steering.

(5) Removable cab assembly to facilitate air transport.

(6) Conveyorized fork attachments.

(7) On-board crane to facilitate the removal and installation of the cab, counterweight, and conveyorized fork attachments.

(8) A 24-volt electrical system capable of operating under standard and blackout modes.

(9) A NATO slave cable receptacle for slave starting the engine.

(10) Air compressor to facilitate inflation of the forklift truck tires under emergency conditions.

(11) Winterization package to protect the forklift truck systems down to -65 OF (-540C).

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

Refer to TM 10-3930-659-10 for information on location and description of major components.

1-10. EQUIPMENT DATA.

Table 1-1. General Characteristics and Specifications.

General Vehicle Specifications:	
Lifting Capacity	10,000 lb (4540 kg)
Vehicle Weight	24,220 lb (10996 kg)
Overall:	
Length	303 in. (769.6 cm)
Width	100 in. (254.0 cm)
Height (Boom Raised)	190 in. (482.6 cm)
Wheelbase	114 in. (289.6 cm)
Wheel Tread	83 in. (210.8 cm)
Ground Clearance	16 in. (40.6 cm)
Steering Radius	195 in. (495.3 cm)
Load Lift Height	75 in. (190.5 cm)
Travel Speeds (Maximum):	
Forward Gears:	
First 4.5 mph (7.2 kph)	
Second	7.6 mph (12.2 kph)
Third	17.2 mph (27.7 kph)
Fourth	24.6 mph (39.6 kph)
Reverse Gears:	
First	4.5 mph (7.2 kph)
Second	7.6 mph (12.2 kph)
Third	17.2 mph (27.7 kph)
Fluid Capacities:	
Fuel Tank	55 gl (208 1)
Engine:	
Oil	20 qt (19 1)
Coolant	25 qt (24 1)
Transmission Oil	10 qt (9 1)
Differential Oil (Each)	17 qt (16 1)
Hydraulic Reservoir	20 gl (76 1)
Engine Specifications:	
Engine Type	John Deere Turbocharged Diesel
Cycle	Four
Number of Cylinders	Six
Piston Displacement	359 cu in.
Rated Horsepower	115 @ 2200 rpm
Fuel Types	No. 1 or No. 2 Grade Diesel Fuel

1-10. EQUIPMENT DATA (Con't).

Table 1-1. General Characteristics and Specifications (Con't).

Transmission Specifications:	
Type	ZF of North America, Countershaft, Power Shift
Forward Speeds	Four
Reverse Speeds	Three
Torque Converter Type	Single Phase, Single Stage
System Pressure @ 150° 100 and 1500 rpm	213-242 psi (1469-1669 kPa)
Axle and Differentials Specifications:	
Type	John Deere, Inboard Planetary Axle with Standard Spiral Bevel Gear Differential
Differential Gear Reduction Ratio	4.333:1
Inboard Planetary Drive Reduction Ratio	4.800:1
Overall Axle Reduction Ratio	20.798:1
Service Brake Specifications:	
Type	Wet Disc
Operation	Hydraulic, Foot Pedal
Accumulators:	
Charging Medium	Dry Nitrogen
Charging Pressure	475-525 psi (3275-3620 kPa)
Parking Brake Specifications:	
Type	ZF of North America, Expanding Shoe
Operation	Manual, Foot Pedal
Mounting	Transmission
Tire Specifications:	
Size	17.5-25
Type	Tubeless
Ply Rating	16
Recommended Inflation Pressure:	
Front	55 psi (379 kPa)
Rear	40 psi (276 kPa)

1-10. EQUIPMENT DATA (Con't).

Table 1-1. General Characteristics and Specifications (Con't).

Hydraulic System Specifications:	
Main Hydraulic Pump:	
Type	Commercial Steering, Gear, Constant Displacement
Output (Maximum)	34 gpm @ 2000 psi
Fork/Brake Hydraulic Pump:	
Type	Sunstrand Piston, Variable Displacement, Pressure Compensated
Output (Minimum)	18.6 gpm @ 2000 psi
Steering System Relief Pressures:	
Priority Valve Relief Setting	2500 psi (17,238 kPa)
Crossover Relief Valve Setting	2900 psi (19,996 kPa)
Forklift Control Valve Setting	2750 psi (18,961 kPa)

Section III. PRINCIPLES OF OPERATION

1-11. DRIVE TRAIN SYSTEM.

a. Engine. The engine is a six-cylinder turbocharged diesel which supplies rotational power to the transmission. The cooling system is pressurized and includes a thermostat, controlled bypass, and coolant recovery bottle. Engine lubrication is pressurized and oil is continuously cleaned by full-flow filters.

b. Drive Dampener. The drive dampener connects the engine to the transmission and absorbs torque spikes that could develop in the drive train.

c. Transmission. The transmission input shaft turns at engine speed. A speed reduction takes place within the transmission according to the speed range selected by the operator. The direction of forklift truck travel is also determined by the transmission. Both speed and direction selection are made by hydraulically operated clutches in the transmission.

d. Drive Shafts. The drive shafts transmit rotation of the transmission output to the front and rear axles.

Connections at both ends are made through universal joints to compensate for any misalinement.

e. Front and Rear Axles. The front and rear axles are identical in operating principle. The rear axle is different in that it oscillates 11 ° above and below horizontal. Both axles drive whenever the transmission is engaged. Neither axle can be independently disconnected.

1-12. SERVICE BRAKE SYSTEM.

a. Introduction. The service brakes are foot controlled, hydraulic-type brakes. The system is supplied pressurized hydraulic oil by a pressure compensated pump that is driven by the engine.

b. Fork/Brake Hydraulic Pump. The fork/brake hydraulic pump is a variable displacement, pressure compensated, piston-type pump. It supplies flow to both the service brake system and to the fork attachment cylinder circuits.

c. Accumulators. The accumulators in the brake system store a charge of pressurized oil which allows a number of brake applications in the event of pump failure or engine shutdown.

d. Brake Valves. The two brake valves are identical and are operated by separate foot pedals. Depressing either foot pedal will cause all four wheel brakes to operate.

1-12. SERVICE BRAKE SYSTEM (Con't).

e. Wheel Brakes. The wheel brakes are a wet disc-type brake arrangement. When hydraulic pressure is routed to the brake pistons via the brake valves, the pistons move outward and compress the brake disc against the stationary backing plate, slowing or stopping the forklift truck.

f. Parking Brake. The parking brake mechanism is mounted on the transmission. The actuating pedal and release handle are located in the operator's cab. A red light flashes and an audible alarm sounds if the parking brake is applied while the engine is running and the transmission is in gear; a yellow light flashes if the parking brake is applied and the transmission is in N (Neutral).

1-13. STEERING SYSTEM.

a. General. The steering system is a full-time power assist-type. A secondary electrically operated pump is included to provide emergency steering. The other components of the system are the steering valve, cylinders, and crossover relief valve.

b. Main Hydraulic Pump. The main hydraulic pump supplies the steering system only. It is mounted on the transmission and is driven by the engine. It is a fixed displacement, external gear-type pump.

c. Secondary Steering Pump. The secondary steering pump is electrically powered. It operates when the key switch is in the ON position and low steering system pressure is sensed by a pressure switch.

1-14. FORKLIFT HYDRAULIC SYSTEM.

a. General. The forklift hydraulic system includes the service brake system, steering system, hydraulic reservoir, and attachment components. The service brake and steering systems are described in paragraphs 1-12 and 1-13. The attachment components consist of the forklift control valve, oil cooler, and two oil filters.

b. Hydraulic Reservoir. The hydraulic reservoir is a 20 gl (76 1) tank, located just ahead of the engine.

c. Forklift Control Valve. The forklift control valve controls the operation of the forks for boom raise and lower, tilt, and spacing.

d. Oil Cooler. The oil cooler is mounted alongside the engine radiator and cools both the hydraulic system oil and the transmission oil in separate sections.

e. Oil Filters. There are two filters that are contained in the hydraulic system. The hydraulic reservoir suction filter, located at the hydraulic reservoir, filters larger contaminates and uses a washable screen. The hydraulic oil return filter contains a bypass valve and a replaceable cartridge-type filter. It filters contaminants entering the hydraulic reservoir from the components of the system. Should the hydraulic oil return filter become clogged, a hydraulic oil filter restriction switch will light and the bypass valve will open.

1-15. ELECTRICAL SYSTEM.

a. Charging System. The 24-volt charging system consists of the batteries and an alternator with an internal regulator.

b. Lighting System. The lighting system is protected by a circuit breaker and contains two front driving lights, an adjustable floodlight, two rear cab mounted worklights, front and rear turn signals, taillights, a domelight, front and rear blackout lights, and instrument panel lights.

1-15. ELECTRICAL SYSTEM (Con't).

c. Monitoring System. The monitoring system includes a variety of electrical senders, and associated gages and Indicators located In the cab. This allows the operator to be aware of the status of the forklift truck during operation. For a description of the function of each monitor within the system, see TM 10-3930-659-10.

d. Windshield Wipers and Washers. Separate wipers, washers, and controls are provided for the front windshield and rear cab window.

1-16. ON-BOARD CRANE.

The 900 lb (409 kg) capacity crane is used to remove and install the conveyorized forks, cab upper section, and counterweight. It is hand-operated and can be raised or lowered to three different operating positions with quick-release pins.

1-17. FORKLIFT WINTERIZATION PACKAGE.

a. The forklift truck is equipped with a winterization package that protects the forklift truck systems down to -650F (-54°C).

b. The winterization package consists of an engine coolant heater, engine oil pan heater, battery heaters, and 110-volt junction box. Heaters are operated by an external 110-volt AC power source and are equipped with a thermostat for overheat protection. An extension cord has been provided to connect the forklift truck to the power source.

c. The engine coolant heater is located in the engine cylinder head just behind the hydraulic reservoir.

d. The engine oil pan heater is located in the engine oil pan.

e. Each battery has a blanket-type heater wrapped around the battery case and a tray heater or warmer underneath it. The battery warmers are mounted on wooden insulators.

CHAPTER 2
GENERAL MAINTENANCE INFORMATION

Section I. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

2-1. COMMON TOOLS AND EQUIPMENT.

For authorized common tools and equipment, refer to Appendix E, Tool Identification List, and to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

2-2. SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT.

Refer to the Maintenance Allocation Chart (see TM 10-3930-659-20) and TM 1 0-3930-659-24P for information on special tools and support equipment for the M544E Forklift Truck.

2-3. REPAIR PARTS.

Repair parts are listed and illustrated in TM 10-3930-659-24R

Section II. GENERAL MAINTENANCE INSTRUCTIONS

2-4. GENERAL.

a. These general maintenance instructions contain general shop practices and specific methods you must be familiar with to properly maintain the M544E Forklift Truck. You should read and understand these practices and methods before performing any Direct Support or General Support Maintenance procedures.

b. Before beginning a task, find out how much repair, modification, or replacement is needed to fix the equipment. Sometimes the reason for equipment failure can be seen right away and complete teardown is not necessary. Disassemble equipment only as far as necessary to repair or replace damaged parts.

c. In some cases, a part may be damaged during removal. If the part appears to be good, and other parts behind it are not defective, leave it in place and continue with the procedure. Here are a few simple rules:

(1) Do not remove dowel pins or studs unless loose, bent, broken, or otherwise damaged.

(2) Do not remove bearings or bushings unless damaged. if you need to remove them to access parts behind, carefully pull out bearings and bushings.

(3) Replace all gaskets, lockwashers, locknuts, seals, cotter pins, and preformed packings.

2-4. GENERAL (Con't).

d. The following "Initial Setup" information applies to all maintenance procedures:

(1) Resources are not listed unless they apply to the procedure.

(2) "Personnel Required" is listed only if more than one mechanic is required to complete the procedure.

e. All tags and forms attached to the equipment must be checked to learn the reason for removal of equipment from service. Modification Work Orders (MWOs) and Technical Bulletins (TBs) must also be checked for equipment changes and updates.

2-5. WORK SAFETY.

a. Before beginning a procedure, think about the safety risks and hazards to yourself and to others. Wear protective gear such as safety goggles or lenses, safety shoes, rubber apron, or gloves.

b. Before beginning a procedure, ensure that the following conditions have been observed, unless otherwise specified:

(1) Forklift truck must be parked on level ground with parking brake applied.

(2) Forks must be lowered to ground.

(3) Transmission must be in N (Neutral) and locked.

(4) Engine must be off.

(5) Battery disconnect switch must be in OFF position.

(6) Components must be at operating temperature to be tested.

c. Immediately clean up spilled fluids to avoid slipping.

d. When lifting heavy parts, have someone help you. Ensure that lifting equipment or jack is working properly, that it meets weight requirement of part being lifted, and that it is securely fastened to part.

e. Always use power tools carefully.

f. Observe all WARNINGs and CAUTIONs.

2-6. CLEANING INSTRUCTIONS.

WARNING

Improper cleaning methods and use of unauthorized cleaning liquids or solvents can Injure personnel and damage equipment. To prevent this, refer to TM 9-247 for further instructions.

a. General. Cleaning instructions will be the same for the majority of parts and components which make up the forklift truck. The following applies to all cleaning operations:

(1) Clean all parts before inspection, after repair, and before assembly.

2-6. CLEANING INSTRUCTIONS (Con't).

(2) Keep hands free of grease which can collect dust, dirt, and 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 after cleaning (see paragraph 2-7).

b. Steam Cleaning.

CAUTION

DO NOT direct water or steam, under pressure, against unsealed electrical systems or any exterior opening. Failure to follow this caution may result in damage to equipment.

(1) Before steam cleaning the forklift truck, protect ail electrical equipment which could be damaged by steam or moisture.

WARNING

Avoid contact with live steam. Live steam can burn skin, cause blindness, and cause other serious injury. Be sure to wear protective apron, gloves, and safety goggles when using live steam.

(2) Place disassembled parts in a suitable container to steam clean. Parts that are subject to rust should be dried and lightly oiled after cleaning (see paragraph 2-7).

c. Castings, Forgings, and Machined Metal Parts.

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 1000F-138°F (380C-590C). If you become dizzy while using cleaning solvent, Immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes and get medical aid.

(1) Clean inner and outer surfaces with dry cleaning solvent (Item 47, Appendix B) and dry with clean rags (Item 43, Appendix B).

(2) Remove grease and accumulated deposits with a scrub brush (Item 5, Appendix B).

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

(3) Clear all threaded holes with compressed air to remove dirt and cleaning fluids.

2-6. CLEANING INSTRUCTIONS (Con't).

CAUTION

DO NOT wash oil seals, electrical cables, and flexible hoses with dry cleaning solvent or mineral spirits. Serious damage or destruction of material will result.

d. Oil Seals, Electrical Cables, and Flexible Hoses. Wash oil seals, electrical cables, and flexible hoses with a solution of detergent (Item 23, Appendix B) and water, and wipe dry with a clean rag (Item 43, Appendix B).

e. Bearings. Clean bearings in accordance with TM 9-214.

f. General Cleaning Covered by Other Manuals.

(1) TB 43-0212: Purging, Cleaning and Coating Interior Ferrous and Terne Sheet Vehicle Fuel Tanks.

(2) TB 750-1047: Elimination of Combustibles from Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks.

(3) TM 9-247: Materials Used for Cleaning, Preserving, Abrading and Cementing Ordnance Materiel and Related Materials Including Chemicals.

2-7. PRESERVATION OF PARTS.

Unpainted metal parts that will not be installed immediately after cleaning may be covered with a thin coat of lubricating oil (Item 39, Appendix B).

2-8. PAINTING.

a. On painted areas where paint has been removed, paint in accordance with procedures outlined in TM 43-0139 and TB 43-0209.

b. For camouflage painting instructions, refer to FM 20-3.

2-9. INSPECTION INSTRUCTIONS.

NOTE

All damaged areas should be marked for repair or replacement.

a. All components and parts must be carefully checked to determine if they are serviceable for use, can be repaired, or must be scrapped.

b. Inspect drilled and tapped (threaded) holes for the following:

(1) Wear, distortion, cracks, and any other damage in or around holes.

(2) Threaded areas for wear distortion (stretching) and evidence of cross-threading.

2-9. INSPECTION INSTRUCTIONS (Con't).

c. Inspect metal lines, flexible lines or hoses, and metal fittings and connectors for the following:

(1) Metal lines for sharp kinks, cracks, bad bends, and dents.

(2) Flexible lines or hoses for fraying, evidence of leakage, and loose metal fittings or connectors.

(3) Metal fittings and connectors for thread damage and worn or rounded hex heads.

d. Inspect castings, forgings, and machined metal parts for the following:

(1) Machined surfaces for nicks, burrs, raised metal wear, and other damage.

(2) Inner and outer surfaces for breaks and cracks.

e. Inspect bearings in accordance with TM 9-214.

2-10. DISASSEMBLY AND ASSEMBLY INSTRUCTIONS.

Follow these general practices when performing disassembly and assembly procedures:

(1) Keep major components together whenever possible and practical.

(2) Tag hoses, electrical wires, cables, and harnesses to identify them and aid during installation.

(3) Keep related parts together for identification purposes.

(4) Temporarily install attaching hardware such as screws, bolts, washers, and nuts to prevent loss.

(5) Only disassemble to the point of the problem.

(6) Ensure that parts are clean and lubricated before assembly.

2-11. REPAIR INSTRUCTIONS.

a. Repair castings, forgings, and machined parts using the following instructions:

(1) Repair minor cracked castings or forgings in accordance with TM 9-237.

(2) Repair minor damage to machined surfaces with an abrasive cloth (Item 7, Appendix B) dipped in dry cleaning solvent (Item 47, Appendix B).

(3) Replace any deeply nicked machined surface that could affect the assembly operation.

(4) Repair minor damage to threaded capscrew holes with thread tap of same size to prevent cutting oversize.

b. After repair, thoroughly clean all parts to prevent dirt, metal chips, or other foreign material from entering any working parts.

2-12. LUBRICATION INSTRUCTIONS.

Refer to LO 10-3930-659-12 for detailed, illustrated instructions on proper lubrication. 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 (see paragraph 2-7).

2-13. APPLICATION OF ADHESIVES.

a. General. Adhesives are recommended in some tasks to ensure and strengthen seals. The following information describes their correct use and application.

b. Silicone Sealing Compound. Silicone sealing compound (Item 17, Appendix B) is used to seal parts against moisture. Use the following instructions when applying:

(1) Anytime a seal is broken, the part must be thoroughly cleaned to remove any remaining sealing compound and dirt.

(2) Thoroughly clean surface before applying silicone sealing compound.

(3) When applying silicone sealing compound, ensure that the area is completely covered. Press silicone sealing compound into and around parts as necessary.

(4) Silicone sealing compound will set in 15-30 minutes depending on temperature and humidity.

c. Loctite Adhesive. Loctite adhesive (Item 2, Appendix B) provides a seal against leakage and a resistance to loosening when used in the assembly of threaded, slip-fitted, or press-fitted parts. Always use the grade of Loctite adhesive specified and never use when other retaining means are provided, such as lockwires, lockwashers, lockplates, and fasteners. DO NOT use Loctite adhesive on brass fittings, plugs, or items that need frequent servicing, or when operating temperatures exceed 300°F (149 OC). Apply Loctite adhesive as follows:

(1) Before application, clean threads to remove oil, grease, and metal chips.

(2) Apply Loctite adhesive to second and third threads. DO NOT apply to first thread to ensure system cleanliness.

(3) Loctite adhesive will dry in 6-24 hours at room temperature.

(4) Adjustments for elbows, gages, and valves can be made up to 24 hours after application without affecting the seal.

2-14. STANDARD TOOL REQUIREMENTS.

a. The following are general practices regarding the use of tools:

(1) Always use the proper tool kit and tools for the procedure being performed.

(2) Ensure that tools are clean and lubricated to reduce wear and to prevent rust.

(3) Keep track of tools. Do not be careless with them.

(4) Return tools to toolbox when finished with repair or maintenance.

(5) Return toolboxes and tools to tool storage when not in use.

(6) Inventory tools before and after each use.

b. 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.

2-15. TAGGING WIRES AND HOSES.

a. Use marker tags (Item 49, Appendix B) to identify all electrical wires, hydraulic, fuel, oil, and coolant 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.

b. 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 numbers near the end of the wire, stamped on a permanent metal tag. Compare this number to wire numbers on the appropriate electrical schematic.

c. Identify hydraulic, fuel, oil, and coolant 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.

d. Identify and tag other parts as required by name and installed location.

2-16. SOLDERING.

WARNING

Cleaning compound, trichlorotrifluoroethane, for electrical parts is toxic and flammable, and reacts violently with aluminum, titanium, barium, lithium, samarium, sodium, and potassium. Always wear protective goggles and rubber gloves, and use only in a well-ventilated area. DO NOT wear jewelry while using cleaning compound. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. Cleaning compound fumes or vapors can take the place of air and may become a cancer producing agent. DO NOT use near open flame or excessive heat. The compound's boiling point Is 114°F (46°C). If you become dizzy while using cleaning compound, immediately get fresh air and medical help. If compound contacts eyes, immediately wash your eyes with water and get medical aid.

CAUTION

Use low wattage soldering gun when soldering electrical wires, connectors, terminal lugs, and receptacles. High wattage soldering guns may damage parts by overheating.

a. Solder connection must be bright and clean before soldering. Remove dirt and grease with trichlorotrifluoroethene (Item 55, Appendix B). Solder used must be of lead alloy (Item 46, Appendix B) with soldering flux (Item 27, Appendix B). All wires, parts, and soldering gun (Item 60, Appendix E) must be tinned for good connection and maximum transfer of heat.

b. To prevent overheating damage to electrical parts when soldering and unsoldering connections, hold bare wire, lead, or terminal lug close to soldering point with long roundnose pliers (Item 71, Appendix E). Pliers act as heat sink and absorb excess heat.

WARNING

Cleaning compound, trichlorotrifluoroethane, for electrical parts is toxic and flammable, and reacts violently with aluminum, titanium, barium, lithium, samarium, sodium, and potassium. Always wear protective goggles and rubber gloves, and use only in a well-ventilated area. DO NOT wear jewelry while using cleaning compound. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. Cleaning compound fumes or vapors can take the place of air and may become a cancer producing agent. DO NOT use near open flame or excessive heat. The compound's boiling point is 114°F (460C). If you become dizzy while using cleaning compound, Immediately get fresh air and medical help. If compound contacts eyes, Immediately wash your eyes with water and get medical aid.

c. Clean all solder joints with a scrub brush (Item 5, Appendix B) and electrical parts with trichlorotrifluoroethane (Item 55, Appendix B) after soldering to get a bright, clean surface.

2-17. HEAT SHRINKABLE TUBING.

Use heat shrinkable tubing (Item 56, Appendix B) to insulate soldered and crimped electrical connections as follows:

(1) Cut desired length of new heat shrinkable tubing twice the diameter of the connection to be covered.
(2) Slide heat shrinkable tubing onto the wire and out of the way before making electrical connection.
(3) After making electrical connection, slide heat shrinkable tubing into place over electrical connection.

WARNING

DO NOT touch heat shrinkable tubing for at least 30 seconds after heating. Heat shrinkable tubing is hot and will burn you.

(4) Hold heat gun (Item 35, Appendix E) 4-5 in. (10.2-12.7 cm) away from heat shrinkable tubing and apply heat for approximately 30 seconds. Stop applying heat as soon as heat shrinkable tubing forms to the shape of the electrical connection.

2-18. ELECTRICAL GROUND POINTS.

Many electrical problems are the result of poor ground connections. You can ensure that ground connections are good by performing the following steps:

WARNING

Although battery disconnect switch must be on and battery ground cable connected In order to test electrical circuit voltage, turn off battery disconnect switch or disconnect battery ground cable before performing resistance tests or replacing parts. This will prevent shock to personnel, and damage to parts and equipment.

(1) Remove hardware connecting ground cable terminal lug to ground point.

WARNING

Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-1380F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

(2) Clean mounting hardware, ground cable terminal lugs, and ground point with dry cleaning solvent (Item 47, Appendix B) and scrub brush (Item 5, Appendix B).

(3) Remove any rust with wire brush (Item 6, Appendix B) and crocus cloth (Item 8, Appendix B).

2-18. ELECTRICAL GROUND POINTS (Con't).

(4) Look for cracks, loose terminal lugs, and stripped threads. Replace any defective parts.
(5) Install hardware connecting ground cable terminal lug to ground point. Ensure that all hardware is tight.

2-19. LINES AND PORTS.

To keep dirt from contaminating fluid systems when removing and installing hydraulic, fuel, oil, and coolant lines, perform the following steps:

(1) Clean fittings and surrounding area before disconnecting lines.
(2) Cover, cap, plug, or tape lines and ports after disconnecting lines. When these are not available, use hand-carved wooden plugs, clean rags (Item 43, Appendix B), duct tape (Item 51, Appendix B), or other similar materials to prevent dirt from entering system.
(3) Ensure that new and used parts are clean before installing.
(4) Wait to remove cover, cap, plug, or tape from lines and ports until just before installing lines.

2-20. ANTISEIZING TAPE.

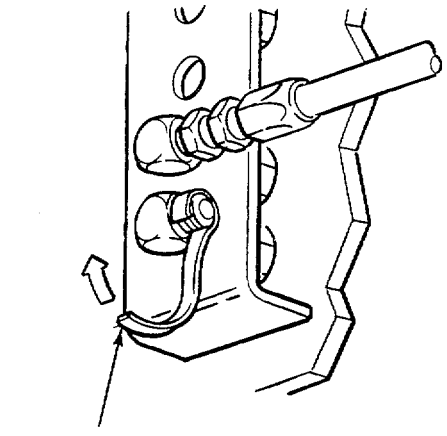
When connecting hydraulic, fuel, and oil lines and fittings without compression sleeves or packings, antiseizing tape (Item 50, Appendix B) may be used to keep connections from leaking. Use as follows:

(1) Ensure that threads are clean and dry.
(2) Start antiseizing tape one or two threads from small or leading edge of fitting, joining tape together with an overlap of about X in. (3.18 mm) for fittings with fine threads. For fittings with coarse threads, tape should be wrapped around threads two or three times.
(3) Tightly wrap antiseizing tape in same direction as you would tighten a nut. Tape must be pressed into threads without cutting or ripping.

CAUTION

DO NOT exceed specified torque or use power tools to tighten fittings taped with antiseizing tape. Overtightening could damage fitting threads and cause connection to leak.

(4) Using hand tools, tighten fittings to specified torque.



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2-21. TUBES AND COMPRESSION FITTINGS.

a. Tubes with inverted nuts and compression fittings are designed for one time assembly. Once assembled, they must be replaced as a unit if any parts are found defective. Used parts may not seal properly when used with new ones.

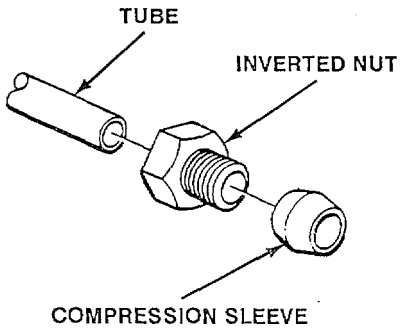
b. Used tube assemblies in good condition can be installed to their original location without leaking.

c. Assemble new tubes, compression sleeves, and inverted nuts as follows:

(1) Slide inverted nut onto end of tube.

(2) Slide compression sleeve onto end of tube.

(3) Repeat previous two steps for other end of tube as required.

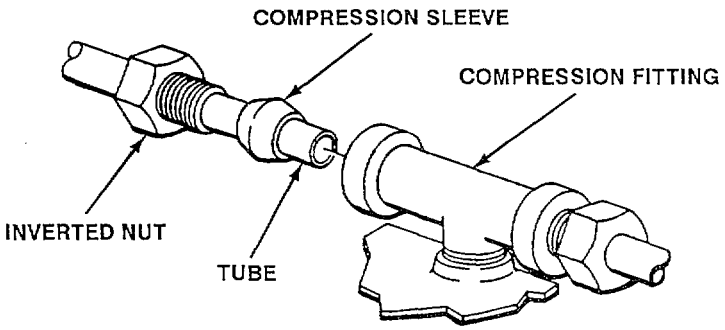


d. Install new tube assemblies as follows:

(1) Insert end of tube as far as it will go into compression fitting to which tube is being installed.

(2) Twist Inverted nut into compression fitting and tighten inverted nut against compression sleeve with open-end wrench (Item 71, Appendix E). Compression sleeve will clamp down around tube and conform to internal surface of compression fitting and inverted nut.

(3) Repeat previous two steps for other end of tube as required.



2-22. LOCKWIRE.

a. Always use nonelectrical wire (Item 59, Appendix B).

b. Drilled head screws and do Its usually do not require lockwiring if they are installed with self-locking nuts or lockwashers.

2-22. LOCKWIRE (Con't).

c. Three screws or bolts are the maximum number that may be lockwired in a series when they are spaced 4-6 in. (10.2-15.2 cm) apart. The maximum number of closely spaced multiple groups of screws or bolts to be lockwired is limited to the number of units that can be lockwired with a 24 in. (61 cm) length of wire.

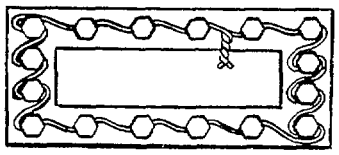
d. Do not secure screws, bolts, or fittings which are spaced more than 6 in. (15.2 cm) apart. Lockwire these fasteners to tie points 6 in. (15.2 cm) or less away.

e. Lockwire parts so that tension will be on lockwire when parts tend to loosen. Lockwire should be installed and twisted tight so that loop around head stays down and does not come up over head of screw or bolt. This does not apply to castellated nuts when slot is close to top of nuts; wire is more secure when made to pass along the side of stud. Ensure that lockwire is tight but not overstressed.

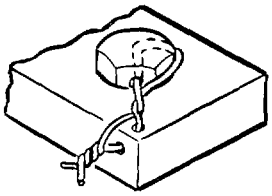
f. Make pigtail of 4-2 in. (6.4-12.7 mm) at end of lockwire. Bend pigtail down so it will not become a snag.

g. When lockwiring castellated nuts, tighten castellated nut to low side of torque range, then continue tightening until slot lines up with hole.

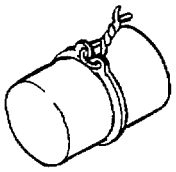
h. In blind, tapped hole application of bolts, castellated nuts, or studs, lockwire as illustrated.



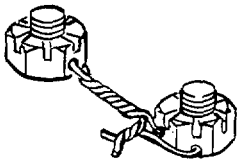
SMALL SCREWS IN CLOSELY SPACED, CLOSED GEOMETRICAL PATTERN: SINGLE WIRE METHOD



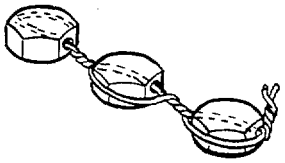
FASTENER APPLICATION: EXTERNAL RETAINER RING: DOUBLE TWIST METHOD



SINGLE FASTENER APPLICATION: SINGLE WIRE METHOD



CASTELLATED NUTS ON UNDRILLED STUDS: DOUBLE TWIST METHOD



MULTIPLE FASTENER APPLICATION: DOUBLE TWIST METHOD

2-23. FLUID DISPOSAL.

Dispose of contaminated drained fluids in accordance with the Standard Operating Procedures (SOP) of your unit.

2-24. BEARING CLEARANCE GAGE.

a. A soft plastic bearing clearance gage (Items 29, 30, and 31, Appendix B) (plastigage) squeezed between parts such as a crankshaft journal and a connecting rod or main bearing may be used to measure clearance.

b. The bearing clearance gage is a specially molded plastic "wire" and is available in three measuring ranges and colors (see Table 2-1).

Table 2-1. Bearing Clearance Gage.

Color	(CAGE) Part Number	Measuring Range	Reference
Green	(77220) PG-1	0.001-0.003 in. (0.0254-0.0762 mm)	(Item 29, Appendix B)
Red	(77220) PLASTIGAGEPR1	0.002-0.006 in. (0.0508-0.1524 mm)	(Item 30, Appendix B)
Blue	(77220) PLASTIGAGEPB1	0.004-0.009 in. (0.1016-0.2286 mm)	(Item 31, Appendix B)

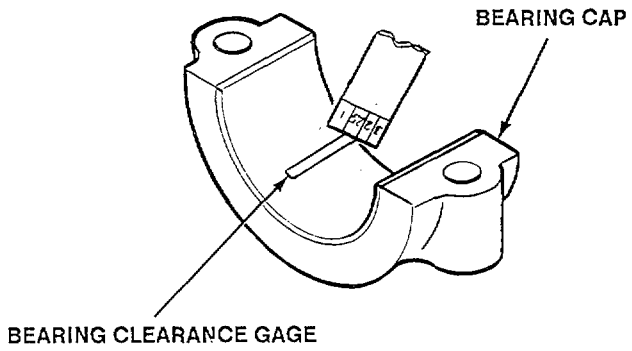
c. Check clearance as follows:

(1) Remove bearing cap and wipe oil from bearing shell and crankshaft journal.

NOTE

When checking main bearing clearance with engine in position and main bearing caps supporting weight of crankshaft and flywheel, an incorrect reading may result due to weight of crankshaft and flywheel. Avoid an incorrect reading by placing a jack under the counterweight next to the bearing being checked.

(2) Place bearing clearance gage in the center of the bearing cap and across three-quarters of the width of the bearing.



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2-24. BEARING CLEARANCE GAGE (Con't).

(3) Rotate crankshaft about 30° from bottom dead center (BDC) and install assembled bearing shell and cap. Tighten screws to specified torque.

(4) Remove bearing shell and cap. Flattened gage will stick to either the bearing shell or the crankshaft.

(5) Compare width of flattened gage at its widest point with graduations on envelope. Number within graduation on envelope indicates bearing clearance at thousandths of an inch.

(6) Taper may be indicated when one end of flattened gage is wider than the other. Measure each end of gage. The difference between readings is the approximate amount of taper.

2-25. SERVICE REPLACEMENT PARTS AND KITS.

Many service replacement parts are available in standard sizes as well as various undersized and/or oversized sizes. Service kits for reconditioning certain parts and service sets, which include all parts necessary to complete a procedure, are also available.

2-26. MULTIMETER.

a. General. The digital multimeter (Item 43, Appendix E) can be found in the Field Maintenance Automotive Shop Set and is used to troubleshoot the electrical system of the forklift truck. The multimeter's ohms scale is used to test for continuity, shorts, and resistance and the voltmeter scale is used to test voltage levels at any point in the electrical system.

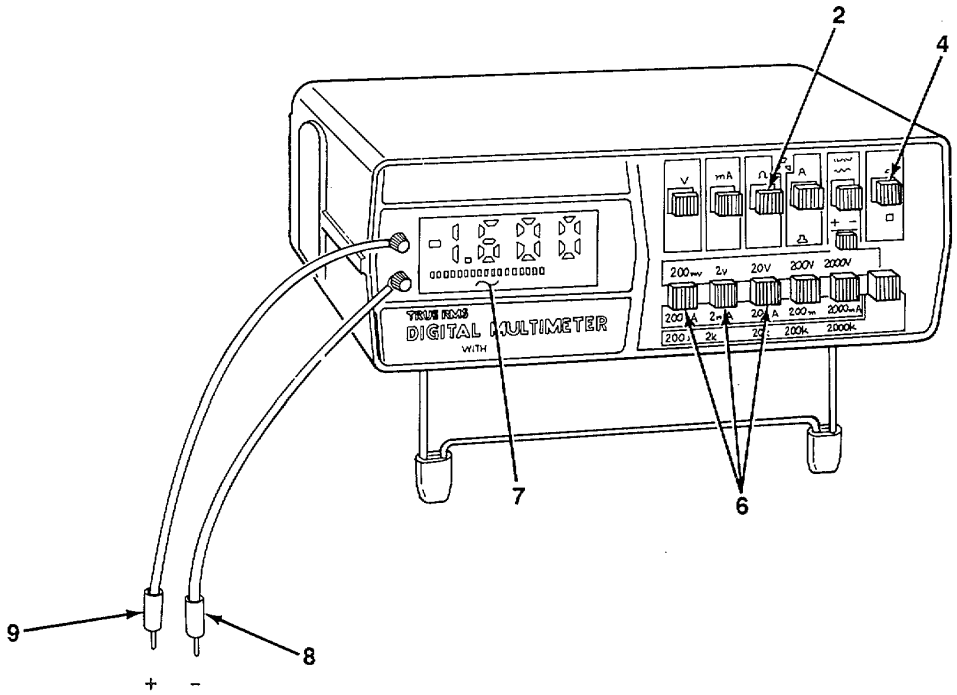
b. Continuity Tests. Continuity tests are performed to check for breaks in a circuit (such as a fuse, switch, light bulb, or electrical cable).

2-26. MULTIMETER (Con't).

NOTE

If digital readout will not zero properly, replace batteries and repeat zeroing procedure.
If digital readout will not zero after batteries have been replaced, notify your supervisor.

(1) Zero the Multimeter.
 (a) Set multimeter ON/OFF switch (4) to ON position.
 (b) Press OHMS FUNCTION switch (2).
 (c) Press LOWEST VOLTAGE/OHMS selector switch (6).
 (d) Touch black and red probes (8 and 9) together and check for a zero reading on digital readout (7).



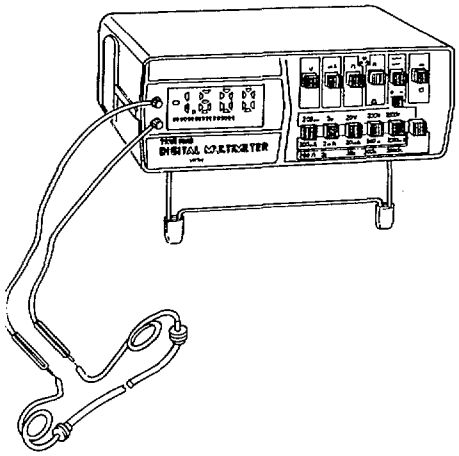
TA708025

2-26. MULTIMETER (Con't).

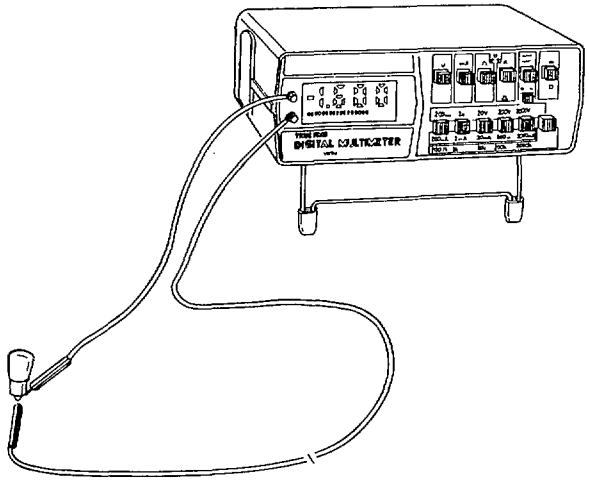
CAUTION

Before performing a continuity test, always disconnect the forklift truck battery ground cable and the circuit to be tested. Failure to follow this caution may damage the multimeter.

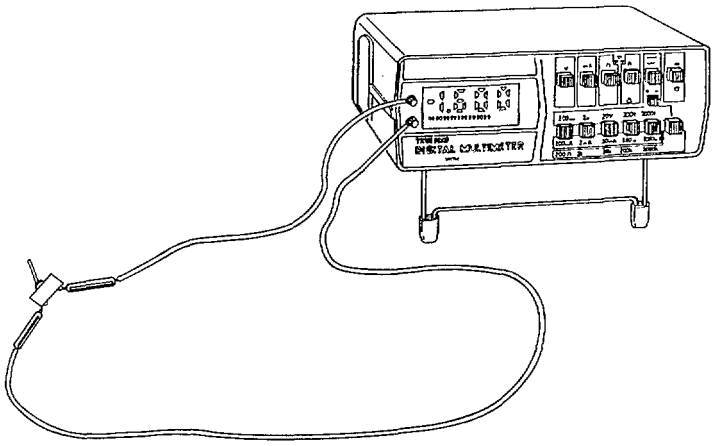
(2) Testing for Continuity.
   (a) Zero multimeter [see subparagraph (1)].
   (b) Connect black and red probes (8 and 9) to both terminals of circuit being tested.



TESTING AN ELECTRICAL CABLE



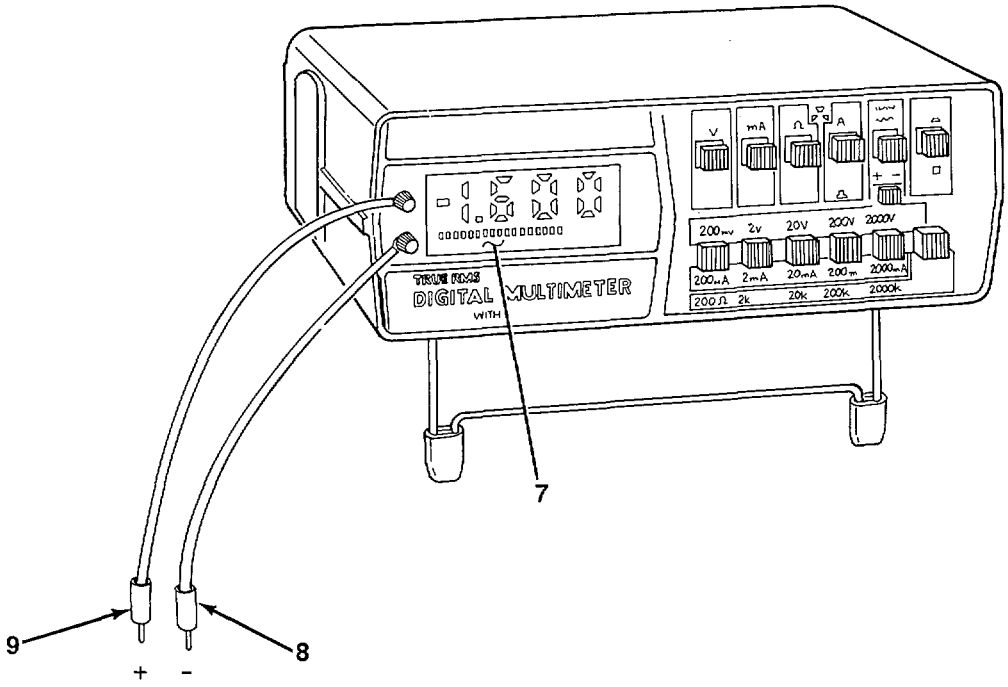
TESTING A BULB



TESTING A SWITCH

2-26. MULTIMETER (Con't).

(c) Read digital readout (7) and interpret the results as follows:
1. If digital readout (7) indicates 0 (zero), circuit has continuity.
2. If digital readout (7) indicates resistance, circuit is open.



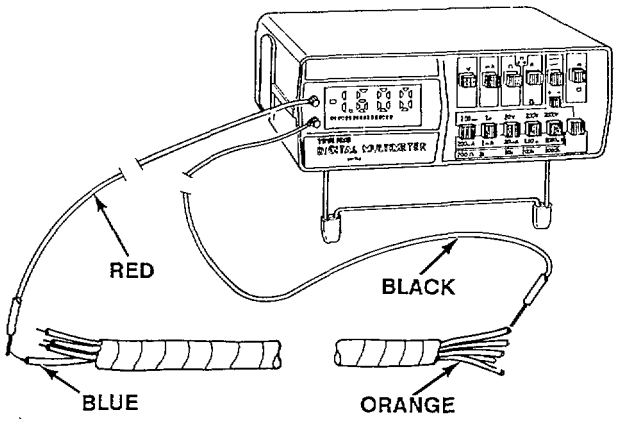
TA708027

2-26. MULTIMETER (Con't).

CAUTION

Before performing a continuity test, always disconnect the forklift truck battery ground cable and the circuit to be tested. Failure to follow this caution may damage the multimeter.

(3) **Testing for Shorts**. A short (or short circuit) occurs when two circuits that should not be connected have metal-to-metal contact with each other. A short also occurs when a circuit that should not touch ground has metal-to-metal contact with ground.



TESTING FOR SHORTS

(a) Zero multimeter [see subparagraph (1)].

(b) Connect black probe (8) to one circuit and red probe (9) to either a ground or another circuit.

(c) Read digital readout (7) and interpret the results as follows:

1. If digital readout (7) indicates 0 (zero), circuits are shorted or circuit is grounded if TA708028 testing to ground.
2. If digital readout (7) does not indicate 0 (zero), circuits are not shorted. 2-19
3. If digital readout (7) jumps or flickers, circuits are shorted or grounded intermittently.

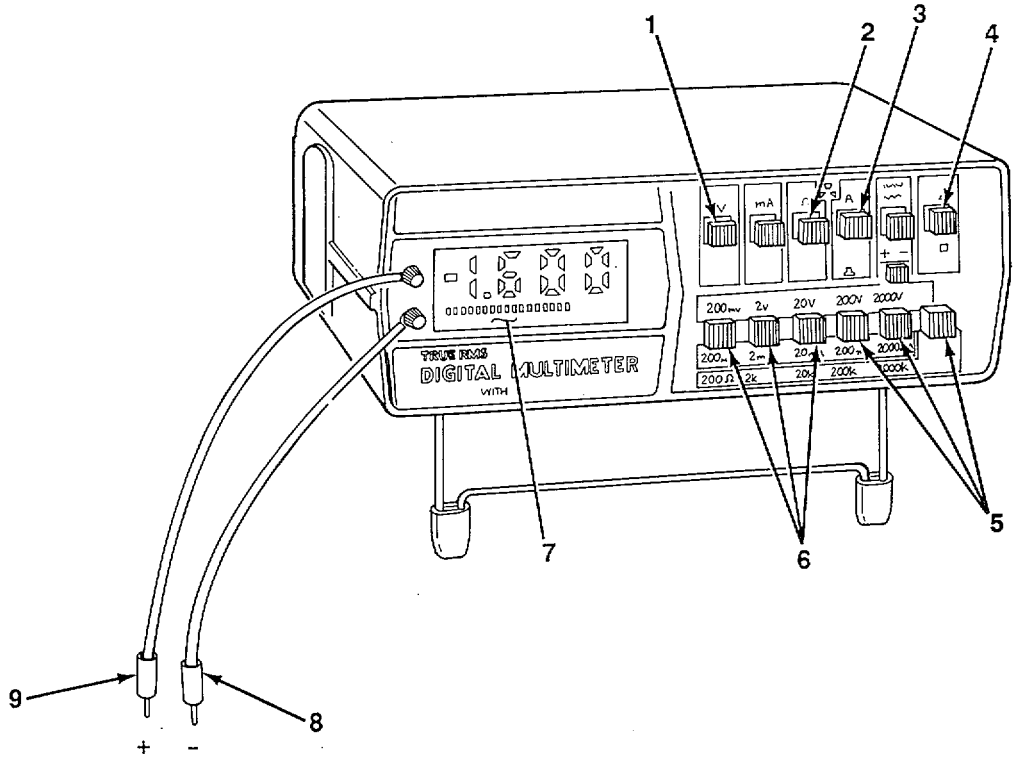
2-26. MULTIMETER (Con't).

CAUTION

Before performing a continuity test, always disconnect the forklift truck battery ground cable and the circuit to be tested. Failure to follow this caution may damage the multimeter.

(4) **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.

(a) Zero multimeter [see subparagraph (1)].
(b) Press OHMS FUNCTION switch (2).
(c) Press LOWEST VOLTAGE/OHMS selector switch (6). If test calls for ohms range other than RX1, set RANGE SELECTOR switch (5) to the required range.
(d) Connect black and red probes (8 and 9) across circuit to be tested.
(e) Read digital readout (7) and interpret the results as circuit resistance.



TA708029

2-26. MULTIMETER (Con't).

c. **Measuring DC Voltage**.

(1) Set multimeter ON/OFF switch (4) to ON position.

(2) Press VOLTS FUNCTION switch (1).

(3) Set AC/DC selector switch (3) to DC.

(4) Select and press LOWEST VOLTAGE/OHMS selector switch (6) for voltage range higher than the volts to be measured.

(5) Connect red probe (9) to positive (+) side of circuit and black probe (8) to negative (-) side of circuit.

(6) Read digital readout (7) and interpret the results as DC voltage in the circuit being tested.

2-27. WELDING.

Refer to TM 9-237, Operator's Manual for Welding Theory and Application, for instructions on welding components of the forklift truck.

2-28. HYDRAULIC SYSTEM WARM-UP.

a. This procedure is to be performed when hydraulic system warm-up is required for maintenance reasons and under normal conditions.

(1) Start engine (see TM 10-3930-659-10).

(2) Slowly cycle lift, tilt, and spacing functions of forklift truck a number of times.

(3) Slowly turn steering wheel in either direction until steer limit is reached. Hold steering wheel in position for a short time.

(4) Turn steering wheel in other direction until steer limit is met. Hold steering wheel in position for a short time.

(5) Repeat this procedure until hydraulic fluid reaches normal operating temperature.

(6) Shut down engine (see TM 10-3930-659-10).

b. If hydraulic system warm-up is required in extreme cold situations, extra precautions and requirements must be performed (see TM 10-3930-659-10).

CHAPTER 3
TROUBLESHOOTING PROCEDURES
Section I. MECHANICAL TROUBLESHOOTING

3-1. GENERAL.

a. This section provides information for identifying and correcting malfunctions which may develop when maintaining the M544E Forklift Truck.

b. The Troubleshooting Symptom Index (see paragraph 3-3) lists common malfunctions which may occur and refers you to the proper page in Table 3-1 for a troubleshooting procedure.

c. This section cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed, or is not corrected by the listed corrective actions, notify your supervisor.

d. When troubleshooting a malfunction:

(1) Ensure that all applicable Unit Maintenance troubleshooting has been performed.

(2) Locate the symptom or symptoms in paragraph 3-3 that best describe the malfunction. If the appropriate symptom is not listed, notify your supervisor.

(3) Turn to the page in Table 3-1 where the troubleshooting procedures for the malfunction in question are described. Headings at the top of each page show how each troubleshooting procedure is organized: Malfunction, Test or Inspection (in step number order), and Corrective Action.

(4) Perform each step in the order listed until the malfunction is corrected. Do not perform any maintenance task unless the troubleshooting procedure tells you to do so.

3-2. EXPLANATIONS OF COLUMNS.

The columns in Table 3-1 are defined as follows:

(1) MALFUNCTION. A visual or operational indication that something is wrong with the forklift truck.

(2) TEST OR INSPECTION. A procedure to isolate the problem in a component or system.

(3) CORRECTIVE ACTION. A procedure to correct the problem.

3-3. TROUBLESHOOTING SYMPTOM INDEX.

3-3. TROUBLESHOOTING SYMPTOM INDEX (Con't).

Table 3-1. Troubleshooting.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

ENGINE ASSEMBLY

WARNING

Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result In death or serious Injury to personnel. If you are burned, immediately seek medical aid.

1. ENGINE TURNS OVER BUT WILL NOT START.
   Step 1. Remove and test fuel injection nozzles (see paragraph 4-23).
   Replace damaged fuel injection nozzles (see paragraph 4-23).
   Step 2. Test fuel injection pump (see STE/ICE Test No. NG31).
   Replace damaged fuel injection pump (see paragraph 4-24).

2. ENGINE SURGES, STALLS, OR MISSES FREQUENTLY.

WARNING

Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result in death or serious Injury to personnel. If you are burned, Immediately seek medical aid.

Step 1. Remove and test fuel injection nozzles (see paragraph 4-23).
Replace damaged fuel injection nozzles (see paragraph 4-23).
Step 2. Test fuel injection pump (see STE/ICE Test No. NG31).
Replace damaged fuel injection pump (see paragraph 4-24).
Step 3. Inspect cylinder head valves for burns or sticking by cranking engine and listening for air leaking past cylinder head valves or uneven starter motor speed.
Replace burned cylinder head valves (see paragraph 4-6).
Clean sticking cylinder head valves and valve seats (see paragraph 4-6).
Step 4. Inspect pushrods for bends (see paragraph 4-12).
Replace damaged pushrods (see paragraph 4-12).
Step 5. Perform engine assembly compression test (see paragraph 4-1).
Replace damaged cylinder head gasket (see paragraph 4-5).
Replace damaged compression ring, oil control ring, and oil ring expander (see paragraph 5-3).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

3. ENGINE DOES NOT DEVELOP FULL POWER OR ACCELERATION IS SLOW.
   Step 1. Inspect turbocharger for wear and damage by spinning turbocharger turbine wheel and listening for noisy bearings or turbine wheel rubbing in center housing.
   Replace damaged turbocharger (see paragraph 4-25).

WARNING

Diesel fuel Is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result in death or serious Injury to personnel. If you are burned, immediately seek medical aid.

   Step 2. Remove and test fuel injection nozzles (see paragraph 4-23).
   Replace damaged fuel injection nozzles (see paragraph 4-23).
   Step 3. Test fuel injection pump (see STE/ICE Test No. NG31).
   Replace damaged fuel injection pump (see paragraph 4-24).
   Step 4. Check cylinder head valve for proper lift (see paragraph 4-2).
   Replace damaged pushrods (see paragraph 4-12).
   Replace damaged camshaft (see paragraph 5-5),
   Step 5. Perform engine assembly compression test (see paragraph 4-1).
   Replace damaged cylinder head gasket (see paragraph 4-5).
   Replace damaged compression ring, oil control ring, and oil ring expander (see paragraph 5-3).

4. ENGINE EMITS EXCESSIVE BLACK OR GRAY EXHAUST SMOKE.

   Step 1. Inspect turbocharger for wear and damage by spinning turbocharger turbine wheel and listening for noisy bearings or turbine wheel rubbing in center housing.
   Replace damaged turbocharger (see paragraph 4-25).

WARNING

Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

   Step 2. Remove and test fuel injection nozzles (see paragraph 4-23).
   Replace damaged fuel injection nozzles (see paragraph 4-23).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WARNING

Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

Step 3. Test fuel injection pump (see STE/ICE Test No. NG31).
Replace damaged fuel injection pump (see paragraph 4-24).

5. ENGINE EMITS EXCESSIVE BLUE OR WHITE EXHAUST SMOKE.

WARNING

Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

Step 1. Remove and test fuel injection nozzles (see paragraph 4-23).
Replace damaged fuel injection nozzles (see paragraph 4-23).
Step 2. Perform engine assembly compression test (see paragraph 4-1).
Replace damaged cylinder head gasket (see paragraph 4-5).
Replace damaged compression ring, oil control ring, and oil ring expander (see paragraph 5-3).
Step 3. Inspect valve seat inserts for wear and damage (see paragraph 4-6).
Replace damaged valve seat inserts (see paragraph 4-6).
Step 4. Inspect cylinder liners for excessive wear, and compression ring, oil control ring, and oil ring expander for damage.
Replace damaged cylinder liners (see paragraph 5-2), and damaged compression ring, oil control ring, and oil ring expander (see paragraph 5-3).

6. ABNORMAL ENGINE NOISE.

Step 1. Inspect turbocharger for wear and damage by spinning turbocharger turbine wheel and listening for noisy bearings or turbine wheel rubbing in center housing.
Replace damaged turbocharger (see paragraph 4-25).
Step 2. Inspect pushrods for bends or rocker arm shafts for wear (see paragraph 4-12).
Replace damaged pushrods (see paragraph 4-12).
Replace damaged rocker arm shafts (see paragraph 4-12).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check camshaft timing (see paragraph 5-5).
Correct camshaft timing (see paragraph 5-5).
Step 4. Inspect engine main bearings and main bearing caps for looseness and wear (see paragraph 5-4).
Replace damaged engine main bearings and tighten loose main bearing caps (see paragraph 5-4).
Step 5. Inspect connecting rod main bearings and main bearing caps for looseness and wear (see paragraph 5-3).
Replace damaged connecting rod main bearings and tighten loose connecting rod main bearing caps (see paragraph 5-3).
Step 6. Inspect piston pin bushing and piston pin for wear (see paragraph 5-3).
Replace damaged piston pin bushing and piston pin (see paragraph 5-3).

7. LOW ENGINE OIL PRESSURE.

Step 1. Inspect turbocharger shaft seal for leakage by spinning turbocharger turbine wheel and listening for noisy bearings or signs of leakage.
Replace damaged turbocharger (see paragraph 4-25).
Step 2. Inspect engine oil pump intake tube screen for contamination.
Clean engine oil pump intake tube screen.
Replace damaged engine oil pump intake tube (see paragraph 4-18).
Step 3. Inspect engine oil pump and drive gear for wear or damage (see paragraph 4-19).
Replace damaged engine oil pump (see paragraph 4-19).
Replace damaged drive gear (see paragraph 4-19).
Step 4. Inspect engine main bearings and main bearing caps for looseness and wear (see paragraph 5-4).
Replace damaged engine main bearings and tighten loose main bearing caps (see paragraph 5-4).
Step 5. Inspect connecting rod main bearings and main bearing caps for looseness and wear (see paragraph 5-4).
Replace damaged connecting rod main bearings and tighten loose connecting rod main bearing caps (see paragraph 5-3).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 6. Inspect engine block for cracks. Replace damaged engine block (see paragraph 5-1).
TRANSMISSION
8. TRANSMISSION SLIPS. Step 1. Perform transmission fluid pressure test (see STE/ICE Test No. GO11). Step 2. Inspect transmission control valve for internal leaking gaskets. Remove transmission control valve and replace damaged gaskets (see paragraph 5-9). Step 3. Inspect transmission control valve for restricted oil orifices and valves. Remove transmission control valve, and clean transmission control valve and oil orifices (see paragraph 5-9). Replace damaged springs (see paragraph 5-9). Replace damaged transmission control valve (see paragraph 5-9). Step 4. Perform transmission pump flow test (see paragraph 4-36). Repair damaged transmission gear pump (see paragraph 5-11). Step 5. Inspect transmission clutch discs for wear or damage (see paragraph 5-12). Replace damaged transmission clutch discs (see paragraph 5-12).
9. FORKLIFT TRUCK WILL NOT MOVE IN F (FORWARD) OR IN R (REVERSE) GEARS. Step 1. With transmission in gear, check drive shaft for rotation. If drive shafts are rotating, perform troubleshooting on differentials. Step 2. Perform transmission fluid pressure test (see STE/ICE Test No. G011). Step 3. Perform converter stall test (see paragraph 4-33). Replace damaged torque converter (see paragraph 4-38). Step 4. Inspect transmission clutch discs for wear or damage (see paragraph 5-12). Replace damaged transmission clutch discs (see paragraph 5-12).
10. LOW TRANSMISSION FLUID PRESSURE. Step 1. Perform transmission fluid pressure test (see STE/ICE Test No. G011). Step 2. Inspect pressure regulator valve sleeve and spring for damage. Replace damaged pressure regulator valve (see paragraph 4-39).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Inspect transmission control valve for internal leaking gaskets.
Remove transmission control valve and replace damaged gaskets (see paragraph 5-9).
Step 4. Perform transmission gear pump flow test (see paragraph 4-36).
Repair damaged transmission gear pump (see paragraph 5-11).
Step 5. Inspect transmission clutch pistons and seal rings for wear or damage (see paragraph 5-12).
Replace damaged transmission clutch pistons and seal rings (see paragraph 5-12).

11. TRANSMISSION SHIFTS TOO SLOWLY.

Step 1. Perform transmission fluid pressure test (see STE/ICE Test No. G011).
Step 2. Inspect transmission control valve for internal leaking gaskets.
Remove transmission control valve and replace damaged gaskets (see paragraph 5-9).
Step 3. Perform transmission pump flow test (see paragraph 4-36).
Repair damaged transmission gear pump (see paragraph 5-11).

12. TRANSMISSION SHIFTS TOO FAST.

Step 1. Perform transmission fluid pressure test (see STE/ICE Test No. G011).
Step 2. Inspect transmission control valve for sticking pistons (see paragraph 5-9).
Replace damaged pistons in transmission control valve (see paragraph 5-9).
Step 3. Inspect transmission control valve for sticking forward or reverse check valve.
Replace damaged transmission control valve (see paragraph 5-9).

13. TRANSMISSION HYDRAULIC SYSTEM OVERHEATS.

Step 1. Perform transmission fluid pressure test (see STE/ICE Test No. G011).
Step 2. Perform converter-out pressure test (see paragraph 4-30).
Step 3. Perform transmission pump flow test (see paragraph 4-36).
Repair damaged transmission gear pump (see paragraph 5-11).
Step 4. Inspect transmission clutch discs and clutch plates for warpage.
Replace damaged transmission clutch discs and clutch plates (see paragraph 5-12).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

14. EXCESSIVE TRANSMISSION NOISE.

Step 1. Perform transmission fluid pressure test (see STE/ICE Test No. G011).
Step 2. Perform converter-out pressure test (see paragraph 4-30).
Step 3. Perform transmission pump flow test (see paragraph 4-36).
Repair damaged transmission gear pump (see paragraph 5-11).
Step 4. Inspect transmission fluid suction tube screen for metal particles.
Disassemble transmission assembly and replace damaged items (see paragraphs 5-10, 5-11, 5-12, and 5-13).
Replace damaged transmission assembly (see paragraph 4-40).

15. FORKLIFT TRUCK LACKS POWER AND ACCELERATION.

Inspect transmission clutch discs and clutch plates for warpage.
Replace damaged transmission clutch discs and clutch plates (see paragraph 5-12).

16. TRANSMISSION TORQUE CONVERTER STALL RPM TOO HIGH.

Step 1. Perform converter-out pressure test (see paragraph 4-30).
Step 2. Inspect transmission clutch discs for wear or damage (see paragraph 5-12).
Replace damaged transmission clutch discs (see paragraph 5-12).
Step 3. Inspect transmission torque converter for damage.
Replace damaged torque converter (see paragraph 4-38).

17. TRANSMISSION TORQUE CONVERTER STALL RPM TOO LOW.

Inspect transmission torque converter for damage.
Replace damaged torque converter (see paragraph 4-38).

PROPELLER SHAFT

18. EXCESSIVE FRONT UNIVERSAL JOINTS OR SUPPORT BEARINGS VIBRATION OR NOISE.

Step 1. Inspect engine-to-transmission universal joint for wear and damage (see paragraph 4-46).
Replace damaged engine-to-transmission universal joint (see paragraph 4-46).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
Step 2. Inspect rear differential assembly, rear axle rear oscillating support assembly, and rear axle front oscillating support assembly for damaged or worn parts. Remove rear axle (see paragraph 4-48) and rear differential assembly (see paragraph 5-17). Replace damaged rear axle rear oscillating support assembly (see paragraph 4-48) or rear axle front oscillating support assembly (see paragraph 5-17).
AXLE
19. DIFFERENTIAL OR AXLE NOISE IS EXCESSIVE.
Step 1. Perform axle bearing adjustment check (see paragraph 4-50). Replace damaged axle housing assembly or differential assembly (see paragraph 4-50 or 5-17). Replace damaged or worn parts (see paragraphs 5-14 and 5-17). Step 2. Remove differential drain plug and check for metal particles. Replace damaged axle housing assembly or differential assembly (see paragraph 4-50 or 5-17). Replace damaged or worn parts (see paragraphs 5-14 and 5-17).
20. OUTER AXLE SEAL LEAKING.
Step 1. Check differential for overfill. Perform troubleshooting on brake system. Step 2. Perform axle bearing adjustment check (see paragraph 4-50). Replace damaged axle housing assembly or differential assembly (see paragraph 4-50 or 5-17). Replace damaged parts (see paragraph 5-14 and 5-17).
BRAKE SYSTEM
21. POOR BRAKING OR NO BRAKES.
Step 1. Inspect brake pistons for leakage by removing differential fill plug and checking for overfilled differential. Apply service brakes and check for leakage from fill plug. Replace damaged brake piston seal (see paragraph 4-51).

Table 3-1. Troubleshooting (Con't).

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Inspect brake discs for wear and damage (see paragraph 4-51).
Replace damaged brake discs (see paragraph 4-51).

22. BRAKES DRAG OR CHATTER.

Inspect brake discs for wear and damage (see paragraph 4-51).
Replace damaged brake discs (see paragraph 4-51).
Repair or replace sticking or damaged brake piston (see paragraph 4-51).

23. HISSING NOISE WITH BRAKE PEDAL DEPRESSED AND ENGINE STOPPED.

Inspect brake pistons for leakage by removing differential fill plug and checking for overfilled differential. Apply service brakes and check for leakage from fill plug.

Replace damaged brake piston seal (see paragraph 4-51).

Section II. STE/ICE-R TROUBLESHOOTING

3-4. GENERAL.

a. This section contains information and tests which may be used with STE/ICE-R (Simplified Test Equipment for Internal Combustion Engines- Reprogrammable) to locate malfunctions that may occur in the M544EQUIPMENT Forklift Truck. These tests can be used during electrical troubleshooting, corrective maintenance, or after parts replacement to isolate malfunctions and to ensure that proper repairs have been made.

b. The STE/ICE-R is used primarily in conjunction with the forklift truck's electrical system. This section cannot list all malfunctions that may occur. If a malfunction is not listed, or is not corrected by the tests and checks provided, refer to the troubleshooting table in Section I of this chapter or notify your supervisor.

3-4. GENERAL (Con't).

c. Refer to TM 9-4910-571-12&P and TM 9-4910-571-34&P for STE/ICE-R set-up, operation, and fault isolation procedures. This manual outlines general tests and maintenance procedures to help you keep the STE/ICE-R working properly. Refer to Table 3-2 for the M544E Forklift Truck Test Card.

3-5. DESCRIPTION AND OPERATION.

The STE/ICE-R is portable and operates on the forklift truck's 24-volt system. It consists of a Vehicle Test Meter (VTM), a Transducer Kit (TK), five electrical cables, a transit case, and technical publications. Refer to the manual provided with the STE/ICE-R for VTM and TK descriptions and operating information.

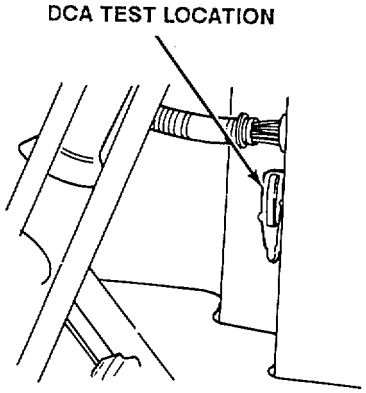
3-6. TEST PROCEDURES.

a. The VTM provides the method to test the forklift truck's electrical and mechanical components. Readings are either GO or NO-GO (pass/fail) indications or digital displays in units (psi, rpm, volts, V dc, ohms, amps, etc.).

b. GO and NO-GO Chain sequences are presented in Tables 3-3, 3-4, and 3-5 as illustrated flowcharts, with test branching controlled by YES and NO decisions. A YES response usually leads to the next test; a NO response directs the technician to NO-GO testing and corrective actions.

c. When the VTM interfaces with the forklift truck through the forklift truck's Diagnostic Connector-Assembly (DCA), the test is referred to as DCA Mode testing. When the VTM interfaces with the forklift truck through the use of the Transducer Kit (TK), the test is referred to as TK Mode testing. DCA and TK Mode testing can be used at the same time.

d. The DCA is mounted on the front of the right side console near the cab floor and is accessible from the operator's seat.



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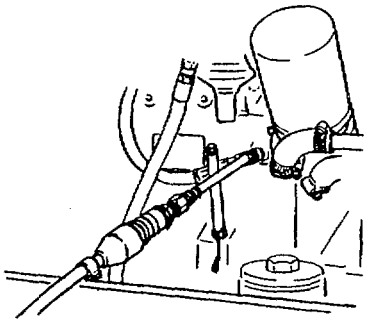
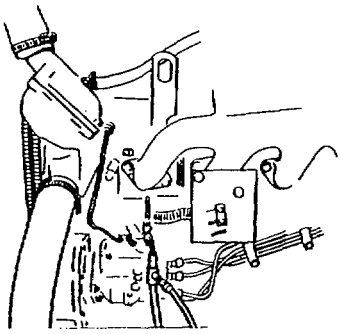
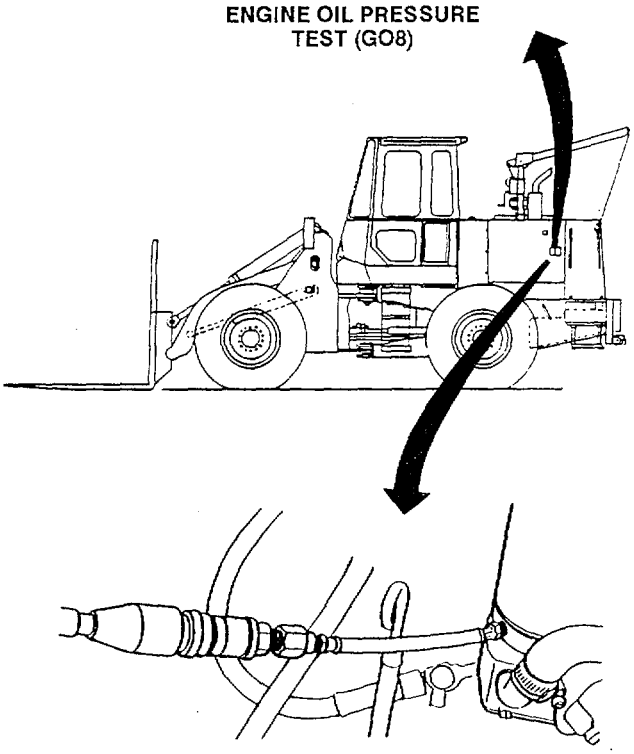
3-6. TEST PROCEDURES (Con't).



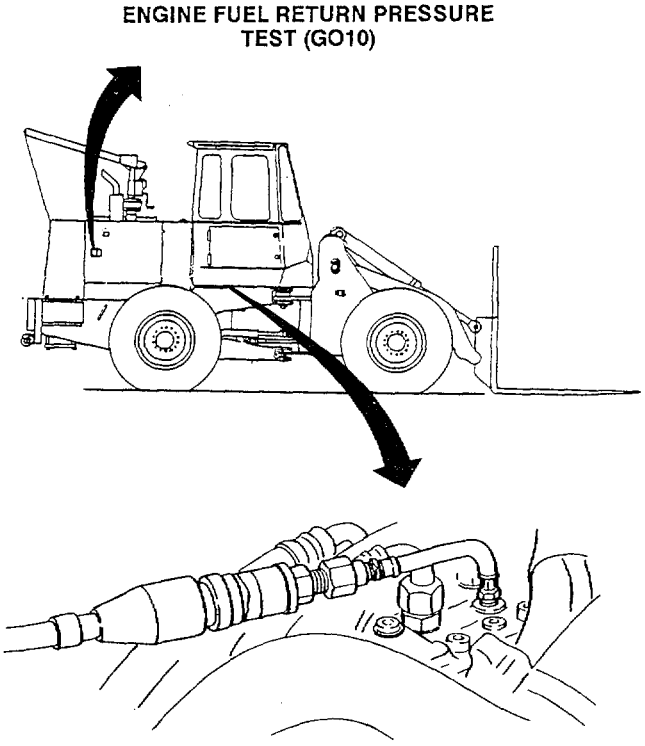
ENGINE OIL FILTER PRESSURE TEST (G08)



TRANSMISSION FLUID PRESSURE TEST (G010)



ENGINE OIL FILTER PRESSURE DROP TEST (GO9)



TRANSMISSION FLUID PRESSURE TEST (GO 1)

TK TEST LOCATIONS

3-7. DCA MODE AND TK MODE TESTING.

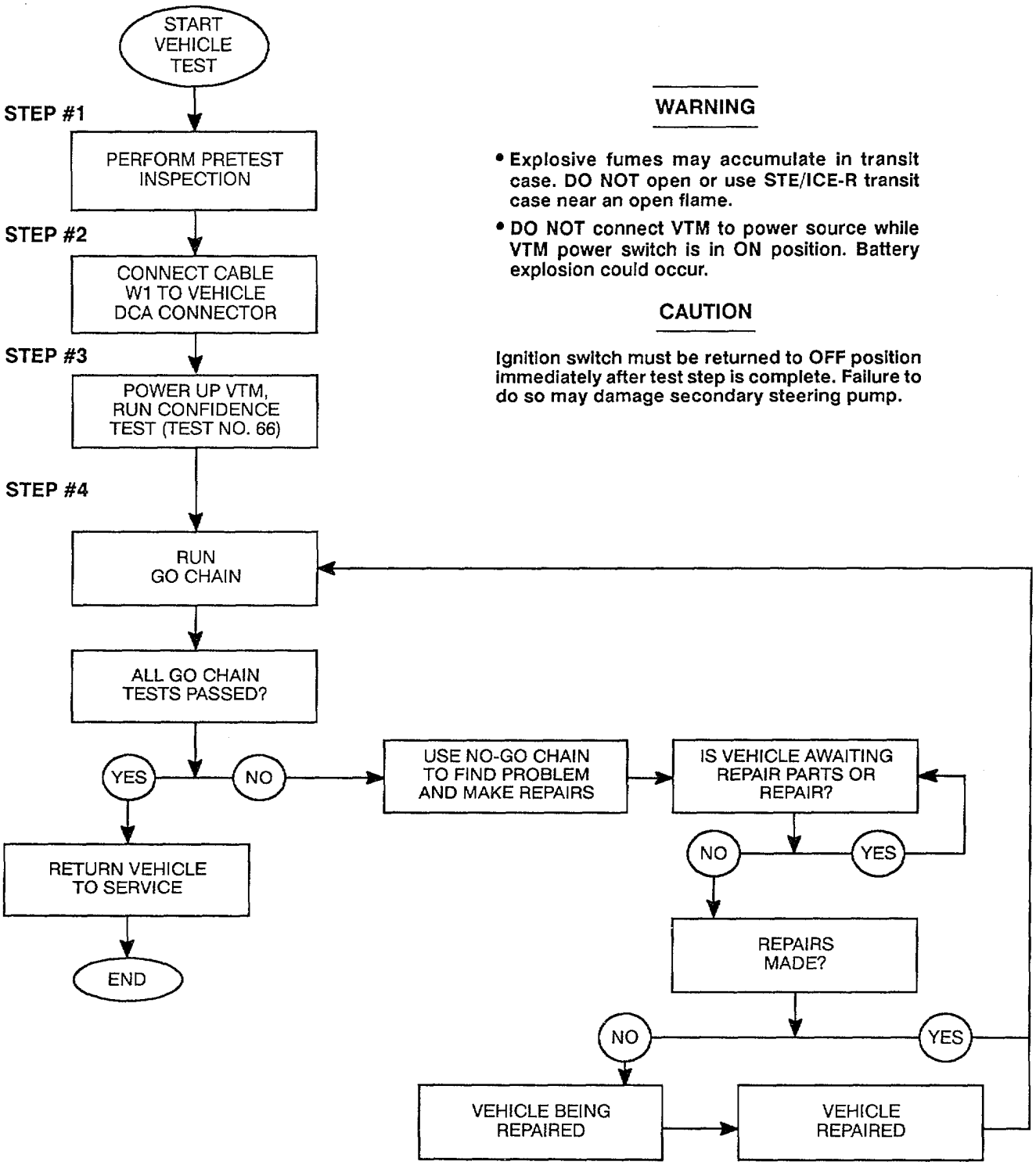
a. **Pretest Inspection**. Ensure that the following pretest inspections have been completed before beginning DCA or TK Mode testing:

(1) Fan belts
(2) Hydraulic fluid level
(3) Coolant level
(4) Fuel level
(5) Batteries

b. **Powering Up the VTM.**

(1) Connect the VTM to cable W1. Cable W1 connects to the batteries.
(2) Perform Confidence Test, Test No. 66 (second entry 99).
(3) Enter VIN into VTM using Test No. 60.

3-7. DCA AND TK MODE TESTING (Con't).



STE/ICE-R DCA AND TK MODE TESTING PROCEDURE FLOWCHART

3-7. DCA AND TK MODE TESTING (Con').

Table 3-2. M544E Forklift Truck Test Card.

Measurement Name	VTM Test No	VTM Offset Limits	Operating Condition	Connections Required	Limits			Units
					Min.	Norm	Max.	
Engine rpm (average)	10	----	Engine Idle Speed	DCA: Cable W1	825	825-875	875	rpm (average)
Power Test Idle Speed	12	----	Low Engine	DCA: Cable W1	2300	2400-2700	2400	rpm
Fuel Supply Pressure	24	----	Engine Idle Speed	DCA: Cable W1	2	2-8	8	psi
Fuel Filter Pressure Drop (pass/fail)	26	----	Engine Idle Speed	DCA: Cable W1				Pass/Fail
Fuel Solenoid Voltage	27	----	Engine Off	DCA: cable WI	20	20-28	28	V dc
Battery Voltage	67	----	Engine Off	DCA: Cable W1	26	26-29	29	V dc
Starter Motor Voltage	68	----	Cranking	DCA: Cable W1	20	20-22.5	24.5	V dc
Starter Motor Solenoid Voltage	70	----	Cranking	DCA: Cable WI	20	20-22.5	24.5	V dc
Starter Motor Current (average)	71	----	Crank on GO	DCA: Cable W1	100	100-750	1000	amps
Starter Motor Current (first peak)	72	±225	Crank on GO	DCA: Cable W1	100	100-2000	2500	amps (peak)
Battery Internal Resistance	73	±225	Crank on GO	DCA: Cable W1	0	4-15	25	milliohms
Starter Motor Circuit Resistance	74	±225	Crank on GO	DCA: Cable W1	0	0-15	20	milliohms
Battery Resistance Change	75	±225	Crank on GO	DCA: Cable W1	0	0-50	100	milliohms/sec
Alternator Output Voltage	82	----	2385 rpm	DCA: Cable W1	27.5	27.5-28.5	28.5	V dc
Alternator Field Voltage	83	----	2385 rpm	DCA: Cable W1	24	24-28.5	28.5	V dc
Alternator Negative Cable Voltage Drop	84	----	2385 rpm	DCA: Cable W1	0	0-0.5	0.05	V dc

3-7. DCA AND TK MODE TESTING (Con't).

Table 3-2. M544E Forklift Truck Test Card (Con't).

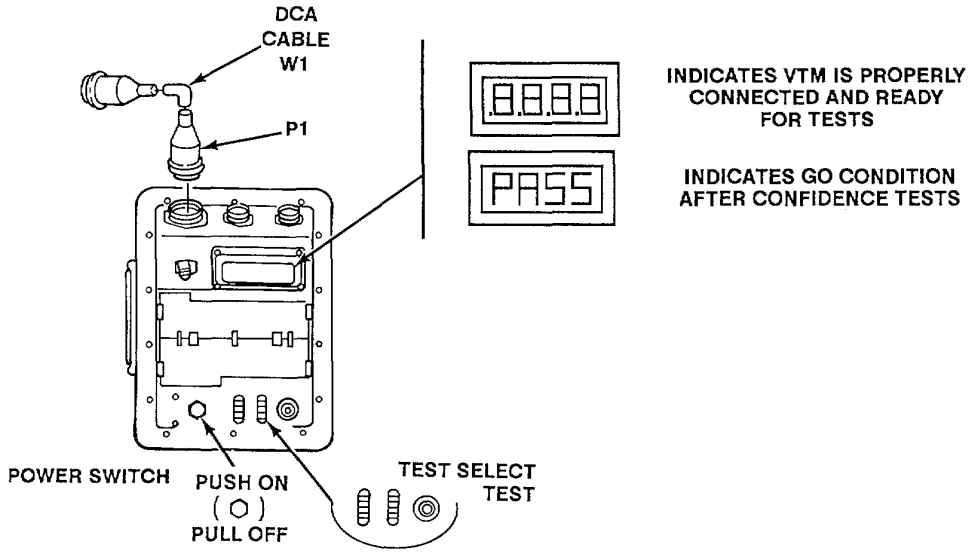
Measurement Name	VTM Test No	VTM Offset Limits	Operating Condition	Connections Required	Limits			Units
					Min	Norm	Max	
Engine Oil Pressure Test	50	+150	850 rpm	DCA: Cable W1 TK: Cable W4, Hose 35, Fuel Pressure Transducer 17, Coupling 19	10	40-60	70	psi
Engine Oil Filter Pressure Drop Test	50	+150	2375 rpm	DCA: Cable W1 TK: Cable W4, Hose 35, Fuel Pressure Transducer 17, Coupling 19	0	0-10	10	psi
Engine Fuel Return Pressure Test	50	+150	2375 rpm	DCA: Cable W1 TK: Cable W4, Fuel Pressure Transducer 22, Coupling 19	0	0-2	2	psi
Transmission Fluid Pressure Test	50	+150	1500 rpm	DCA: Cable W1 TK: Cable W4, Hose 35, Fuel Pressure Transducer 17, Coupling 19	213	213-240	240	psi

3-8. STE/ICE-R GO CHAIN TESTS - DCA MODE.

a. The following GO Chain Tests are made using the forklift truck's DCA connector. All tests must be performed sequentially.

b. For normal readings, refer to the M544E Forklift Truck Test Card at Table 3-2. For DCA test location, refer to paragraph 3-6.

Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode.



NOTE

Perform all GO steps until a NO-GO condition exists, then perform the NO-GO step indicated.

GO1 — VTM CONNECTIONS AND CHECKOUT — DCA MODE

CAUTION

- **DO NOT connect or disconnect VTM while forklift truck is running.**
- **Connect DCA cable to VTM before connecting DCA cable to diagnostic connector.**

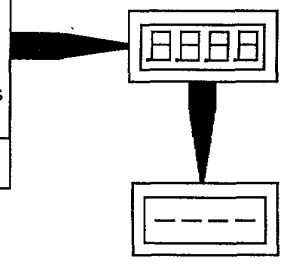
1 CONNECT VTM TO FORKLIFT TRUCK DIAGNOSTIC CONNECTOR:

- Pull OFF VTM power switch.
- Connect DCA cable to VTM.
- Connect DCA cable to forklift truck's DCA.
- Push ON VTM power switch.
- Verify that display indicates .8.8.8.8 for approximately two seconds and then changes to ----.

- Does VTM display .8.8.8.8 and then change to ----?

NO → • Proceed to next page.

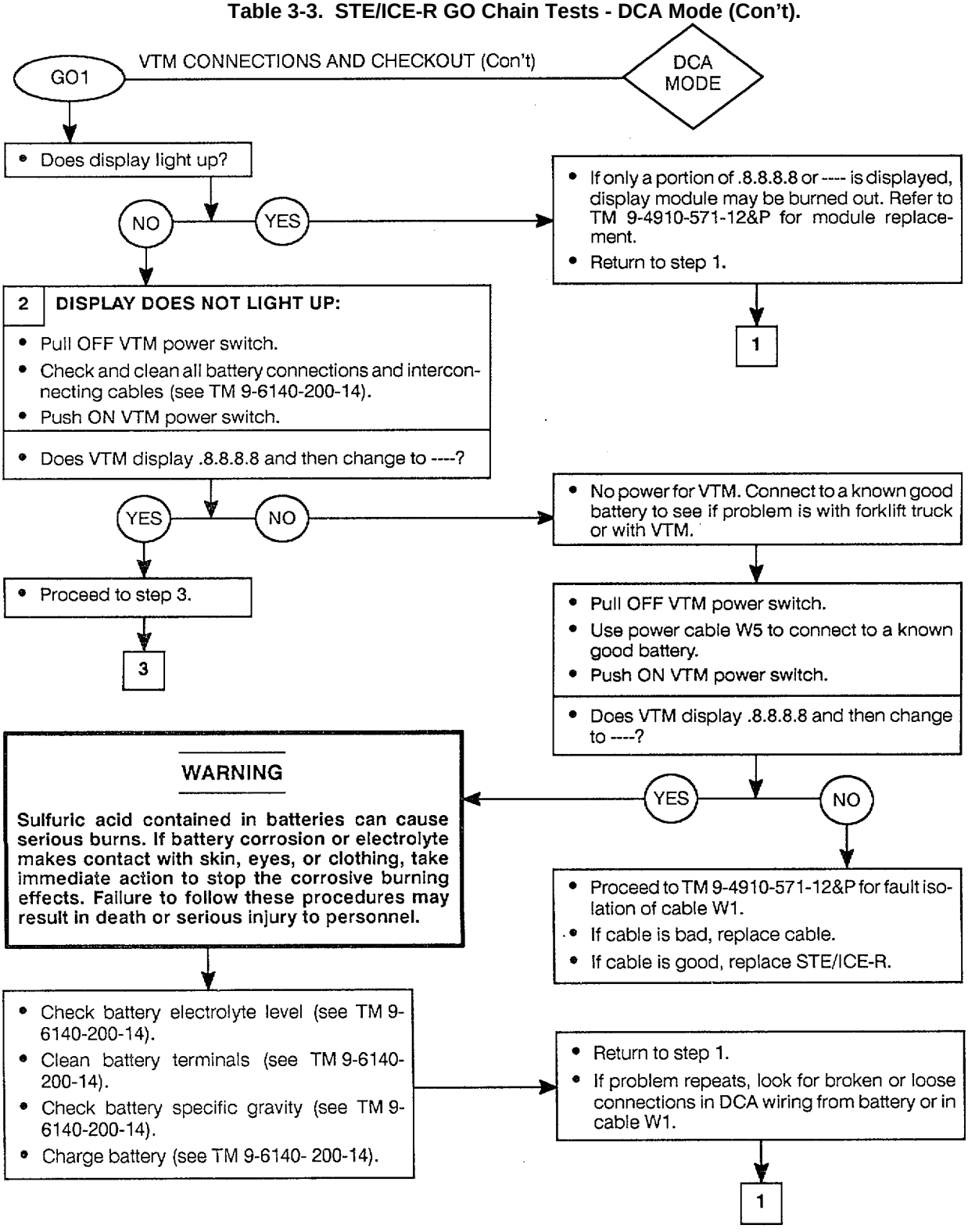
YES → • Proceed to step 3. → 3



AFTER 2 SECONDS

TA708439

Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).



GO1

VTM CONNECTIONS AND CHECKOUT (Con't)

DCA MODE

3 RUN CONFIDENCE TEST:

- Dial 66 into TEST SELECT, press and release TEST.
- Does VTM display and hold 0066?

YES

NO

- Pull OFF VTM power switch.
- Push ON VTM power switch.
- Verify that display indicates .8.8.8.8 for approximately two seconds and then changes to ----.
- Dial 66 into TEST SELECT, press and release TEST.
- Does VTM display and hold 0066?

YES

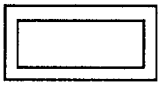
NO

- Dial 99 into TEST SELECT, press and release TEST.
- Look for this display:

- STE/ICE-R is bad. Replace STE/ICE-R.

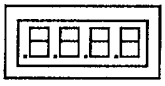
1

2

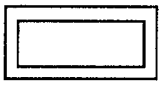


(BLANK)

3



4



(BLANK)

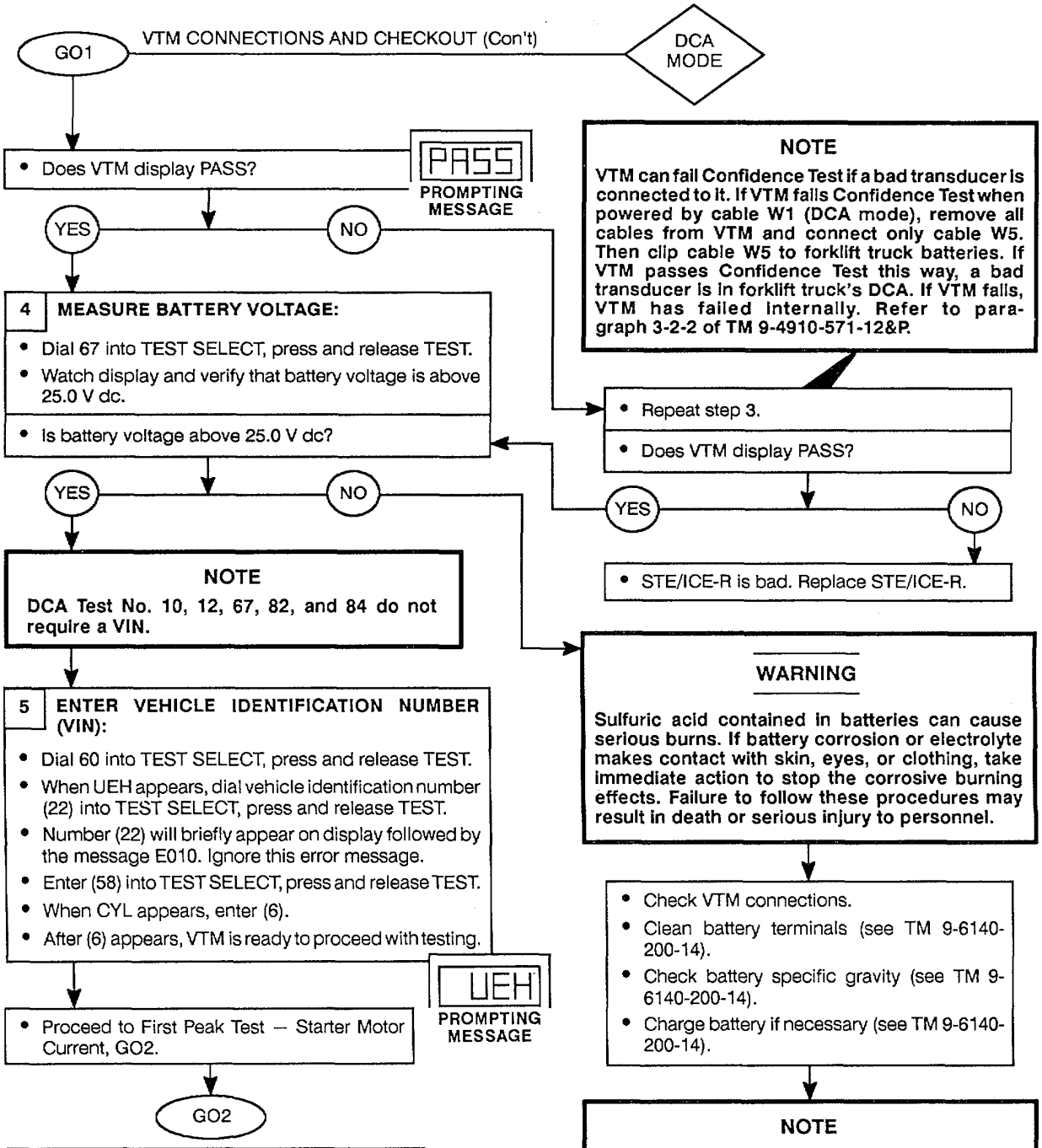
NOTE

At this point, several numbers will appear on display. Wait for readout display of PASS.

- Proceed to next page.

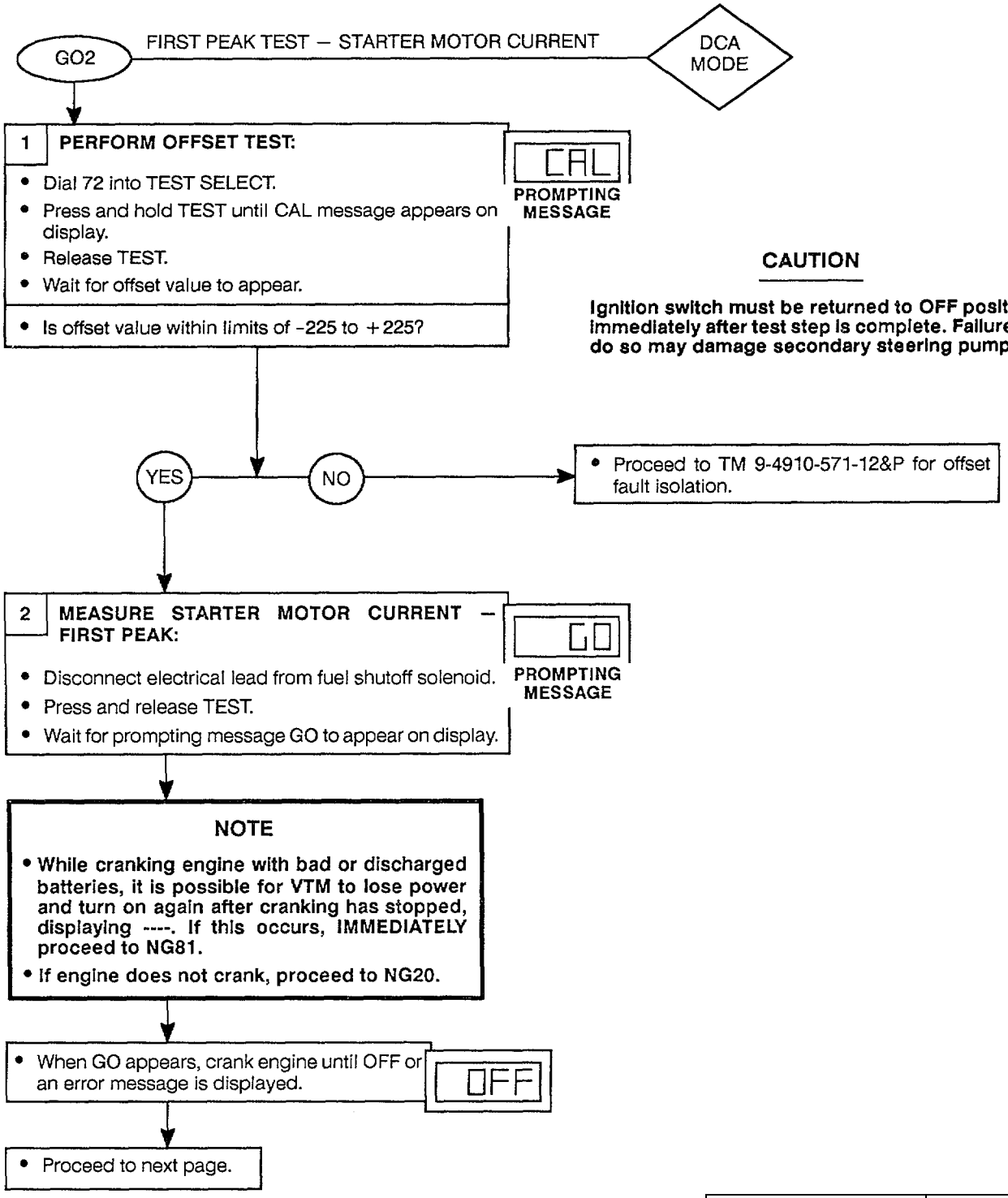
Test Number	Test
66/99	Confidence Test

Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).



Test Number	Test
60	Vehicle Identification Number
67	Battery Voltage

Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).



Test Number	Test
72	Starter Motor Current - First Peak

Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).

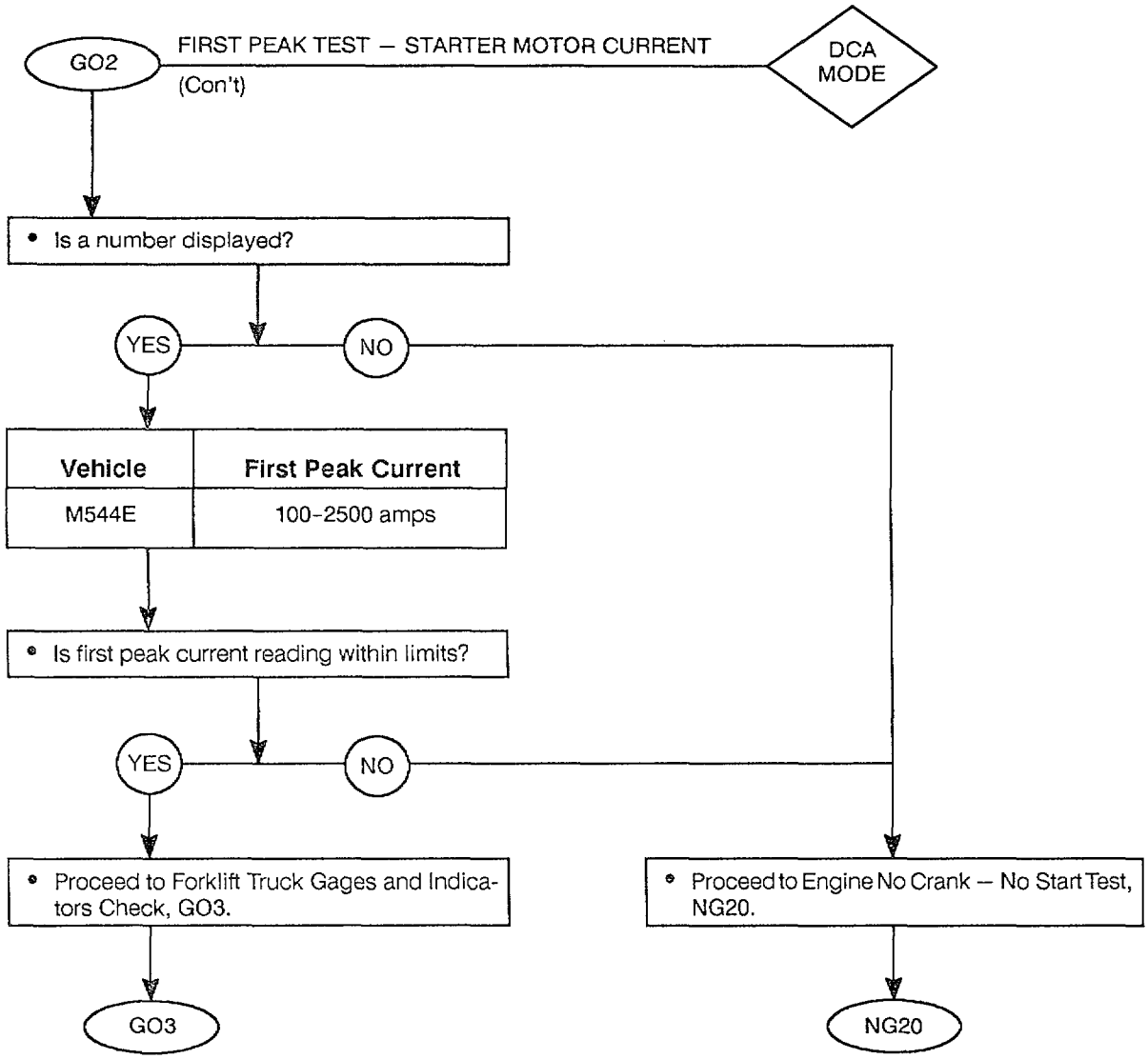


Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).

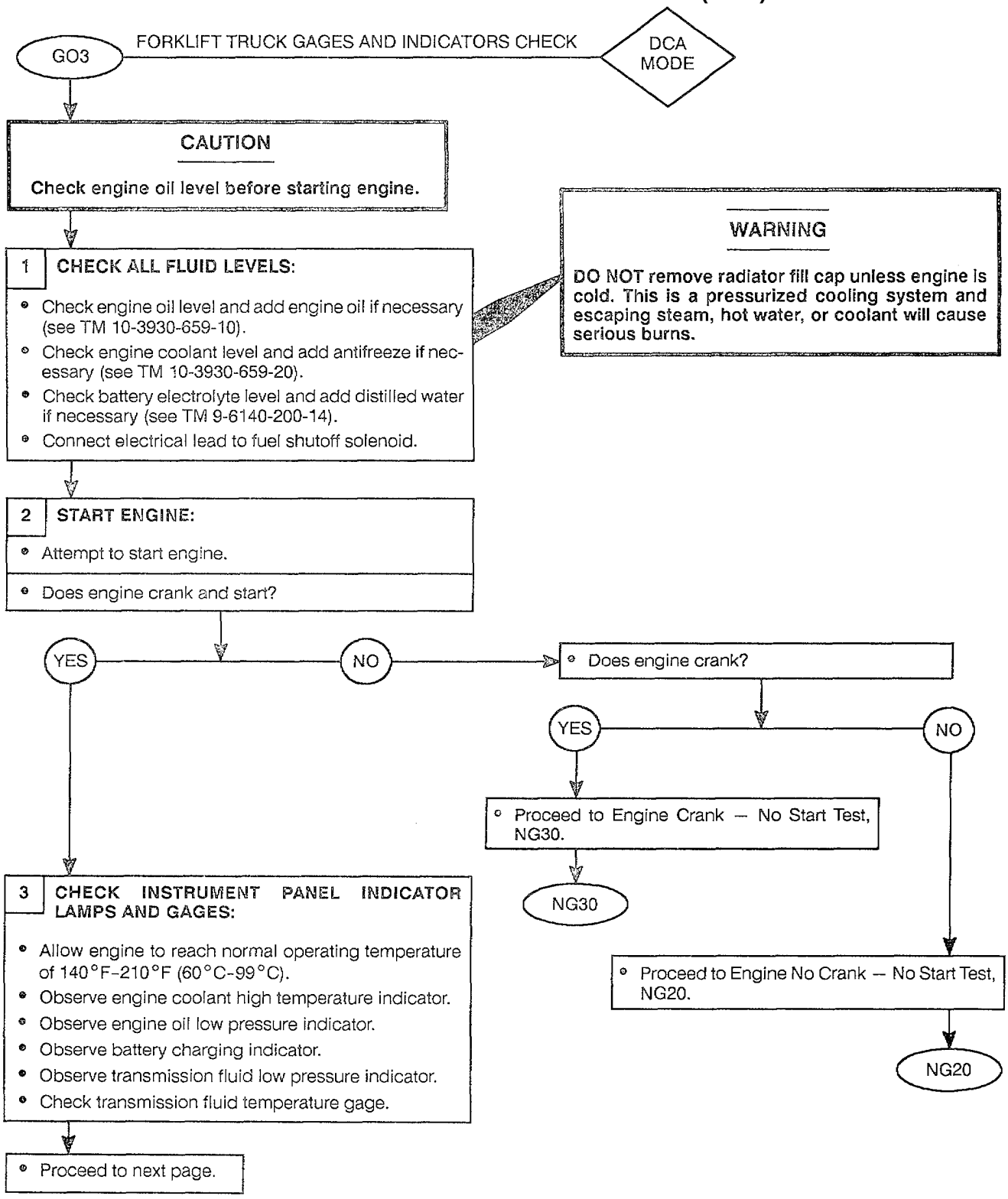


Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).

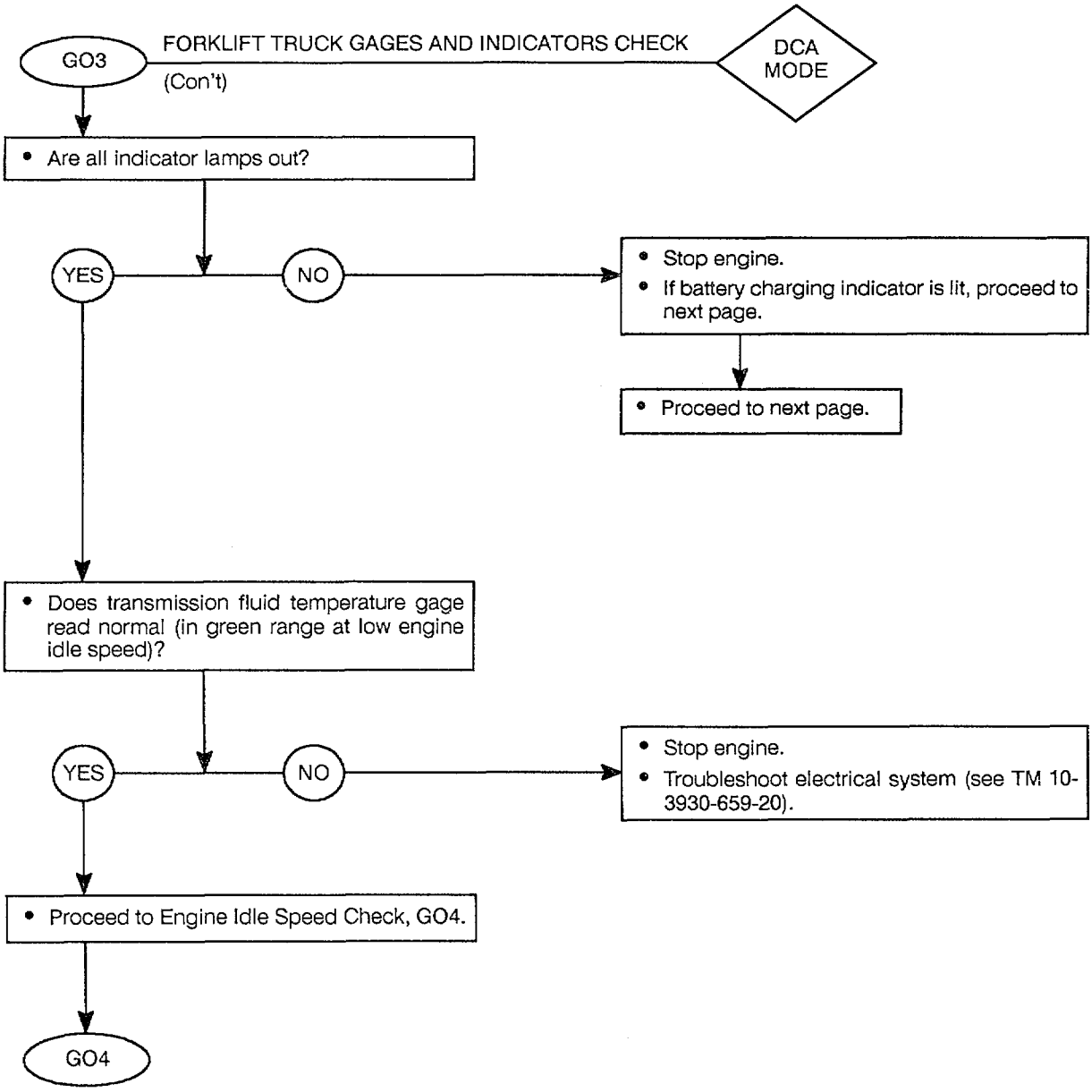


Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).

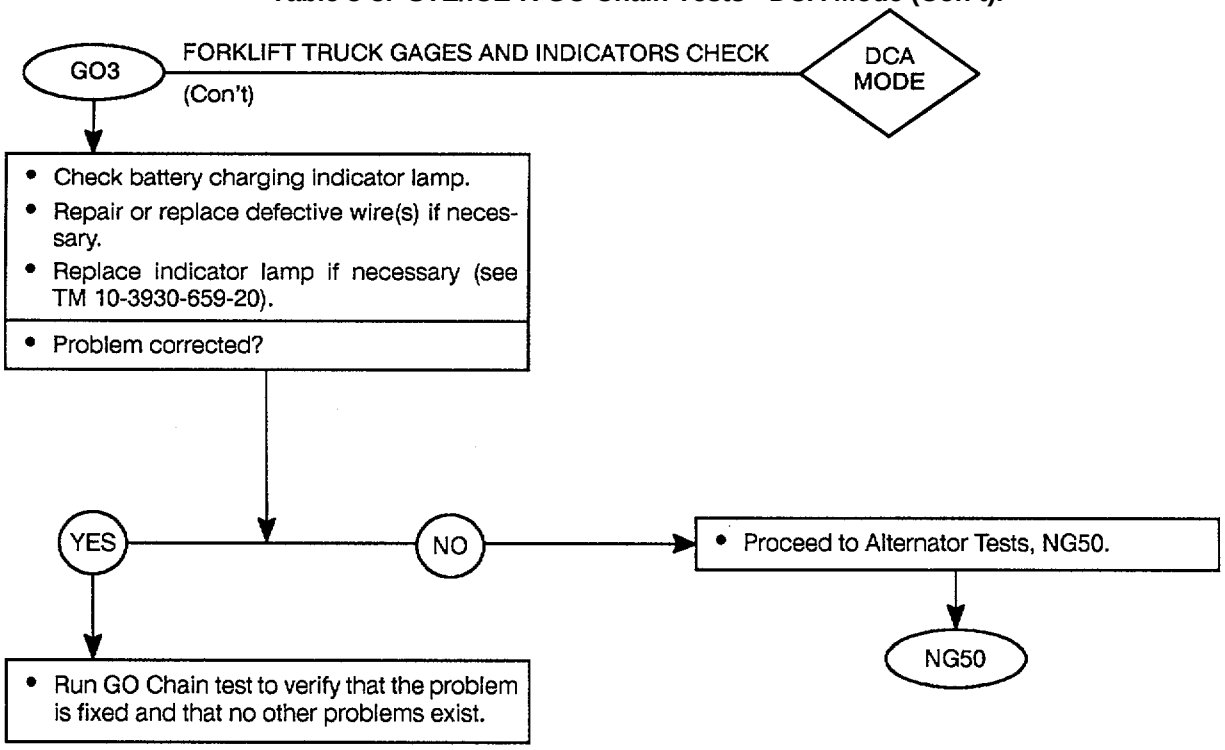
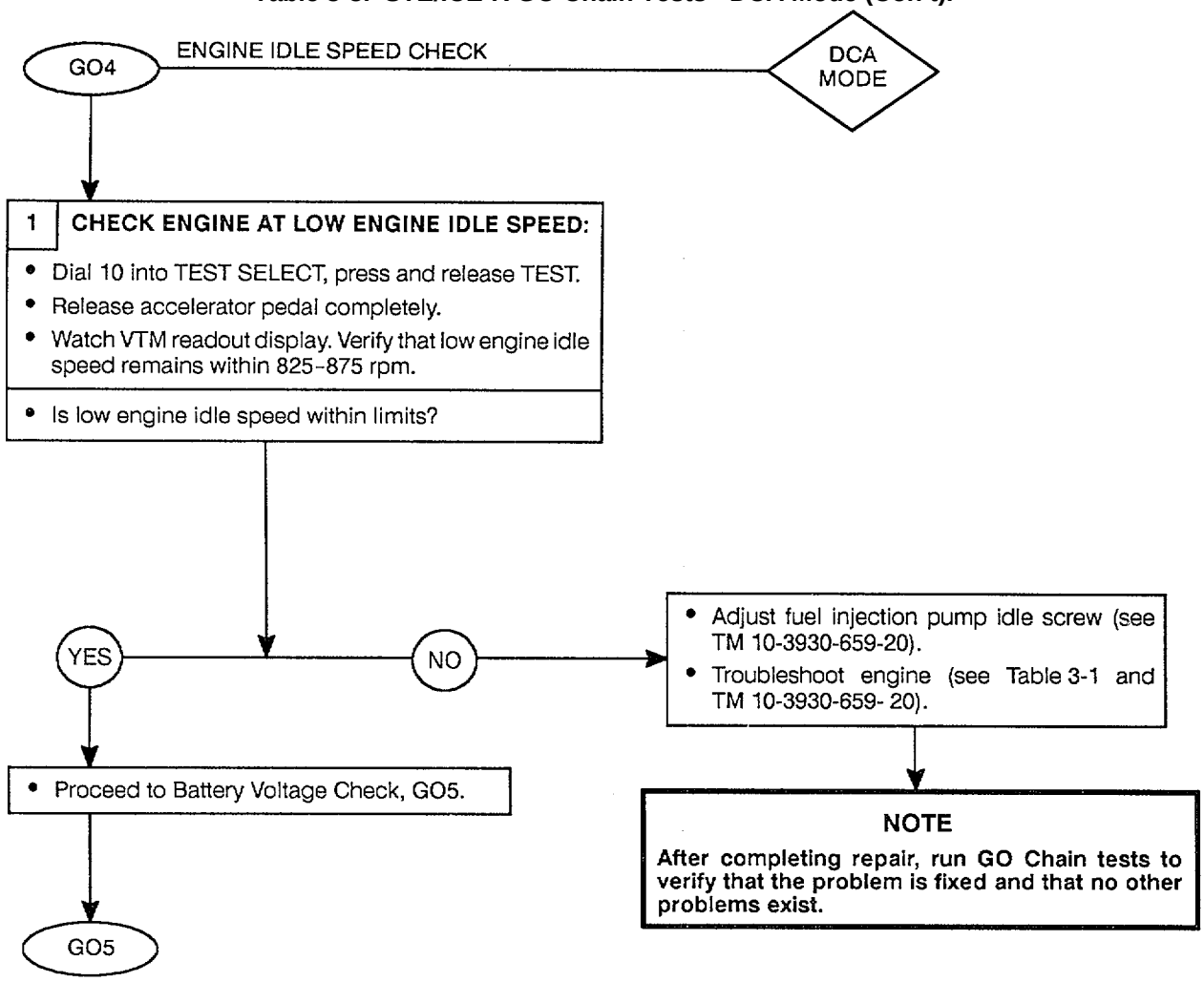
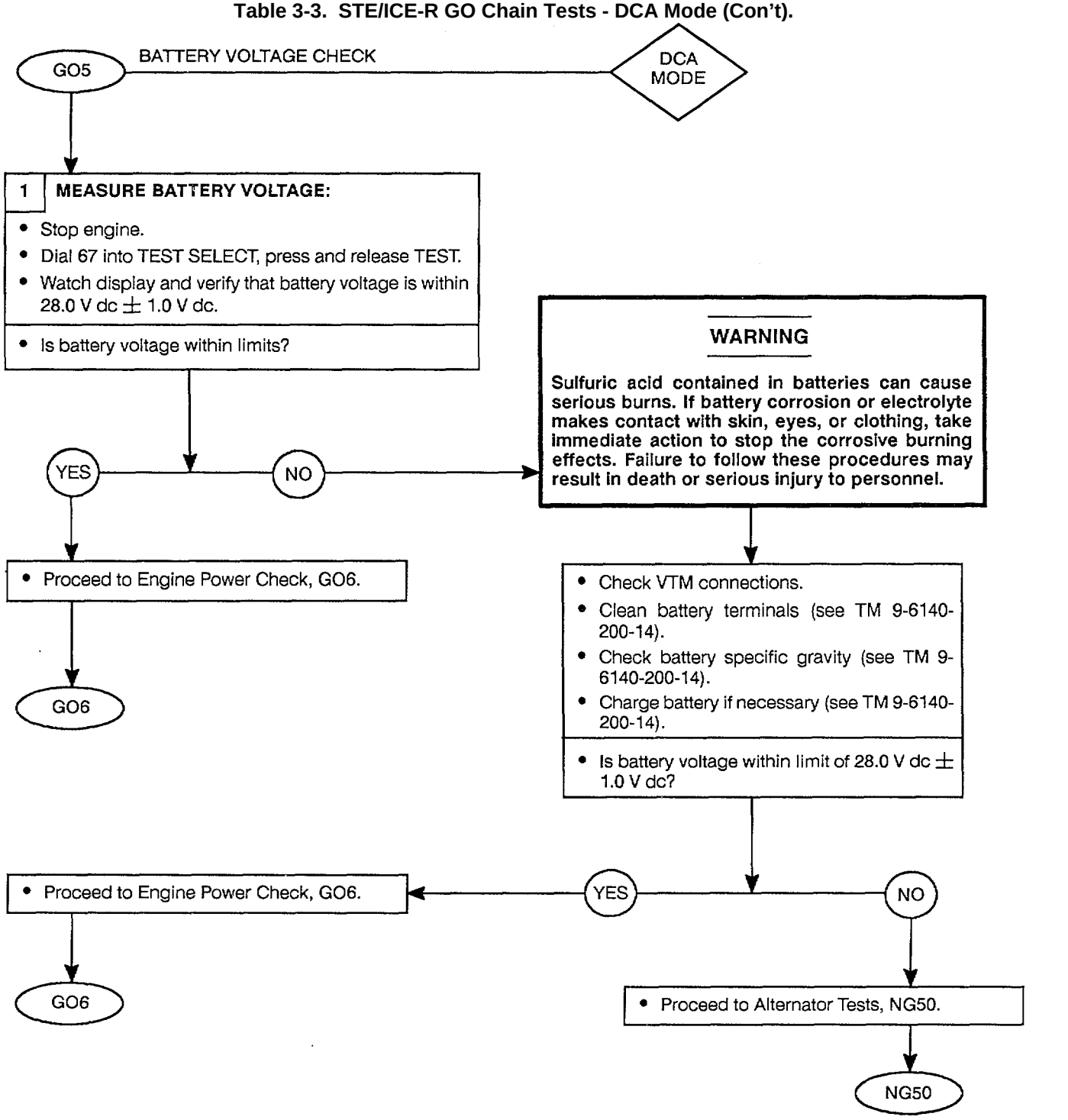


Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).



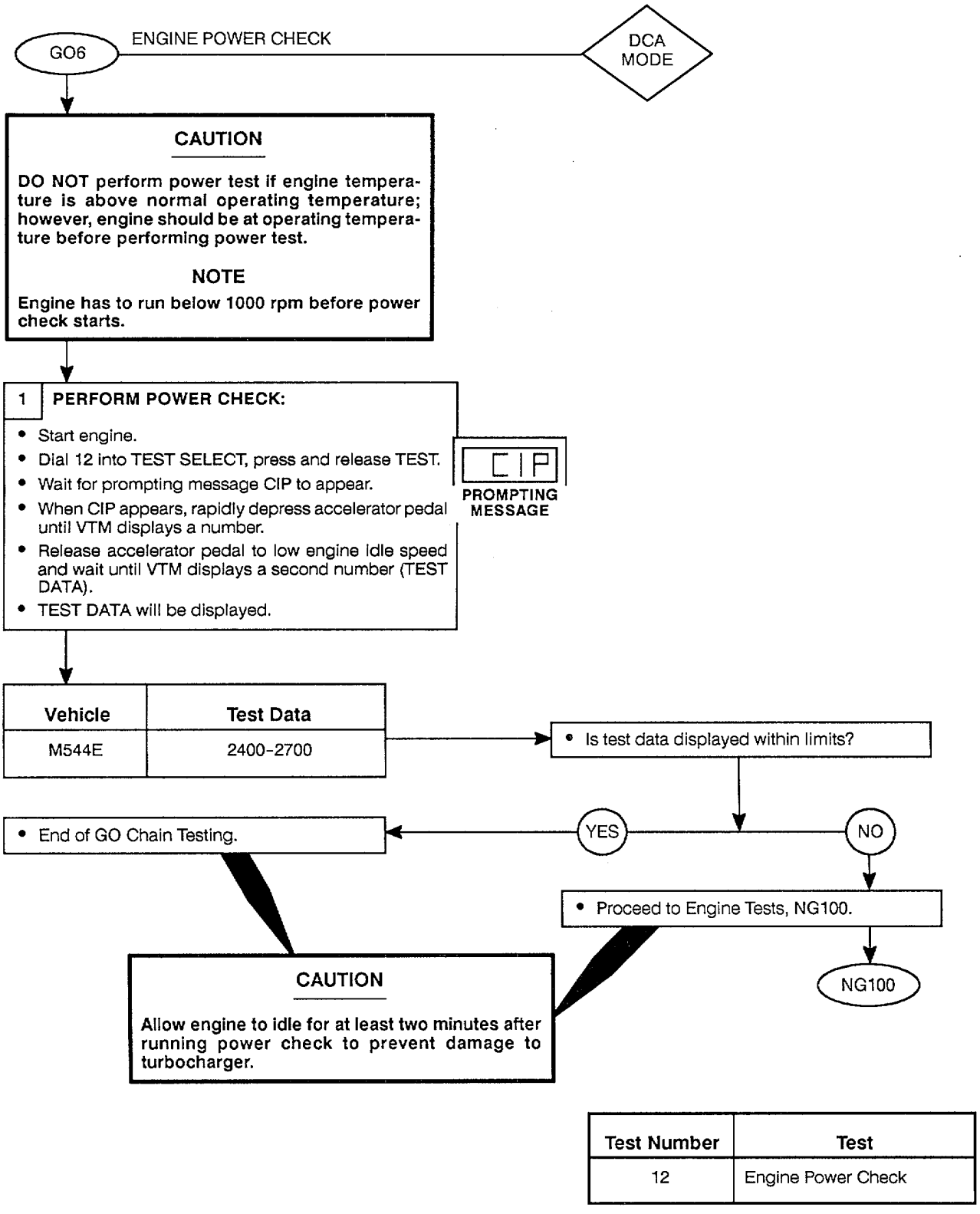
Test Number	Test
10	Engine rpm (average)

Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).



Test Number	Test
67	Battery Voltage

Table 3-3. STE/ICE-R GO Chain Tests - DCA Mode (Con't).



Test Number	Test
12	Engine Power Check

3-9. STE/ICE-R NO-GO CHAIN TESTS - DCA MODE.

a. The following NO-GO Chain Tests are made using the forklift truck's DCA connector. Each test is referenced from the GO Chain testing sequence. Do not perform any of these tests unless you are instructed to do so by the GO Chain testing procedure or by Table 3-1. All testing is referenced by the NG (NO-GO) number.

b. For normal readings, refer to the M544E Forklift Truck Test Card at Table 3-2. For DCA test location, refer to paragraph 3-6.

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode.

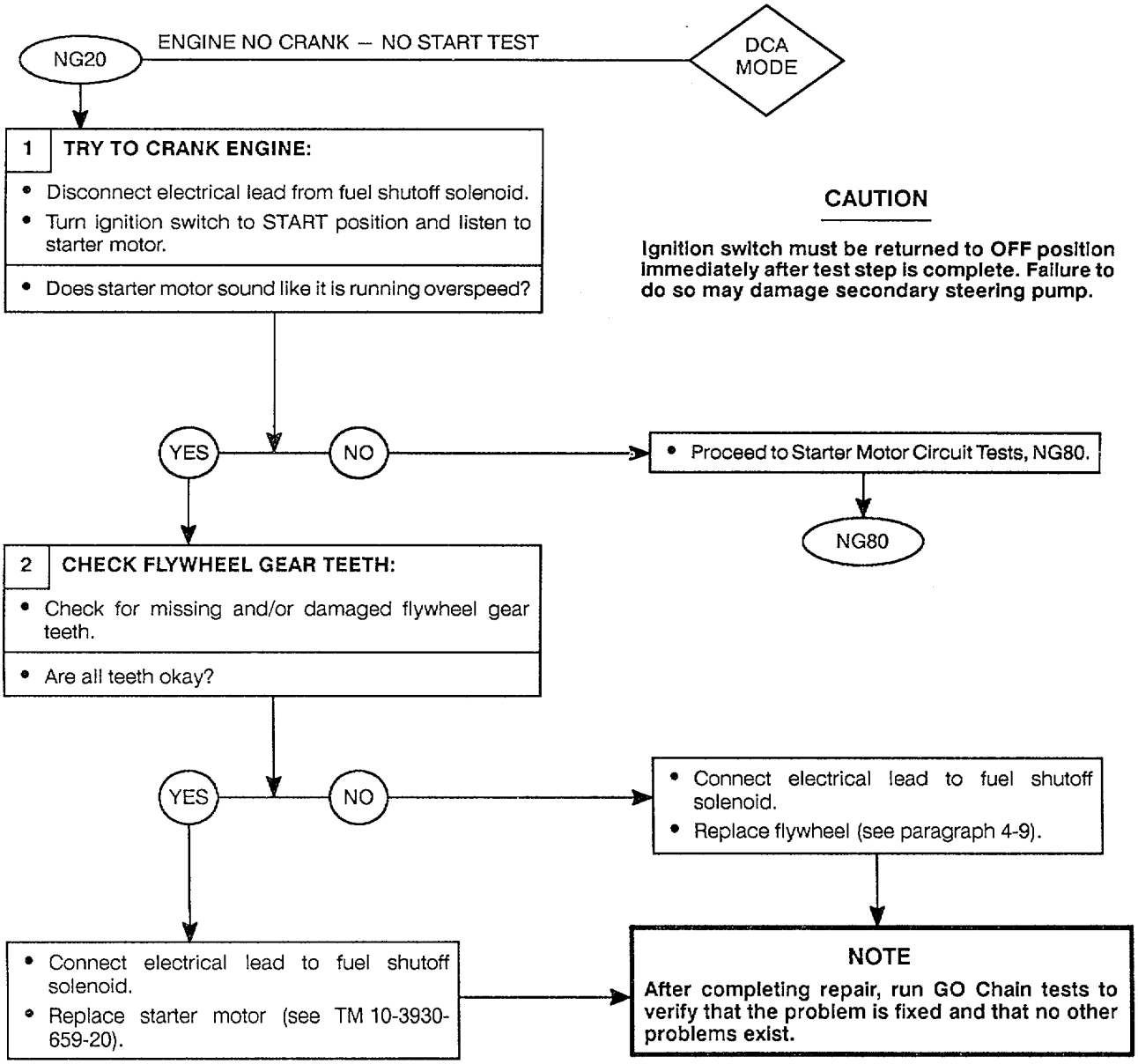
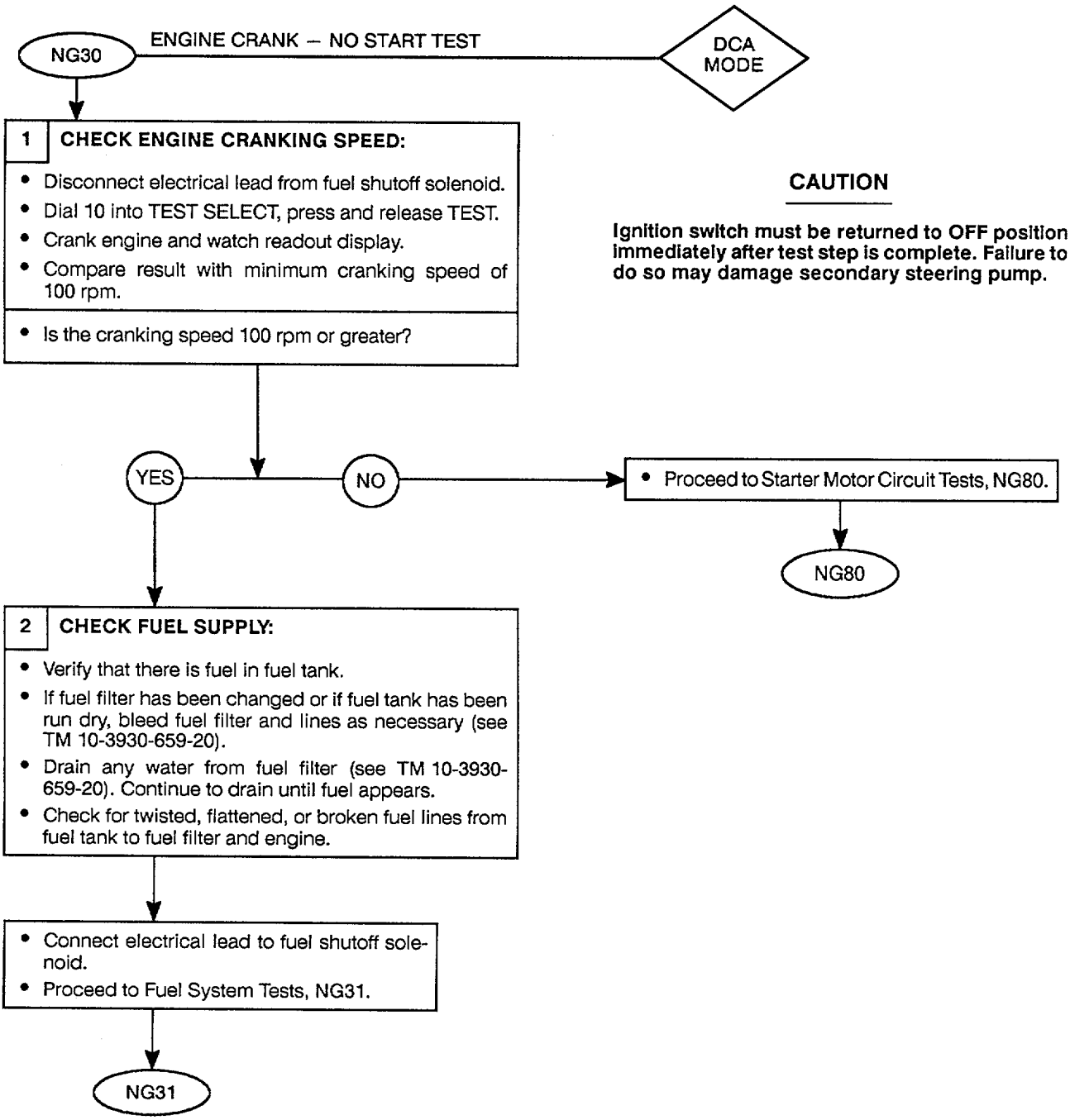
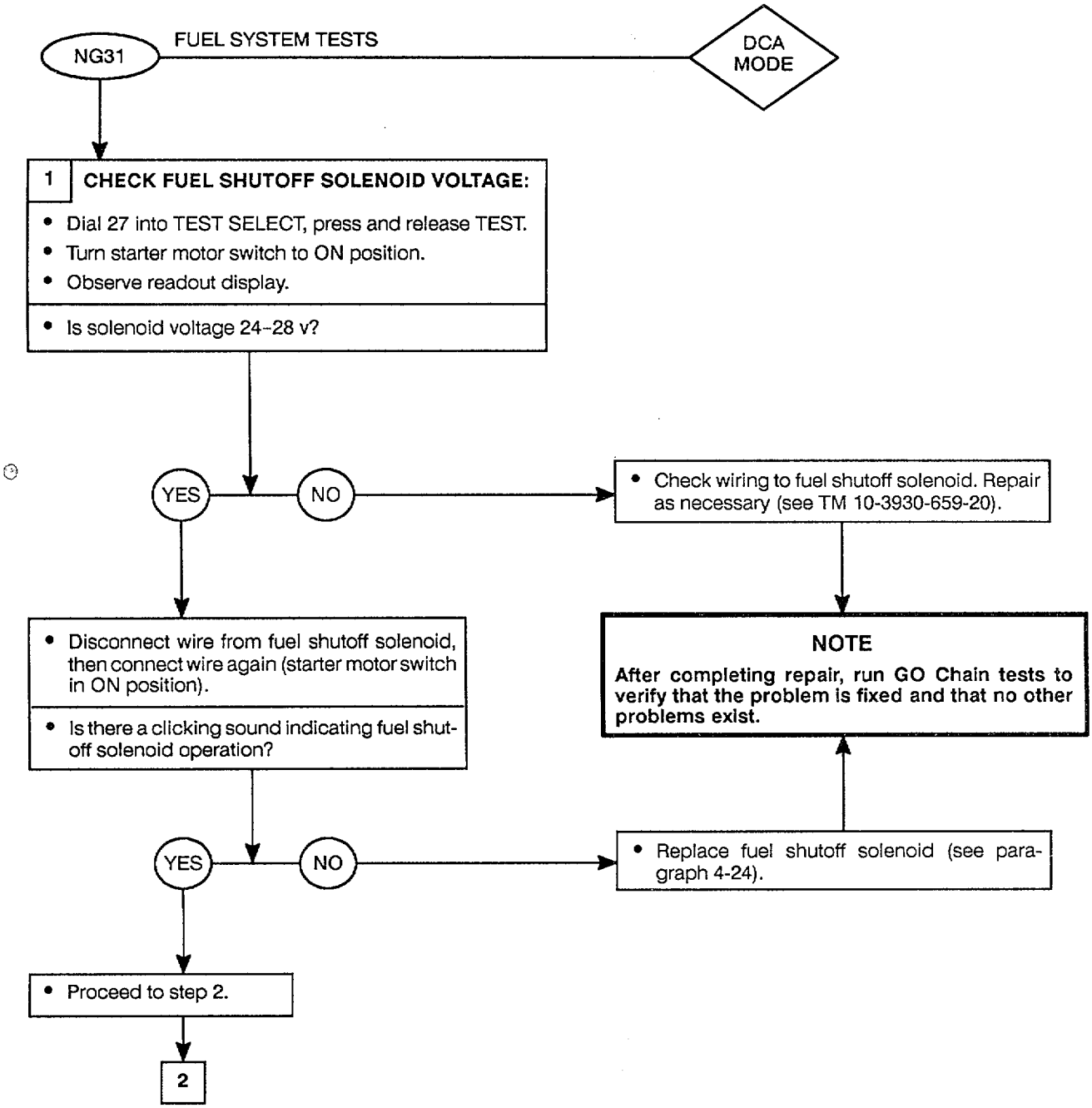


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



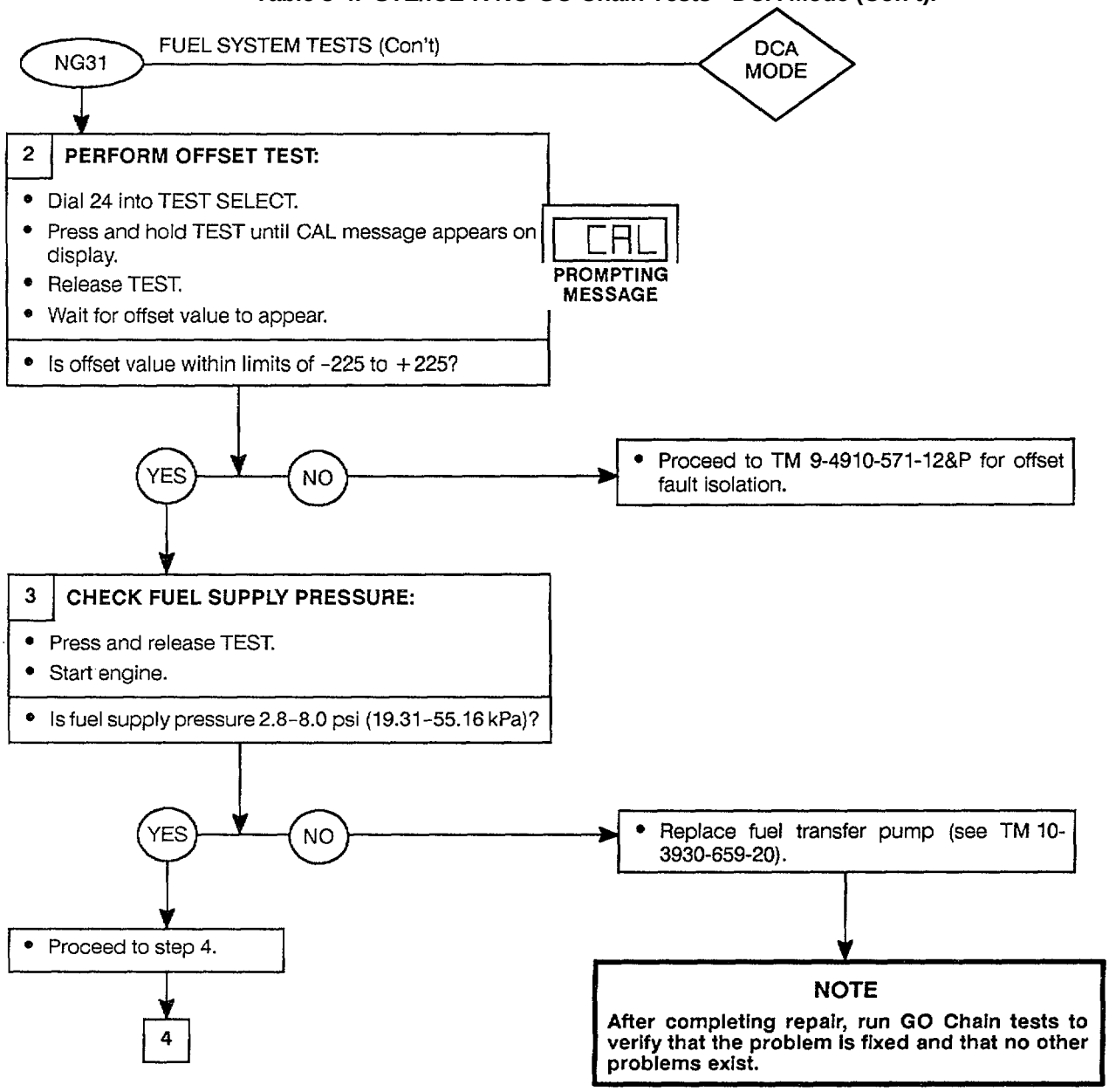
Test Number	Test
10	Engine rpm (average)

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



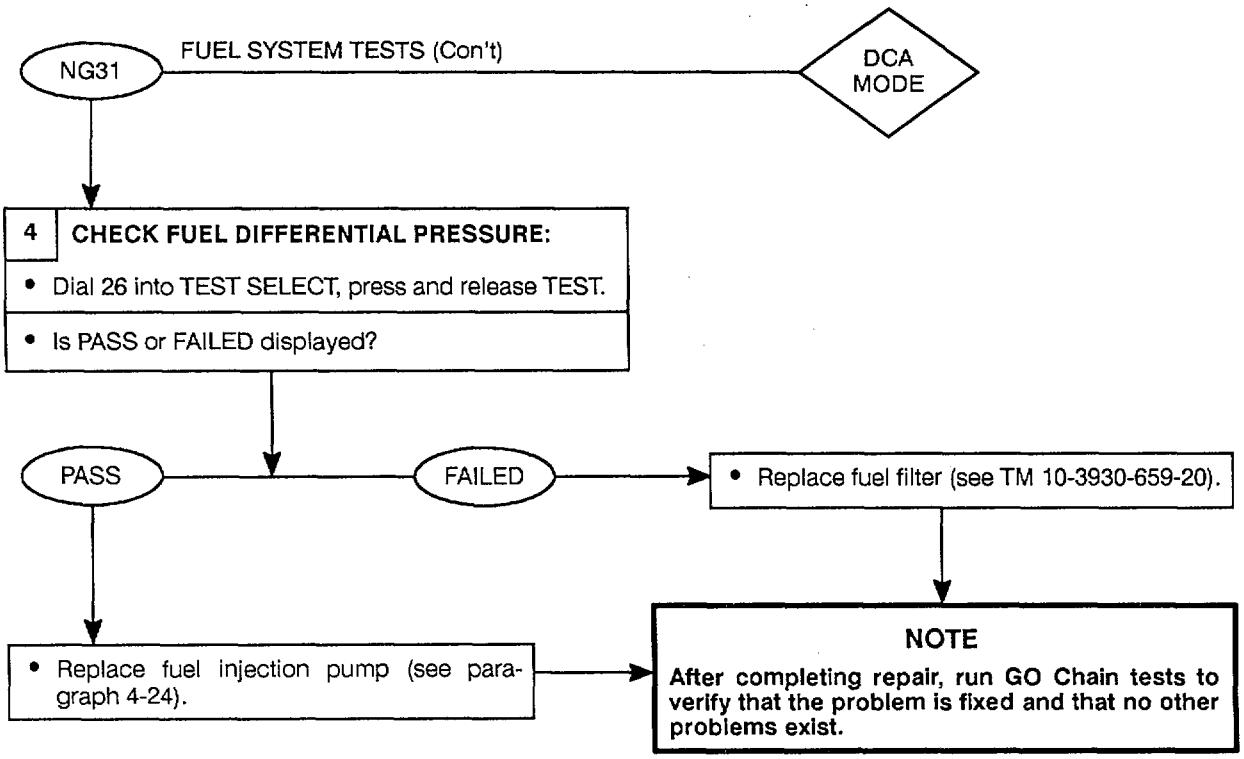
Test Number	Test
27	Fuel Shutoff Solenoid
Voltage	

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



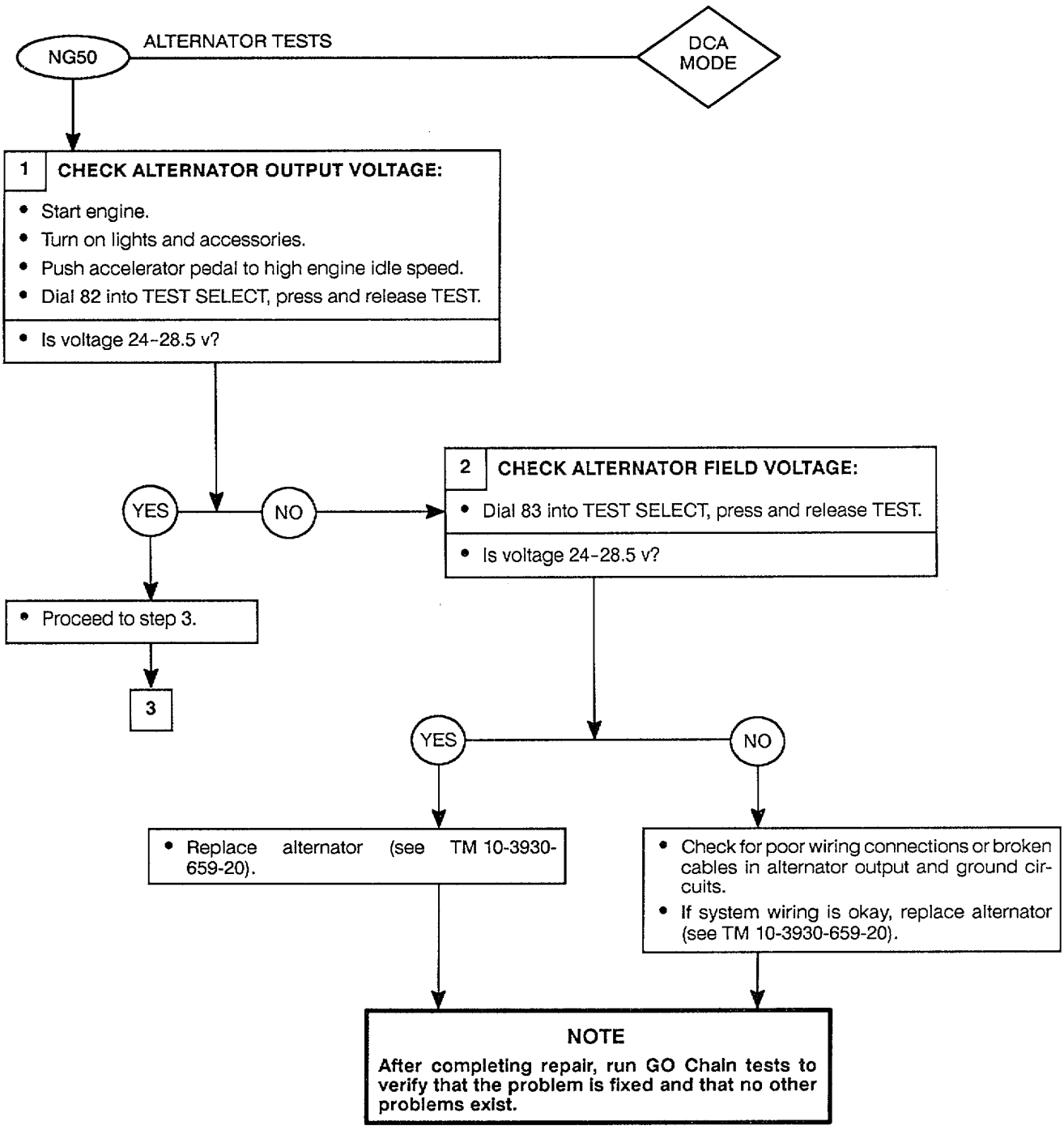
Test Number	Test
24	Fuel Supply Pressure

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



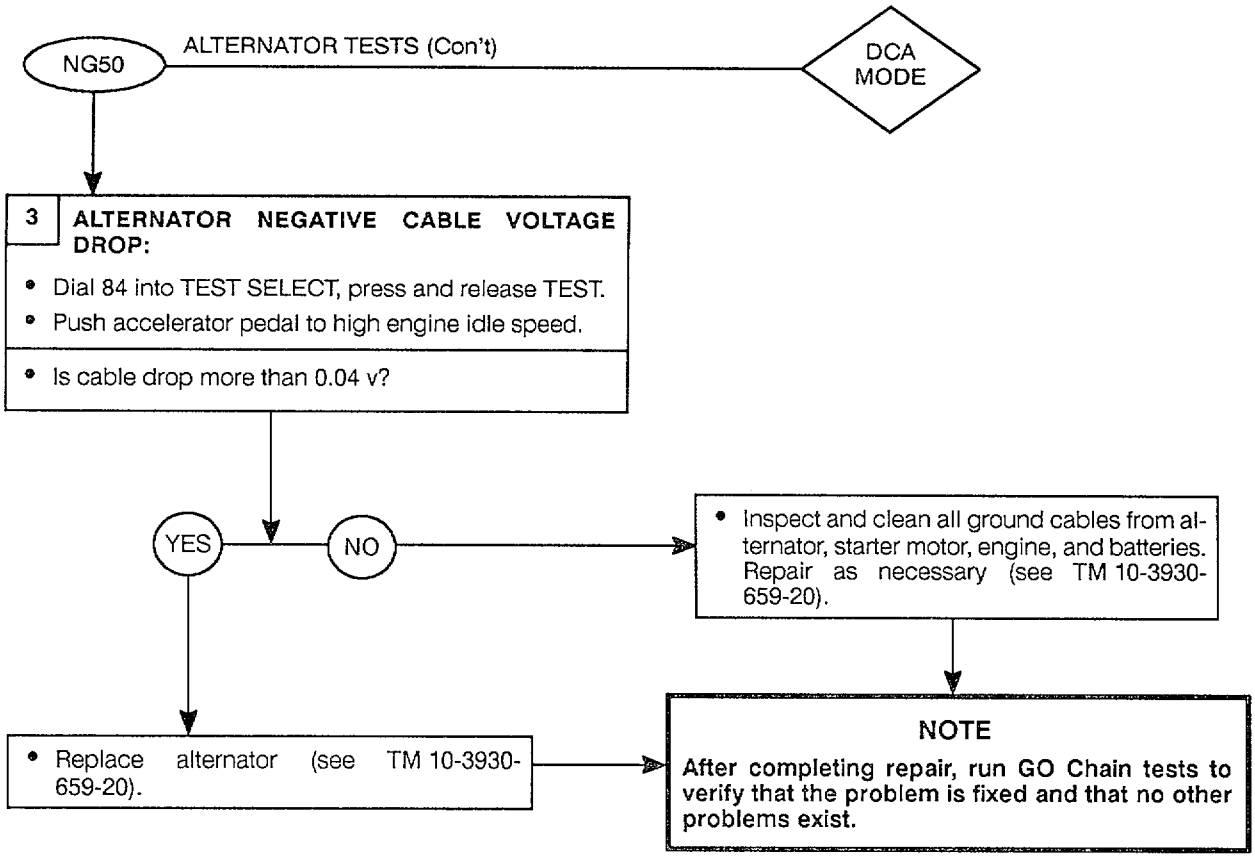
Test Number	Test
26	Fuel Filter Differential Pressure.

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



Test Number	Test
82	Alternator Output Voltage
83	Alternator Field Voltage

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



Test Number	Test
84	Alternator Negative Cable
Voltage Drop	

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

NG80 — STARTER MOTOR CIRCUIT TESTS — DCA MODE

NOTE

While cranking engine with bad or discharged batteries, it is possible for VTM to lose power and turn on again after cranking has stopped, displaying ----. If this occurs, clean battery posts and clamps, and try again. If VTM still loses power, Test 74 cannot be performed. Refer to Test 78 in TM 9-4910-571-12&P.

1 PERFORM OFFSET TEST:

- Dial 74 into TEST SELECT.
- Press and hold TEST until CAL message appears on display.
- Release TEST.
- Wait for offset value to appear.

CAL — PROMPTING MESSAGE

- Is offset value within limits of -225 to +225?

YES / NO

- Proceed to TM 9-4910-571-12&P for offset fault isolation.

CAUTION

Ignition switch must be returned to OFF position immediately after test step is complete. Failure to do so may damage secondary steering pump.

2 CHECK STARTER MOTOR CIRCUIT RESISTANCE:

- Disconnect electrical lead from fuel shutoff solenoid.
- Press and release TEST.
- When GO appears, attempt to crank engine.
- Stop cranking engine when VTM displays OFF, a test value, .9.9.9.9, or an error message.
- Wait for display to change.

GO — PROMPTING MESSAGE

OFF

NOTE

Error message indicates a short circuit, a frozen starter, or a tight engine.

- Proceed to next page.

Test Number	Test
74	Starter Motor Circuit Resistance

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

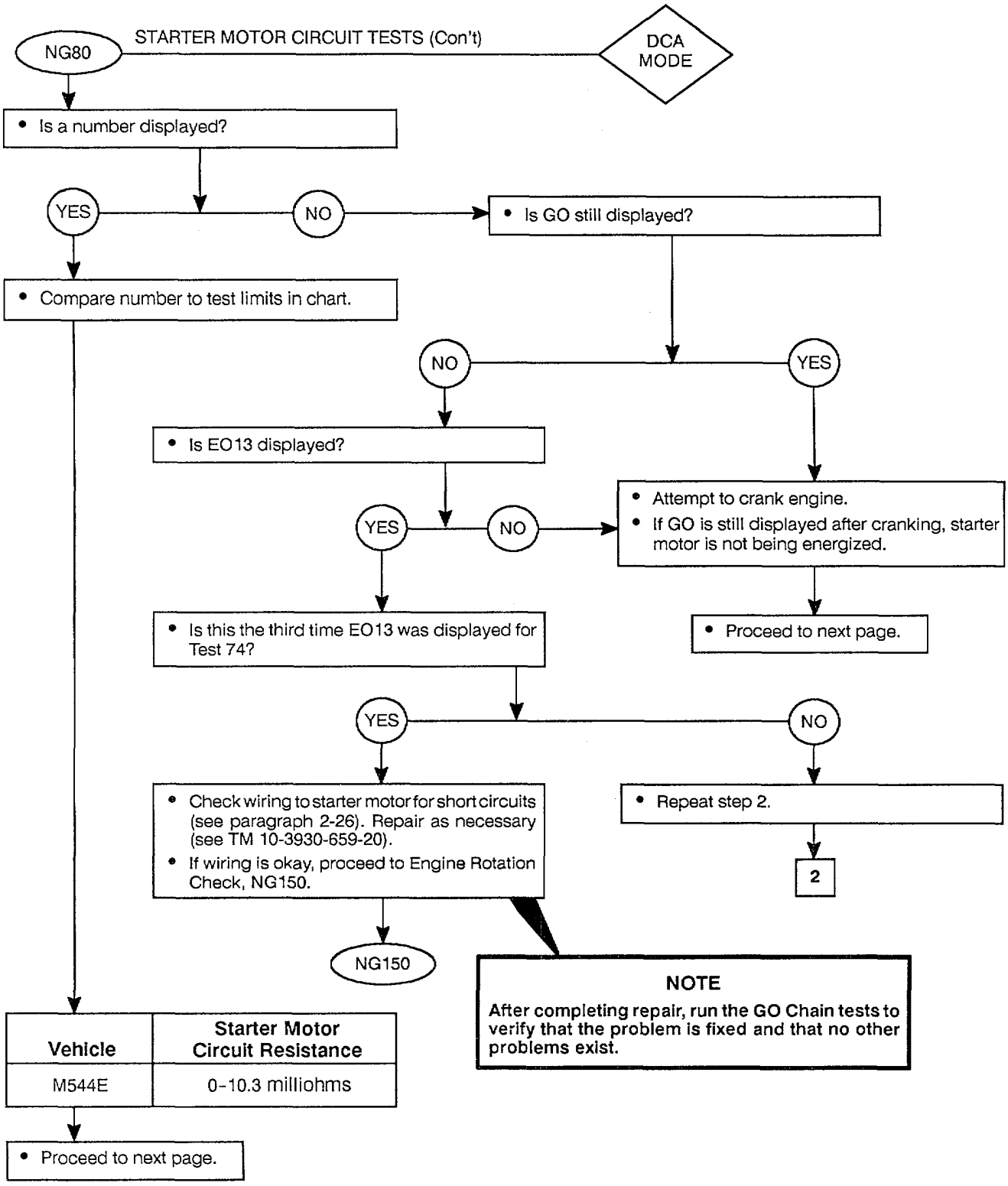


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

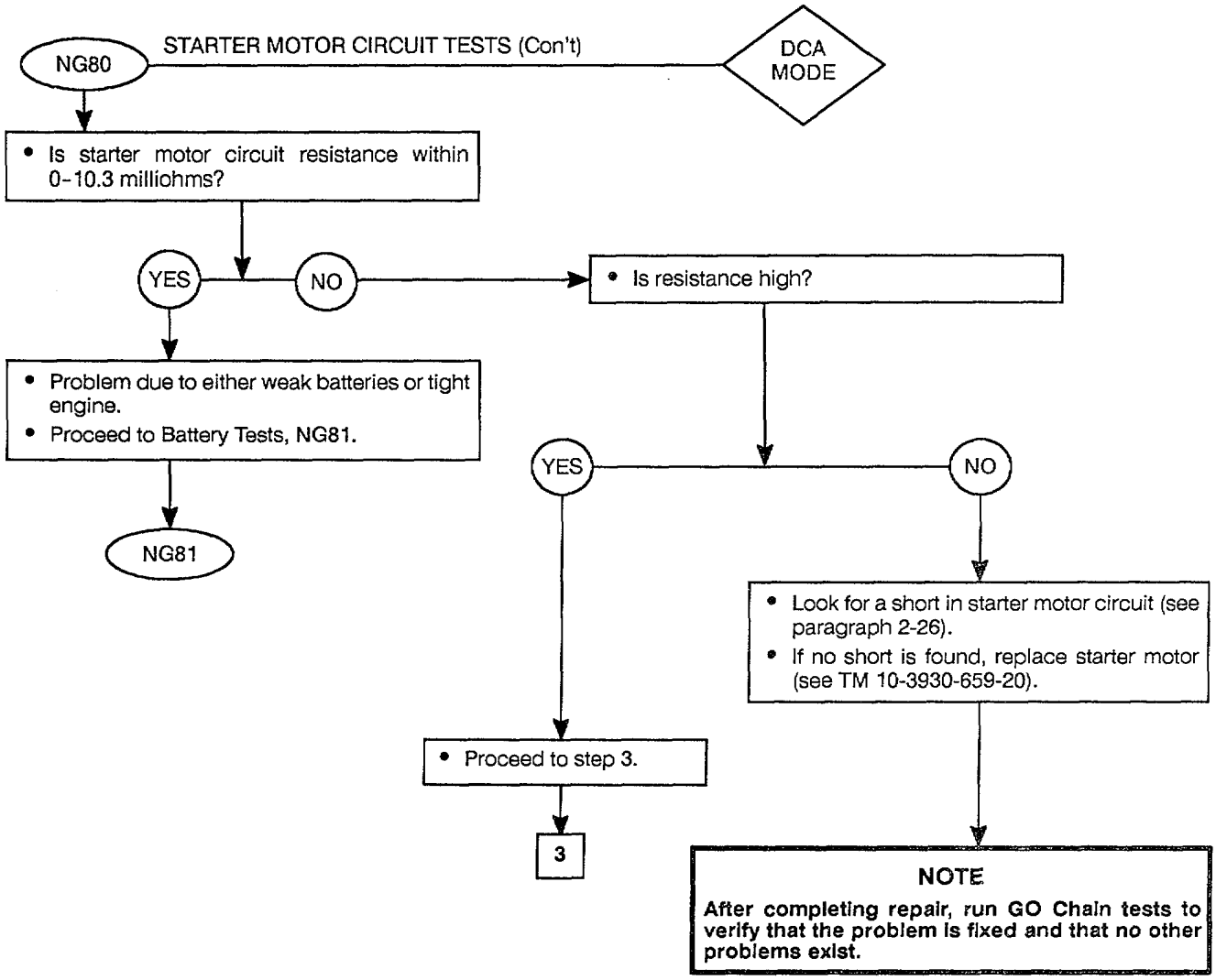


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

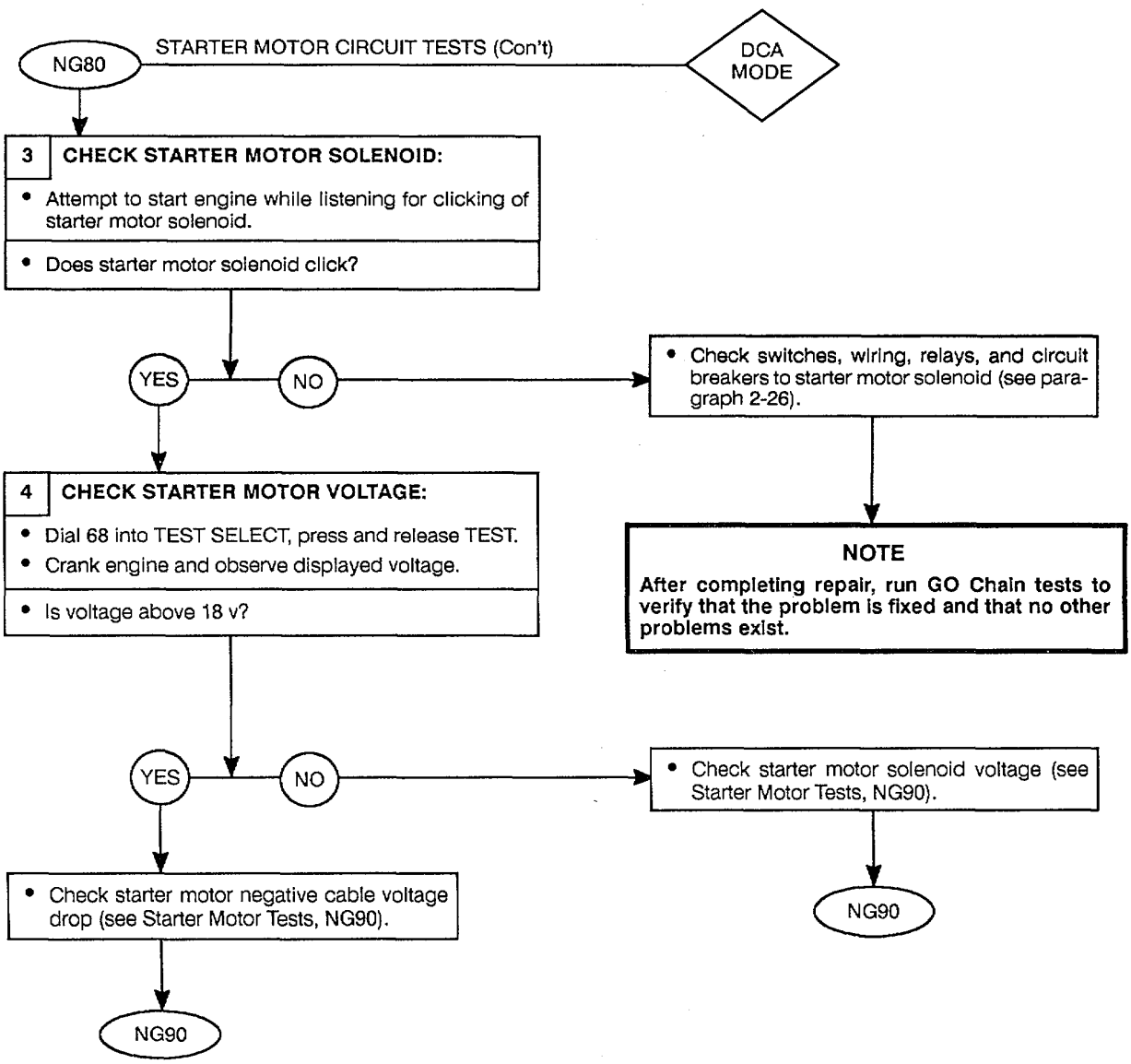


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

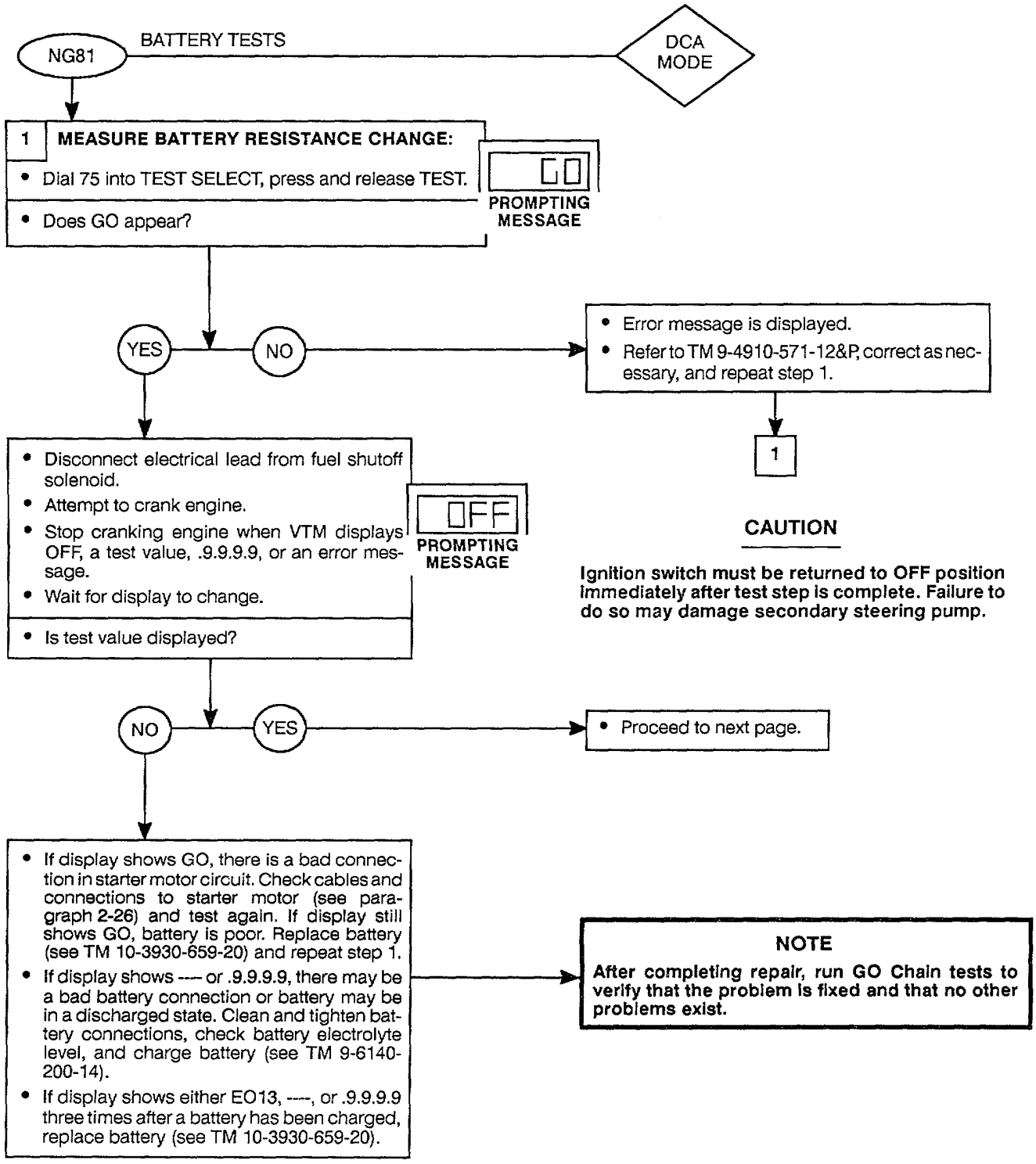
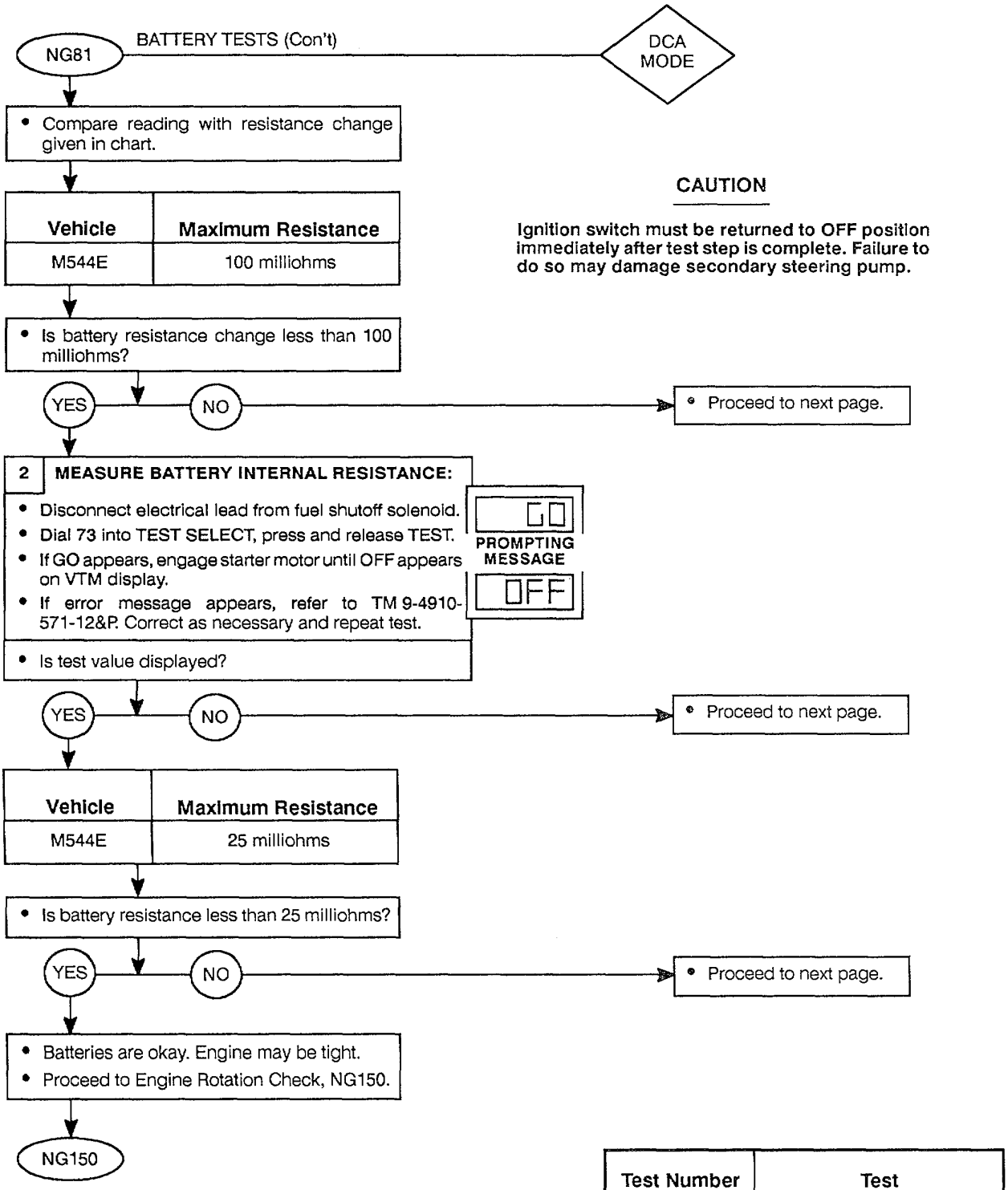


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



Test Number	Test
73	Battery Internal Resistance

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

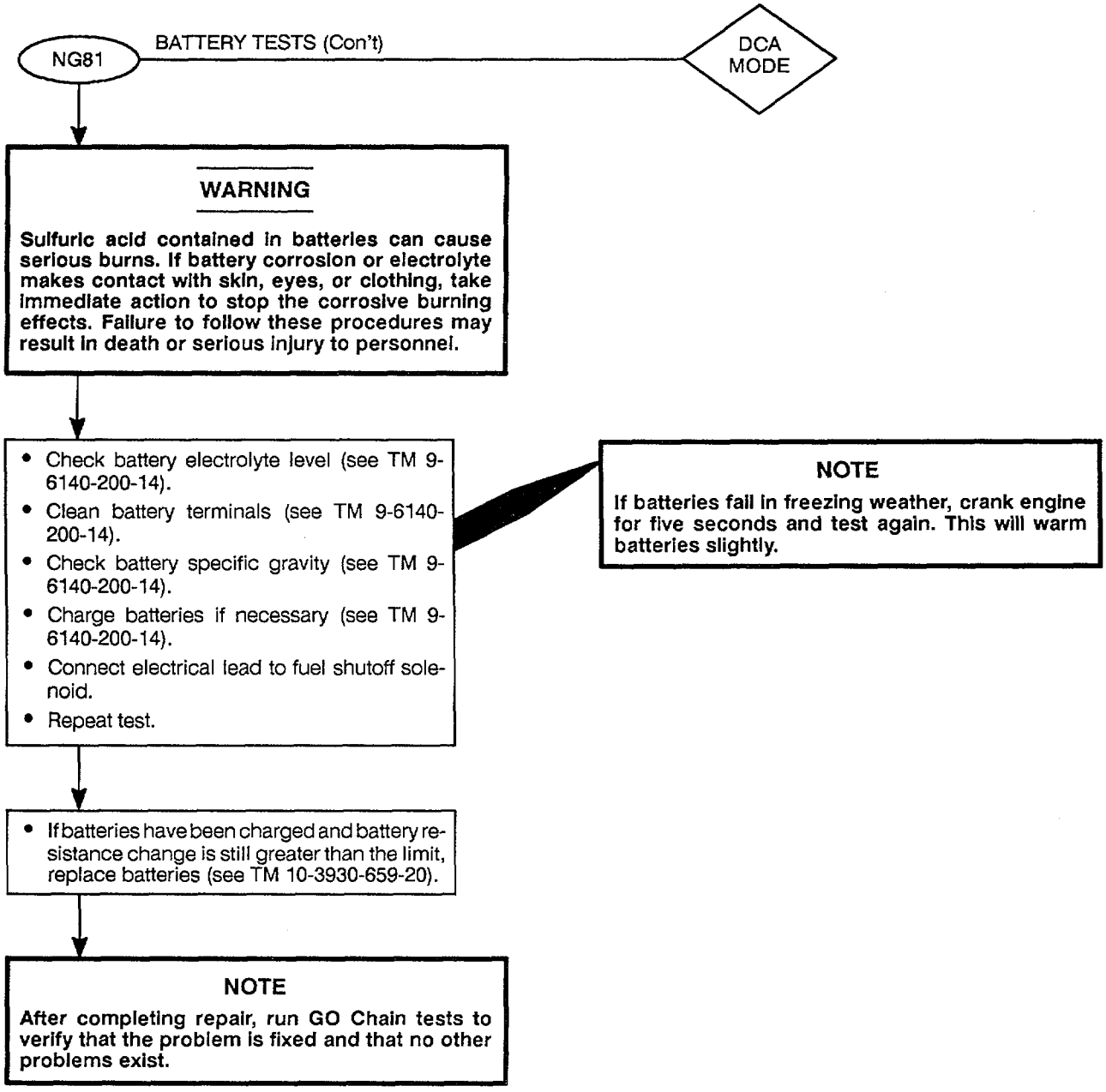


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

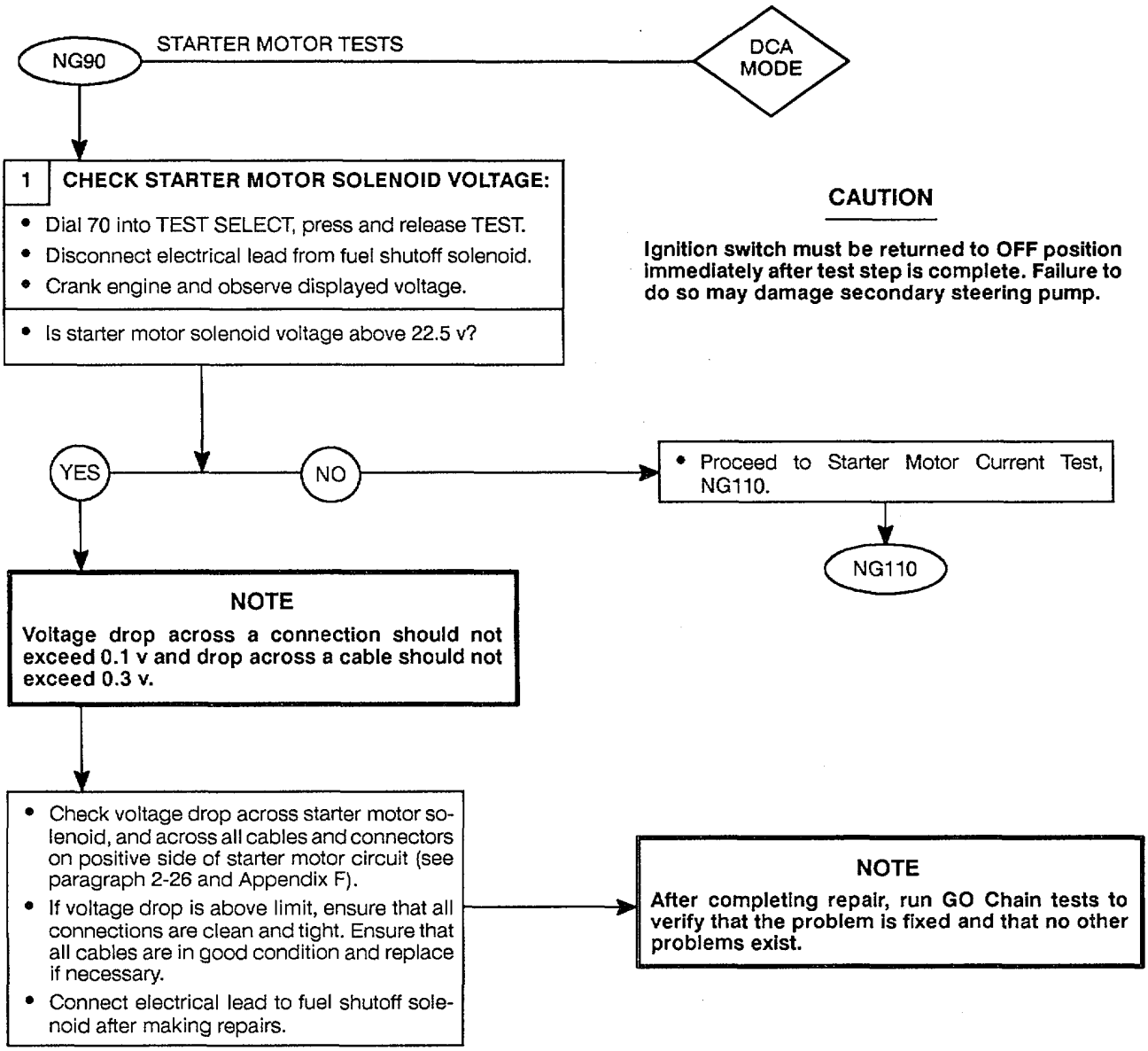


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

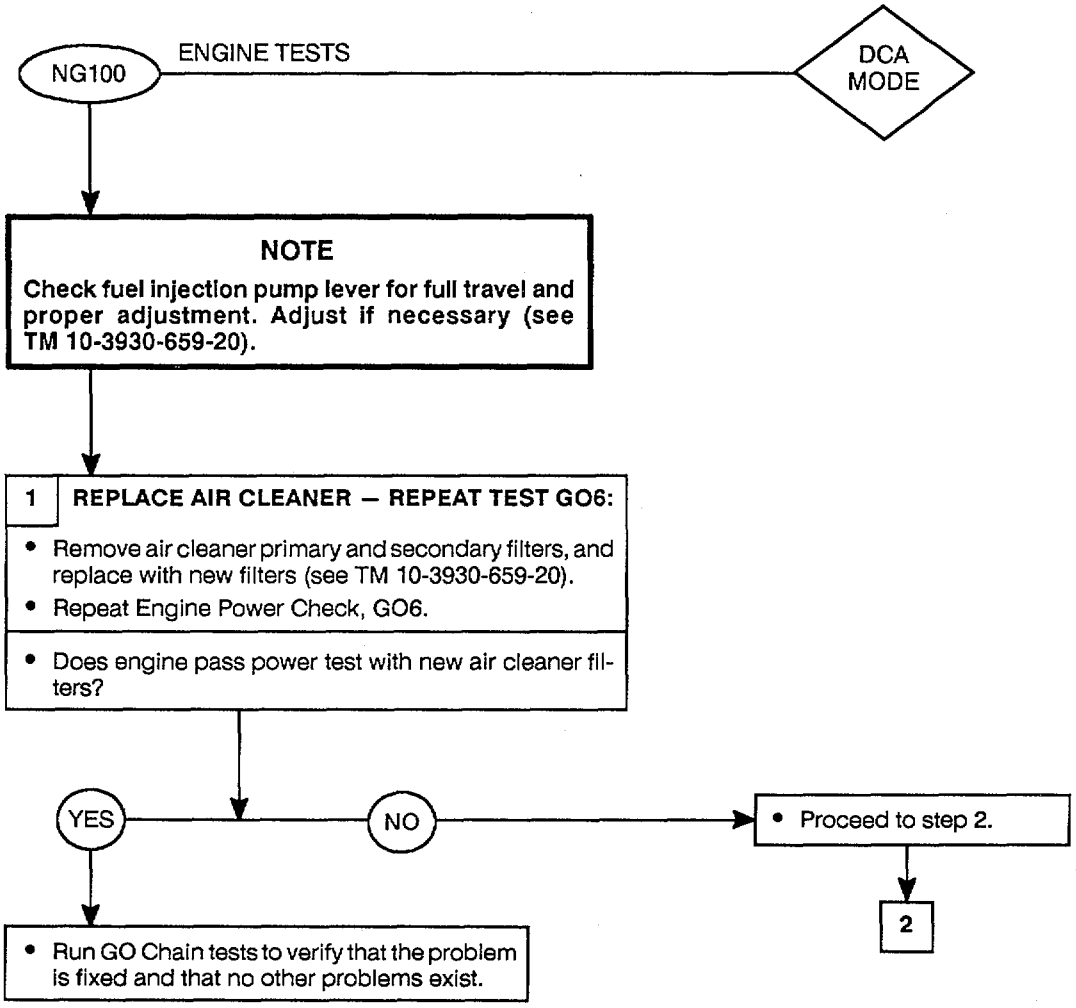


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

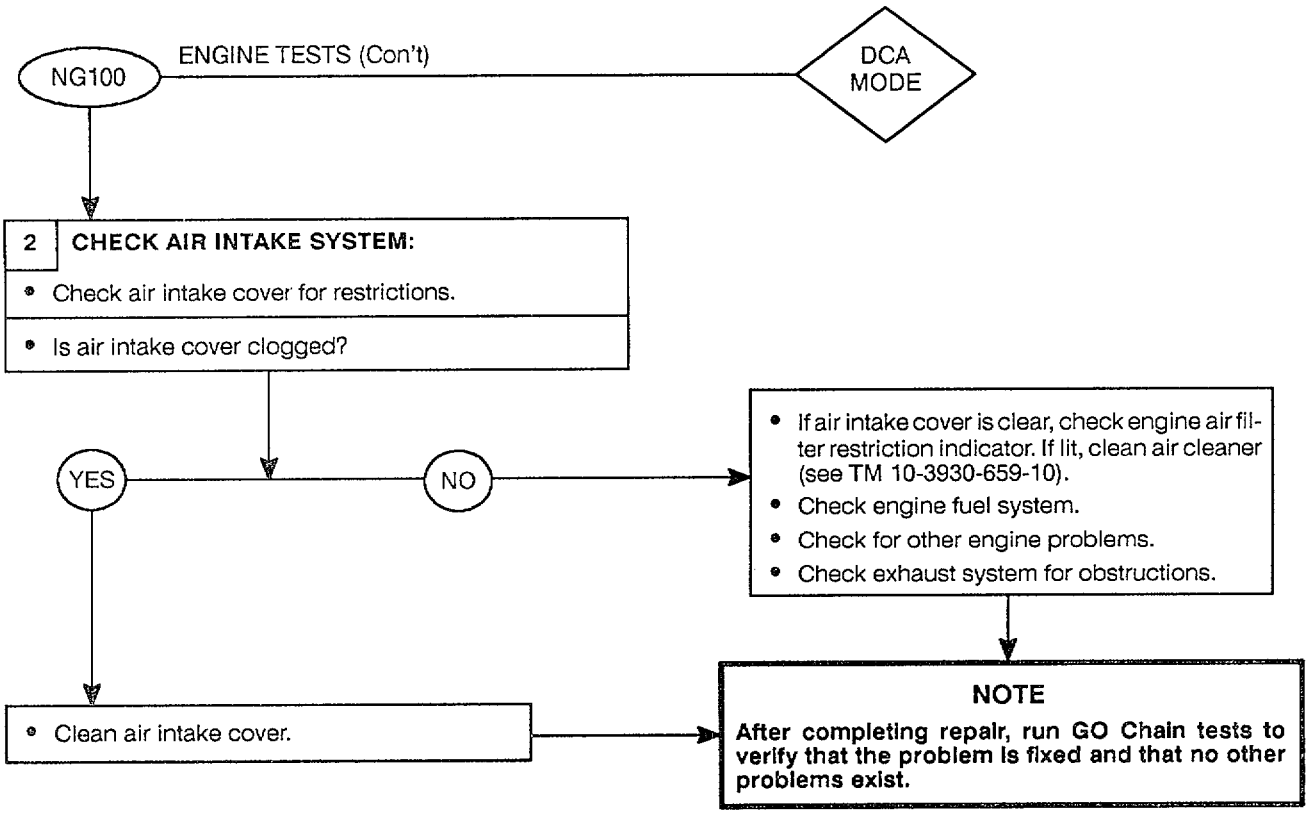
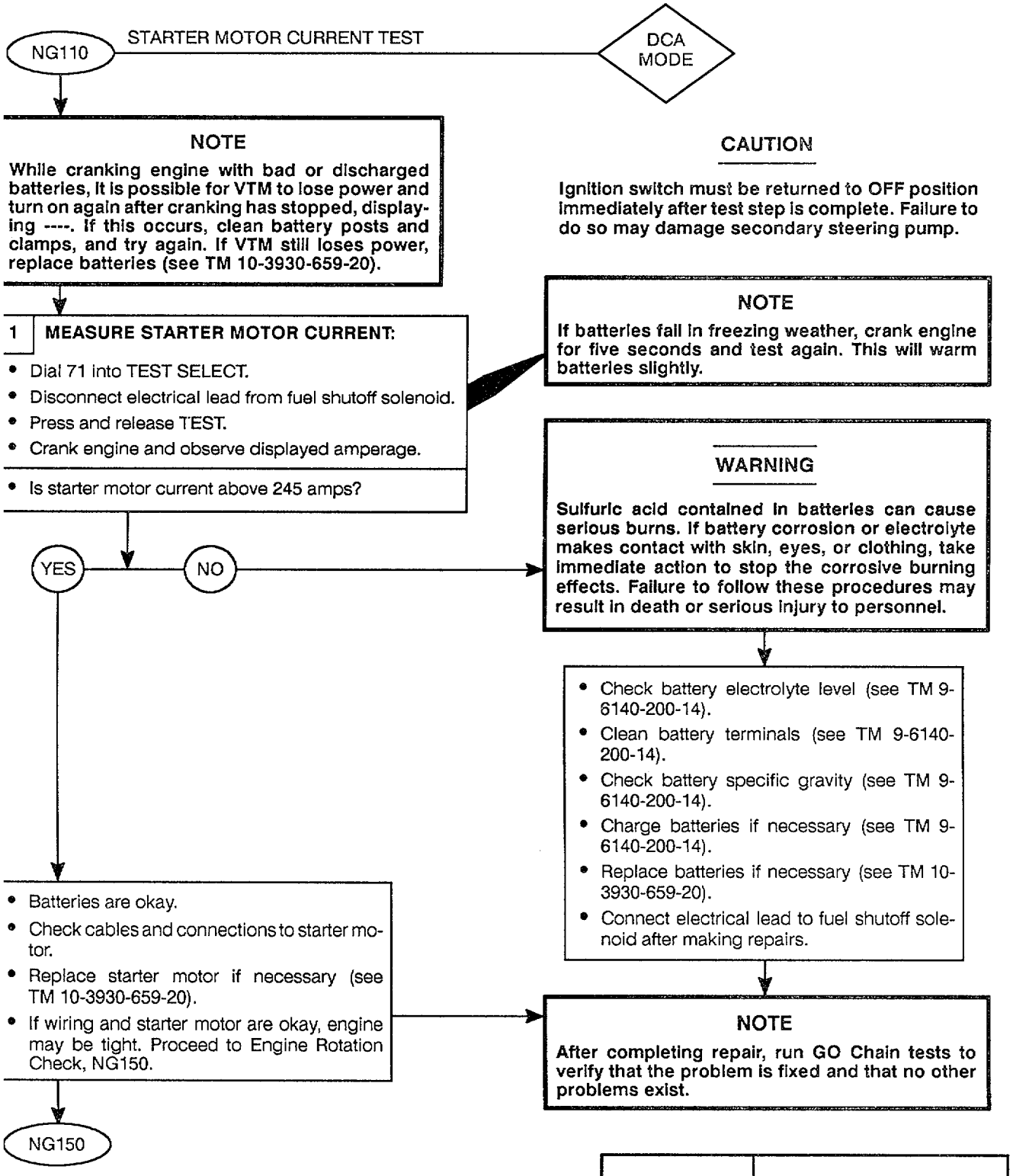
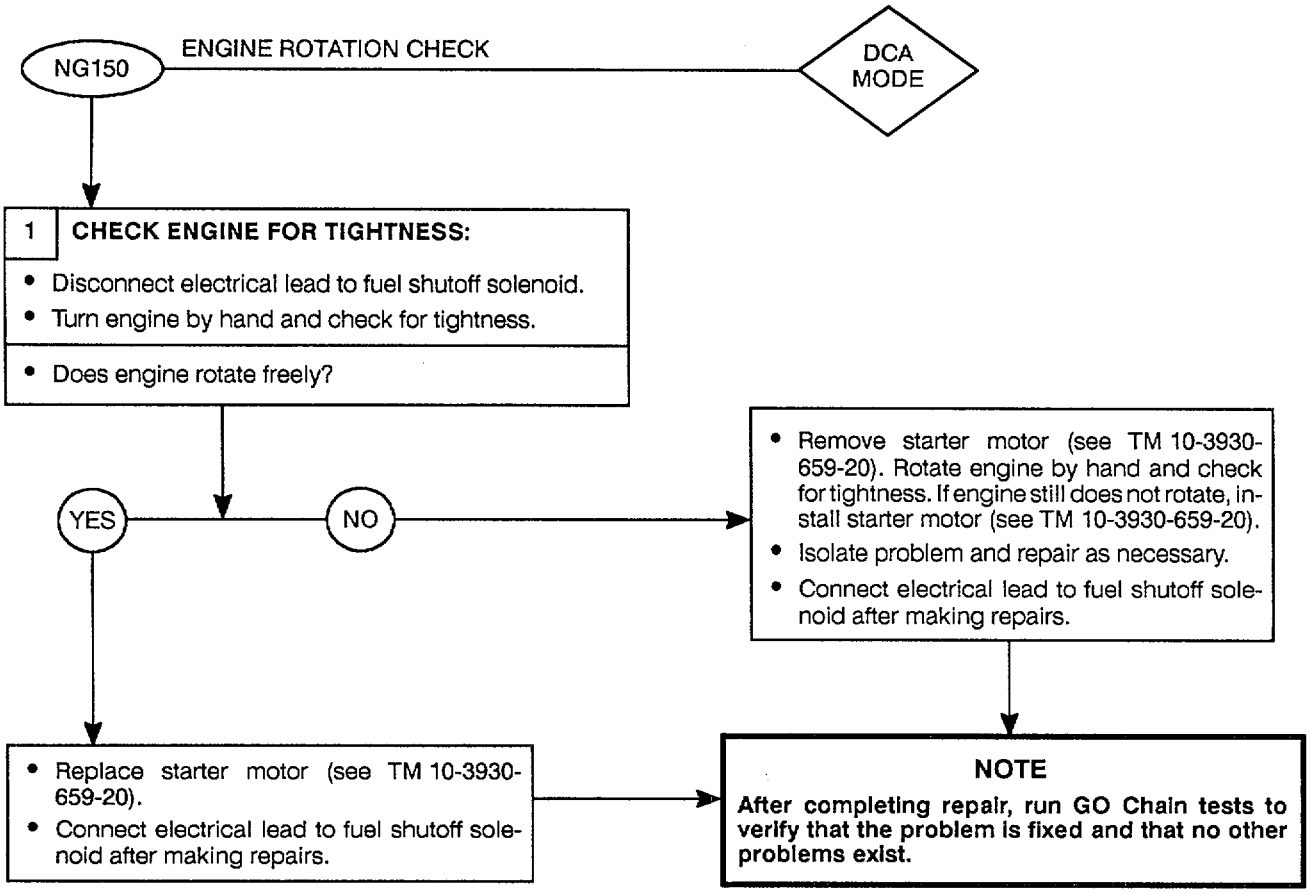


Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).



Test Number	Test
71	Starter Motor Current (average)

Table 3-4. STE/ICE-R NO-GO Chain Tests - DCA Mode (Con't).

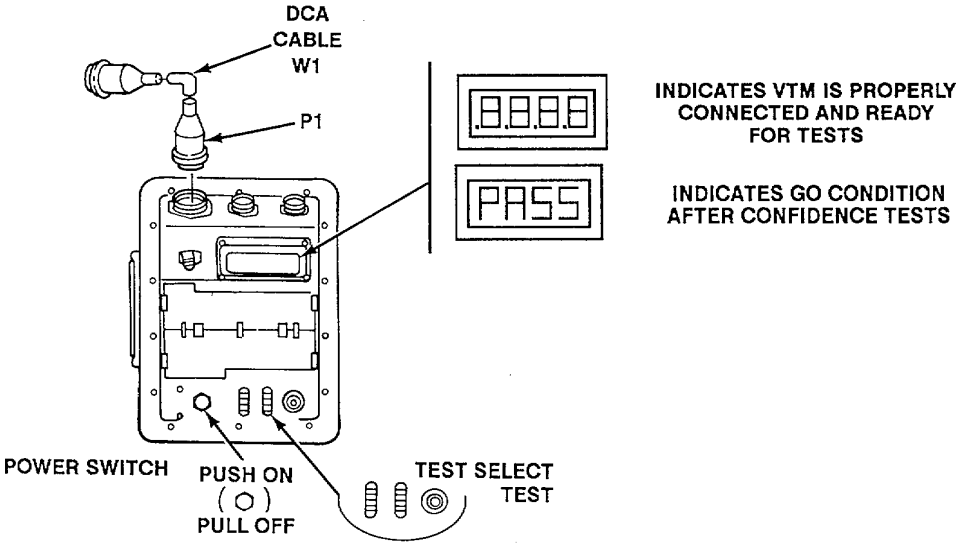


3-10. STE/ICE-R GO CHAIN TESTS - TK MODE.

a. The following GO Chain Tests are made using the Transducer Kit (TK). All tests must be performed sequentially.

b. For normal readings, refer to the M544E Forklift Truck Test Card at Table 3-2. For TK test locations, refer to paragraph 3-6.

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode.



NOTE

Perform all GO steps until a NO-GO condition exists, then perform the NO-GO step indicated.

GO7 — VTM CONNECTIONS AND CHECKOUT — DCA MODE

CAUTION

- **DO NOT connect or disconnect VTM while forklift truck is running.**
- **Connect DCA cable to VTM before connecting DCA cable to diagnostic connector.**

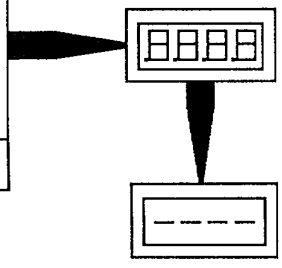
1 CONNECT VTM TO FORKLIFT TRUCK DIAGNOSTIC CONNECTOR:

- Pull OFF VTM power switch.
- Connect DCA cable to VTM.
- Connect DCA cable to forklift truck's DCA.
- Push ON VTM power switch.
- Verify that display indicates .8.8.8.8 for approximately two seconds and then changes to ----.

- Does VTM display .8.8.8.8 and then change to ----?

NO → • Proceed to next page.

YES → • Proceed to step 3. → 3



AFTER 2 SECONDS

TA708440

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).

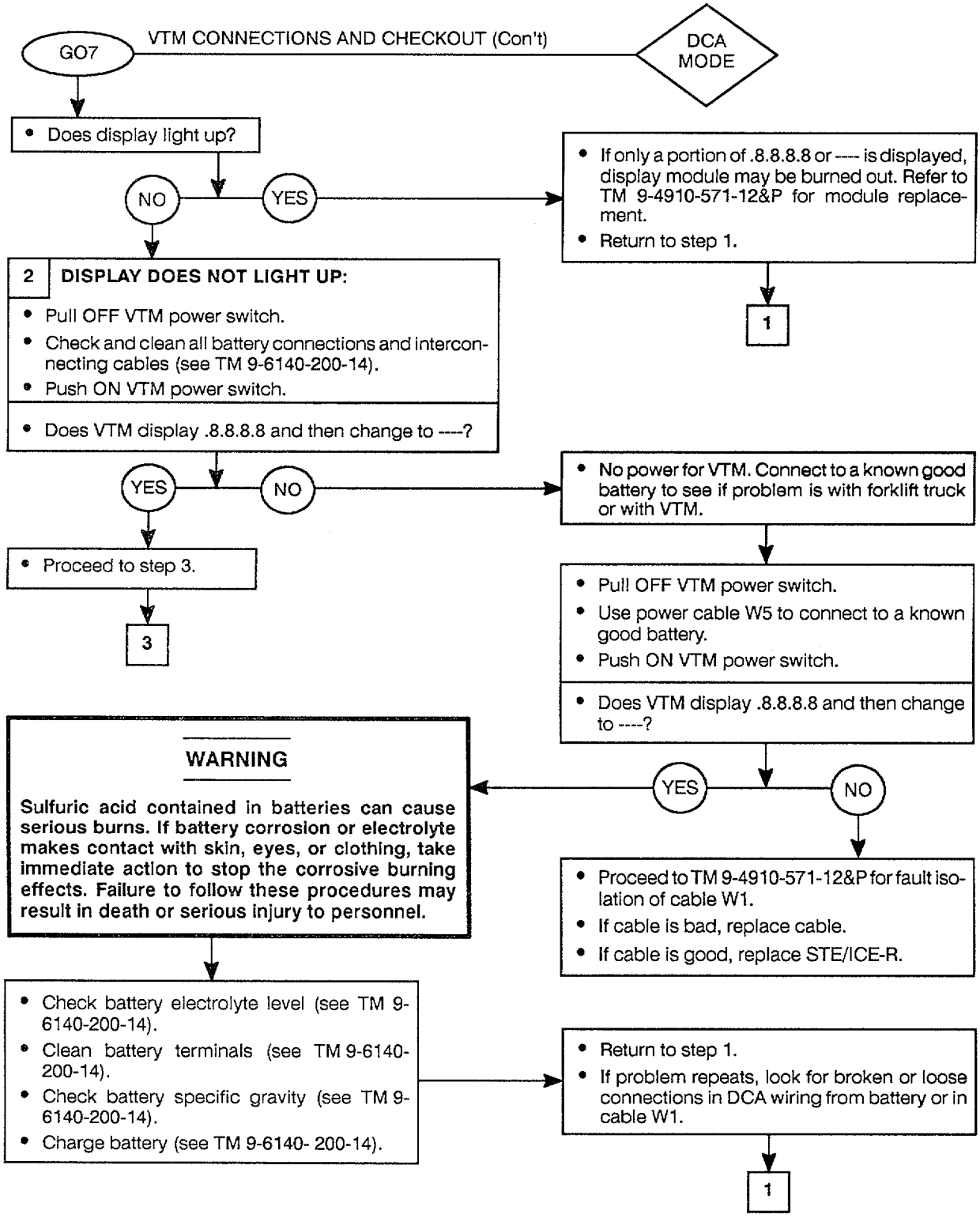
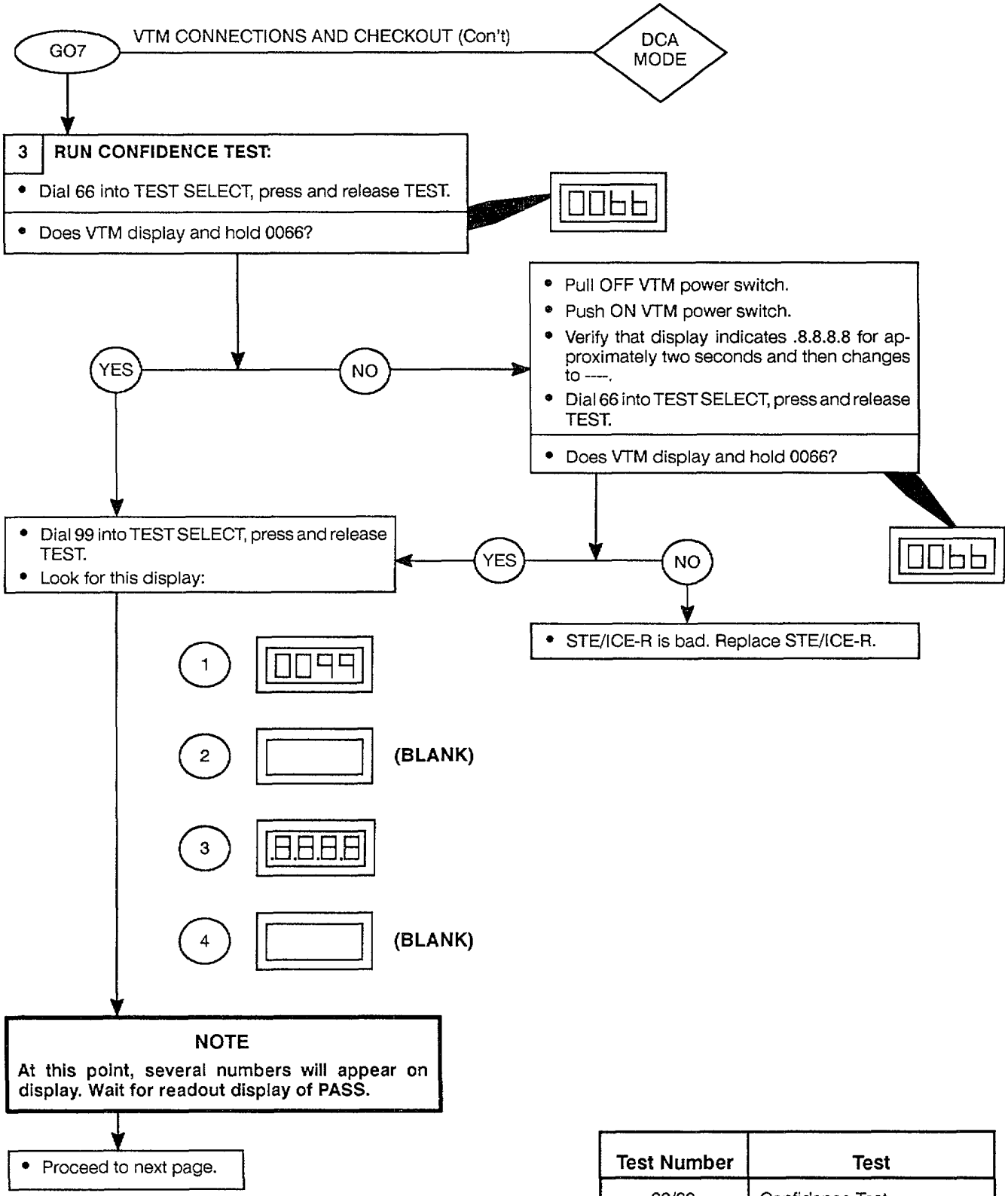
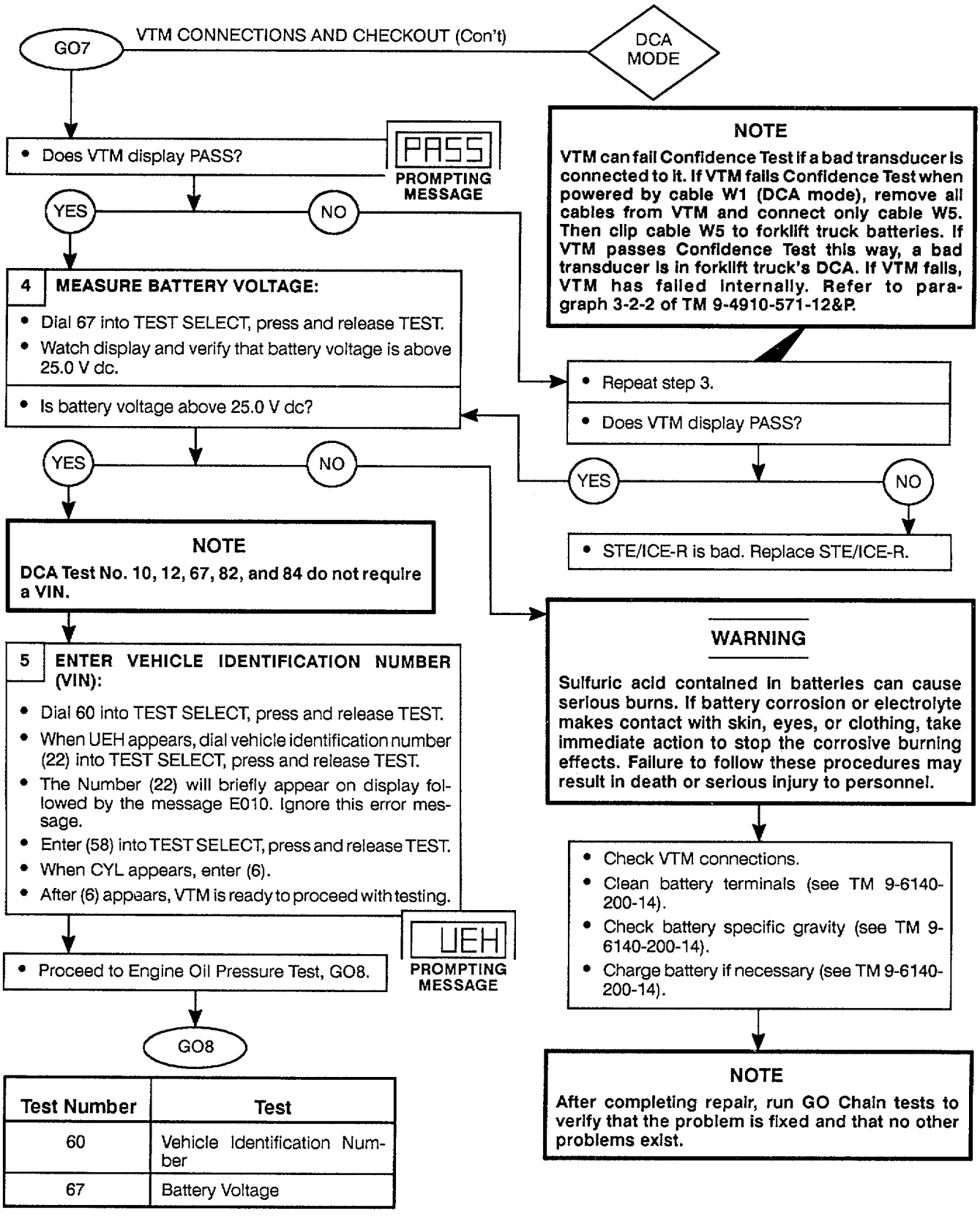


Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



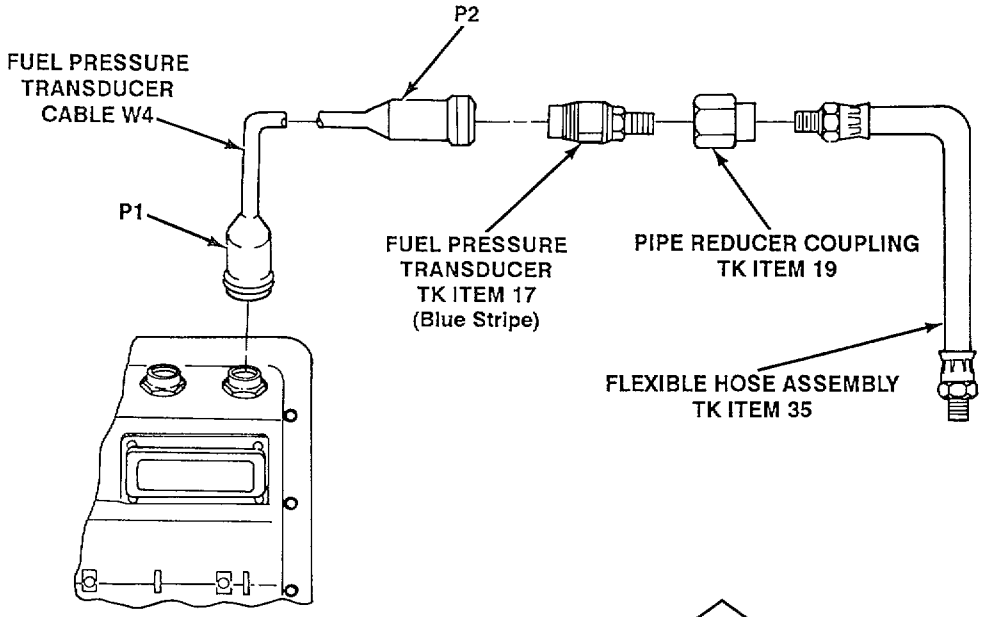
Test Number	Test
66/99	Confidence Test

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



Test Number	Test
60	Vehicle Identification Number
67	Battery Voltage

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



GO8 — ENGINE OIL PRESSURE TEST — TK MODE

1 INSTALL FUEL PRESSURE TRANSDUCER, PERFORM OFFSET TEST:

- Remove engine oil sampling valve (see TM 10-3930-659-20).
- Install flexible hose assembly (TK Item 35) in tee.
- Install pipe reducer coupling (TK Item 19) on flexible hose assembly.
- Install fuel pressure transducer (TK Item 17, blue stripe) to pipe reducer coupling.
- Connect P1 of fuel pressure transducer cable W4 to J1 or J2 on VTM.
- Connect P2 of fuel pressure transducer cable W4 to connector on fuel pressure transducer (TK Item 17, blue stripe).

- Dial 50 into TEST SELECT.
- Press and hold TEST until CAL message appears on display.
- Release TEST.
- Wait for offset value to appear on display.

CAL — PROMPTING MESSAGE

- Is offset value within limits of -150 to +150?

Test Number	Test
50	0-1000 psig Pressure

NO

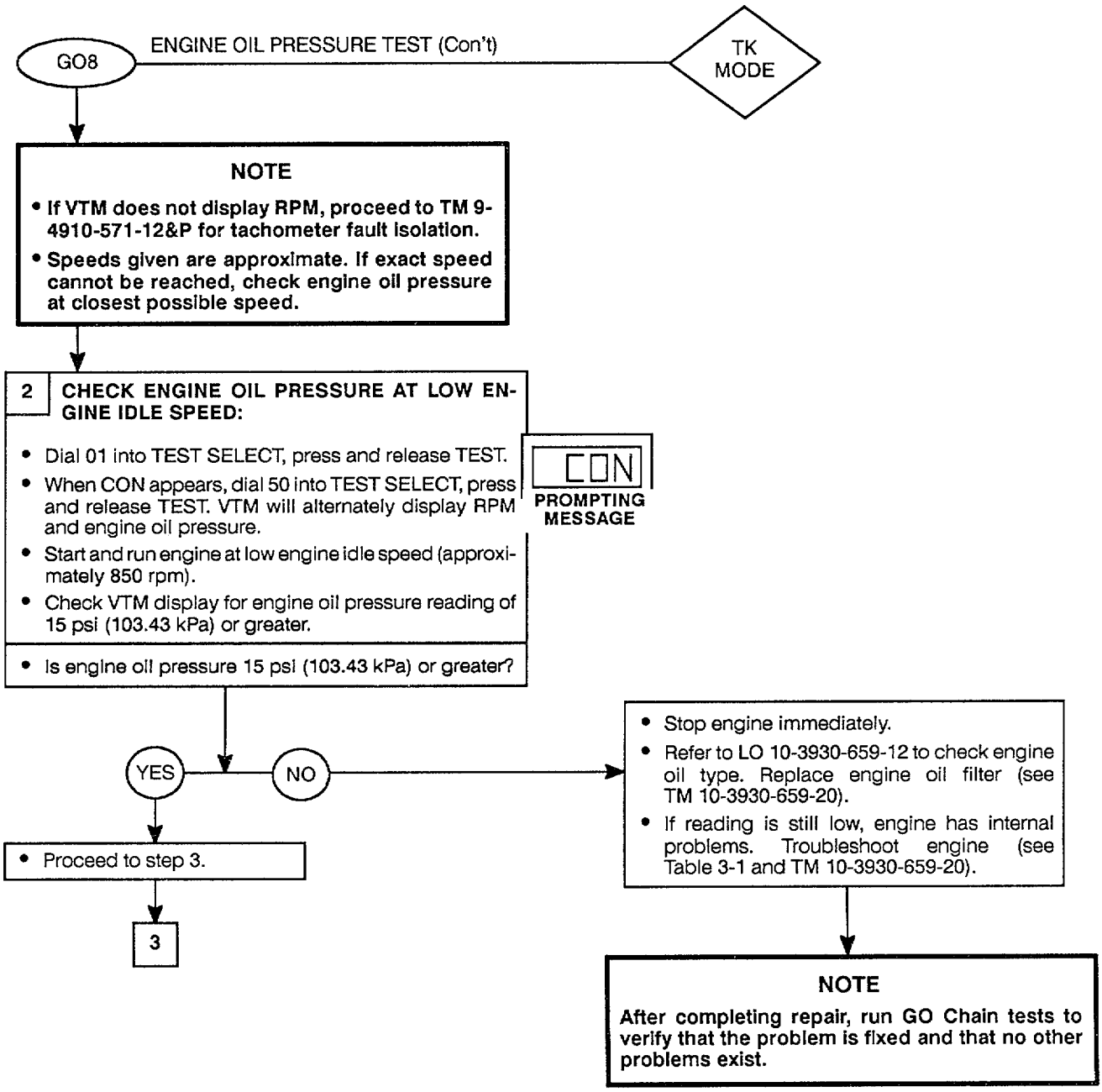
- Proceed to TM 9-4910-571-12&P for offset fault isolation.

YES

- Proceed to step 2. → 2

TA708441

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



Test Number	Test
01	Interleave
50	0-1000 psig Pressure

Table 3-5. STE/ICE-R GO Chain Tests - TK **Mode (Con't).**

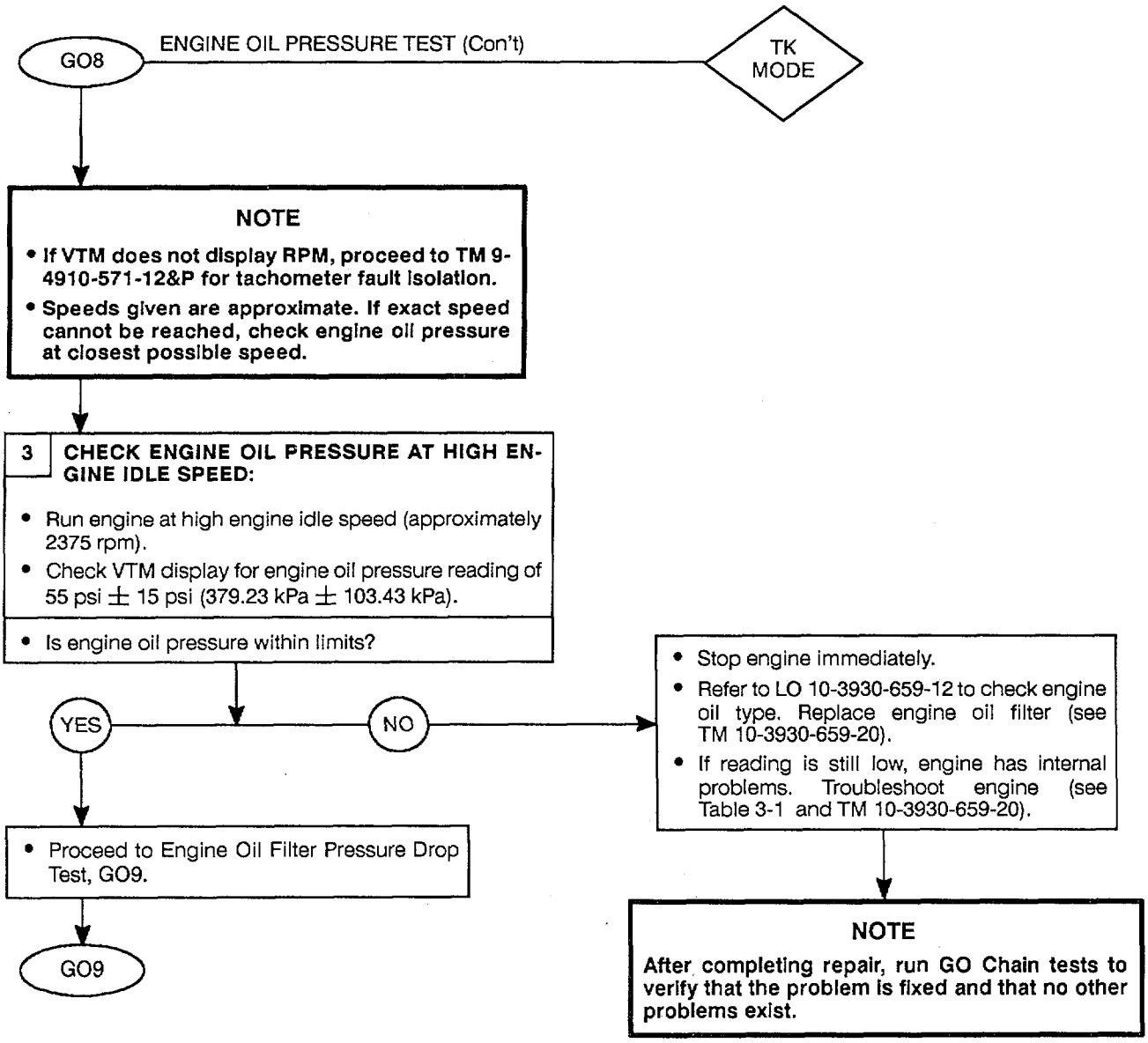
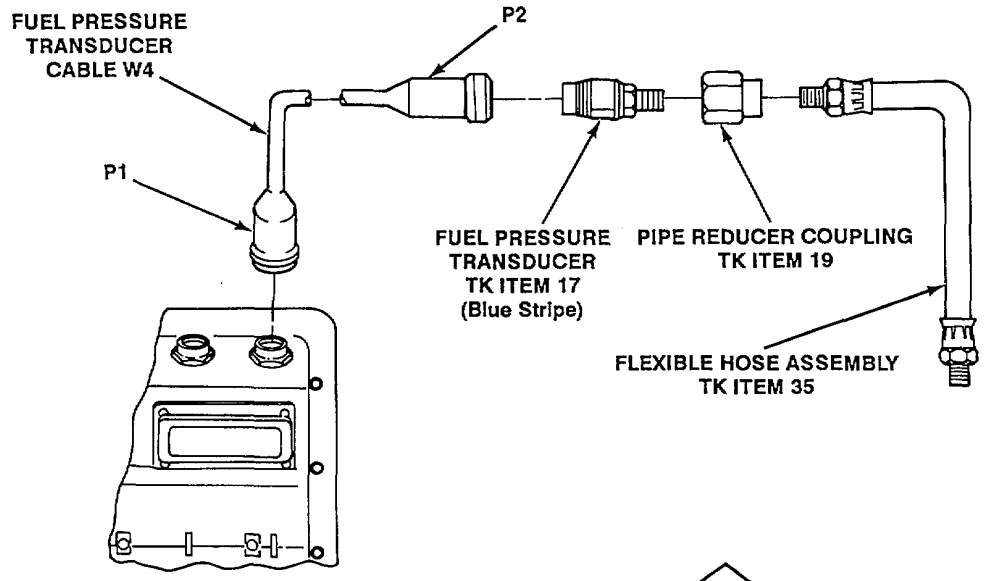


Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



GO9 — ENGINE OIL FILTER PRESSURE DROP TEST — TK MODE

1 INSTALL FUEL TRANSDUCER, PERFORM OFFSET TEST:

- Stop engine.
- Remove plug from engine oil filter base.
- Install flexible hose assembly (TK Item 35) to engine oil filter base.
- Install pipe reducer couping (TK Item 19) to flexible hose assembly.
- Install fuel pressure transducer (TK Item 17, blue stripe) to pipe reducer coupling.
- Connect P1 of fuel pressure transducer cable W4 to J1 or J2 on VTM.
- Connect P2 of fuel pressure transducer cable W4 to connector on fuel pressure transducer (TK Item 17, blue stripe).

- Dial 50 into TEST SELECT.
- Press and hold TEST until CAL message appears on display.
- Release TEST.
- Wait for offset value to appear on display.

CAL
PROMPTING MESSAGE

- Is offset value within limits of -150 to +150?

NO → • Proceed to TM 9-4910-571-12&P for offset fault isolation.

YES → • Proceed to step 2. → 2

Test Number	Test
50	0-1000 psig Pressure

TA708442

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).

GO9 — ENGINE OIL FILTER PRESSURE DROP TEST (Con't) — TK MODE

NOTE

- **If VTM does not display RPM, proceed to TM 9-4910-571-12&P for tachometer fault isolation.**
- **Speeds given are approximate. If exact speed cannot be reached, check engine oil pressure at closest possible speed.**

2 CHECK ENGINE OIL FILTER PRESSURE DROP:

- Dial 01 into TEST SELECT, press and release TEST.
- When CON appears, dial 50 into TEST SELECT, press and release TEST. VTM will alternately display RPM and engine oil pressure.
- Start and run engine at high engine idle speed (approximately 2375 rpm).
- Record pressure reading.
- Stop engine.
- Remove fuel pressure transducer and install ⅛ in. (3.18 mm) pipe plug.
- Remove engine oil sampling valve (see TM 10-3930-659-20).
- Install fuel pressure transducer.
- Run engine at high engine idle speed (approximately 2375 rpm).
- Record second pressure reading.

PROMPTING MESSAGE

- Is first pressure reading more than 10 psi (68.95 kPa) higher than second pressure reading?

YES — Replace engine oil filter (see TM 10-3930-659-20).

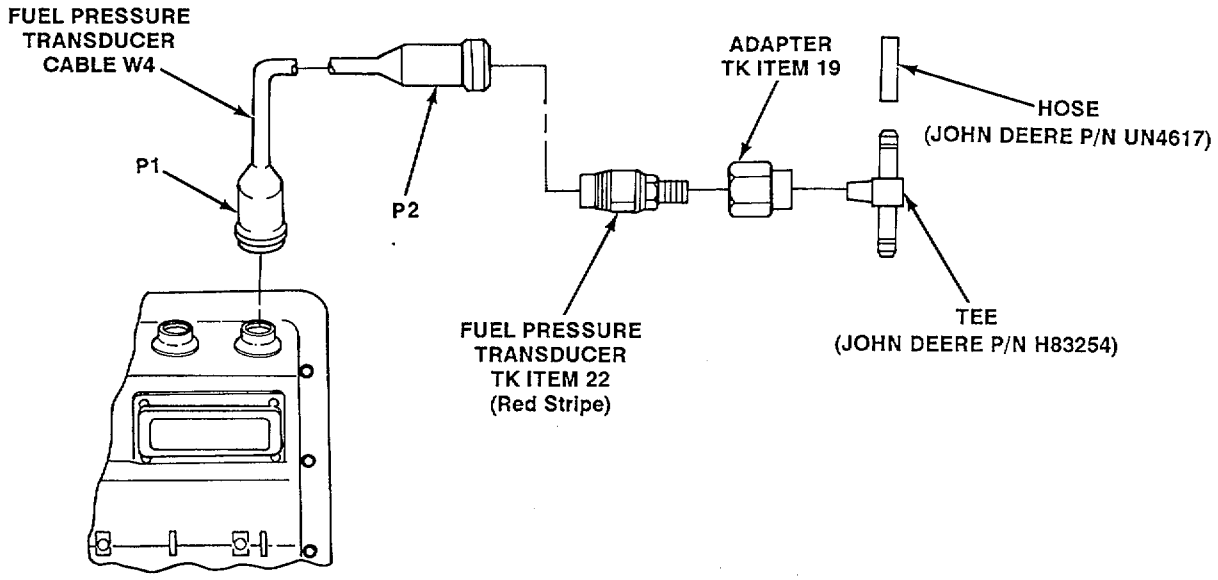
NO — Proceed to Engine Fuel Return Pressure Test, GO10. → GO10

NOTE

After completing repair, run GO Chain tests to verify that the problem is fixed and that no other problems exist.

Test Number	Test
01	Interleave
50	0-1000 psig Pressure

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



GO10 — ENGINE FUEL RETURN PRESSURE TEST — TK MODE

1 INSTALL FUEL PRESSURE TRANSDUCER, PERFORM OFFSET TEST:

- Remove fuel injection pump-to-fuel tank fuel line (see TM 10-3930-659-20).
- Install special tee (John Deere P/N H83254) and special hose (John Deere P/N UN4617) between fuel injection pump and fuel injection pump-to-fuel tank fuel line.
- Install adapter (TK Item 19) to special tee.
- Install fuel pressure transducer (TK Item 22, red stripe) to adapter.
- Connect P1 of fuel pressure transducer cable W4 to J1 or J2 of VTM.
- Connect P2 of fuel pressure transducer cable W4 to fuel pressure transducer (TK Item 22, red stripe).

- Dial 50 into TEST SELECT.
- Press and hold TEST until CAL message appears on display.
- Release TEST.
- Wait for offset value to appear on display.

CAL — PROMPTING MESSAGE

- Is offset value within limits of -150 to +150?

NO — YES

- Proceed to TM 9-4910-571-12&P for offset fault isolation.

- Proceed to step 2. → 2

NOTE

Special tee (John Deere P/N H83254) and special hose (John Deere P/N UN4617) are stored in toolbox under operator's seat.

Test Number	Test
50	0-1000 psig Pressure

TA708443

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).

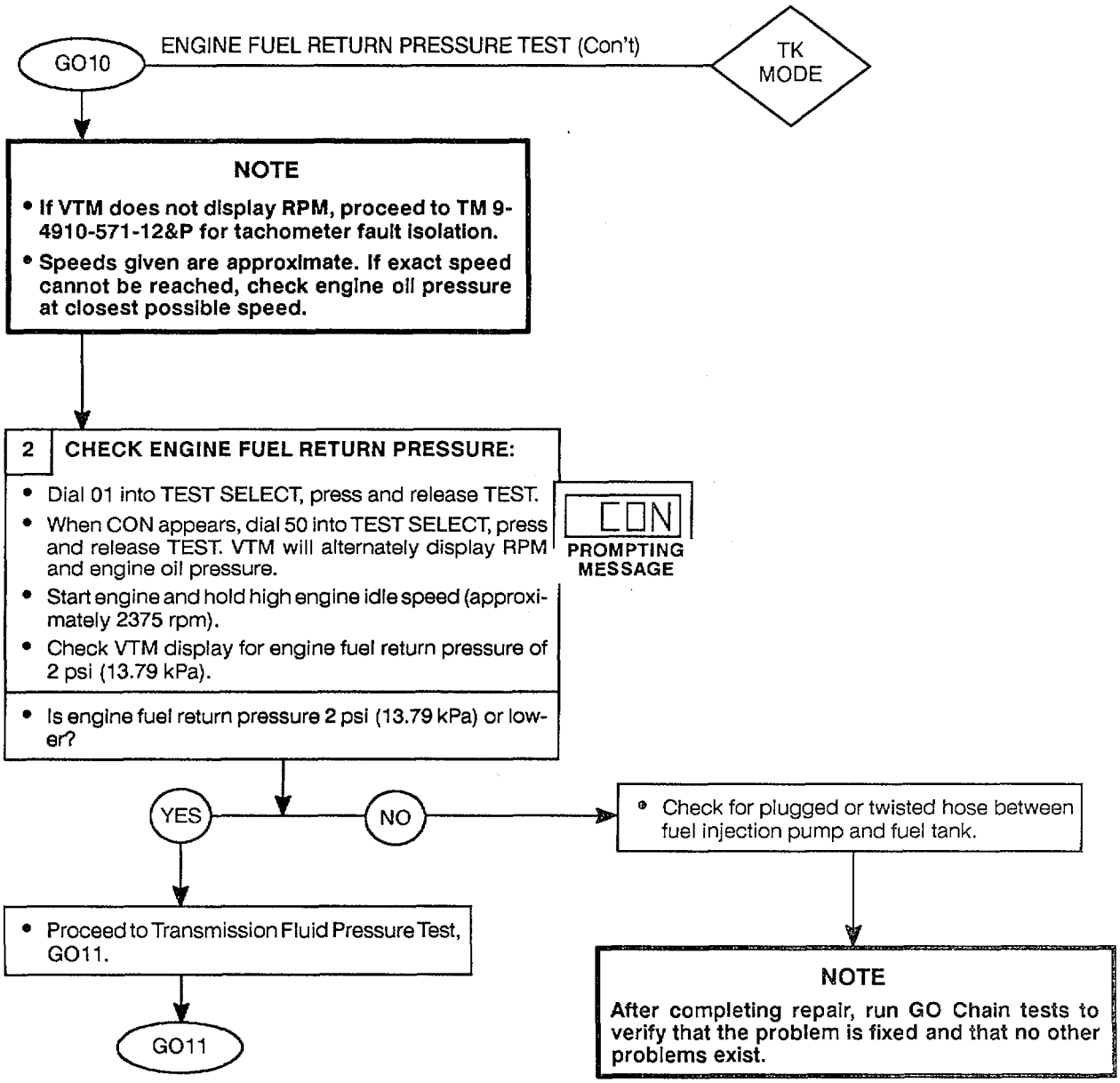
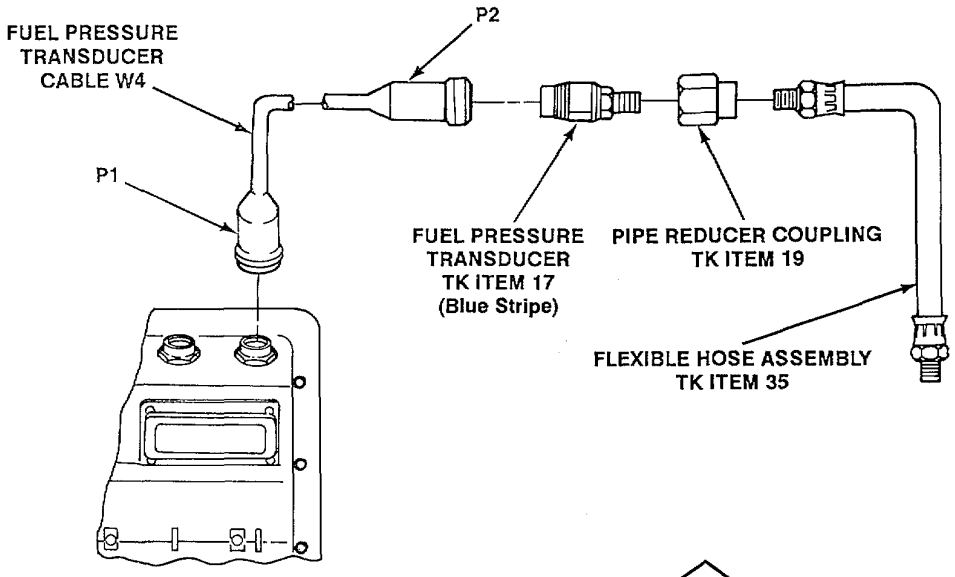


Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



GO11 — TRANSMISSION FLUID PRESSURE TEST — TK MODE

1 INSTALL FUEL PRESSURE TRANSDUCER, PERFORM OFFSET TEST:

- Stop engine.
- Remove right transmission side guard (see TM 10-3930-659-20).
- Remove transmission fluid pressure switch from transmission control valve (see TM 10-3930-659-20).
- Install flexible hose assembly (TK Item 35) to transmission control valve.
- Install pipe reducer coupling (TK Item 19) to flexible hose assembly.
- Install fuel pressure transducer (TK Item 17, blue stripe) to pipe reducer coupling.
- Connect P1 of fuel pressure transducer cable W4 to J1 or J2 on fuel VTM.
- Connect P2 of fuel pressure transducer cable W4 to fuel pressure transducer (TK Item 17, blue stripe).

- Dial 50 into TEST SELECT.
- Press and hold TEST until CAL message appears on display.
- Release TEST.
- Wait for offset value to appear on display.

PROMPTING MESSAGE

- Is offset value within limits of -150 to +150?

NO — Proceed to TM 9-4910-571-12&P for offset fault isolation.

YES — Proceed to step 2. → 2

Test Number	Test
50	0-1000 psig Pressure

TA708444

Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).

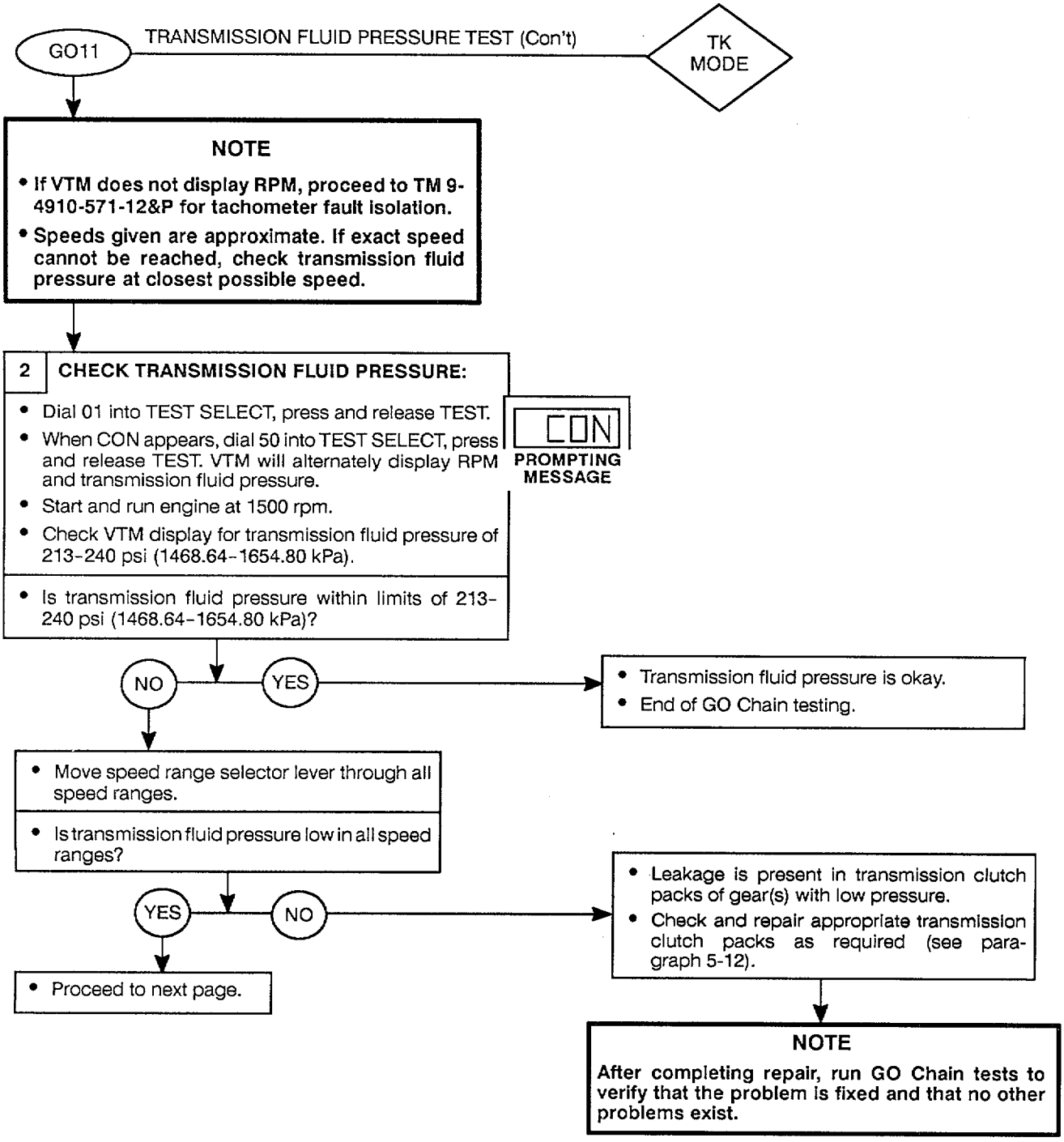
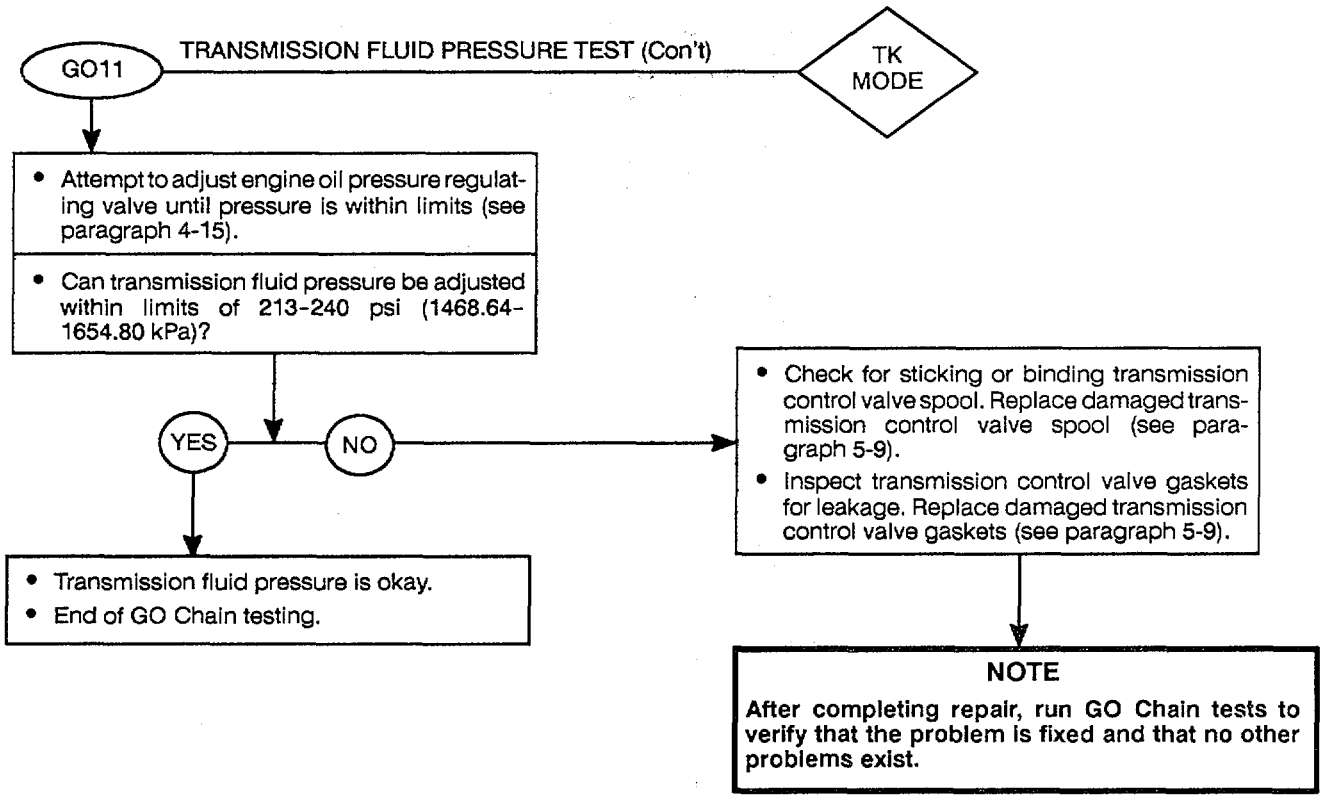


Table 3-5. STE/ICE-R GO Chain Tests - TK Mode (Con't).



CHAPTER 4
DIRECT SUPPORT MAINTENANCE

Section I. ENGINE ASSEMBLY MAINTENANCE

4-1. ENGINE ASSEMBLY COMPRESSION TEST.

This Task Covers: Compression Test

Initial Setup:

Equipment Conditions:
- Parking brake set (see TM 10-3930-659-10),
- Engine warmed to operating temperature (see TM 10-3930-659-10).
- Conveyorized fork attachments removed from side of forklift truck (see TM 10-3930-659-20).
- Right and left engine upper sideshields opened (see TM 10-3930-659-10).
- Direction selector lever in N (Neutral) position (see TM 10-3930-659-10).

Tools/Test Equipment:
- General mechanic's tool kit (item 71, Appendix E)
- Hand oiler (Item 45, Appendix E)
- Cylinder compression tester (Item 66, Appendix E)

Materials/Parts:
- Lubricating oil (Item 37, Appendix B)

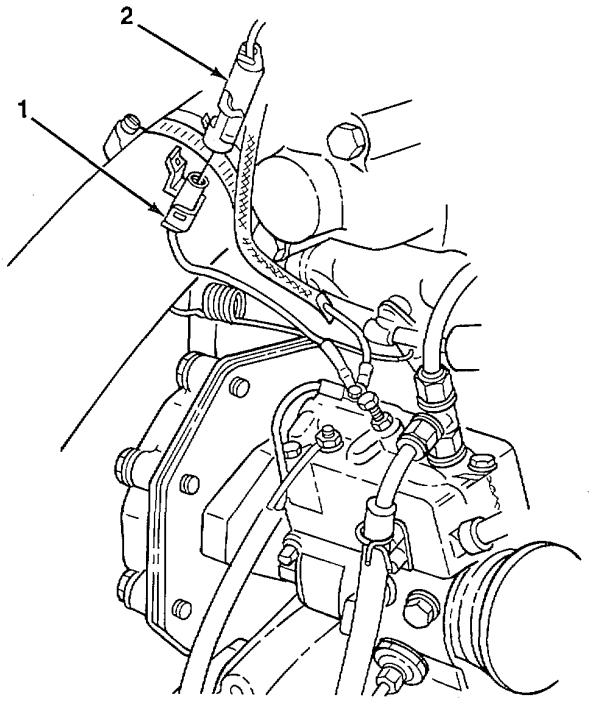
Personnel Required: Two

References
- TM 10-3930-659-10
- TM 10-3930-659-20

COMPRESSION TEST

1. Remove connector (2) from fuel injection pump connector (1).

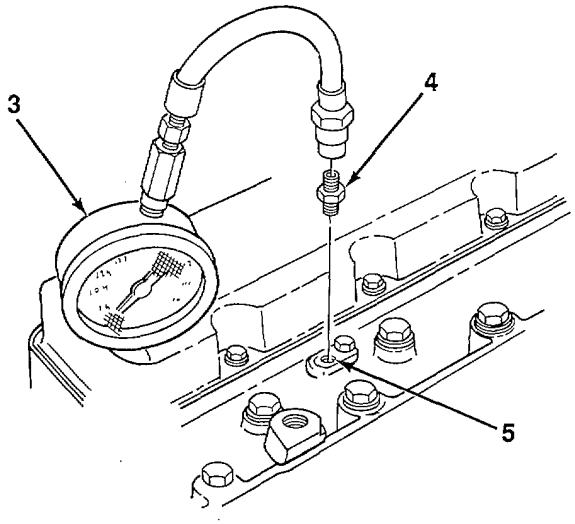
2. Remove fuel injection nozzles (see paragraph 4-23).



TA708055

4-1. ENGINE ASSEMBLY COMPRESSION TEST (Con't).

3. Install adapter (4) and cylinder compression tester (3) in fuel injection nozzle bore (5).



WARNING

Stay clear of rotating fan blades when cranking engine. Failure to follow this warning may result in serious injury to personnel.

CAUTION

DO NOT operate starter motor for more than 20 seconds at a time. Allow two minutes for cooling before using starter motor again or starter motor may overheat.

4. Using ignition switch, crank engine assembly with starter motor for four revolutions of engine and note compression reading on cylinder compression tester (3).

5. Remove cylinder compression tester (3) and adapter (4) from fuel injection nozzle bore (5).

6. Repeat steps 3 through 5 for remaining fuel injection nozzle bores (5). Compression readings must be greater than 350 psi (2413 kPa) and difference between highest and lowest compression readings must be less than 50 psi (344 kPa). If compression readings are within specification, proceed to step 9.

7. Using hand oiler, apply four squirts of lubricating oil on piston rings on cylinder being tested through fuel injection nozzle bore (5).

8. Repeat steps 3 through 5. If compression reading is below specification, worn or sticking valves or head gasket are indicated. If compression reading is higher than previous compression reading, worn or sticking piston rings are indicated.

9. Install fuel injection nozzles (see paragraph 4-23).

10. Connect fuel injection pump connector (1) to connector (2).

FOLLOW-ON TASKS:

- Close right and left engine upper sideshields (see TM 10-3930-659-10).
- Install conveyorized fork attachments on side of forklift truck (see TM 10-3930-659-20).

TA708056

4-2. CYLINDER HEAD VALVE LIFT CHECK.

This Task Covers: Lift Check

Initial Setup:

Equipment Conditions:

- Battery disconnect switch in OFF position (see TM 10-3930-659-10).
- Engine rocker arm cover removed (see TM 10-3930-659-20).
- Cylinder head valves adjusted (see TM 10-3930-659-20).

Personnel Required: Two

Tools/Test Equipment:

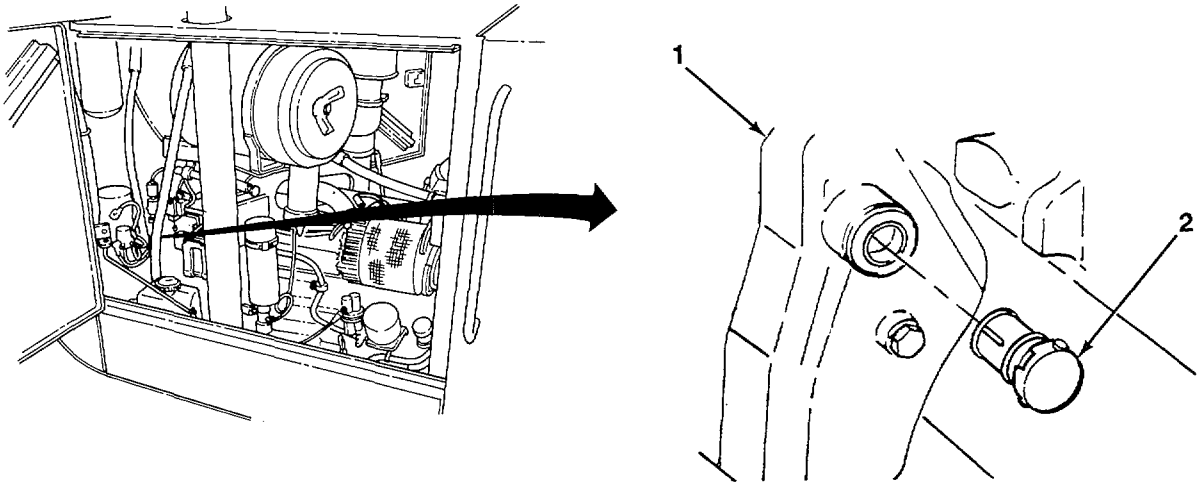
- General mechanic's tool kit (Item 71, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Flywheel turning tool (Item 25, Appendix E)

References:

- TM 10-3930-659-10
- TM 10-3930-659-20

LIFT CHECK

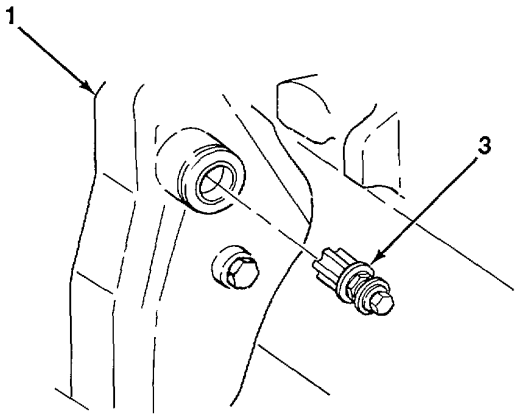
1. Remove plug (2) from engine (1).



TA708057

4-2. CYLINDER HEAD VALVE LIFT CHECK (Con't).

2. Install flywheel turning tool (3) on engine (1).



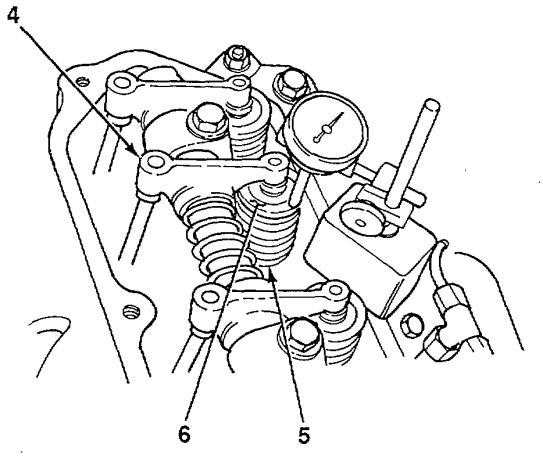
NOTE

Cylinder head valve lift is checked the same way for all cylinder head valves. One cylinder head valve is illustrated.

3. Using flywheel turning tool (3), rotate flywheel until there is clearance between engine rocker arm (4) and cylinder head valve (5).

4. Install dial indicator on cylinder head valve (5) with stylus against cylinder head valve rotator (6). Zero dial indicator.

5. Using flywheel turning tool (3), rotate flywheel and note reading on dial indicator when clearance between engine rocker arm (4) and cylinder head valve (5) is fully opened. Intake cylinder head valve lift measurement must be 0.4600.490 in. (11.68412.446 mm) and exhaust cylinder head valve lift measurement must be 0.4560.482 in. (11.58212.243 mm). If measurements are not within specification, inspect cylinder head valves (see paragraph 4-6), engine rocker arm assembly and pushrods (see paragraph 4-12), and tappets (see paragraph 4-13).



6. Remove dial indicator from cylinder head valve (5).

7. Repeat steps 4 through 6 for remaining cylinder head valves.

8. Remove flywheel turning tool (3) from engine (1).

9. Install plug (2) on engine (1).

TA708058

FOLLOW-ON TASKS:

- Install engine rocker arm cover (see TM 10-3930-659-20) 4-5

TA708058

4-3. ENGINE ASSEMBLY REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Equipment Conditions:

- Parking brake set (see TM 10-3930-659-10).
- Battery disconnect switch in OFF position (see TM 10-3930-659-1 0).
- Engine oil drained (see LO 10-3930-659-12).
- Right and left engine upper sideshields removed (see TM 10-3930-659-20).
- Right and left engine lower sideshields removed (see TM 10-3930-659-20).
- Engine hood removed (see TM 10-3930-659-20).
- Engine oil drain tube removed (see paragraph 4-17).
- On-board crane support mast removed (see TM 10-3930-659-20).
- Fan removed (see TM 10-3930-659-20).
- Air cleaner removed (see TM 10-3930-659-20). Engine starting aid line and fittings removed (see TM 10-3930-659-20).
- Engine starting aid bracket removed (see TM 10-3930-659-20)
- Window washer assembly removed (see TM 10-3930-659-20).
- Engine radiator removed (see TM 10-3930-659-20).
- Transmission oil cooler removed (see TM 10-3930-659-20).
- Outside cab heater hoses removed (see TM 10-3930-659-20).
- Fuel injection pump-to-fuel tank fuel line and fittings removed (see TM 10-3930-659-20).

Equipment Conditions (Con't):

- Accelerator cable and bracket removed (see TM 10-3930-659-20).
- Starter motor ground cable removed (see TM 10-3930-659-20).
- Engine wiring harness disconnected (see TM 10-3930-659-20)
- Fuel tank-to-fuel transfer pump fuel line and fittings removed (see TM 10-3930-659-20).
- Engine coolant heater and cable removed (see TM 10-3930-659-20).
- Engine oil pan heater, thermostat, and cable removed (see TM 10-3930-659-20).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

Personnel Required: Two

References:

- LO 10-3930-659-12
- TM 10-3930-659-10
- TM 10-3930-659-20

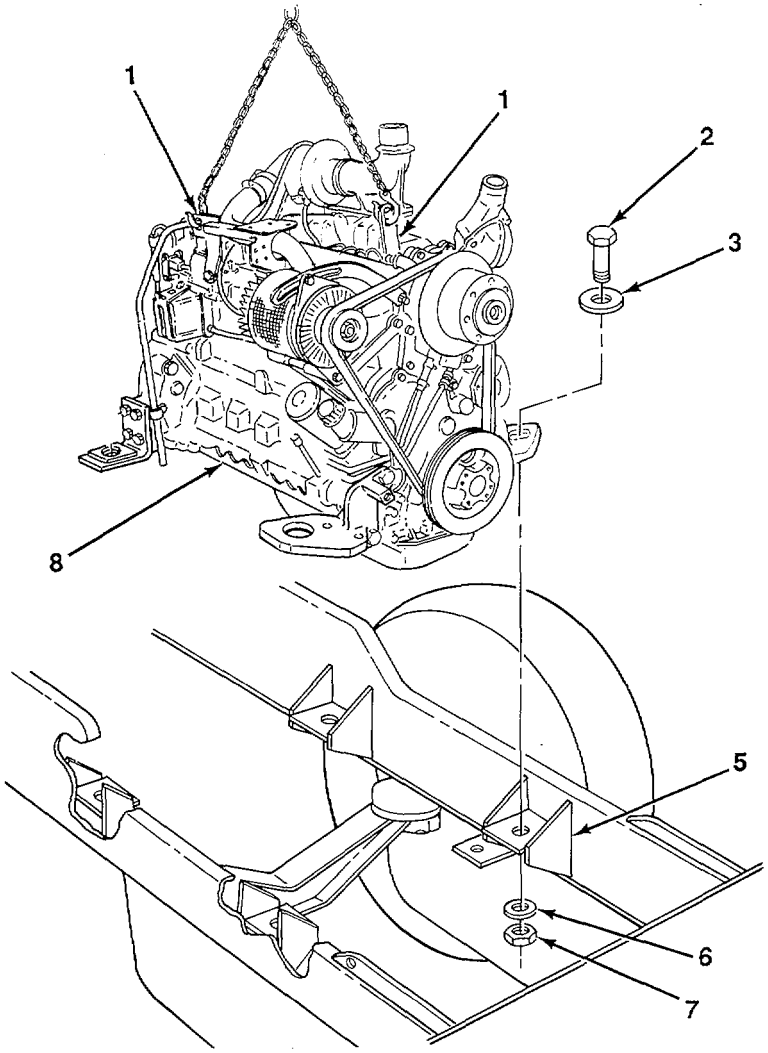
a. REMOVAL

1. Position suitable lifting device over engine assembly (8). Attach lifting sling to two engine lifting brackets (1) and raise lifting device enough to support weight of engine assembly.

2. Disconnect engine-to-transmission universal joint from engine (see paragraph 4-46).

3. Remove four nuts (7), washers (6), screws (2), and washers (3) from frame brackets (5).

4-3. ENGINE ASSEMBLY REPLACEMENT (Con't).



WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

Engine assembly weighs approximately 1525 lb (692 kg).

4. Using suitable lifting device, raise engine assembly (8) and remove from forklift truck.

TA708059

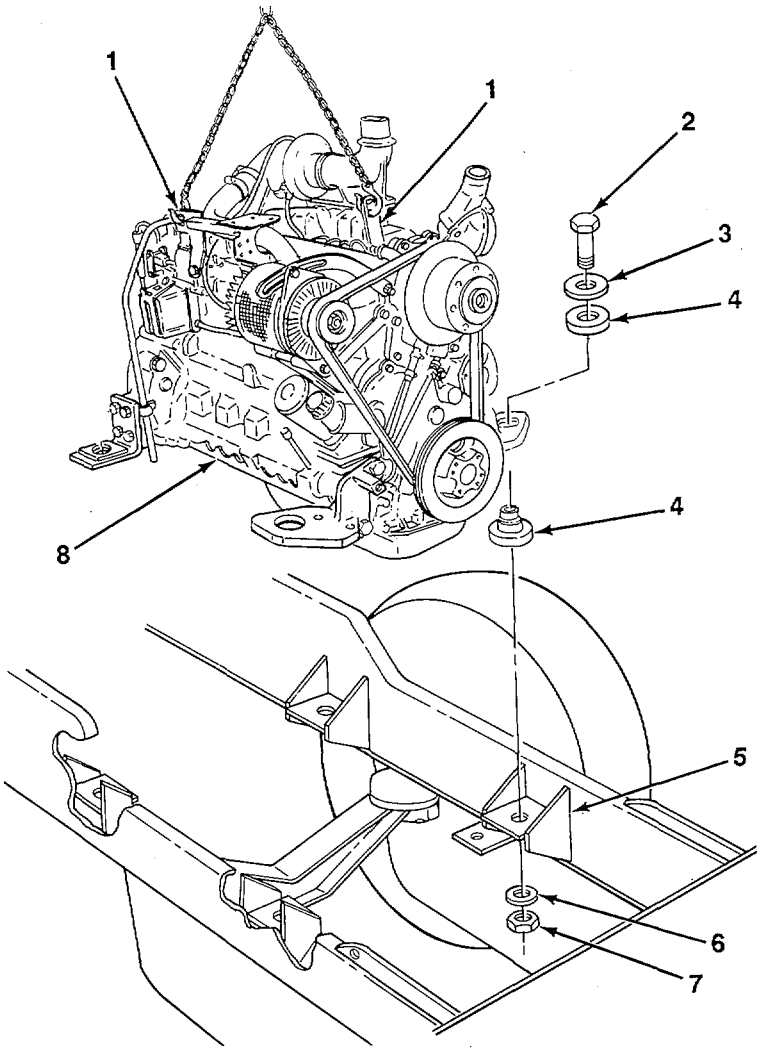
4-3. ENGINE ASSEMBLY REPLACEMENT (Con't).

CAUTION

DO NOT rest engine on engine oil pan. Damage to engine oil pan will result.

5. Remove four resilient mounts (4) from engine assembly (8).

6. Position engine assembly (8) on engine stand or blocks and remove lifting device and sling.



TA708060

4-3. ENGINE ASSEMBLY REPLACEMENT (Con't).

b. INSTALLATION

1. Position suitable lifting device over engine assembly (8). Attach lifting sling to two engine lifting brackets (1) and raise lifting device enough to support weight of engine assembly.

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE
Engine assembly weighs approximately 1525 lb (692 kg).

2. Slowly lift engine assembly (8) from engine stand or blocks, and position engine assembly over forklift truck.

3. Install four resilient mounts (4) on engine assembly (8).

4. Slowly lower engine assembly (8) into forklift truck.

5. Connect engine-to-transmission universal joint to engine (see paragraph 4-46).

6. Install four washers (3), screws (2), washers (6), and nuts (7) on engine assembly (8) and four frame brackets (5).Torque screws to 270 lb.-ft. (366 Nom).

7. Remove suitable lifting device and lifting sling from engine assembly (8).

FOLLOW-ON TASKS:

- Install engine oil pan heater, thermostat, and cable (see TM 10-3930-659-20).
- Install engine coolant heater and cable (see TM 10-3930-659-20).
- Install fuel tank-to-fuel transfer pump fuel line and fittings (see TM 10-3930-659-20).
- Connect engine wiring harness (see TM 10-3930-659-20).
- Install starter motor ground cable (see TM 10-3930-659-20).
- Install accelerator cable and bracket (see TM 10-3930-659-20).
- Install fuel injection pump-to-fuel tank fuel line and fittings (see TM 10-3930-659-20).
- Install engine radiator (see TM 10-3930-659-20).
- Install transmission oil cooler (see TM 10-3930-659-20).
- Fill engine radiator with antifreeze (see TM 10-3930-659-20).
- Install window washer assembly (see TM 10-3930-659-20).
- Install engine starting aid bracket (see TM 10-3930-659-20).
- Install engine starting aid line and fittings (see TM 10-3930-659-20).
- Install air cleaner (see TM 10-3930-659-20).
- Install fan (see TM 10-3930-659-20).
- Install on-board crane support mast (see TM 10-3930-659-20).
- Install right and left engine lower sideshields (see TM 10-3930-659-20).
- Install right and left engine upper sideshields (see TM 10-3930-659-20).
- Install outside cab heater hoses (see TM 10-3930-659-20).
- Install engine hood (see TM 10-3930-659-20).
- Install engine oil drain tube (see paragraph 4-17).
- Fill engine with engine oil (see LO 10-3930-659-12).

4-4. ENGINE MOUNTS REPLACEMENT.

This Task Covers:

a. Front Engine Mounts Replacement b. Rear Engine Mounts Replacement

Initial Setup:

Equipment Conditions:

- Engine hood removed (see TM 10-3930-659-20).

Personnel Required: Two

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

References:

- TM 10-3930-659-20

a. FRONT ENGINE MOUNTS REPLACEMENT

NOTE

Two front engine mounts are replaced the same way. One front engine mount is illustrated.

1. Attach suitable lifting device to engine assembly (5). Attach lifting sling to two engine lifting brackets (4) and raise lifting device enough to support weight of engine assembly.

2. Remove nut (8), washer (9), screw (3), and washer (2) from frame bracket (7).

NOTE

Take up slack on lifting device as necessary to remove engine mounting bracket and resilient mount.

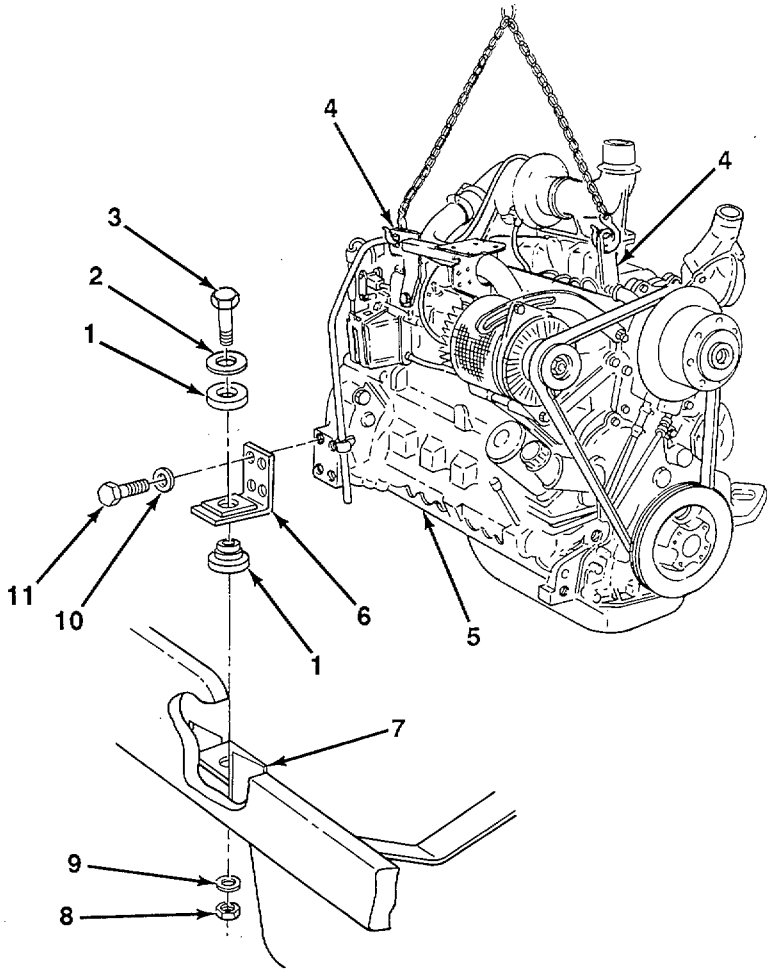
3. Remove four screws (11), washers (10), engine mounting bracket (6), and resilient mount (1) from engine assembly (5) and frame bracket (7).

4. Position resilient mount (1) on engine mounting bracket (6) and install engine mounting bracket on engine assembly (5) with four washers (10) and screws (11). Torque screws to 105 lb.-ft. (142 N•m).

5. Install engine mounting bracket (6), washer (2), screw (3), washer (9), and nut (8) on frame bracket (7). Torque nut to 270 lb.-ft. (366 N•m).

6. Remove suitable lifting device and lifting sling from engine assembly (5).

4-4. ENGINE MOUNTS REPLACEMENT (Con't).



TA708061

4-4. ENGINE MOUNTS REPLACEMENT (Con't).

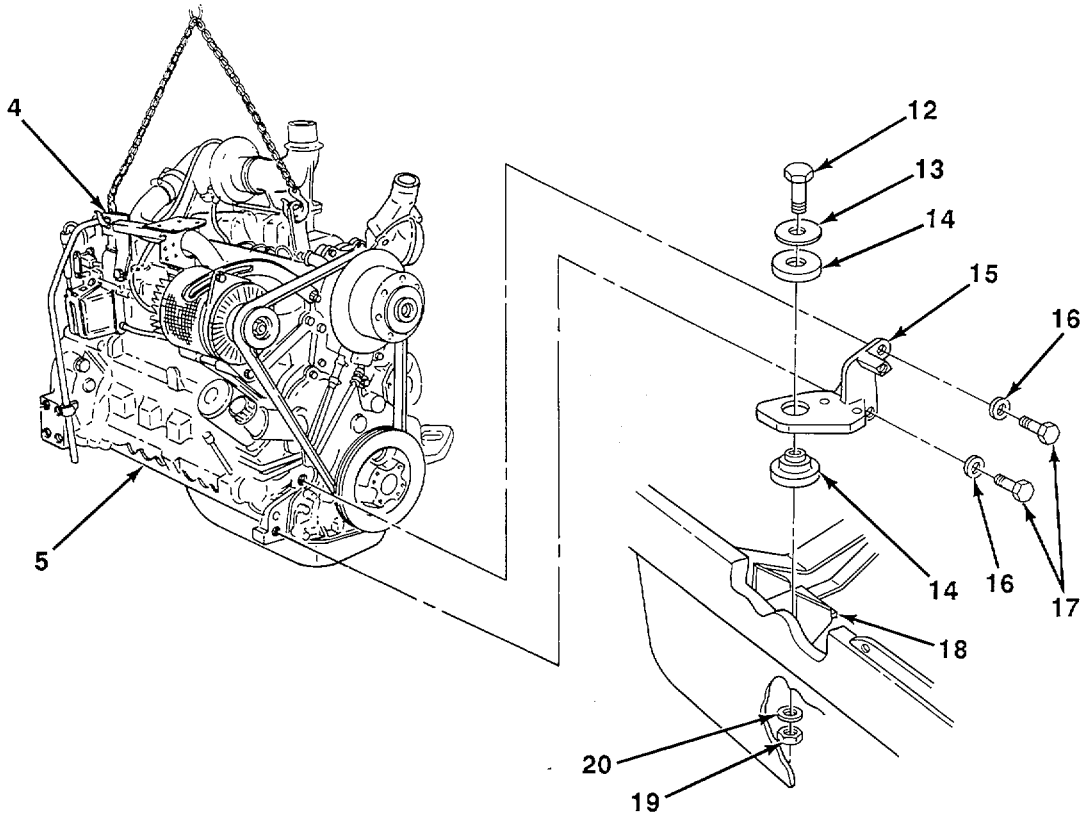
b. REAR ENGINE MOUNTS REPLACEMENT

NOTE

Two rear engine mounts are replaced the same way. One rear engine mount is illustrated.

1. Attach suitable lifting device to engine assembly (5). Attach lifting sling to two engine lifting brackets (4) and raise lifting device enough to support weight of engine assembly.

2. Remove nut (19), washer (20), screw (12), and washer (13) from frame bracket (18).



TA708062

4-4. ENGINE MOUNTS REPLACEMENT (Con't).

NOTE

Take up slack on lifting device as necessary to remove engine mounting plate and resilient mount.

3. Remove two screws (17), washers (16), engine mounting plate (15), and resilient mount (14) from engine assembly (5) and frame bracket (18).

4. Position resilient mount (14) on engine mounting plate (15) and install engine mounting plate on engine assembly (5) with two washers (16) and screws (17). Torque screws to 105 lb.-ft. (142 N•m).

5. Install engine mounting plate (15), washer (13), screw (12), washer (20), and nut (19) on frame bracket (18). Torque nut to 270 lb.-ft. (366 N•m).

6. Remove suitable lifting device and lifting sling from engine assembly (5).

FOLLOW-ON TASKS:

- Install engine hood (see TM 10-3930-659-20).

4-5. CYLINDER HEAD ASSEMBLY REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Engine hood removed (see TM 10-3930-659-20).
- Engine high temperature switch removed (see TM 10-3930-659-20).
- Fuel filter housing and bracket removed (see TM 10-3930-659-20).
- Fuel lines and fittings removed (see TM 10-3930-659-20).
- Engine thermostat housing removed (see TM 10-3930-659-20).
- Engine rocker arm assembly and pushrods removed (see paragraph 4-12).
- Exhaust manifold removed (see paragraph 4-21).
- Fuel injection nozzles removed (see paragraph 4-23).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Soft hammer (Item 34, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Lubricating oil (Item 37, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One gasket

Personnel Required: Two

References
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. REMOVAL

1. Attach suitable lifting device to cylinder head (2) and raise lifting device enough to support weight of cylinder head.

2. Remove 26 screws (1) from cylinder head (2).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

4-5. CYLINDER HEAD ASSEMBLY REPLACEMENT (Con't).

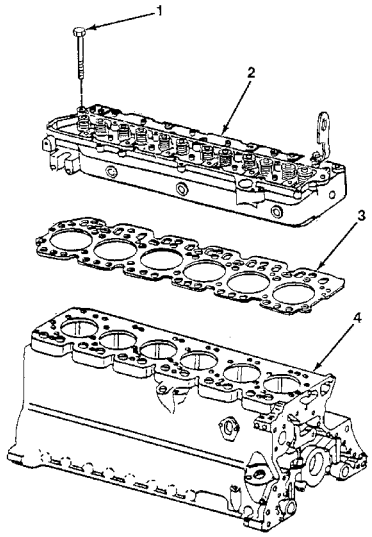
CAUTION

- DO NOT use tools to separate cylinder head from engine block. Cylinder head or engine block may be damaged and leaks may result.
- DO NOT rotate crankshaft with cylinder head removed. Failure to follow this caution may result in damage to parts.

NOTE

Tap cylinder head with soft hammer if cylinder head sticks to engine block.

3. Using suitable lifting device, remove cylinder head (2) from engine block (4).
4. Remove gasket (3) from engine block (4). Discard gasket.
5. Remove suitable lifting device from cylinder head (2).



TA708063

4-5. CYLINDER HEAD ASSEMBLY REPLACEMENT (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean all remaining gasket material from engine block with dry cleaning solvent and dry with clean rags.

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

2. Clean all loose debris from engine block using compressed air.

c. INSTALLATION

1. Attach suitable lifting device to cylinder head (2) and raise lifting device enough to support weight of cylinder head.
2. Position new gasket (3) on engine block (4).

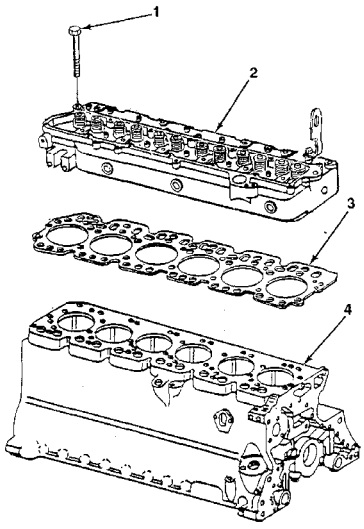
4-5. CYLINDER HEAD ASSEMBLY REPLACEMENT (Con't).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

3. Using suitable lifting device, position cylinder head (2) on engine block (4).

4. Apply lubricating oil to threads of 26 screws (1) and install screws on cylinder head (2).



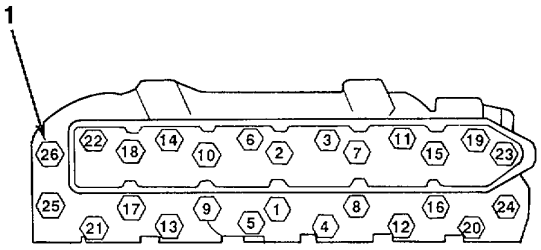
TA708064

4-5. CYLINDER HEAD ASSEMBLY REPLACEMENT (Con't).

NOTE

Perform steps 5 through 7 in sequence as illustrated.

5. Torque 26 screws (1) to 35 lb.-ft. (47 N•m).
6. Torque 26 screws (1) to 65 lb.-ft. (88 N•m).
7. Torque 26 screws (1) to 95 lb.-ft. (129 N•m).



TORQUE SEQUENCE

FOLLOW-ON TASKS:

- Install fuel injection nozzles (see paragraph 4-23).
- Install exhaust manifold (see paragraph 4-21).
- Install engine rocker arm assembly and pushrods (see paragraph 4-12).
- Install engine thermostat housing (see TM 10-3930-659-20).
- Install fuel lines and fittings (see TM 10-3930-659-20).
- Install fuel filter housing and bracket (see TM 10-3930-659-20).
- Install engine high temperature switch (see TM 10-3930-659-20).
- Install engine hood (see TM 10-3930-659-20).

TA708065

4-6. CYLINDER HEAD ASSEMBLY REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Cylinder head assembly removed (see paragraph 4-5).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Inside caliper micrometer (Item 8, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Depth gage micrometer (Item 27, Appendix E)
- Valve face grinding machine (Item 33, Appendix E)
- Valve spring lifter (Item 42, Appendix E)
- Valve seat puller (Item 52, Appendix E)
- Machinist's steel rule (Item 56, Appendix E)
- Spring tester (Item 67, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Wire brush (Item 6, Appendix B)
- Carbon removing compound (Item 10, Appendix B)
- Prussian blue dye (Item 24, Appendix B)
- Lubricating oil (Item 39, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).
- Carbon removing compound can cause serious burns and blindness. Use only with protective clothing.
- Prussian blue dye is poisonous and can cause serious burns and dizziness. Use only in a well-ventilated area.

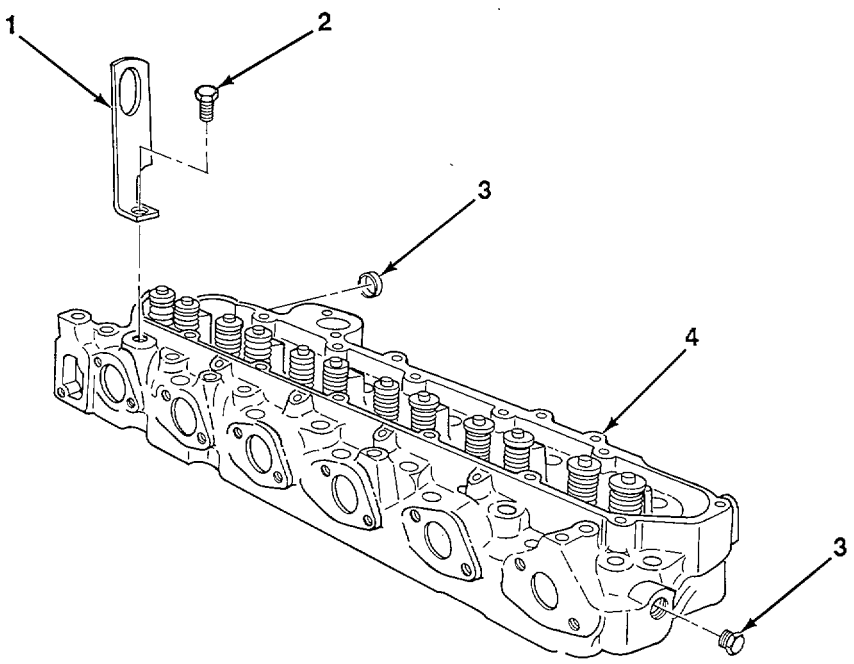
4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

a. DISASSEMBLY

NOTE

Six intake cylinder head valves and six exhaust cylinder head valves are removed the same way. One exhaust cylinder head valve is illustrated.

1. Remove screw (2) and engine lifting bracket (1) from cylinder head (4).
2. If damaged, remove two plugs (3) from cylinder head (4).



TA708066

4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

3. Using valve spring lifter, compress valve spring (6) and remove valve spring retaining lock (8) from cylinder head valve (5).

CAUTION

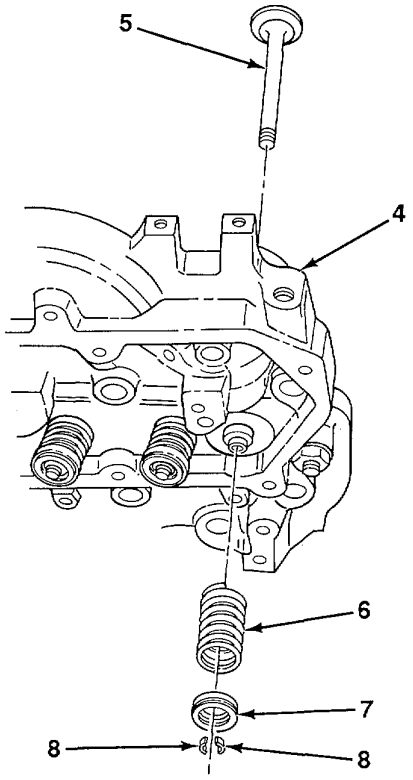
Use care not to nick or scratch surface between cylinder head valve face and stem. A small nick or scratch can cause cylinder head valve to break during operation.

NOTE

Note position of cylinder head valves in cylinder head to aid during installation. Cylinder head valves must be installed in same position to prevent damage to parts.

4. Slowly release tension from valve spring lifter and remove rotator (7), valve spring (6), and cylinder head valve (5) from cylinder head (4).

5. Repeat steps 3 and 4 for remaining cylinder head valves.



b. CLEANING AND INSPECTION

WARNING

- Carbon removing compound is a corrosive liquid. If splashed in eyes, it can cause blindness. If splashed on skin, it can cause serious burns. Always wear protective goggles or lenses, rubber apron, and rubber gloves. If accidently splashed in eyes or on skin, flush with clean, cool water. Refer to FM 21-1 1 for first aid information and seek medical attention immediately.
- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

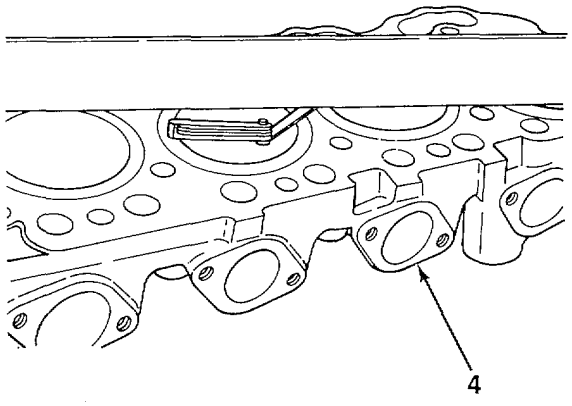
1. Soak cylinder head and cylinder head valves overnight in carbon removing compound. Using wire brush and hot water, clean all carbon deposits from cylinder head and cylinder head valves. Dry thoroughly with compressed air.

2. Inspect cylinder head for cracks, breaks, warping, and abnormal wear. Replace cylinder head if damaged.

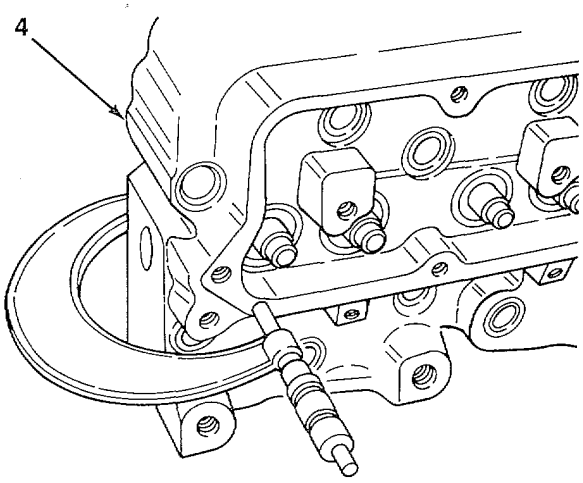
TA708067

4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

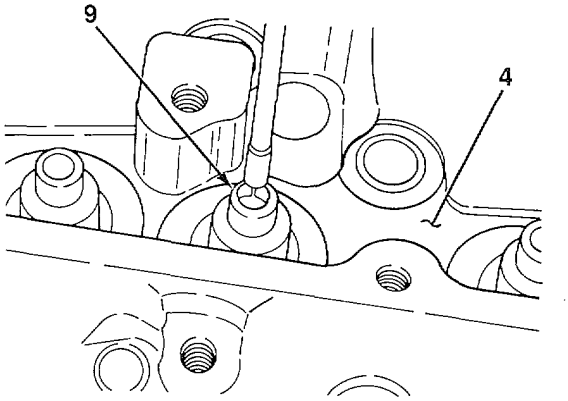
3. Using machinist's steel rule and thickness gage, check cylinder head (4) for flatness in several places. Out-of-flat measurement must not exceed 0.005 in. (0.127 mm) for entire length or width of cylinder head, or 0.001 in. (0.025 mm) for every 5.90 in. (14.99 cm) of length or width of cylinder head. If any measurement exceeds specification, replace cylinder head.



4. Using outside caliper micrometer, measure cylinder head (4) thickness. If thickness is less than 4.104 in. (10.424 cm), replace cylinder head.



5. Using inside caliper micrometer, measure valve guides (9) for wear. Maximum allowable clearance is 0.006 in. (0.152 mm). If measurement is not within specification, replace cylinder head (4).



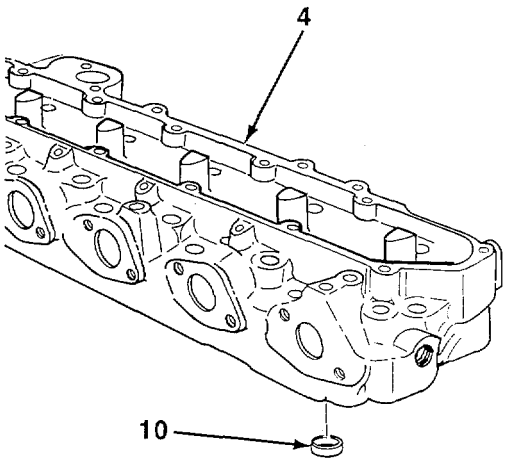
TA708068

4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

6. Inspect 12 valve seat inserts (10) for cracks, pits, and excessive wear. Replace damaged valve seat inserts (see step 7).

NOTE
Perform step 7 only if valve seat inserts are damaged.

7. Using valve seat puller, remove valve seat insert (10) from cylinder head (4).



WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

8. Clean valve springs, valve spring retaining lock, and rotators with dry cleaning solvent and dry with clean rags.

9. Inspect cylinder head valves and valve springs for damage. Replace damaged parts.

10. Inspect rotators for proper movement. Rotators must turn freely in both directions. Replace defective rotators.

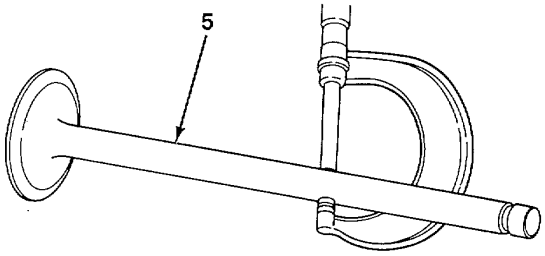
11. Using spring tester and torque wrench, compress valve springs to 1.81 in. (4.60 cm) and note compression force on torque wrench. Compression force must be 54-62 lb.-ft. (73-84 N.m). Replace valve springs not within specification.

12. Using spring tester and torque wrench, compress valve springs to 1.36 in. (3.45 cm) and note compression force on torque wrench. Compression force must be 133-135 lb.-ft. (180-183 Nom). Replace valve springs not within specification.

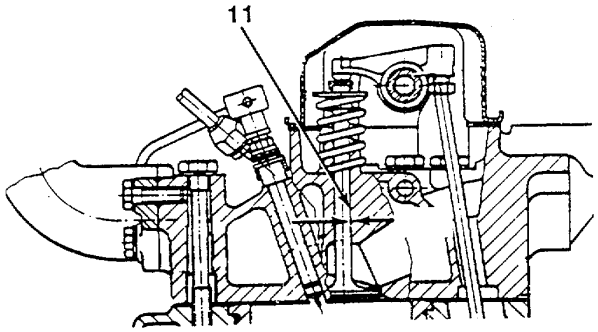
TA708069

4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

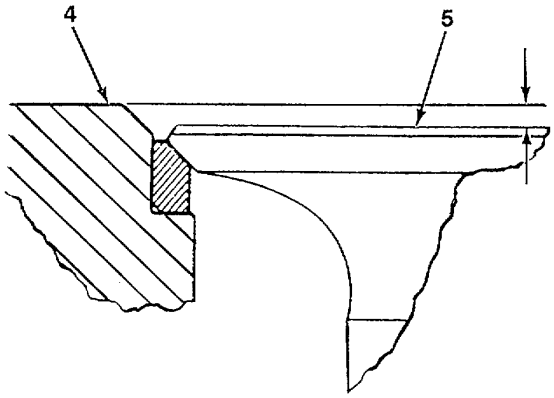
13. Using outside caliper micrometer, measure outside diameter of cylinder head valve (5) stems. Outside diameter must be 0.3096-0.3104 in. (7.8638-7.8842 mm) for intake cylinder head valves and 0.3090-0.3100 in. (7.84867.8740 mm) for exhaust cylinder head valves. If measurement is not within specification, replace cylinder head valve.



14. Subtract measurement taken in step 13 from measurement taken in step 5. Difference is valve to-guide clearance (11). Clearance measurement must be 0.0020-0.0040 in. (0.0508-0.1016 mm). If clearance is not within specification, replace cylinder head valve.



15. Position cylinder head valve (5) in cylinder head (4). Using depth gage micrometer, measure distance from deck of cylinder head to cylinder head valve. Measurement must be 0.024-0.044 in. (0.610-1.118 mm) for intake cylinder head valves and 0.089 in. (2.26 mm) for exhaust cylinder head valves. If measurement is not within specification, replace cylinder head valve.



TA708070

4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

WARNING

Prussian blue dye is poisonous and can burn skin on contact. Always wear protective goggles and gloves, and use only in a well-ventilated area. Overexposure to Prussian blue dye can cause serious heart and skin problems, dizziness, and unconsciousness if not handled properly.

16. Remove cylinder head valve (5) from cylinder head (4) and apply a thin coat of Prussian blue dye to face of cylinder head valve.

17. Position cylinder head valve (5) in cylinder head (4) and turn cylinder head valve one complete revolution. Remove cylinder head valve from cylinder head.

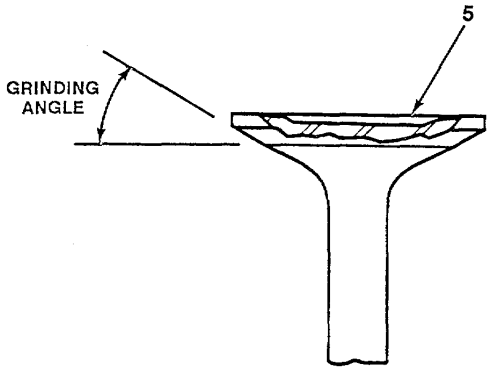
18. Inspect cylinder head valve (5) for low spots or evidence of poor contact between cylinder head valve and cylinder head (4). Low spots will be free of Prussian blue dye.

NOTE

Perform step 19 only if cylinder head valve has low spots or poor contact with cylinder head.

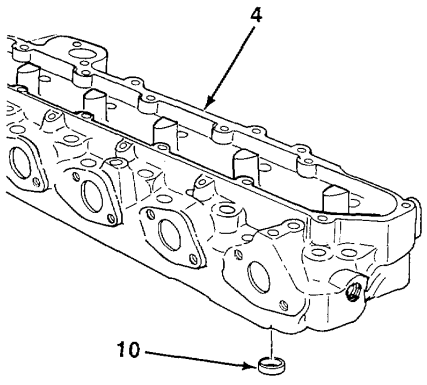
19. Using valve face grinding machine, grind cylinder head valve (5) as necessary. Intake cylinder head valve must be ground to an angle of 29.50°. Exhaust cylinder head valve must be ground to an angle of 43.5°.

20. Repeat steps 16 through 18. If cylinder head valve still will not seat, replace valve seats insert (see step 7).



c. ASSEMBLY

1. If removed, install valve seat insert (10) in cylinder head (4).

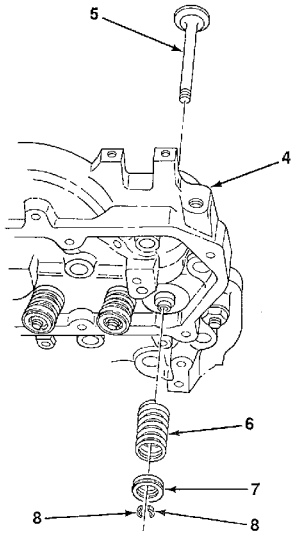


TA708071

4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

2. Apply a light amount of lubricating oil to stem of cylinder head valve (5). Slide cylinder head valve In cylinder head (4) and hold in position. Ensure that stem slides up and down without resistance.

3. Position valve spring (6) and rotator (7) on cylinder head valve (5). Using valve spring lifter, compress valve spring and install valve spring retaining lock (8) on cylinder head valve.

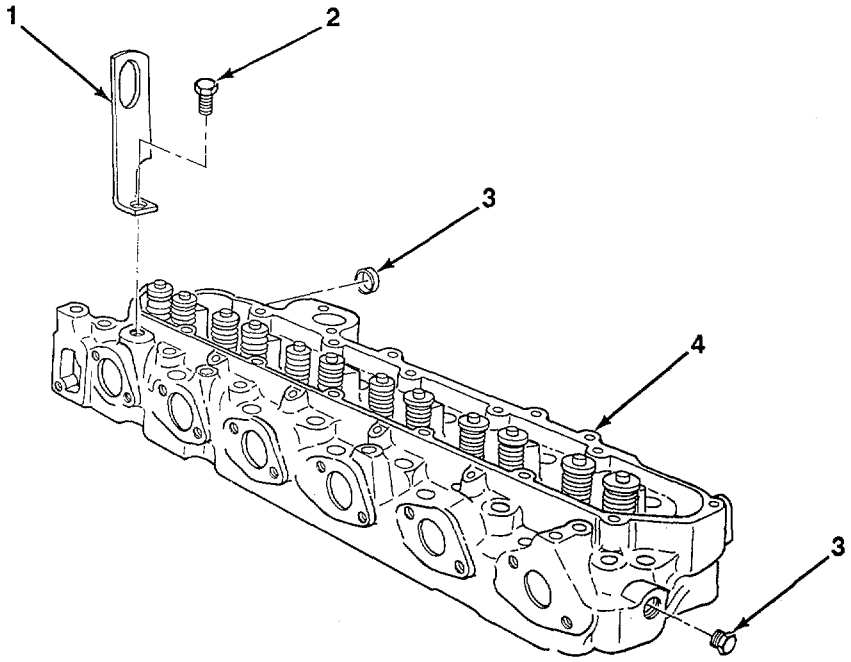


TA708072

4-6. CYLINDER HEAD ASSEMBLY REPAIR (Con't).

4. If removed, install two plugs (3) on cylinder head (4).

5. Install engine lifting bracket (1) on cylinder head (4) with screw (2).



FOLLOW-ON TASKS:

- Install cylinder head assembly (see paragraph 4-5).

TA708073

4-7. CRANKSHAFT DAMPENER MAINTENANCE.

This Task Covers:

a. Wobble Test
b. Runout Test
c. Rotation Test
d. Removal
e. Installation

INITIAL SETUP:

Equipment Conditions:

- Engine warmed to operating temperature (see TM 10-3930-659-10).
- Battery disconnect switch in OFF position (see TM 10-3930-659-10).
- Conveyorized fork attachments removed from side of forklift truck (see TM 10-3930-659-20).
- Right engine upper sideshield opened (see TM 10-3930-659-10).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Flywheel turning tool (Item 25, Appendix E)
- Puller kit (Item 50, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:

- Loctite adhesive (Item 2, Appendix B)
- Rags (Item 43, Appendix B)

Personnel Required: Two

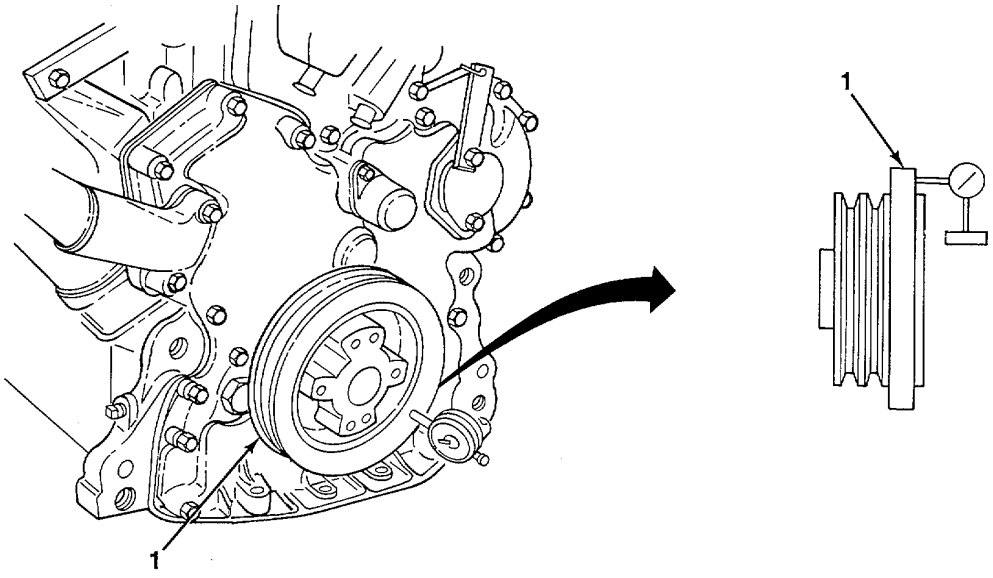
References:

- TM 10-3930-659-10
- TM 10-3930-659-20

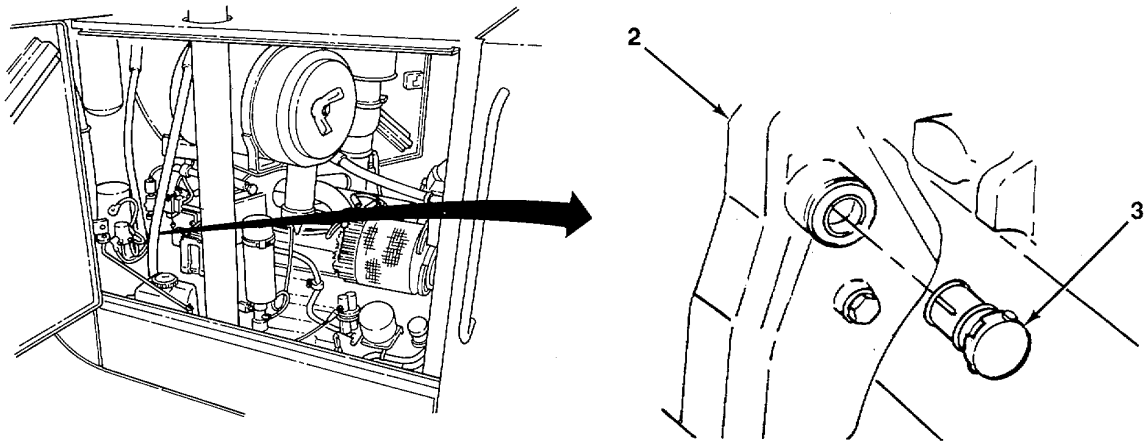
a. WOBBLE TEST

1. Shut down engine (see TM 10-3930-659-10).
2. Loosen fan belts (see TM 10-3930-659-20).
3. Clean outer surface of crankshaft dampener (1) with a clean rag.
4. Position dial indicator stylus against outer edge of crankshaft dampener (1).

4-7. CRANKSHAFT DAMPENER MAINTENANCE (Con't).



5. Remove plug (3) from engine (2).



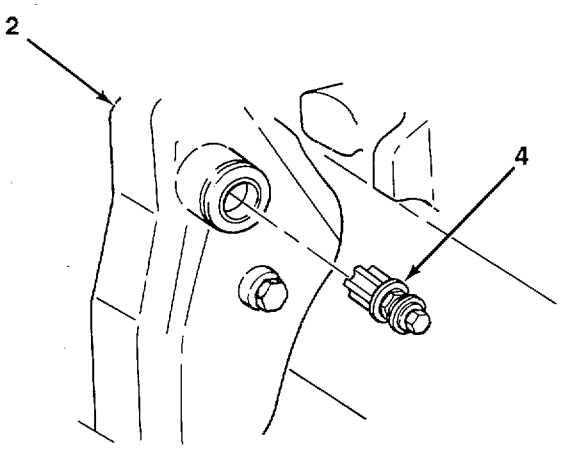
TA708074

4-7. CRANKSHAFT DAMPENER MAINTENANCE (Con't).

6. Install flywheel turning tool (4) on engine (2).

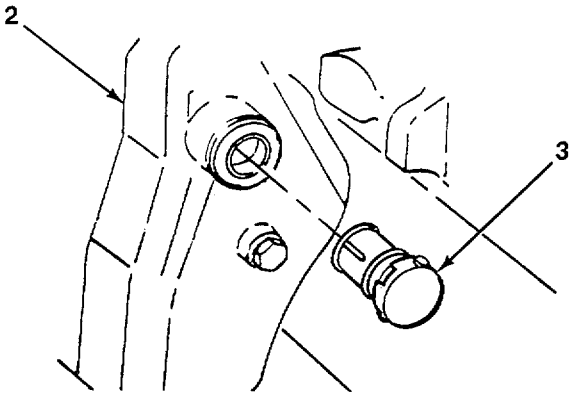
7. Using flywheel turning tool (4), rotate flywheel and note reading on dial indicator. If reading exceeds 0.060 in. (1.524 mm), replace crankshaft dampener (see subparagraph d).

8. flywheel turning tool (4) from engine (2).



9. Install plug (3) on engine (2).

10. Tighten fan belts (see TM 10-3930-659-20).

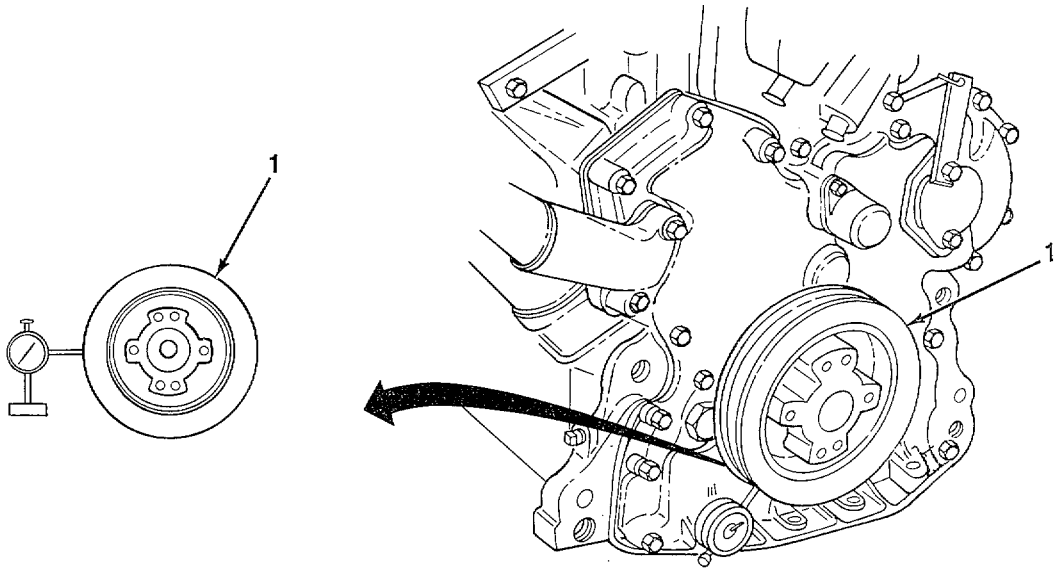


b. RUNOUT TEST

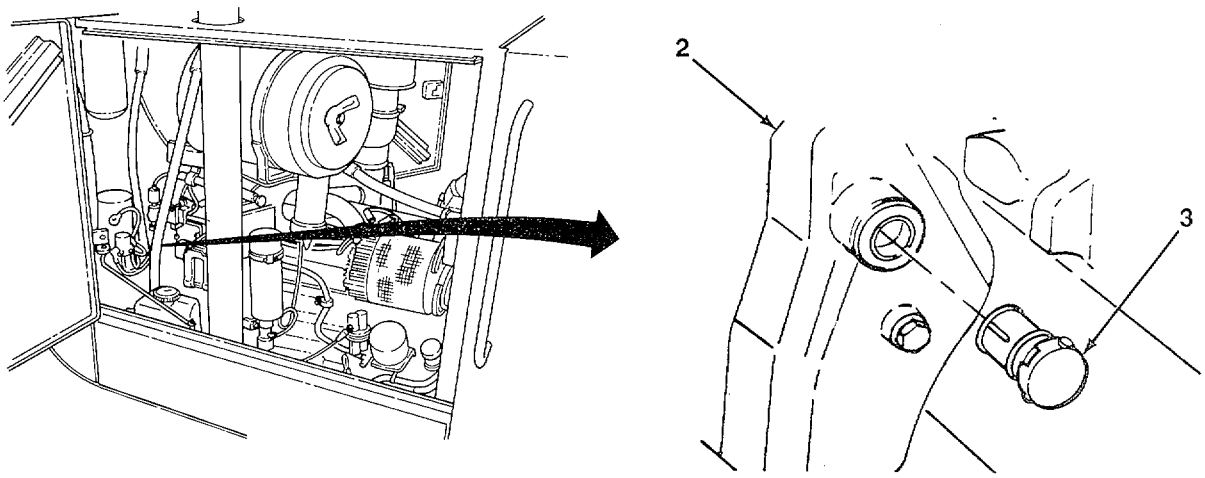
1. Shut down engine (see TM 10-3930-659-10).
2. Loosen fan belts (see TM 10-3930-659-20).
3. Clean outer surface of crankshaft dampener (1) with a clean rag.
4. Position dial indicator stylus against outer diameter of crankshaft dampener (1).

TA708075

4-7. CRANKSHAFT DAMPENER MAINTENANCE (Con't).



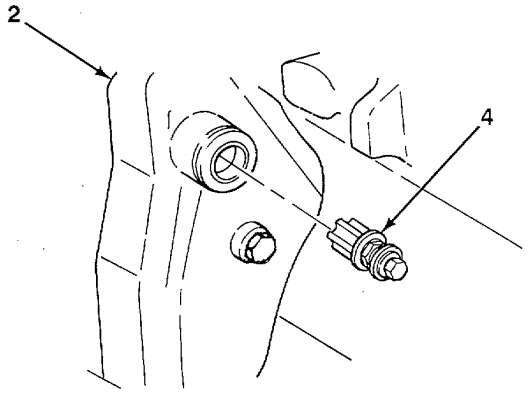
5. Remove plug (3) from engine (2).



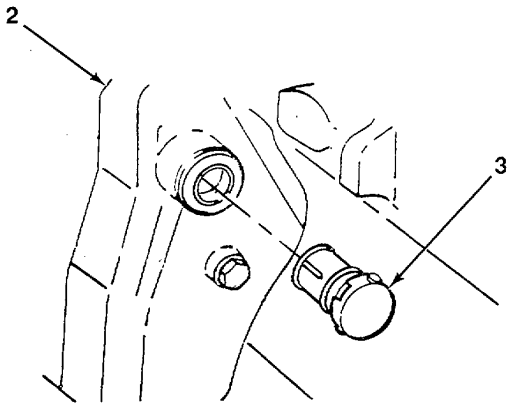
TA708076

4-7. CRANKSHAFT DAMPENER MAINTENANCE (Con't).

6. Install flywheel turning tool (4) on engine (2).
7. Using flywheel turning tool (4), rotate flywheel and note reading on dial indicator. If reading exceeds 0.060 in. (1.524 mm), replace crankshaft dampener (see subparagraph d).
8. Remove flywheel turning tool (4) from engine (2).



9. Install plug (3) on engine (2).
10. Tighten fan belts (see TM 10-3930-659-20).



TA708077

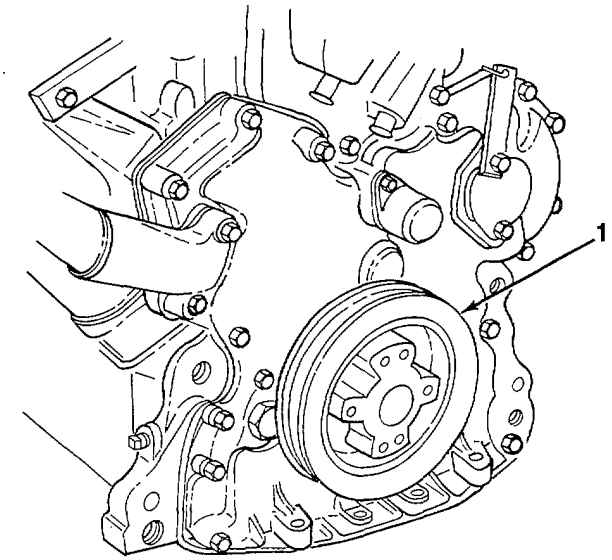
4-7. CRANKSHAFT DAMPENER MAINTENANCE (Con't).

c. ROTATION TEST

1. Shut down engine (see TM 10-3930-659-10).
2. Loosen fan belts (see TM 10-3930-659-20).
3. Grasp crankshaft dampener (1) in both hands and attempt to turn in both directions. If rotation is felt, replace crankshaft dampener (see subparagraph d).
4. Tighten fan belts (see TM 10-3930-659-20).

d. REMOVAL

1. Shut down engine (see TM 10-3930-659-10).
2. Remove engine radiator (see TM 10-3930-659-20).
3. Remove transmission oil cooler (see TM 10-3930-659-20).
4. Loosen fan belts (see TM 10-3930-659-20).



TA708078

4-7. CRANKSHAFT DAMPENER MAINTENANCE (Con't).

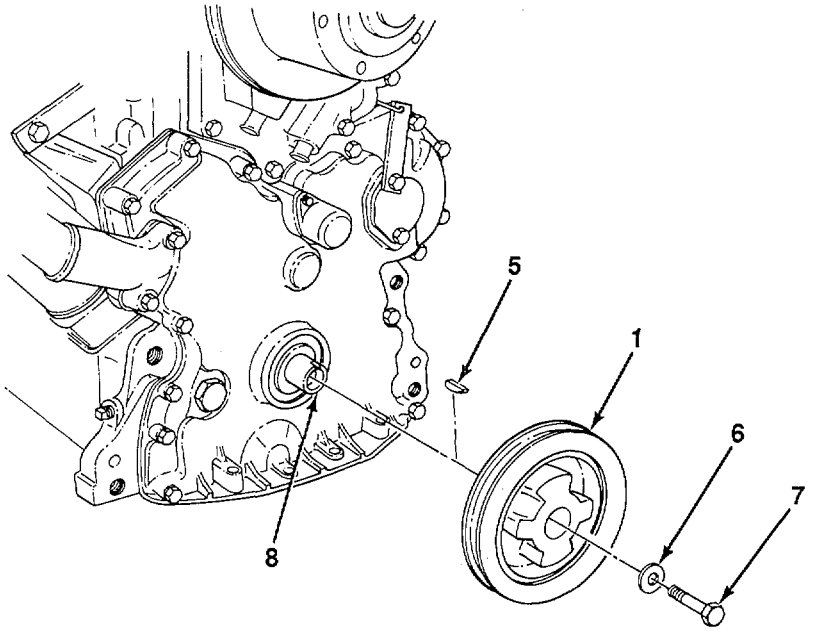
5. Remove screw (7) and washer (6) from crankshaft dampener (1).

CAUTION

DO NOT apply force to outer edge of crankshaft dampener. Force applied against outer edge will damage crankshaft dampener.

6. Using puller kit, remove crankshaft dampener (1) from crankshaft (8).

7. Remove key (5) from crankshaft (8).



e. INSTALLATION

NOTE

Ensure that crankshaft dampener is properly alined when positioning crankshaft dampener on crankshaft.

1. Install key (5) and crankshaft dampener (1) on crankshaft (8).

2. Apply Loctite adhesive to threads of screw (7), and install washer (6) and screw on crankshaft dampener (1).Torque screw to 110 lb.-ft. (149 N.m).

TA708079

4-7. CRANKSHAFT DAMPENER MAINTENANCE (Con't).

3. Install transmission oil cooler (see TM 10-3930-659-20)
4. Install engine radiator (see TM 10-3930-659-20).
5. Perform wobble test (see subparagraph a).
6. Perform runout test (see subparagraph b).
7. Perform rotation test (see subparagraph c).

FOLLOW-ON TASKS:

- Close right engine upper sideshield (see TM 10-3930-659-10).
- Install conveyorized fork attachments on side of forklift truck (see TM 10-3930-659-20).

4-8. IDLER GEARS MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Equipment Conditions:

- Engine assembly removed (see paragraph 4-3).
- Engine front cover removed (see paragraph 4-14).

Tools/Test Equipment:
- General mechanic's tool kit (item 71, Appendix E) a
- Vernier caliper (Item 10, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Sharpening stone (Item 61, Appendix E)

- Die and tap threading set (item 68, Appendix E)
- Gear timing tool (Item 70, Appendix E)
- Torque wrench, 0-175 Ib.-ft. (Item 81, Appendix E)

Materials/Parts:

- Lubricating oil (Item 39, Appendix B)
- Rags (Item 43, Appendix B)

- Dry cleaning solvent (Item 47, Appendix B)
  Nonelectrical wire (Item 59, Appendix B)

General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. REMOVAL

1. Pry lower idler gear (5) away from cylinder block front plate (1) as far as possible.

2. Using dial indicator, measure and note end play of lower idler gear (5). End play must be 0.0010-0.0080 in. (0.0254-0.2032 mm).
3. Remove nut (8) and thrustwasher (7) from screw (11).

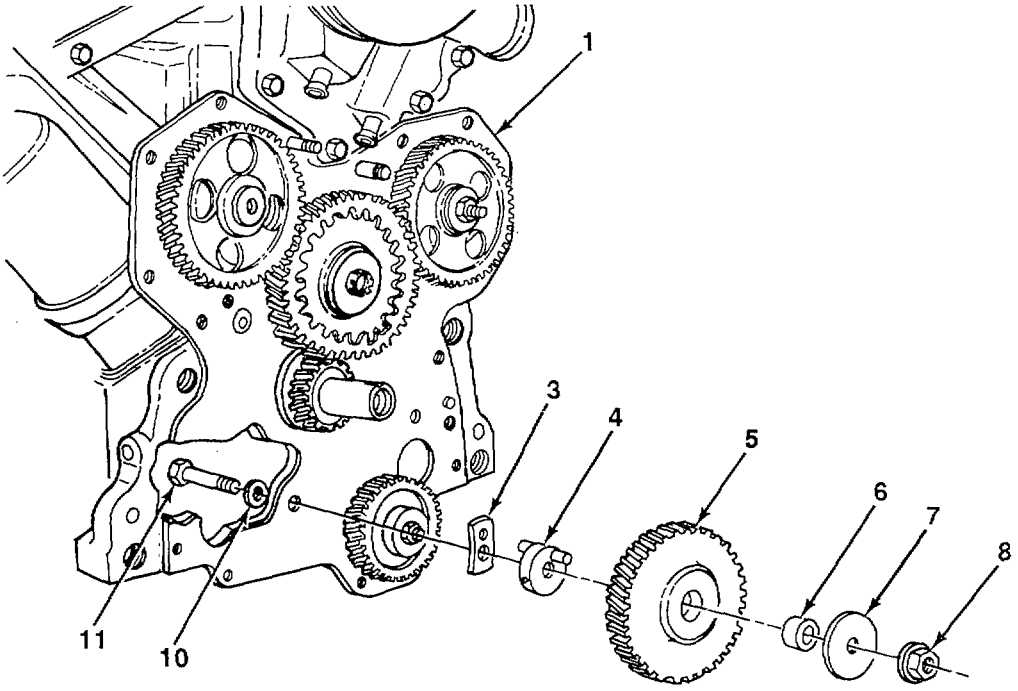
4. Remove bushing (6) from lower idler gear (5).

CAUTION

To prevent loss of timing, ensure that other gears DO NOT turn when removing lower idler gear.

5. Remove lower idler gear (5) from lower idler gearshaft (4).

4-8. IDLER GEARS MAINTENANCE (Con't).



NOTE
Perform steps 6 through 9 only if lower idler gearshaft is damaged.

6. Remove engine oil pan (see paragraph 4-17).

7. Remove screw (11) and washer (10) from cylinder block front plate (1) and lower idler gearshaft (4).

8. Alternately pry and tap lower idler gearshaft (4) from side-to-side until it can be removed from cylinder block front plate (1).

9. Remove thrustwasher (3) from lower idler gearshaft (4).

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4-8. IDLER GEARS MAINTENANCE (Con't).

10. Pry upper idler gear (15) away from cylinder block front plate (1) as far as possible.

11. Using dial indicator, measure and note end play of upper idler gear (15). End play must be 0.0010-0.0080 in. (0.0254-0.2032 mm).

12. Remove bolt (17) and thrustwasher (16) from upper idler gear (15).

CAUTION

To prevent loss of timing, ensure that other gears DO NOT turn when removing upper idler gear.

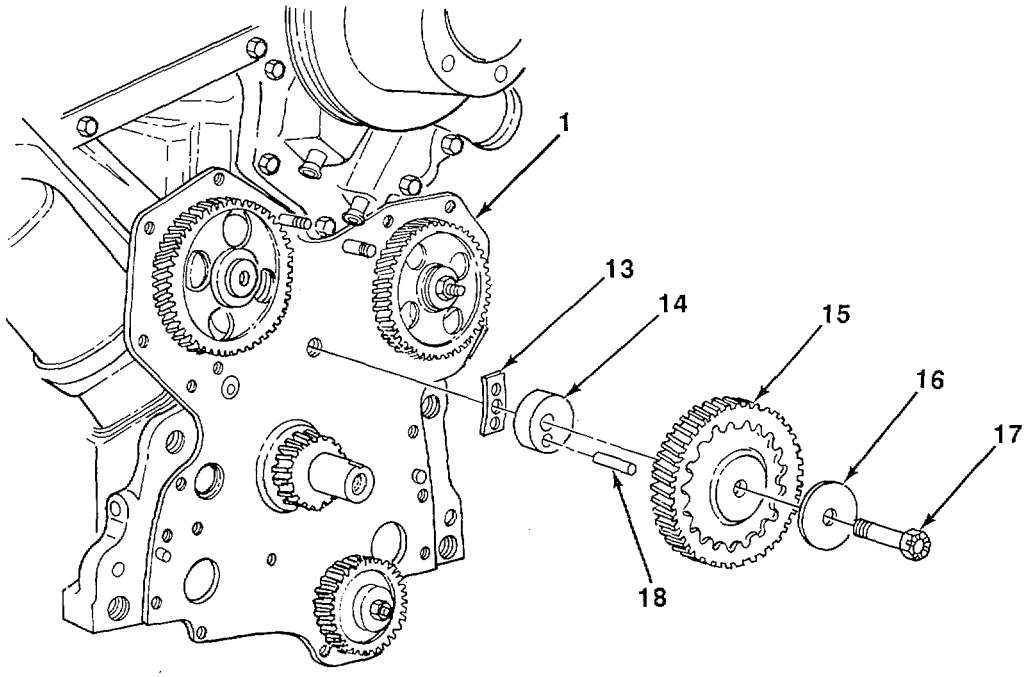
13. Remove upper idler gear (15) from upper idler gearshaft (14).

NOTE

Perform steps 14 and 15 only if upper idler gearshaft is damaged.

14. Remove upper idler gearshaft (14) from cylinder block front plate (1).

15. Remove thrustwasher (13) from upper idler gearshaft (14) and springpin (18).



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4-8. IDLER GEARS MAINTENANCE (Con't).

b. DISASSEMBLY

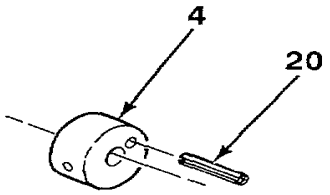
CAUTION

DO NOT remove springpins unless damaged. Removal may damage parts.

NOTE

Upper and lower idler gearshafts are disassembled the same way. Lower idler gearshaft is illustrated.

Remove springpin (20) from lower idler gearshaft (4).



c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138° F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean upper and lower idler gears with dry cleaning solvent and allow to dry.
2. Clean oil passage holes with nonelectrical wire and flush with dry cleaning solvent. Dry with clean rags.
3. Clean all other parts with dry cleaning solvent and dry with clean rags.
4. Inspect all metal parts for cracks, bends, and breaks. Replace cracked, bent, or broken parts.
5. Inspect all threaded parts for damaged threads. Repair damaged threads with die and tap threading set.
6. Inspect upper and lower idler gears for burrs, abnormal wear, and damaged teeth. Remove burrs with sharpening stone. Replace upper or lower idler gear if otherwise damaged.

4-8. IDLER GEARS MAINTENANCE (Con't).

NOTE
If replacing upper or lower idler gearshaft, springpin must also be replaced.

7. Using vernier caliper, measure outside diameter of upper or lower idler gearshaft. Outside diameter must measure 1.749-1.750 in. (4.442-4.445 cm). Replace worn upper or lower idler gearshaft.

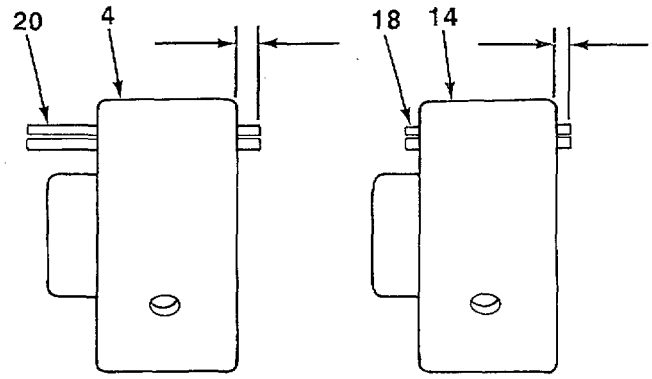
8. Inspect sleeve bushings for grooves. Using vernier caliper, measure inside diameter of sleeve bushing. Inside diameter must measure 1.751-1.753 in. (4.448-4.453 cm). Replace damaged or worn upper or lower idler gear.

9. If end play recorded in subparagraph a, steps 2 and 11, was not within specification and idler gears are within specification, replace thrustwashers.

d. ASSEMBLY

1. If removed, install springpin (18) on upper idler gearshaft (14) until springpin extends beyond surface of upper idler gearshaft 0.138-0.177 in. (3.505-4.496 mm).

2. If removed, install springpin (20) on lower idler gearshaft (4) until springpin extends beyond surface of lower idler gearshaft 0.197-0.275 in. (5.004-6.985 mm).



e. INSTALLATION

NOTE
Perform steps 1 and 2 only if upper idler gearshaft was removed.

1. Install thrustwasher (13) on upper idler gearshaft (14) and springpin (18).
2. Apply lubricating oil to upper idler gearshaft (14) and position upper idler gearshaft on cylinder block front plate (1).
3. Using gear timing tool, aline timing marks on fuel injection pump gear (12), camshaft gear (19), and crankshaft (2).

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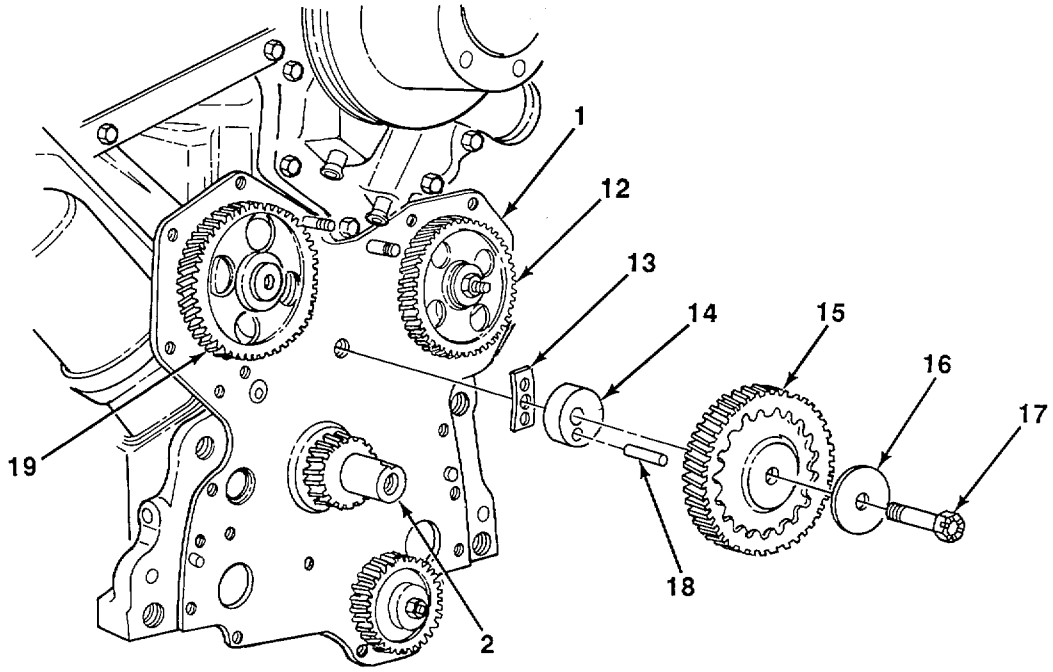
4-8. IDLER GEARS MAINTENANCE (Con't).



CAUTION

To prevent loss of timing, ensure that other gears DO NOT turn when installing upper idler gear.

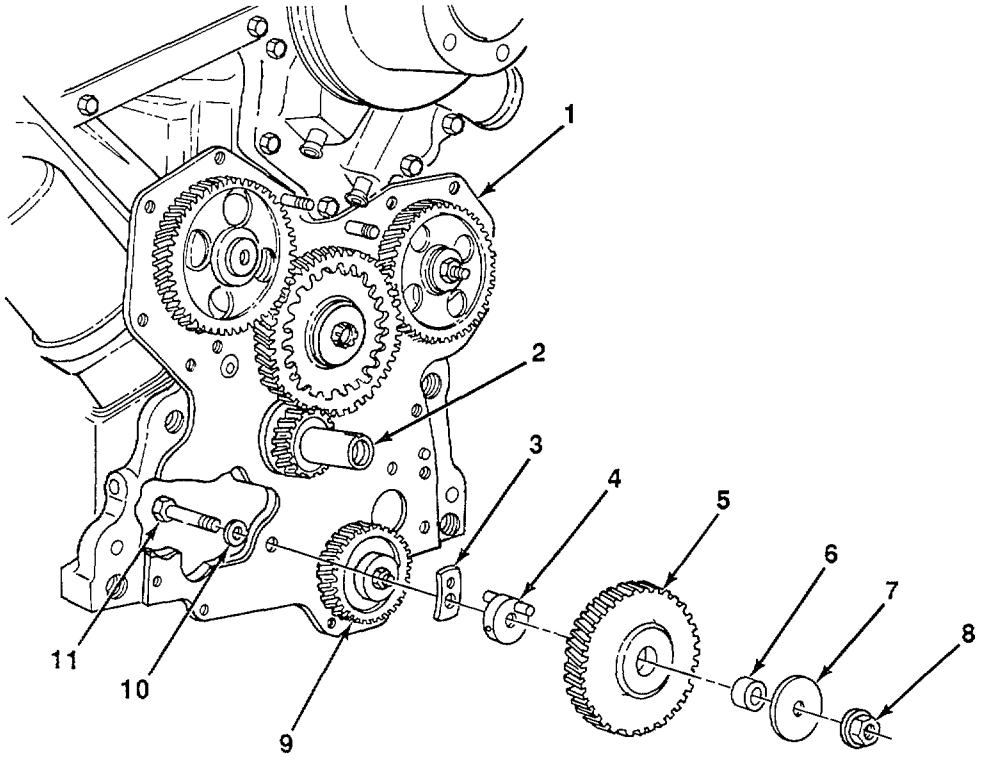
4. Apply lubricating oil to upper idler gear (15) and install upper idler gear on upper idler gearshaft (14). TA708084

5. Install thrustwasher (16) and bolt (17) on upper idler gear (15). Torque bolt to 65 lb.-ft. (88 N.m). 4-41

4-8. IDLER GEARS MAINTENANCE (Con't).

NOTE
Perform steps 6 through 9 only if lower idler gearshaft was removed.

6. Install thrustwasher (3) on lower idler gearshaft (4).
7. Apply lubricating oil to lower idler gearshaft (4) and position lower idler gearshaft on cylinder block front plate (1).
8. Install washer (10) and screw (11) in cylinder block front plate (1) and lower idler gearshaft (4).
9. Install engine oil pan (see paragraph 4-17).
10. Using gear timing tool, aline timing marks on engine oil pump gear (9) and crankshaft (2).
11. Apply lubricating oil to lower idler gear (5).



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4-8. IDLER GEARS MAINTENANCE (Con't).

CAUTION

To prevent loss of timing, ensure that other gears DO NOT turn when installing lower idler gear.

12. Install lower idler gear (5) on lower idler gearshaft (4).
13. Install bushing (6), thrustwasher (7), and nut (8) on screw (11). Do not tighten nut.
14. Position number one piston at top-dead-center on compression stroke (see paragraph 4-24).
15. Torque nut (8) to 95 lb.-ft. (129 N.m).

FOLLOW-ON TASKS:

- Install engine front cover (see paragraph 4-14).
- Install engine assembly (see paragraph 4-3).

4-9. FLYWHEEL AND RING GEAR REPLACEMENT.

This Task Covers:

a. Removal b. Installation

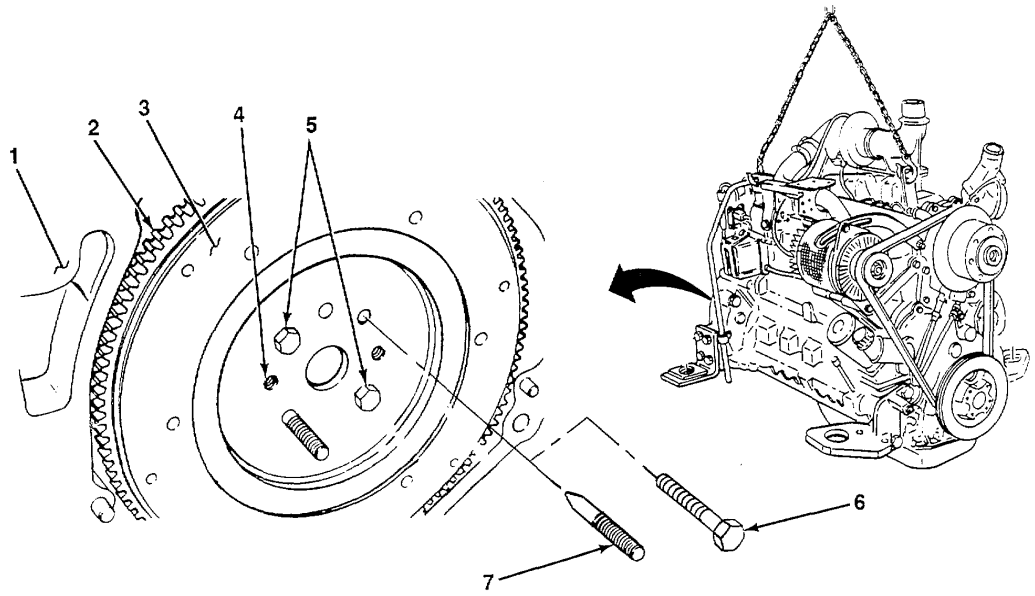
Initial Setup:

Equipment Conditions:
• Drive dampener removed (see paragraph 4-45).
Personnel Required: Two

Tools/Test Equipment:
• General mechanic's tool kit (Item 71, Appendix E)
• Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)
• Flywheel guide studs (two) (Figure C-1, Appendix C)

a. REMOVAL

1. Remove two screws (6) from flywheel (3).
2. Install two flywheel guide studs (7) on flywheel (3).
3. With assistant holding flywheel (1), remove two screws (5).



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4-9. FLYWHEEL AND RING GEAR REPLACEMENT (Con't).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 1 00 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

4. Install two screws (5) in threaded holes (4) to push flywheel (3) off crankshaft.
5. Remove flywheel (3) and ring gear (2) from flywheel housing (1).
6. Remove two guide studs (7) from flywheel (3).
7. Remove two screws (5) from flywheel (3).

b. INSTALLATION

1. Install two guide studs (7) on flywheel housing (1).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

2. Position flywheel (3) and ring gear (2) on two flywheel guide studs (7).
3. Install two screws (5) on flywheel (3). Do not tighten screws.
4. Remove two flywheel guide studs (7) from flywheel (3).
5. Install two screws (6) on flywheel (3).
6. Torque four screws (5 and 6) to 120 lb.-ft. (163 N•m).

FOLLOW-ON TASKS:

- Install drive dampener (see paragraph 4-45).

4-10. FLYWHEEL HOUSING REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Flywheel and ring gear removed (see paragraph 4-9).
  * Starter motor removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Die and tap threading set (Item 68, Appendix E)

References:
- TM 10-3930-659-20

Materials/Parts:
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One gasket

Personnel Required: Two

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. REMOVAL

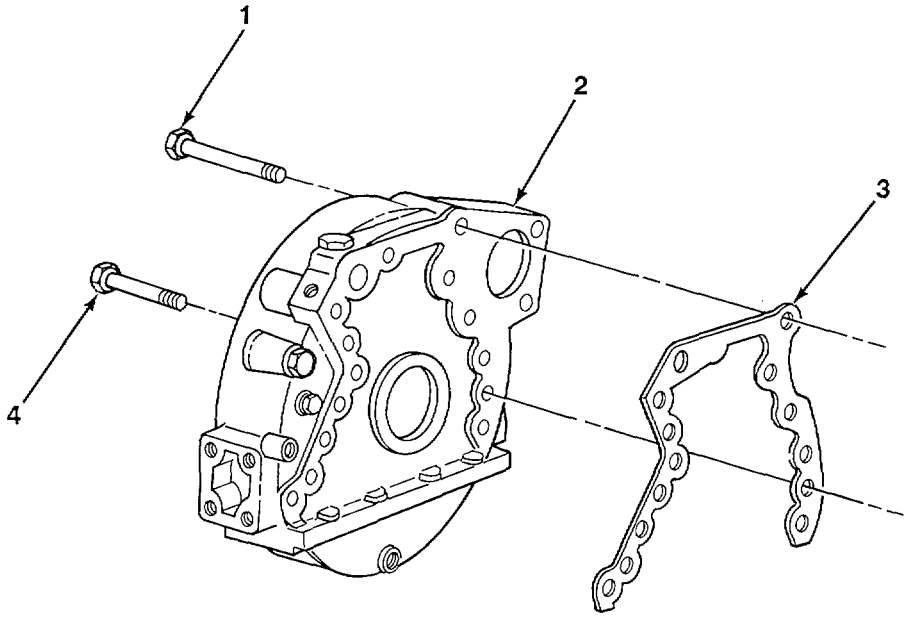
1. Attach suitable lifting device to flywheel housing (2) and raise lifting device enough to support weight of flywheel housing.
2. Remove four screws (1) and eight screws (4) from flywheel housing (2).

WARNING

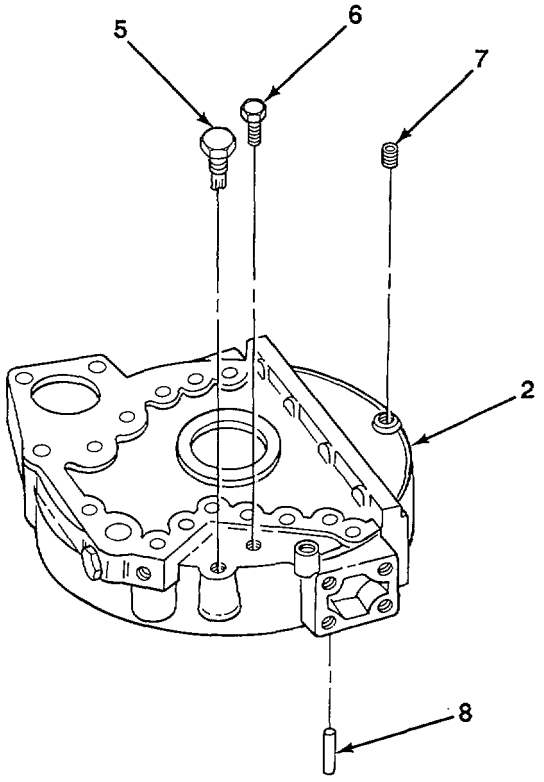
Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

3. Using suitable lifting device, remove flywheel housing (2) from engine block.
4. Remove gasket (3) from mating surfaces of flywheel housing (2) and engine block. Discard gasket.
5. Remove rear oil seal (see paragraph 4-11).

4-10. FLYWHEEL HOUSING REPLACEMENT (Con't).



6. Remove suitable lifting device from flywheel housing (2).
7. If damaged, remove screw (6) and plug (5) from flywheel housing (2).
8. If damaged, remove pipe plug (7) and two pins (8) from flywheel housing (2).



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4-10. FLYWHEEL HOUSING REPLACEMENT (Con't).

b. CLEANING AND INSPECTION

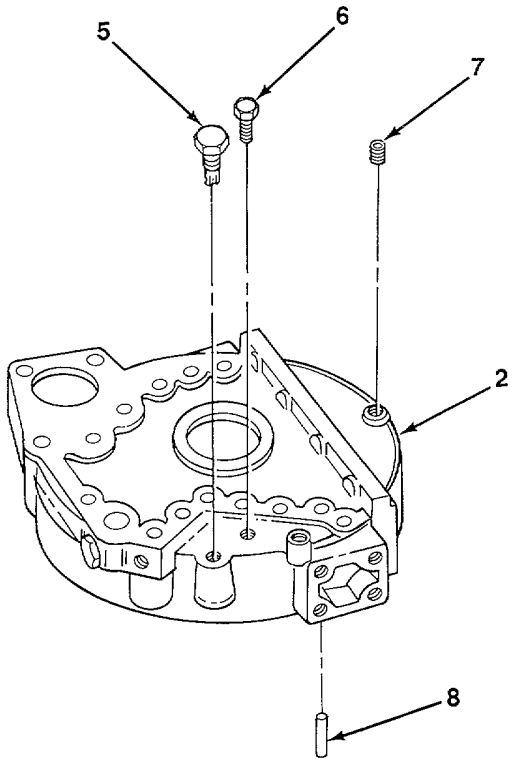
WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Using putty knife and dry cleaning solvent, remove gasket material from mounting surface of flywheel housing and engine block.
2. Clean all metal parts with dry cleaning solvent and dry with clean rags.
3. Inspect flywheel housing for damage. Replace damaged flywheel housing.
4. Inspect threaded parts for damaged threads. Repair damaged threads using tap and die threading set.

c. INSTALLATION

1. If removed, install two pins (8) and pipe plug (7) in flywheel housing (2).
2. If removed, install plug (5) and screw (6) in flywheel housing (2).



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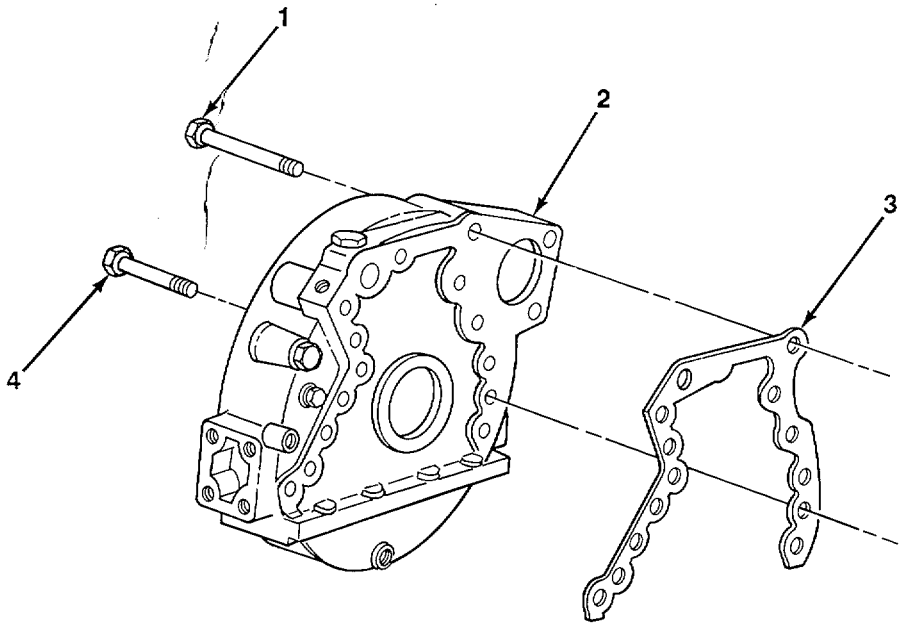
4-10. FLYWHEEL HOUSING REPLACEMENT (Con't).

3. Install rear oil seal (see paragraph 4-11).
4. Position new gasket (3) on engine block.
5. Attach suitable lifting device to flywheel housing (2).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

6. Using suitable lifting device, position flywheel housing (2) on engine block and install eight screws (4). Torque screws to 23 lb.-ft. (31 N•m).
7. Install four screws (1) on flywheel housing (2). Torque screws to 167 lb.-ft. (226 N•m).
8. Torque eight screws (4) to 35 lb.-ft. (47 N•m).



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FOLLOW-ON TASKS:

- Install starter motor (see TM 10-3930-659-20).
- Install flywheel and ring gear (see paragraph 4-9).

4-11. REAR OIL SEAL REPLACEMENT.

This Task Covers:
a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Flywheel and ring gear removed (see paragraph 4-9).

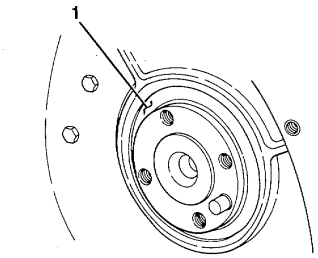
Tools/Test Equipment:
- Dry cleaning solvent (Item 47, Appendix B)
- General mechanic's tool kit (Item 71, Appendix E)
- Electric drill, portable (Item 20, Appendix E)
- Twist drill set (Item 21, Appendix E)
- Seal inserter and remover (Item 38, Appendix E)
- Puller kit (Item 50, Appendix E)

Materials/Parts:
- Loctite adhesive (Item 2, Appendix B)
- Abrasive cloth (Item 9, Appendix B)
- Rags (Item 43, Appendix B)

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. REMOVAL

1. Drill three equally spaced holes through rear oil seal (1).



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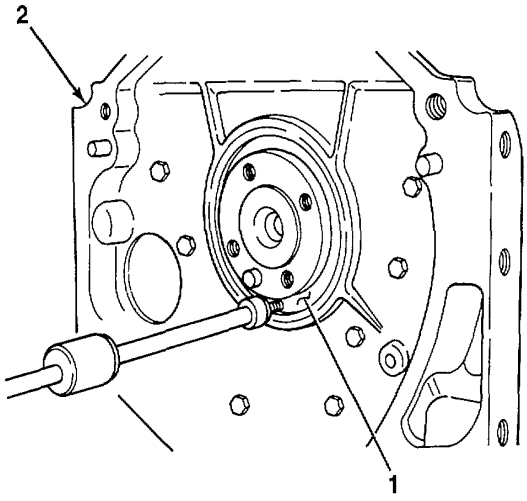
4-11. REAR OIL SEAL REPLACEMENT (Con't).

2. Using puller kit, remove rear oil seal (1) from flywheel housing (2).



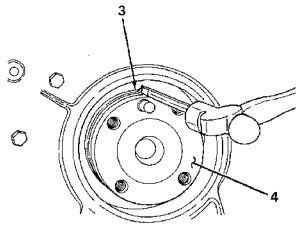
CAUTION

Use care not to damage crankshaft when removing wear sleeve.

NOTE

Perform step 3 only if wear sleeve was not removed with rear oil seal.

3. Using small, sharp cold chisel, carefully cut wear sleeve (3) off crankshaft (4).



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4-11. REAR OIL SEAL REPLACEMENT (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean outer diameter of crankshaft flange with dry cleaning solvent and dry with clean rags.
2. Inspect crankshaft flange and flywheel housing bore for nicks and burrs. Remove nicks and burrs with abrasive cloth.

c. INSTALLATION I

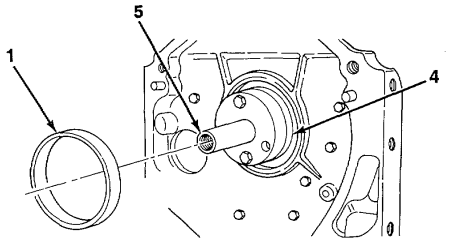
1. Apply a light coat of Loctite adhesive to outer diameter of crankshaft (4). Wipe excess sealant from rear oil seal bore.

2. Install pilot (5) on crankshaft (4).

CAUTION

Handle rear oil seal and wear sleeve assembly with care. If rear oil seal and wear sleeve separate, they must be discarded. Tapered edge of wear sleeve and open side of rear oil seal must be on same side and must face toward engine.

3. Position rear oil seal (1) over pilot (5) and crankshaft (4).



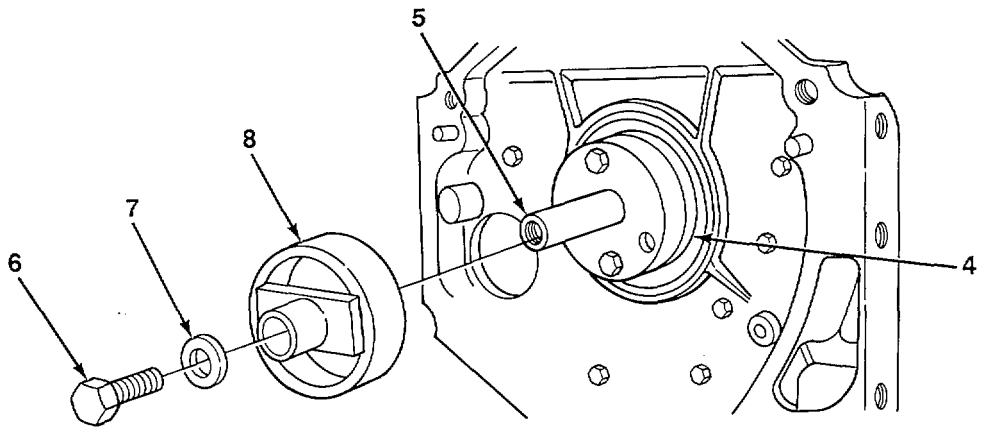
TA708092

TA708092

4-11. REAR OIL SEAL REPLACEMENT (Con't).

4. Attach driver (8) to pilot (5) with washer (7) and screw (6). Tighten screw until driver bottoms on pilot.

5. Remove screw (6), washer (7), driver (8), and pilot (5) from crankshaft (4).



TA708093

FOLLOW-ON TASKS:

- Install flywheel and ring gear (see paragraph 4-9).

4-12. ENGINE ROCKER ARM ASSEMBLY AND PUSHRODS MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Materials/Parts:

Equipment Conditions:

- Engine rocker arm cover and vent tube removed (see TM 10-3930-659-20).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Inside caliper micrometer (Item 8, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Soft hammer (item 34, Appendix E)
- Spring tester (Item 67, Appendix E)
- Machinist's vise (Item 76, Appendix E)
- Torque wrench, 0-175 Ib.-ft. (Item 81, Appendix E)
- Lubricating oil (Item 37, Appendix B)
- Rags (Item 43 Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Marker tags (Item 49, Appendix B)

References

- TM 10-3930-659-20

General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. REMOVAL

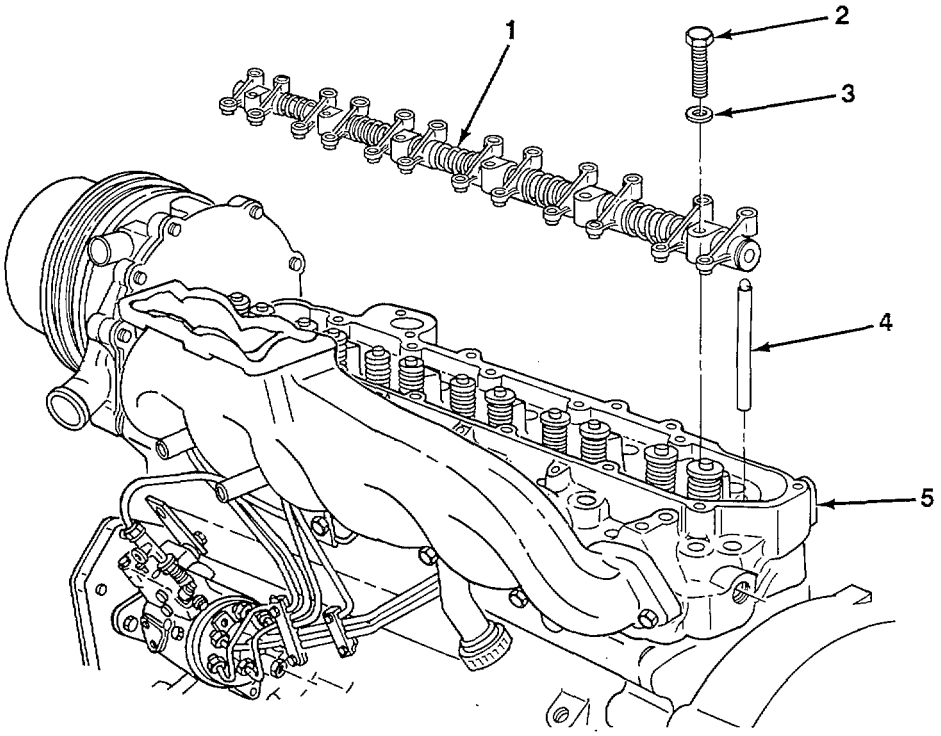
1. Remove six screws (2), washers (3), and engine rocker arm assembly (1) from cylinder head (5).

CAUTION

Note position of pushrods to aid during installation. Pushrods must be installed in the same location as removed.

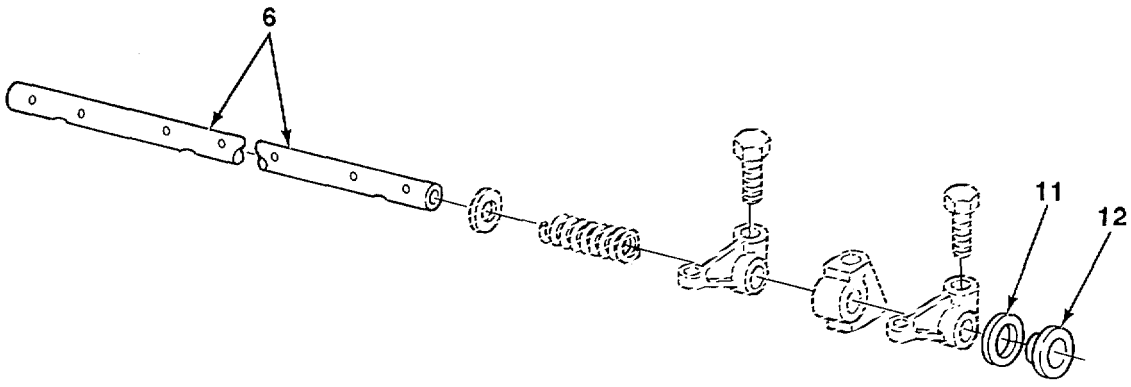
2. Remove 12 pushrods (4) from cylinder head (5).

4-12. ENGINE ROCKER ARM ASSEMBLY AND PUSHRODS MAINTENANCE (Con't).



b. DISASSEMBLY

1. Position engine rocker arm assembly (1) in machinist's vise with vise jaw caps.
2. Remove two plugs (12) and washers (11) from shaft (6).



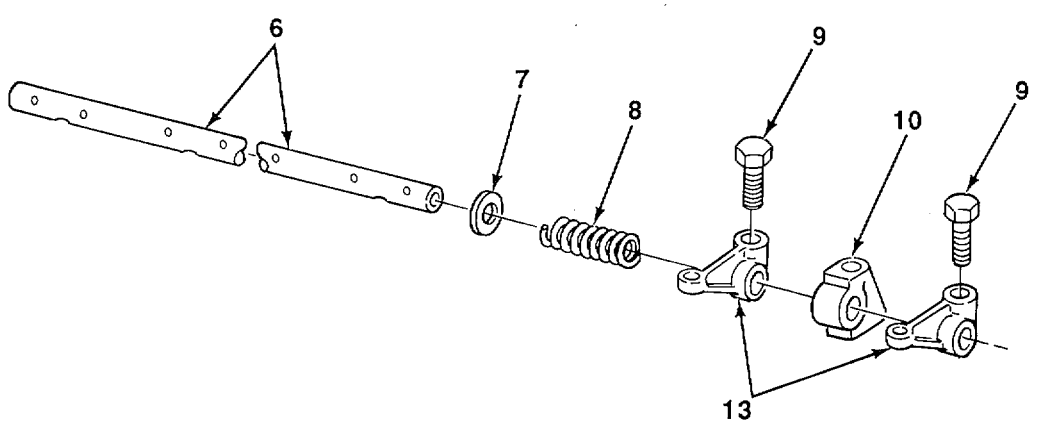
TA708094

4-12. ENGINE ROCKER ARM ASSEMBLY AND PUSHRODS MAINTENANCE (Con't).

CAUTION

Note position of engine rocker arms and shaft supports to aid during installation. Engine rocker arms and shaft supports must be installed in the same location as removed.

3. Remove 12 engine rocker arms (13), six shaft supports (10), five springs (8), and two washers (7) from shaft (6).
4. Remove 12 adjusting screws (9) from engine rocker arms (13).



c. CLEANING AND INSPECTION I

WARNING

- **Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.**

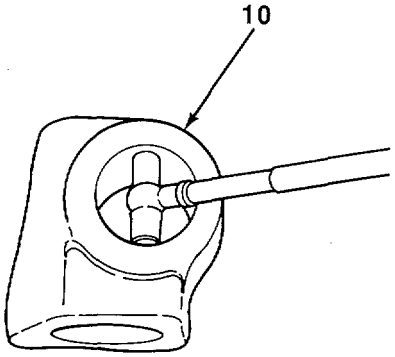
- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

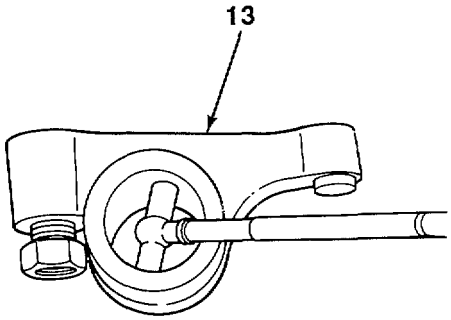
1. Clean parts with dry cleaning solvent and dry with compressed air.
2. Inspect parts for cracks, bends, and breaks. Replace defective parts.

TA708095

4-12. ENGINE ROCKER ARM ASSEMBLY AND PUSHRODS MAINTENANCE (Con't).

3. Inspect shaft for severe scratching, scoring, or excessive wear at points of engine rocker arm contact. Replace shaft if damaged.
4. Roll shaft on flat surface to check for bends and distortion. Replace shaft if bent or distorted.
5. Using outside caliper micrometer, measure outside diameter of shaft at each engine rocker arm location. If outside diameter is smaller than 0.785 in. (19.939 mm), replace shaft.
6. Using inside caliper micrometer, measure inside diameter of six shaft supports (10). If inner diameter is more than 0.794 in. (20.168 mm), replace shaft supports.
7. Using inside caliper micrometer, measure inside diameter of 12 engine rocker arms (13). If inside diameter is more than 0.794 in. (20.168 mm), re- place engine rocker arm.





8. Inspect 12 engine rocker arms for cups and concave wear on ends where contact is made with cylinder head valve tips. Replace engine rocker arms if worn.
9. Using spring tester and torque wrench, compress five springs to 1.81 in. (4.60 cm) and note compression force on torque wrench. Compression force must be 4-6 lb.-ft. (5-8 N-m). Replace spring if defective.
10. Roll 12 pushrods on flat surface to check for bends or distortions. Replace pushrod if bent or distorted.

TA708096

4-12. ENGINE ROCKER ARM ASSEMBLY AND PUSHRODS MAINTENANCE (Con't).

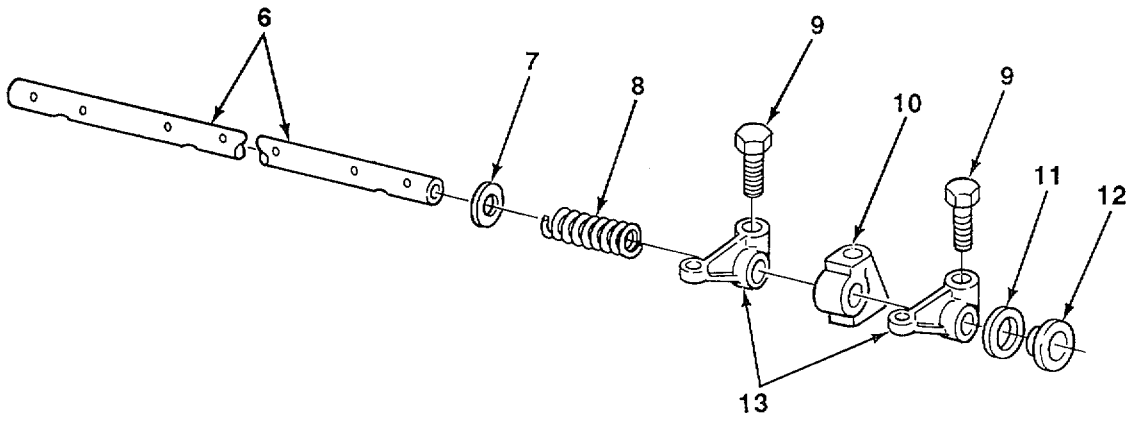
d. ASSEMBLY

1. Install 12 adjusting screws (9) on engine rocker arms (13).
2. Apply a light coat of lubricating oil to 12 engine rocker arms (13) and six shaft supports (10).

CAUTION

Engine rocker arms and shaft supports must be installed in the same position as removed. Failure to follow this caution may result in damage to parts.

3. Install two washers (7), five springs (8), 12 engine rocker arms (13), and six shaft supports (10) on shaft (6).
4. Using soft hammer, install two washers (11) and plugs (12) on shaft (6).



TA708097

4-12. ENGINE ROCKER ARM ASSEMBLY AND PUSHRODS MAINTENANCE (Con't).

e. INSTALLATION

CAUTION

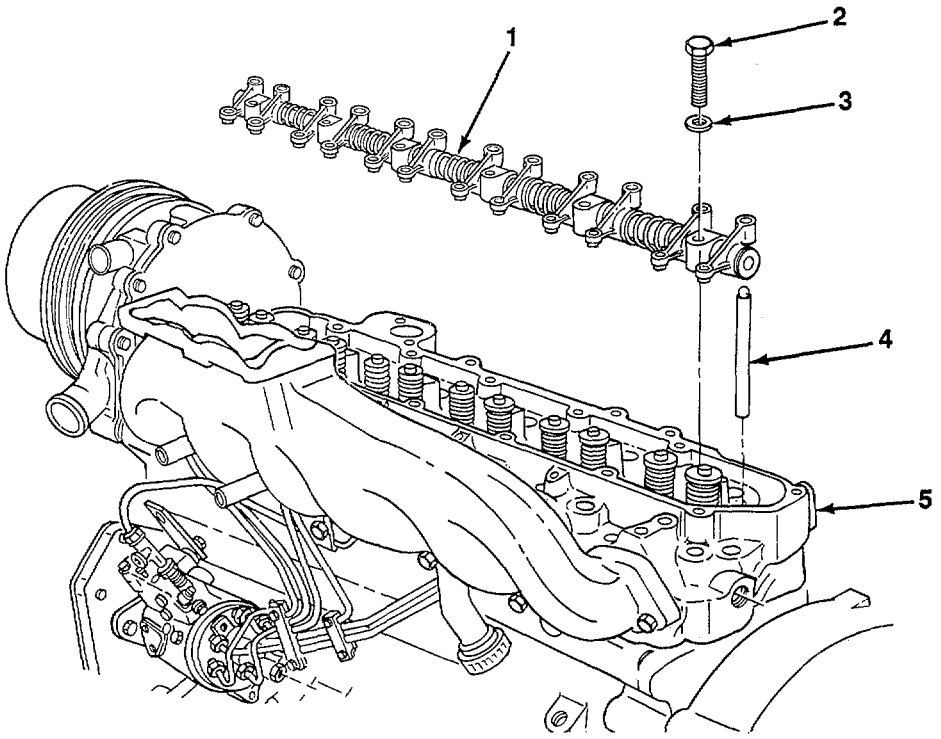
Pushrods must be installed in the same position as removed. Failure to follow this caution may result in damage to parts.

1. Position 12 pushrods (4) on cylinder head (5).

NOTE

Ensure that cutouts in engine rocker arm assembly aline with screw holes In shaft supports.

2. Install engine rocker arm assembly (1) on cylinder head (5) with sixwashers (3) and screws (2). Torque screws to 35 lb.-ft. (47 N•m).



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FOLLOW-ON TASKS:

- Adjust cylinder head valves (see TM 10-3930-659-20).
- Install engine rocker arm cover and vent tube (see TM 10-3930-659-20).

4-13. TAPPETS REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Cylinder head assembly removed (see paragraph 4-5).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Compressor unit (Item 16, Appendix E)

Personnel Required: Two

Materials/Parts:
- Lubricating oil (Item 39, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)

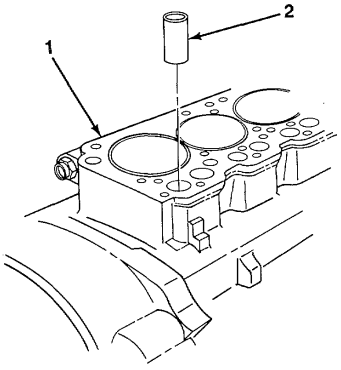
General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. REMOVAL

NOTE

Note position of tappets to aid during installation. Tappets must be installed in thesame position on engine block.

Remove 12 tappets (2) from engine block (1).



TA708099

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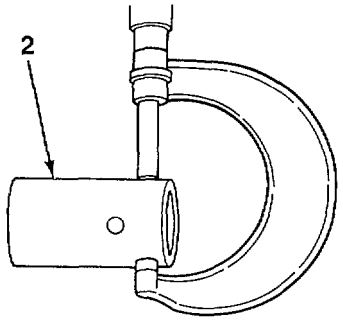
4-13. TAPPETS REPLACEMENT (Con't).

b. CLEANING AND INSPECTIONI

WARNING

- **Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.**
- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

1. Clean tappets with dry cleaning solvent and dry with compressed air.
2. Using outside caliper micrometer, measure outside diameter of tappets (2). Outside diameter must be 1.245-1.246 in. (3.162-3.165 cm). If measurement is less than specified, replace tap pet.



c INSTALLATION

Apply a thin coat of lubricating oil to 12 tappets (2) and install tappets in engine block (1).

FOLLOW-ON TASKS:

- Install cylinder head assembly (see paragraph 4-5).

TA708100

4-14. ENGINE FRONT COVER REPLACEMENT.

This Task Covers:
a. Removal b Installation

Initial Setup:

Equipment Conditions:
- Engine oil filler neck removed (see TM 10-3930-659-20).
- Accelerator cable and spring removed (see TM 10-3930-659-20).
- Alternator removed (see TM 10-3930-659-20).
- Magnetic pickup removed (see TM 10-3930-659-20).
- Engine oil pressure regulating valve removed (see paragraph 4-15).
- Crankshaft dampener removed (see paragraph 4-7).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Crankshaft front oil seal driver (Item 26, Appendix E)
- Torque wrench, 0-300 lb.-in. (Item 80, Appendix E)

Materials/Parts:
- Sealing compound (Item 15, Appendix B)
- Grease (Item 33, Appendix B)
- Rags (Item 43, Appendix B)
- Marker tags (Item 49, Appendix B)
- One front seal
- One preformed packing
- Two gaskets
- Eight lockwashers

References:

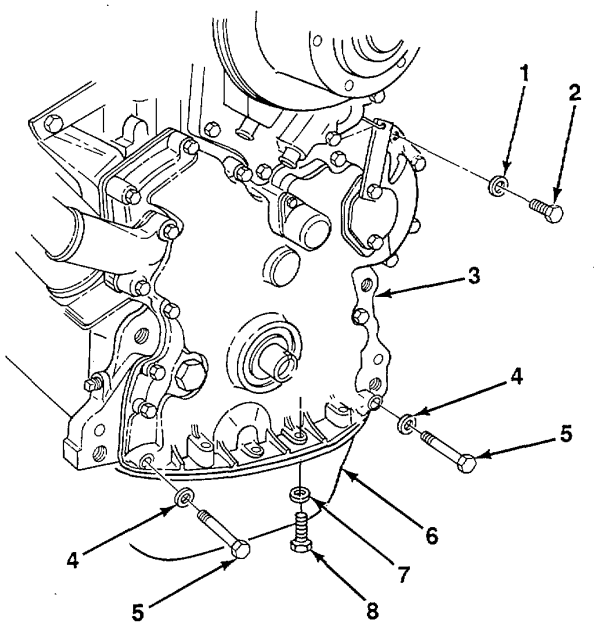
- TM 10-3930-659-20

a. REMOVAL

NOTE

All screws should be tagged to aid during installation. Screws must be installed in the same position on engine oil pan and engine front cover.

1. Remove six screws (8) and lockwashers (7) from engine oil pan (6) and engine front cover (3). D card lockwashers.
2. Remove two screws (5) and washers (4) from Engine front cover (3).
3. Remove ten screws (2) and washers (1) from engine front cover (3).



TA708101

TA708101

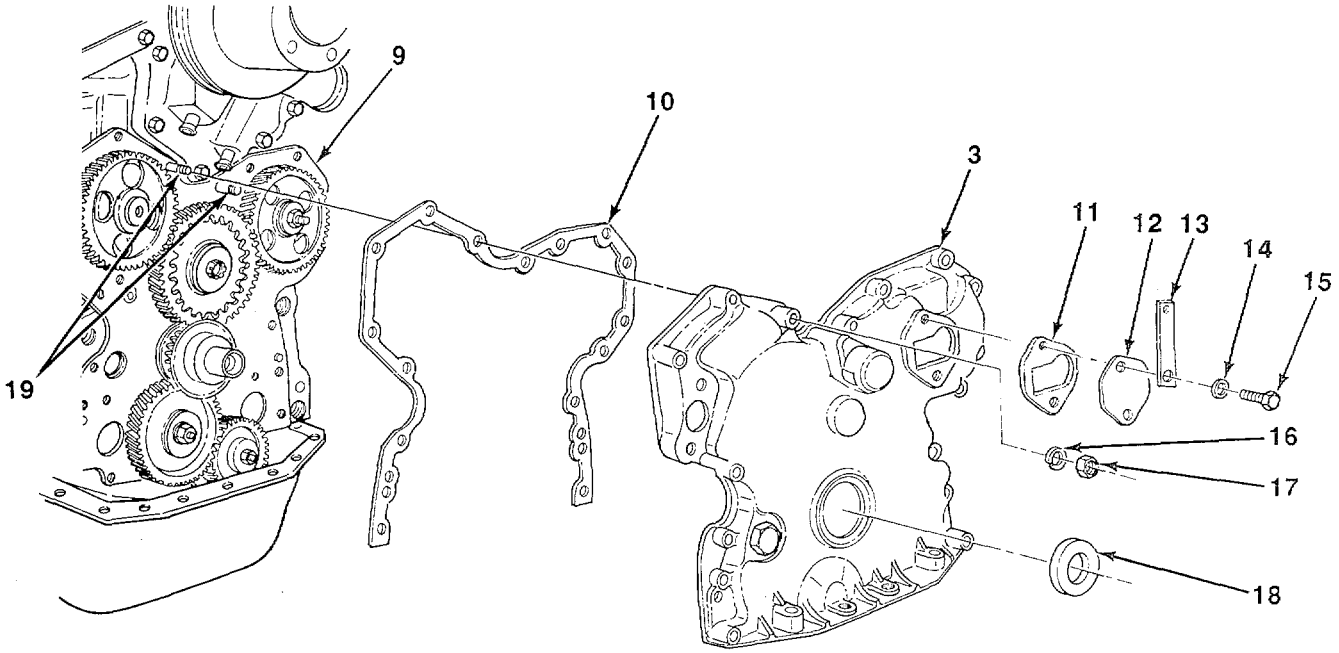
4-14. ENGINE FRONT COVER REPLACEMENT (Con't).

4. Release fuel injection lever spring from spring retaining bracket (13).
5. Remove two nuts (17), lockwashers (16), engine front cover (3), and gasket (10) from two studs (19) and engine block (9). Discard gasket and lockwashers.
6. If damaged, remove two studs (19) from engine block (9).
7. Remove two screws (15), washers (14), spring retaining bracket (13), access cover (12), and gasket (11) from engine front cover (3). Discard gasket.

CAUTION

DO NOT pry or press against engine front cover with excessive force when removing front seal. Engine front cover is made of aluminum and excessive force may cause damage.

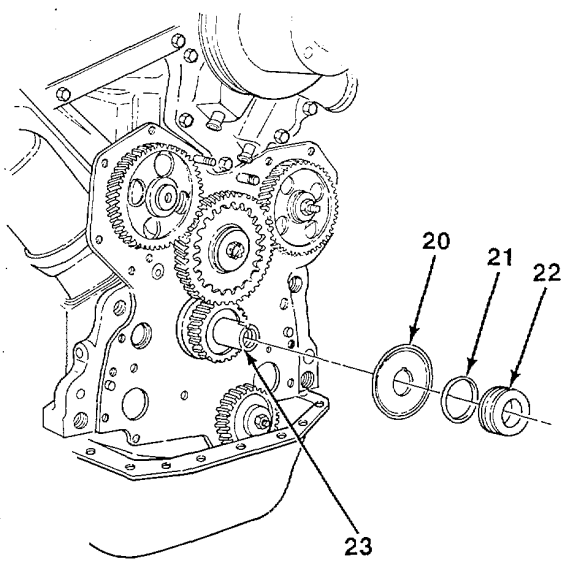
8. Remove front seal (18) from engine front cover (3). Discard front seal.



TA708102

4-14. ENGINE FRONT COVER REPLACEMENT (Con't).

9. Remove wear sleeve (22), preformed packing (21), and slinger (20) from crankshaft (23). Discard preformed packing.



b. INSTALLATION I

1. Install slinger (20), new preformed packing (21), and wear sleeve (22) on crankshaft (23).
2. Apply grease to springloaded lip of new front seal (18).
3. Apply sealing compound to outside edge of new front seal (18) and position front seal in engine front cover (3) with springloaded lip facing rearward.

CAUTION

DO NOT pry or press against engine front cover with excessive force when installing front seal. Engine front cover is made of aluminum and excessive force may cause damage.

4. Using crankshaft front oil seal driver and a hammer, install front seal (18) on engine front cover (3).

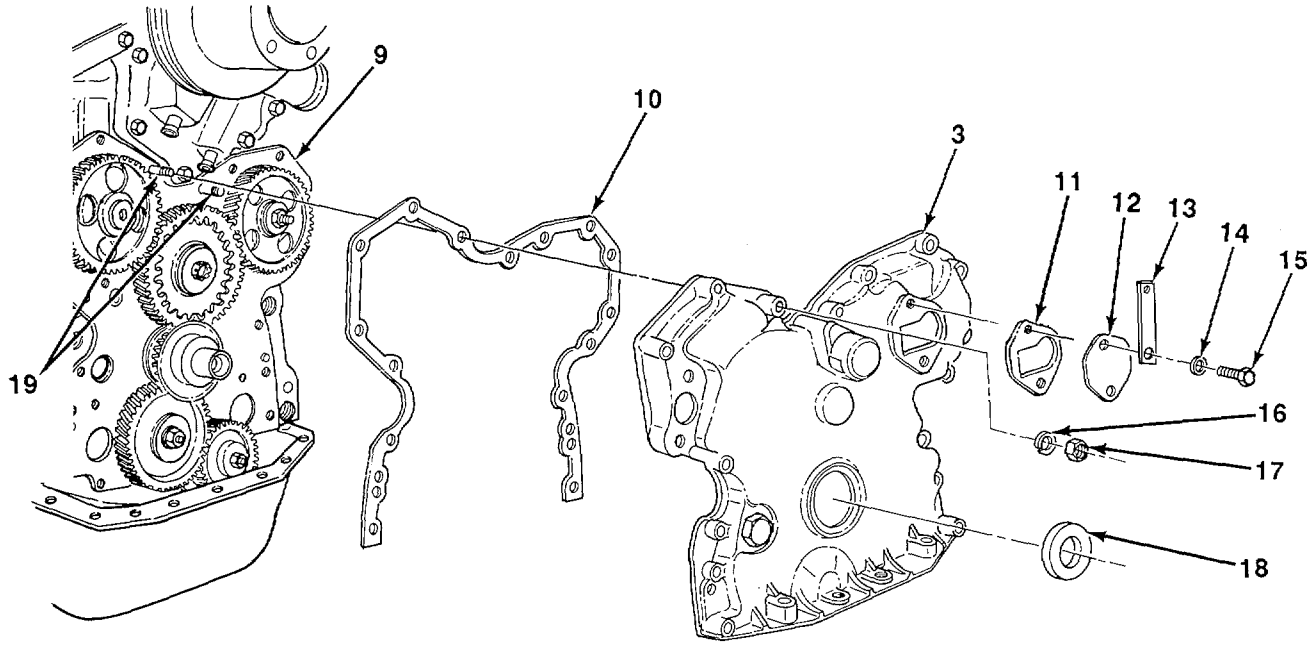
5. Install new gasket (11), access cover (12), and spring retaining bracket (13) on engine front cover (3) with two washers (14) and screws (15). Torque screws to17 lb.-in. (2 N•m).

6. If removed, install two studs (19) on engine block (9).

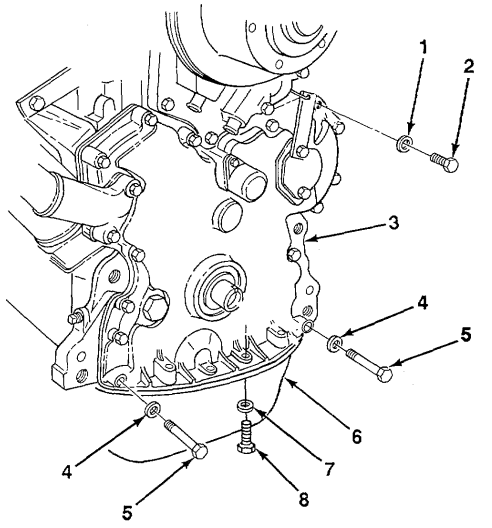
7. Install new gasket (10) and engine front cover (3) on two studs (19) with new lockwashers (16) and nuts (17).

8. Connect fuel injection lever spring to spring retaining bracket (13).

TA708103



9. Install ten washers (1) and screws (2) on engine front cover (3).
10. Install two washers (4) and screws (5) on engine front cover (3).
11. Install six new lockwashers (7) and screws (8) on engine oil pan (6) and engine front cover (3).



TA708104

FOLLOW-ON TASKS:

- Install crankshaft dampener (see paragraph 4-7).
- Install engine oil pressure regulating valve (see paragraph 4-15).
- Install magnetic pickup (see TM 10-3930-659-20).
- Install alternator (see TM 10-3930-659-20).
- Install accelerator cable and spring (see TM 10-3930-659-20).
- Install engine oil filler neck (see TM 10-3930-659-20).

4-15. ENGINE OIL PRESSURE REGULATING VALVE REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

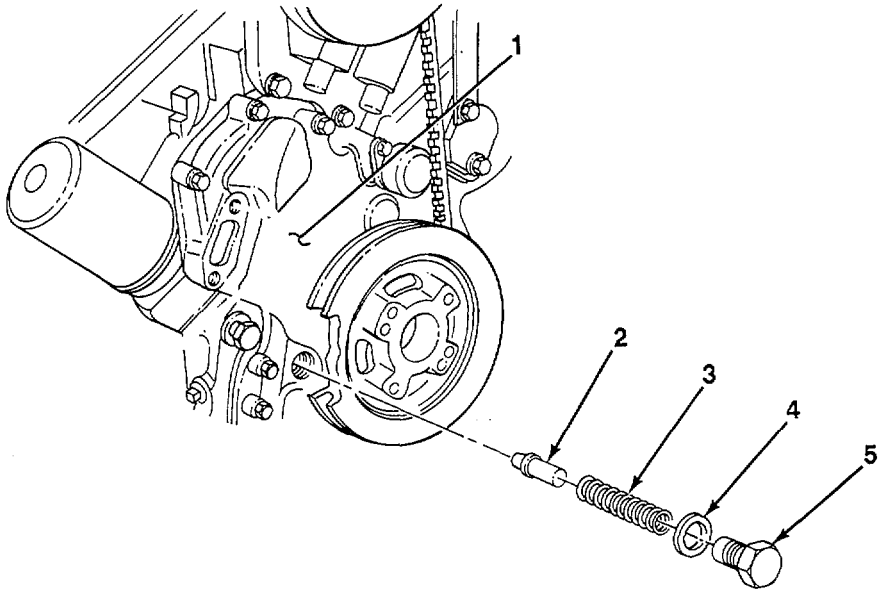
Equipment Conditions:
- Battery disconnect switch in OFF position (see TM 10-3930-659-10).
- Left engine upper sideshield opened (see TM 10-3930-659-10).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

References:
- TM 10-3930-659-10

a. REMOVAL

Remove plug (5), washer (4), spring (3), and engine oil pressure regulating valve (2) from engine timing gear cover (1).



b. INSTALLATION I

Install engine oil pressure regulating valve (2) and spring (3) on engine timing gear cover (1) with washer (4) and plug (5). Torque plug to 70 lb.-ft. (95 N•m).

FOLLOW-ON TASKS:
o Close left engine upper sideshield (see TM 10-3930-659-10).

TA708105

Section II. LUBRICATION SYSTEM MAINTENANCE

4-16. ENGINE OIL COOLER REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Equipment Conditions:
- Engine cooling system drained (see TM 10-3930-659-20).
- Engine oil filter removed (see TM 10-3930-659-20).
- Engine oil cooler tubes and hoses removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Rags (Item 43, Appendix B)
- Two preformed packings

References:
- TM 10-3930-659-20

General Safety Instructions:
- DO NOT perform engine cooling system maintenance unless engine is cold.

4-16. ENGINE OIL COOLER REPLACEMENT (Con't).

a. REMOVAL I

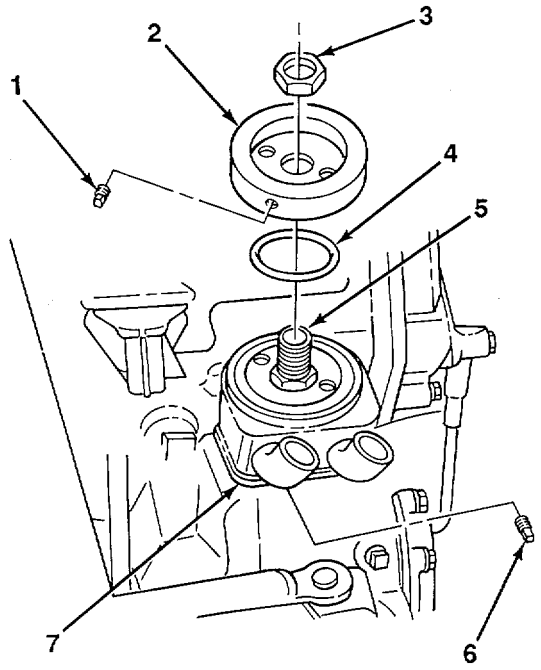
WARNING

Servicing of engine cooling system should only be performed on a cool engine. NEVER remove clamps or hoses when engine is hot. Pressurized steam, hot water, or coolant will cause serious burns.

NOTE

A suitable container should be used to catch any draining antifreeze. Ensure that all spills are properly cleaned.

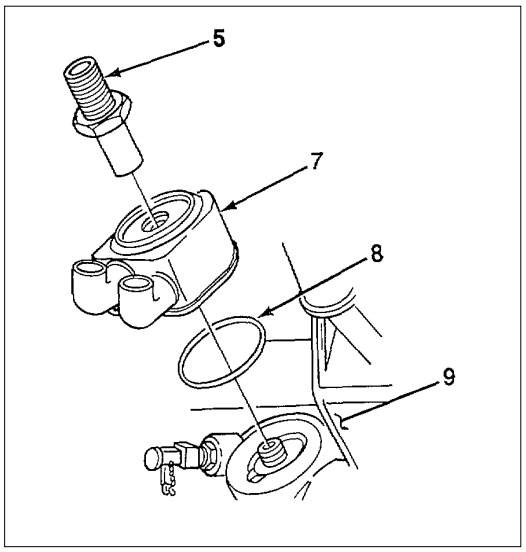
1. Remove drainplug (6) from oil engine cooler (7). Allow antifreeze to drain.
2. Remove nut (3) from nipple (5).
3. Remove adapter (2) from engine oil cooler (7).
4. Remove preformed packing (4) and drainplug (1) from adapter (2). Discard preformed packing.



TA708106

4-16. ENGINE OIL COOLER REPLACEMENT (Con't).

5. Remove nipple (5), engine oil cooler (7), and pre- formed packing (8) from engine block (9). Discard preformed packing.



b. INSTALLATION

1. Install new preformed packing (8) on engine oil cooler (7).
2. Position engine oil cooler (7) on engine block (9) and install nipple (5). Torque nipple to 25 lb.-ft. (34 N.m).
3. Install drainplug (1) and new preformed packing (4) on adapter (2).
4. Position adapter (2) over nipple (5) and on engine oil cooler (7).
5. Install nut (3) on nipple (5). Torque nut to 25 lb.-ft. (34 N.m).
6. Install drainplug (6) on engine oil cooler (7).

FOLLOW-ON TASKS:

- Install engine oil cooler tubes and hoses (see TM 10-3930-659-20).
- Install engine oil filter (see TM 10-3930-659-20).
- Fill engine cooling system (see TM 10-3930-659-20).

TA708107

4-17. ENGINE OIL PAN REPLACEMENT.

This task covers:
a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
- Engine oil drained (see LO 10-3930-659-12)
- Engine oil pan heater and thermostat removed (see TM 10-3930-659-20)
- Fuel tank removed (see paragraph 4-26).

Materials/Parts:
- Marker tags (Item 49, Appendix B)
- One gasket
- Eight lockwashers

Personnel Required: Two

Tools/Test Equipment:
- General mechanic's tool kit (item 71, Appendix E)
- Hydraulic jack, 10 ton (Item 39, Appendix E)
- Torque wrench, 0-175 lb.-ft (Item 81, Appendix E)

References:
- LO 10-3930-659-12
- TM 10-3930-659-10
- TM 10-3930-659-20

a. REMOVAL

1. Remove nut (13), plug (14), connector (15), and engine oil drain tube (12) from forklift truck.
2. Remove engine oil drain tube (12) from engine oil pan (3).
3. Position hydraulic jack under engine oil pan (3). Raise jack until weight of engine oil pan is supported.

NOTE

Tag screws to aid during installation. Screws are of different lengths and hardness, and must be installed in the same position on engine oil pan.

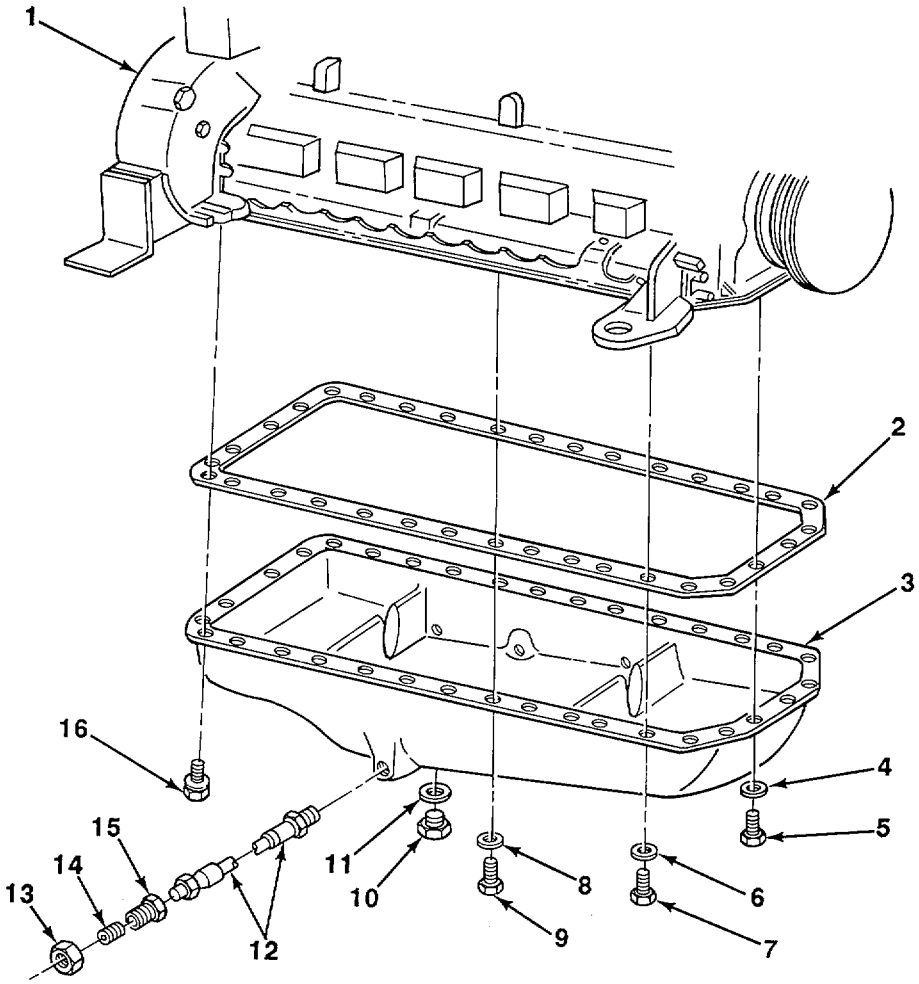
4. Remove four screws (5), lockwashers (4), two screws (7), and lockwashers (6) from engine oil pan (3) and engine front cover. Discard lockwashers.
5. Remove two screws (9) and lockwashers (8) from engine oil pan (3) and engine block (1). Discard lockwashers.
6. Remove 28 screws (16) from engine oil pan (3) and engine block (1).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

7. Using hydraulic jack, lower and remove engine oil pan (3) from engine block (1).

4-17. ENGINE OIL PAN REPLACEMENT (Con't).



8. Remove gasket (2) from engine block (1). Discard gasket.

9. Remove plug (10) and washer (11) from engine oil pan (3).

TA708108

4-17. ENGINE OIL PAN REPLACEMENT (Con't).

b. INSTALLATION

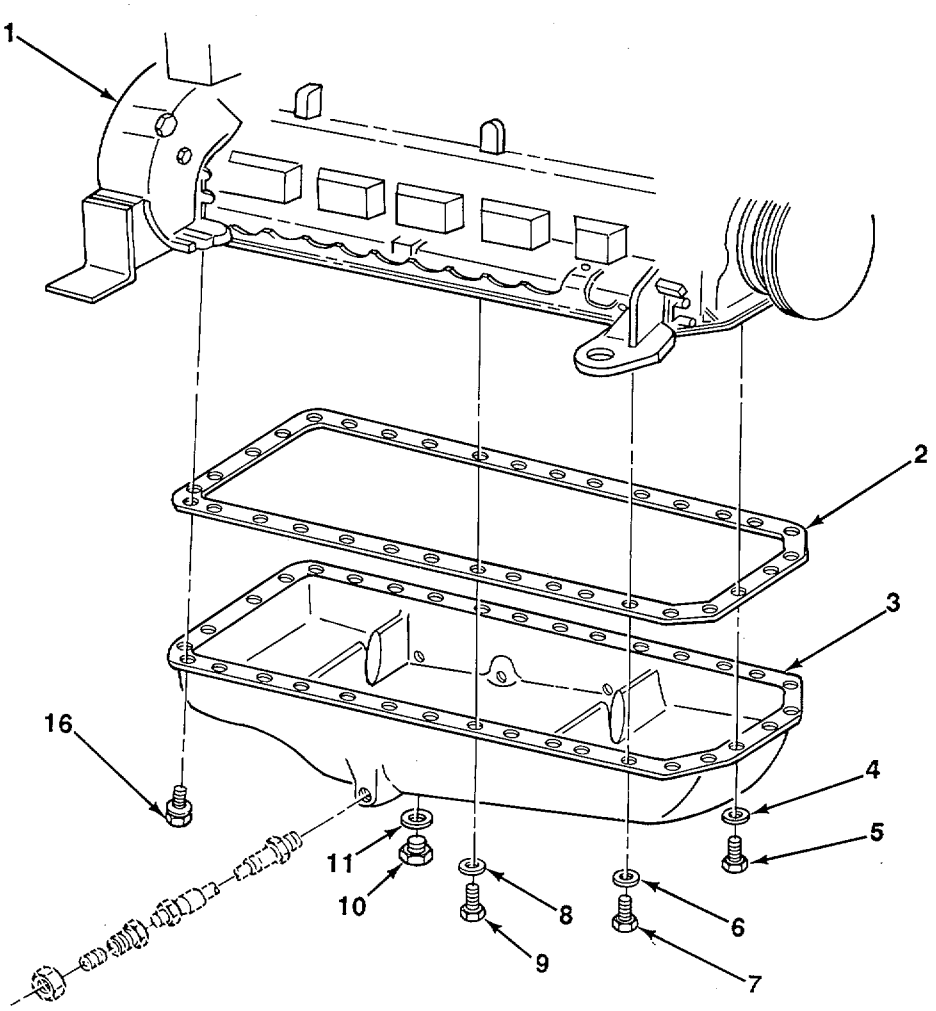
1. Install washer (11) and plug (10) on engine oil pan (3).
2. Position hydraulic jack under engine oil pan (3).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

3. Position new gasket (2) and engine oil pan (3) on engine block (1).
4. Loosely install 28 screws (16) on engine oil pan (3) and engine block (1).
5. Loosely install two new lockwashers (8) and screws (9) on engine oil pan (3) and engine block (1).
6. Install two new lockwashers (6), screws (7), four new lockwashers (4), and screws (5) on engine oil pan (3) and engine front cover. Torque screws to 23 lb.-ft. (31 Nom).
7. Torque screws (9 and 16) to 35 lb.-ft. (47 Nom).
8. Lower and remove hydraulic jack from under engine oil pan (3).

4-17. ENGINE OIL PAN REPLACEMENT (Con't).



FOLLOW-ON TASKS:

- Install fuel tank (see paragraph 4-26).
- install engine oil pan heater and thermostat (see TM 10-3930-659-20).
- Fill engine with engine oil (see TM 10-3930-659-10).

TA708109

4-18. ENGINE OIL PUMP INTAKE TUBE REPLACEMENT.

This task covers:
a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
• Engine oil pan removed (see paragraph 4-17).

Materials/Parts:
• One preformed packing

Tools/Test Equipment:
• General mechanic's tool kit (Item 71, Appendix E)
• Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

a. REMOVAL

1. Remove two screws (4), washers (5), and engine oil pump intake tube (1) from engine oil pump (3).

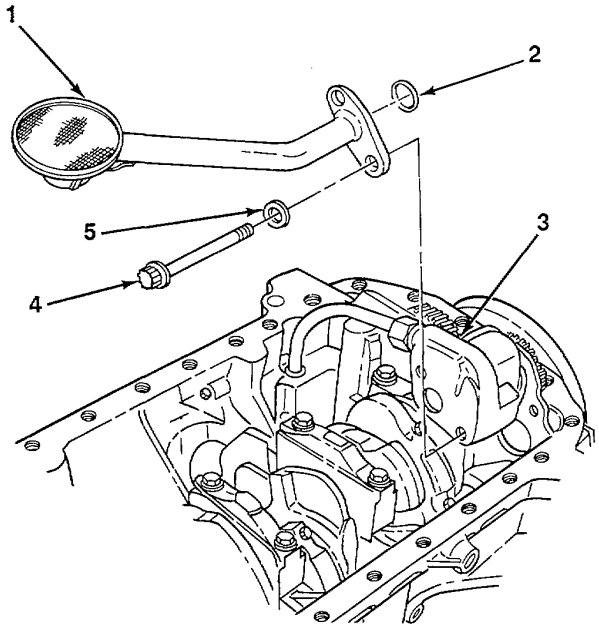
NOTE
Preformed packing may stay in engine oil pump or remain with engine oil pump inlet tube.

2. Remove preformed packing (2) from engine oil pump (3) or engine oil pump intake tube (1). Dis card preformed packing.

b. INSTALLATION

1. Install preformed packing (2) on engine oil pump Intake tube (1).

2. Install engine oil pump intake tube (1) on engine oil pump (3) with two washers (5) and screws (4). Torque screws to 35 lb.-ft. (47 N.m).



TA708110

FOLLOW-ON TASKS:
• Install engine oil pan (see paragraph 4-17).

4-19. ENGINE OIL PUMP REPLACEMENT.

This task covers:
a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
- Engine oil pump intake tube removed (see paragraph 4-18).

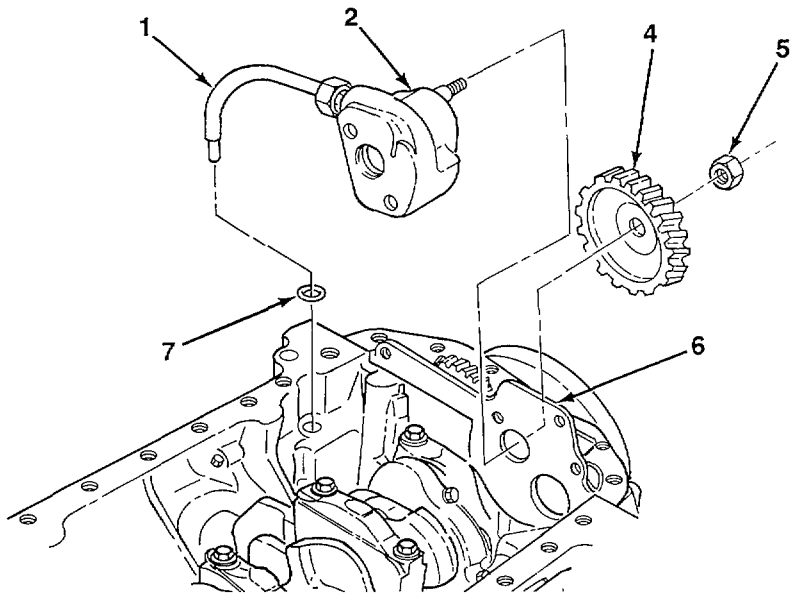
Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Inside caliper micrometer (Item 8, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Die and tap threading set (Item 68, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One jamnut
- One preformed packing

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. REMOVAL

1. Remove jamnut (5) and drive gear (4) from engine (6). Discard jamnut.
2. Remove engine oil pump (2) with outlet tube (1) from engine (6).
3. Remove preformed packing (7) from engine (6). Discard preformed packing.

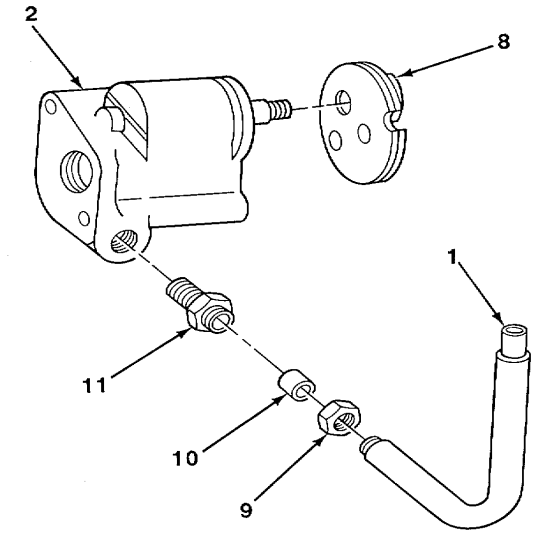


TA708111

4-19. ENGINE OIL PUMP REPLACEMENT (Con't).

4. Remove cover (8) from engine oil pump (2).

5. Remove outlet tube (1), nut (9), sleeve (10), and adapter (11) from engine oil pump (2).



TA708112

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean cover, engine oil pump, and outlet tube with dry cleaning solvent and dry with clean rags.

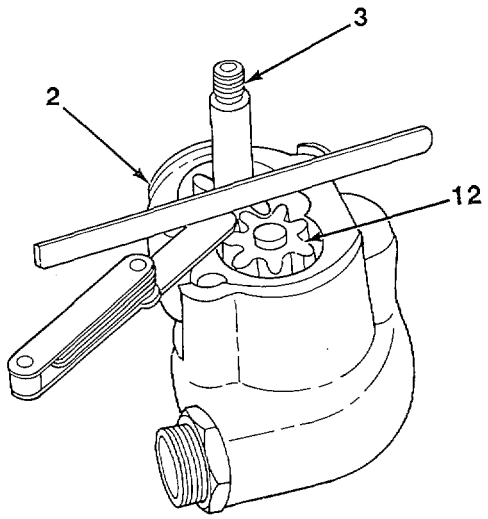
2. Inspect parts for cracks, bends, warped mating surfaces, and damaged threads. Repair damaged threads with die and tap threading set.

4-19. ENGINE OIL PUMP REPLACEMENT (Con't).

NOTE

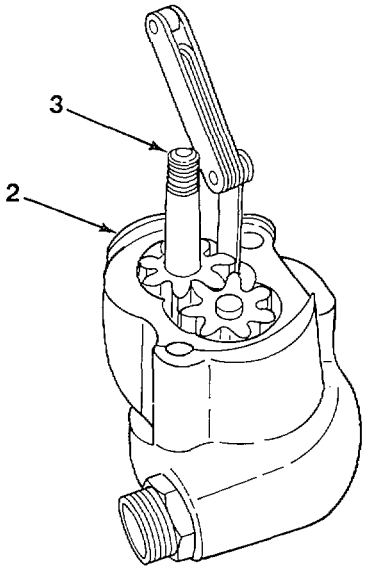
If any measurement in steps 3 through 10 does not meet specification, replace engine oil pump.

3. Using feeler gage and ruler, measure clearance between drive shaft spur gear (3) and engine oil pump (2). Maximum allowable clearance is 0.0085 in. (0.2159 mm).



4. Using feeler gage, measure clearance between each tooth of drive shaft spur gear (3) and engine oil pump (2), and between each tooth of spur gear (12) and engine oil pump. Maximum allowable clearance is 0.009 in. (0.2286 mm).

5. Remove drive shaft spur gear (3) from engine oil pump (2).



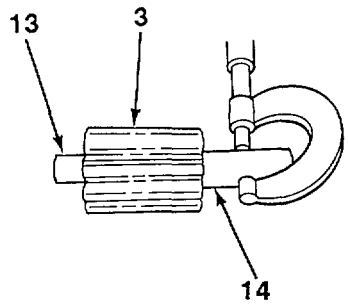
TA708113

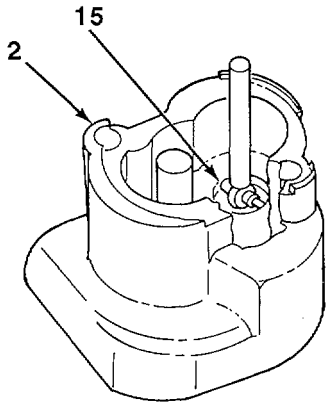
4-19. ENGINE OIL PUMP REPLACEMENT (Con't).

6. Using outside caliper micrometer, measure outside diameter of long end (14) of drive shaft spur gear (3). Minimum allowable measurement is 0.629 in. (15.9766 mm).

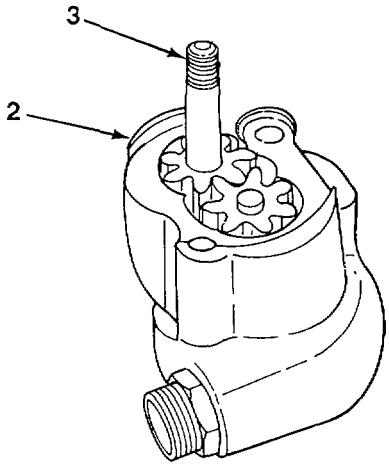
7. Using outside caliper micrometer, measure outside diameter of short end (13) of drive shaft spur gear (3). Minimum allowable measurement is 0.4815 in. (12.2301 mm).

8. Using inside caliper micrometer, measure inside diameter of drive shaft spur gear bore (15) of engine oil pump (2). Maximum allowable measurement is 0.4850 in. (12.3190 mm).





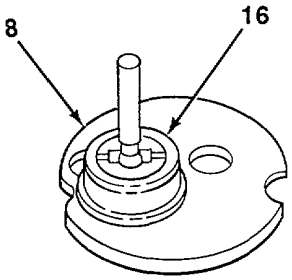
9. Install drive shaft spur gear (3) in engine oil pump (2).



TA708114

4-19. ENGINE OIL PUMP REPLACEMENT (Con't).

10. Using inside caliper micrometer, measure inside diameter of drive shaft spur gear bore (16) of cover (8). Maximum allowable measurement is 0.636 in. (16.154 mm).

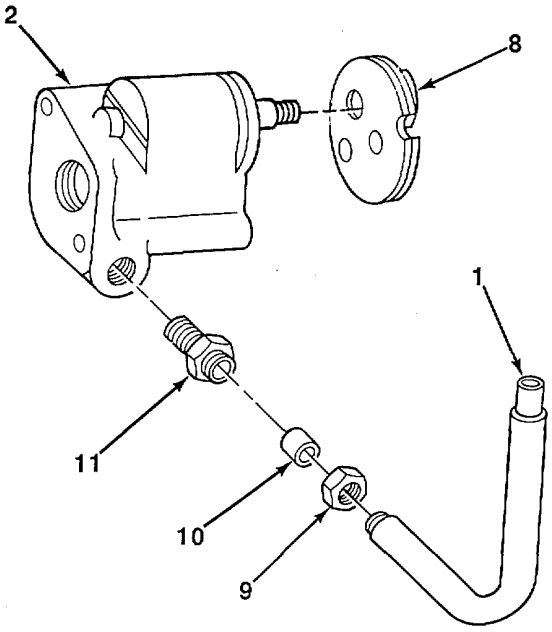


C. INSTALLATION

1. Install adapter (11) in engine oil pump (2).

2. Install sleeve (10), nut (9), and outlet tube (1) on engine oil pump (2).

3. Install cover (8) on engine oil pump (2).



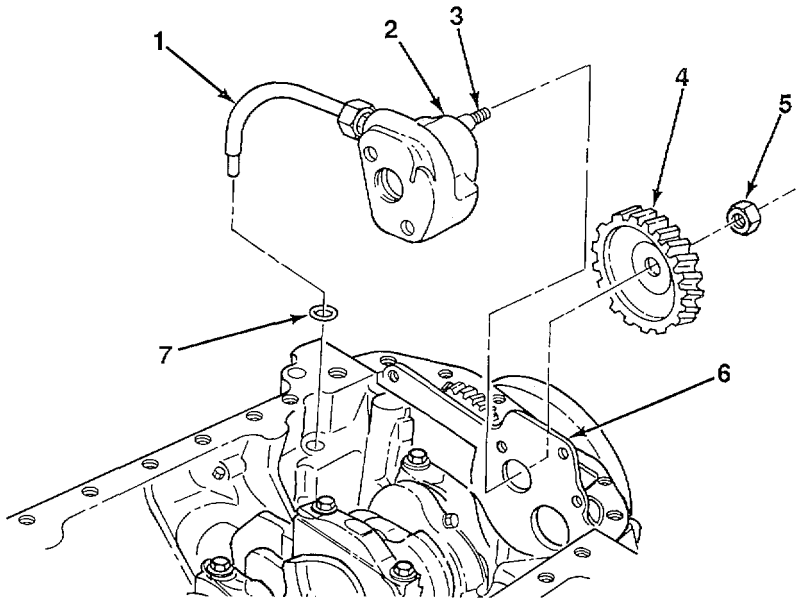
TA708115

4-19. ENGINE OIL PUMP REPLACEMENT (Con't).

4. Install new preformed packing (7) on engine (6).

5. Position engine oil pump (2) and outlet tube (1) on engine (6).

6. Install drive gear (4) on drive shaft spur gear (3) with new jamnut (5). Torque jamnut to 55 lb.-ft. (75 N.m). Stake jamnut in three places.



FOLLOW-ON TASKS:

- Install engine oil pump intake tube (see paragraph 4-18).

TA708116

Section III. EXHAUST SYSTEM MAINTENANCE

4-20. EXHAUST ELBOW AND EXHAUST ADAPTER REPLACEMENT.

This task covers:

a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
- Muffler removed (see TM 10-3930-659-20)
- Torque wrench, 0-175 lb.-ft

References:
- TM 10-3930-659-20

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E) (Item 81, Appendix E)

General Safety Instructions:
- DO NOT perform engine cooling system maintenance unless engine is cold.

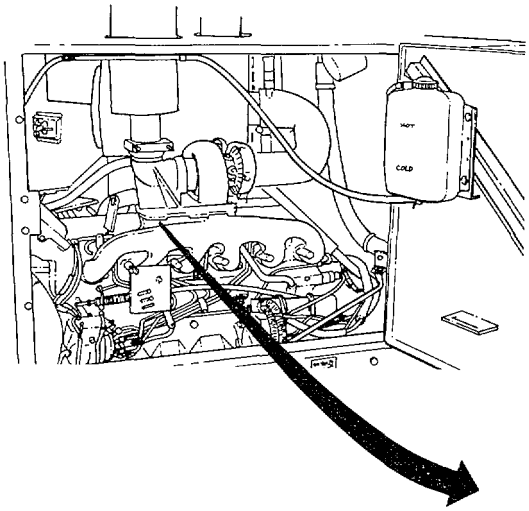
4-20. EXHAUST ELBOW AND EXHAUST ADAPTER REPLACEMENT (Con't).

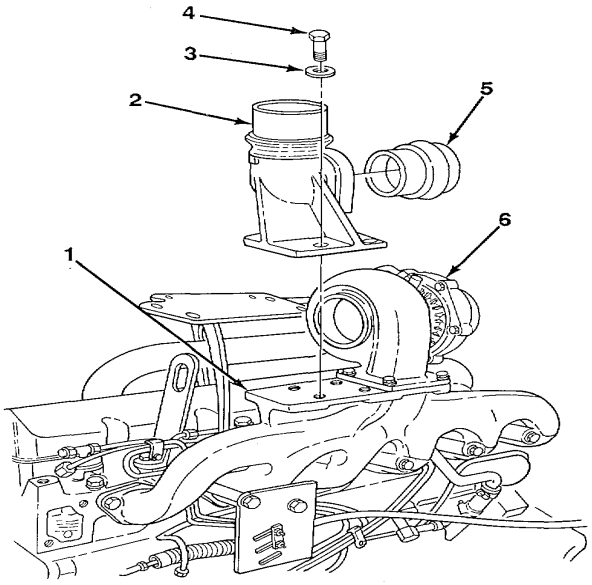
a. REMOVAL

WARNING

Before attempting to replace any part of exhaust system, allow exhaust system to cool. Failure to follow this warning may result in serious burns.

1. Remove four screws (4) and washers (3) from turbocharger exhaust elbow (2) and exhaust manifold (1).
2. Remove turbocharger exhaust elbow (2) and exhaust adapter (5) from exhaust manifold (1) and turbocharger (6).





b. INSTALLATION

1. Position exhaust adapter (5) in turbocharger (6).
2. Install turbocharger exhaust elbow (2) on exhaust adapter (5) and exhaust manifold (1) with four washers (3) and screws (4). Torque screws to 35 lb.-ft. (47 Nrm).

FOLLOW-ON TASKS:
• Install muffler (see TM 10-3930-659-20).

TA708117

4-21. EXHAUST MANIFOLD REPLACEMENT.

This task covers:
a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
- Turbocharger removed (see paragraph 4-25).
- Exhaust elbow and exhaust adapter removed (see paragraph 4-20).

Materials/Parts:
- Marker tags (Item 49, Appendix B)
- Six gaskets

Personnel Required: Two

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

General Safety Instructions:
- DO NOT perform engine cooling system maintenance unless engine is cold.

a. REMOVAL

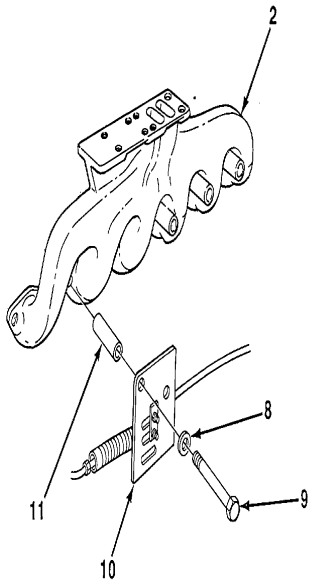
WARNING

Before attempting to replace any part of exhaust system, allow exhaust system to cool. Failure to follow this warning may result in serious burns.

NOTE

Tag screws to aid during installation. Screws are different lengths and must be installed in the same position on exhaust manifold.

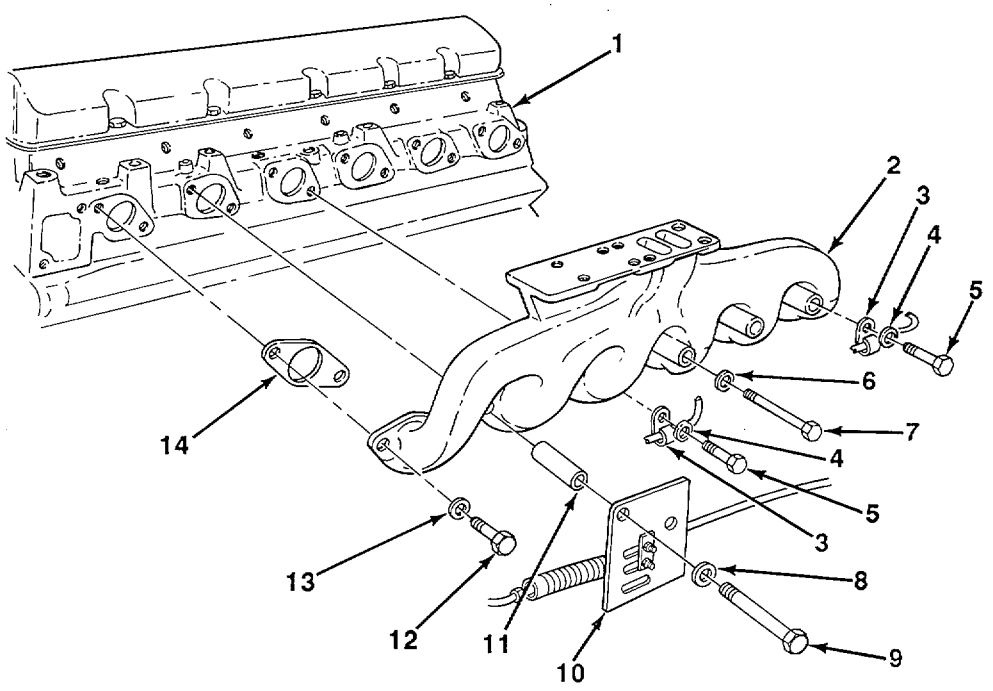
1. Remove two screws (9), washers (8), bracket (10), and two spacers (11) from exhaust manifold (2).



TA708118

4-21. EXHAUST MANIFOLD REPLACEMENT (Con't).

2. Remove two screws (5), washers (4), and clamps (3) from exhaust manifold (2).
3. Remove three screws (7) and washers (6) from exhaust manifold (2).
4. Remove five screws (12), washers (13), exhaust manifold (2), and six gaskets (14) from cylinder head (1). Discard gaskets.



b. INSTALLATION

1. Install six new gaskets (14) and exhaust manifold (2) on cylinder head (1) with five washers (13) and screws (12).
2. Install three washers (6) and screws (7) on exhaust manifold (2).
3. Install two clamps (3), washers (4), and screws (5) on exhaust manifold (2).
4. Install two spacers (11) and bracket (10) on exhaust manifold (2) with two washers (8) and screws (9).
5. Torque screws (5, 7, and 9) to 35 lb.-ft. (47 Nom).

FOLLOW-ON TASKS:

- Install exhaust elbow and exhaust adapter (see paragraph 4-20).
- Install turbocharger (see paragraph 4-25).

TA708119

Section IV. FUEL SYSTEM MAINTENANCE

4-22. LEAK-OFF TUBES AND FUEL LINES REPLACEMENT.

This task covers:

a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
- Exhaust manifold removed (see paragraph 4-21).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)

Materials/Parts:
- Rags (Item 43, Appendix B)

General Safety Instructions:
- DO NOT perform this procedure near fire, flames, or sparks.

WARNING

Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel lines. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

CAUTION

DO NOT force or bend fuel lines when removing or installing. If fuel lines are bent, leaks may develop and fuel lines will be damaged.

NOTE

A suitable container should be used to catch any draining fuel. Ensure that all spills are properly cleaned.

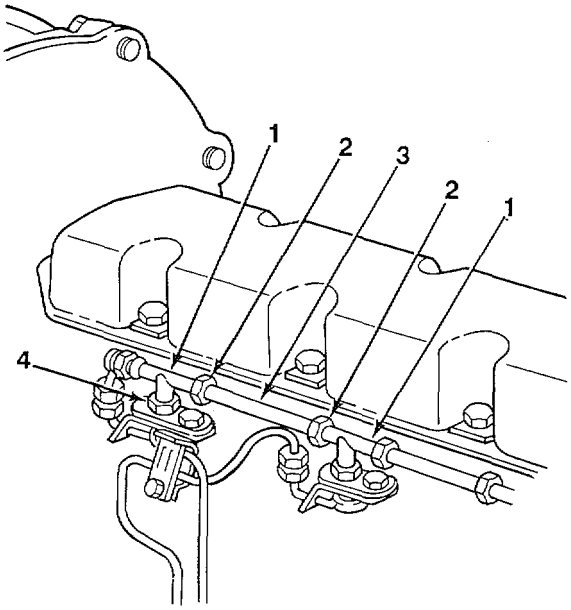
4-22. LEAK-OFF TUBES AND FUEL LINES REPLACEMENT (Con't).

a. REMOVAL

NOTE

Four leak-off tubes are removed the same way. One leak-off tube is illustrated.

1. Loosen nut (4).
2. Loosen two nuts (2) and remove leak-off tube (3) from two tees (1).



NOTE

One leak-off tube Is permanently connected to fuel injection pump fuel line. Perform step 3 to remove this leak-off tube.

3. Loosen nut (12) and remove fuel line (13) and leak-off tube (7) from engine.

NOTE

Five clamps hold fuel line assembly. Remove clamps as necessary to remove fuel lines.

4. Remove screw (9) and clamp (8) from engine.

NOTE

Fuel lines, numbers one through six, are removed the same way. Fuel line number two is illustrated.

5. Remove nut (14) from fuel injection nozzle (6).

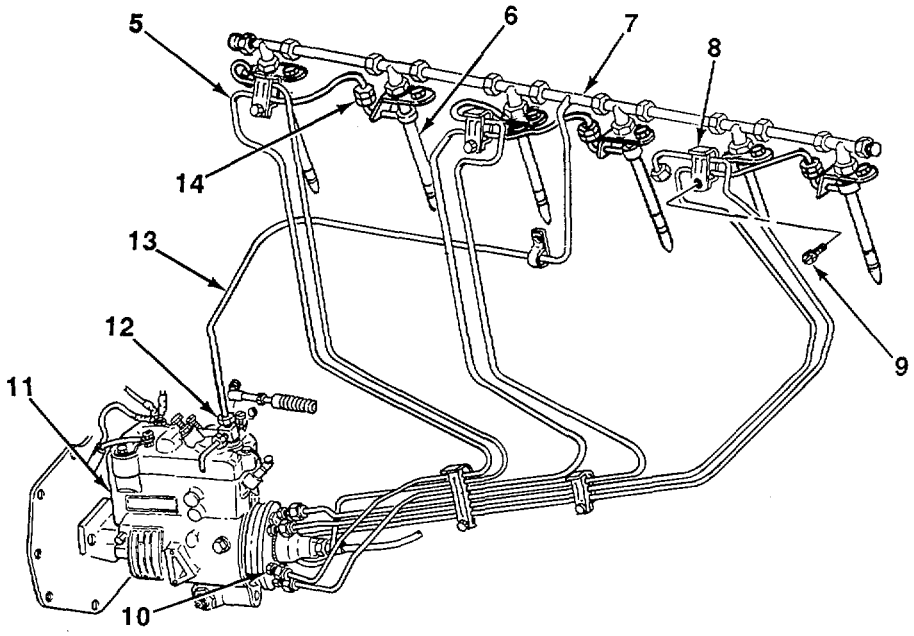
CAUTION

Ensure that fuel injection pump fitting does not turn when removing fuel line nuts. Damage to fuel injection pump may result if fitting turns.

6. Remove nut (10) and fuel line (5) from fuel injection pump (11).

TA708164

4-22. LEAK-OFF TUBES AND FUEL LINES REPLACEMENT (Con't).



b. INSTALLATION

CAUTION

Ensure that fuel injection pump fitting does not turn when installing fuel line nuts. Damage to fuel injection pump may result if fitting turns.

NOTE

Fuel lines, numbers one through six, are installed the same way. Fuel line number two is illustrated.

1. Install fuel line (5) on fuel injection nozzle (6) with nut (14).
2. Install fuel line (5) on fuel injection pump (11) with nut (10).

NOTE

Install clamps as necessary.

3. Install clamp (8) on engine with screw (9).

NOTE

One leak-off tube is permanently connected to fuel injection pump fuel line. Perform step 4 to install this leak-off tube.

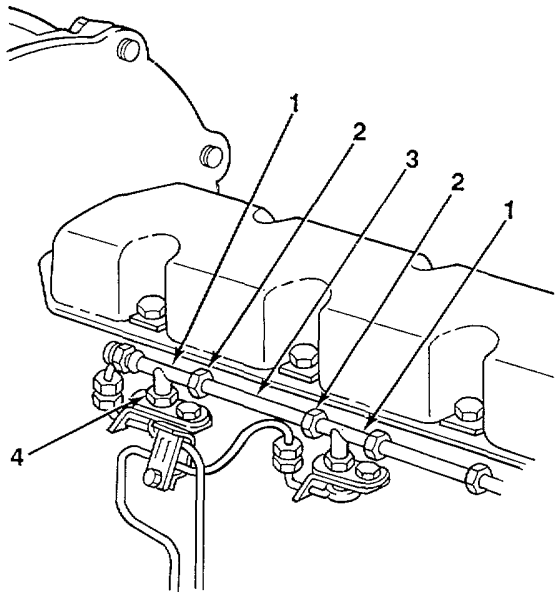
4. Position fuel line (13) and leak-off tube (7) on engine. Tighten nut (12).

4-22. LEAK-OFF TUBES AND FUEL LINES REPLACEMENT (Con't).

NOTE

Four leak-off tubes are installed the same way. One leak-off tube is illustrated.

5. Install leak-off tube (3) on two tees (1) and tighten two nuts (2).
6. Tighten nut (4).



FOLLOW-ON TASKS:

- Install exhaust manifold (see paragraph 4-21).

TA708166

4-23. FUEL INJECTION NOZZLE REPLACEMENT.

This task covers:

a. Removal
b. Testing and Adjustment
c. Installation

INITIAL SETUP:

Equipment Conditions:
- Leak-off tubes and fuel lines removed (see paragraph 4-22).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Fuel injection nozzle puller (Item 48, Appendix E)
- Torque wrench, 0-300 lb.-in. (Item 80, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Scrub brush (Item 5, Appendix B)
- Carbon removing compound (Item 10, Appendix B)
- Diesel fuel (Item 28, Appendix B)
- Rags (Item 43, Appendix B)
- One preformed packing

References:
- TM 9-4910-409-12

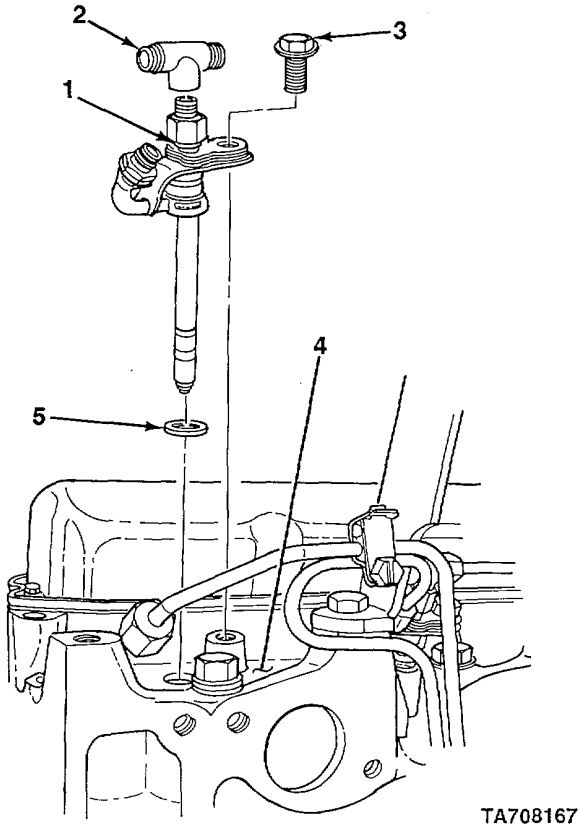
General Safety Instructions:
- DO NOT perform this procedure near fire, flames, or sparks.
- Carbon removing compound can cause serious burns and blindness. Use only with protective clothing.

WARNING

Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel injection nozzles. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

NOTE

All six fuel injection nozzles are removed, tested, adjusted, and installed the same way. One fuel injection nozzle is illustrated.



a. REMOVAL

1. Using a clean rag, clean area around cylinder head (4) and fuel injection nozzle (1).
2. Remove tee (2) from fuel injection nozzle (1).
3. Remove screw (3) from fuel injection nozzle (1) and cylinder head (4).
4. Using fuel injection nozzle puller, remove fuel injection nozzle (1) and preformed packing (5) from cylinder head (4). Discard preformed packing.

4-23. FUEL INJECTION NOZZLE REPLACEMENT (Con't).

b. TESTING AND ADJUSTMENT

WARNING

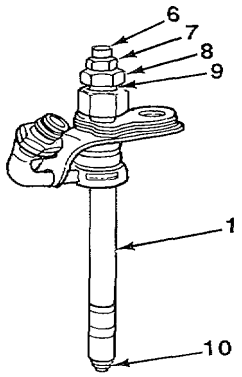
• Carbon removing compound Is a corrosive liquid. If splashed in eyes, it can cause blindness. If splashed on skin, it can cause serious burns. Always wear protective goggles or lenses, rubber apron, and rubber gloves. If accidentally splashed in eyes or on skin, flush with clean, cool water. Refer to FM 21-11 for first aid information and seek medical attention Immediately.

• Diesel fuel is combustible. DO NOT smoke or allow open flame nearby. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

CAUTION

DO NOT scrape or otherwise damage protective coating on fuel injection nozzle body above carbon washer groove. Carbon removing compound must not contact fuel injection nozzle body above carbon washer groove. DO NOT clean fuel injection nozzle body with motor driven brush. Any of these actions will damage fuel injection nozzle.

1. Remove carbon from fuel injection nozzle tip (10) with carbon removing compound. Rinse with clean diesel fuel.
2. Clean fuel injection nozzle tip (10) with a scrub brush and clean diesel fuel.
3. Test opening pressure of fuel injection nozzle (1) (see TM 9-4910-409-12). Opening pressure must be 3650-3750 psi (25167-25856 kPa). If opening pressure is within specification, go to step 14.
4. Loosen adjusting nut (8) and pressure adjusting screw (9).
5. While holding pressure adjusting screw (9), loosen locknut (7) and lift adjusting screw (6).
6. Tighten lift adjusting screw (6) as far as it will go into pressure adjusting screw (9).



TA708168

4-23. FUEL INJECTION NOZZLE REPLACEMENT (Con't).

7. Loosen lift adjusting screw (6) out of pressure adjusting screw (9) one full turn.

8. If opening pressure measured in step 3 was too low, turn pressure adjusting screw (9) clockwise to increase opening pressure. If opening pressure was too high, turn pressure adjusting screw counterclockwise to decrease opening pressure. Repeat step 3.

9. Loosen lift adjusting screw (6) out of pressure adjusting screw (9) one-half turn. Repeat step 3.

10. If opening pressure is still not within specification, repeat step 9.

11. If correct opening pressure cannot be reached after several tries, replace fuel injection nozzle.

12. Hold pressure adjusting screw (9) to keep from turning and torque locknut (7) to 42 lb.-in. (5 N.m).

13. Hold pressure adjusting screw (9) to keep from turning and torque adjusting nut (8) to 84 lb.-in. (9 N-m).

NOTE

If spray pattern is incorrect or fuel injection nozzle leaks or chatters, replace fuel injection nozzle.

14. Test spray pattern of fuel injection nozzle (1) (see TM 9-4910-409-12). Spray pattern should be finely atomized, even, and cone-shaped without gaps or irregularities.

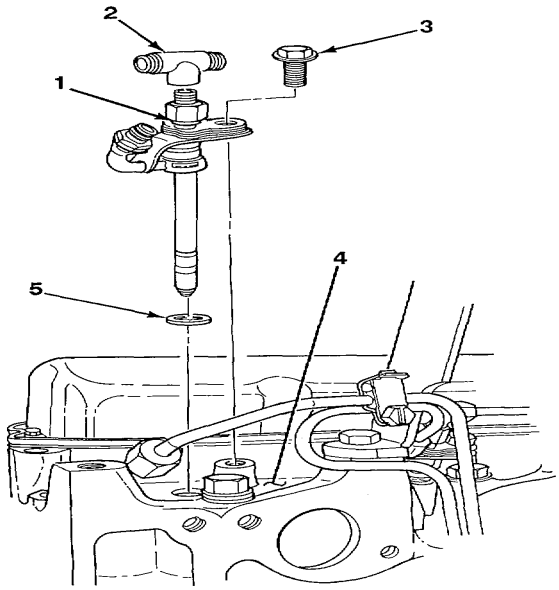
15. Test leakage of fuel injection nozzle (1) (see TM 9-4910-409-12). Leakage from return end of fuel injection nozzle must not exceed 3-10 drops in 30 seconds at 1500 psi (10343 kPa).

16. Test chatter of fuel injection nozzle (1) (see TM 9-4910-409-12). Fuel injection nozzle should chatter softly and consistently. An occasional miss is acceptable.

4-23. FUEL INJECTION NOZZLE REPLACEMENT (Con't).

c. INSTALLATION

1. Install new preformed packing (5) on fuel injection nozzle (1).
2. Position fuel injection nozzle (1) in cylinder head (4) with a slight twisting motion until fuel injector nozzle is seated.
3. Install tee (2) on fuel injection nozzle (1).
4. Loosely install leak-off tubes and fuel lines (see paragraph 4-22).
5. Install screw (3) on fuel injection nozzle (1). Torque screw to 23 lb.-ft. (31 N.m).



TA708169

FOLLOW-ON TASKS:

- Tighten leak-off tubes and fuel lines (see paragraph 4-22)

4-24. FUEL INJECTION PUMP REPLACEMENT.

This task covers:

a. Setting to Top Dead Center (TDC)
b. Removal
c. Installation

INITIAL SETUP:

Equipment Conditions:
- Fuel injection pump terminal leads removed (see TM 10-3930-659-20)
- Accelerator cable and spring removed (see TM 10-3930-659-20).
- Fuel injection pump-to-fuel tank fuel line and fittings removed (see TM 10-3930-659-20).
- Fuel filter housing-to-fuel injection pump fuel line and fittings removed (see TM 10-3930-659-20).
- Leak-off tubes and fuel lines removed (see paragraph 4-22).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Flywheel turning tool (Item 25, Appendix E)
- Timing pin (Item 69, Appendix E)
- Fuel injection pump shaft removal tool (Item 53, Appendix E)
- Torque wrench, 0-300 lb.-in Item 80, Appendix E)
- Torque wrench, 0-175 lb.-ft Item 81, Appendix E)
- Fuel injection pump pipe driver (Figure C-2, Appendix C)

Materials/Parts:
- Rags (Item 43, Appendix B)
- Two gaskets
- Three lockwashers

Personnel Required: Two

References:
- TM 10-3930-659-20

General Safety Instructions:
- DO NOT perform this procedure near fire, flames, or sparks.

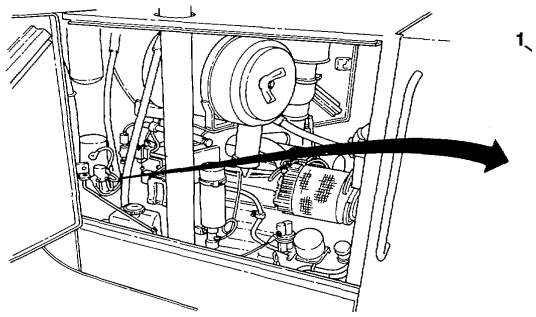
WARNING

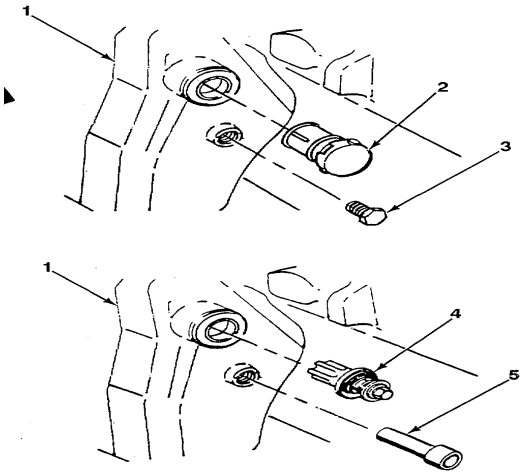
Diesel fuel is combustible. DO NOT smoke or allow open flame near fuel injection pump. Failure to follow this warning will result in death or serious injury to personnel. If you are burned, immediately seek medical aid.

4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).

a. SETTING TO TOP DEAD CENTER (TDC)

1. Remove plugs (2 and 3) from engine (1).





2. Install flywheel turning tool (4) on engine (1).
3. Turn flywheel turning tool (4) clockwise until timing pin (5) can be installed on engine (1) and engages flywheel.
4. Remove two screws (11), cover (10), and gasket (9) from fuel injection pump (6). Discard gasket.
5. Note timing marks (7 and 8).
   (a) If timing mark (7) is visible, No. 1 piston is at top dead center (TDC) on the compression stroke.
   (b) If timing mark (7) is not visible, perform step 6.

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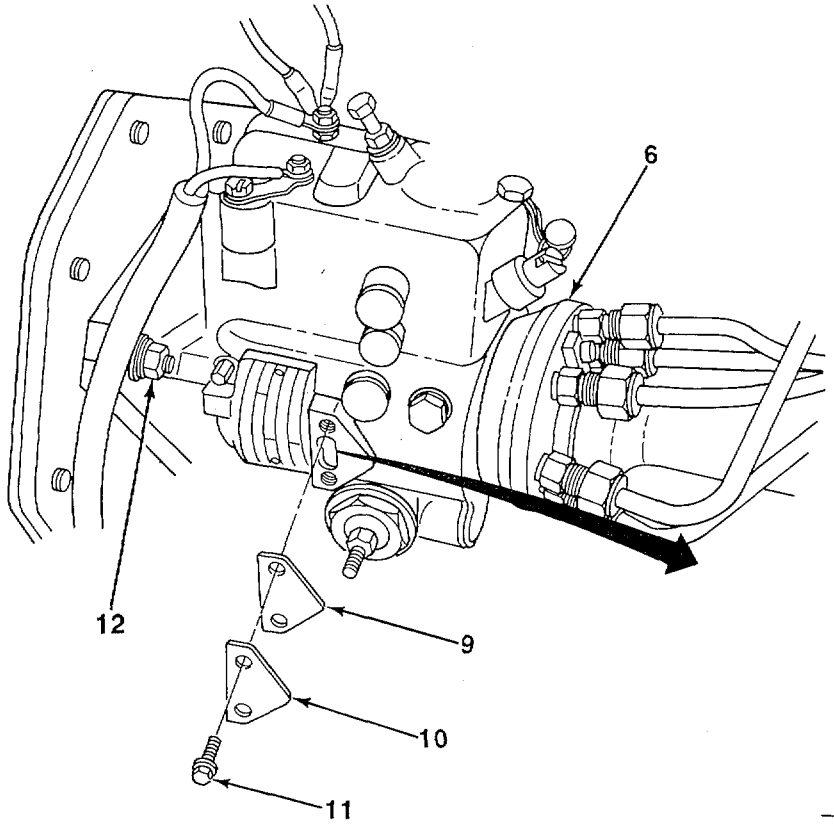
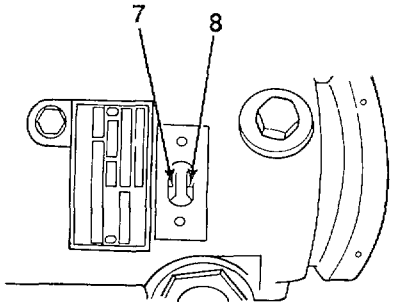
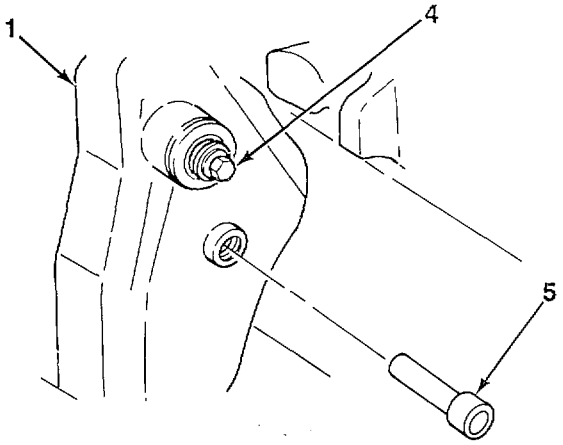
4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).





6. Remove timing pin (5) and, using flywheel turning tool (4), rotate flywheel one complete turn to place No. 1 piston at TDC. Install timing pin.
7. Check that timing mark (7) is alined with timing mark (8). If timing marks are not alined, loosen three nuts (12) and rotate fuel injection pump (6) until marks are alined. Torque nuts to 20 lb.-ft. (27 N•m).



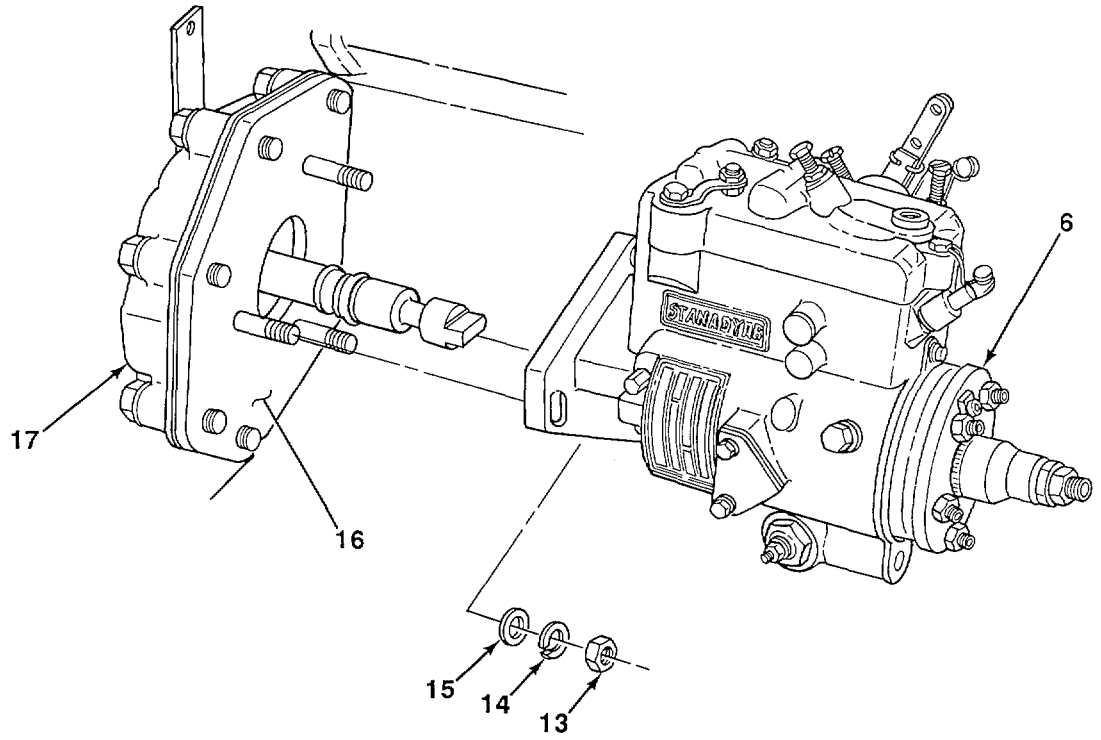
4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).

b. REMOVAL

NOTE

Fuel injection pump shaft will remain in engine assembly when fuel injection pump is removed.

1. Mark fuel injection pump (6) and front plate (16) to aid during installation.
2. Remove three nuts (13), lockwashers (14), washers (15), and fuel injection pump (6) from front plate (16). Discard lockwashers.



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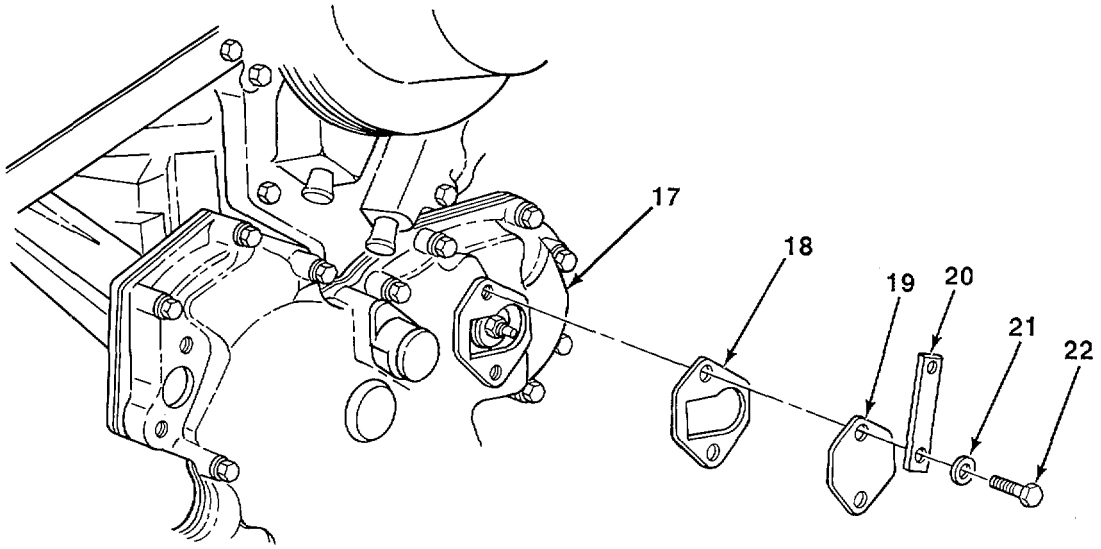
4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).

3. Remove two screws (22), washers (21), spring retaining bracket (20), access cover (19), and gasket (18) from engine front cover (17). Discard gasket.

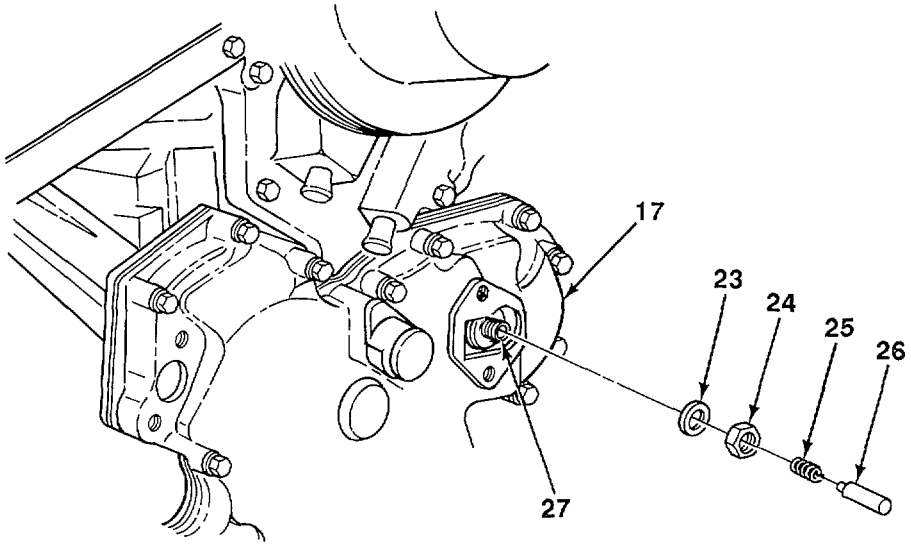


4. Remove thrust pin (26) and spring (25) from drive shaft (27).

NOTE

Use care when removing nut or washer from drive shaft. Should nut or washer fall into engine front cover, it will be necessary to remove engine front cover to retrieve nut or washer.

5. Remove nut (24) and washer (23) from drive shaft (27).



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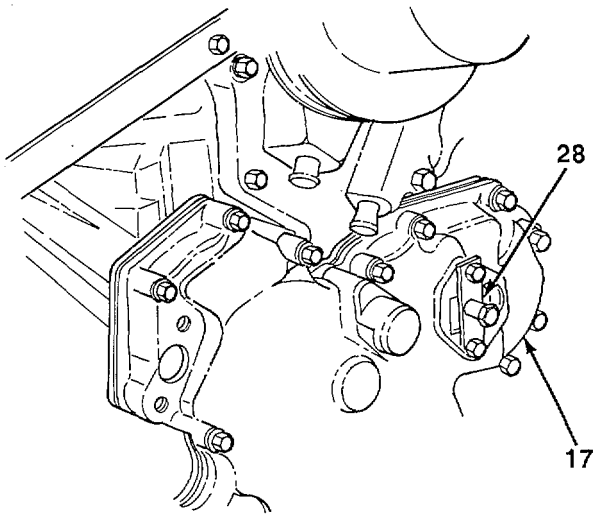
4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).

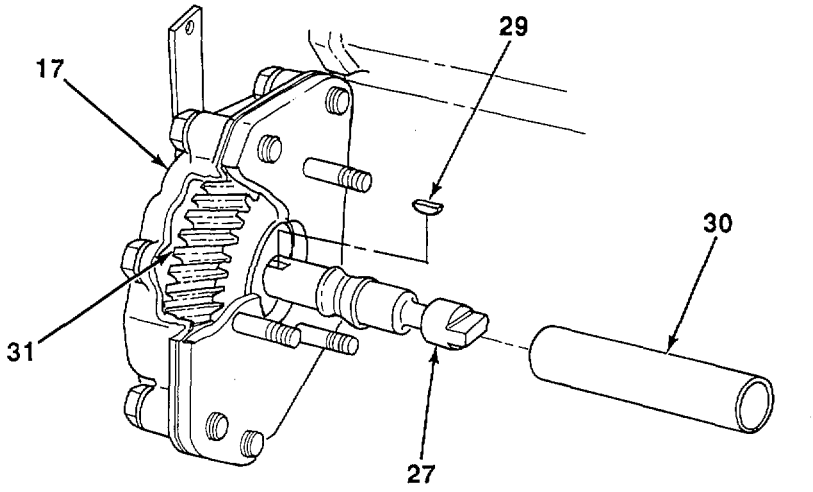
CAUTION

Use care when tightening center screw of fuel injection pump shaft removal tool. If too much force is used, engine front cover may be damaged.

6. Install fuel injection pump shaft removal tool (28) on engine front cover (17).



7. Using fuel injection pump pipe driver (30), remove drive gear (31) from drive shaft (27).
8. Remove fuel injection pump pipe driver (30), drive shaft (27), and woodruff key (29) from engine front cover (17).
9. Remove fuel injection pump shaft removal tool (28) from engine front cover (17).



TA708174

4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).

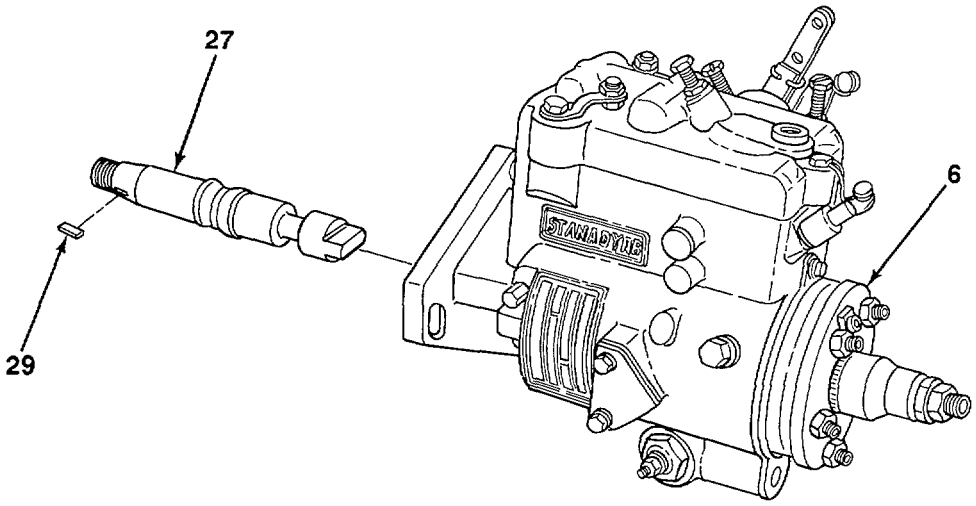
C. INSTALLATION AND ADJUSTMENT

1. Ensure that No. I piston is at TDC (see subparagraph a).
2. Install woodruff key (29) on drive shaft (27).

CAUTION

Ensure that drive shaft seals are not inverted when installing drive shaft into fuel injection pump. An inverted seal will cause fuel injection pump to leak.

3. Install drive shaft (27) in fuel injection pump (6).



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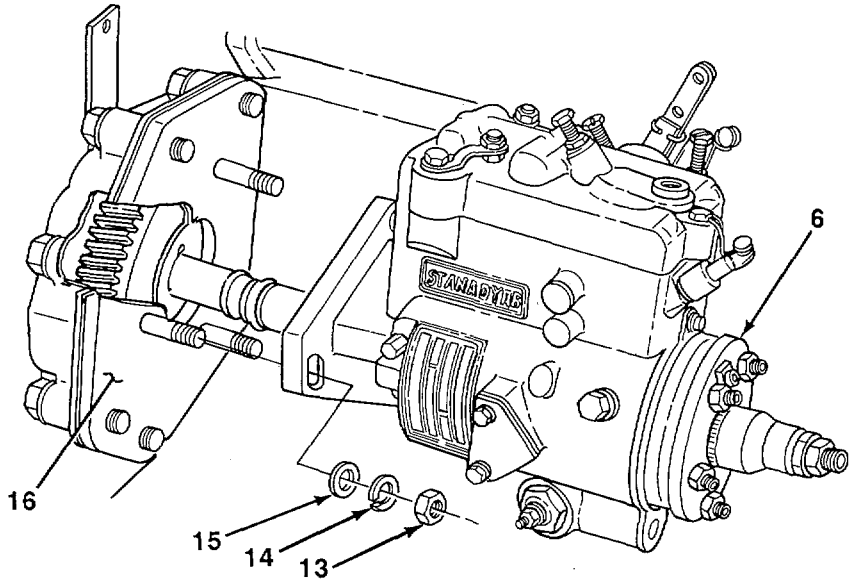
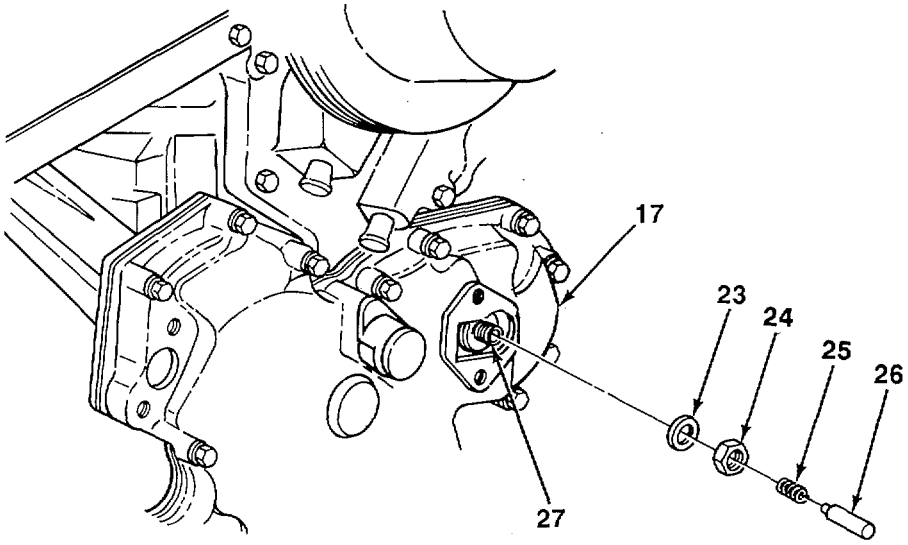
4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).

4. Install fuel injection pump (6) on front plate (16) with three washers (15), new lockwashers (14), and nuts (13). Tighten nuts to 20 lb.-ft. (27 N•m)



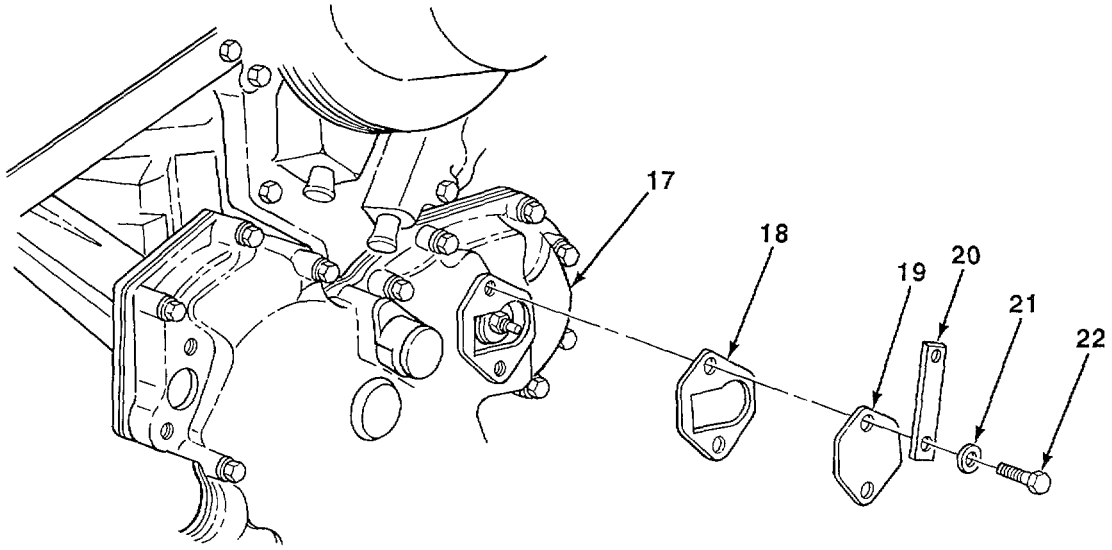
5. Install washer (23) and nut (24) on drive shaft (27). Torque nut to 95 lb.-ft. (129 N•m).

6. Position spring (25) on thrust pin (26) and install thrust pin in drive shaft (27).

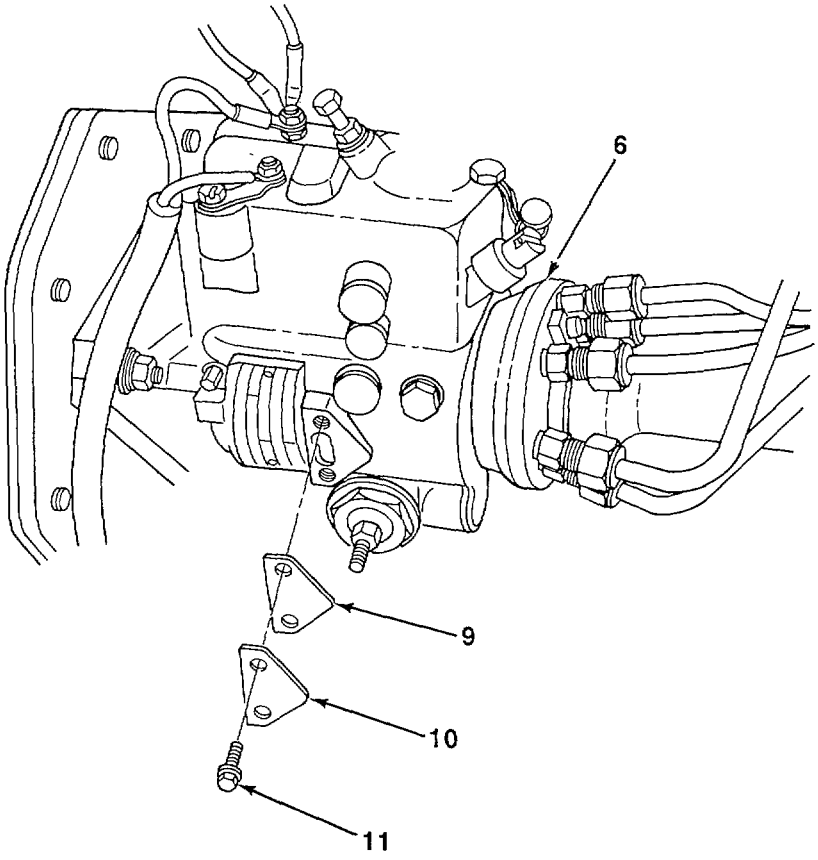


7. Install new gasket (18), access cover (19), and spring retaining bracket (20) on engine front cover (17) with two washers (21) and screws (22). Torque screws to 17 lb.-in. (2 N•m).

4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).



8. Install new gasket (9) and cover (10) on fuel injection pump (6) with two screws (11).



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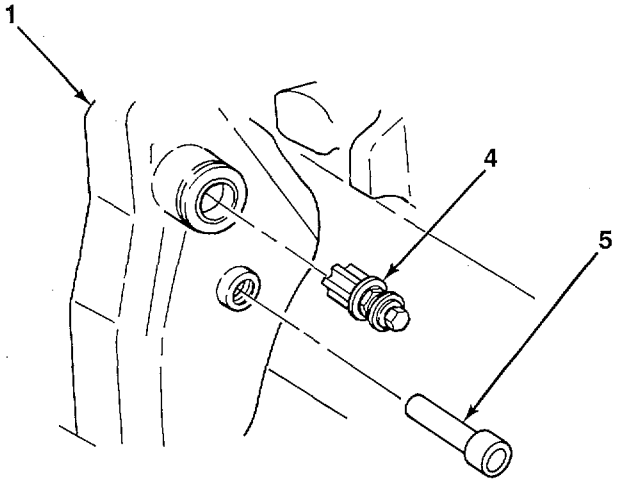
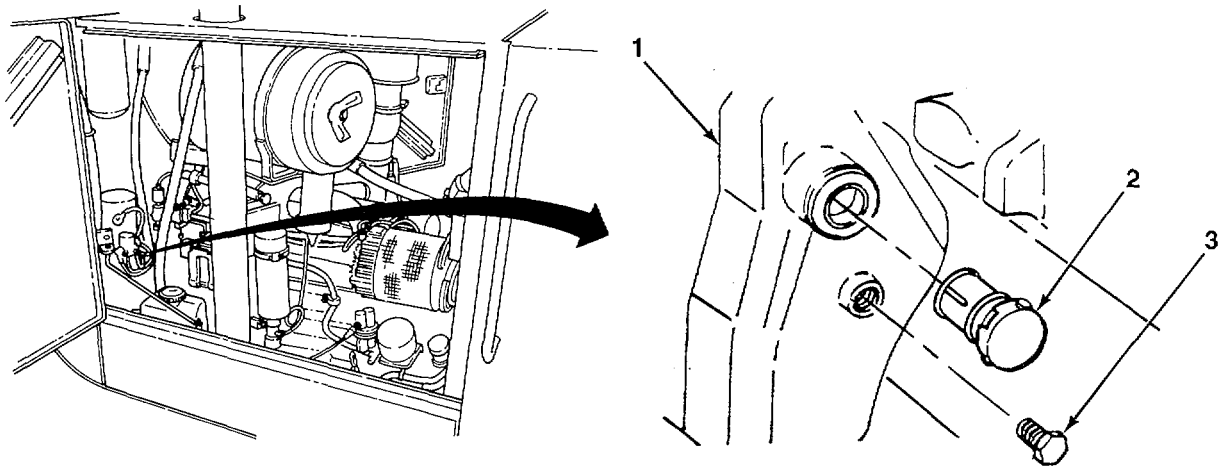
4-24. FUEL INJECTION PUMP REPLACEMENT (Con't).

9. Remove timing pin (5) and flywheel turning tool (4) from engine (1).



10. Install plugs (2 and 3) on engine (1).



FOLLOW-ON TASKS:

- Install leak-off tubes and fuel lines (see paragraph 4-22).
- Install fuel filter housing-to-fuel injection pump fuel line and fittings (see TM 10-3930-659-20).
- Install fuel injection pump-to-fuel tank fuel line and fittings (see TM 10-3930-659-20).
- Install accelerator cable and spring (see TM 10-3930-659-20).
- Install fuel injection pump terminal leads (see TM 10-3930-659-20).

4-25. TURBOCHARGER REPLACEMENT.

This Task Covers:

a. Removal b. Installation

Initial Setup:

Equipment Conditions:
- Turbocharger oil lines and fittings removed (see TM 10-3930-659-20).
- Air intake tube removed (see TM 10-3930-659-20).

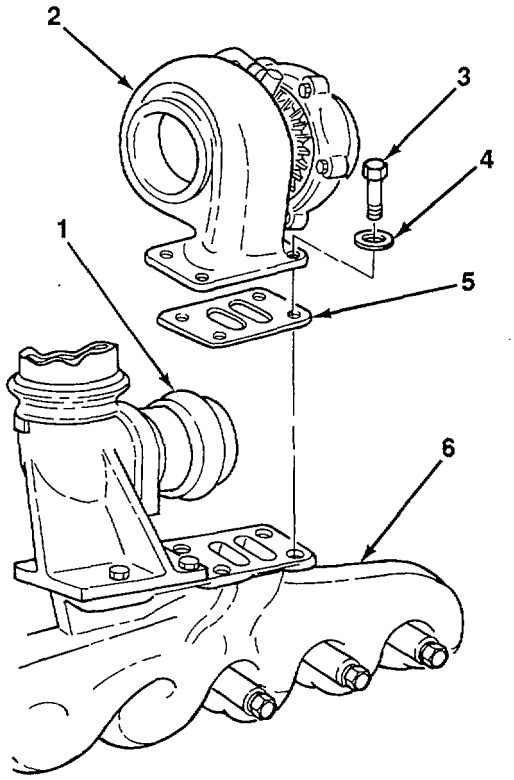
Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
- One gasket

References:
- TM 10-3930-659-20

a. REMOVAL

Remove four screws (3), washers (4), turbocharger (2), and gasket (5) from turbocharger exhaust elbow (1) and exhaust manifold (6). Discard gasket.



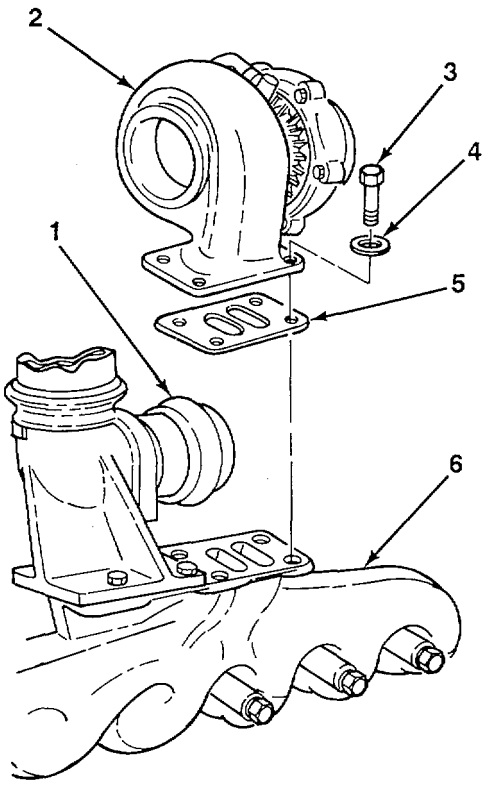
4-25. TURBOCHARGER REPLACEMENT (Con't).

b. INSTALLATION

1. Install new gasket (5) and turbocharger (2) on turbocharger exhaust elbow (1) and exhaust manifold (6) with four washers (4) and screws (3). Torque screws to 35 lb.-ft. (47 N•m).

2. Install turbocharger oil return line and fittings (see TM 10-3930-659-20).

3. Fill center of turbocharger (2) with lubricating oil through oil inlet hole and rotate turbine wheel by hand to lubricate turbocharger bearings.



FOLLOW-ON TASKS:

- Install turbocharger oil supply line and fittings (see TM 10-3930-659-20).
- Install air intake tube (see TM 10-3930-659-20).

4-26. FUEL TANK REPLACEMENT.

This Task Covers:

a. Draining
b. Removal
c. Installation

Initial Setup:

Equipment Conditions:
- Fuel level sending unit removed (see TM 10-3930-659-20).
- Fuel injection pump-to-fuel tank fuel line and fittings removed (see TM 10-3930-659-20).
- Fuel tank-to-fuel transfer pump fuel line and fittings removed (see TM 10-3930-659-20).
- Rear bottom guard removed (see TM 10-3930-659-20).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Hydraulic jack, 10 ton (Item 39, Appendix E)

Materials/Parts:
- Rags (Item 43, Appendix B)

Personnel Required: Two

References
- TM 10-3930-659-10
- TM 10-3930-659-20

General Safety Instructions:

- DO NOT perform this procedure near fire, flames, or sparks.

WARNING

Diesel fuel Is combustible. DO NOT smoke or allow open flame near fuel tank. Failure to follow this warning will result In death or serious injury to personnel. If you are burned, Immediately seek medical aid.

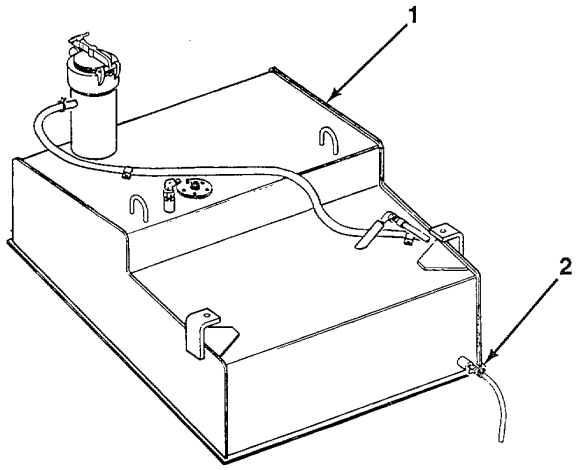
4-26. FUEL TANK REPLACEMENT (Con't).

a. DRAINING I

NOTE

- **A suitable container should be used to catch any draining fuel. Ensure that all spills are properly cleaned.**
- **Fuel tank capacity is 55 gl (208 1).**

1. Open draincock (2) on fuel tank (1) and allow fuel to drain.
2. Close draincock (2).



b. REMOVAL

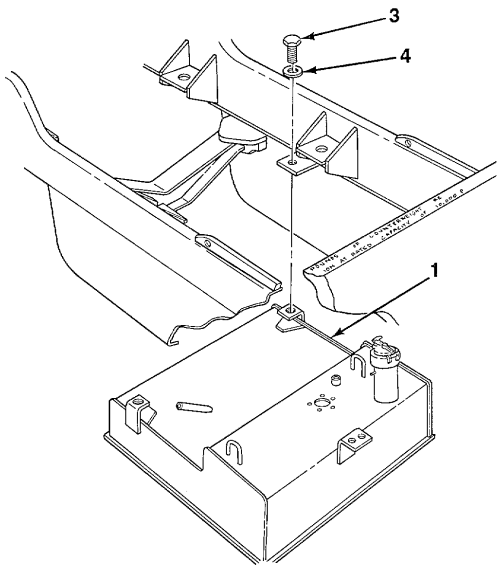
1. Position hydraulic jack under fuel tank (1) and raise jack until weight of fuel tank is supported.
2. Remove four bolts (3) and washers (4) from fuel tank (1).
3. Carefully lower fuel tank (1) and remove from under forklift truck.

4-26. FUEL TANK REPLACEMENT (Con't).

c. INSTALLATION

1. Position fuel tank (1) under forklift truck and install four washers (4) and bolts (3).

2. Lower hydraulic jack and remove from under fuel tank (1).



FOLLOW-ON TASKS:

- Install rear bottom guard (see TM 10-3930-659-20).
- Install fuel tank-to-fuel transfer pump fuel line and fittings (see TM 10-3930-659-20).
- Install fuel injection pump-to-fuel tank fuel line and fittings (see TM 10-3930-659-20).
- Install fuel level sending unit (see TM 10-3930-659-20).
- Fill fuel tank with diesel fuel (see TM 10-3930-659-10). TA708182

Section V. COOLING SYSTEM MAINTENANCE

4-27. ENGINE RADIATOR REPAIR.

Refer to TM 750-254 (Tactical Vehicles, Cooling Systems) for instructions on engine radiator repair.

Section VI. ELECTRICAL SYSTEM MAINTENANCE

4-28. ALTERNATOR REPAIR.

Refer to TM 9-2920-225-34 (Direct and General Support Level Maintenance, Generator Assembly) for instructions on alternator repair.

4-29. STARTER MOTOR REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:

- Starter motor removed (see TM 10-3930-659-20).

:

Tools/Test Equipment

- General mechanic's tool kit (Item 71, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Armature test set (Item 64, Appendix E)
- Test stand, generator and starter (Item 65, Appendix E)

References:

- TM 10-3930-659-20

Materials/Parts:

- Adhesive (Item 1, Appendix B)
- Crocus cloth (Item 8, Appendix B)
- Lubricating oil (Item 40, Appendix B)
- Rags (Item 43, Appendix B)
- Paint thinner (Item 54, Appendix B)
- One gasket
- One locknut
- One ring
  One seal
- Fourteen preformed packings

Personnel Required: Two

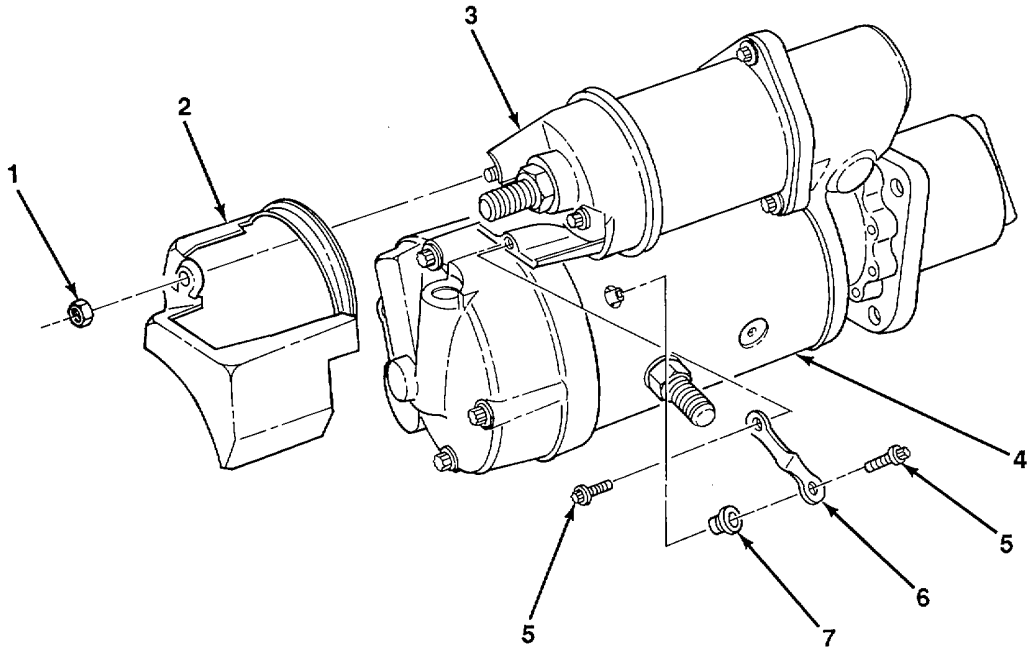
General Safety Instructions:

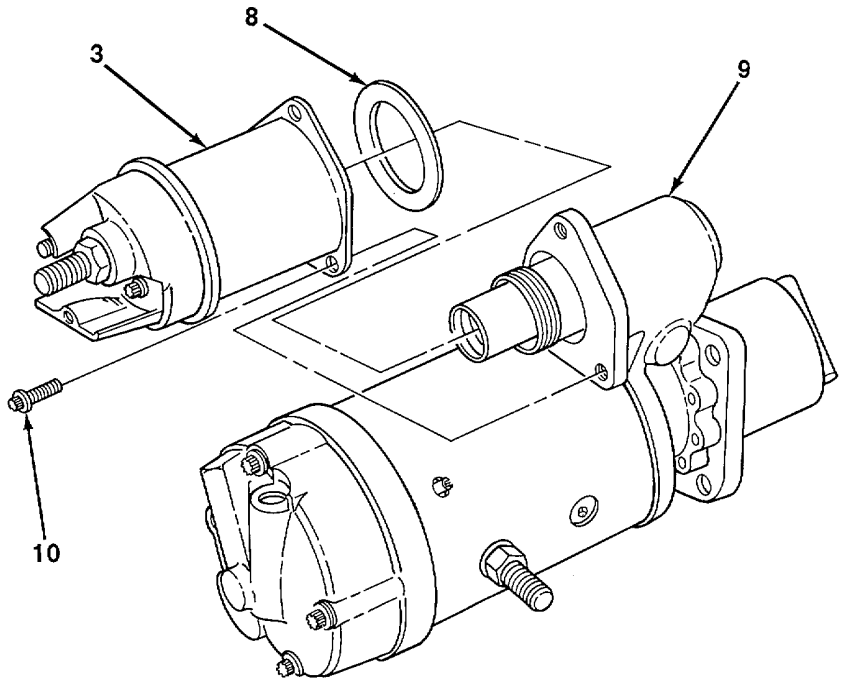
- Paint thinner is flammable and must not be used near open flame.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. DISASSEMBLY

1. Remove nut (1) and cover (2) from starter motor solenoid (3).
2. Remove two screws (5), strap (6), and grommet (7) from starter motor solenoid (3) and starter housing (4).
3. Mark starter motor solenoid (3) and housing (9) to aid during assembly.
4. Remove three screws (10), starter motor solenoid (3), and preformed packing (8) from housing (9). Discard preformed packing.

4-29. STARTER MOTOR REPAIR (Con't).





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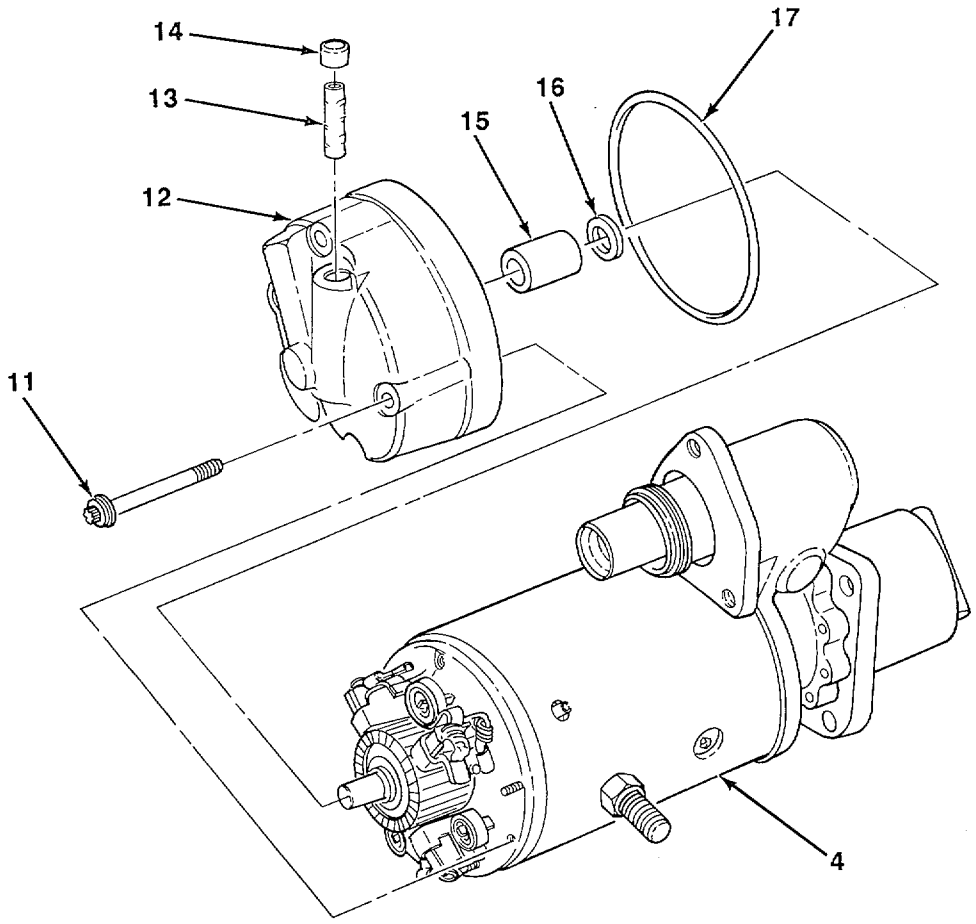
4-29. STARTER MOTOR REPAIR (Con't).

5. Mark frame (12) and starter housing (4) to aid during assembly.

6. Remove four screws (11), frame (12), thrustwasher (16), and preformed packing (17) from starter housing (4). Discard preformed packing.

7. If damaged, remove bushing (15) from frame (12).

8. If cup (14) is damaged, remove cup and wick (13) from frame (12).



TA708184

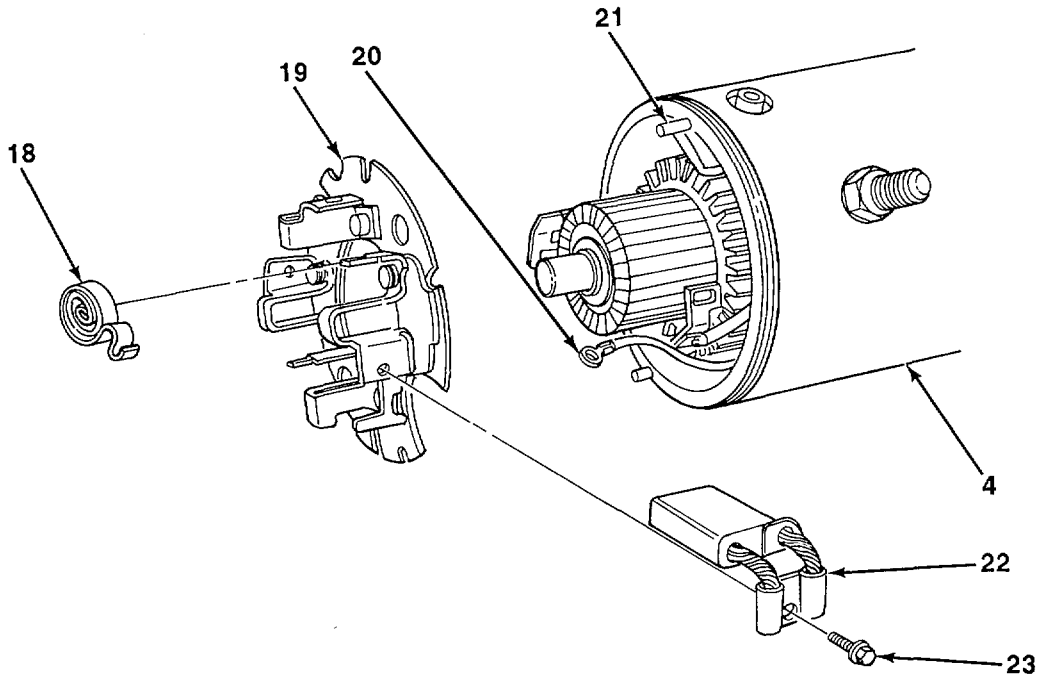
4-29. STARTER MOTOR REPAIR (Con't).

9. Mark brush plate (19) and starter housing (4) to aid during assembly.

10. Remove four screws (23), three terminal leads (20), four brushes (22), and brush springs (18) from brush plate (19).

11. Remove brush plate (19) from starter housing (4).

12. If damaged, remove two springpins (21) from starter housing (4). Discard springpins.



TA708185

4-29. STARTER MOTOR REPAIR (Con't).

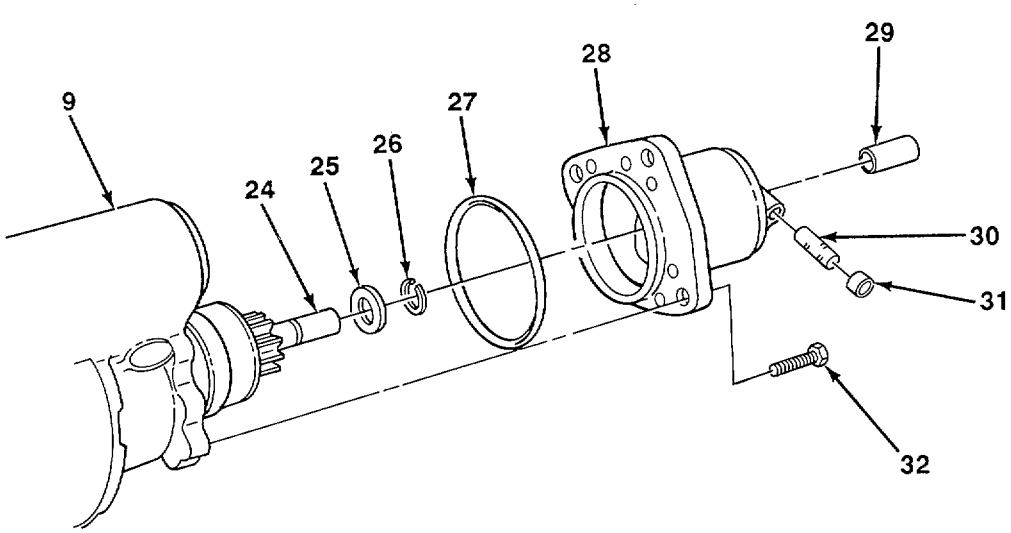
13. Mark drive housing (28) and housing (9) to aid during assembly.

14. Remove three screws (32), drive housing (28), and preformed packing (27) from housing (9). Discard preformed packing.

15. Remove bushing (29) from drive housing (28).

16. If cup (31) is damaged, remove cup and wick (30) from drive housing (28).

17. Remove retaining ring (26) and stop (25) from armature shaft (24).



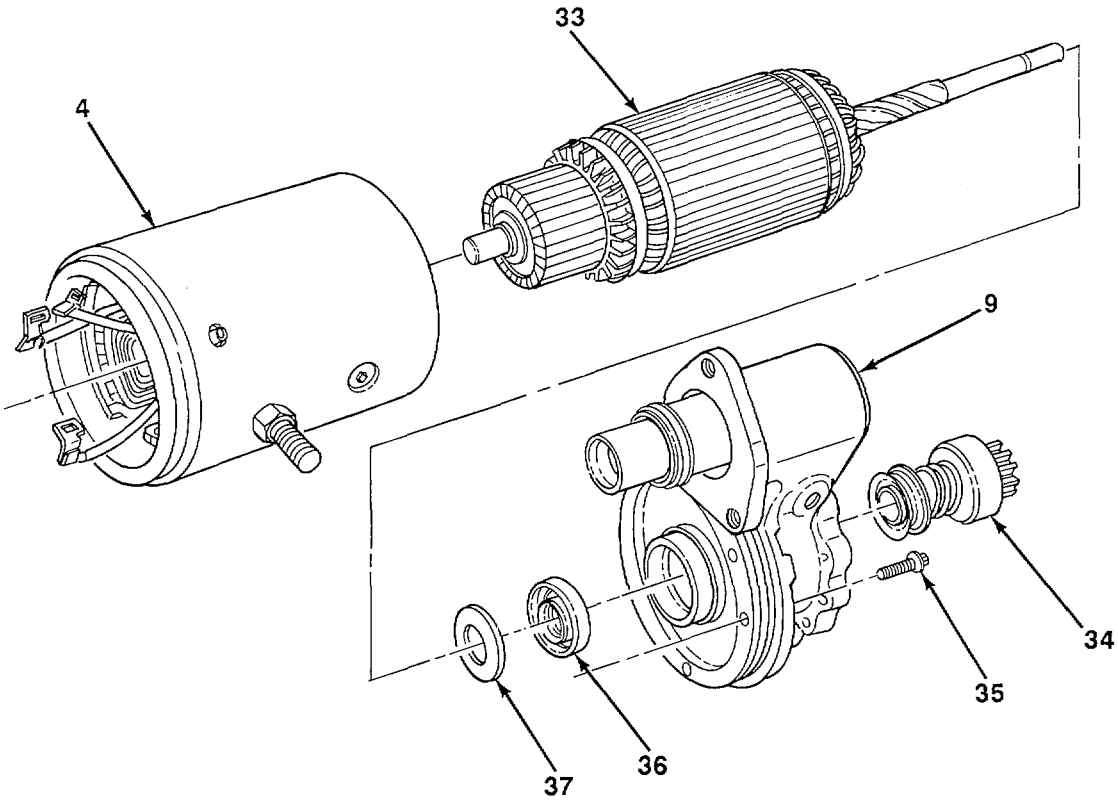
18. Mark starter housing (4) and housing (9) to aid during assembly.

NOTE

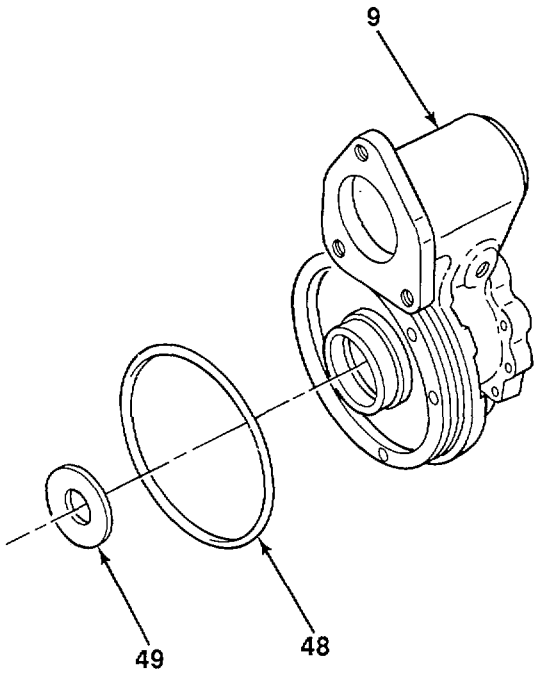
Release drive assembly from lever of housing as parts are removed from starter housing.

19. Remove five screws (35), housing (9), drive assembly (34), seal (36), washer (37), and armature (33) from starter housing (4). Discard seal.

4-29. STARTER MOTOR REPAIR (Con't).



20. Remove preformed packing (48) from housing (9). Discard preformed packing.
21. Remove washer (49) from housing (9).



TA708187

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4-29. STARTER MOTOR REPAIR (Con't).

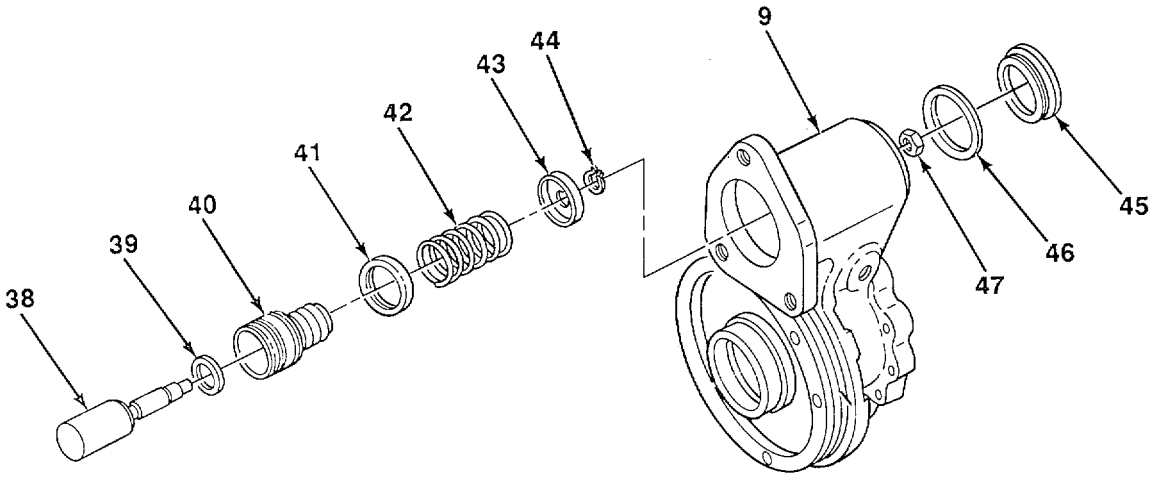
22. Remove plug (45) and gasket (46) from housing (9). Discard gasket.

NOTE

Note position of locknut on shaft of plunger to aid during assembly.

23. Remove locknut (47) and plunger (38) assembly from housing (9). Discard locknut.

24. Remove retaining ring (44), retainer (43), spring (42), retainer (41), boot (40), and washer (39) from plunger (38).



25. Remove ring (54) and shaft (53) from housing (9). Discard ring.

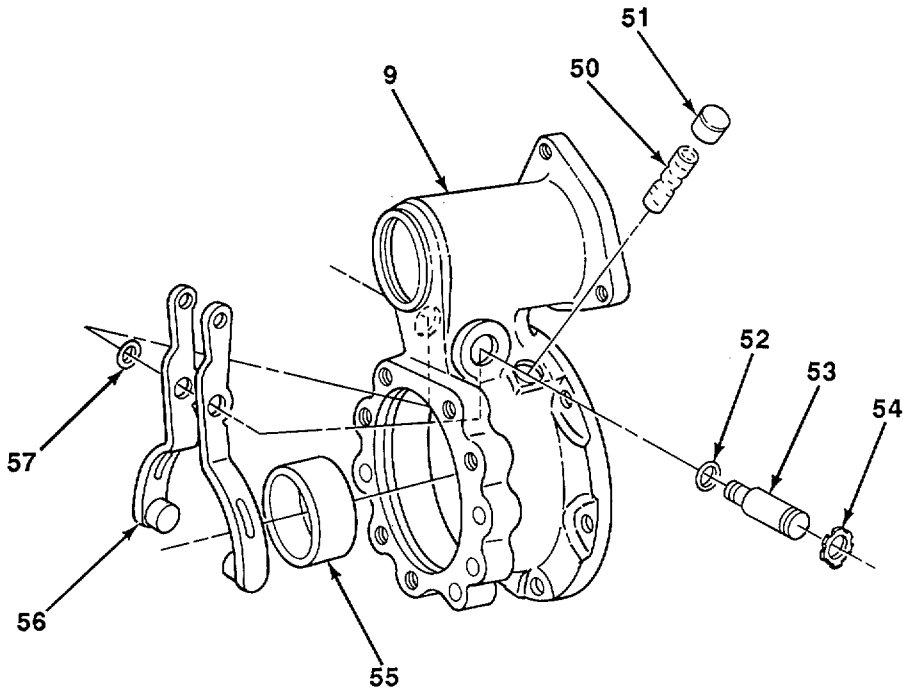
26. Remove preformed packing (52) from shaft (53). Discard preformed packing.

27. Remove lever (56) and preformed packing (57) from housing (9). Discard preformed packing.

28. Remove bushing (55) from housing (9).

29. If cup (51) is damaged, remove cup and wick (50) from housing (9).

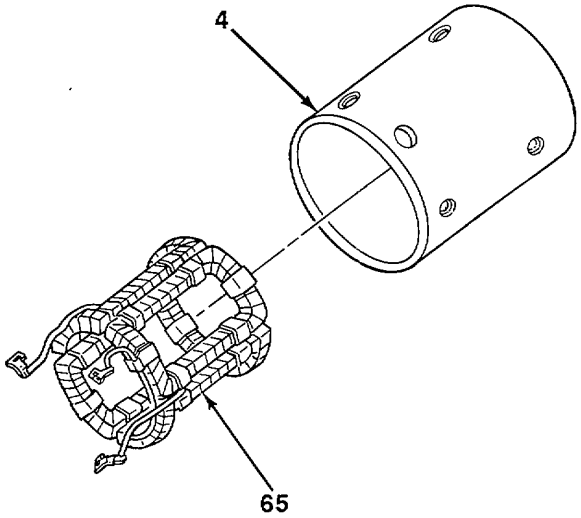
4-29. STARTER MOTOR REPAIR (Con't).



NOTE

Perform steps 30 through 33 only if field coil is damaged.

30. Mark field coil (65) and starter housing (4) to aid during assembly.



TA708189

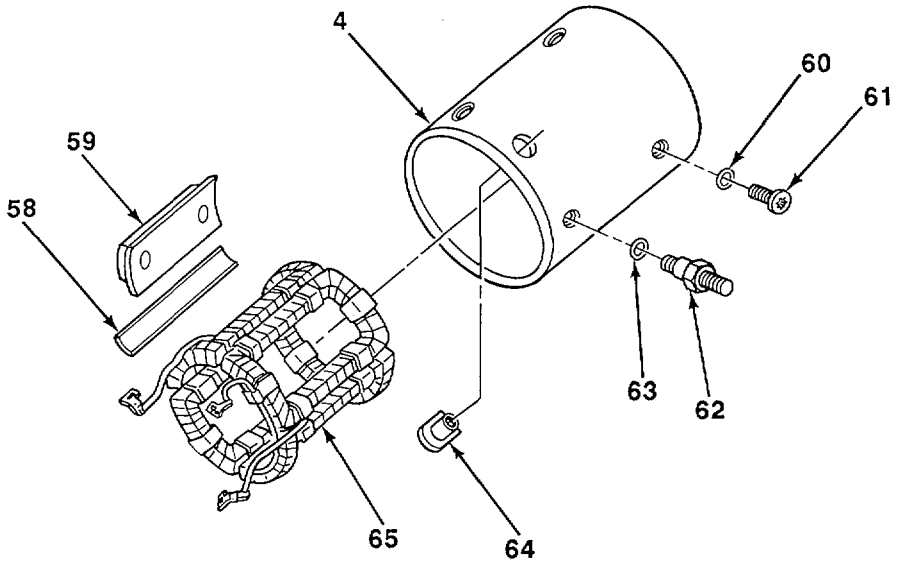
4-29. STARTER MOTOR REPAIR (Con't).

NOTE
Note location of terminal to aid during assembly.

31. Remove seven screws (61) and preformed packings (60) from starter housing (4). Discard preformed packings.

32. Remove terminal (62) and preformed packing (63) from starter housing (4). Discard preformed packing.

33. Remove field coil (65), four poles (59), insulator (58), and insulator (64) from starter housing (4).



b. CLEANING AND INSPECTION

WARNING

Paint thinner burns easily and fumes can explode. Paint thinner's flash point is 100°F (380C). DO NOT smoke or allow flame nearby when using paint thinner. Failure to follow this warning may result in serious injury or death to personnel.

1. Clean parts (except armature, bushings, field coil, starter motor solenoid, wicks, and brushes) with paint thinner. Dry with clean rags.

2. Clean all other parts with clean, dry rags.

3. Inspect all parts for cracks, breaks, burns, and wear. Replace defective parts.

4-29. STARTER MOTOR REPAIR (Con't).

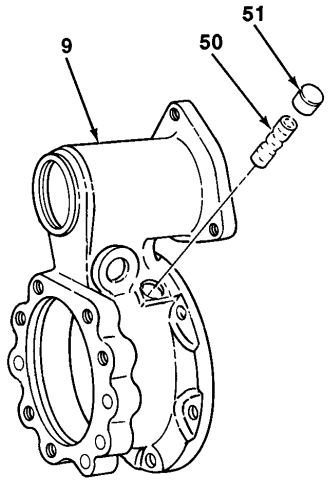
WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

4. Using crocus cloth, clean and polish commutator of armature. Remove loose particles with compressed air.
5. Using armature test set, test armature for shorting.
6. Check brushes for excessive wear. Replace if broken or excessively worn. Full surface of each brush should contact commutator of armature.
7. Inspect brush springs for breaks and discoloration. Replace broken or discolored brush springs.
8. Inspect threaded parts for damaged threads. Replace damaged parts.
9. If removed, inspect wicks for damage. Replace damaged wicks.
10. Inspect windings of field coil for damage or burned insulation. Replace damaged field coil.

c. ASSEMBLY

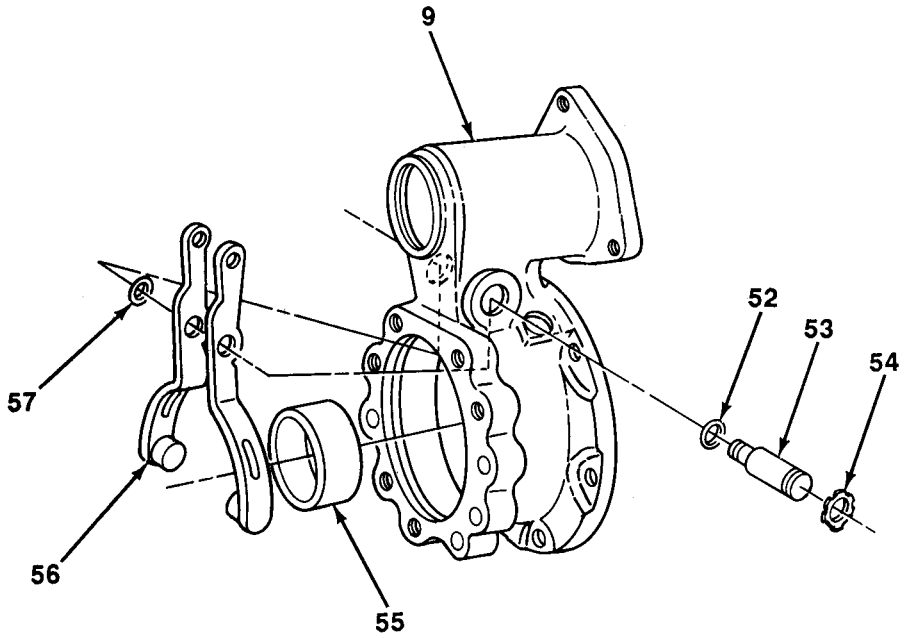
1. Install insulator (64) on starter housing (4).
2. Install insulator (58), four poles (59), and field coil (65) on starter housing (4) with seven new preformed packings (60) and screws (61).
3. Install new preformed packing (63) and terminal (62) on starter housing (4).
4. If removed, saturate wick (50) with lubricating oil. Install wick and new cup (51) on housing (9).



TA708191

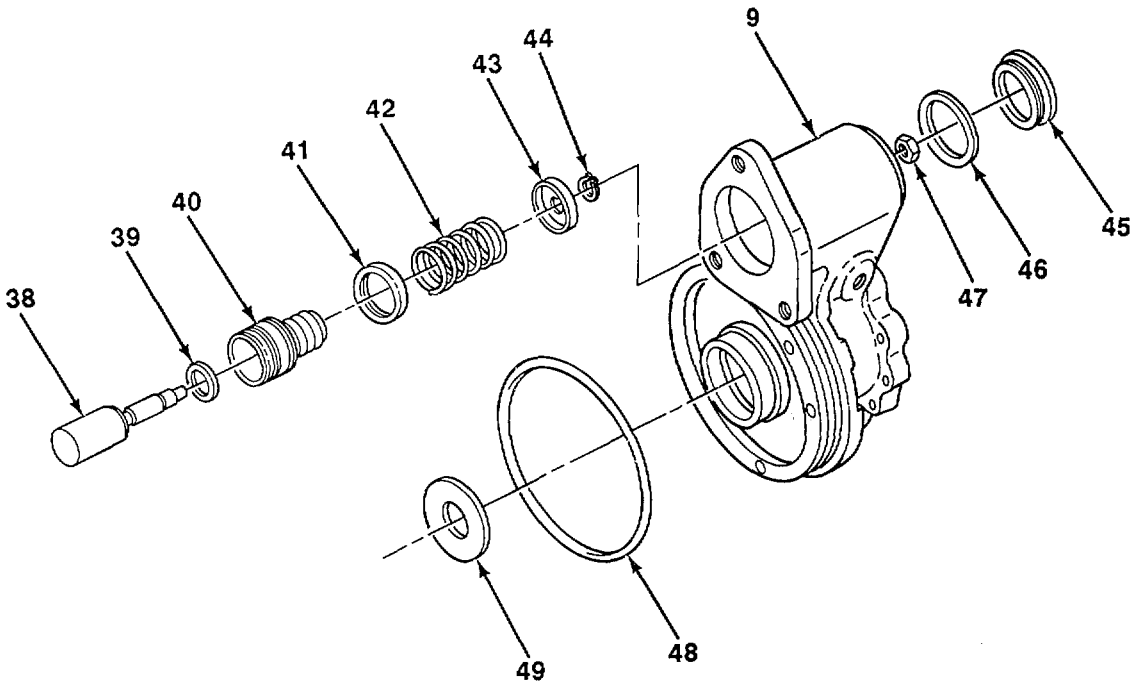
4-29. STARTER MOTOR REPAIR (Con't).

5. Install bushing (55) on housing (9).
6. Position new preformed packing (57) and lever (56) in housing (9).
7. Install new preformed packing (52) on shaft (53).
8. Install shaft (53) through lever (56) in housing (9) and secure with new ring (54).



4-29. STARTER MOTOR REPAIR (Con't).

9. Install washer (39), boot (40), retainer (41), spring (42), and retainer (43) on plunger (38) with retaining ring (44).
10. Install plunger (38) assembly on housing (9) with new locknut (47).
11. Install new gasket (46) and plug (45) on housing (9).
12. Apply adhesive to one side of washer (49) and install washer on housing (9).
13. Install new preformed packing (48) on housing (9).

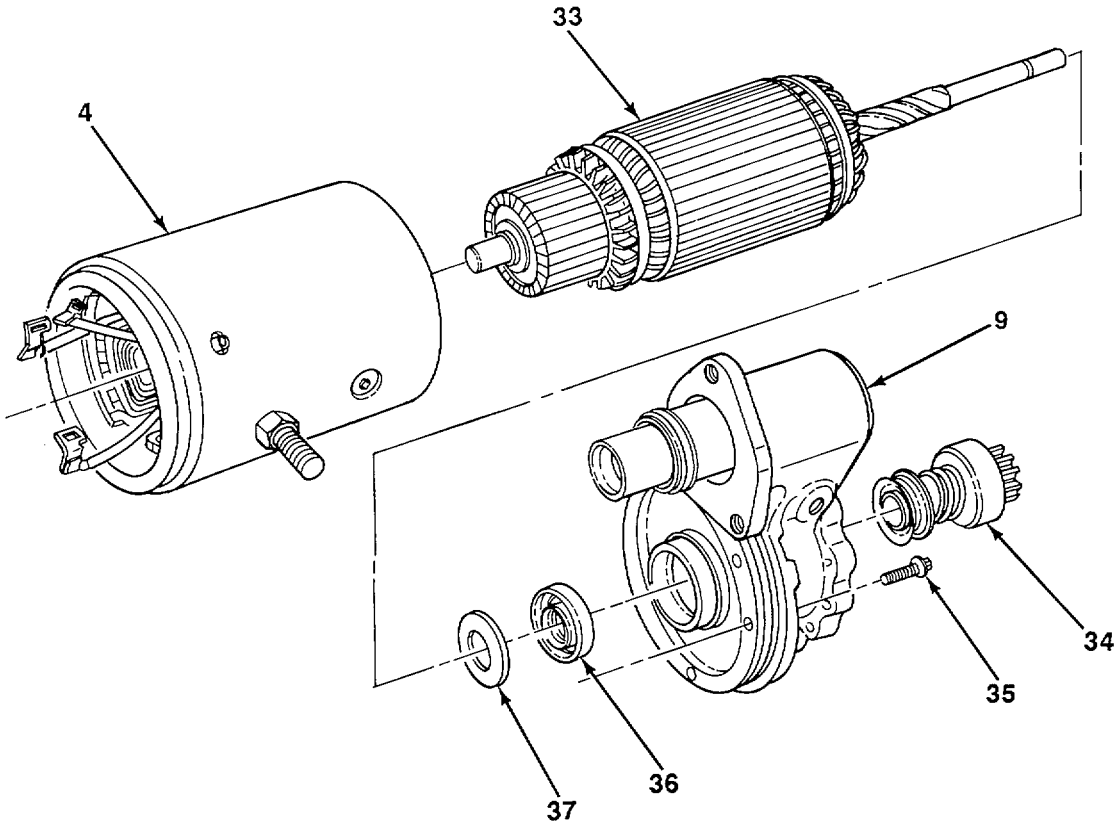


TA708193

4-29. STARTER MOTOR REPAIR (Con't).

NOTE
Position drive assembly on lever of housing as parts are installed to starter housing.

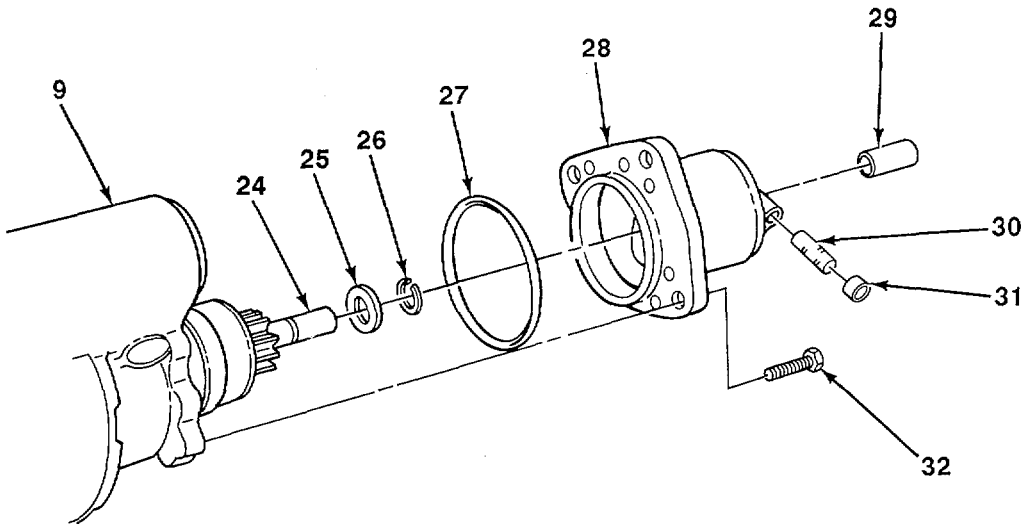
14. Install new seal (36), washer (37), armature (33), drive assembly (34), and housing (9) on starter housing (4) with five screws (35).



TA708194

4-29. STARTER MOTOR REPAIR (Con't).

15. Install stop (25) and retaining ring (26) on armature shaft (24).
16. If removed, saturate wick (30) with lubricating oil. Install wick and new cup (31) on drive housing (28).
17. Install bushing (29) on drive housing (28).
18. Install new preformed packing (27) and drive housing (28) on housing (9) with three screws (32).



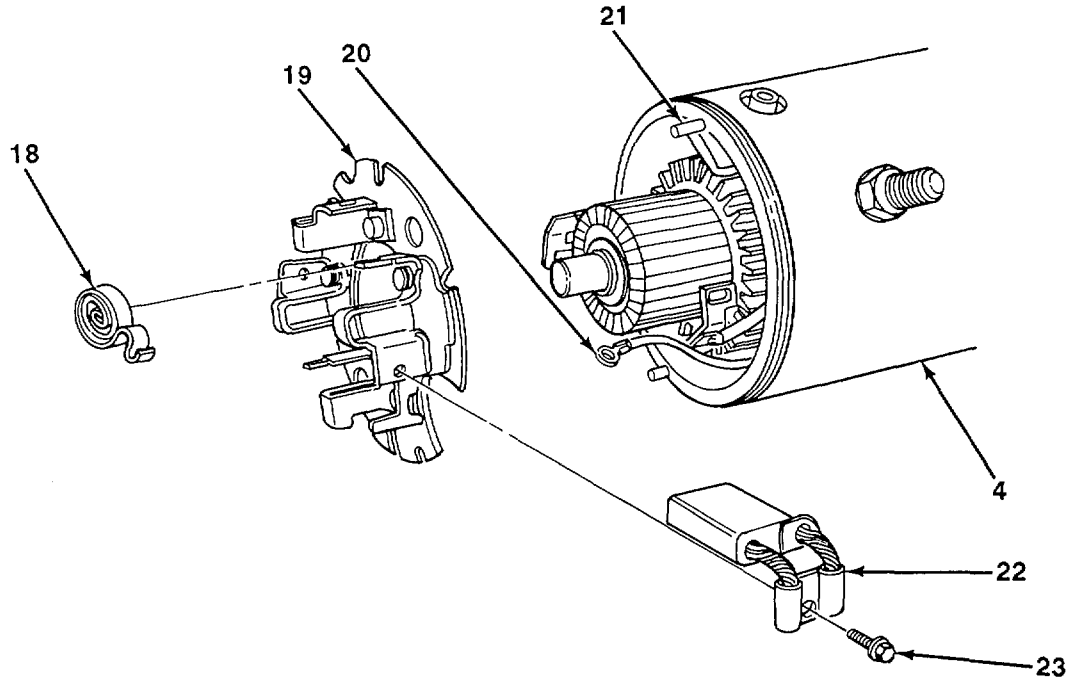
TA708195

4-29. STARTER MOTOR REPAIR (Con't).

19. If removed, install two new springpins (21) on starter housing (4).

20. Position brush plate (19) on starter housing (4).

21. Install four brushes (22), brush springs (18), and three terminal leads (20) on brush plate (19) with four screws (23).



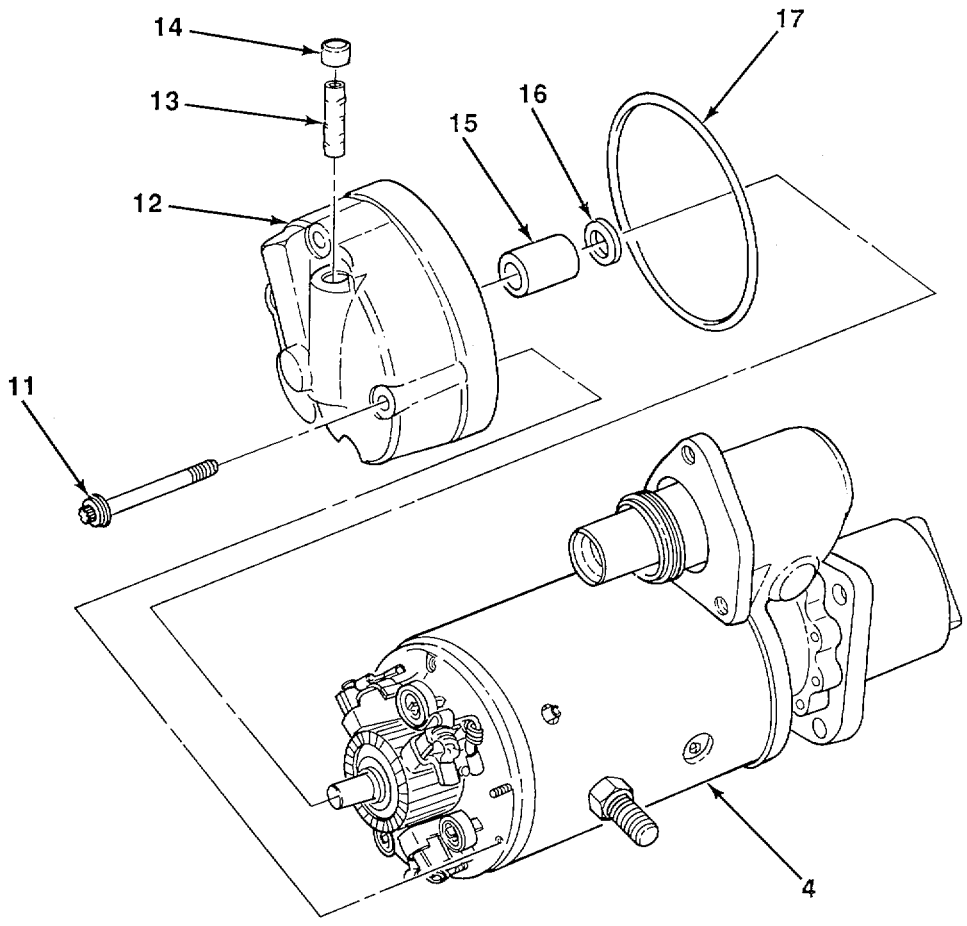
TA708196

4-29. STARTER MOTOR REPAIR (Con't).

22. If removed, saturate wick (13) with lubricating oil. Install wick and new cup (14) on frame (12).

23. Install bushing (15) on frame (12).

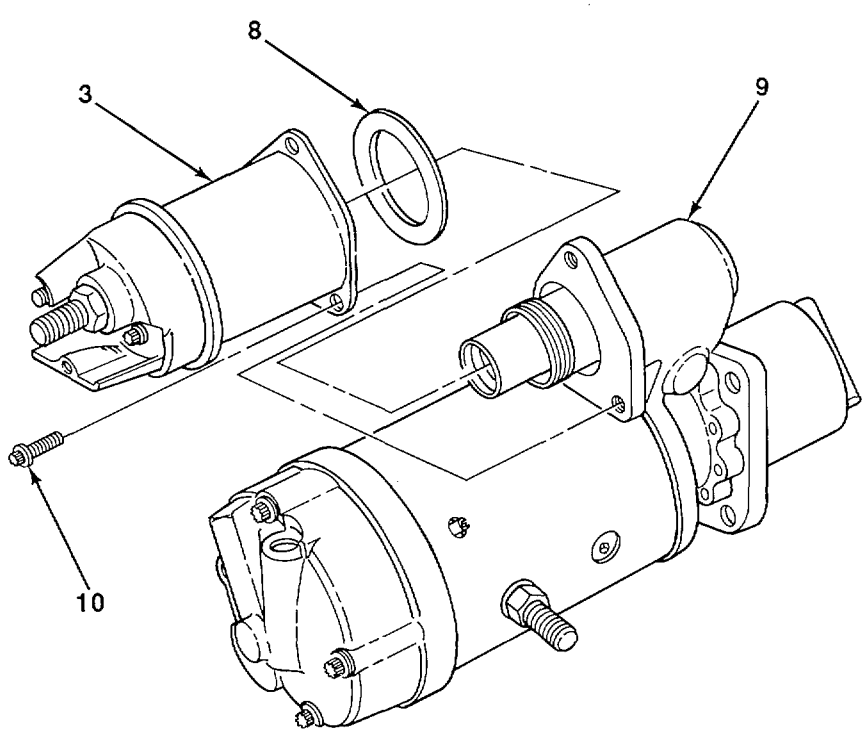
24. Install new preformed packing (17), thrustwasher (16), and frame (12) on starter housing (4) with four screws 11).



TA708197

4-29. STARTER MOTOR REPAIR (Con't).

25. Install new preformed packing (8) and starter motor solenoid (3) on housing (9) with three screws (10).

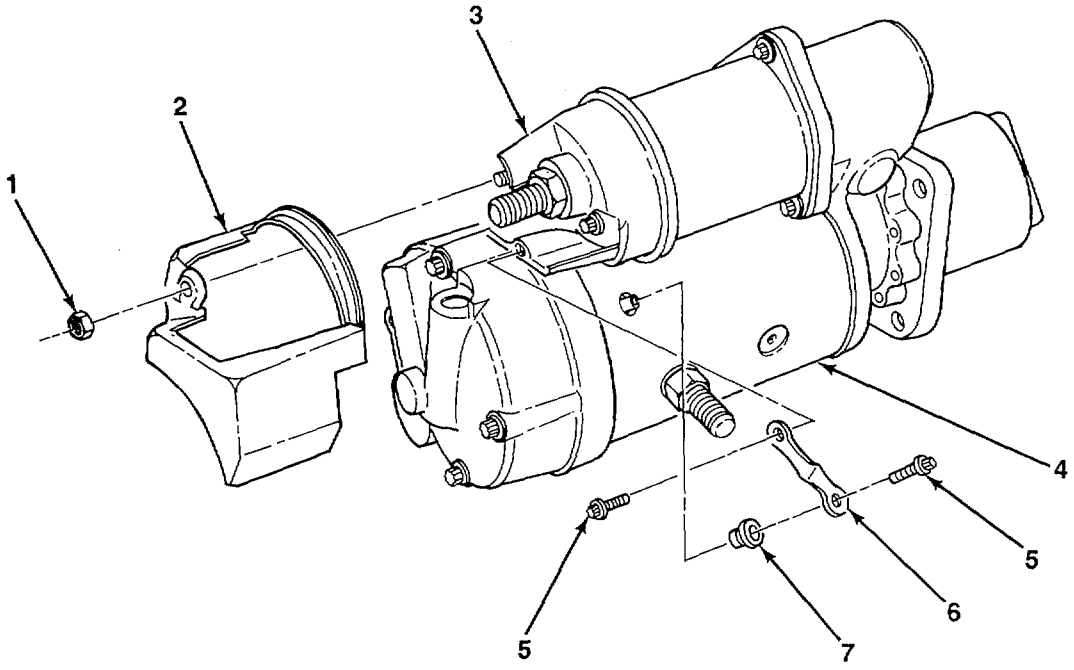


26. Install grommet (7) and strap (6) on starter housing (4) and starter motor solenoid (3) with two screws (5).

27. Install cover (2) on starter motor solenoid (3) with nut (1).

28. Using generator and starter test stand, test starter motor.

4-29. STARTER MOTOR REPAIR (Con't).



FOLLOW-ON TASKS:

- Install starter motor (see TM 10-3930-659-20).

Section VII. TRANSMISSION MAINTENANCE

4-30 CONVERTER-OUT PRESSURE TEST.

This Task Covers: Pressure Test

Initial Setup:

Equipment Conditions:

- Parking brake set (see TM 10-3930-659-10)
- Frame locking bar installed (see TM 10-3930-659-10)
- Right transmission side guard removed (see TM 10-3930-659-20)
- Transmission oil temperature sender removed (see
- TM 10-3930-659-20)

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Adapter (Item 2, Appendix E)
- Pressure gage (Item 31, Appendix E)
- Hose assembly (Item 37, Appendix E)

Materials/Parts:

- One preformed packing

Personnel Required: Two

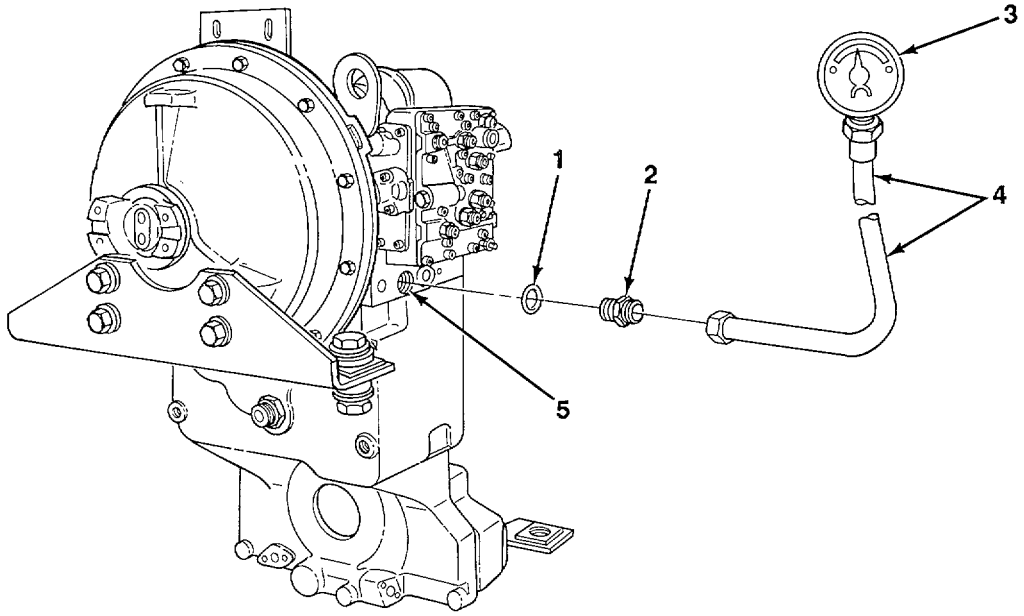
References:

- TM 10-3930-659-10
- TM 10-3930-659-20

4-30. CONVERTER-OUT PRESSURE TEST (Con't).

PRESSURE TEST

1. Install preformed packing (1) on adapter (2) and install adapter in transmission oil temperature sender port (5).
2. Install hose (4) and pressure gage (3) on adapter (2).
3. Start engine and run at fast engine idle speed for a maximum of 30 seconds (see TM 10-3930-659-10).
4. Reduce engine speed to slow engine idle speed and shift transmission direction selector lever to N (Neutral) (see TM 10-3930-659-10).



NOTE

Forklift truck must not move when performing step 5.

5. Move transmission speed range selector lever to fourth gear and transmission direction selector lever to F (Forward) with engine at slow engine idle speed (see TM 10-3930-659-10).
6. Note pressure reading on pressure gage (3). Pressure reading must be 70-100 psi (483-690 kPa). If pressure reading is within specification, go to step 12.

4-30. CONVERTER-OUT PRESSURE TEST (Con't).

NOTE

Perform steps 7 through 9 only If pressure reading was above 100 psi (690 kPa) in step 6.

7. Check for pinched or blocked hoses between torque converter and transmission oil cooler.
8. Remove transmission thermal bypass valve and check for restrictions (see TM 10-3930-659-20).
9. Remove transmission suction tube and check for restrictions in transmission suction tube screen (see TM 10-3930-659-20).

NOTE

Perform steps 10 and 11 only if pressure was below 70 psi (483 kPa) in step 6.

10. Perform converter relief valve pressure check (see paragraph 4-32).
11. Check for leaking torque converter. If leaking, replace torque converter (see paragraph 4-38).
12. Remove pressure gage (3) and hose (4) from adapter (2).
13. Remove adapter (2) and preformed packing (1) from transmission oil temperature sender port (5). Discard preformed packing.
14. If pressure reading still is not within specification, replace transmission assembly (see paragraph 4-40).

FOLLOW-ON TASKS:

- Install transmission oil temperature sender (see TM 10-3940-659-20).
- Install right transmission side guard (see TM 10-3930-659-20).
- Remove frame locking bar (see TM 10-3930-659-10).

4-31. CONVERTER-OUT FLOW TEST.

This Task Covers: Flow Test

Initial Setup:

Equipment Conditions:

- Parking brake set (see TM 10-3930-659-10)
- Left engine upper sideshield opened (see TM 10-3930-659-10)
- Left engine lower sideshield removed (see TM 10-3930-659-20)

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Adapter (Item 4, Appendix E)
- Hydraulic flowmeter (Item 24, Appendix E)
- Hose assembly (Item 37, Appendix E)
- Union (Item 74, Appendix E)

Materials/Parts:

- Rags (Item 43, Appendix B)
- Three preformed packings

Personnel Required: Two

References:

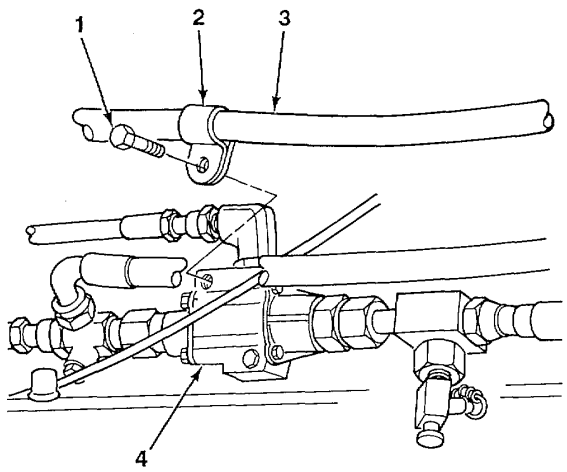
- TM 10-3930-659-10
- TM 10-3930-659-20

NOTE

A suitable container should be used to catch any draining hydraulic fluid. Ensure that all spills are properly cleaned.

FLOW TEST

1. Remove screw (1) and clamp (2) from transmission thermal bypass valve (4). Move hose (3) aside.



TA708206

4-31. CONVERTER-OUT FLOW TEST (Con't).

2. Remove hose (5) and preformed packing (6) from elbow (7). Discard preformed packing.

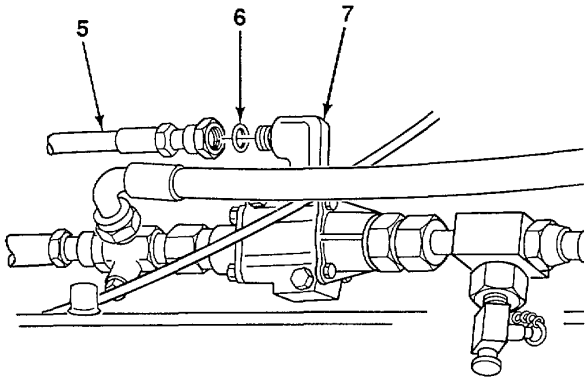
3. Install preformed packing (8), union (9), and adapter (10) on elbow (7).

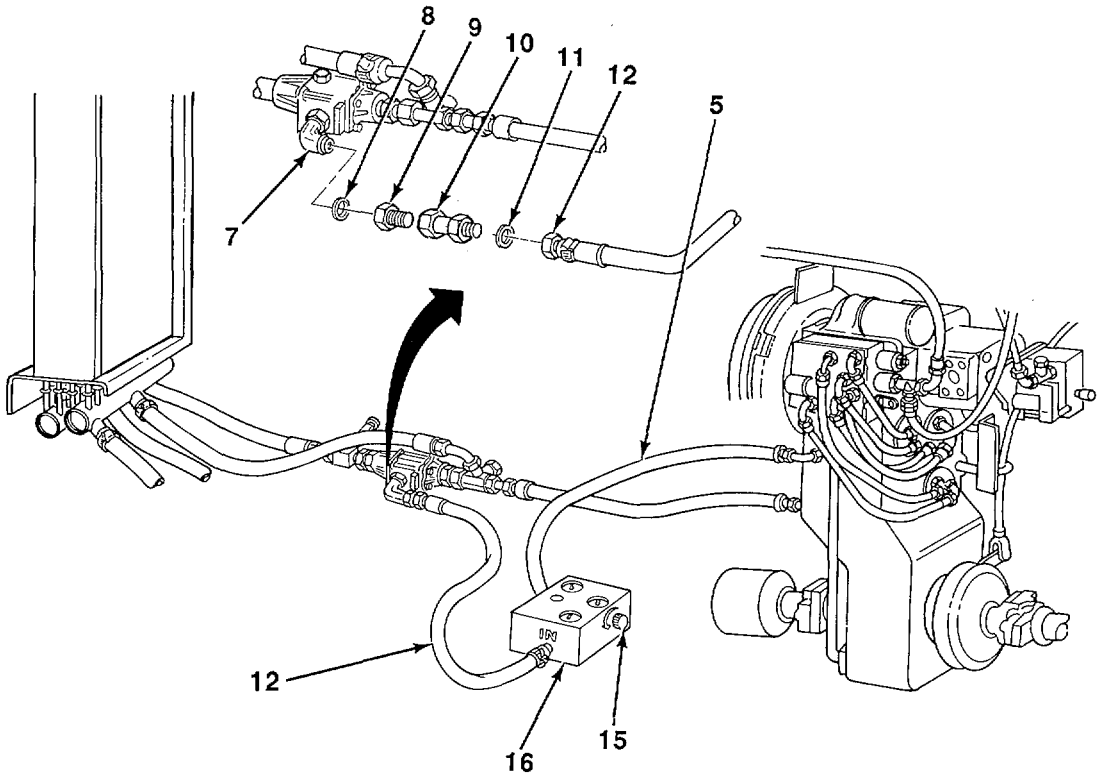
4. Install preformed packing (1 1) and hydraulicflowmeter inlet hose (12) on adapter (10).

5. Install hose (5) on hydraulic flowmeter (16).

6. Check that loading valve (15) is in full OPEN position.

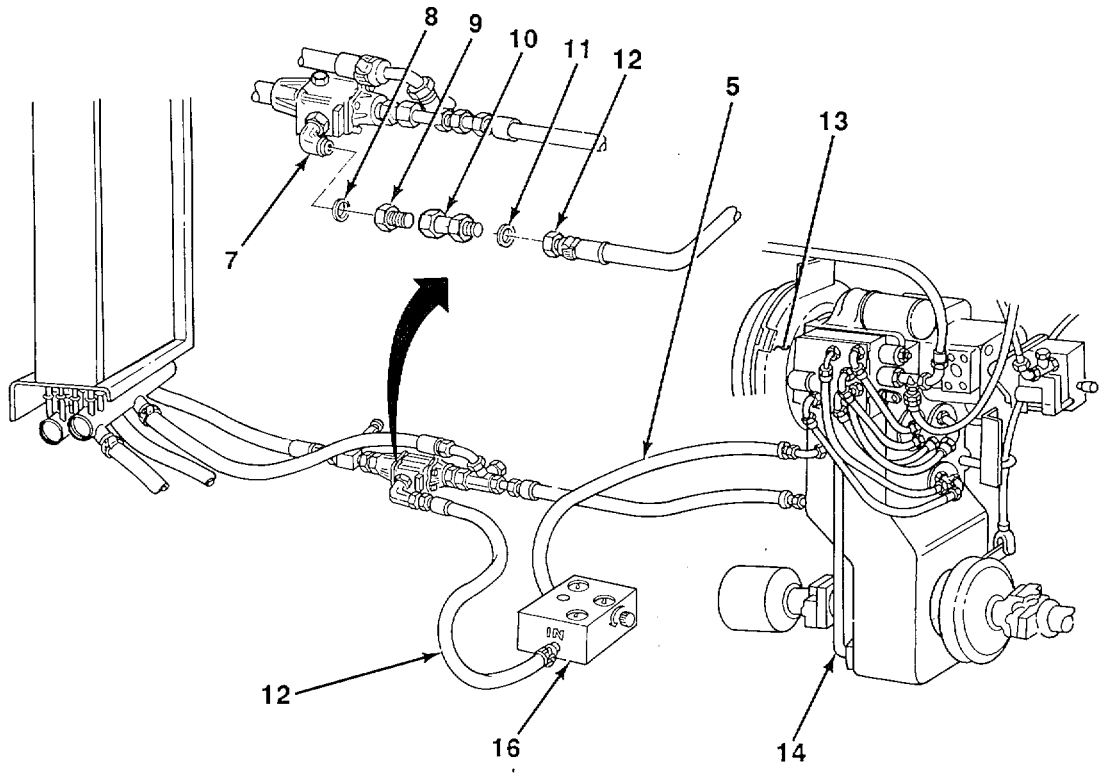
7. Start forklift truck and run until transmission oil temperature gage indicates that transmission fluid is warm (see TM 10-3930-659-10).





4-31. CONVERTER-OUT FLOW TEST (Con't).

8. Operate engine at 2000 rpm (see TM 10-3930659-10) and note reading on hydraulic flowmeter (16). Minimum allowable flow rate is 7 gpm (26 lpm). If reading is within specification, go to step 16.
9. Shut down engine (see TM 10-3930-659-10).
10. Check transmission fluid level and fill as necessary C(TM 10-3930-659-20).
11. Check for air leak in transmission suction tube (14).
12. Check for leaking torque converter (13).



TA708208

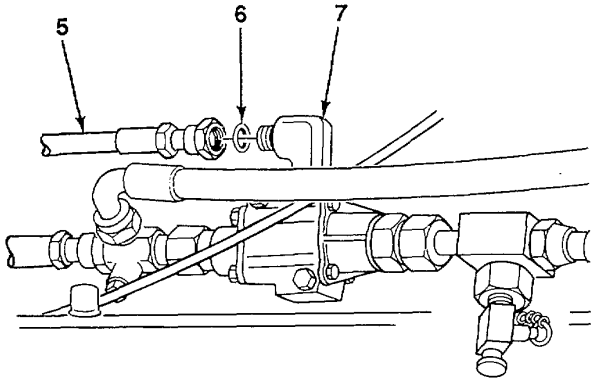
13. Remove transmission suction tube and check for restrictions (see TM 10-3930-659-20).
14. Remove transmission thermal bypass valve and check for restrictions (see TM 10-3930-659-20).
15. Perform converter relief valve pressure check (see paragraph 4-32).
16. Remove hose (5) from hydraulic flowmeter (16).
17. Remove hydraulic flowmeter inlet hose (12) from adapter (10).
18. Remove preformed packing (11) from adapter (10). Discard preformed packing.

4-31. CONVERTER-OUT FLOW TEST (Con't).

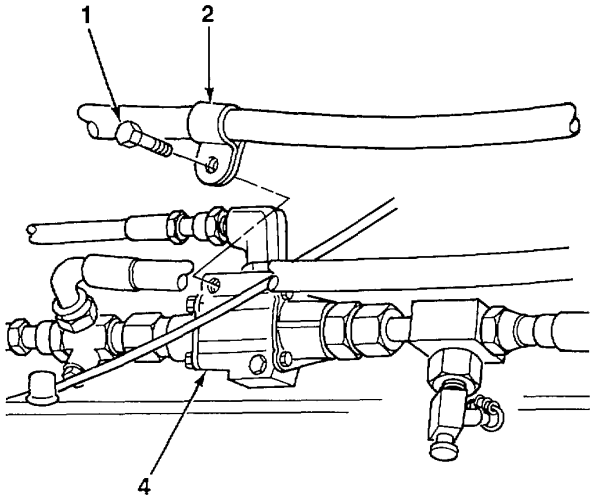
19. Remove adapter (10) and union (9) from elbow (7).

20. Remove preformed packing (8) from elbow (7). Discard preformed packing.

21. Install new preformed packing (6) and hose (5) on elbow (7).



22. Install clamp (2) on transmission thermal bypass valve (4) with screw (1).



TA708209

FOLLOW-ON TASKS:

- Install left engine lower sideshield (see TM 10-3930-659-20).
- Close left engine upper sideshield (see TM 10-3930-659-10).

4-32. CONVERTER RELIEF VALVE PRESSURE CHECK.

This Task Covers: Pressure Check

Initial Setup:

Equipment Conditions:

- Parking brake set (see TM 10-3930-659-10).
- Frame locking bar installed (see TM 10-3930-659-10).
- Left engine upper sideshield opened (see TM 10-3930-659-10).
- Left engine lower sideshield removed (see TM 10-3930-659-20).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Adapter (Item 1, Appendix E)
- Adapter (Item 4, Appendix E)
- Cap (Item 11, Appendix E)
- Pressure gage (Item 31, Appendix E)
- Union (Item 74, Appendix E)

Materials/Parts:

- Rags (Item 43, Appendix B)
- Four preformed packings

Personnel Required: Two

References:

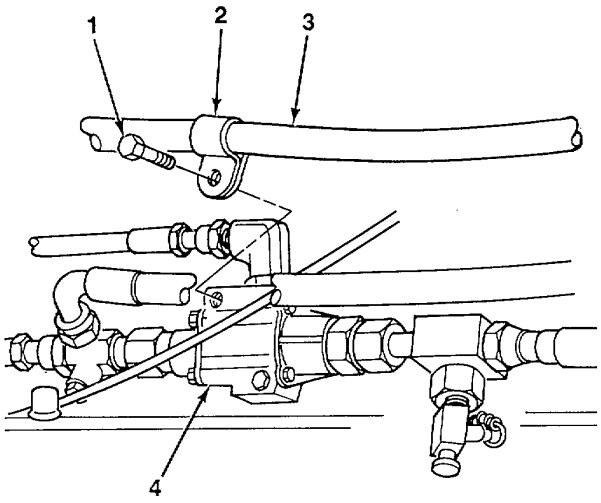
- TM 10-3930-659-10
- TM 10-3930-659-20

NOTE

A suitable container should be used to catch any draining hydraulic fluid. Ensure that all spills are properly cleaned.

PRESSURE CHECK

1. Remove screw (1) and clamp (2) from transmission thermal bypass valve (4). Move hose (3' aside.



TA708210

4-32. CONVERTER RELIEF VALVE PRESSURE CHECK (Con't).

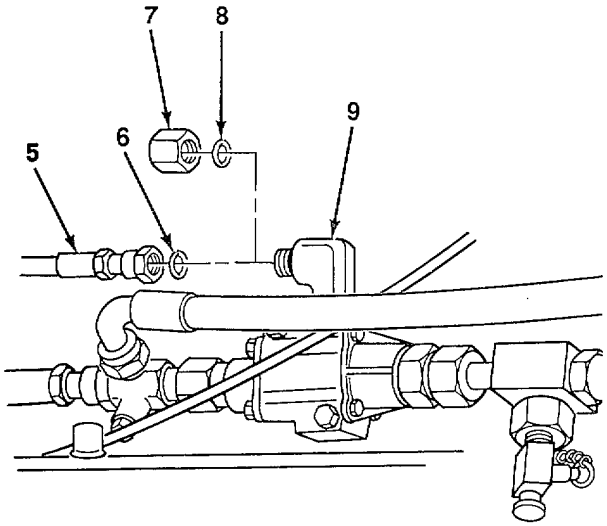
2. Remove hose (5) and preformed packing (6) from elbow (9). Discard preformed packing.

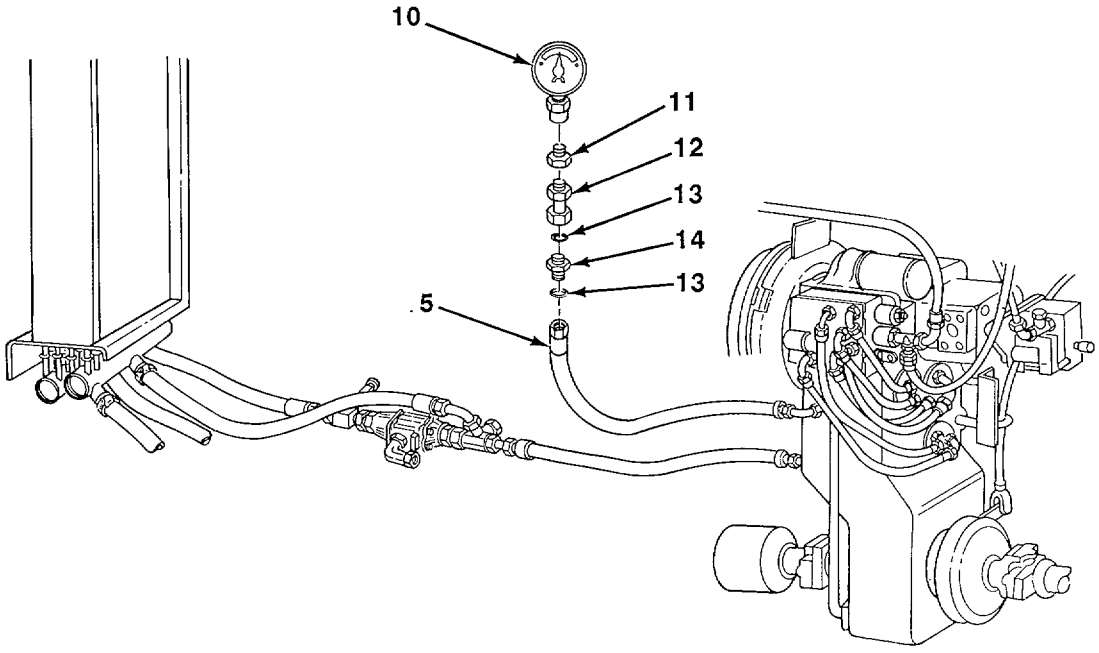
3. Install preformed packing (8) and cap (7) on elbow (9).

4. Install two preformed packings (13) and union (14) on hose (5).

5. Install adapter (12), adapter (11), and pressure gage (10) on union (14).

6. Start forklift truck and run until transmission oil temperature gage indicates that transmission fluid is warm (see TM 10-3930-659-10).





TA708211

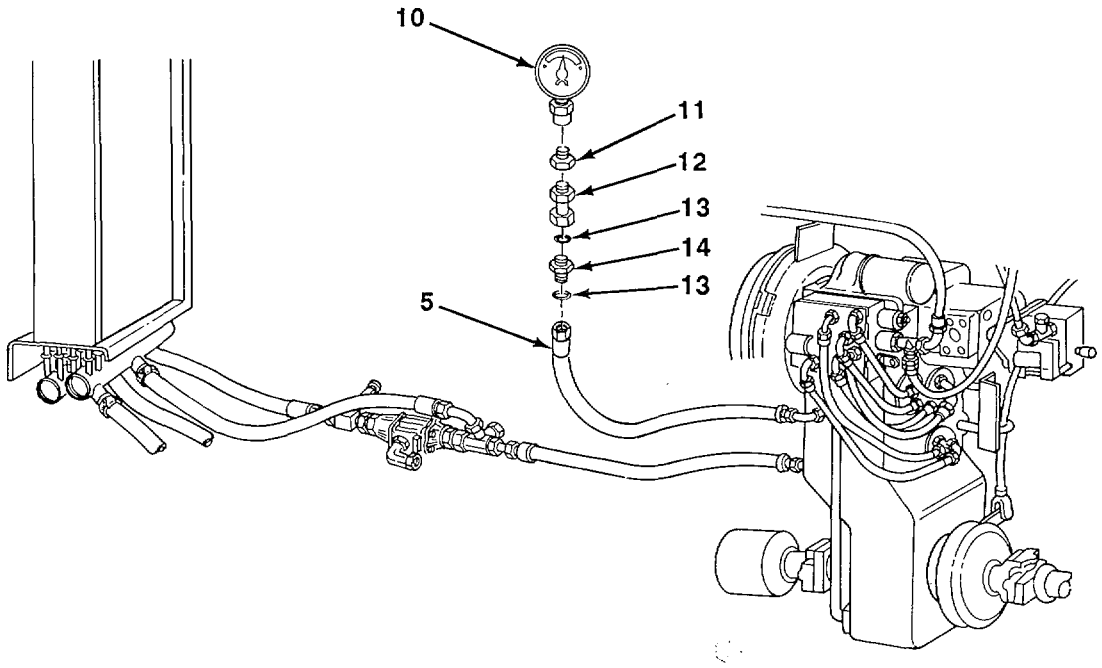
4-32. CONVERTER RELIEF VALVE PRESSURE CHECK (Con't).

7. Operate engine at 1500 rpm (see TM 10-3930-659-10) and note pressure reading on pressure gage (10). Reading must be 123-152 psi (848-1048 kPa). If pressure reading is not within specification, replace transmission assembly (see paragraph 4-40).

8. Shut down engine (see TM 10-3930-659-10).

9. Remove pressure gage (10), adapter (11), adapter (12), and union (14) from hose (5).

10. Remove two preformed packings (13) from union (14). Discard preformed packings.

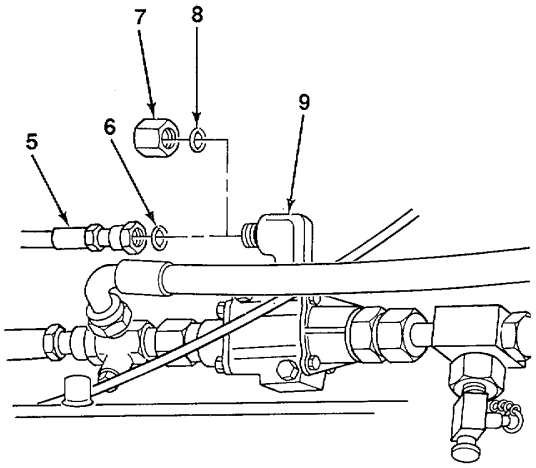


TA708212

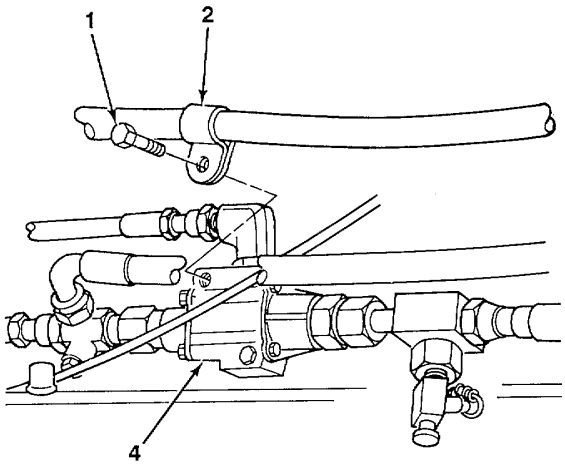
4-32. CONVERTER RELIEF VALVE PRESSURE CHECK (Con't).

11. Remove cap (7) and preformed packing (8) from elbow (9). Discard preformed packing.

12. Install new preformed packing (6) and hose (5) on elbow (9).



13. Install clamp (2) on transmission thermal bypass valve (4) with screw (1).



TA708213

FOLLOW-ON TASKS:

- Install left engine lower sideshield (see TM 10-3930-659-20).
- Close left engine upper sideshield (see TM 10-3930-659-10).
- Remove frame locking bar (see TM 10-3930-659-10).

4-33. CONVERTER STALL TEST.

This Task Covers: Stall Test

Initial Setup:

Equipment Conditions:
- Clutch cutoff switch disengaged (see TM 10-3930-659-10).

Tools/Test Equipment:
- STE/ICE (Item 58, Appendix E)

References:
- TM 10-3930-659-10

STALL TEST

1. Connect STE/ICE to read engine rpm (see paragraph 3-4).
2. Hold down service brake pedal.
3. Move transmission speed range selector lever to fourth gear and hold down service brake pedal (see TM 10-3930-659-10). Engine should stall at 2100 rpm.
4. If engine stall speed is excessively low, perform STE/ICE engine power check (see STE/ICE-R Test G06).
5. Repeat steps 2 and 3.
6. If engine stall speed is still low, replace torque converter (see paragraph 4-38).
7. If engine stall speed is excessively high, replace torque converter (see paragraph 4-38).

4-34. TRANSMISSION SYSTEM PRESSURE CHECK.

This Task Covers: Pressure Check

Initial Setup:

Equipment Conditions:

- Parking brake set (see TM 10-3930-659-10)
- Frame locking bar installed (see TM 10-3930-659-10)
- Right transmission side guard removed (see TM 10-3930-659-20)
- Transmission oil pressure switch removed (see TM 10-3930-659-20)

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Connector (Item 17, Appendix E)
- Quick coupler (Item 18, Appendix E)
- Pressure gage (Item 31, Appendix E)

Materials/Parts:

- One preformed packing

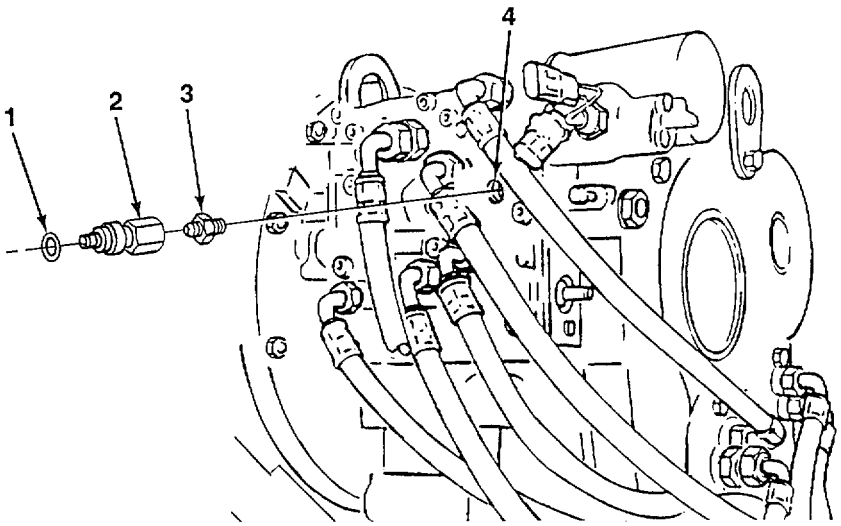
Personnel Required: Two

References:

- TM 10-3930-659-10
- TM 10-3930-659-20

PRESSURE CHECK

1. Install connector (3) and quick coupler (2) in transmission oil pressure switch port (4).
2. Install preformed packing (1) on quick coupler (2).

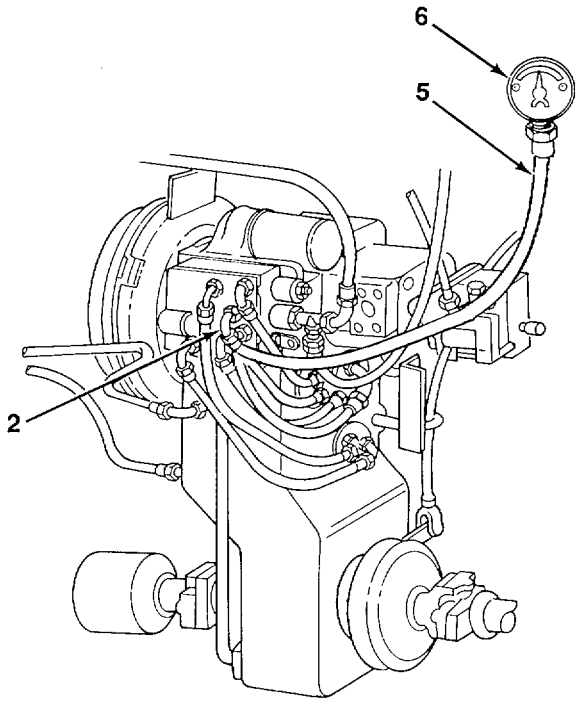


TA708214

4-34. TRANSMISSION SYSTEM PRESSURE CHECK (Con't).

3. Install hose (5) and pressure gage (6) on quick coupler (2).

4. Warm hydraulic system to operating temperature (see paragraph 2-28).



5. Move transmission direction selector lever to N (Neutral) and run engine at 1500 rpm. Note pressure reading on pressure gage (6). Pressure gage must read 213-242 psi (1469-1669 kPa). If pressure reading is within specification, go to step 9.

6. Move transmission direction selector leverto F (Forward) a ,d move transmission speed range selector leverto several different gear ranges (see TM 10-3930-659-10). Note if pressure reading increases to within specification in any gear range.

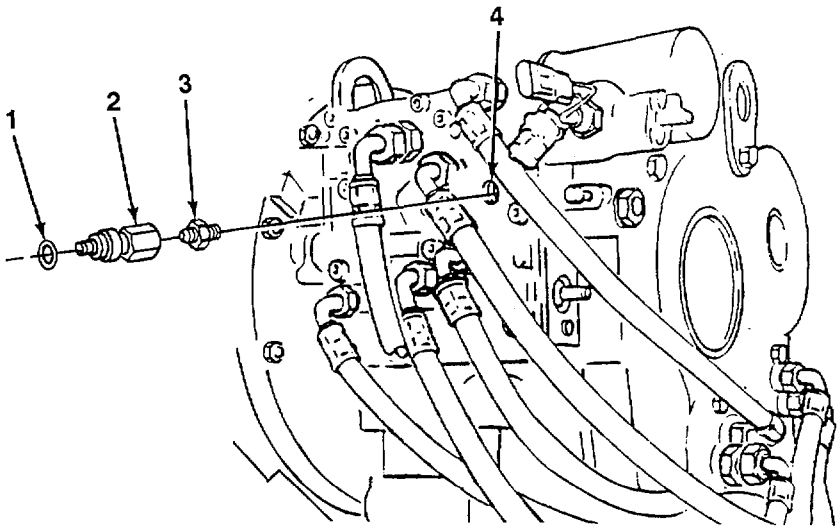
7. Move transmission direction selector leverto R (Reverse) and move transmission speed range selector leverto several different gear ranges (see TM 10-3930-659-10). Note if pressure reading increases to within specification in any gear range.

8. If pressure reading is still below minimum specification, replace pressure regulator (see paragraph 4-39).

9. Remove hose (5) and pressure gage (6) from quick coupler (2).

4-34. TRANSMISSION SYSTEM PRESSURE CHECK (Con't).

10. Remove preformed packing (1), quick coupler (2), and connector (3) from transmission oil pressure switch port (4).



FOLLOW-ON TASKS:

- Install transmission oil pressure switch (see TM 10-3930-659-20).
- Install right transmission side guard (see TM 10-3930-659-20).
- Remove frame locking bar (see TM 10-3930-659-10).

TA70821 6

4-35. TRANSMISSION LUBE PRESSURE TEST.

This Task Covers: Pressure Test

Initial Setup:

Equipment Conditions:
- Window washer tank bracket removed (see TM 10-3930-659-20).
- Left engine lower sideshield removed (see TM 10-3930-659-20).

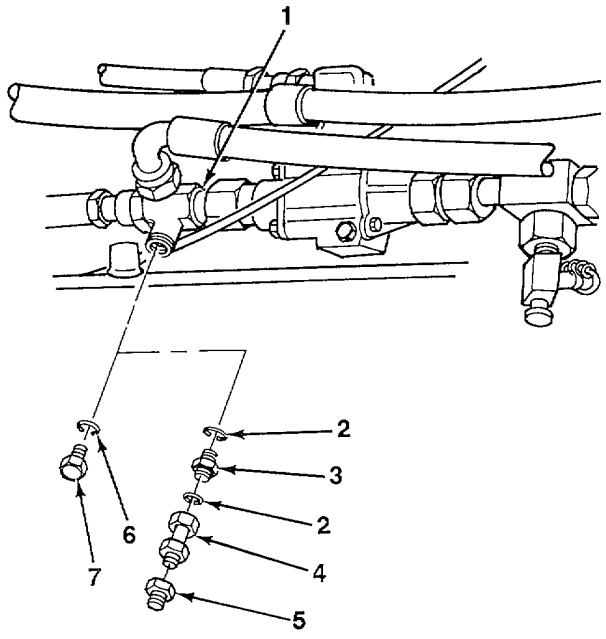
Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Adapter (Item 1, Appendix E)
- Adapter (item 3, Appendix E)
- Pressure gage (Item 31, Appendix E)
- Hose assembly (Item 37, Appendix E)
- Union (Item 75, Appendix E)

Materials/Parts:
- Three preformed packings

References:
- TM 10-3930-659-10
- TM 10-3930-659-20

PRESSURE TEST

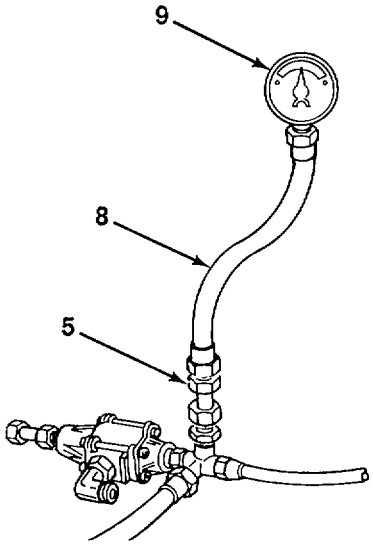
1. Remove plug (7) and preformed packing (6) from tee (1). Discard preformed packing.
2. Install two preformed packings (2) and union (3) on tee (1).
3. Install adapter (4) and adapter (5) on union (3).

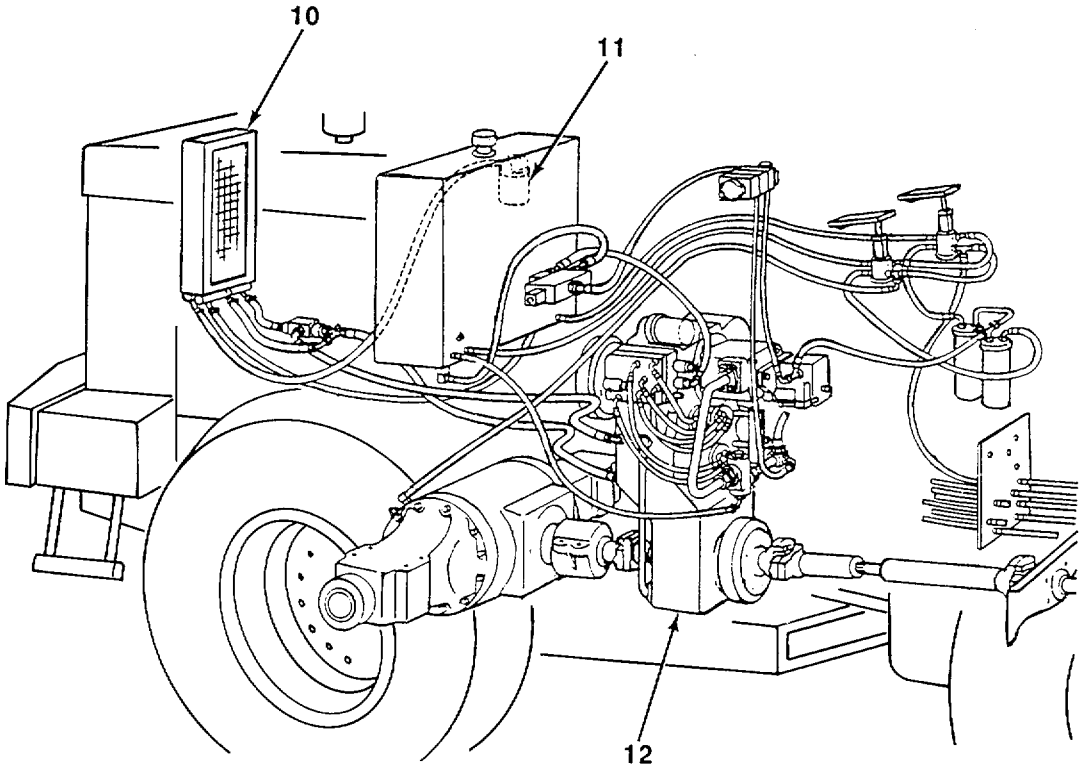


TA708217

4-35. TRANSMISSION LUBE PRESSURE TEST.

4. Install hose (8) and pressure gage (9) on adapter (5).
5. Start forklift truck and run until transmission oil temperature gage indicates that transmission fluid is warm (see TM 10-3930-659-10).
6. Operate engine at fast engine idle speed (see TM 10-3930-659-10) and note pressure reading on pressure gage (9). Pressure must read 3-15 psi (21-103 kPa). If pressure reading is within specification, go to step 12.
7. Check for pinched or blocked hoses between transmission oil cooler (10) and transmission assembly (12).
8. Remove hydraulic reservoir suction filter (11) and check for restrictions in suction screen (see TM 10-3930-659-20).



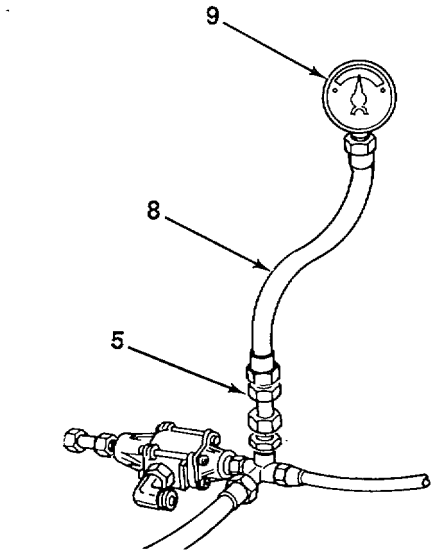


TA708218

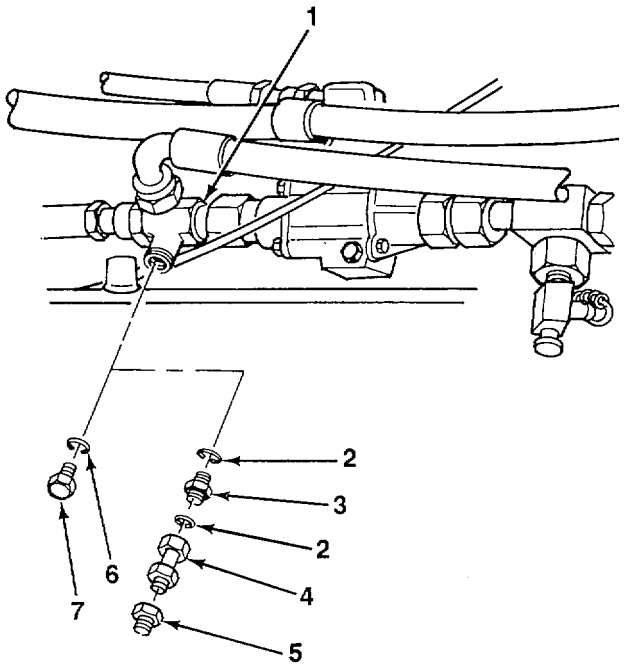
4-35. TRANSMISSION LUBE PRESSURE TEST.

9. Remove transmission thermal bypass valve and check for restrictions (see TM 10-3930-659-20).

10. Remove pressure regulator and check piston for sticking (see paragraph 4-39).
11. Replace transmission assembly (see paragraph 4-40).
12. Remove pressure gage (9) and hose (8) from adapter (5).



13. Remove adapter (5), adapter (4), and union (3) from tee (1).
14. Remove two preformed packings (2) from union (3). Discard preformed packings.
15. Install new preformed packing (6) and plug (7) on tee (1).



FOLLOW-ON TASKS: *
- Install left engine lower sideshield (see TM 10-3930-659-20).
- Install window washer tank bracket (see TM 10-3930-659-20).

TA708219

4-36. TRANSMISSION PUMP FLOW TEST.

This Task Covers: Flow Test

Initial Setup:

Equipment Conditions:
- Frame locking bar installed (see TM 10-3930-659-10).
- Right side cab skirt removed (see TM 10-3930-659-20).
- Right transmission side guard removed (see TM 10-3930-659-20).
- Transmission oil filter removed (see TM 10-3930-659-20).

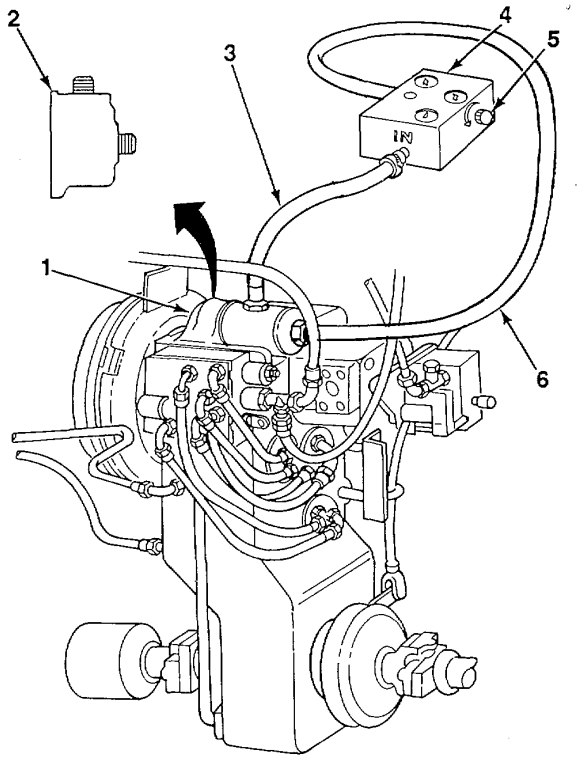
Personnel Required: Two

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Filter adapter (Item 23, Appendix E)
- Hydraulic flowmeter (Item 24, Appendix E)

References:
- TM 10-3930-659-10
- TM 10-3930-659-20

FLOW TEST

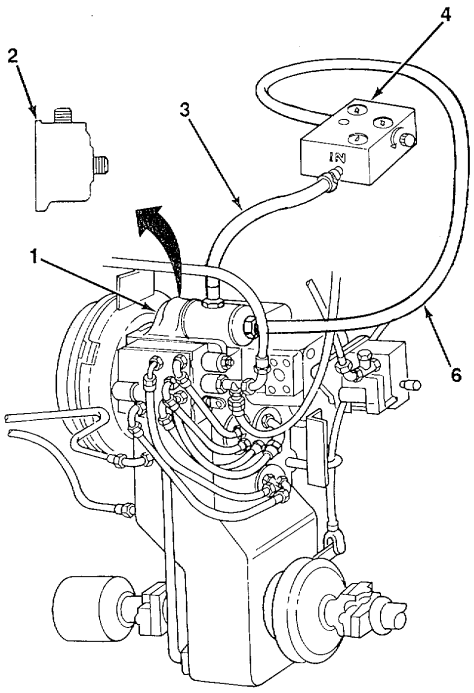
1. Install filter adapter (2) in transmission oil filter housing (1).
2. Install hydraulic flowmeter inlet hose (3) on top of filter adapter (2).
3. Install hydraulic flowmeter outlet hose (6) on front of filter adapter (2).
4. Check that loading valve (5) is in full OPEN position.
5. Start forklift truck and run until transmission oil temperature gage indicates that transmission fluid is warm (see TM 10-3930-659-10).
6. Move direction selector lever to N (Neutral) and run engine at fast engine idle speed (see TM 10-3930-659-10). Note reading on hydraulic flowmeter (4). Minimum allowable flow rate is 9.5 gpm (36 lpm). If reading is not within specification, replace transmission assembly (see paragraph 4-40).



TA708220

4-36. TRANSMISSION PUMP FLOW TEST (Con't).

7. Remove hydraulic flowmeter (4), hydraulic flowmeter inlet hose (3), and hydraulic flowmeter outlet hose (6) from filter adapter (2).
8. Remove filter adapter (2) from transmission oil filter housing (1).



FOLLOW-ON TASKS:

- Install transmission oil filter (see TM 10-3930-659-20).
- Install right transmission side guard (see TM 10-3930-659-20).
- Install right side cab skirt (see TM 10-3930-659-20).
- Remove frame locking bar (see TM 10-39330-659-10).
- Check transmission fluid level and fill as necessary (see TM 10-3930-659-10).

TA708221

4-37. TRANSMISSION LIFTING EYES REPLACEMENT.

This Task Covers:
a. Removal b. Installation

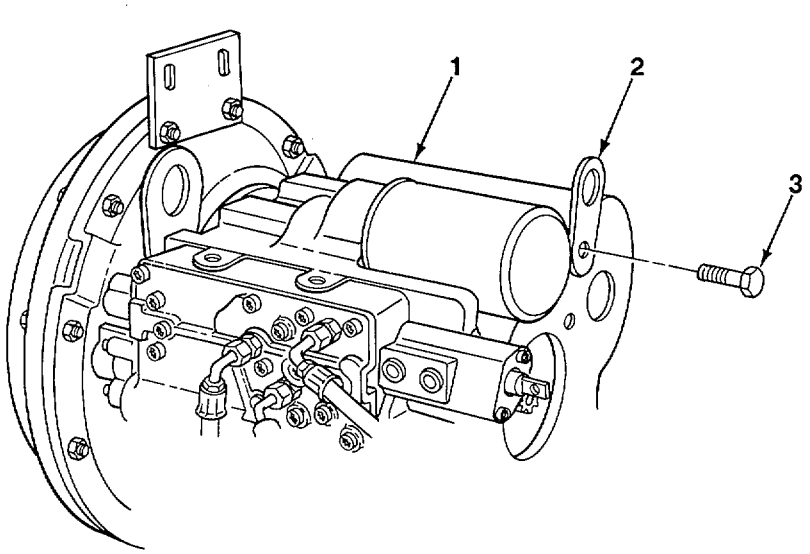
Initial Setup:
Equipment Conditions:
• Cab skirts removed (see TM 10-3930-659-20).
References:
• TM 10-3930-659-20

Tools/Test Equipment:
• General mechanic's tool kit (Item 71, Appendix E)

NOTE
Forward and rear transmission lifting eyes are removed and installed the same way. Forward transmission lifting eye is illustrated.

a. REMOVAL

Remove screw (3) and lifting eye (2) from transmission assembly (1).



b. INSTALLATION

Install lifting eye (2) on transmission assembly (1) with screw (3).

FOLLOW-ON TASKS:
• Install cab skirts (see TM 10-3930-659-20).

TA708222

4-38. TORQUE CONVERTER REPLACEMENT.

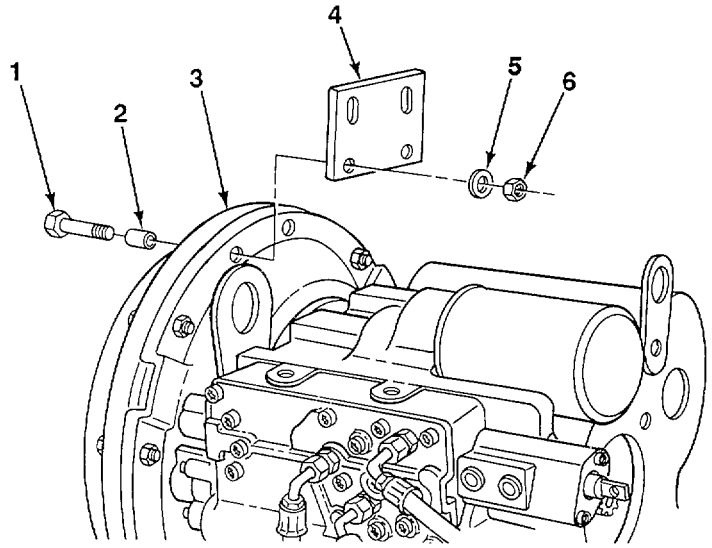
This Task Covers:
a. Removal b. Installation

Initial Setup:
Equipment Conditions:
• Transmission assembly removed (see paragraph 4-40).
• Two grooved pins
Tools/Test Equipment:
• General mechanic's tool kit (Item 71, Appendix E)
• Electric drill, portable (Item 20, Appendix E)
• Twist drill set (Item 21, Appendix E)
• Mechanical puller (Item 51, Appendix E)
• Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)
Materials/Parts:
• Rags (Item 43, Appendix B)
• One locking strap

NOTE
A suitable container should be used to catch any draining hydraulic fluid. Ensure that all spills are properly cleaned.

a. REMOVAL

1. Remove two nuts (6), washers (5), mounting plate (4), two screws (1), and spacers (2) from transmission cover (3).



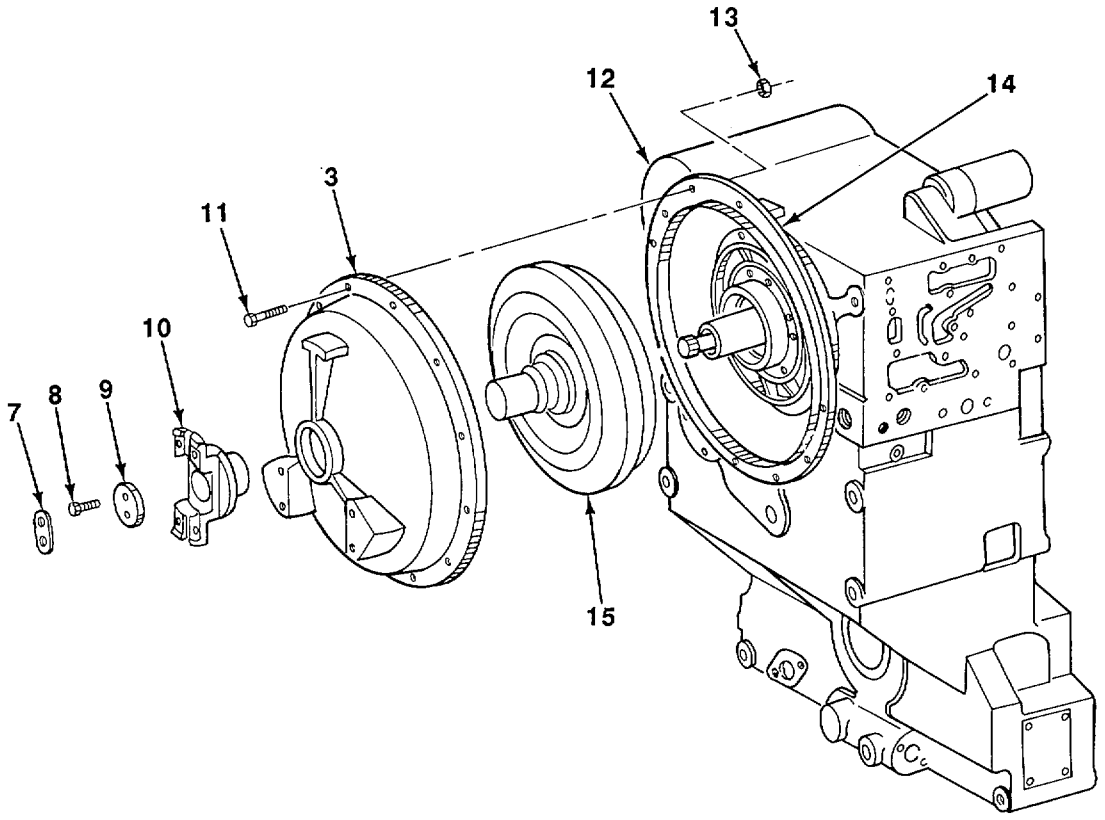
TA708223

4-38. TORQUE CONVERTER REPLACEMENT (Con't).

2. Mark transmission cover (3), housing (14), and transmission assembly (12) to aid during installation.

3. Remove ten nuts (13), screws (11), and transmission cover (3) from housing (14).

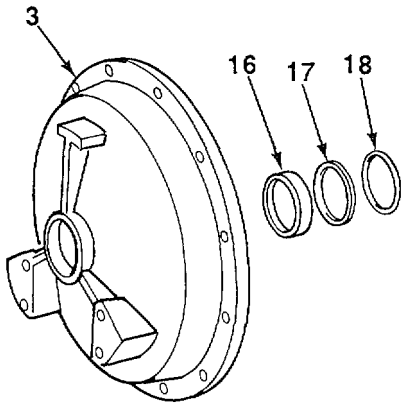
4. Remove locking strap (7), two screws (8), washer (9), yoke (10), and torque converter (15) from transmission cover (3). Discard locking strap.



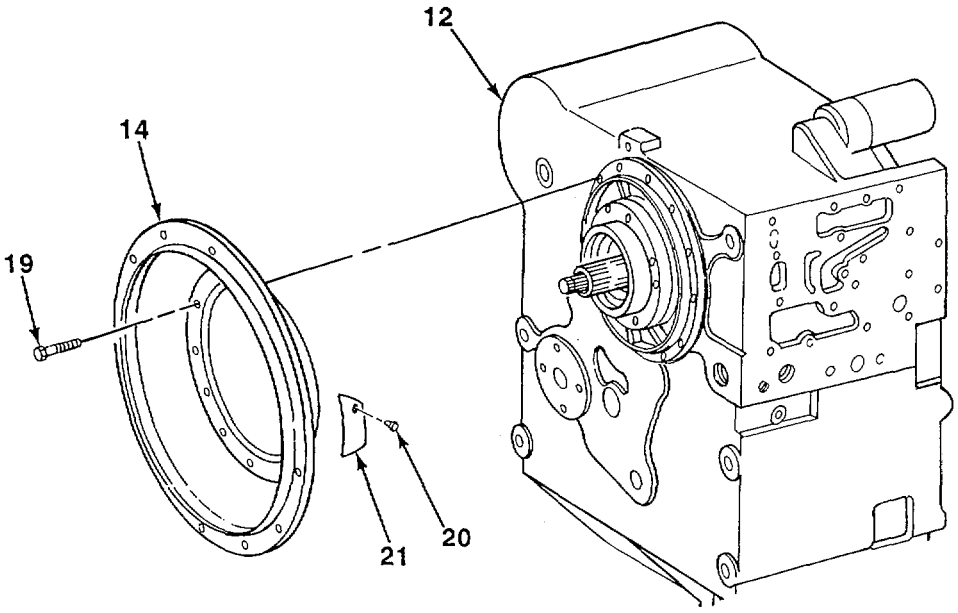
TA708224

4-38. TORQUE CONVERTER REPLACEMENT (Con't).

5. Remove retaining ring (18), spacer (17), and bearing (16) from transmission cover (3).



6. Remove 12 screws (19) and housing (14) from transmission assembly (12).
7. If cover plate (21) is damaged, remove two grooved pins (20) and cover plate from housing (14). Discard grooved pins.



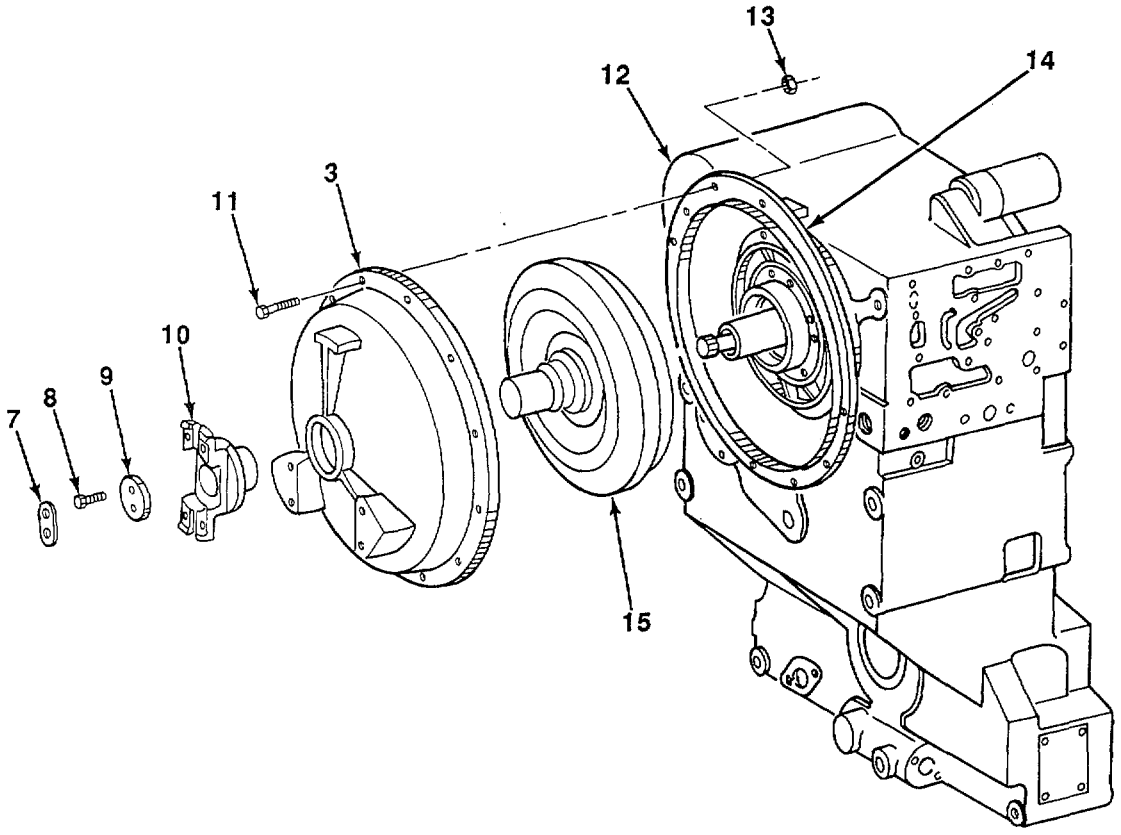
b. INSTALLATION

1. If removed, install cover plate (21) on housing (14) with two new grooved pins (20).
2. Install housing (14) on transmission assembly (12) with 12 screws (19). Torque screws to 50 lb.-ft. (68 N•m).
3. Install bearing (16) and spacer (17) on transmission cover (3) with retaining ring (18).

TA708225

4-38. TORQUE CONVERTER REPLACEMENT (Con't).

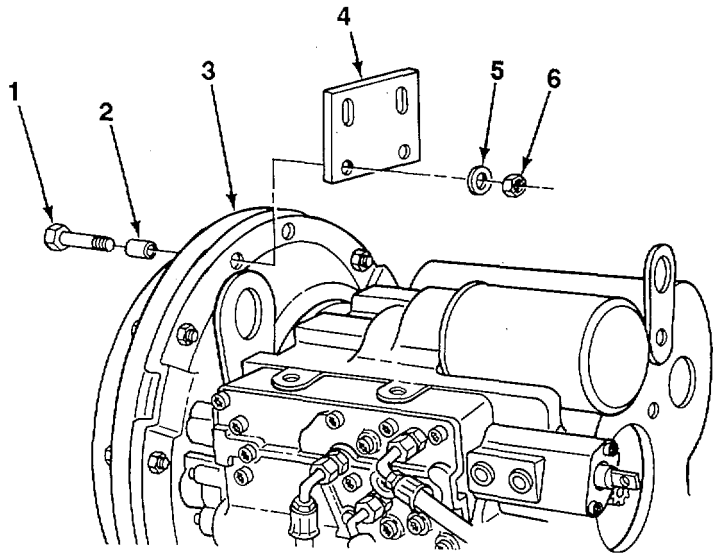
4. Install torque converter (15) and yoke (10) on transmission cover (3) with washer (9) and two screws (8). Torque screws to 29 lb.-ft. (39 N-m).
5. Install new locking strap (7) on two screws (8).
6. Install transmission cover (3) on housing (14) with ten screws (11) and nuts (13). Torque screws to 50 lb.-ft. (68 N-m).



TA708226

4-38. TORQUE CONVERTER REPLACEMENT (Con't).

7. Install mounting plate (4) on transmission cover (3) with two spacers (2), screws (1), washers (5), and nuts (6).Torque screws to 50 lb.-ft. (68 N•m).



TA708227

FOLLOW-ON TASKS:
• Install transmission assembly (see paragraph 4-40).

4-39. PRESSURE REGULATOR REPLACEMENT.

This Task Covers:

a. Removal b. Installation

Initial Setup:

Equipment Conditions:
- Transmission oil temperature sender removed (see TM 10-3930-659-20).
- Torque converter removed (see paragraph 4-38).

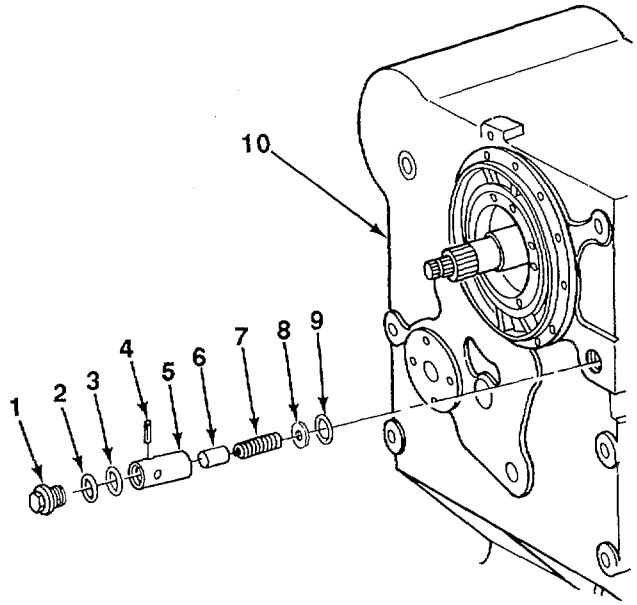
Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Retaining ring pliers (Item 46, Appendix E)

Materials/Parts:
- One preformed packing
- Two retaining rings

References:
- TM 10-3930-659-20

a. REMOVAL

1. Remove plug (1) and preformed packing (2) from transmission assembly (10). Discard preformed packing.
2. Remove retaining ring (3), valve sleeve (5), piston (6), spring (7), washer (8), and retaining ring (9) from transmission assembly (10). Discard retaining rings.
3. Remove pin (4) from valve sleeve (5).

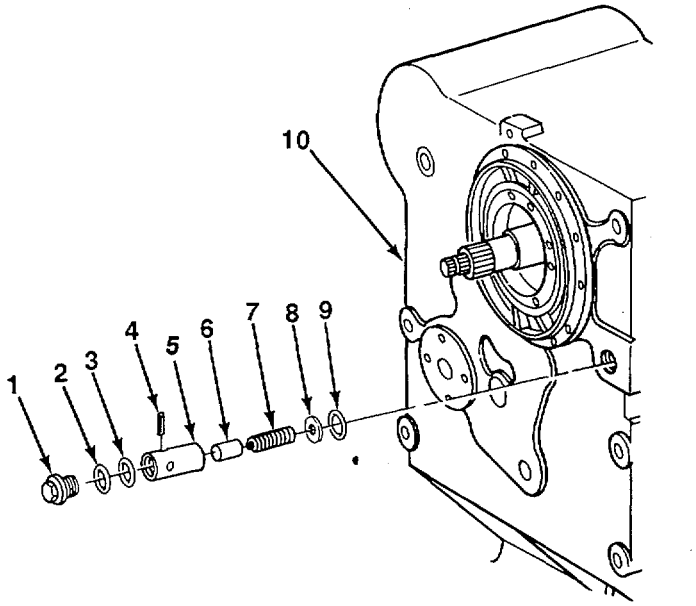


TA708228

4-39. PRESSURE REGULATOR REPLACEMENT (Con't).

b. INSTALLATION

1. Install new retaining ring (9) on transmission assembly (10).
2. Install pin (4) in valve sleeve (5).
3. Install washer (8), spring (7), piston (6), valve sleeve (5), and new retaining ring (3) on transmission assembly (10).
4. Install new preformed packing (2) and plug (1) on transmission assembly (10).



FOLLOW-ON TASKS:
- Install torque converter (see paragraph 4-38).
- Install transmission oil temperature sender (see TM 10-3930-659-20).

TA708229

4-40. TRANSMISSION ASSEMBLY REPLACEMENT.

This Task Covers:

a. Removal b. Installation

Initial Setup:

Equipment Conditions:
- Transmission drained (see TM 10-3930-659-20).
- Cab assembly with ROPS removed (see paragraph 4-61).
- Front universal joint and support bearing removed (see TM 10-3930-659-20).
- Rear universal joint removed (see TM 10-3930-659-20).
- Engine-to-transmission universal joint removed (see paragraph 4-46).
- Main hydraulic pump removed (see TM 10-3930-659-20).
- Transmission oil level tube removed (see TM 10-3930-659-20).
- Crossover relief valve and bracket removed (see TM 10-3930-659-20).
- Priority valve removed (see TM 10-3930-659-20).
- Transmission thermal bypass valve-to-transmission hose removed (see TM 10-3930-659-20).

Equipment Conditions (Con't):
- Transmission shift linkage bracket removed (see TM 10-3930-659-20).
- Forklift control valve-to-priority valve hose removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Socket wrench set, 4 in. drive (Item 78, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

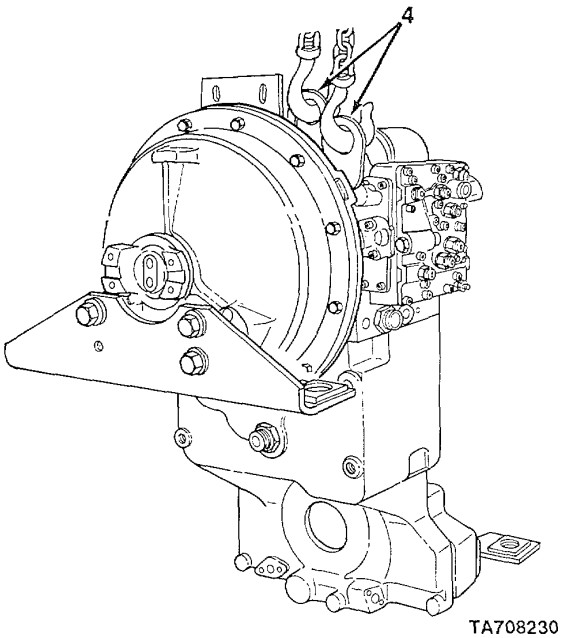
- **Personnel Required**: Two

- **References:**

- TM 10-3930-659-10
- TM 10-3930-659-20

a. REMOVAL

1. Attach suitable lifting device to two transmission lifting eyes (4). Raise lifting device enough to support weight of transmission assembly.



4-40. TRANSMISSION ASSEMBLY REPLACEMENT (Con't).

WARNING

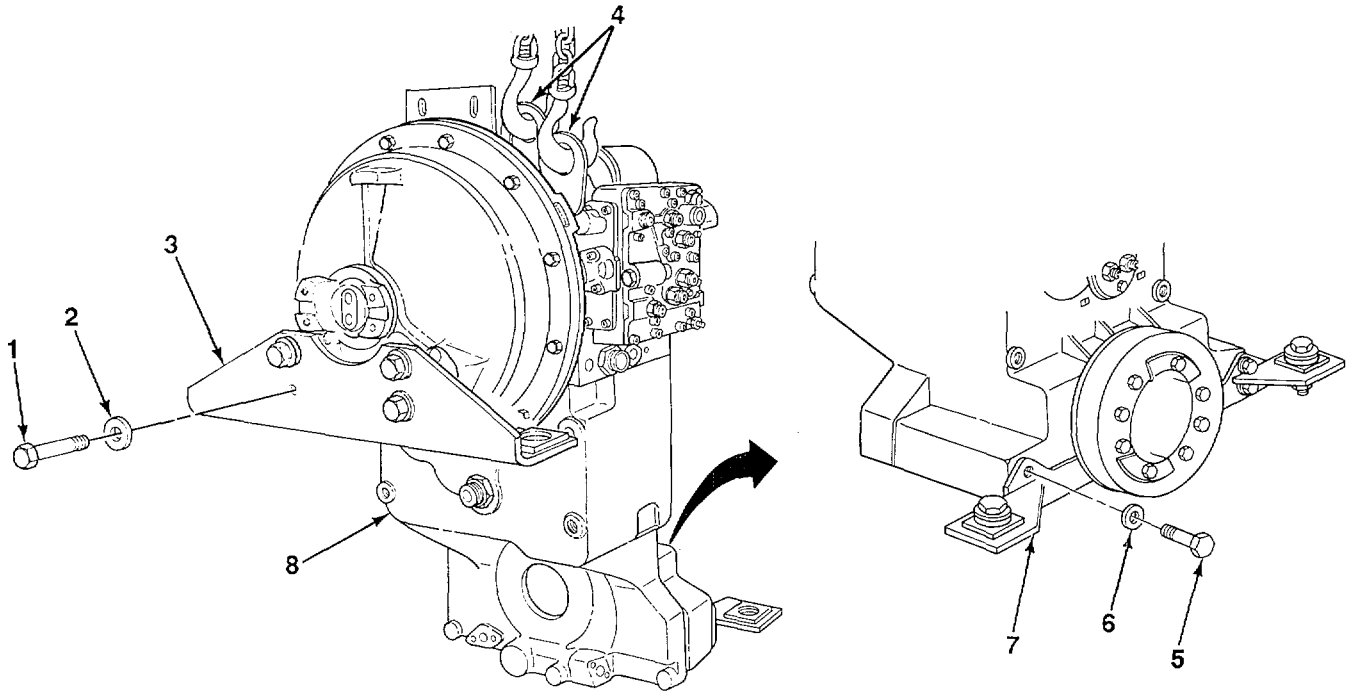
Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

2. Remove four screws (1) and washers (2) from transmission upper bracket (3).
3. Remove four screws (5) and washers (6) from transmission lower bracket (7).

CAUTION

Ensure that all hydraulic hoses and wiring harnesses are clear when lifting transmission assembly from forklift truck. Equipment may be damaged if hydraulic hoses or wiring harnesses catch on transmission assembly.

4. Using suitable lifting device, remove transmission assembly (8) from forklift truck. Remove lifting device from transmission assembly.



TA708231

4-40. TRANSMISSION ASSEMBLY REPLACEMENT (Con't).

b. INSTALLATION

1. Attach suitable lifting device to two transmission assembly lifting eyes (4). Raise lifting device enough to support weight of transmission assembly.

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

2. Using suitable lifting device, lift transmission assembly (8) and position over forklift truck.

NOTE

Have assistant guide transmission assembly onto transmission upper and lower brackets to ensure that all hydraulic hoses and wiring harnesses are clear.

3. Lower transmission assembly (8) into forklift truck.
4. Install four washers (6) and screws (5) in transmission lower bracket (7).
5. Install four washers (2) and screws (1) in transmission upper bracket (3).
6. Torque screws (5) to 320 lb.-ft. (434 N•m) and screws (1) to 214 lb.-ft. (290 N•m).
7. Remove suitable lifting device from transmission lifting eyes (4).

FOLLOW-ON TASKS:

- Install forklift control valve-to-priority valve hose (see TM 10-3930-659-20).
- Install transmission shift linkage bracket (see TM 10-3930-659-20).
- Install transmission thermal bypass valve-to-transmission hose (see TM 10-3930-659-20).
- Install priority valve (see TM 10-3930-659-20).
- Install crossover relief valve and bracket (see TM 10-3930-659-20).
- Install transmission oil level tube (see TM 10-3930-659-20).
- Install main hydraulic pump (see TM 10-3930-659-20).
- Install engine-to-transmission universal joint (see paragraph 4-46).
- Install rear universal joint (see TM 10-3930-659-20).
- Install front universal joint and support bearing (see TM 10-3930-659-20).
- Install cab assembly with ROPS (see paragraph 4-61).
- Fill transmission assembly with hydraulic fluid (see TM 10-3930-659-10).

4-41. TRANSMISSION UPPER BRACKET REPLACEMENT.

This Task Covers:

a. Removal b. Installation

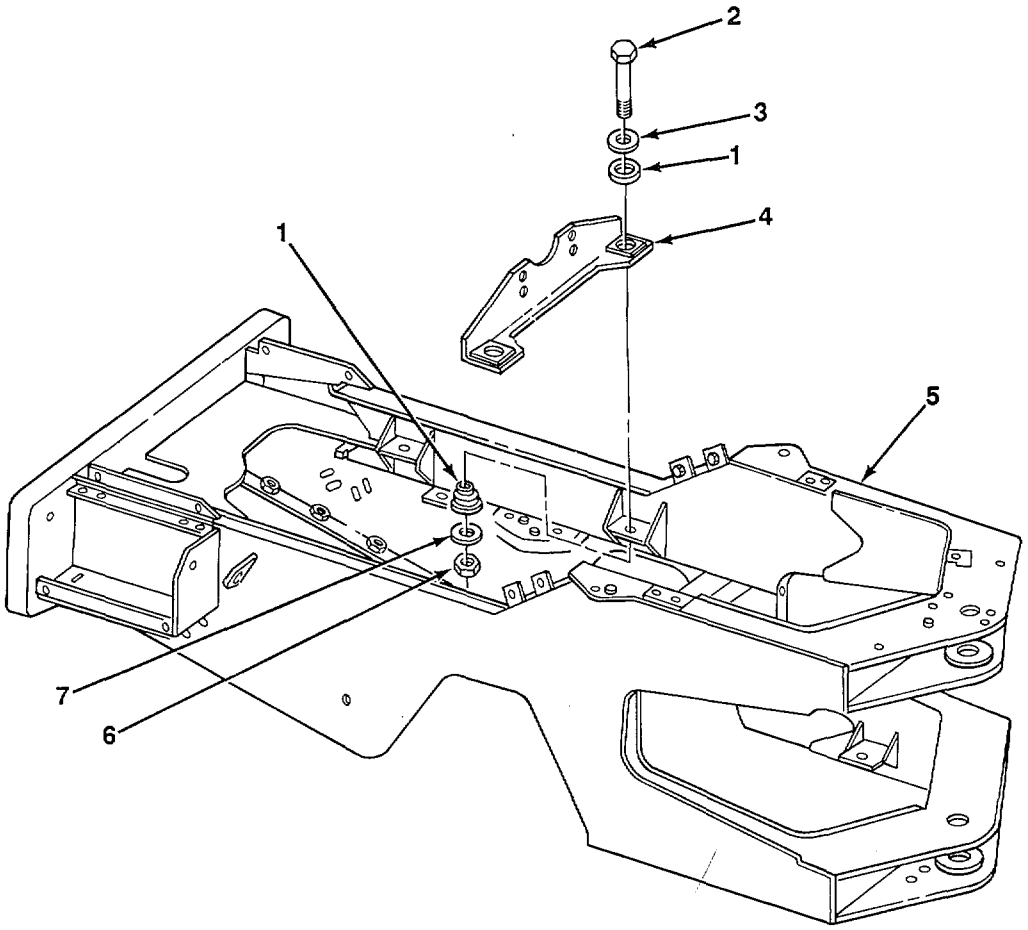
Initial Setup:

Equipment Conditions:
• Transmission assembly removed (see paragraph 4-40).

Tools/Test Equipment:
• General mechanic's tool kit (Item 71, Appendix E)
• Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

a. REMOVAL

1. Remove two nuts (6), washers (7), screws (2), washers (3), and resilient mounts (1) from transmission upper bracket (4) and frame (5).
2. Remove transmission upper bracket (4) from frame (5).



TA708232

4-41. TRANSMISSION UPPER BRACKET REPLACEMENT (Con't).

b. INSTALLATION

1. Position transmission upper bracket (4) on frame (5).
2. Install transmission upper bracket (4) and two resilient mounts (I) on frame (5) with two washers (3), screws (2), washers (7), and nuts (6). Torque screws to 270 lb.-ft. (366 N-m).

FOLLOW-ON TASKS:
• Install transmission assembly (see paragraph 4-40).

4-42. TRANSMISSION LOWER BRACKET REPLACEMENT.

This Task Covers:

a. Removal b. Installation

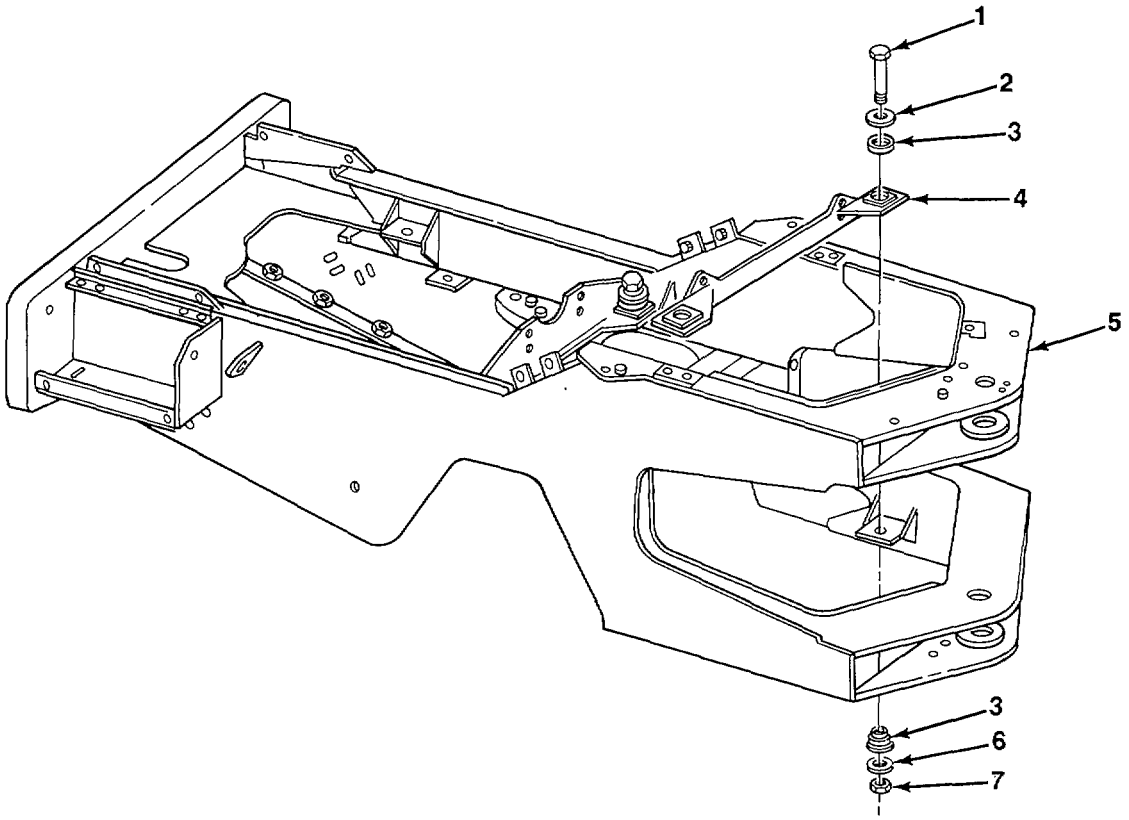
Initial Setup:

Equipment Conditions:
- Transmission assembly removed (see paragraph 4-40).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

a. REMOVAL

1. Remove two nuts (7), washers (6), screws (1), washers (2), and resilient mounts (3) from transmission lower bracket (4) and frame (5).
2. Remove transmission lower bracket (4) from frame (5).



TA708233

4-42. TRANSMISSION LOWER BRACKET REPLACEMENT (Con't).

b. INSTALLATION

1. Position transmission lower bracket (4) on frame (5).
2. Install transmission lower bracket (4) and two resilient mounts (3) on frame (5) with two washers (2), screws (1), washers (6), and nuts (7). Torque screws to 270 lb.-ft. (366 N.m).

FOLLOW-ON TASKS:

- Install transmission assembly (see paragraph 4-40).

4-43. TRANSMISSION INPUT SEAL AND BEARING REPLACEMENT.

This Task Covers:
a. Removal b. Installation

Initial Setup:

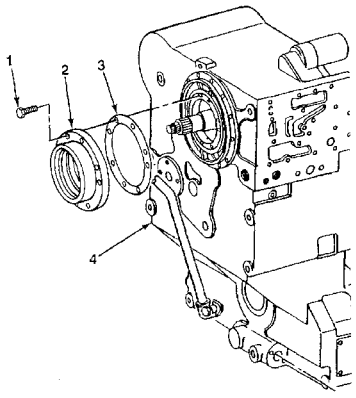
Equipment Conditions:
• Torque converter removed (see paragraph 4-38).

Materials/Parts:
• One gasket
• One seal

Tools/Test Equipment:
• General mechanic's tool kit (Item 71, Appendix E)
• Arbor press (Item 47, Appendix E)
• Mechanical puller (Item 51, Appendix E)
• Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

a. REMOVAL

1. Remove eight screws (1), bearing cover (2), and gasket (3) from transmission assembly (4). Discard gasket.

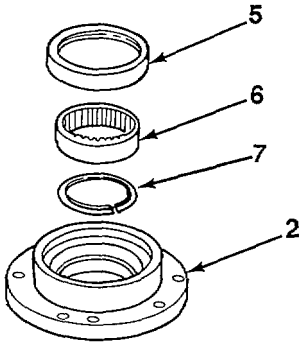


TA708234

4-43. TRANSMISSION INPUT SEAL AND BEARING REPLACEMENT (Con't)

2. Using mechanical puller, remove seal (5) and bearing (6) from bearing cover (2). Discard seal.

3. Remove retaining ring (7) from bearing cover (2).

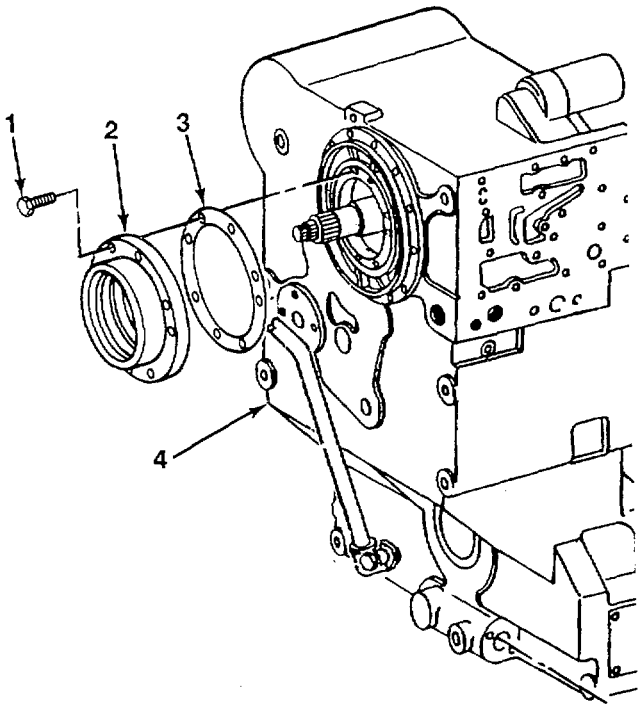


b. INSTALLATION

1. Install retaining ring (7) in bearing cover (2)

2. Using arbor press, install bearing (6) and new seal (5) in bearing cover (2)

3. Install new gasket (3) and bearing cover (2) on transmission assembly (4) with eight screws (1) Torque screws to 18 lb.-ft. (24 N.m)



TA708235

FOLLOW-ON TASKS:
• Install torque converter (see paragraph 4-38).

4-44. TRANSMISSION OIL COOLER REPAIR

Refer to TM 750-254 (Tactical Vehicles, Cooling Systems) for instructions on transmission oil cooler repair.

Section VIII. PROPELLER SHAFT MAINTENANCE

4-45. DRIVE DAMPENER REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Equipment Conditions:

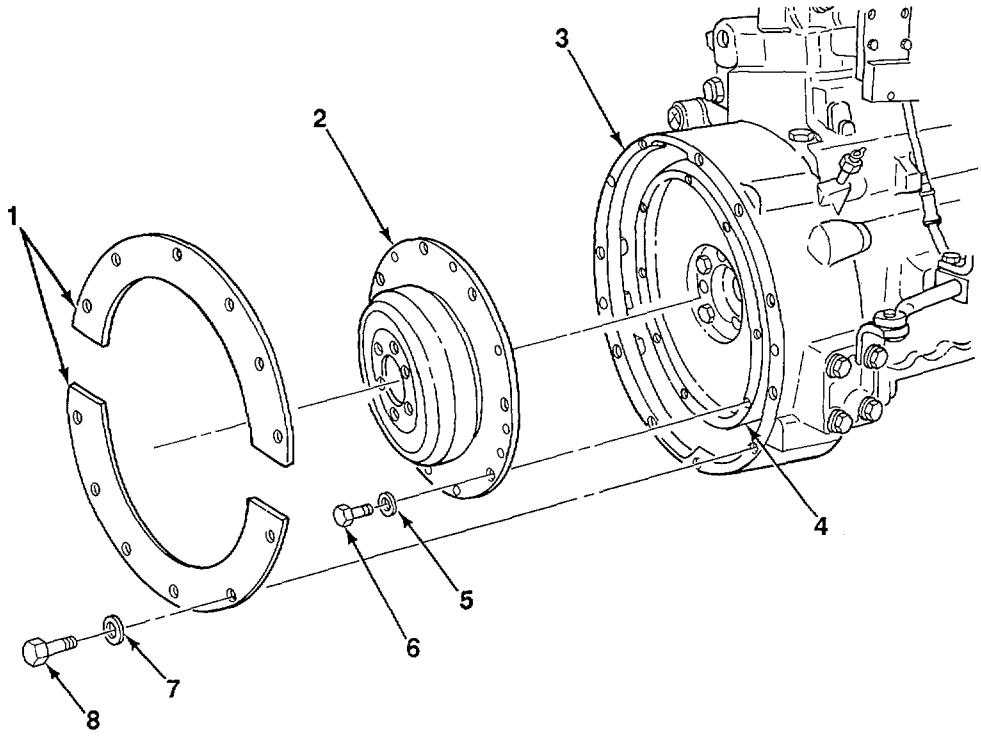
- Engine assembly removed (see paragraph 4-3).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

a. REMOVAL

1. Remove 12 screws (8), washers (7), and cover (1) from flywheel housing (3).
2. Remove eight screws (6), washers (5), and drive dampener (2) from flywheel (4).



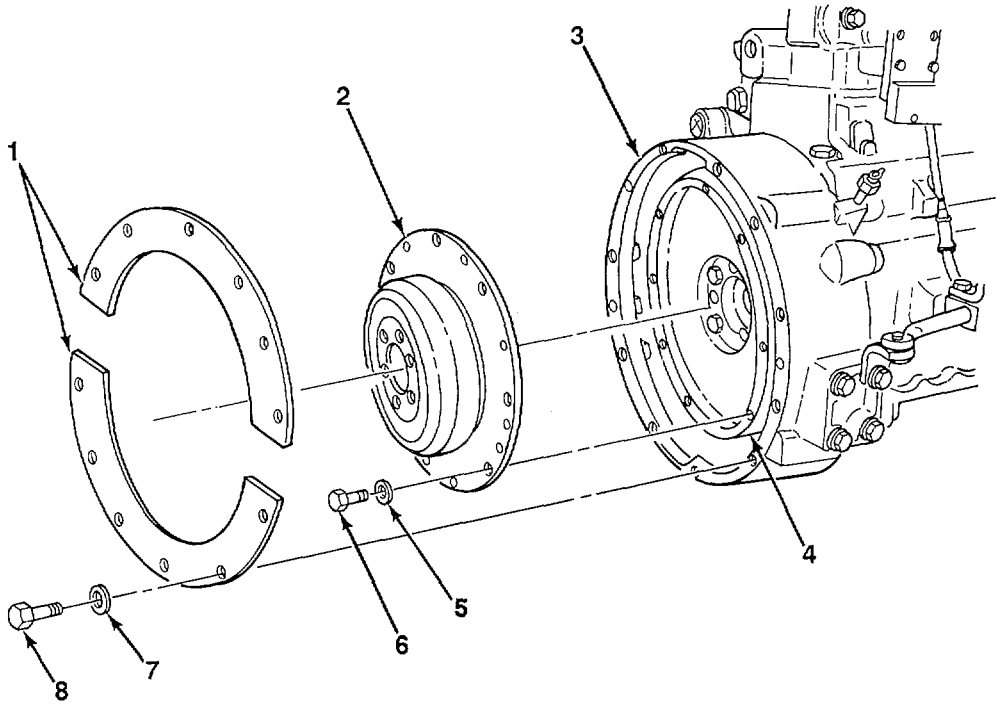
TA708236

4-45. DRIVE DAMPENER REPLACEMENT (Con't).

b. INSTALLATION

1. Install drive dampener (2) on flywheel (4) with eight washers (5) and screws (6). Torque screws to 35 lb.-ft. (47 N•m).

2. Install cover (1) on flywheel housing (3) with 12 washers (7) and screws (8).



FOLLOW-ON TASKS:

- Install engine assembly (see paragraph 4-3).

TA708237

4-46. ENGINE-TO-TRANSMISSION UNIVERSAL JOINT MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Equipment Conditions:

- Wheels chocked.
- Left engine lower sideshield removed (see TM 10-3930-659-20).
- Left engine upper sideshield removed (see TM 10-3930-659-20).
- Window washer bottle and bracket removed (see TM 10-3930-659-20).
- Hydraulic reservoir removed (see TM 10-3930-659-20).
- Engine hood removed (see TM 10-3930-659-20).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:

- Dry cleaning solvent (Item 47, Appendix B)

References:

- TM 10-3930-659-20

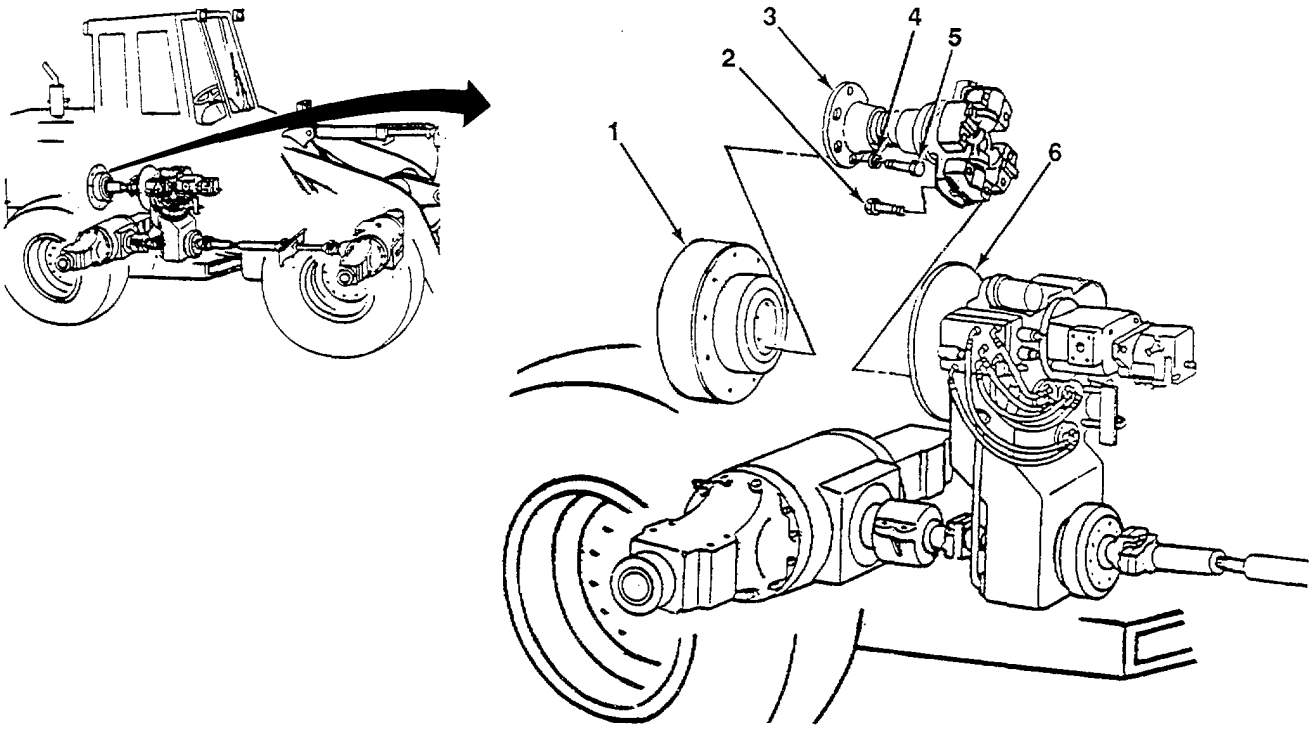
General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

4-46. ENGINE-TO-TRANSMISSION UNIVERSAL JOINT MAINTENANCE (Con't).

a. REMOVAL

1. Remove four screws (2) and universal joint (3) from transmission assembly (6).
2. Remove six screws (5) and washers (4) from universal joint (3) and drive dampener (1).
3. Loosen two front engine mounting bolts (see paragraph 4-3).
4. Remove two rear engine mounting bolts (see paragraph 4-3).
5. Using suitable lifting device, lift rear of engine approximately 1 in. (25.4 mm) and remove universal joint (3) from drive dampener (1).



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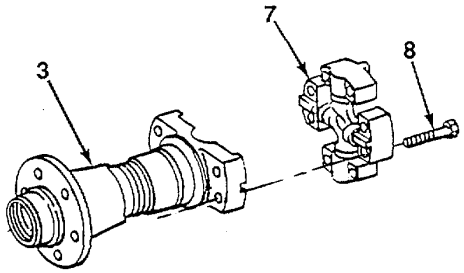
4-46. ENGINE-TO-TRANSMISSION UNIVERSAL JOINT MAINTENANCE (Con't).

b. DISASSEMBLY

Remove four screws (8) and spider bearing assembly (7) from universal joint (3).



c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes and get medical aid.

1. Clean parts with dry cleaning solvent and allow to dry.
2. Inspect spider bearing assembly for broken or missing parts. Replace damaged spider bearing assembly.
3. Inspect spider bearing assembly for free movement. Replace spider bearing assembly if it does not move freely.

d. ASSEMBLY

Install spider bearing assembly (7) on universal joint (3) with four screws (8). Torque screws to 45 lb.-ft. (61 N•m).

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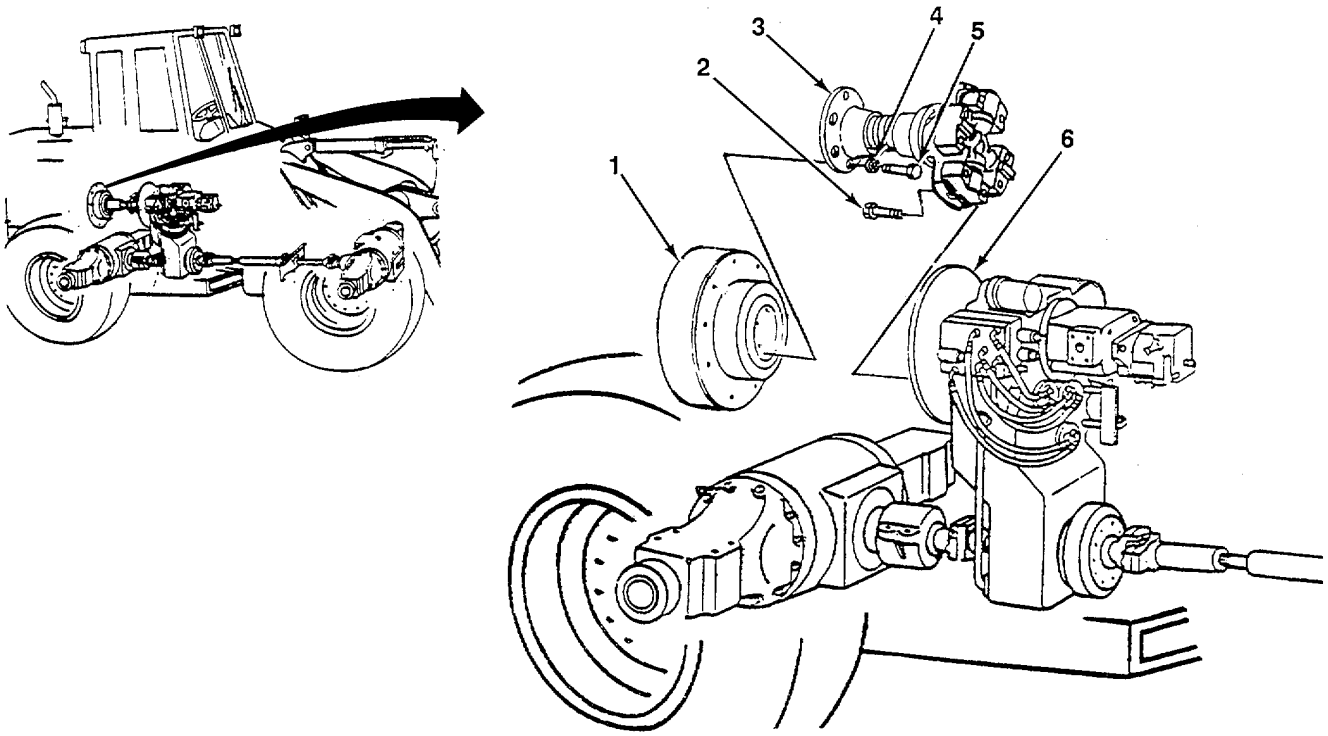
4-46. ENGINE-TO-TRANSMISSION UNIVERSAL JOINT MAINTENANCE (Con't).

e. INSTALLATION

1. Using suitable lifting device, lift rear of engine approximately 1 in. (25.4 mm) and position universal joint (3) on drive dampener (1) and transmission assembly (6).
2. Install two rear engine mounting bolts (see paragraph 4-3).
3. Tighten two front engine mounting bolts (see paragraph 4-3).
4. Install universal joint (3) on transmission assembly (6) with four screws (2). Torque screws to 45 lb.-ft. (61 N•m).
5. Install six washers (4) and screws (5) on universal joint (3) and drive dampener (1). Torque screws to 45 lb.-ft. (61 N•m).



FOLLOW-ON TASKS:

- Install engine hood (see TM 10-3930-659-20).
- Install hydraulic reservoir (see TM 10-3930-659-20).
- Install window washer bottle and bracket (see TM 10-3930-659-20).
- Install left engine upper sideshield (see TM 10-3930-659-20).
- Install left engine lower sideshield (see TM 10-3930-659-20).

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Section IX. AXLE MAINTENANCE

4-47. FRONT AXLE ASSEMBLY REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Equipment Conditions:

- Frame locking bar installed (see TM 10-3930-659-10).
- Battery disconnect switch in OFF position (see TM 10-3930-659-10).
- Boom lock removed (see TM 10-3930-659-20).
- Front bottom guard removed (see TM 10-3930-659-20).
- Front differential drained (see TM 10-3930-659-20).
- Front brake hose disconnected (see TM 10-3930-659-20).
- Front universal joint disconnected (see TM 10-3930-659-20).
- Carriage assembly removed (see TM 10-3930-659-20)

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Hydraulic jack, 10 ton (Item 39, Appendix E)
- Impact socket set (Item 59, Appendix E)
- Trestle, 7 ton (four) (Item 73, Appendix E)
- Socket wrench set (Item 78, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

Personnel Required: Three

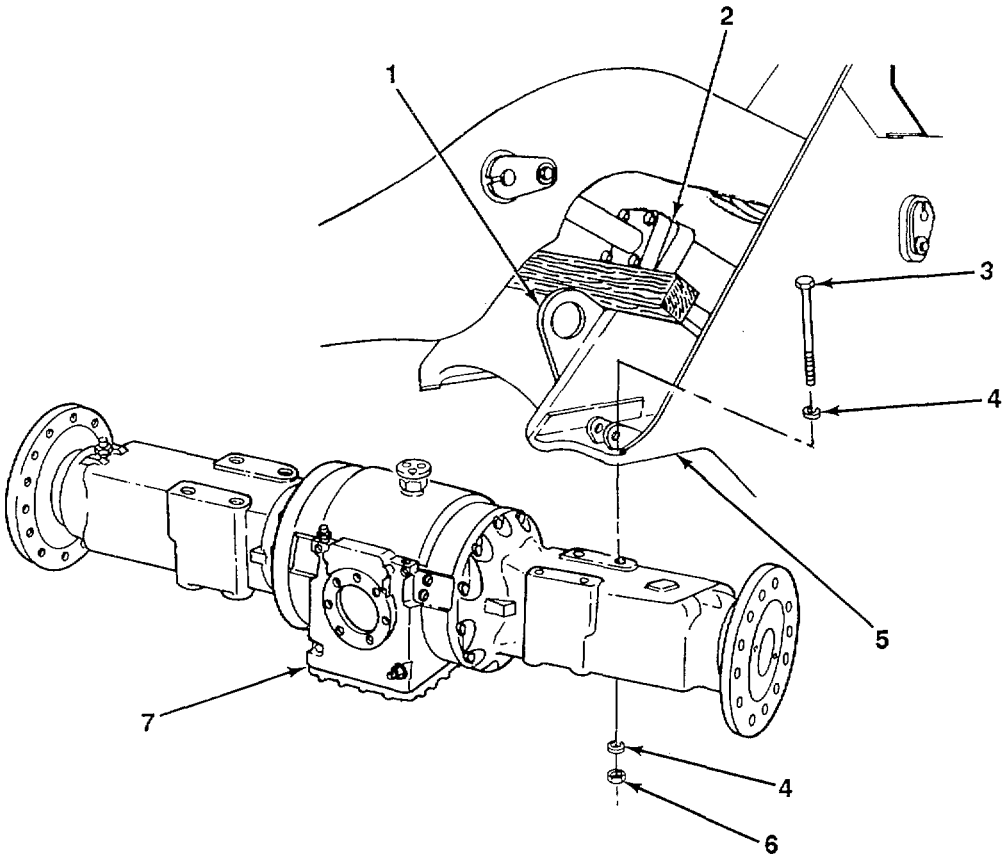
References:

- TM 10-3930-659-10
- TM 10-3930-659-20

4-47. FRONT AXLE ASSEMBLY REPLACEMENT (Con't).

a. REMOVAL

1. Raise fork/boom assembly and forks (see TM 10-3930-659-10).
2. Placewooden blocks between fork/boom cylinders (2) and lifting eyes (1)to support fork/boom assembly and forks.
3. Position hydraulic jack under front axle assembly (7) and raise jack enough to support front axle assembly.
4. Support frame (5) with four trestles and remove front wheels (see TM 10-3930-659-20).
5. Remove eight nuts (6), 16 washers (4), and eight bolts (3) from frame (5) and front axle assembly (7).
6. Lower front axle assembly (7) and remove from under frame (5).



TA708241

4-47. FRONT AXLE ASSEMBLY REPLACEMENT (Con't).

b. INSTALLATION

1. Place front axle assembly (7) on hydraulic jack and position front axle assembly under frame (5).

2. Raise front axle assembly (7) and install on frame (5) with eight bolts (3), 16 washers (4), and eight nuts (6). Torque nuts to 457 lb.-ft. (620 N•m).

3. Install front wheels (see TM 10-3930-659-20).

4. Remove hydraulic jack from under front axle assembly (7).

5. Remove wooden blocks from fork/boom cylinders (2) and lifting eyes (1), and lower fork/boom assembly and forks to ground (see TM 10-3930-659-10).

FOLLOW-ON TASKS:

- Remove trestles from under frame.
- Install carriage assembly (see TM 10-3930-659-20).
- Connect front universal joint (see TM 10-3930-659-20).
- Connect front brake hose (see TM 10-3930-659-20).
- Fill front differential with oil (see TM 10-3930-659-20).
- Install front bottom guard (see TM 10-3930-659-20).
- Install boom lock (see TM 10-3930-659-20).
- Remove frame locking bar (see TM 10-3930-659-10).

4-48. REAR AXLE ASSEMBLY REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Equipment Conditions:
- Frame locking bar installed (see TM 10-3930-659-10).
- Battery disconnect switch in OFF position (see TM 10-3930-659-10).
- Rear bottom guard removed (see TM 10-3930-659-20).
- Rear differential drained (see TM 10-3930-659-20).
- Rear brake hose disconnected (see TM 10-3930-659-20).
- Front universal joint disconnected (see TM 10-3930-659-20).
- Remote differential support lubrication hoses disconnected (see TM 10-3930-659-20).
- Frame supported on suitable supports.
- Rear wheels and tires removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Hydraulic jack, 10 ton (Item 39, Appendix E)
- Impact socket set (Item 59, Appendix E)
- Socket wrench set (Item 78, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

Personnel Required: Three

References:
- TM 10-3930-659-20
- TM 10-3930-659-20

a. REMOVAL

1. Position hydraulic jack under rear axle assembly (2) and raise jack enough to support rear axle assembly.
2. Remove four bolts (5) from frame and front oscillating support assembly (4).
3. Remove four bolts (6) and washers (3) from frame and rear oscillating support assembly (1).
4. Lower rear axle assembly (2) and remove from under frame.

b. INSTALLATION

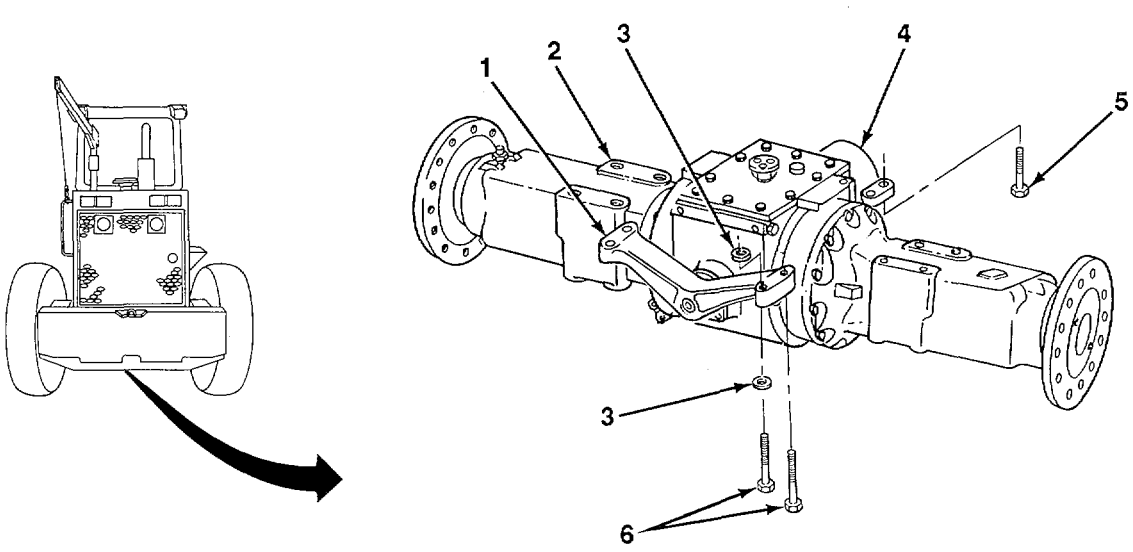
1. Place rear axle assembly (2) on hydraulic jack and position rear axle assembly under frame.

NOTE

Washers are used on two rear bolts on rear oscillating support assembly.

2. Install rear oscillating support assembly (1) on frame with four washers (3) and bolts (6). Torque bolts to 457 lb.-ft. (620 N•m).
3. Install front oscillating support assembly (4) on frame with four bolts (5). Torque bolts to 457 lb.-ft. (620 N•m).
4. Remove hydraulic jack from under rear axle assembly (2).

4-48. REAR AXLE ASSEMBLY REPLACEMENT (Con't).



FOLLOW-ON TASKS:

- Install rear wheels and tires (see TM 10-3930-659-20).
- Remove supports from frame.
- Connect remote differential support lubrication hoses (see TM 10-3930-659-20).
- Connect front universal joint (see TM 10-3930-659-20).
- Connect rear brake hose (see TM 10-3930-659-20).
- Fill rear differential with oil (see TM 10-3930-659-20).
- Install rear bottom guard (see TM 10-3930-659-20).
- Remove frame locking bar (see TM 10-3930-659-10).

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4-49. REAR AXLE REAR OSCILLATING SUPPORT ASSEMBLY REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Equipment Conditions:

- Rear axle assembly removed (see paragraph 4-48).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Wrecking bar (Item 6, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Arbor press (Item 47, Appendix E)

Materials/Parts:

- Lubricating oil (Item 41, Appendix B)
- One preformed packing
- One seal

a. REMOVAL

1. Pull rear oscillating support (2) away from rear axle assembly (8).

NOTE

Number of shims may vary. Note number of shims to aid during installation.

2. Remove two thrust plates (6), shims (5), and washer (4) from pivot pin (1).

3. Remove preformed packing (7) and seal (9) from rear axle assembly (8). Discard preformed packing and seal.

4. Using arbor press, press pivot pin (1) out of rear oscillating support (2).

4-49. REAR AXLE REAI OSCILLATING SUPPORT ASSEMBLY REPLACEMENT (Con't).

5. Remove dowel pin (3) from rear oscillating support (2).
6. Remove four bushings (10) from rear oscillating support (2).

b. INSTALLATION

1. Install four bushings (10) in rear oscillating support (2).
2. Install dowel pin (3) in rear oscillating support (2).
3. Apply lubricating oil to bore of rear oscillating support (2).
4. Using arbor press, press pivot pin (1) in rear oscillating support (2).
5. Install new seal (9) and new preformed packing (7) in rear axle assembly (8).

NOTE

Rear thrust plate is installed with straightedge up. Front thrust plate is installed with curved edge up. Grease grooves in thrust plates must face each other.

6. Install two thrust plates (6) on pivot pin (1).
7. Install rear oscillating support (2) on rear axle assembly (8).
8. Install rear axle assembly (8) on frame with only two screws in front support and two screws in rear support (see paragraph 4-48).
9. Using wrecking bar, move rear axle assembly (8) as far forward as possible.
10. Using feeler gage, measure clearance between two thrust plates (6) and rear oscillating support (2).
11. Combine shims (5) into a shim pack that equals clearance measured in step 10.
12. Remove rear axle assembly (8) (see paragraph 4-48).
13. Pull rear oscillating support (2) away from rear axle assembly (8).
14. Remove two thrust plates (6) from pivot pin (1).

NOTE

Rear thrust plate is installed with straightedge up. Front thrust plate is installed with curved edge up. Grease grooves in thrust plates must face each other.

15. Install washer (4), shims (5), and two thrust plates (6) on pivot pin (1).
16. Install rear oscillating support (2) and pivot pin (1) on rear axle assembly (8).

FOLLOW-ON TASKS:

- Install rear axle assembly (see paragraph 4-48).

4-50. AXLE HOUSING ASSEMBLY REPLACEMENT.

This Task Covers:

a. Axle Bearing Adjustment Check
b. Removal
c. Cleaning and Inspection
d. Installation

Initial Setup:

Equipment Conditions:

- Frame locking bar installed (see TM 10-3930-659-10).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Dial indicator (Item 19, Appendix E)
- Hydraulic jack, 10 ton (Item 39, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

References:

- TM 10-3930-659-10

Materials/Parts:

- Gasket forming compound (Item 13, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)

Personnel Required: Two

General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. AXLE BEARING ADJUSTMENT CHECK

1. Clean axle shaft flange (2) to bare metal in area where dial indicator will be installed.

NOTE

- Dial indicator probe must not contact axle housing.
- Dial indicator can be installed on bottom of axle housing.

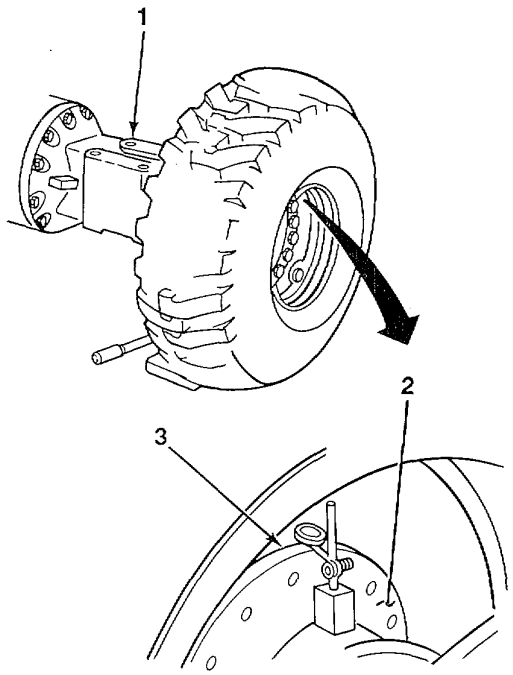
2. Install dial indicator on axle shaft flange (2), as close to axle housing (1) as possible, with dial indictor probe touching inside of wheel rim (3).

3. Position hydraulic jack under axle assembly and raise axle assembly until wheel being checked is off ground.

4. Depress service brake pedal.

5. Zero dial indicator and lower axle assembly to ground.

6. Record reading on dial indicator.



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4-50. AXLE HOUSING ASSEMBLY REPLACEMENT (Con't).

7. Repeat steps 3 through 6 to ensure accurate measurement.

8. Axle shaft should not move more than 0.015 in. (0.381 mm). If axle shaft movement exceeds specification, replace axle housing (1).

b. REMOVAL

NOTE

All four axle housing assemblies are removed the same way. One axle housing assembly is illustrated.

1. Remove axle assembly (see paragraph 4-47 or 4-48).

WARNING

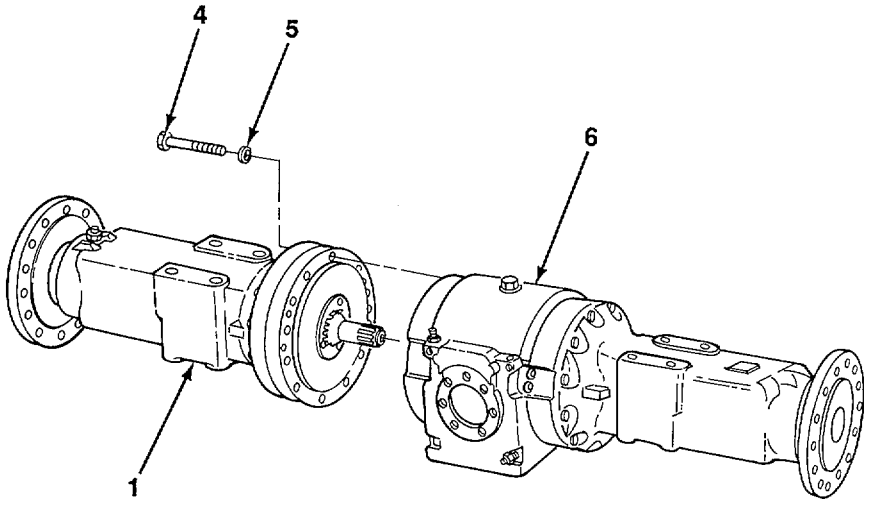
Axle housing weighs approximately 270 lb (123 kg). Use suitable lifting device and assistants to lift axle housing. Failure to follow this warning may result in injury to personnel.

NOTE

When axle housing is removed, brake disc and drive shaft may fall out or stay with axle housing.

2. Mark axle housing (1) and differential case (6) to aid during installation.

3. Remove 12 screws (4), washers (5), and axle housing (1) from differential case (6).



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4-50. AXLE HOUSING ASSEMBLY REPLACEMENT (Con't).

c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean components with dry cleaning solvent and dry with a clean rag.
2. Remove all gasket forming compound from mating surfaces of axle housing and differential case.
3. Inspect axle housing for damage. Replace damaged axle housing.

d. INSTALLATION

WARNING

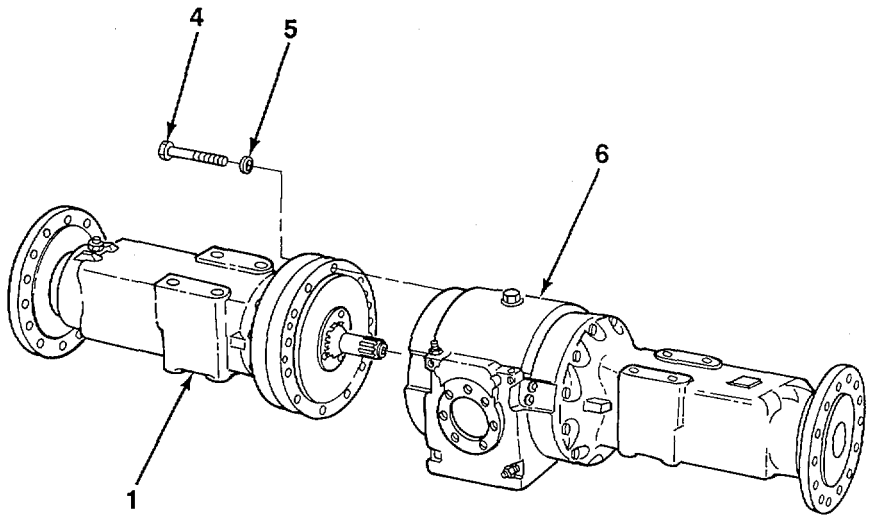
Axle housing weighs approximately 270 lb (123 kg). Use suitable lifting device and assistants to lift axle housing. Failure to follow this warning may result in injury to personnel.

NOTE

All four axle housing assemblies are installed the same way. One axle housing assembly is illustrated.

1. Apply gasket forming compound to mating surfaces of axle housing (1) and differential case (6).
2. Install axle housing (1) on differential case (6) with 12 washers (5) and screws (4). Torque screws to 200 lb.-ft. (271 N•m).

4-50. AXLE HOUSING ASSEMBLY REPLACEMENT (Con't).



FOLLOW-ON TASKS:

- Install axle assembly (see paragraph 4-47 or 4-48).

TA708246

Section X. BRAKE SYSTEM MAINTENANCE

4-51. SERVICE BRAKE DISC REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Parking brake set (see TM 10-3930-659-10).
- Frame locking bar installed (see TM 10-3930-659-10).
- Axle housing assembly removed (see paragraph 4-50).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Depth gage micrometer (Item 27, Appendix E)
- Feeler gage (Item 28, Appendix E)

Materials/Parts:
- Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
- Three paper washers
- Three preformed packings

References:
- TM 10-3930-659-10

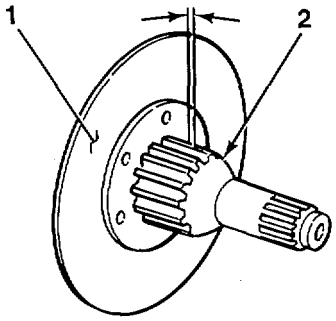
4-51. SERVICE BRAKE DISC REPLACEMENT (Con't).

NOTE

There are four service brake discs on forklift truck. Two on front axle and two on rear axle. All brake discs are removed and installed the same way. Front axle left service brake disc is illustrated.

a. REMOVAL

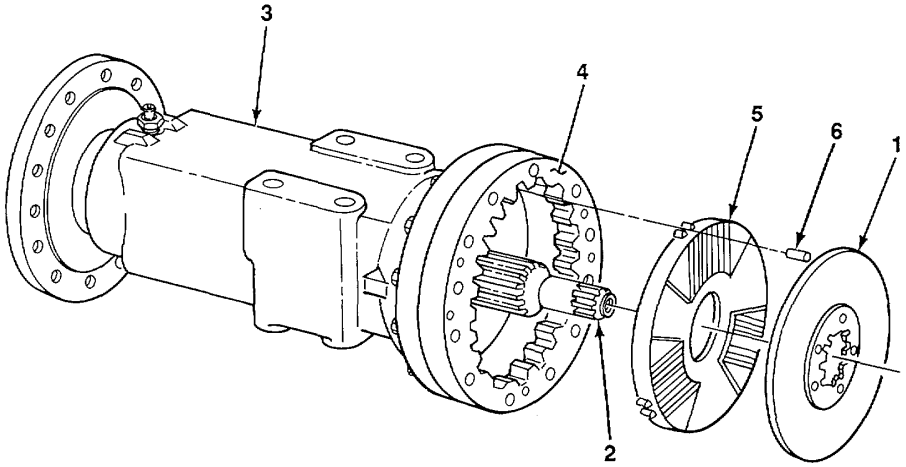
1. Using feeler gage, measure service brake disc (1) to pinion shaft (2) backlash. If backlash is greater than 0.040 in. (1.016 mm), discard service brake disc in step 2.



NOTE

Brake backing plate is held In place on ring gear with three dowel pins.

2. Remove service brake disc (1) and brake backing plate (5) from ring gear (4).
3. Mark ring gear (4) and axle housing (3) to aid during installation.
4. Remove ring gear (4) and pinion shaft (2) from axle housing (3).
5. Remove three dowel pins (6) from ring gear (4).



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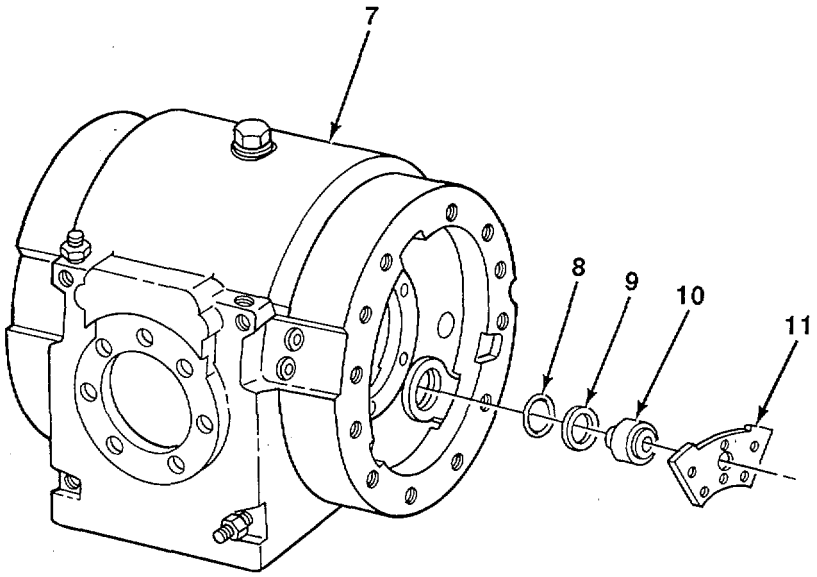
4-51. SERVICE BRAKE DISC REPLACEMENT (Con't).

6. Remove three pressure plates (11) from differential case (7).

7. Remove three paper washers (9) and preformed packings (8) from differential case (7). Discard preformed packings and paper washers.

8. If damaged, remove three pistons (10) from pressure plates (11).



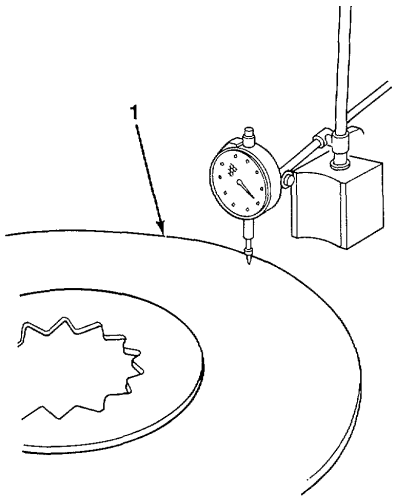
b. CLEANING AND INSPECTION

1. Clean parts with a clean rag.

NOTE

If one service brake disc is defective, both service brake discs MUST be replaced on axle assembly.

2. Using dial indicator, measure service brake disc (1) flatness variation. Flatness variation must not be more than 0.045 in. (1.143 mm).



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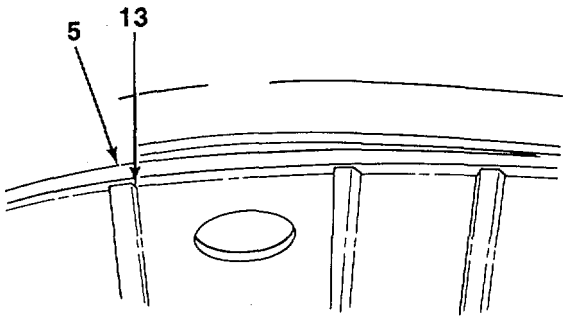
4-51. SERVICE BRAKE DISC REPLACEMENT (Con't).

NOTE

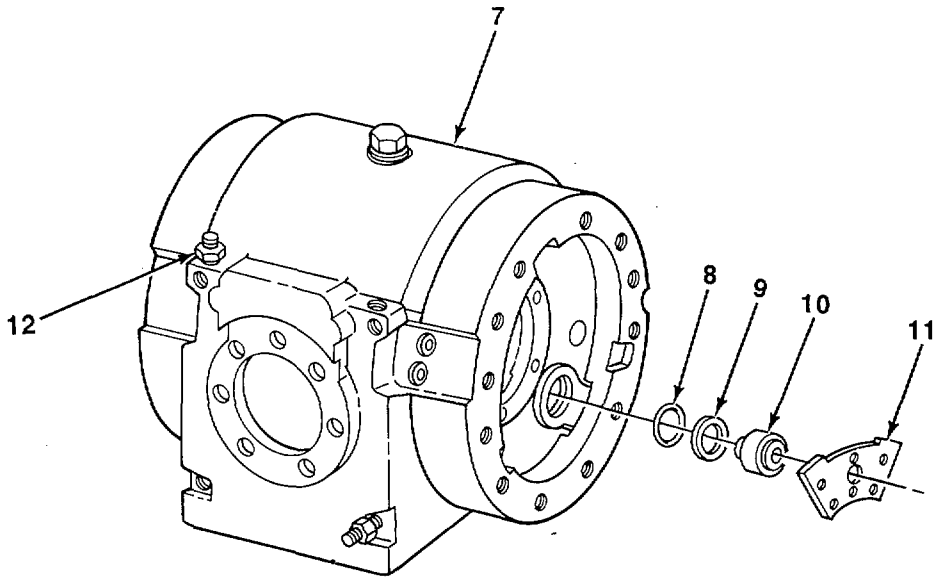
If pressure plates or brake backing plate are defective or worn, both brake backing plates and all six pressure plates must be replaced.

3. Using depth gage micrometer, measure brake backing plate (5) and each pressure plate lining groove (13) depth. Depth must not be less than 0.015 in. (0.381 mm).



c. INSTALLATION

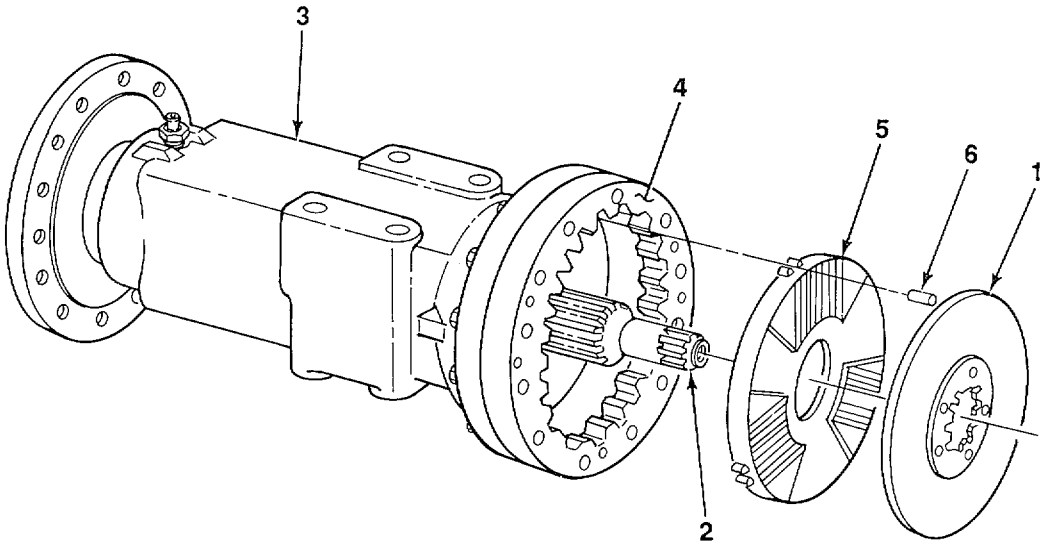
1. Soak three new paper washers (9) and new preformed packings (8) in lubricating oil.
2. Install three preformed packings (8) and paper washers (9) in differential case (7).
3. If removed, install three pistons (10) in pressure plates (11).
4. Loosen bleed screw (12).
5. Install three pistons (10) and pressure plates (11) in differential housing (7).
6. Tighten bleed screw (12).



TA708315

4-51. SERVICE BRAKE DISC REPLACEMENT (Con't).

7. Install brake backing plate (5) on ring gear (4) with three dowel pins (6).
8. Position ring gear (4) on axle housing (3).
9. Install pinion shaft (2) in axle housing (3).
10. Install service brake disc (1) on pinion shaft (2) and brake backing plate (5).



FOLLOW-ON TASKS:

- Install axle housing assembly (see paragraph 4-50).
- Remove frame locking bar (see TM 10-3930-659-10).

TA708316

4-52. ACCUMULATOR PRECHARGE TEST.

This Task Covers: Precharge Test

Initial Setup:

Equipment Conditions:

- Parking brake set (see TM 10-3930-659-10).
- Frame locking bar installed (see TM 10-3930-659-10).
- Left side cab skirt removed (see TM 10-3930-659-20).
- Hydraulic system warmed to operating temperature (see paragraph 2-28).

Materials/Parts:

- Four preformed packings

Personnel Required: Two
References:

- TM 10-3930-659-10
- TM 10-3930-659-20

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Adapter (Item 1, Appendix E)
- Adapter (Item 3, Appendix E)
- Quick coupler (Item 18, Appendix E)
- Pressure gage (Item 31, Appendix E)
- Hose assembly (Item 37, Appendix E)
- Tee (Item 63, Appendix E)

PRECHARGE TEST

WARNING

Pressure stored in accumulator Is approximately 500 psi (3448 kPa). Ensure that accumulator pressure Is relieved before removing service brake hoses or components. Failure to follow this warning may result in serious injury or death to personnel.

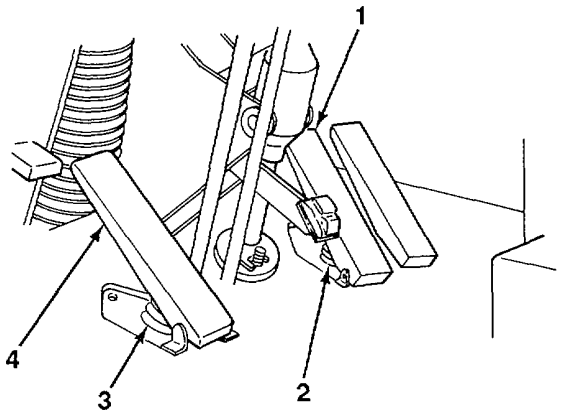
NOTE

- **It is necessary to hold boot of one brake pedal with hand while opposite brake pedal is pumped. Movement inside boot will be felt as opposite brake pedal is pumped. Accumulator pressure is relieved when movement stops.**
- **Each brake pedal should be pumped a full 75 times even if no movement is felt after pumping brake pedal several times.**

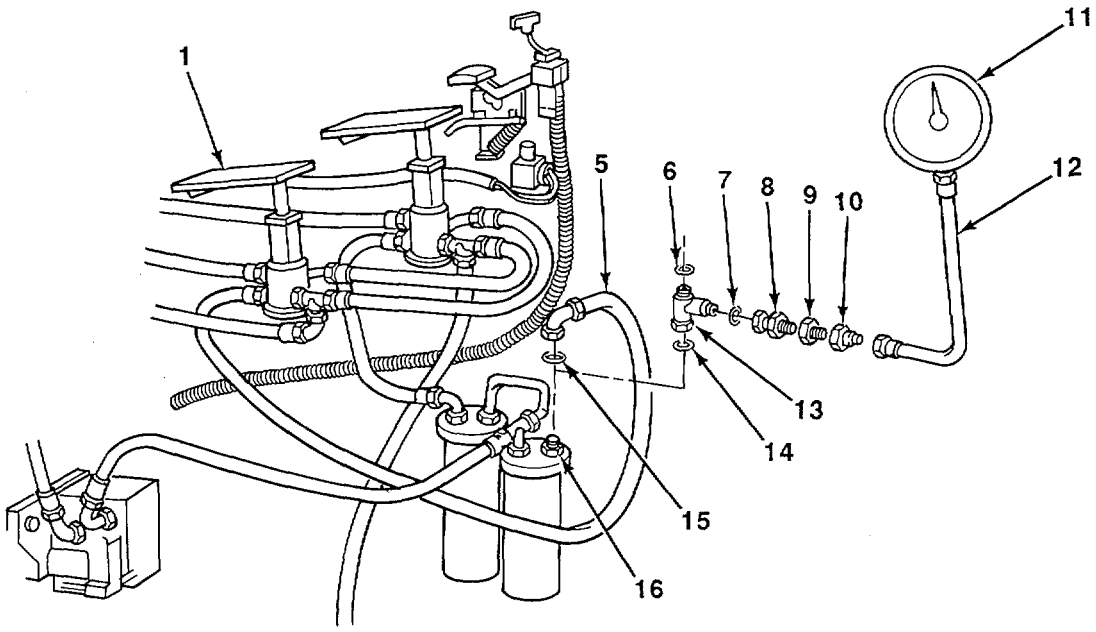
1. Hold boot (3) of left brake pedal (4) with hand and pump right brake pedal (1) 75 times. Release boot.

4-52. ACCUMULATOR PRECHARGE TEST (Con't).

2. Hold boot (2) of right brake pedal (1) with hand and pump left brake pedal (4) 75 times.



3. Remove hose (5) and preformed packing (15) from adapter (16). Discard preformed packing.
4. Install preformed packing (14) and tee (13) on adapter (16).
5. Install preformed packing (6) and hose (5) on tee (13).
6. Install performed packing (7), two adapters (8 and 9), and quick coupler (10) on tee (13).
7. Install hose (12) and pressure gage (11) on quick coupler (10).



TA708317

4-52. ACCUMULATOR PRECHARGE TEST (Con't).

8. Start engine (see TM 10-3930-659-10) and run until pressure gage (11) shows a reading of 2300-2400 psi (15859-16548 kPa).

9. Shut down engine (see TM 10-3930-659-10).

10. Press right brake pedal (1) and note reading on pressure gage (1 1). Reading must slowly decrease to 500 psi (3448 kPa) and then rapidly drop to zero.

11. If reading on pressure gage (11) is not within specification, charge accumulator (see paragraph 4-54).

12. Repeat steps 1 and 2.

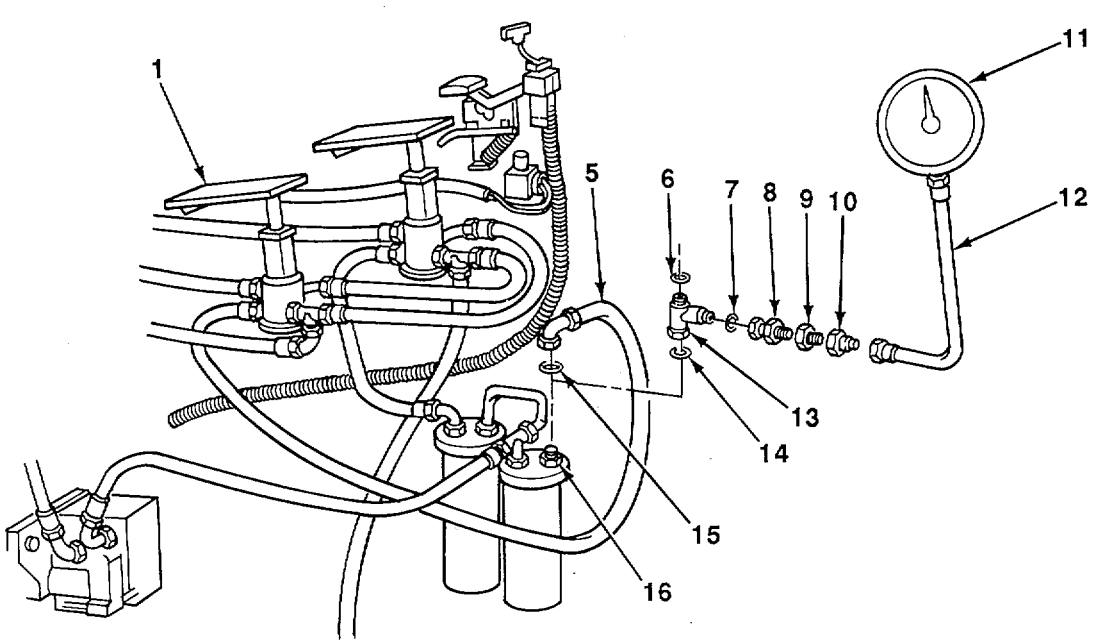
13. Remove pressure gage (11) and hose (12) from quick coupler (10).

14. Remove quick coupler (10), two adapters (8 and 9), and preformed packing (7) from tee (13). Discard preformed packing.

15. Remove hose (5) and preformed packing (6) from tee (13). Discard preformed packing.

16. Remove tee (13) and preformed packing (14) from adapter (16). Discard preformed packing.

17. Install new preformed packing (15) and hose (5) on adapter (16).



FOLLOW-ON TASKS:

- Install left side cab skirt (see TM 10-3930-659-20).
- Remove frame locking bar (see TM 10-3930-659-10).

TA708318

4-53. ACCUMULATOR MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Equipment Conditions:
- Right and left brake valves-to-accumulators hoses and fittings removed (see TM 10-3930-659-20).
- Accumulator-to-fork/brake hydraulic pump hose and fittings removed (see TM 10-3930-659-20).
- Accumulator-to-accumulator crossover line removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Nitrogen accumulator charging kit (Item 13, Appendix E)
- Machinist's vise (Item 76, Appendix E)

Materials/Parts:
- Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Six preformed packings

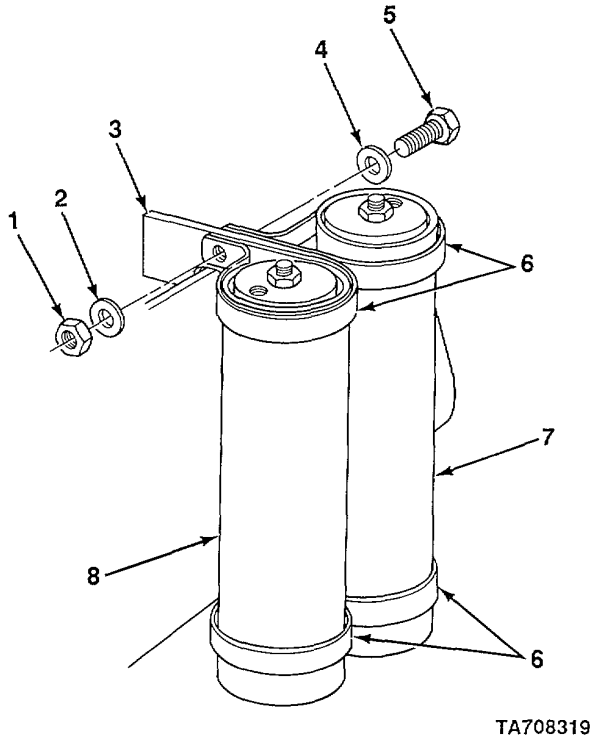
References:
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. REMOVAL

1. Loosen two nuts (1) and remove accumulators (7 and 8) from four clamps (6).

2. If clamps (6) are damaged, remove two nuts (1), washers (2), screws (5), washers (4), and four clamps from bracket (3).



4-53. ACCUMULATOR MAINTENANCE (Con't).

b. DISASSEMBLY

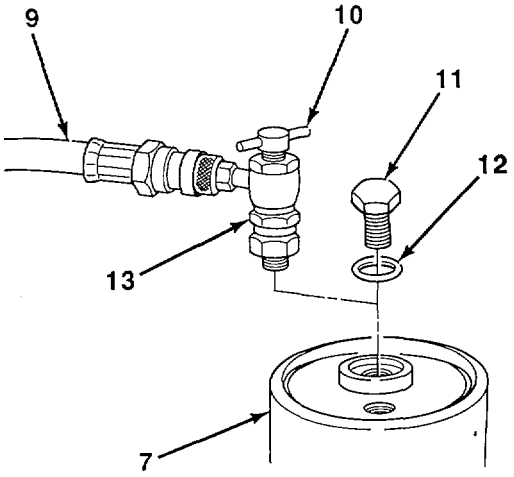
WARNING

Nitrogen pressure stored In accumulator Is approximately 500 psi (3448 kPa). Ensure that nitrogen pressure is released before disassembling accumulators. Failure to follow this warning may result in serious injury or death to personnel.

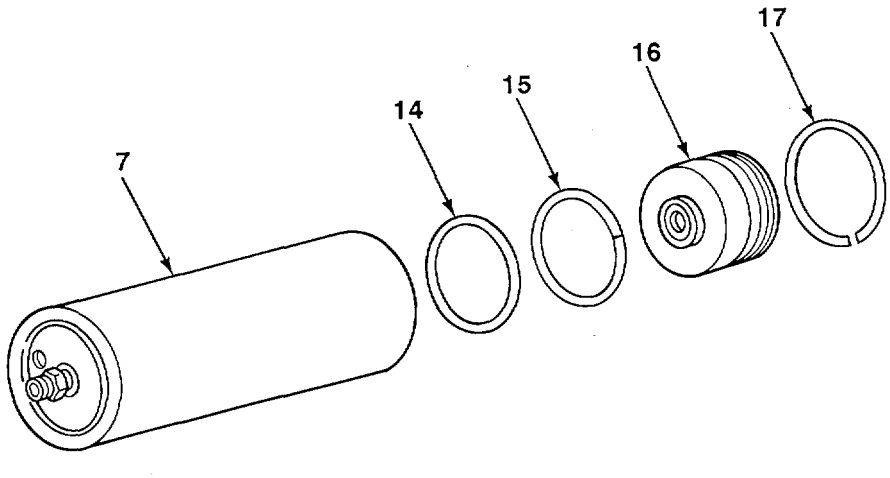
NOTE

Accumulators are disassembled the same way. One accumulator is illustrated.

1. Install accumulator (7) in machinist's vise with vise jaw caps.
2. Remove plug (11) and preformed packing (12) from bottom of accumulator (7). Discard preformed packing.
3. Install nitrogen accumulator charging kit valve (10) and hose (9) on accumulator (7). Tighten nut (13).
4. Slowly open nitrogen accumulator charging kit valve (10) and fully release pressure from accumulator (7).
5. Remove nitrogen accumulator charging kit valve (10) and hose (9) from accumulator (7).



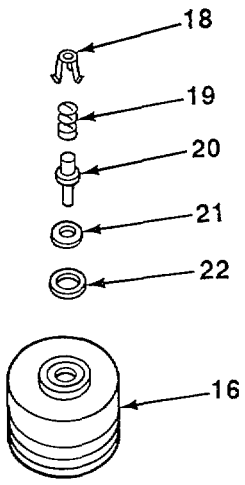
6. Remove snapring (17), gas end cap (16), backup ring (15), and preformed packing (14) from bottom of accumulator (7). Discard preformed packing.



TA708320

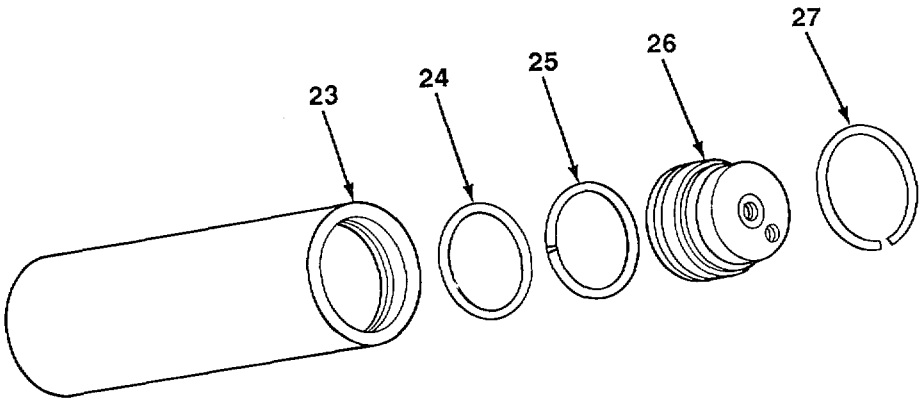
4-53. ACCUMULATOR MAINTENANCE (Con't).

7. guide (18), spring (19), valve (20), washer (21), and preformed packing (22) from gas end cap (16). Discard preformed packing.



8. Remove snapring (27) and oil cap (26) from accumulator barrel (23).

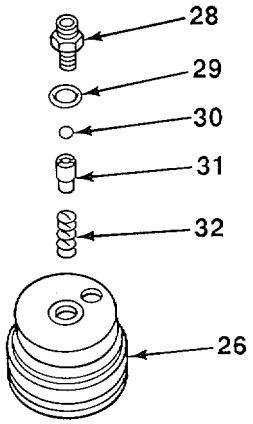
9. Remove preformed packing (24) and backup ring (25) from oil cap (26). Discard preformed packing.



TA708321

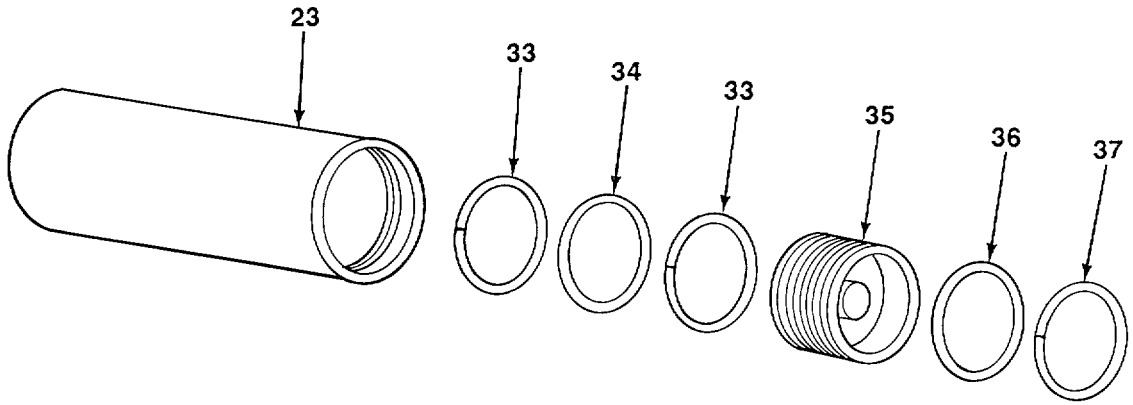
4-53. ACCUMULATOR MAINTENANCE (Con't).

10. adapter (28), preformed packing (29), ball (30), spring guide (31), and spring (32) from oil cap (26). Discard preformed packing.



11. Remove piston (35) from accumulator barrel (23).

12. Remove two backup rings (33), preformed packing (34), backup ring (37), and preformed packing (36) from piston (35). Discard preformed packings.



TA708322

4-53. ACCUMULATOR MAINTENANCE (Con't).

c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

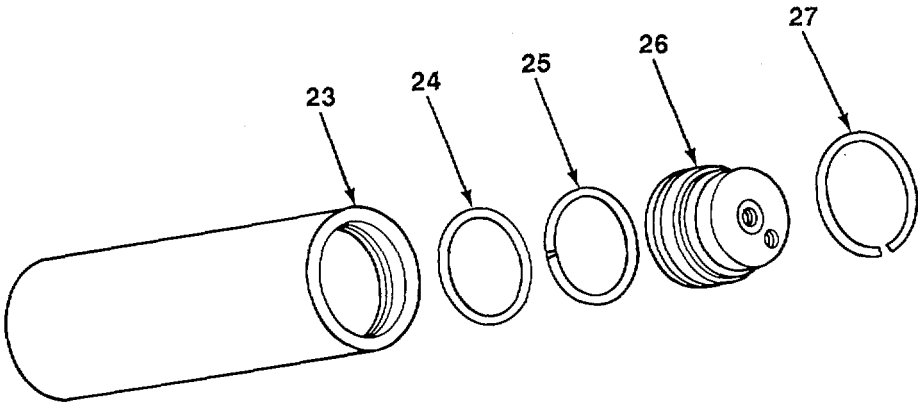
1. Clean parts with dry cleaning solvent and dry with clean rags.
2. Inspect metal parts for cracks and breaks. Replace damaged parts.

d. ASSEMBLY

NOTE

* Accumulators are assembled the same way. One accumulator is illustrated.
* Apply lubricating oil to all preformed packings before assembly.

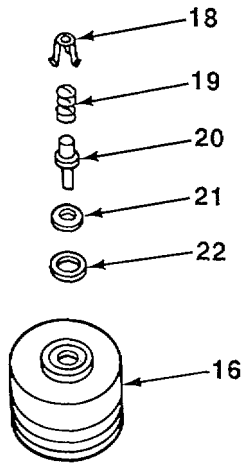
1. Install new preformed packing (36) and backup ring (37) on piston (35).
2. Install new preformed packing (34) and two backup rings (33) on piston (35).
3. Install piston (35) in accumulator barrel (23).
4. Install spring (32), spring guide (31), ball (30), new preformed packing (29), and adapter (28) on oil cap (26).
5. Install backup ring (25) and new preformed packing (24) on oil cap (26).
6. Install oil cap (26) in accumulator barrel (23) with snapring (27).



TA708323

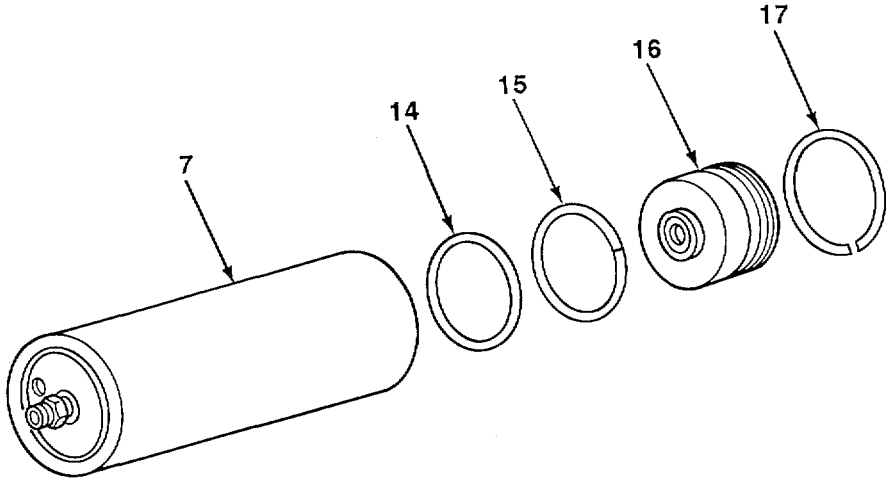
4-53. ACCUMULATOR MAINTENANCE (Con't).

7. new preformed packing (22), washer (21), valve (20), spring (19), and guide (18) on gas end cap (16).



8. Install backup ring (15) and new preformed packing (14) on gas end cap (16).

9. install gas end cap (16) in accumulator (7) with snapring (17).



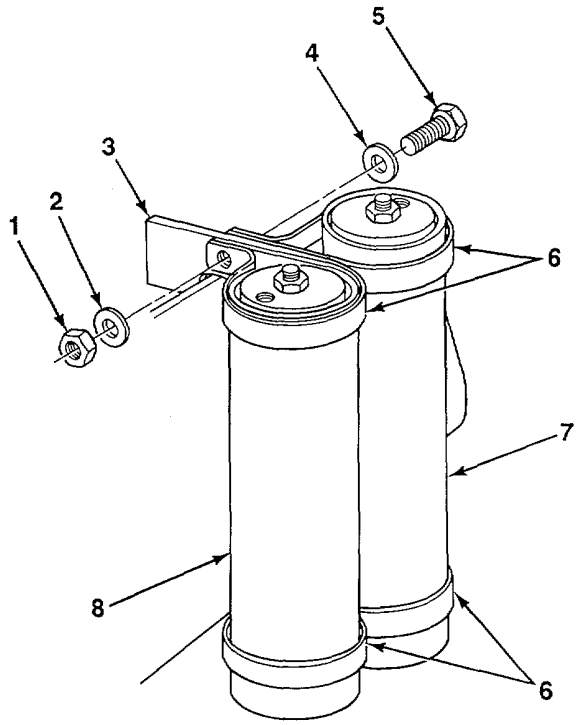
TA708324

4-53. ACCUMULATOR MAINTENANCE (Con't).

e. INSTALLATION

1. If removed, install four clamps (6) on bracket (3) with two washers (4), screws (5), washers (2), and nuts (1). Do not tighten nuts.

2. accumulators (7 and 8) in four clamps (6). Tighten two nuts (1).



FOLLOW-ON TASKS:

- Install accumulator-to-accumulator crossover line (see TM 10-3930-659-20).
- Install accumulator-to-fork/brake hydraulic pump hose and fittings (see TM 10-3930-659-20).
- Install right and left brake valves-to-accumulators hoses and fittings (see TM 10-3930-659-20).
- Charge accumulator (see paragraph 4-54).

TA708325

4-54. ACCUMULATOR CHARGING.

This Task Covers: Charging

Initial Setup:

Equipment Conditions:
- Parking brake set (see TM 10-3930-659-10).
- Frame locking bar installed (see TM 10-3930-659-1 0).
- Left transmission side guard removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Nitrogen accumulator charging kit (Item 13, Appendix E)

Materials/Parts:
- Nitrogen (Item 36, Appendix B)
- One preformed packing

References:
- TM 10-3930-659-10
- TM 10-3930-659-20

WARNING

Ensure that nitrogen accumulator charging kit pressure regulator and gage are used while charging accumulator so that accumulator is not overcharged. Failure to follow this warning may result in serious injury or death to personnel.

CAUTION

Accumulator must be charged with dry nitrogen only. DO NOT use air or any other gas, or accumulator will be damaged.

NOTE

- **Charge accumulator slowly to avoid dislodging inlet check valve seal. Complete charging should take three minutes or more.**
- **Accumulators are charged the same way. One accumulator is shown.**

4-54. ACCUMULATOR CHARGING (Con't).

CHARGING

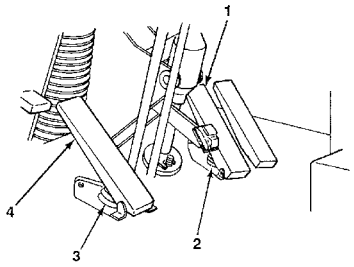
WARNING

Pressure stored in accumulator is approximately 500 psi (3448 kPa). Ensure that accumulator pressure is relieved before charging accumulators. Failure to follow this warning may result in serious injury or death to personnel.

NOTE

- **It is necessary to hold boot of one brake pedal with hand while opposite brake pedal is pumped. Movement inside boot will be felt as opposite brake pedal is pumped. Accumulator pressure is relieved when movement stops.**
- **Each brake pedal should be pumped a full 75 times even if no movement is felt after pumping brake pedal several times.**

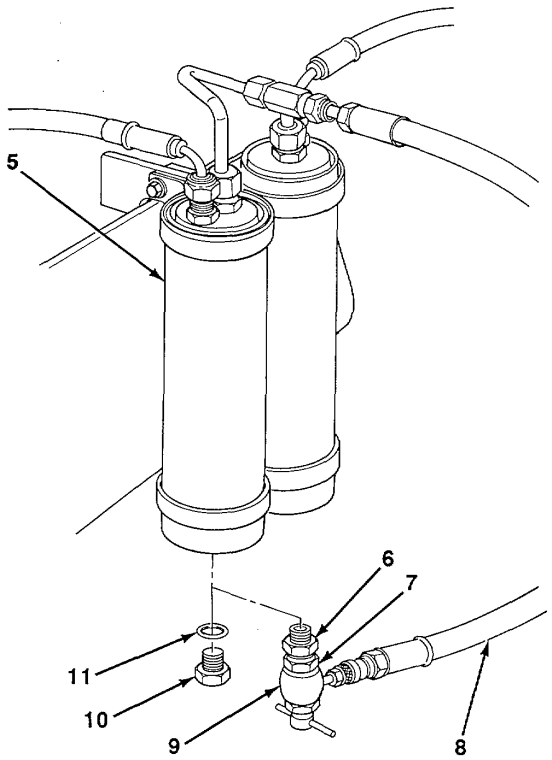
1. boot (3) of left brake pedal (4) with hand and pump right brake pedal (1) 75 times. Release boot.
2. boot (2) of right brake pedal (1) with hand and pump left brake pedal (4) 75 times. Release boot.



TA708326

4-54. ACCUMULATOR CHARGING (Con't).

3. plug (10) and preformed packing (11) from bottom of accumulator (5). Discard preformed packing.
4. nitrogen accumulator charging kit valve (9) and hose (8) on accumulator (5). Tighten nut (6).
5. nitrogen accumulator charging kit to pressure regulator on nitrogen cylinder.
6. Open valve on nitrogen cylinder.
7. Slowly open nitrogen accumulator charging kit valve (9). Adjust for a pressure reading of 475-525 psi (3275-3620 kPa) on pressure gage.
8. turn nut (7) counterclockwise until a pressure reading of 500 psi (3448 kPa) is reached on pressure gage.
9. Tighten nut (7) clockwise.
10. Relieve pressure on nitrogen accumulator charging kit.
11. nitrogen accumulator charging kit valve (9) and hose (8) from accumulator (5).
12. new preformed packing (11) and plug (10) on accumulator (5).
13. steps 3 through 12 for other accumulator.



TA708327

FOLLOW-ON TASKS:

- Install left transmission side guard (see TM 10-3930-659-20).
- Remove frame locking bar (see TM 10-3930-659-10).

Section XI. WHEEL AND TIRE MAINTENANCE

4-55. TIRE REPAIR.

Refer to TM 9-2610-200-14 (Operator's, Unit, Direct Support, and General Support Maintenance Manual for Care, Maintenance, Repair and Inspection of Pneumatic Tires and Inner Tubes) for instructions on tire repair.

Section XII. STEERING SYSTEM MAINTENANCE

4-56. STEERING CYLINDER REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Steering cylinder removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Machinist's vise (Item 76, Appendix E)
- Spanner wrench (Item 79, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

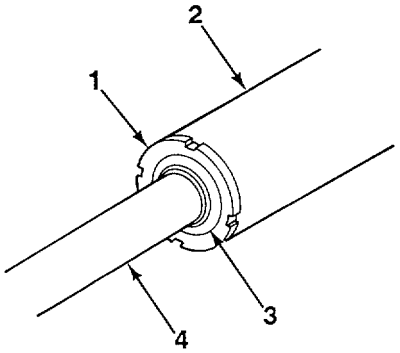
References:
- TM 10-3930-659-20

Materials/Parts:
- Abrasive cloth (Item 9, Appendix B)
- Sealing compound (Item 14, Appendix B)
- Lubricating oil (Item 38, Appendix B)
- Petrolatum (Item 42, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One locknut
- One preformed packing
- Two repair kits

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. DISASSEMBLY

1. Secure steering cylinder barrel (2) in machinist's vise.
2. Mark nut (1) and guide (3) to aid during assembly.
3. Remove nut (1) from guide (3) and slide nut up piston rod (4).

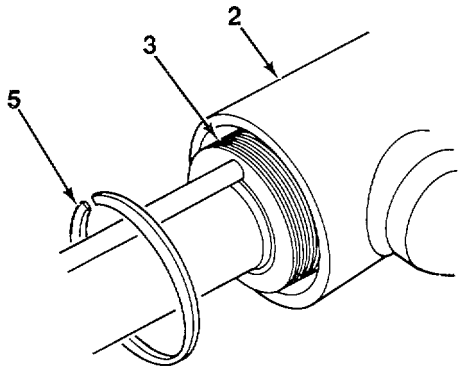


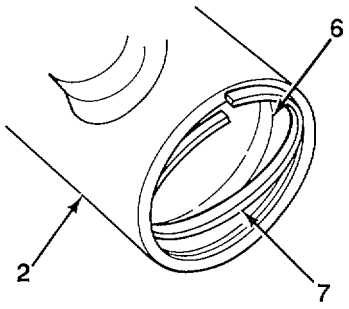
TA708328

4-56. STEERING CYLINDER REPAIR (Con't).

4. guide (3) into steering cylinder barrel (2) and remove retaining ring (5).

5. filler ring (7) into retaining ring groove (6) in steering cylinder barrel (2).





6. Remove piston rod (4) from steering cylinder barrel (2).

7. Remove steering cylinder barrel (2) from machinist's vise.

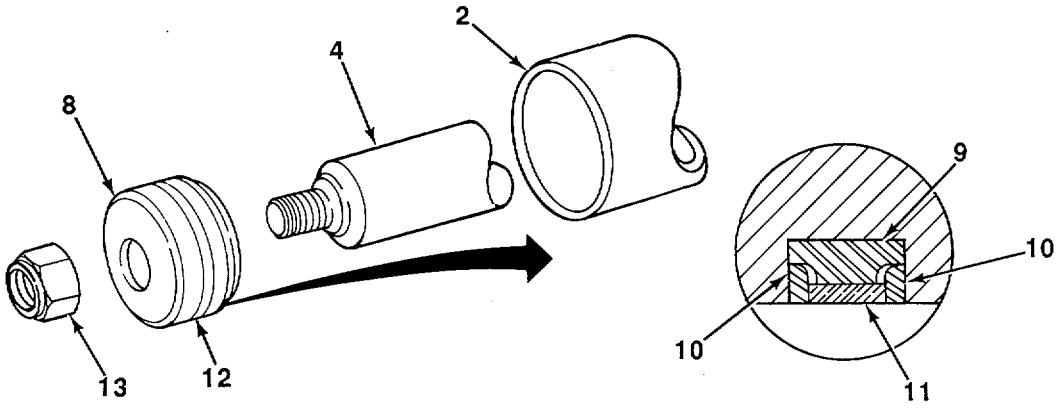
8. Secure piston rod (4) in machinist's vise.

9. Remove locknut (13) and piston (8) from piston rod (4). Discard locknut.

10. Remove and discard wear ring (12), cap seal (11), two backup rings (10), and expander seal (9) from piston (8).

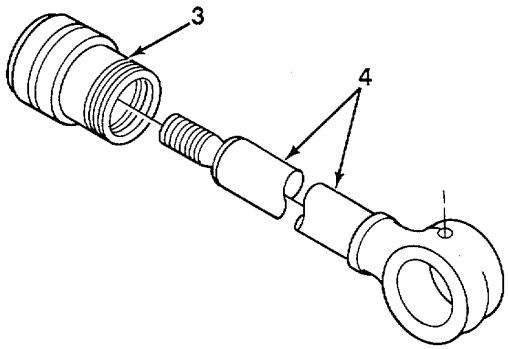
TA708329

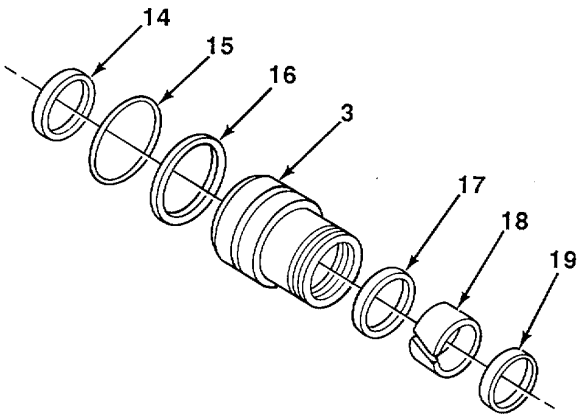
4-56. STEERING CYLINDER REPAIR (Con't).



11. Remove guide (3) from piston rod (4).

12. Remove and discard seal (14), preformed packing (15), backup ring (16), seal (19), wear ring (18), and seal (17) from guide (3).





TA708330

4-56. STEERING CYLINDER REPAIR (Con't).

13. Remove nut (1) from piston rod (4).

14. If damaged, remove lubrication fitting (20) from piston rod (4). Discard lubrication fitting.

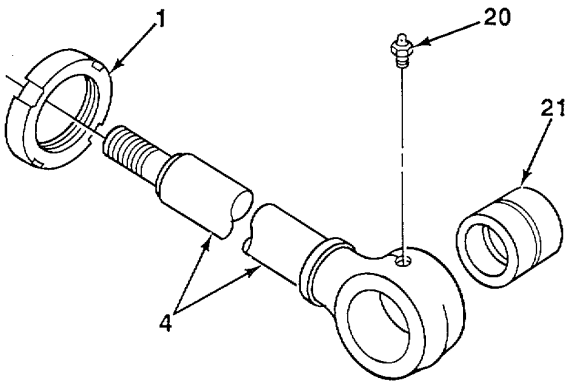
15. damaged, remove bushing (21) from piston rod (4).

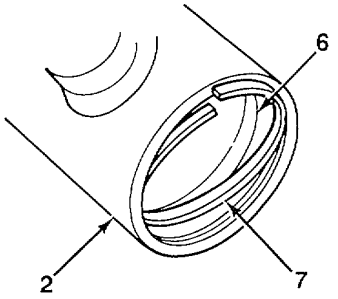
16. Remove piston rod (4) from machinist's vise.

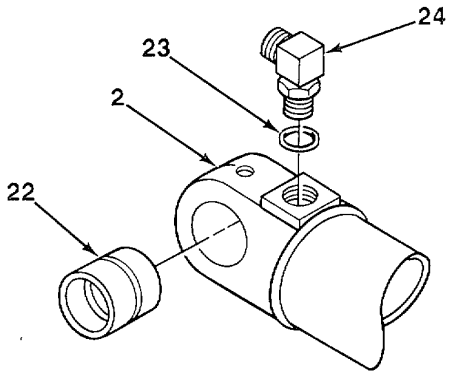
17. Remove filler ring (7) from steering cylinder barrel (2). Discard filler ring.

18. damaged, remove bushing (22) from steering cylinder barrel (2).

19. elbow (24) and preformed packing (23) from steering cylinder barrel (2). Discard preformed packing.







TA708331

4-56. STEERING CYLINDER REPAIR (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and allow to air dry.
2. Inspect parts for cracks, breaks, deformed metal, and other damage that would impair operation. Replace damaged parts.
3. retaining ring groove In steering cylinder barrel for nicks and burrs. Smooth nicks and burrs in retaining ring groove with an abrasive cloth.
4. Inspect lands on piston for burrs and nicks. Smooth nicks and burrs on lands on piston with an abrasive cloth.

c. ASSEMBLY

NOTE

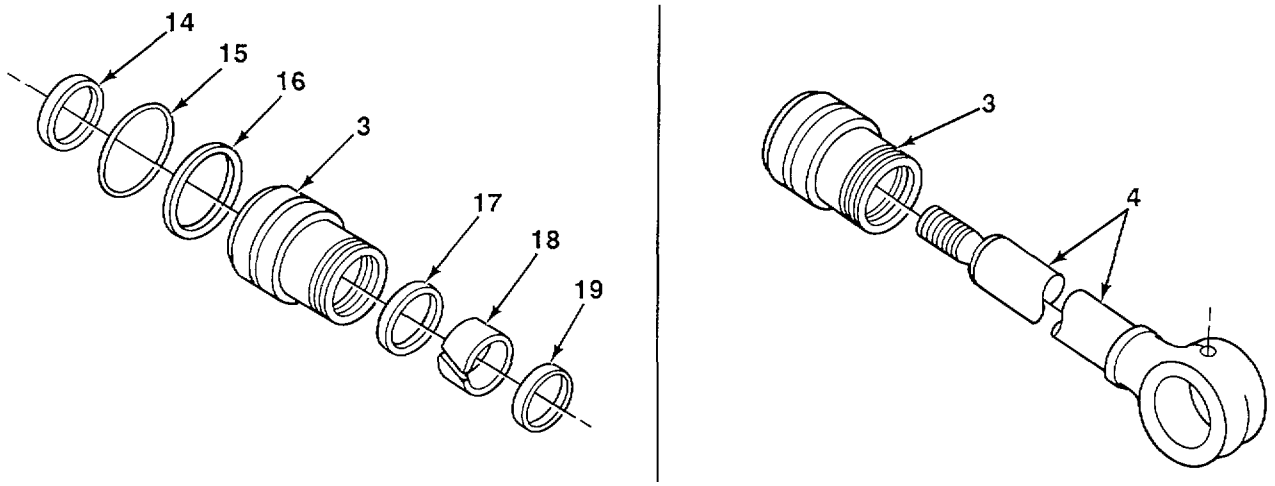
Soak all seals and preformed packings in clean lubricating oil prior to assembly.

1. Install new preformed packing (23) and elbow (24) on steering cylinder barrel (2).
2. If removed, install bushing (22) on steering cylinder barrel (2).
3. Install new filler ring (7) in retaining ring groove (6) in steering cylinder barrel (2).
4. If removed, install bushing (21) on piston rod (4).
5. If removed, install new lubrication fitting (20) on piston rod (4).
6. Apply a light coat of lubricating oil to nut (1) and slide nut on piston rod (4).

4-56. STEERING CYLINDER REPAIR (Con't).

7. new seal (17), new wear ring (18), new seal (19), new backup ring (16), new preformed packing (15), and new seal (14) into guide (3).

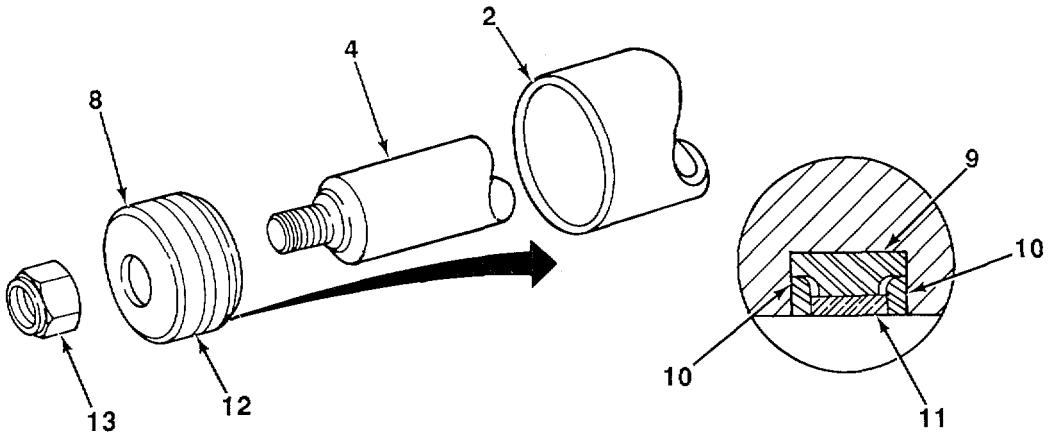
8. a light coat of lubricating oil to guide (3) and slide guide on piston rod (4).



9. Install new expander seal (9) in seal groove of piston (8).

10. Install two new backup rings (10) with curved portion toward expander seal (9) and new cap seal (11) on piston (8).

11. Install new wear ring (12) on piston (8).



TA708332

4-56. STEERING CYLINDER REPAIR (Con't).

NOTE

Piston must be installed with wear ring closest to threaded end of piston rod.

12. Install piston (8) on piston rod (4) with nut (13). Torque nut to 70 lb.-ft. (95 N.m).

13. Mark piston (8) at 12 o'clock position over nut (13) and at 1 o'clock position. Torque nut from 12 o'clock position to 1 o'clock position.

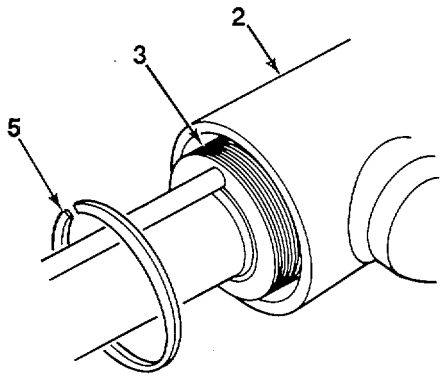
14. petrolatum to two backup rings (10), cap seal (11), and raised areas of steering cylinder barrel (2).

CAUTION

Ensure that alinement of steering cylinder barrel, piston, and piston rod is maintained during installation. Failure to follow this caution could cause seals to be damaged and steering cylinder to malfunction.

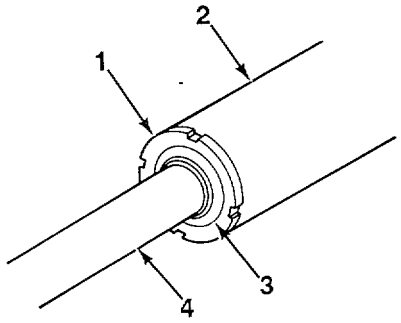
15. position piston rod (4) into steering cylinder barrel (2).

16. guide (3) into steering cylinder barrel (2) and install retaining ring (5).



17. Apply sealing compound to nut (1) and guide (3).

18. Install nut (1) on steering cylinder barrel (2). Tighten nut until marks made during disassembly are alined and nut is tight.



TA708333

FOLLOW-ON TASKS:

- Install steering cylinder (see TM 10-3930-659-20).

4-57. STEERING VALVE REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Steering valve removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Machinist's vise (Item 76, Appendix E)
- Torque wrench, 0-300 lb.-in. (Item 80, Appendix E)

Materials/Parts:
- Dry cleaning solvent (Item 47, Appendix B)
- Steering valve repair kit

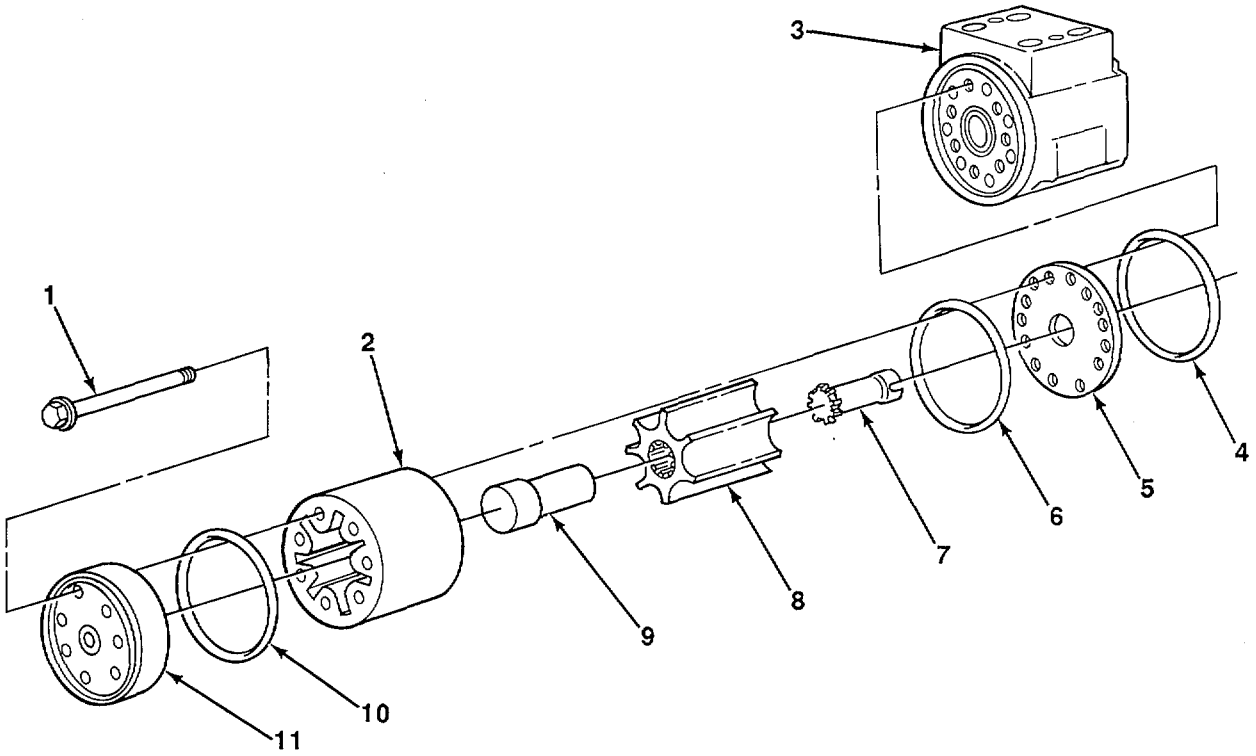
References:
- TM 9-214
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

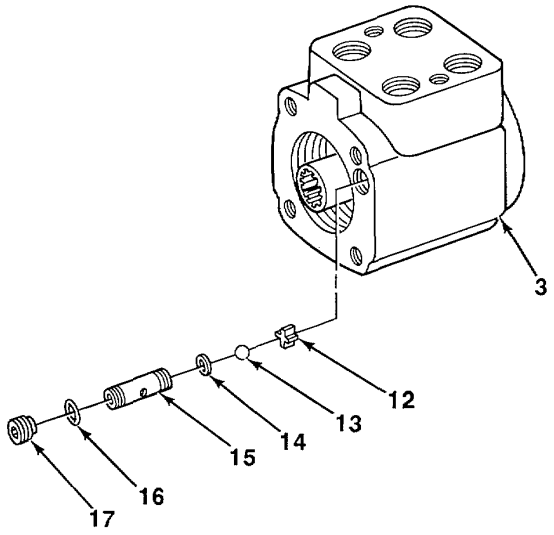
a. DISASSEMBLY I

1. Secure steering valve body (3) in machinist's vise with vise jaw caps.
2. Remove seven screws (1), end cap (11), and washer (10) from steering valve body (3). Discard washer.
3. Remove generator (2) and washer (6) from steering valve body (3). Discard washer.
4. Remove spacer (9) and rotor (8) from drive shaft (7).
5. Remove drive shaft (7) from steering valve body (3).
6. Remove spacer plate (5) and washer (4) from steering valve body (3). Discard washer.

4-57. STEERING VALVE REPAIR (Con't).



7. Remove setscrew (17), preformed packing (16), check ball seat (15), preformed packing (14), check ball (13), and check ball retainer (12) from steering valve body (3). Discard preformed packings.



TA708334

4-57. STEERING VALVE REPAIR (Con't).

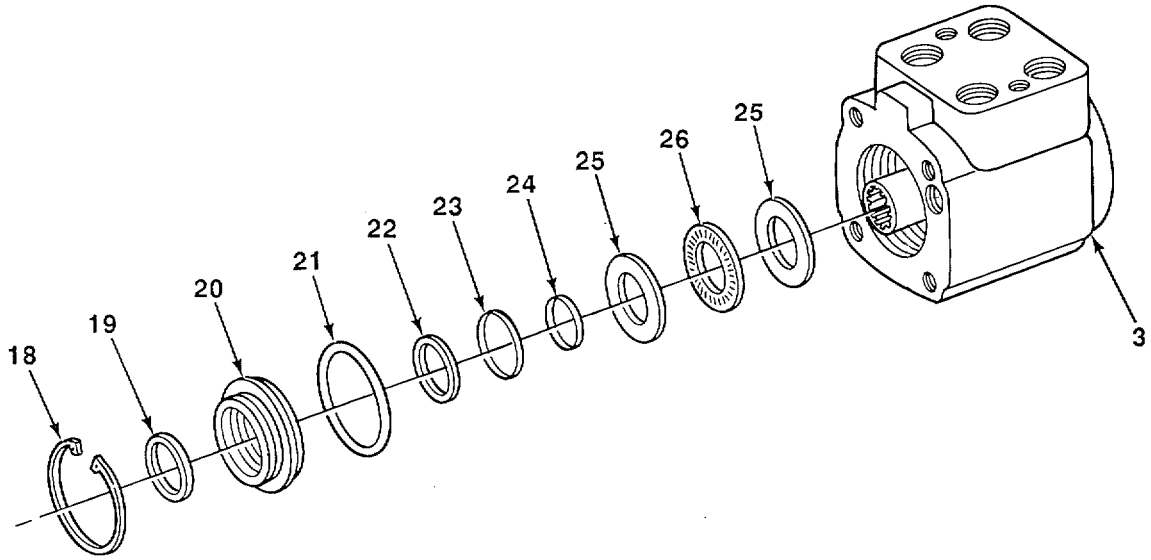
8. Remove retaining ring (18), seal (19), and bushing (20) from steering valve body (3). Discard seal.

9. Remove preformed packing (21), backup ring (22), preformed packing (23), oil seal (24), two thrustwashers (25), and needle bearing (26) from steering valve body (3). Discard preformed packings, backup ring, and oil seal.

NOTE

No further disassembly of steering valve body is authorized. If steering valve body is damaged, it must be replaced.

10. steering valve body (3) from machinist's vise.



b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. parts with dry cleaning solvent and allow to air dry.

TA708335

4-57. STEERING VALVE REPAIR (Con't).

2. Inspect parts for nicks, burrs, and damage. Replace damaged parts.

3. Inspect and clean bearings in accordance with TM 9-214.

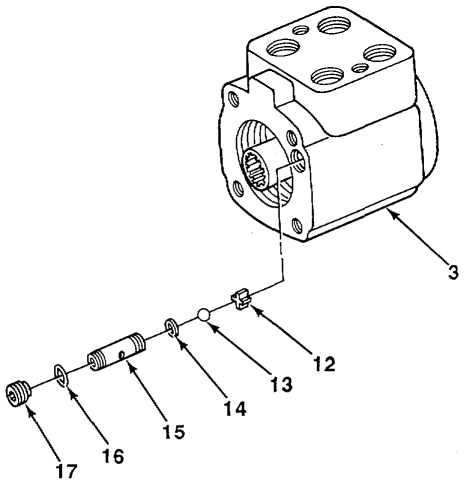
c. ASSEMBLY

1. Secure steering valve body (3) in machinist's vise with vise jaw caps.

2. Install two thrustwashers (25), needle bearing (26), new oil seal (24), new preformed packing (23), new backup ring (22), and new preformed packing (21) on steering valve body (3).

3. Install bushing (20), new seal (19), and retaining ring (18) on steering valve body (3).

4. Install check ball retainer (12), check ball (13), new preformed packing (14), check ball seat (15), new preformed packing (16), and setscrew (17) on steering valve body (3).



TA708336

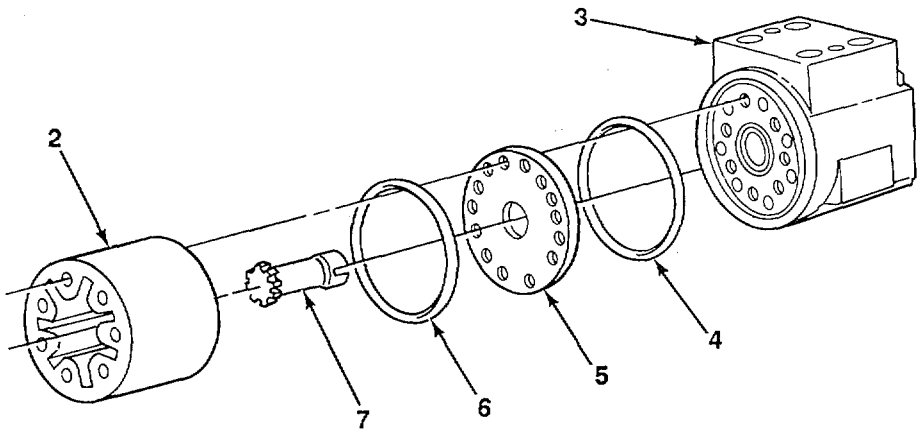
4-57. STEERING VALVE REPAIR (Con't).

5. new washer (4) and spacer plate (5) on steering valve body (3).

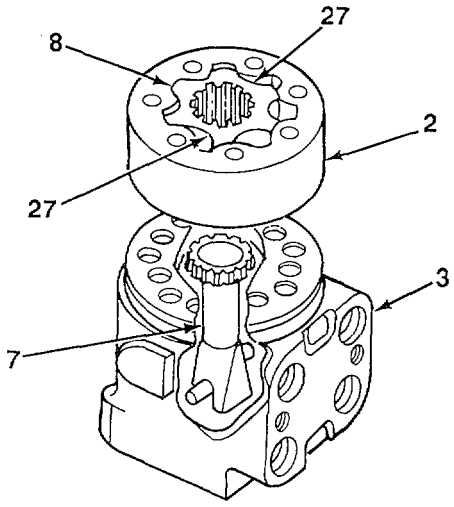
WARNING

Timing of generator is critical to proper operation of steering system. Slotted end of drive shaft must be properly alined with one of rotor valleys for timing to be correct. Failure to properly perform steps 6 through 10 could cause violent steering wheel oscillation, which could result in injury to personnel.

6. Mark splined end of drive shaft (7) parallel to slotted end.
7. Install drive shaft (7) In steering valve body (3).
8. Install washer (6) on generator (2).



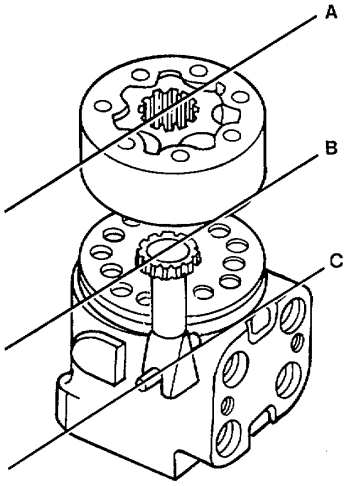
9. Aline rotor valleys (27) with mark made on splined end of drive shaft (7).



TA708337

4-57. STEERING VALVE REPAIR (Con't).

10. Install rotor (8) and generator (2) onto drive shaft (7) and steering valve body (3). Ensure that alinement is as illustrated by lines A, B, and C.

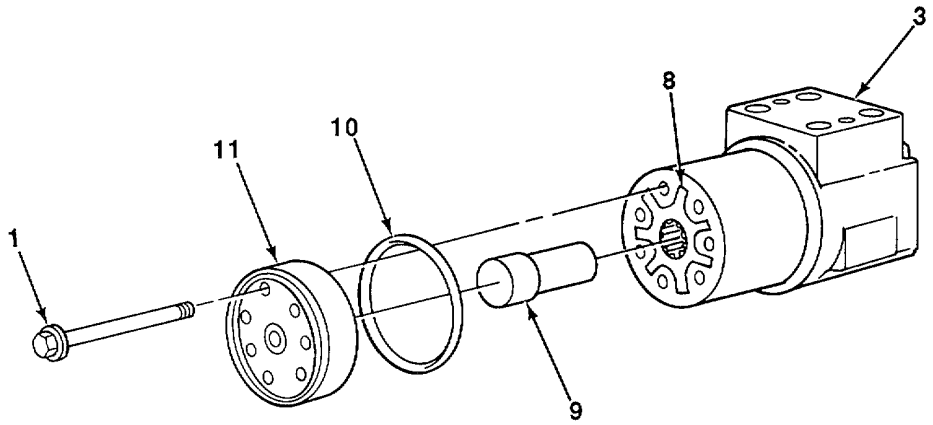


11. Install spacer (9) in rotor (8).

12. Install new washer (10) and end cap (11) on steering valve body (3) with seven screws (1). Torque screws in crisscross pattern to 125 lb.-in. (14 N•m).

13. Torque seven screws (1) again in crisscross pattern to 250 lb.-in. (28 N•m).

14. Remove steering valve body (3) from machinist's vise.



TA708338

FOLLOW-ON TASKS:

- Install steering valve (see TM 10-3930-659-20).

4-58. CROSSOVER RELIEF VALVE REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Crossover relief valve removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Machinist's vise (Item 76, Appendix E)

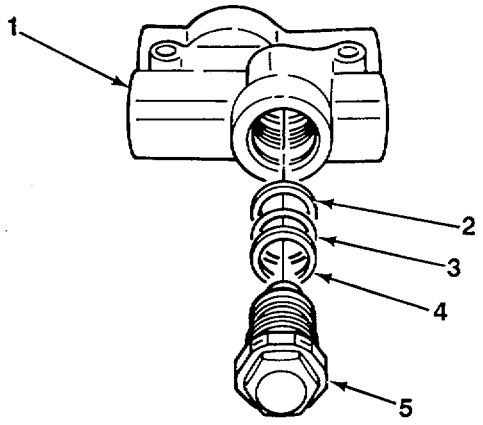
Materials/Parts:
- Dry cleaning solvent (Item 47, Appendix B)
- Four preformed packings

References:
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. DISASSEMBLY

1. Secure crossover relief valve housing (1) in machinist's vise with vise jaw caps.
2. Remove two relief valve cartridges (5), preformed packings (4), backing rings (3), and preformed packings (2) from crossover relief valve housing (1). Discard preformed packings.
3. Remove crossover relief valve housing (1) from machinist's vise.



TA708339

4-58. CROSSOVER RELIEF VALVE REPAIR (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and allow to air dry.

2. Inspect parts for cracks, breaks, burrs, and distortions. Replace damaged parts.

c. ASSEMBLY

1. Install two new preformed packings (2), backing rings (3), new preformed packings (4), and relief valve cartridges (5) on crossover relief valve housing (1).

2. Remove crossover relief valve housing (1) from machinist's vise.

FOLLOW-ON TASKS:

- Install crossover relief valve (see TM 10-3930-659-20).

4-59. PRIORITY VALVE REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Priority valve removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Socket head screw key set (Item 41, Appendix E)
- Machinist's vise (item 76, Appendix E)
- Combination wrench set (Item 77, Appendix E)
- Socket wrench set (Item 78, Appendix E)

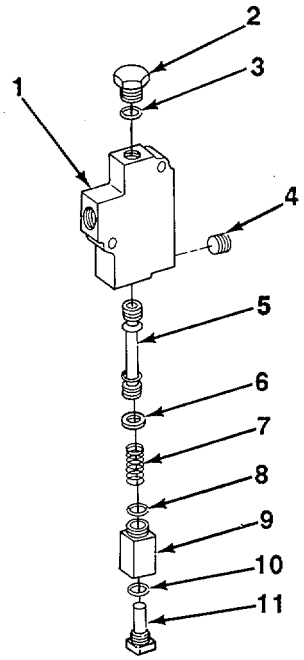
Materials/Parts:
- Dry cleaning solvent (Item 47, Appendix B)
- Three preformed packings

References:
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. DISASSEMBLY

1. Secure priority valve housing (1) in machinist's vise with vise jaw caps.
2. Remove relief valve cartridge (11) and preformed packing (10) from relief valve housing (9). Discard preformed packing.
3. Remove relief valve housing (9), preformed packing (8), and spring (7) from priority valve housing (1). Discard preformed packing.
4. Remove washer (6) and priority valve spool (5) from priority valve housing (1).
5. Remove setscrew (4) from priority valve housing (1).
6. Remove plug (2) and preformed packing (3) from priority valve housing (1). Discard preformed packing.
7. Remove priority valve housing (1) from machinist's vise.



TA708340

4-59. PRIORITY VALVE REPAIR (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-1380F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean parts in dry cleaning solvent and allow to air dry.
2. Inspect parts for damage, burrs, and nicks. Replace damaged parts.
3. Inspect priority valve housing for cracks and other defects. Replace damaged priority valve housing.
4. Inspect priority valve spool for damage. Replace priority valve spool and priority valve housing if priority valve spool is damaged,

c. ASSEMBLY

1. Secure priority valve housing (1) in machinist's vise with vise jaw caps.
2. Install new preformed packing (3) and plug (2) on priority valve housing (1).
3. Install setscrew (4) on priority valve housing (1).
4. Install priority valve spool (5) and washer (6) on priority valve housing (1).
5. Install spring (7), new preformed packing (8), and relief valve housing (9) on priority valve housing (1).
6. Install new preformed packing (10) and relief valve cartridge (11) on relief valve housing (9).
7. Remove priority valve housing (1) from machinist's vise.

FOLLOW-ON TASKS:

- Install priority valve (see TM 10-3930-659-20).

4-60. PIVOT PINS AND BUSHINGS REPLACEMENT.

This task covers:

a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
- Forklift truck parked on a smooth, level, hard surface with wheels straight ahead (see TM 10-3930-659-10).
- Parking brake set (see TM 10-3930-659-10).
- Boom lock raised (see TM 10-3930-659-20).
- Steering valve removed (see TM 10-3930-659-20).
- Front universal joints and support bearing removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Hydraulic jack, 10 ton (Item 39, Appendix E)
- Hydraulic jack kit (Item 40, Appendix E)
- Torque wrench multiplier (Item 44, Appendix E)
- Puller kit (Item 50, Appendix E)
- Trestle, 7 ton (two) (Item 73, Appendix E)
- Socket wrench set (Item 78, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)

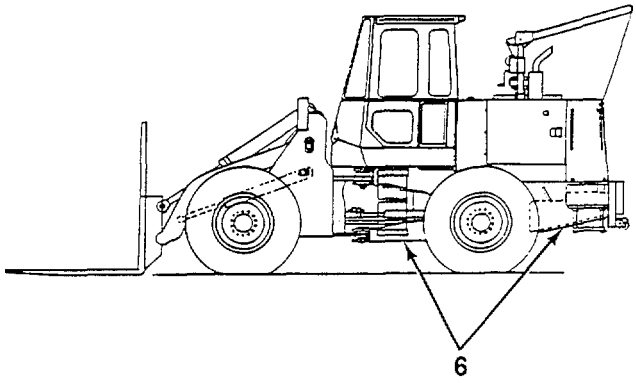
Materials/Parts:
- Silicone compound (Item 16, Appendix B)
- Grease (Item 33, Appendix B)
- One locknut
- Two lubrication fittings
- Four seals

Personnel Required: Three

References:
- LO 10-3930-659-12
- TM 10-3930-659-10
- TM 10-3930-659-20

a. REMOVAL

1. Position two trestles under rear of engine frame (6).
2. Position wood cribbing under front of engine frame (6).



TA708341

4-60. PIVOT PINS AND BUSHINGS REPLACEMENT (Con't).

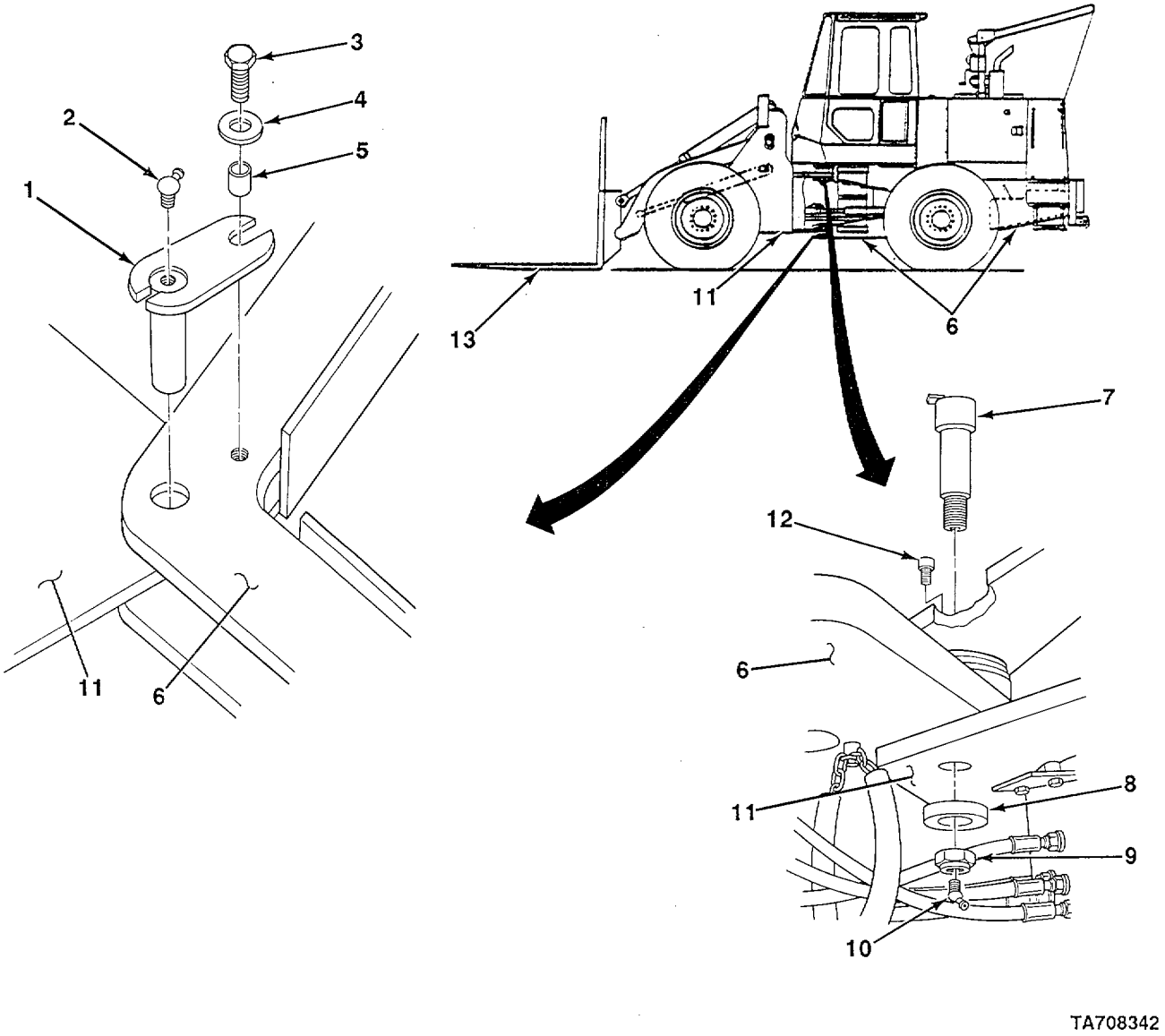
3. Position hydraulic jack under center of carriage assembly (13). Raise jack enough to remove weight of loader frame (11) from pivot pins (1 and 7).

NOTE
If only replacing pivot pins, replace one pivot pin at a time to aid during installation.

4. Remove screw (3), washer (4), spacer (5), and lower pivot pin (1) from engine frame (6).

5. Remove lubrication fitting (2) from lower pivot pin (1). Discard lubrication fitting.

6. Remove locknut (9), retainer (8), and upper pivot pin (7) from engine frame (6). Discard locknut.



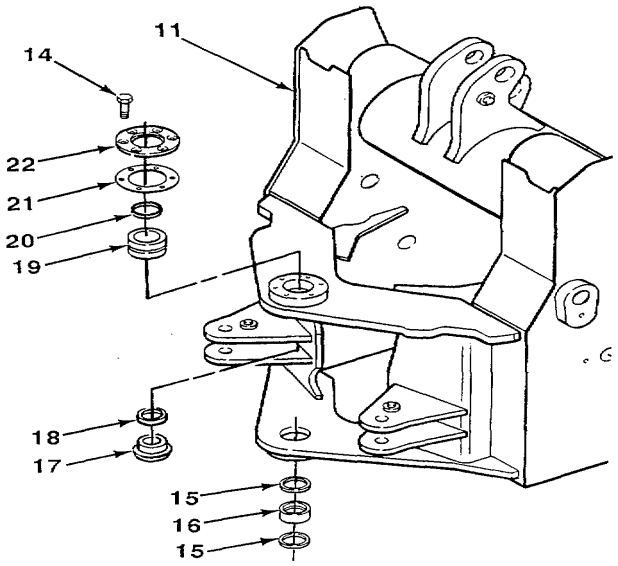
TA708342

4-60. PIVOT PINS AND BUSHINGS REPLACEMENT (Con't).

7. Remove lubrication fitting (10) from upper pivot pin (7). Discard lubrication fitting.
8. Remove capscrew (12) from engine frame (6).

NOTE
Perform steps 9 through 16 to fully separate loader frame from engine frame.

9. Install suitable lifting device to loader frame (11). Raise suitable lifting device enough to support weight of loader frame.
10. Disconnect steering cylinders (see TM 10-3930-659-20).
11. Disconnect STE/ICE turn signal/emergency flashers and blackout lights wiring harness (see TM 10-3930-659-20).
12. Disconnect loader frame wiring harness (see TM 10-3930-659-20).
13. Disconnect front brake hose (see TM 10-3930-659-20).
14. Disconnect plate-to-loader frame bracket hoses (see TM 10-3930-659-20).
15. Separate loader frame (11) from engine frame (6).
16. Position wood cribbing under rear of loader frame (1 1).
17. Remove six screws (14), cover (22), four shims (21), and seal (20) from loader frame (1 1).Discard seal.
18. Remove nut sleeve (17) and seal (18) from loader frame (11). Discard seal.
19. Using puller kit, remove bearing (19) from loader frame (11).
20. Remove two seals (15) and bushing (16) from loader frame (11). Discard seals.



TA708343

4-60. PIVOT PINS AND BUSHINGS REPLACEMENT (Con't).

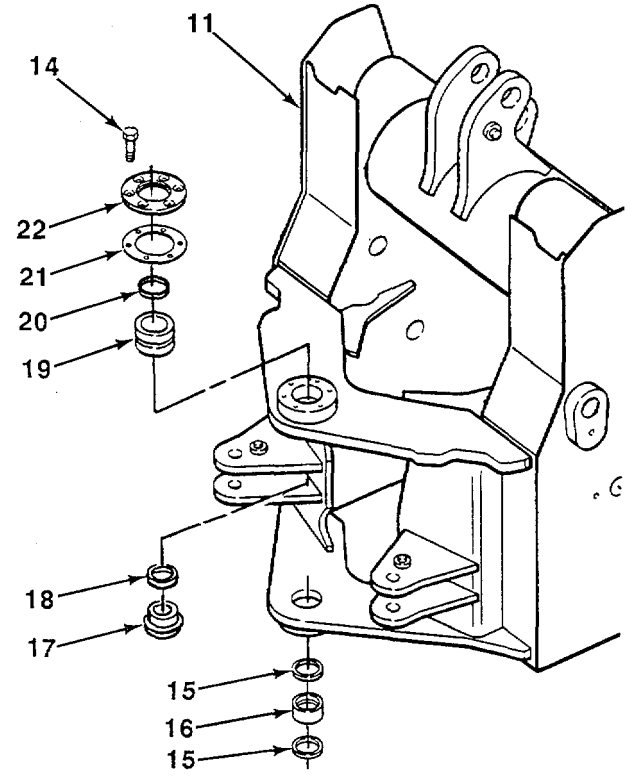
b. INSTALLATION

1. Apply a coat of silicone compound to bore of loader frame (11) and outer surface of bushing (16).
2. Press bushing (16) into loader frame (11) until Y4 in. (6 mm) from bottom surface.
3. Press two new seals (15) in loader frame (11) until tight against bushing (16) with lips of seals facing outward.
4. Apply a coat of grease to inner surface of bushing (16) and two seals (15).
5. Apply a coat of grease to inner and outer surfaces of bearing (19).

NOTE

If installing new bearing, use new shims furnished with new bearing.

6. Press bearing (19) into loader frame (11) until fully seated in bore of loader frame.
7. Press new seal (20) into cover (22) with lip of seal facing outward and extending Y in. (3 mm) from cover.
8. Apply a coat of grease to lip of seal (20).
9. Press seal (18) into loader frame (11) with lip of seal facing downward.
10. Apply coat of grease to lip of seal (18).
11. Install cover (22) WITHOUT shims (21) on loader frame (11) with six screws (14). Tighten screws evenly until cover contacts top of bearing (19).
12. Using feeler gage, measure gap between cover (22) and loader frame (11).
13. Assemble shim pack (21) with thickness of 0.001-0.005 in. (0.025-0.127 mm) LESS than gap measurement.
14. Remove six screws (14) and cover (22) from loader frame (11).
15. Install shim pack (21) and cover (22) on loader frame (11) with six screws (14). Torque screws to 105 lb.-ft. (142 N-m).
16. Apply a coat of grease to inner and outer surfaces of nut sleeve (17).
17. Install nut sleeve (17) in seal (18).



TA708344

4-60. PIVOT PINS AND BUSHINGS REPLACEMENT (Con't).

18. Remove wood cribbing from under loader frame (11).

19. Position loader frame (11) to engine frame (6).

20. Connect plate-to-loader frame bracket hoses (see TM 10-3930-659-20).

21. Connect front brake hose (see TM 10-3930659-20).

22. Connect loader frame wiring harness (see TM 10-3930-659-20).

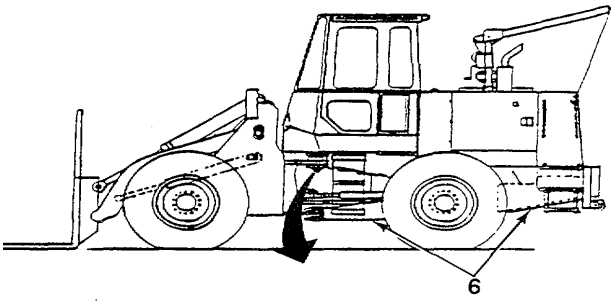
23. Connect STE/ICE turn signal/emergency flashers and blackout lights wiring harness (see TM 10-3930-659-20).

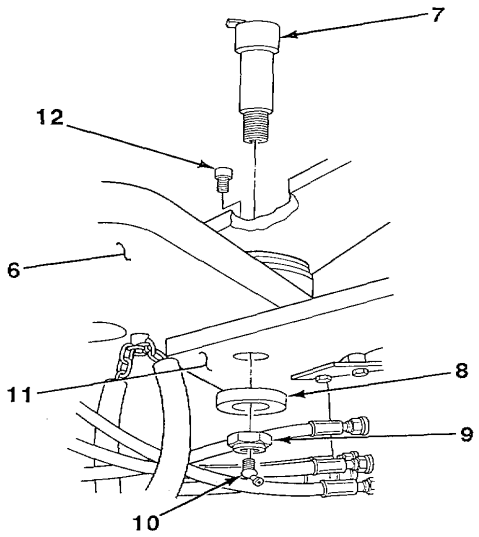
24. Connect steering cylinders (see TM 10-3930659-20).

25. Install capscrew (12) on engine frame (6).

26. Install new lubrication fitting (10) on upper pivot pin (7).

27. Install upper pivot pin (7) and retainer (8) on engine frame (6) with new locknut (9). Torque locknut to 1000 lb.-ft. (1356 N.m).

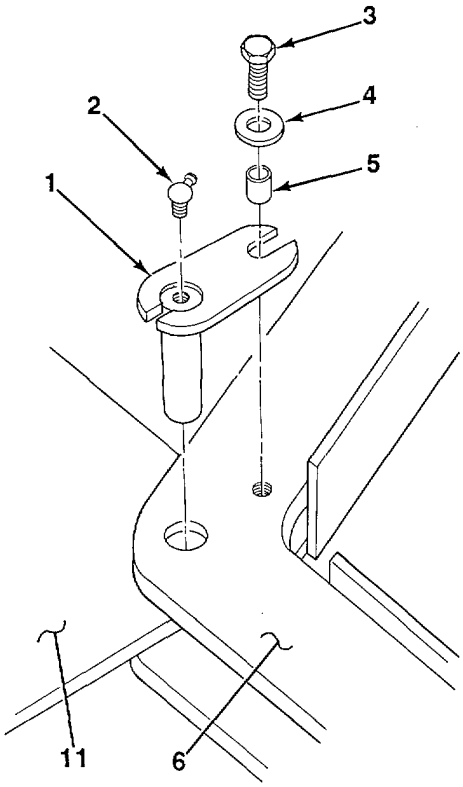


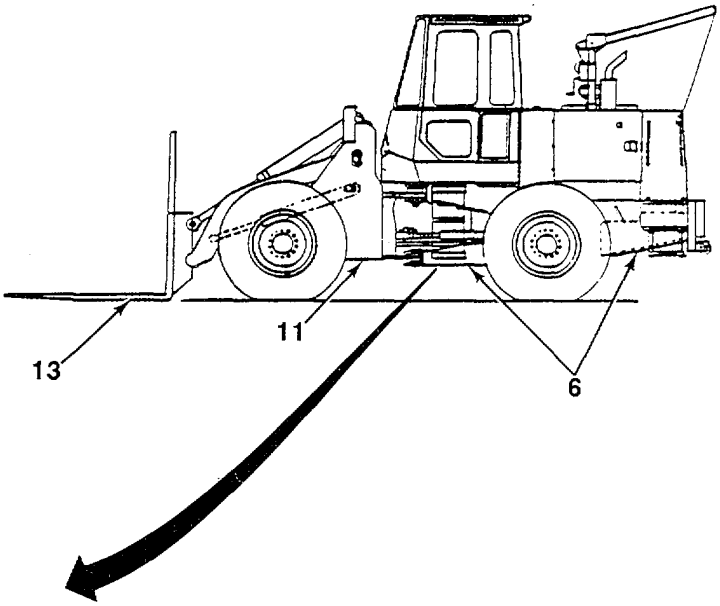


TA708345

4-60. PIVOT PINS AND BUSHINGS REPLACEMENT (Con't).

28. Install new lubrication fitting (2) on lower pivot pin (1).
29. Install lower pivot pin (1) on engine frame (6) with spacer (5), washer (4), and screw (3).
30. Remove suitable lifting device from loader frame (11).
31. Remove hydraulic jack from under carriage (13).
32. Remove wood cribbing from under engine frame (6).
33. Remove two trestles from under engine frame (6).





FOLLOW-ON TASKS:

- Install front universal joints and support bearing (see TM 10-3930-659-20).
- Install steering valve (see TM 10-3930-659-20).
- Lower boom lock (see TM 10-3930-659-20).
- Lubricate pivot pins (see LO 10-3930-659-12).

TA708346

Section XIV. BODY AND CAB MAINTENANCE

4-61. CAB ASSEMBLY WITH ROPS REPLACEMENT

This task covers:

a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:

- Forks resting on ground (see TM 10-3930-659-10).
- Cab skirts removed (see TM 10-3930-659-20).
- Cab ground strap removed (see TM 10-3930-659-20).
- Outside cab heater hoses disconnected (see TM 10-3930-659-20).
- Under cab wiring harness disconnected (see TM 10-3930-659-20).
- Forklift control valve levers disconnected (see TM 10-3930-659-20).
- Forklift control valve lowered (see TM 10-3930-
- Accelerator cable removed (see TM 10-3930-659-20).
- Transmission shift linkage removed (see TM 10-3930-659-20).
- Transmission shift cables removed (see TM 10-3930 659-20)
- Brake light switch disconnected (see TM 10-3930-659-20).
- Steering valve removed (see TM 10-3930-659-20).

Equipment Conditions (Con't):

- Brake valves removed (see TM 10-3930-659-20).
- Parking brake cable disconnected (see TM 10-3930-659-20).
- Front windshield and rear window washer hoses disconnected (see TM 10-3930-659-20).

Tools/Test Equipment

- General mechanic's tool kit (Item 71, Appendix E)
- Lifting brackets (four) (Item 7, Appendix E)
- Impact socket set (Item 59, Appendix E)
- Combination wrench set (Item 77, Appendix E)
- Torque wrench, 0-600 Ib.-ft. (Item 82, Appendix E)

- **Personnel Required**: Tree

References:

- * TM 10-3930-659-10
- TM 10-3930-659-20

4-61. CAB ASSEMBLY WITH ROPS REPLACEMENT (Con't).

a. REMOVAL

1. Install four lifting brackets on lifting eyes (1) with fourj in. x 2/ in. x 13 screws and nuts. Attach suitable lifting device to lifting brackets and raise lifting device enough to support weight of cab assembly (2).

2. Remove four nuts (3), washers (4), screws (10), eight washers (8 and 9), and four resilient mounts (7) from cab assembly (2) and frame (6).

WARNING

Use extreme caution when handling heavy parts. Lifting device Is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to followthis warning may cause serious injury or death to personnel.

CAUTION

Ensure that hoses and linkages DO NOT catch or bind. Hoses and linkages could be damaged.

NOTE

Cab weighs 1650 lb (750 kg).

3. Using suitable lifting device, remove cab assembly (2) from frame (6).

4-61. CAB ASSEMBLY WITH ROPS REPLACEMENT (Con't).

4. Remove four resilient mounts (5) from cab assembly (2).

5. Lower cab assembly (2) to ground and remove suitable lifting device.

6. Remove four nuts, screws, and lifting brackets from cab assembly (2).

b. INSTALLATION

1. Install four lifting brackets on lifting eyes (1) with four j in. x 212 in. x 13 screws and nuts. Attach suitable lifting device to lifting brackets and raise lifting device enough to support weight of cab assembly (2).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

Cab weighs 1650 lb (750 kg).

2. Using suitable lifting device, raise cab assembly (2) and install four resilient mounts (5).

3. Position cab assembly (2) on frame (6). Ensure that all hoses and linkages are clear.

4. Install four resilient mounts (7), eight washers (8 and 9), four screws (6), washers (4), and nuts (3). Torque nuts to 235 lb.-ft. (319 N.m).

5. Remove suitable lifting device and lifting brackets from cab assembly (2).

6. Remove four nuts, screws, and lifting brackets from cab assembly (2).

FOLLOW-ON TASKS:

- Connect front windshield and rear window washer (see TM 10-3930-659-20).
- Connect parking brake cable (see TM 10-3930-659-20).
- Install brake valves (see TM 10-3930-659-20).
- install steering valve (see TM 10-3930-659-20).
- Connect brake light switch (see TM 10-3930-659-20).
- Install transmission shift cables (see TM 10-3930-659-20).
- Install transmission shift linkage (see TM 10-3930-659-20).
- Install accelerator cable (see TM 10-3930-659-20).
- Install forklift control valve (see TM 10-3930-659-20).
- Connect forklift control valve levers (see TM 10-3930-659-20).
- Connect under cab wiring harness (see TM 10-3930-659-20).
- Connect outside cab heater hoses (see TM 10-3930-659-20).
- Install cab ground strap (see TM 10-3930-659-20).
- Install cab skirts (see TM 10-3930-659-20).

4-62. CAB WINDOW GLASS REPLACEMENT.

This task covers:

a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:

- Front windshield wiper arm removed (if replacing front windshield glass) (see TM 10-3930-659-20).
- Rear window wiper arm removed (if replacing rear window glass) (see TM 10-3930-659-20).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Window glass installation tool kit (Item 72, Appendix E)

References:

- TM 10-3930-659-20

Personnel Required: Two

a. REMOVAL

1. Using window glass installation tool kit, pull open locking tab (3) of isolator molding (2) around full length of isolator molding.

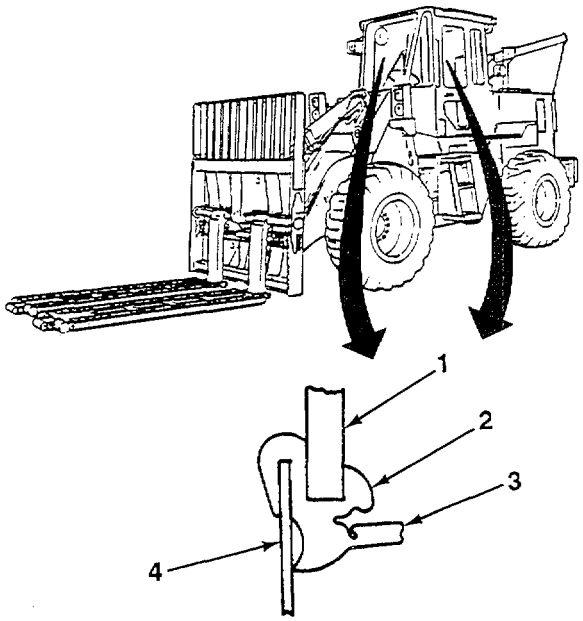
2. Pull isolator molding (2) outward and away from window glass (1) to expose edge of window glass.

CAUTION

Support window glass as glass is removed from isolator molding.

3. Continue to pull isolator molding (2) while pushing outward on window glass (1) until window glass is removed.

4. Remove isolator molding (2) from cab (4).



TA708385

4-62. CAB WINDOW GLASS REPLACEMENT (Con't).

b. INSTALLATION

1. Install isolator molding (2) on cab (4) with joint at side of window opening.

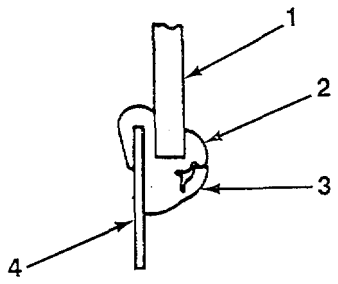
CAUTION

Support window glass as glass is installed on isolator molding.

2. Pull isolator molding (2) outward and away from window opening. Install edge of window glass (1) on isolator molding.

3. Continue to pull isolator molding (2) while pushing inward on window glass (1) until window glass is seated.

4. Using window glass installation tool kit, push locking tab (3) of isolator molding (2) closed around full length of isolator molding.



FOLLOW-ON TASKS:

- Install rear window wiper arm (if rear window glass replaced) (see TM 10-3930-659-20).
- Install front windshield wiper arm (if front windshield glass replaced) (see TM 10-3930-659-20).

TA708386

4-63. SEAT ASSEMBLY REPAIR.

This task covers:

a. Removal **b. Installation**

INITIAL SETUP:

Equipment Conditions:
- Seatbelts removed (see TM 10-3930-659-20)
- Operator's manual holder removed (see TM 10-3930-659-20)
- Seat assembly removed (see TM 10-3930-659-20)

Tools/Test Equipment:
- Two dowel pins
- General mechanic's tool kit (Item 71, Appendix E)
- Electric drill, portable (Item 20, Appendix E)
- Twist drill set (Item 21, Appendix E)
- Blind hand riveter (Item 55, Appendix E)

Personnel Required: Two

References:
TM 10-3930-659-20

Materials/Parts:
- Detergent (Item 23, Appendix B)
- Grease (Item 33, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (item 47, Appendix B)
- One cotter pin
- Two locknuts
- Three roll pins
- Four rivets

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

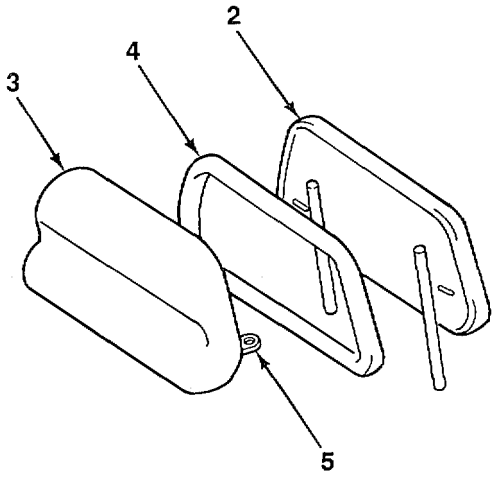
a. DISASSEMBLY

1. Remove backrest extension (2) from backrest (1).

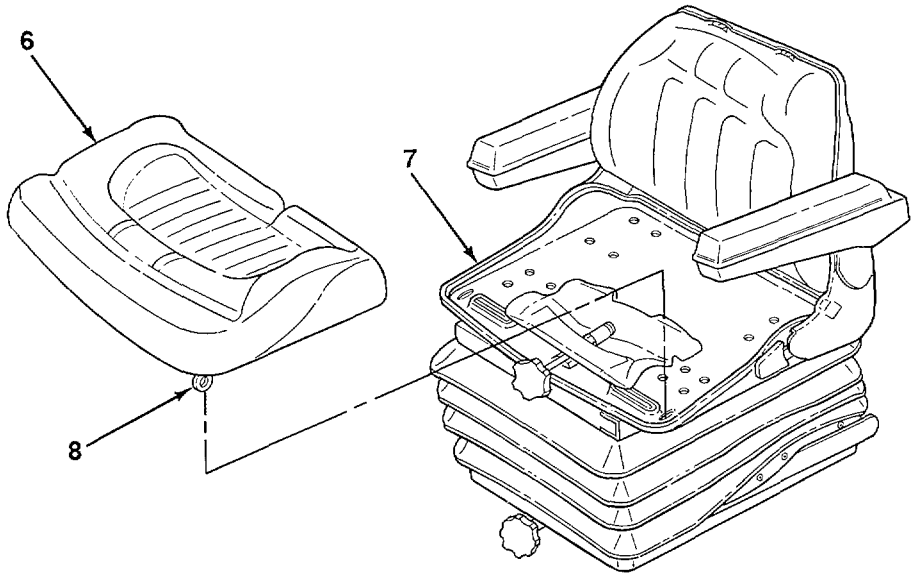
4-63. SEAT ASSEMBLY REPAIR (Con't).

2. Lift two eyelets (5) and turn until eyelets are alined with slots in backrest extension (2).

3. Remove cushion (3) and molding (4) from backrest extension (2).



4. Lift four eyelets (8) and turn until eyelets are alined with slots in seat pan (7). Pull cushion (6) up and forward, and remove from seat pan.

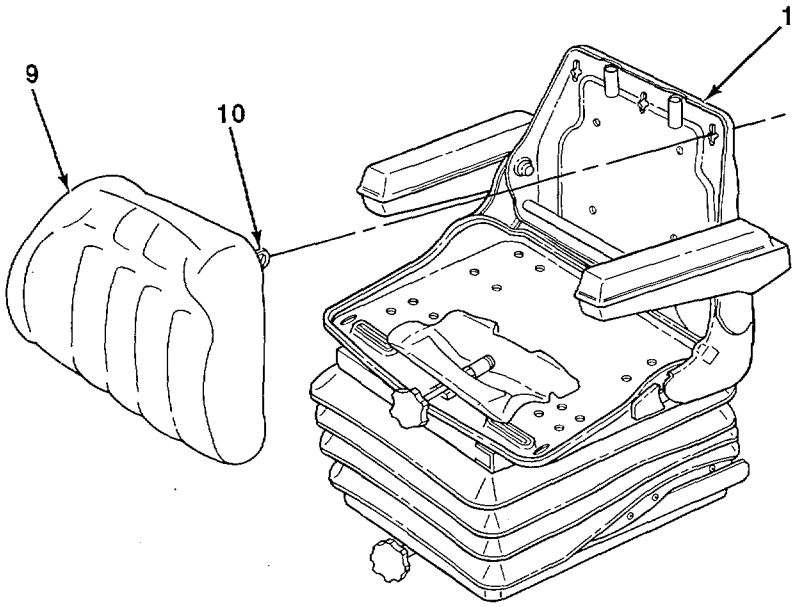


TA708388

4-63. SEAT ASSEMBLY REPAIR (Con't).

5. Lift three eyelets (10) and turn until eyelets are alined with slots in backrest (1).

6. Remove cushion (9) from backrest (1).

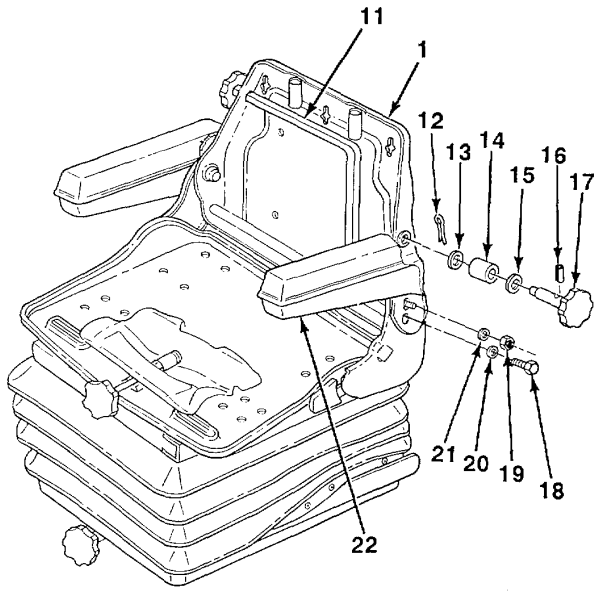


7. Remove two screws (18), washers (20), nuts (19), washers (21), and armrests (22) from backrest (1).

8. Remove cotter pin (12), washer (13), spacer (14), washer **(15),** dowel pin (16), and lumbar adjustment knob (17), from backrest (1). Discard dowel pin and cotter pin.

9. Repeat step 8 for other lumbar adjustment knob (17).

10. Remove molding (11) from backrest (1).



TA708389

4-63. SEAT ASSEMBLY REPAIR (Con't).

WARNING

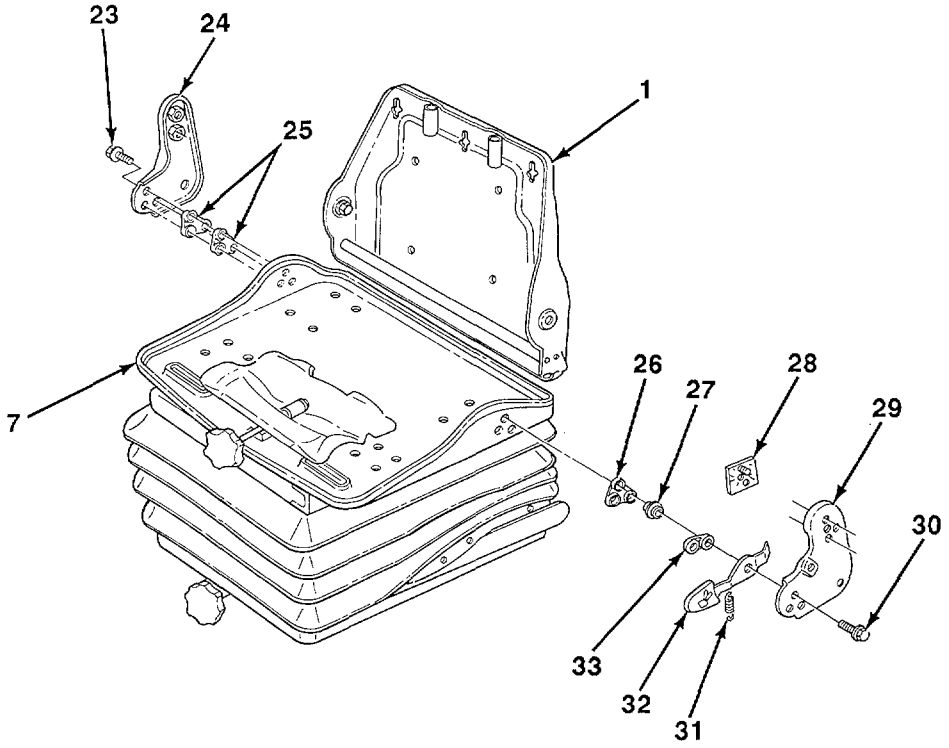
Use care when removing bracket. Seat spring is attached under tab and if released too quickly could injure personnel.

NOTE

Note location of spacers to aid during assembly.

11. Remove two screws (23), bracket (24), and two spacers (25) from seat pan (7).

12. Remove two screws (30), bracket (29), adjusting arm lever (32), spring (31), spacer (33), bushing (27), two spacers (26 and 28), and backrest (1) from seat pan (7).



TA708390

4-63. SEAT ASSEMBLY REPAIR (Con't).

13. Remove spacer (36), screw (40), and washer (39) from backrest (1).

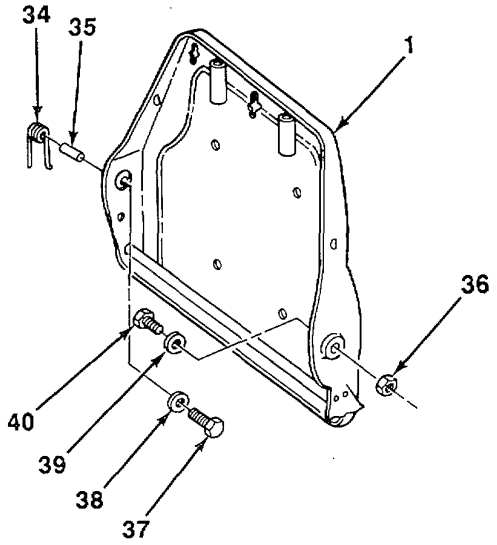
14. Remove screw (37), washer (38), spring (34), and spacer (35) from backrest (1).

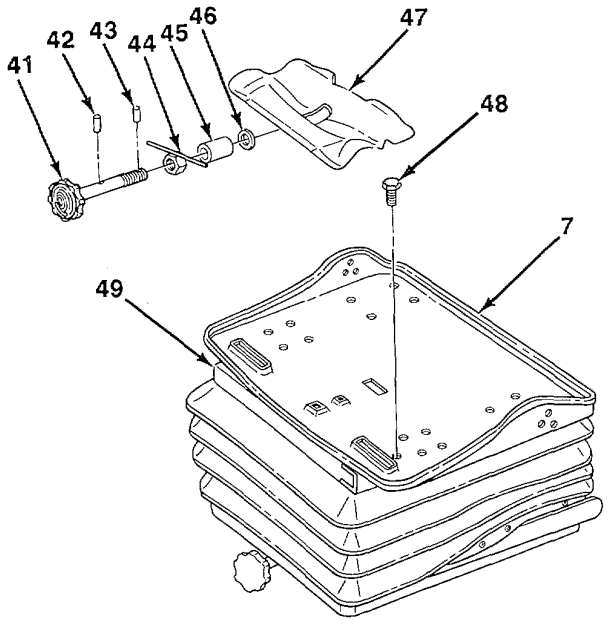
15. Remove adjustment angle support (47) from seat pan (7).

16. Remove dowel pin (43), washer (46), adjustment angle support knob (41), adjustment nut (44), and spacer (45) from seat pan (7). Discard dowel pin.

17. If damaged, remove dowel pin (42) from adjustment angle support knob (41).

18. Remove four screws (48) and seat pan (7) from top plate (49).





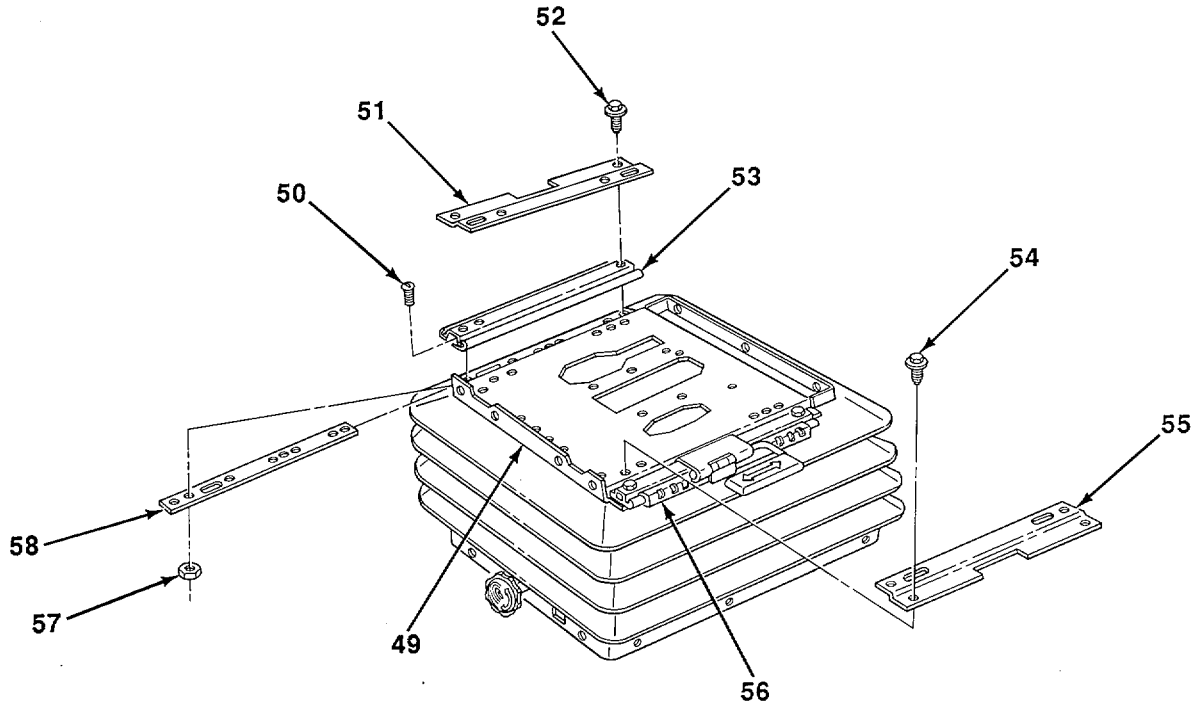
TA708391

4-63. SEAT ASSEMBLY REPAIR (Con't).

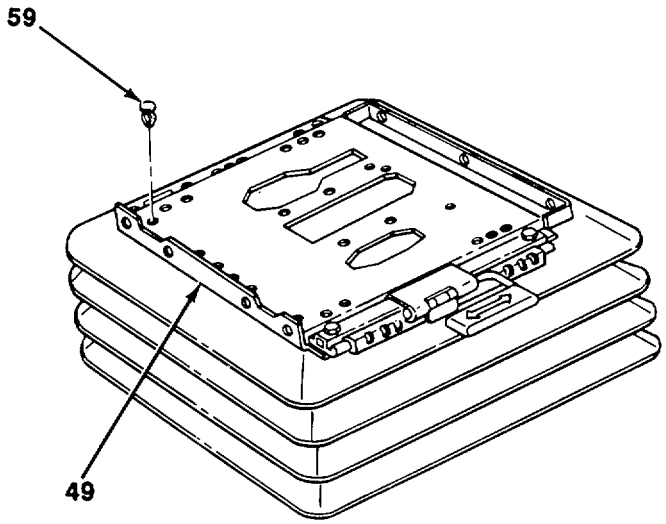
19. Remove two screws (52) and bracket (51) from right adjustment bracket (53).

20. Remove two screws (54) and bracket (55) from left adjustment bracket (56).

21. Remove four nuts (57), screws (50), right and left adjustment brackets (53 and 56), and two stiffener plates (58) from top plate (49).



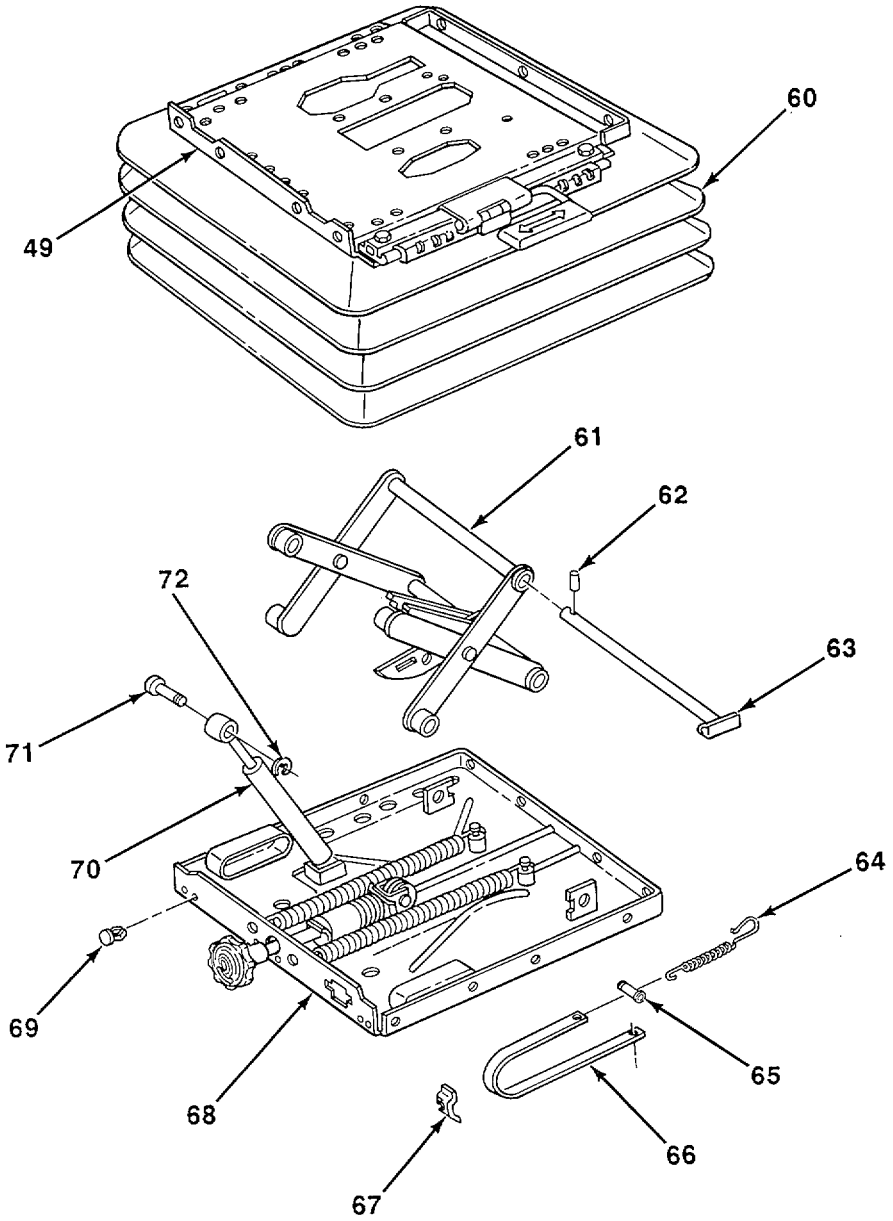
22. Remove seven plugs (59) from top plate (49).



TA708392

4-63. SEAT ASSEMBLY REPAIR (Con't).

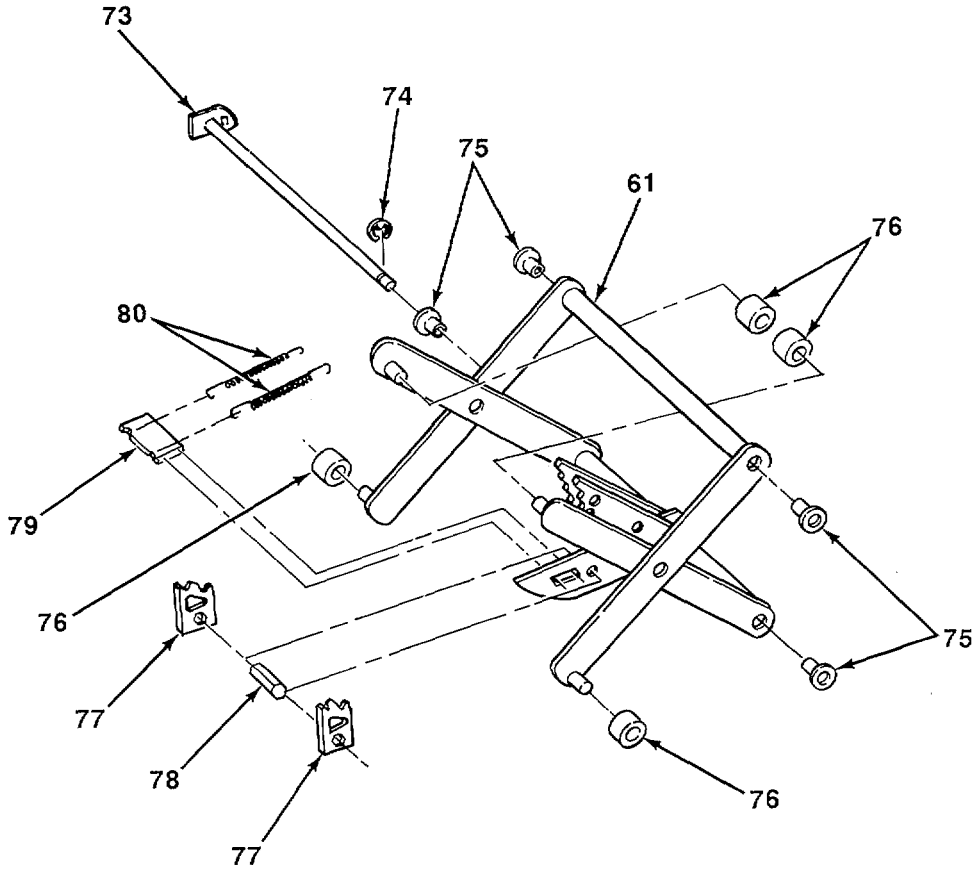
23. Remove 15 plugs (69) from base plate (68).
24. Remove bellows (60) from base plate (68).
25. Remove roll pin (62) and pivot bar (63) from top plate (49) and scissor assembly (61). Discard roll pin.
26. Remove retaining ring (72) and pin (71) from shock absorber (70).
27. Remove top plate (49) from scissor assembly (61).



TA708393

4-63. SEAT ASSEMBLY REPAIR (Con't).

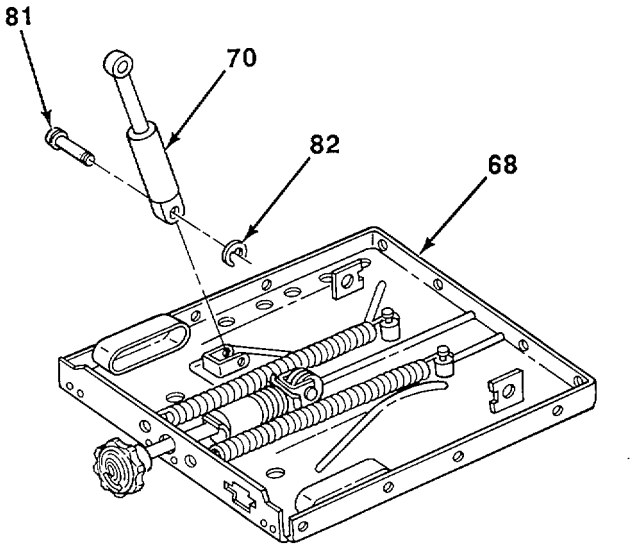
28. Remove spring (64) from scissor assembly (61).
29. Remove pin (65), weight indicator (66), and bracket (67) from base plate (68) and spring (64).
30. Remove scissor assembly (61) from base plate (68).
31. Remove four rollers (76) from scissor assembly (61).
32. Remove retaining ring (74) and pivot bar (73) from scissor assembly (61).
33. Remove two springs (80) and spring holder (79) from scissor assembly (61).
34. Remove two adjustment levers (77) and spacer (78) from scissor assembly (61).
35. Remove four bushings (75) from scissor assembly (61).



TA708394

4-63. SEAT ASSEMBLY REPAIR (Con't).

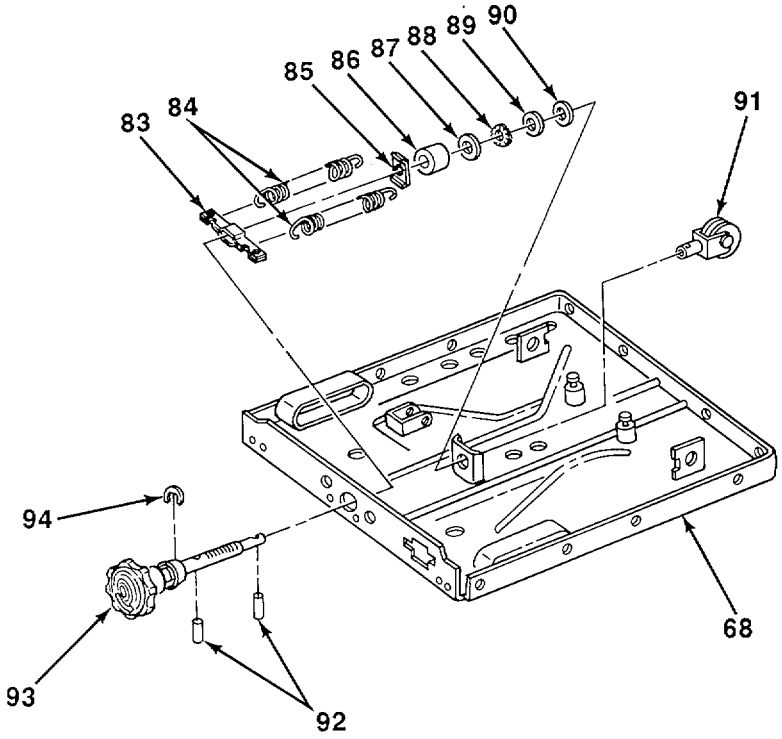
36. Remove retaining ring (82), pin (81), and shock absorber (70) from base plate (68).



37. Remove two springs (84) from weight adjuster (83) and base plate (68).

38. Remove retaining ring (94) and two roll pins (92) from adjuster spindle (93). Discard roll pins.

39. Remove adjuster spindle (93), weight adjuster (83), spindle bracket (85), spacer (86), three washers (87, 88, and 89), rubber washer (90), and roller assembly (91) from base plate (68).



TA708395

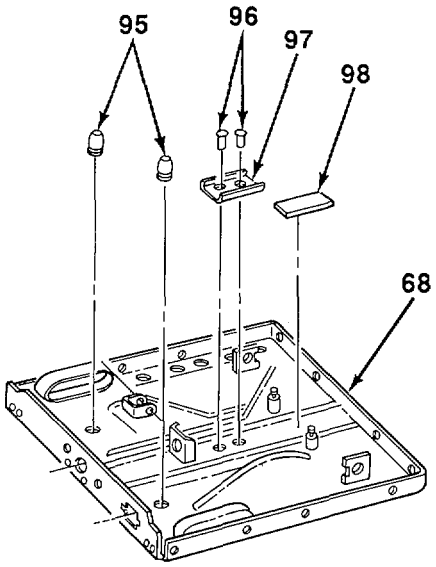
4-63. SEAT ASSEMBLY REPAIR (Con't).

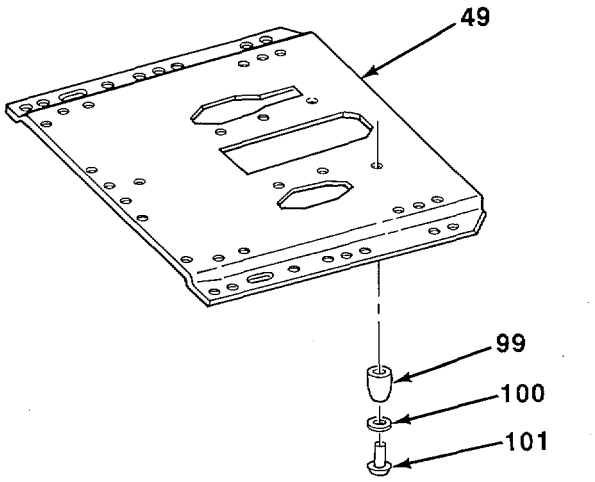
40. Remove two rubber stops (95) from base plate (68).

41. Remove two rivets (96) and bracket (97) from base plate (68). Discard rivets.

42. Remove stop (98) from base plate (68).

43. Remove two rivets (101), washers (100), and bumpers (99) from top plate (49). Discard rivets.





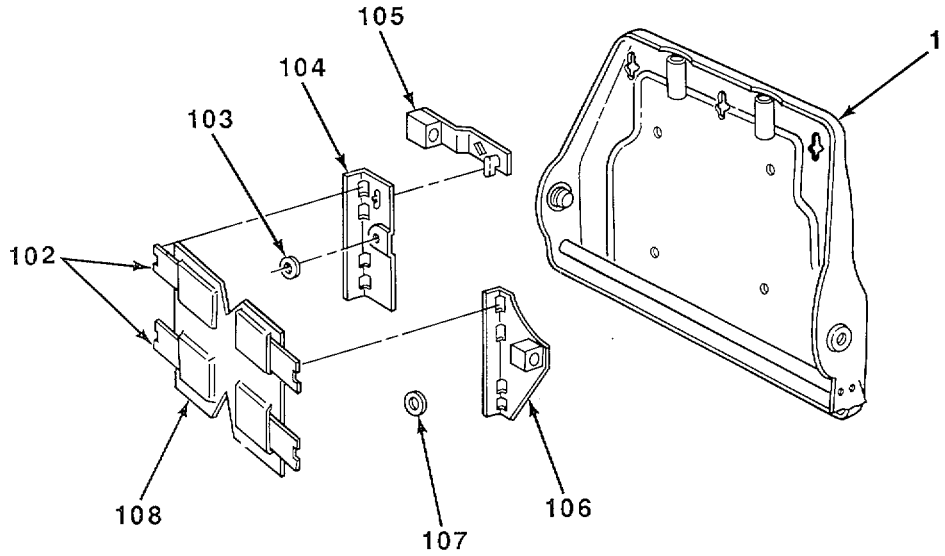
TA708396

4-63. SEAT ASSEMBLY REPAIR (Con't).

44. Remove locknut (107) and left adjustment bracket (106) from backrest (1). Discard locknut.

45. Remove locknut (103), two right adjustment brackets (104 and 105), and back support (108) from backrest (1). Discard locknut.

46. Remove two tension springs (102) from back support (108).



b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-1380°F (380°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with clean rags.

2. Clean cushions with detergent and water. Allow to air dry.

3. Clean plastic parts and bellows with detergent and water. Dry with clean rags.

4. Inspect parts for cracks, wear, and damage. Replace damaged parts.

TA708397

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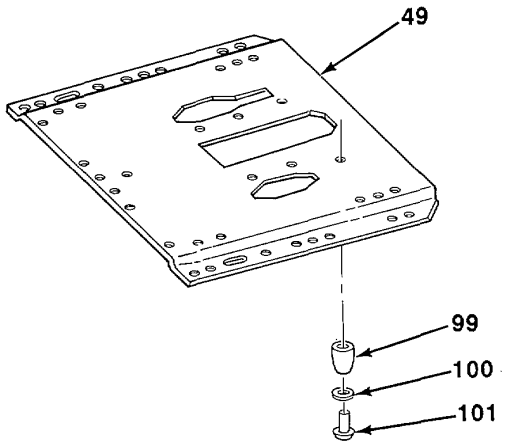
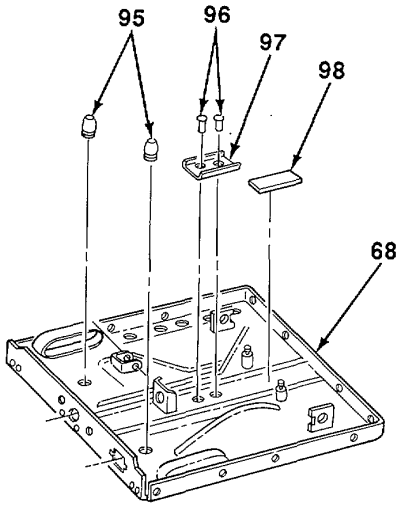
4-63. SEAT ASSEMBLY REPAIR (Con't).

c. ASSEMBLYI

1. Position two tension springs (102) in back support (108).
2. Install back support (108) and two right adjustment brackets (104 and 105) on backrest (1) with new locknut (103).
3. Install left adjustment bracket (106) on backrest (1) with new locknut (107).
4. Install two bumpers (99) on top plate (49) with two washers (100) and new rivets (101).



5. Install stop (98) on base plate (68).
6. Install bracket (97) on base plate (68) with two new rivets (96).
7. Install two rubber stops (95) on base plate (68).



TA708398

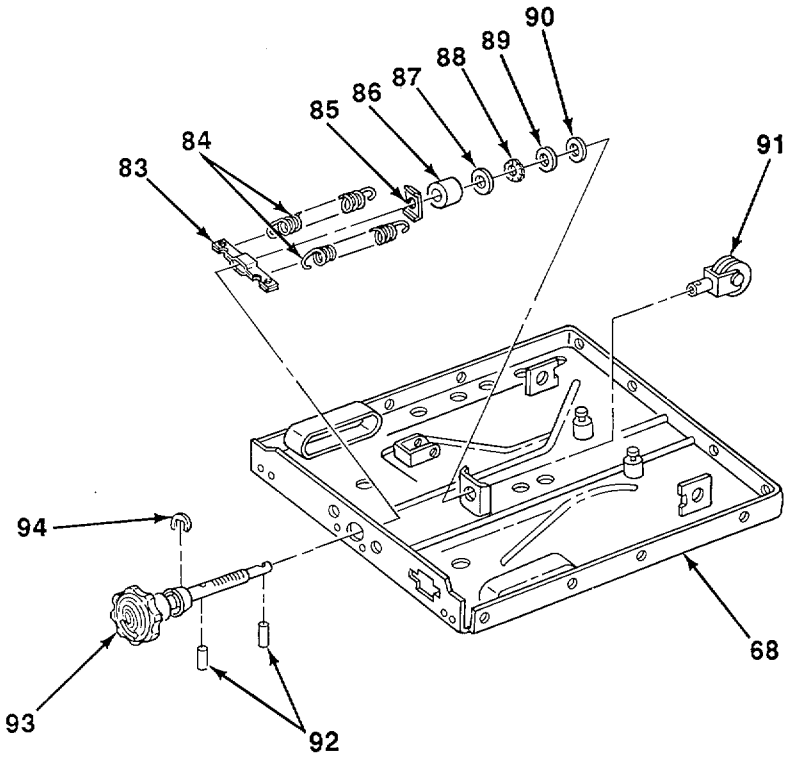
4-63. SEAT ASSEMBLY REPAIR (Con't).

8. Position roller assembly (91) on base plate (68).

9. Install rubber washer (90), three washers (87, 88, and 89), spacer (86), spindle bracket (85), weight adjuster (83), and adjuster spindle (93) on base plate (68).

10. Install two new roll pins (92) and retaining ring (94) on adjuster spindle (93).

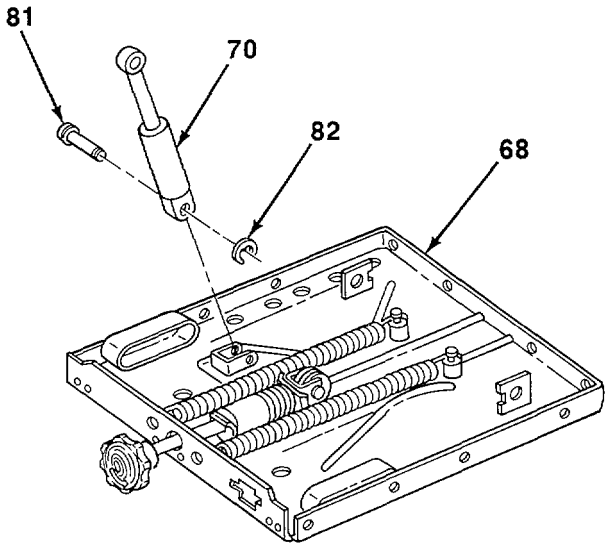
11. Install two springs (84) on base plate (68) and weight adjuster (83).

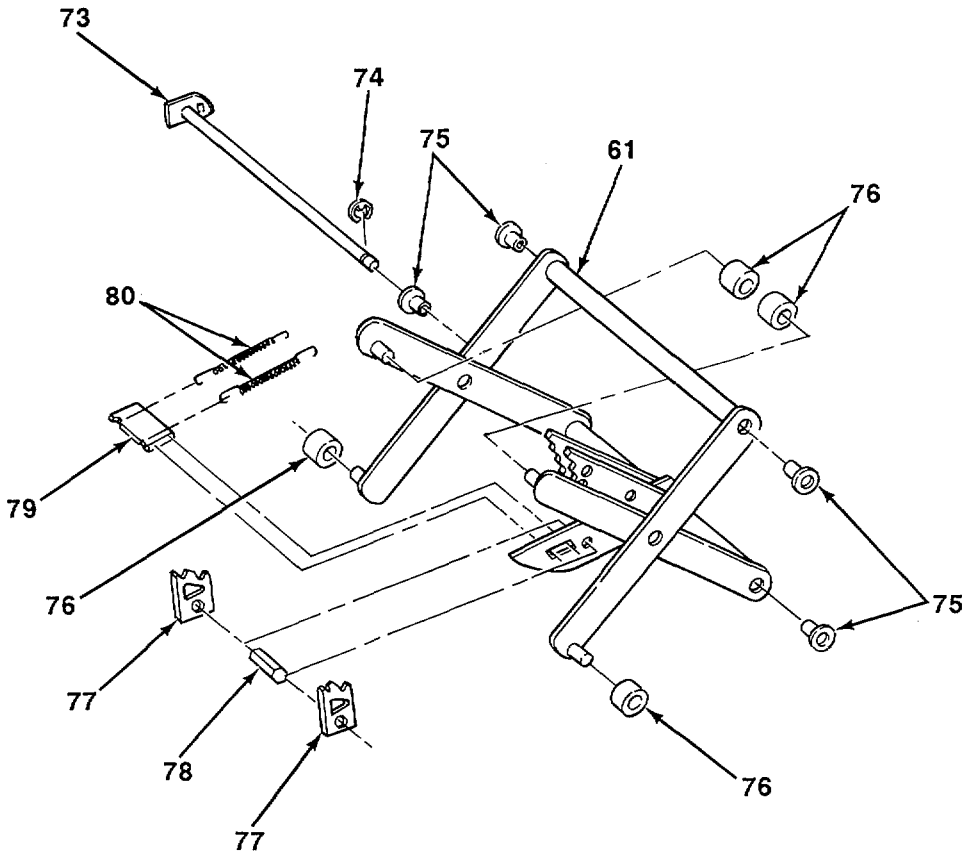


TA708399

4-63. SEAT ASSEMBLY REPAIR (Con't).

12. Install shock absorber (70) on base plate (68) with pin (81) and retaining ring (82).
13. Install four bushings (75) on scissor assembly (61).
14. Position spacer (78) and two adjustment levers (77) on scissor assembly (61).
15. Install spring holder (79) on scissor assembly (61) with two springs (80).
16. Install pivot bar (73) on scissor assembly (61) with retaining ring (74).
17. Install four rollers (76) on scissor assembly (61).



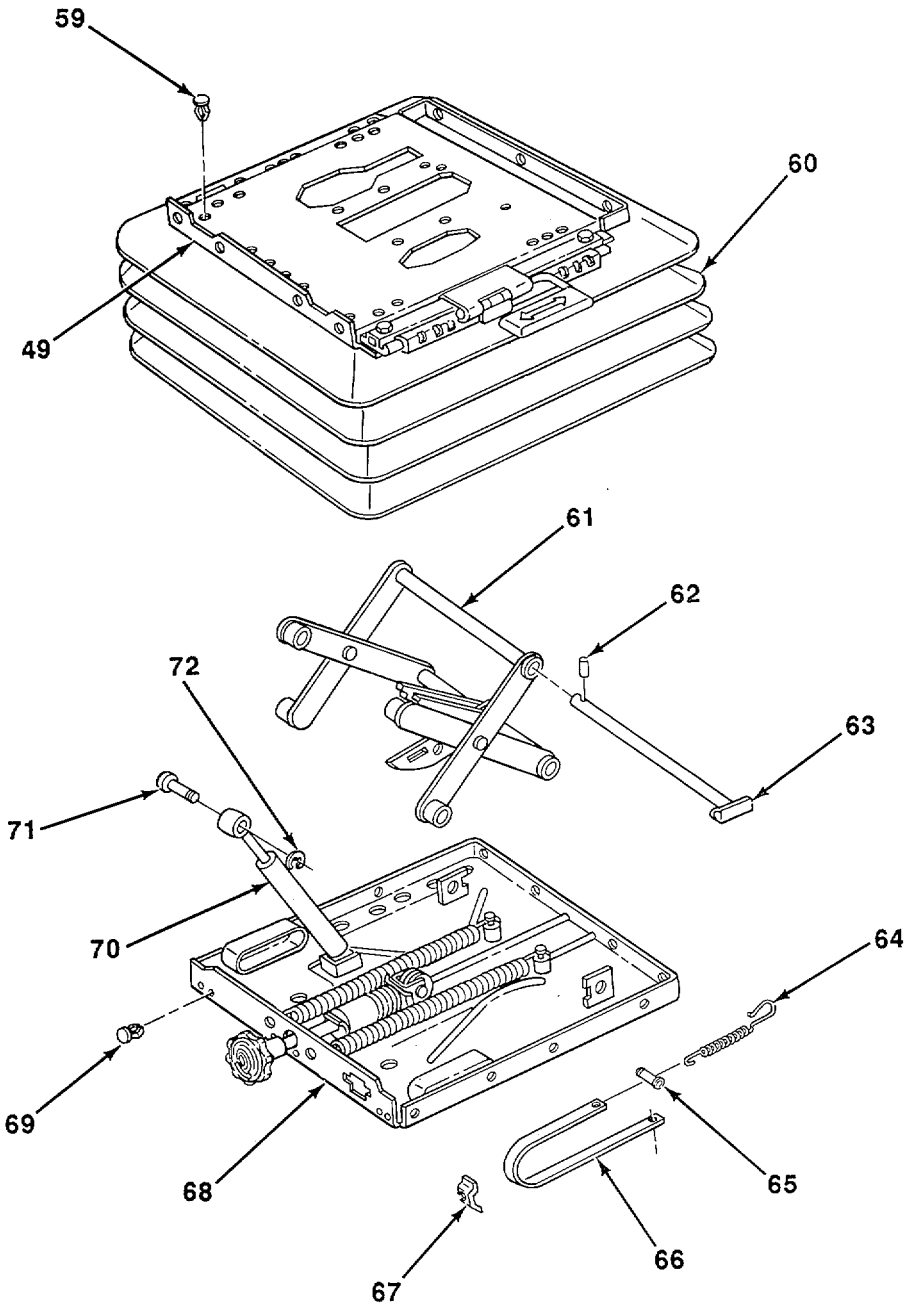


TA708400

4-63. SEAT ASSEMBLY REPAIR (Con't).

18. Install pivot bar (63) on scissor assembly (61) with new roll pin (62).
19. Position scissor assembly (61) on base plate (68).
20. Install spring (64) on weight indicator (66) and base plate (68) with bracket (67) and pin (65).

21. Install spring (64) on scissor assembly (61).



TA708401

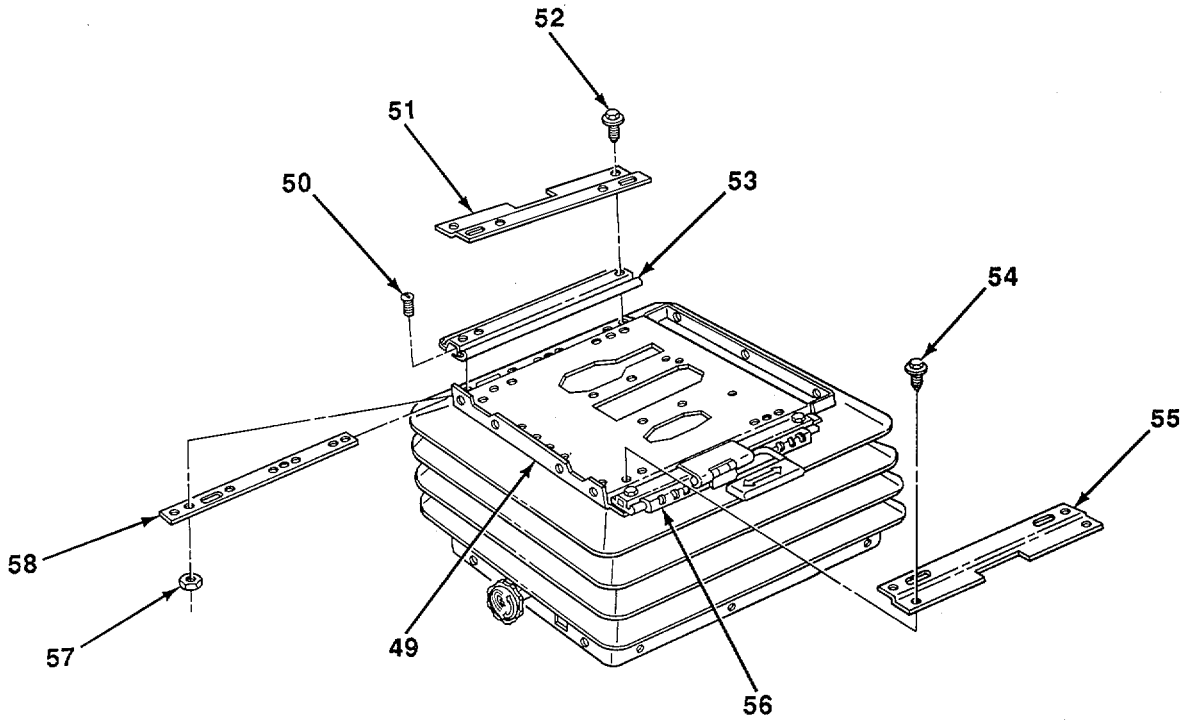
4-63. SEAT ASSEMBLY REPAIR (Con't).

22. Position top plate (49) on scissor assembly (61).
23. Install shock absorber (70) on top plate (49) with pin (71) and retaining ring (72).
24. Install bellows (60) on base plate (68) with 15 plugs (69).
25. Install bellows (60) on top plate (49) with seven plugs (59).

NOTE

Ensure that lip of bellows is secured between stiffener plates and adjustment brackets.

26. Install right and left adjustment brackets (53 and 56) and two stiffener plates (58) on top plate (49) with four screws (50) and nuts (57).
27. Install bracket (55) on left adjustment bracket (56) with two screws (54).
28. Install bracket (51) on right adjustment bracket (53) with two screws (52).



TA708402

4-63. SEAT ASSEMBLY REPAIR (Con't).

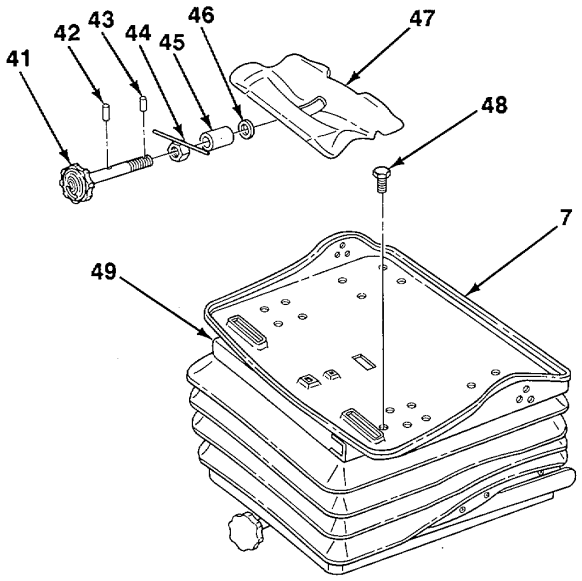
29. Install seat pan (7) on top plate (49) with four screws (48).

30. If removed, install new dowel pin (42) in adjustment angle support knob (41).

31. Position adjustment angle support knob (42) partway in seat pan (7).

32. Install adjustment nut (44) on adjustment angle support knob (41) and install adjustment angle support knob fully in seat pan (7).

33. Install spacer (45) and washer (46) on adjustment angle support knob (41) with new dowel pin (43).

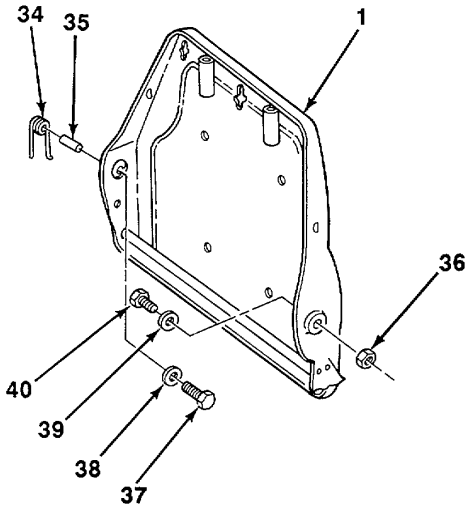


34. Install adjustment angle support (47) on seat pan (7).

35. Install washer (39), screw (40), and spacer (36) on backrest (1).

36. Install washer (38), screw (37), spacer (35), and spring (34) on backrest (1).

37. Position backrest (1) on seat pan (7).



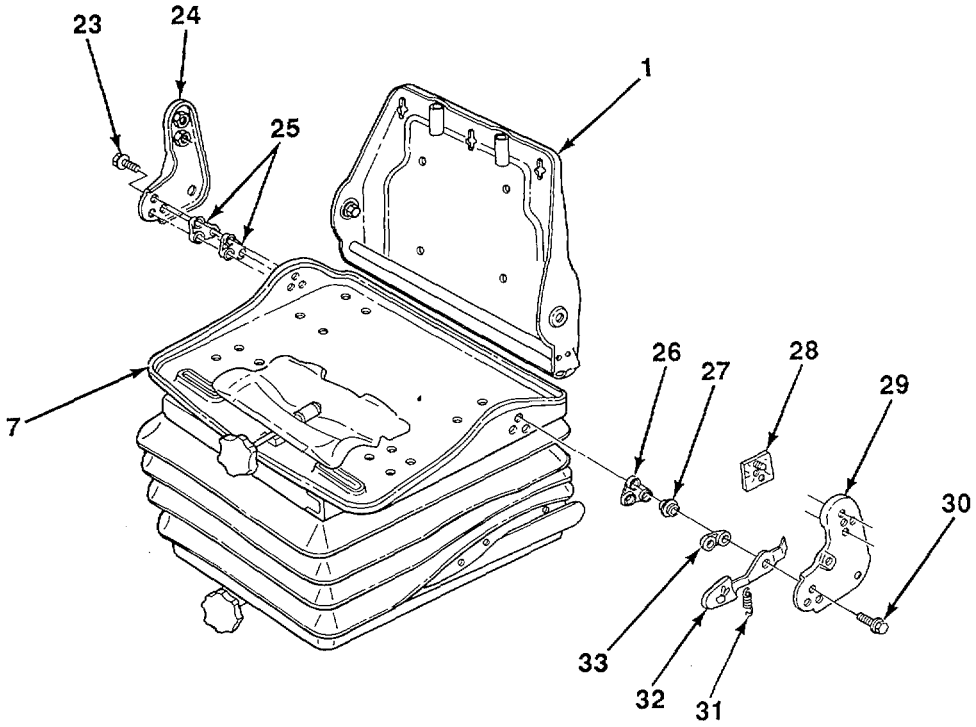
TA708403

4-63. SEAT ASSEMBLY REPAIR (Con't).

38. Install spacer (26), bushing (27), two spacers (28 and 33), adjusting arm lever (32), and bracket (29) on seat pan (7) with two screws (30).

39. Install two spacers (25) and bracket (24) on seat pan (7) with two screws (23).

40. Install spring (31) on adjusting arm lever (32) and bracket (29).



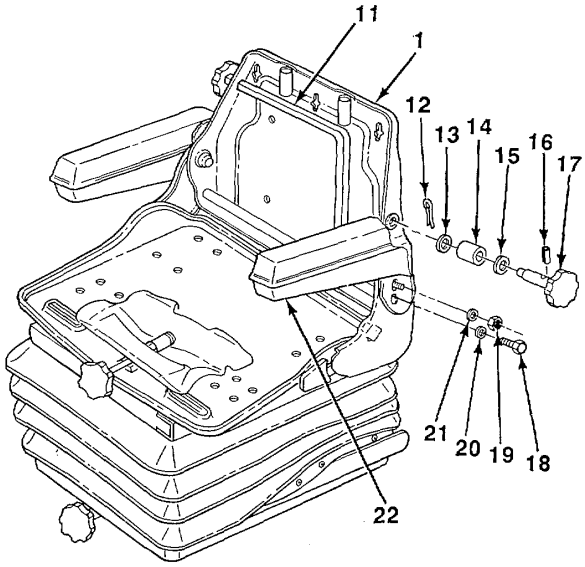
41. Install two armrests (22) on backrest (1) with two washers (20), screws (18), washers (21), and nuts (19).

42. Install lumbar adjustment knob (17) on backrest (1) with new dowel pin (16).

43. Install washer (15), spacer (14), and washer (13) on lumbar adjustment knob (17) with new cotter pin (12).

44. Repeat steps 42 and 43 for other lumbar adjustment knob (17).

45. Install molding (11) on backrest (1).

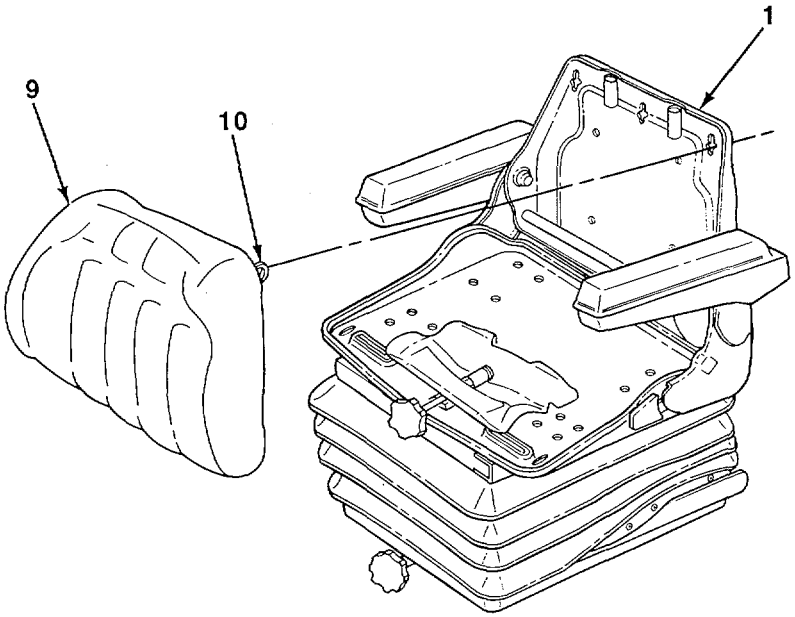


TA708404

4-63. SEAT ASSEMBLY REPAIR (Con't).

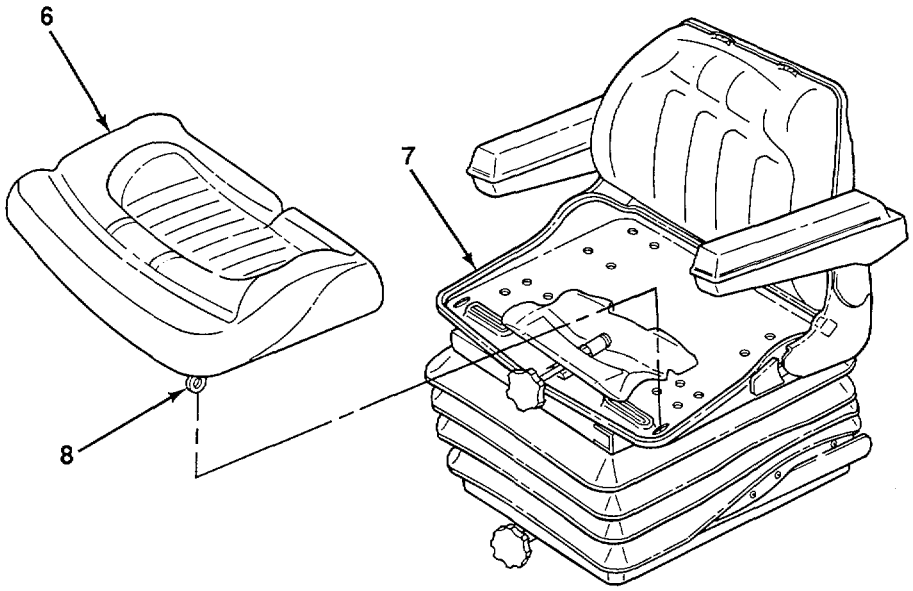
46. Aline three eyelets (10) with slots in backrest (1).

47. Install cushion (9) on backrest (1). Press three eyelets (10) to lock.



48. Aline four eyelets (8) with slots in seat pan (7).

49. Install cushion (6) on seat pan (7). Press four eyelets (8) to lock.



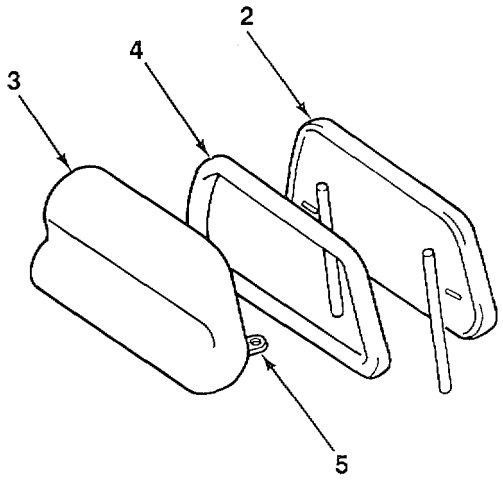
TA708405

4-63. SEAT ASSEMBLY REPAIR (Con't).

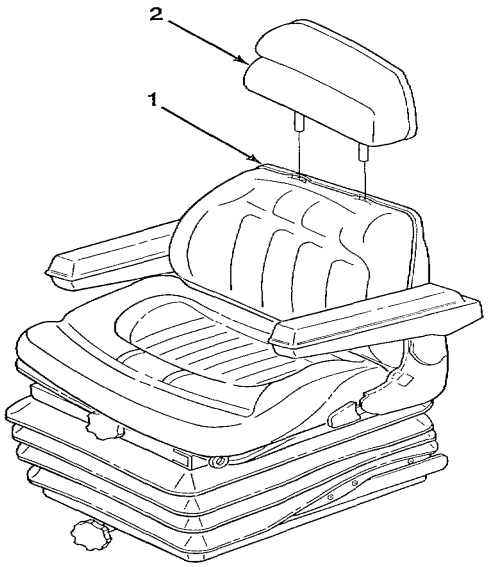
50. Install molding (4) on backrest extension (2).

51. Aline two eyelets (5) with slots in backrest extension (2).

52. Install cushion (3) on backrest extension (2). Press two eyelets (5) to lock.



53. Install backrest extension (2) on backrest (1).



TA708406

FOLLOW-ON TASKS:

- Install seat assembly (see TM 10-3930-659-20).
- Install operator's manual holder (see TM 10-3930-659-20)
- Install seatbelts (see TM 10-3930-659-20).

Section XV. HYDRAULIC SYSTEM MAINTENANCE

4-64. MAIN HYDRAULIC PUMP REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Main hydraulic pump removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- Two repair kits
- General mechanic's tool kit (Item 71, Appendix E)
- Arbor press (Item 47, Appendix E)
- Socket wrench set (Item 78, Appendix E)
- Torque wrench, 0-600 Ib.-ft. (Item 82, Appendix E)

Materials/Parts:
- Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)

References:
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

4-64. MAIN HYDRAULIC PUMP REPAIR (Con't).

a. DISASSEMBLY

1. Mark front cover (2), main hydraulic pump body (17), and rear cover (13) to aid during assembly.
2. Remove two bolts (11) and washers (12) from rear cover (13).
3. Remove two nuts (9) and washers (8) from studs (7).

NOTE
Note position of thrust plate and channel seal to aid during assembly.

4. Hold together main hydraulic pump body (17) and rear cover (13), and separate front cover (2), thrust plate (4), and channel seal (3) from main hydraulic pump body. Discard channel seal and thrust plate.
5. Remove seal (1) from front cover (2). Discard seal.
6. Remove drive shaft (5) and idler gear (6) from main hydraulic pump body (17).

NOTE
Note position of thrust plate and channel seal to aid during assembly.

7. Remove main hydraulic pump body (17), thrust plate (15), and channel seal (14) from rear cover (13). Discard channel seal and thrust plate.
8. Remove two seals (16) from main hydraulic pump body (17). Discard seals.
9. Remove two studs (7) and seal (10) from rear cover (13). Discard seal.

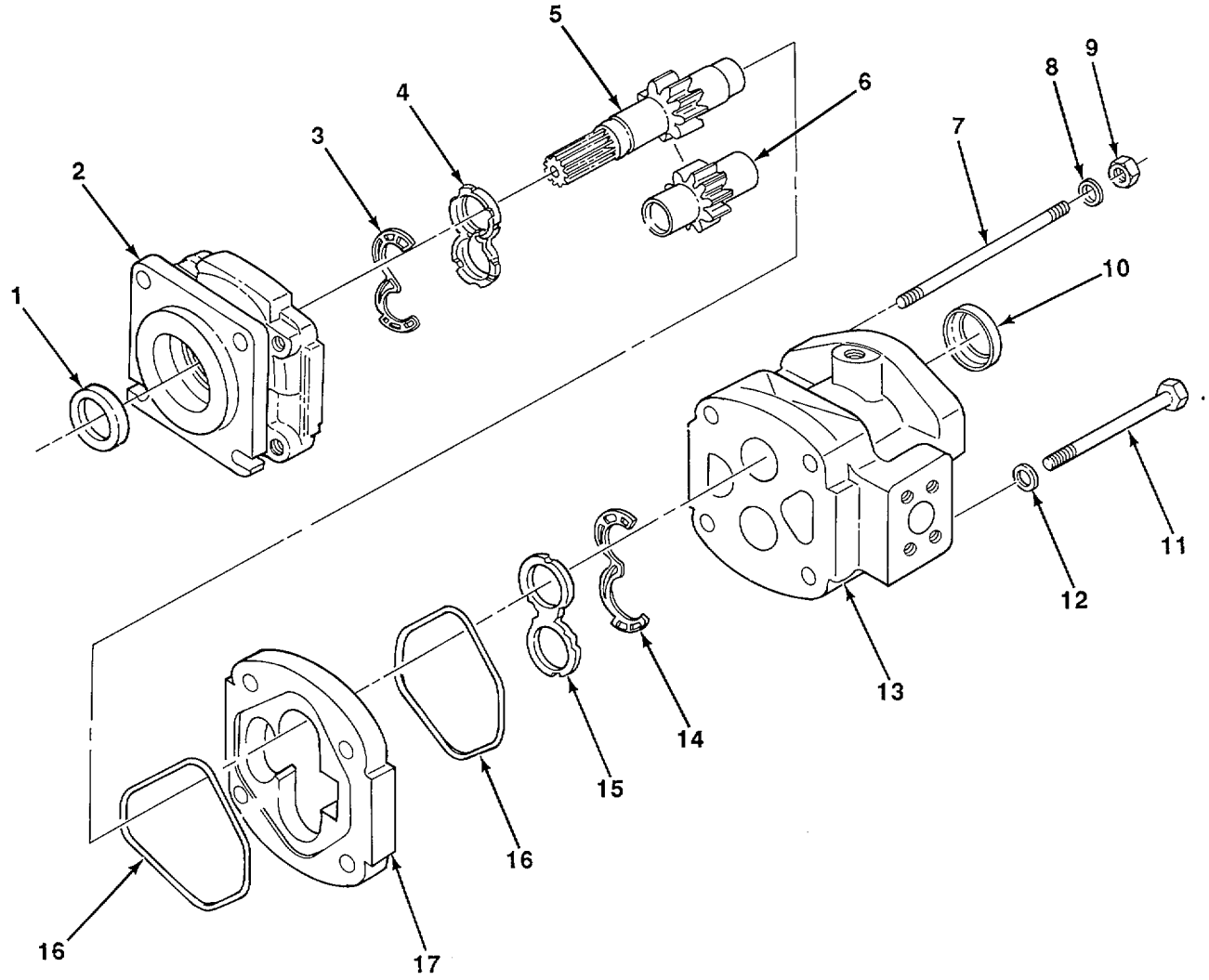
b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with clean rags.
2. Inspect parts for cracks, wear, and damage. Replace damaged main hydraulic pump.
3. Inspect front cover and rear cover bushings for wear and excessive scoring. Replace main hydraulic pump if bushings are damaged.

4-64. MAIN HYDRAULIC PUMP REPAIR (Con't).

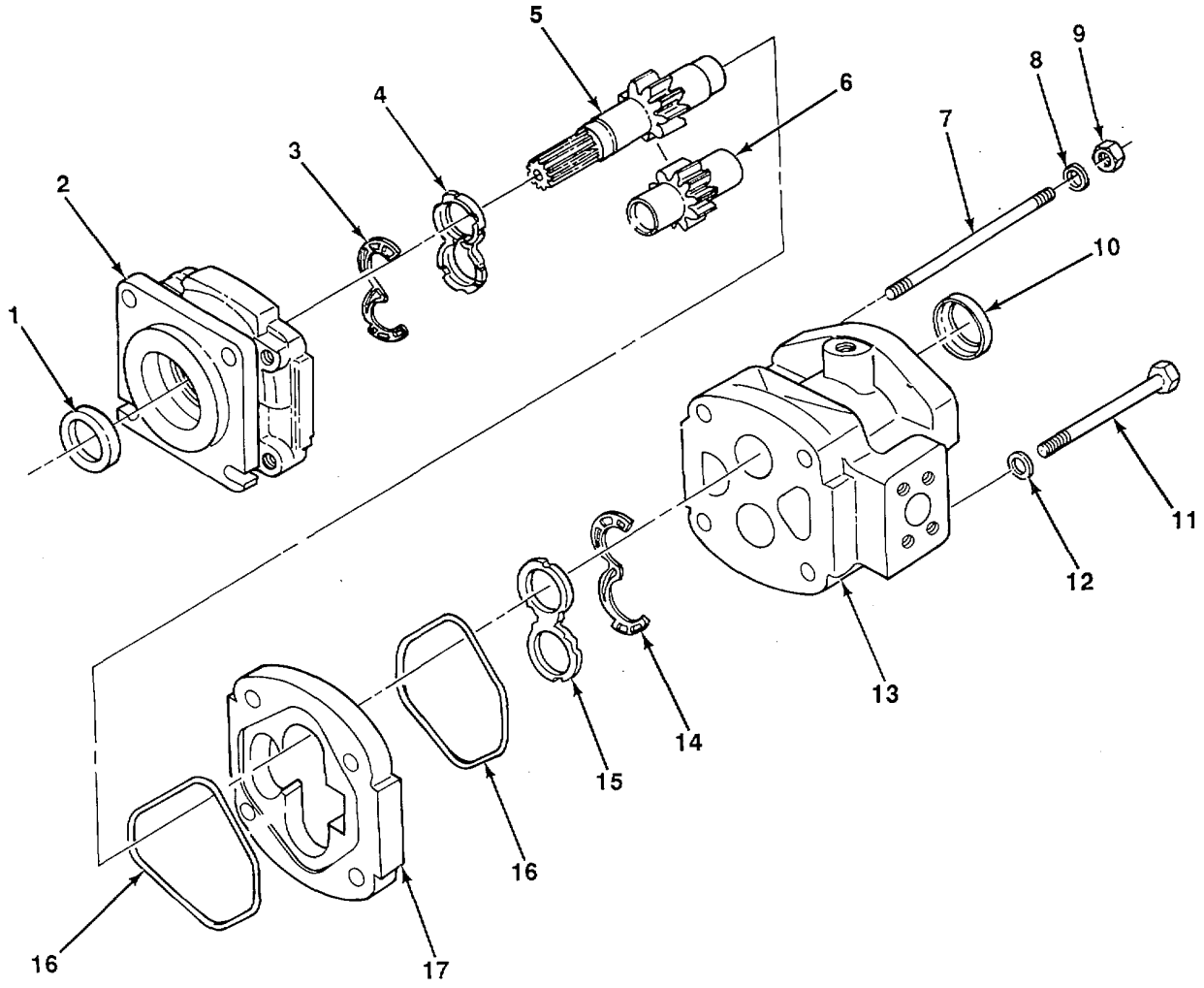


TA708414

4-64. MAIN HYDRAULIC PUMP REPAIR (Con't).

c. ASSEMBLY

1. Apply a coat of lubricating oil to surfaces of all internal parts.
2. Install new seal (10) and two studs (7) on rear cover (13).
3. Install two new seals (16) on main hydraulic pump body (17).
4. Install new channel seal (14), new thrust plate (15), and main hydraulic pump body (17) on rear cover (13).
5. Install idler gear (6) and drive shaft (5) on main hydraulic pump body (17).



TA708415

4-64. MAIN HYDRAULIC PUMP REPAIR (Con't).

6. Using arbor press, press new seal (1) into front cover (2).
7. Install new channel seal (3), new thrust plate (4), and front cover (2) on main hydraulic pump body (17).
8. Install two washers (8) and nuts (9) on studs (7). Torque nuts to 200 lb.-ft. (271 Nom).
9. Install two washers (12) and bolts (11) on rear cover (13). Torque bolts to 200 lb.-ft. (271 N-m).

FOLLOW-ON TASKS:

- Install main hydraulic pump (see TM 10-3930-659-20).

4-65. FORK/BRAKE HYDRAULIC PUMP REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Fork/brake hydraulic pump removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- One seal
- General mechanic's tool kit (Item 71, Appendix E)
- Arbor press (Item 47, Appendix E)
- Torque wrench, 0-300 lb.-in. (Item 80, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

References:
- TM 9-214
- TM 10-3930-659-20

Materials/Parts:
- Hydraulic fluid (Item 25, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Two gaskets
- Four preformed packings

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

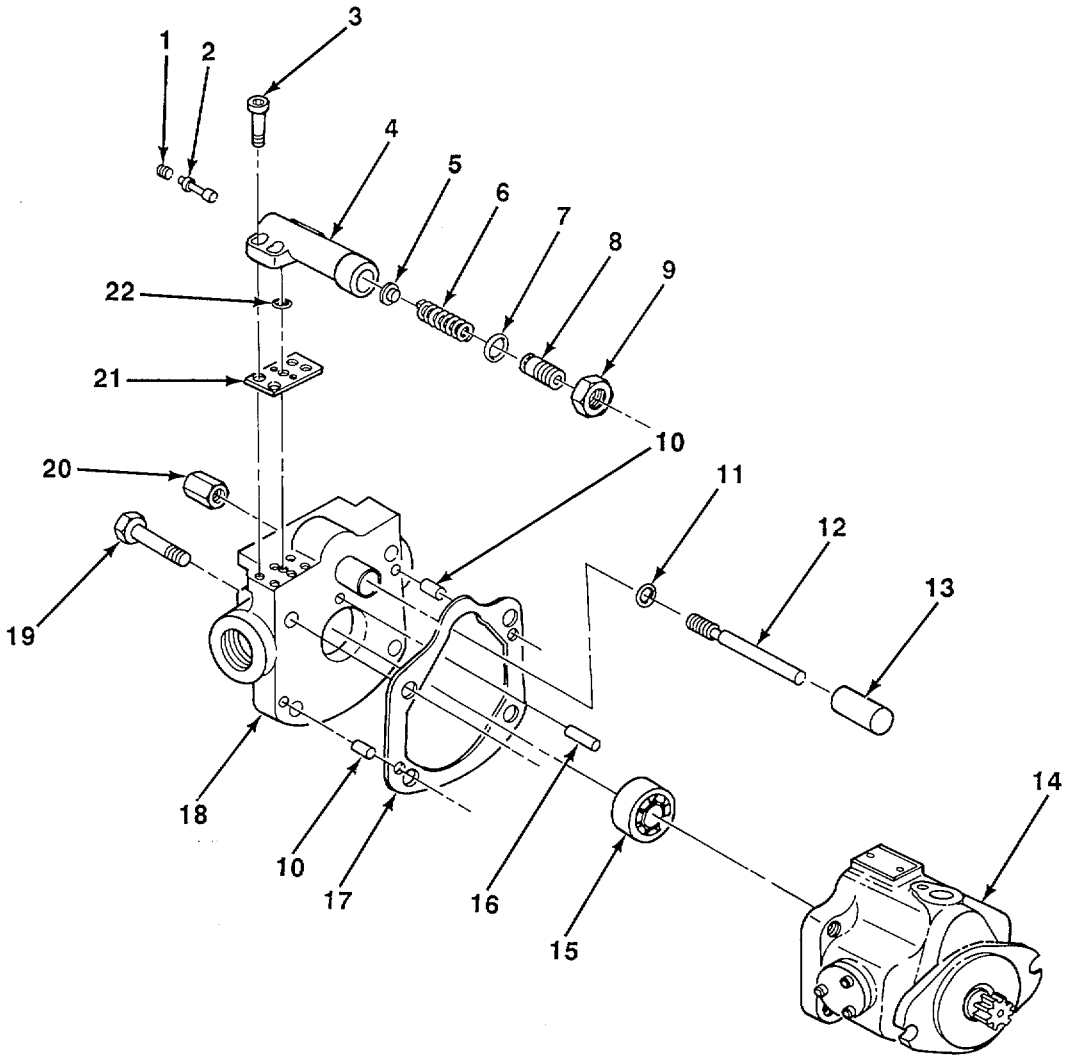
a. DISASSEMBLY

1. Remove four screws (3), compensator (4), preformed packing (22), and gasket (21) from end cap (18). Discard preformed packing and gasket.

NOTE
- Perform steps 2 and 3 only if disassembly of compensator is required.
- Note position of adjusting screw to aid during assembly.

2. Remove locknut (9), adjusting screw (8), preformed packing (7), spring (6), and spring seat (5) from compensator (4). Discard locknut and preformed packing.
3. Remove plug (1) and spool (2) from compensator (4).
4. Remove four screws (19), end cap (18), and gasket (17) from fork/brake hydraulic pump housing (14). Discard gasket.

4-65. FORK/BRAKE HYDRAULIC PUMP REPAIR (Con't).



TA708416

NOTE
Perform step 5 only if pins or bearing are damaged.

5. Remove three pins (10 and 16) and bearing (15) From end cap (18). Discard pins.
6. Remove cap (20), adjustment screw (12), preformed packing (1 1), and cylinder (13) from end cap (18). Discard reformed packing.

4-65. FORK/BRAKE HYDRAULIC PUMP REPAIR (Con't).

7. Remove valve plate (23) from fork/brake hydraulic pump housing (14).

8. Using arbor press, compress spring (26) and remove retaining ring (24), two washers (25), and spring.

9. Remove cylinder block (27), washer (29), guide (30), retainer (32), and plate (33) from fork/brake hydraulic pump housing (14).

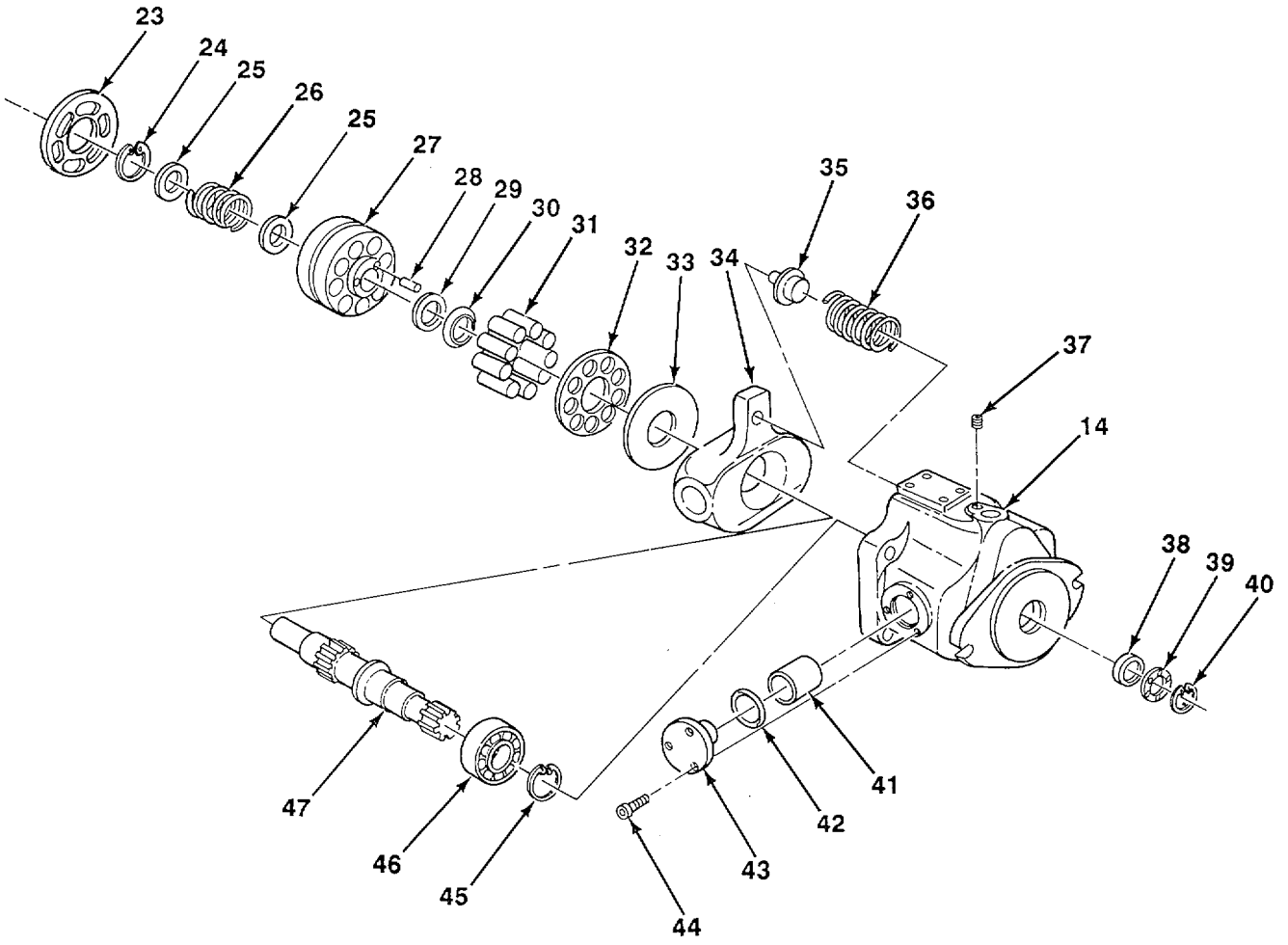
10. Remove three pins (28) and nine pistons (31) from cylinder block (27).

11. Remove retaining ring (40), seal retainer (39), seal (38), and drive shaft (47) from fork/brake hydraulic pump housing (14). Discard seal.

12. Remove retaining ring (45) and bearing (46) from drive shaft (47).

13. Mark two trunnions (43) to aid during assembly.

14. Remove six screws (44), two trunnions (43), preformed packings (42), and bearings (41) from fork/brake hydraulic pump housing (14). Discard preformed packings.



TA708417

4-65. FORK/BRAKE HYDRAULIC PUMP REPAIR (Con't).

15. Remove swash plate (34), spring retainer (35), and spring (36) from fork/brake hydraulic pump housing (14).

16. Remove plug (37) from fork/brake hydraulic pump housing (14).

b. CLEANING AND INSPECTIONI

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with clean rags.

2. Inspect parts for cracks, wear, and damage. Replace damaged parts.

3. Inspect pistons, cylinder block, and plate for excessive scoring. Replace damaged pistons, cylinder block, or plate.

4. Clean and inspect bearings in accordance with TM 9-214.

c. ASSEMBLY

1. Apply a coat of hydraulic fluid to surfaces of all internal metal parts, seals, and preformed packings.

2. Install plug (37) on fork/brake hydraulic pump housing (14).

3. Position spring (36), spring retainer (35), and swash plate (34) on fork/brake hydraulic pump housing (14).

4. Install two bearings (41), new preformed packings (42), and trunnions (43) on fork/brake hydraulic pump housing (14) with six screws (44). Torque screws to 97 lb.-in. (11 N.m).

5. Install bearing (46) and retaining ring (45) on drive shaft (47).

6. Install drive shaft (47), new seal (38), seal retainer (39), and retaining ring (40) in fork/brake hydraulic pump housing (14).

7. Install nine pistons (31) and three pins (28) in cylinder block (27).

8. Install plate (33), retainer (32), guide (30), washer (29), and cylinder block (27) in fork/brake hydraulic pump housing (14).

9. Using arbor press, install spring (26), two washers (25), and retaining ring (24) in cylinder block (27).

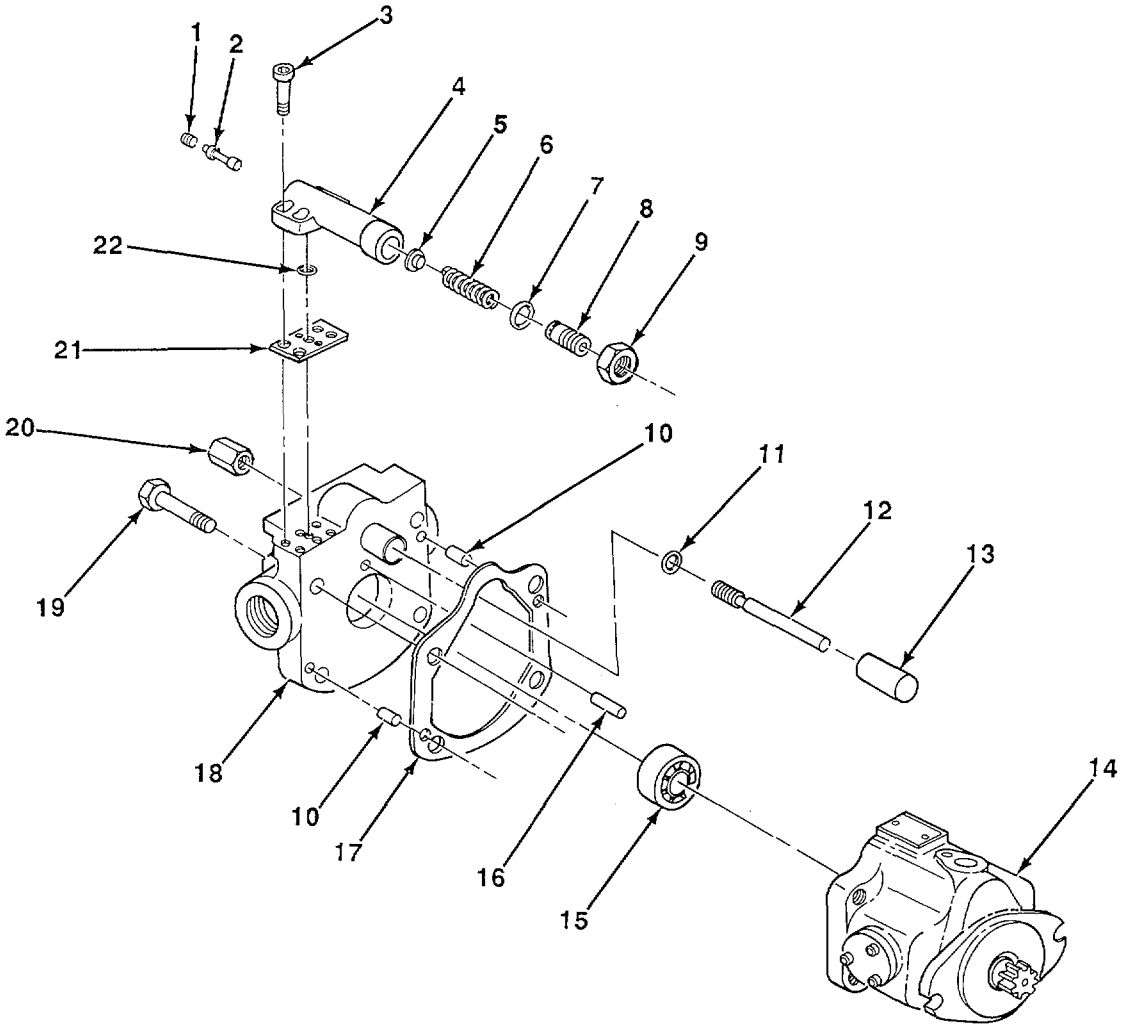
10. Install valve plate (23) on fork/brake hydraulic pump housing (14).

4-65. FORK/BRAKE HYDRAULIC PUMP REPAIR (Con't).

11. Install cylinder (13), new preformed packing (11), adjustment screw (12), and cap (20) on end cap (18).

12. If removed, install bearing (I5) and three pins (10 and 16) on end cap (18). Bearing must extend 0.088-0.098 in. (2.235-2.489 mm) from surface of end cap.

13. Install new gasket (17) and end cap (18) on fork/brake hydraulic pump housing (14) with four screws (19). Torque screws to 40 lb.-ft. (54 N.m).



TA708418

4-65. FORK/BRAKE HYDRAULIC PUMP REPAIR (Con't).

NOTE

Perform steps 14 and 15 only if compensator was disassembled.

14. Install spool (2) and plug (1) in compensator (4).
15. Install spring seat (5), spring (6), new preformed packing (7), adjusting screw (8), and new locknut (9) on compensator (4). Torque locknut to 168 lb.-in. (19 Norm).
16. Install new gasket (21), new preformed packing (22), and compensator (4) on end cap (18) with four screws (3). Torque screws to 62 lb.-in. (7 Nom).

FOLLOW-ON TASKS:

- Install fork/brake hydraulic pump (see TM 10-3930-659-20).
- Perform fork/brake hydraulic pump standby pressure test (only if compensator was disassembled) (see TM 10-3930-659-20).

4-66. FORKLIFT CONTROL VALVE REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Forklift control valve removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Socket head screw key set (Item 41, Appendix E)

Materials/Parts:
· Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
  Dry cleaning solvent (Item 47, Appendix B)
- Forty-one preformed packings

References:
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. DISASSEMBLY

NOTE
Ensure that components of forklift control valve sections remain separate.

1 eight nuts (12), washers (11), and four studs (31) from outlet (32), fork spacing valve (4), carriage tilt valve (8), fork/boom valve (9), and inlet valve (10).

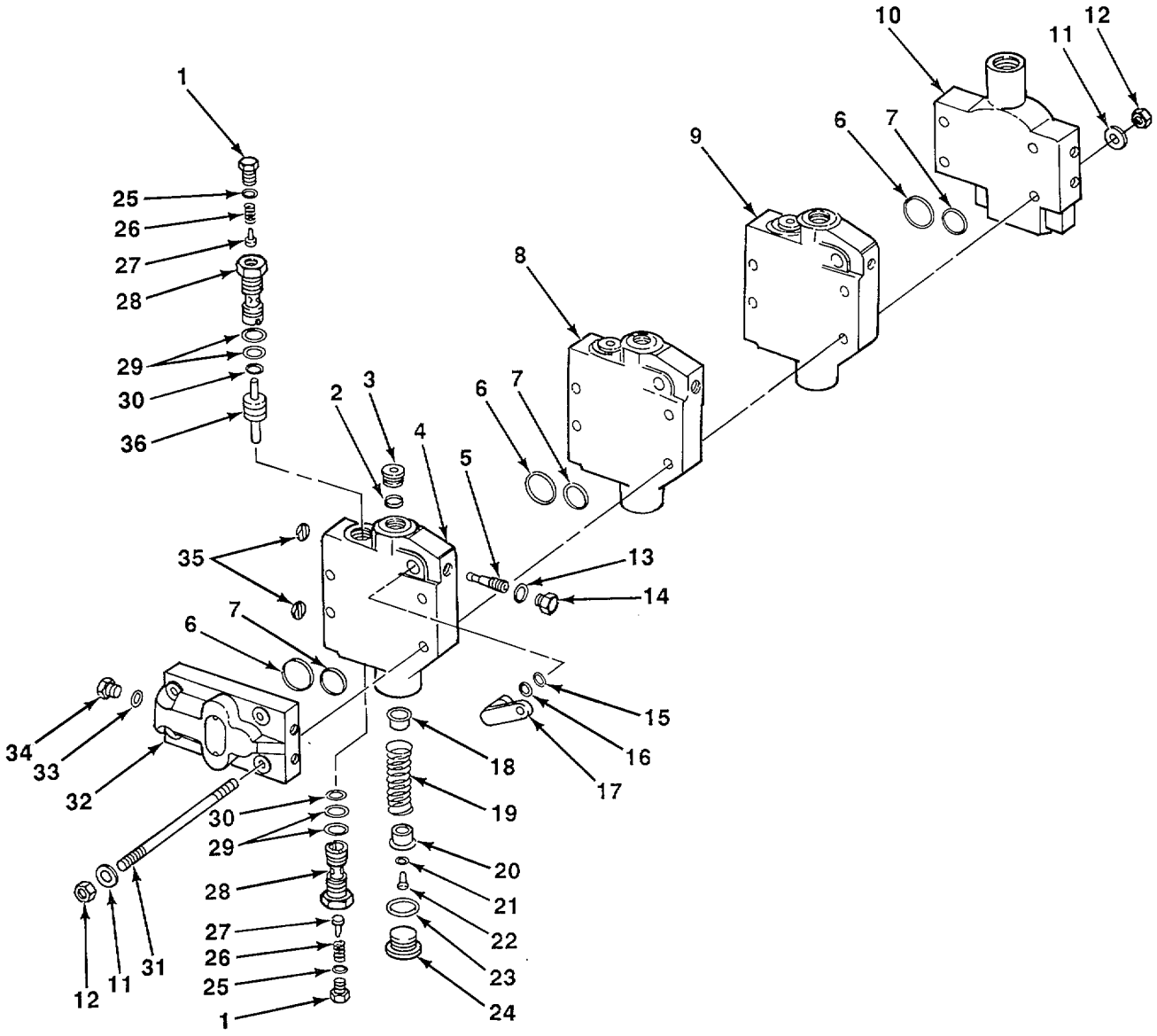
NOTE
Note position of valves and preformed packings to aid during assembly.

2. Separate outlet (32), fork spacing valve (4), carriage tilt valve (8), fork/boom valve (9), inlet valve (10), and six preformed packings (6 and 7). Discard preformed packings.
3. Remove plug (34) and preformed packing (33) from outlet (32). Discard preformed packing.

NOTE
Fork spacing, carriage tilt, and fork/boom valves are disassembled the same way. Fork spacing valve is illustrated.

4. Remove plug (3) and preformed packing (2) from fork spacing valve (4). Discard preformed packing.
5. Remove handle pin (17), backup ring (16), and preformed packing (15) from fork spacing valve (4). Discard preformed packing.
6. Remove two plates (35) from fork spacing valve (4).

4-66. FORKLIFT CONTROL VALVE REPAIR (Con't).

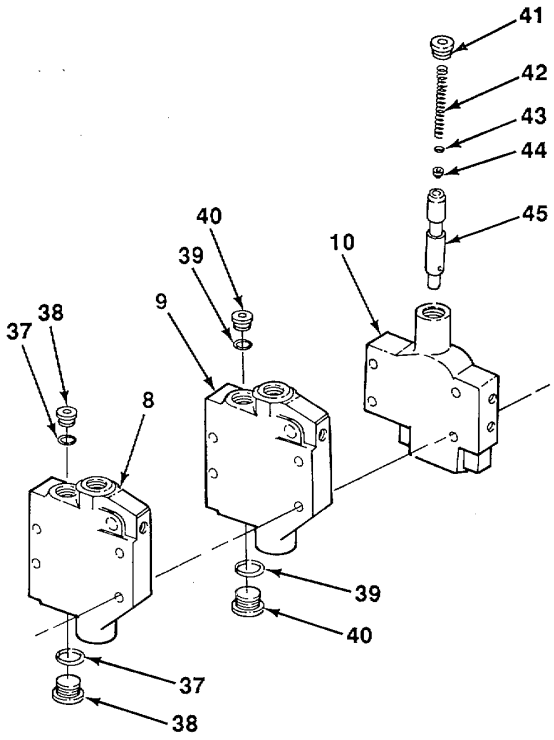


7. Remove plug (14), preformed packing (13), and stroke lever (5) from fork spacing valve (4). Discard preformed packing.
8. Remove plug (24), preformed packing (23), screw (22), washer (21), spring guide (20), spring (19), and spring guide (18) from fork spacing valve (4). Discard preformed packing.
9. Remove two plugs (1), preformed packings (25), springs (26), check valves (27), housings (28), four preformed packings (29), and two backup rings (30) from fork spacing valve (4). Discard preformed packings.
10. Remove pilot pin (36) from fork spacing valve (4).

TA708419

4-66. FORKLIFT CONTROL VALVE REPAIR (Con't).

11. Repeat steps 4 through 9 for carriage tilt valve (8).
12. Repeat steps 4 through 9 for fork/boom valve (9).
13. Remove two plugs (38) and preformed packings (37) from carriage tilt valve (8). Discard preformed packings.
14. Remove two plugs (40) and preformed packings (39) from fork/boom valve (9). Discard preformed packings.
15. Remove plug (41), spring (42), shim (43), orifice (44), and valve (45) from inlet valve (10).



b. CLEANING AND INSPECTION

WARNING

- **Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.**

- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

1. Clean metal parts with dry cleaning solvent and dry with compressed air.
2. Inspect parts for cracks, wear, and damage. Replace damaged parts.
3. Inspect valve wear surfaces for wear and scoring. Replace damaged valves.

TA708420

4-66. FORKLIFT CONTROL VALVE REPAIR (Con't).

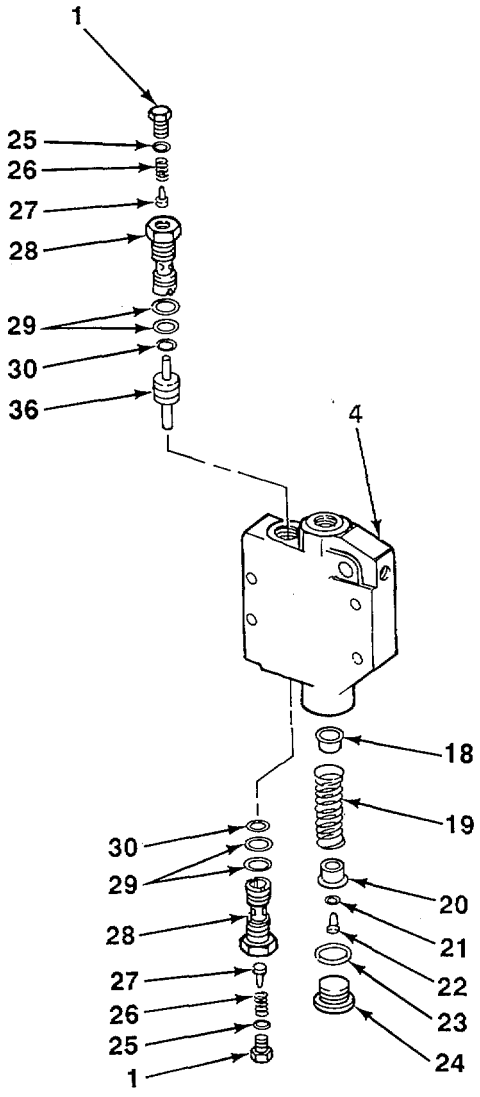
c. ASSEMBLY

1. Apply a coat of lubricating oil to all preformed packings and seals.
2. Install valve (45), orifice (44), shim (43), spring (42), and plug (41) in inlet valve (10).
3. Install two new preformed packings (39) and plugs (40) in fork/boom valve (9).
4. Install two new preformed packings (37) and plugs (38) in carriage tilt valve (8).

NOTE

Fork spacing, carriage tilt, and fork/boom valves are assembled the same way. Fork spacing valve is illustrated.

5. Install pilot pin (36) in fork spacing valve (4).
6. Install two backup rings (30), four new preformed packings (29), two housings (28), check valves (27), springs (26), new preformed packings (25), and plugs (1) in fork spacing valve (4).
7. Install spring guide (18), spring (19), spring guide (20), washer (21), screw (22), new preformed packing (23), and plug (24) in fork spacing valve (4).

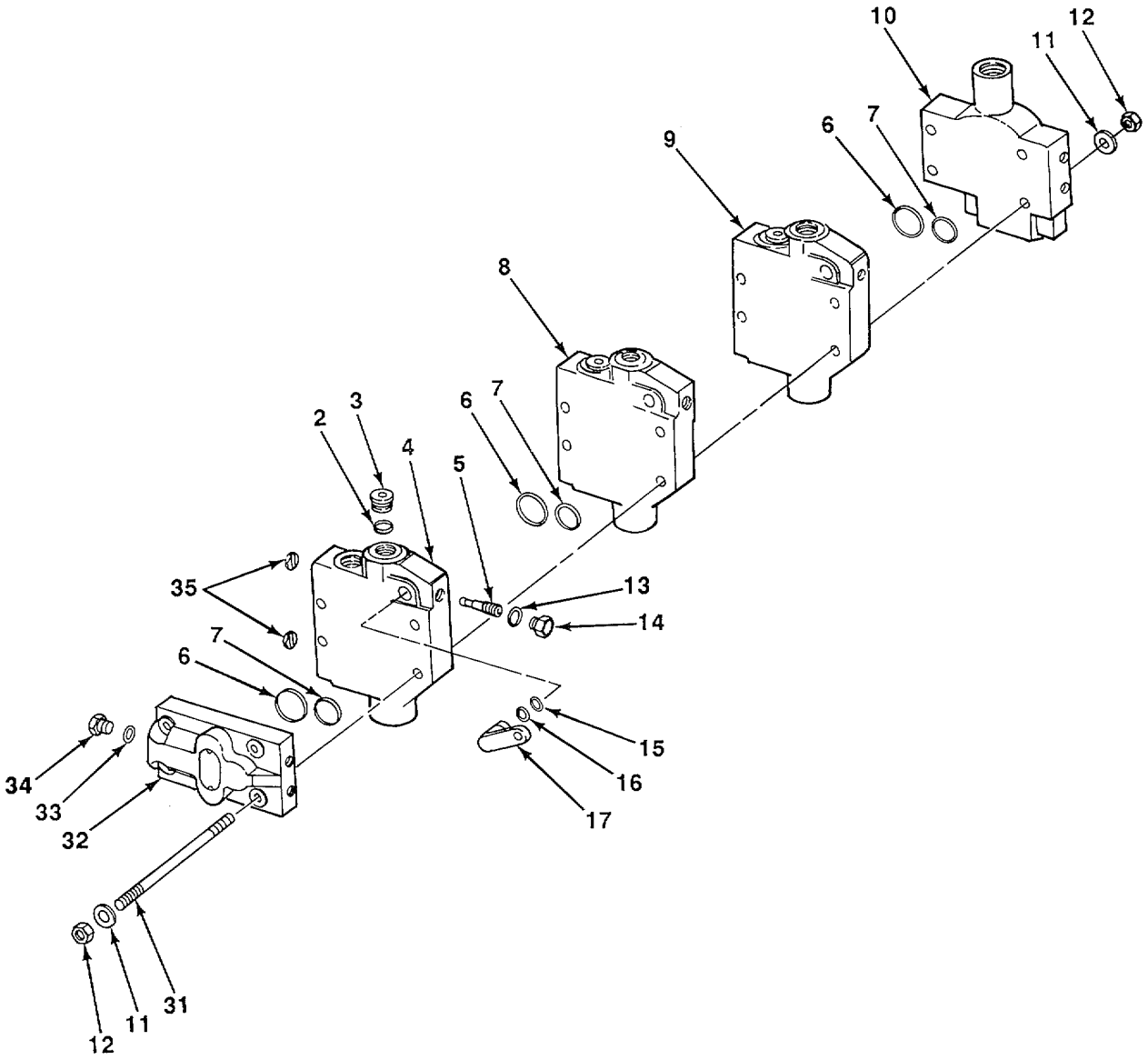


TA708421

TA708421

4-66. FORKLIFT CONTROL VALVE REPAIR (Con't).

8. Install stroke lever (5), new preformed packing (13), and plug (14) in fork spacing valve (4).
9. Install two plates (35) in fork spacing valve (4).
10. Install new preformed packing (15), backup ring (16), and handle pin (17) on fork spacing valve (4).
11. Install new preformed packing (2) and plug (3) on fork spacing valve (4).



TA708422

TA7098422

4-66. FORKLIFT CONTROL VALVE REPAIR (Con't).

12. Repeat steps 5 through 11 for carriage tilt valve (8).
13. Repeat steps 5 through 11 for fork/boom valve (9).
14. Install new preformed packing (33) and plug (34) on outlet (32).
15. Install six new preformed packings (6 and 7), fork/boom valve (9), carriage tilt valve (8), fork spacing valve (4), and outlet (32) on inlet valve (10) with four studs (31), eight washers (11), and nuts (12).

FOLLOW-ON TASKS:

- Install forklift control valve (see TM 10-3930-659-20).

4-67. CARRIAGE TILT CYLINDER REPAIR.

This Task Covers:
a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Carriage tilt cylinder removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Torque wrench multiplier (Item 44, Appendix E)
- Arbor press (Item 47, Appendix E)
- Socket wrench set (Item 78, Appendix E)

Personnel Required: Two

References:
- TM 10-3930-659-20

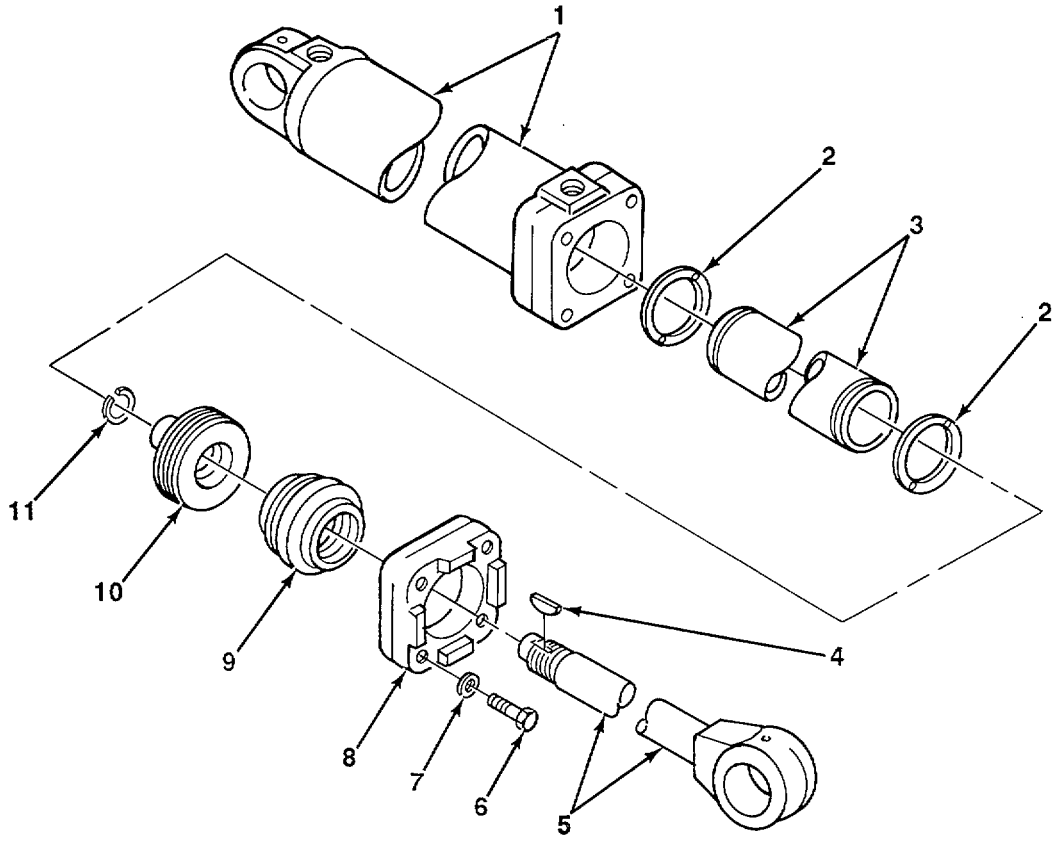
Materials/Parts:
- Grease (Item 33, Appendix B)
- • Lubricating oil (Item 40, Appendix B)
- Petrolatum (Item 42, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One lubrication fitting
- Two repair kits
- Four seals

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. DISASSEMBLY

1. Extend rod (5) fully from barrel (1).
2. Hold barrel (1) securely, and remove four screws (6) and washers (7) from retainer (8) and barrel.
3. Remove rod (5) from barrel (1).
4. Remove two spacer rings (2) and extension tube (3) from barrel (1).
5. Remove retaining ring (11), key (4), piston (10), guide (9), and retainer (8) from rod (5).

4-67. CARRIAGE TILT CYLINDER REPAIR (Con't).

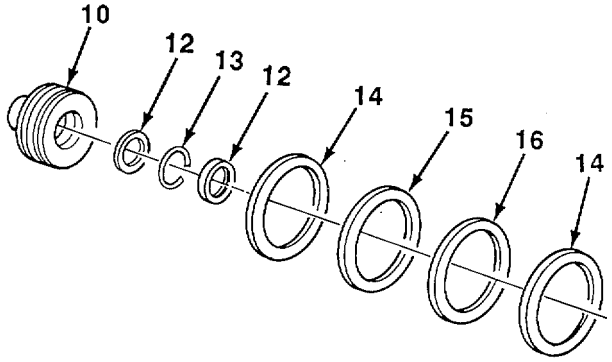


NOTE
Note position of wear rings, piston seal, and spacer to aid during assembly.

6. Remove two wear rings (14), piston seal (16), and spacer (15) from piston (10). Discard piston seal and wear rings.

NOTE
Note position of backup rings and preformed packings to aid during assembly.

7. Remove two backup rings (12) and preformed packing (13) from piston (10). Discard backup rings and preformed packing.



TA708423

4-67. CARRIAGE TILT CYLINDER REPAIR (Con't).

NOTE

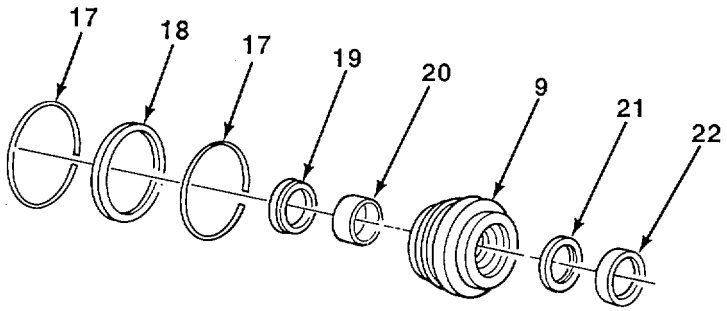
Note position of preformed packings and backup ring to aid during assembly.

8. Remove two preformed packings (17) and backup ring (18) from guide (9). Discard preformed packings and backup ring.

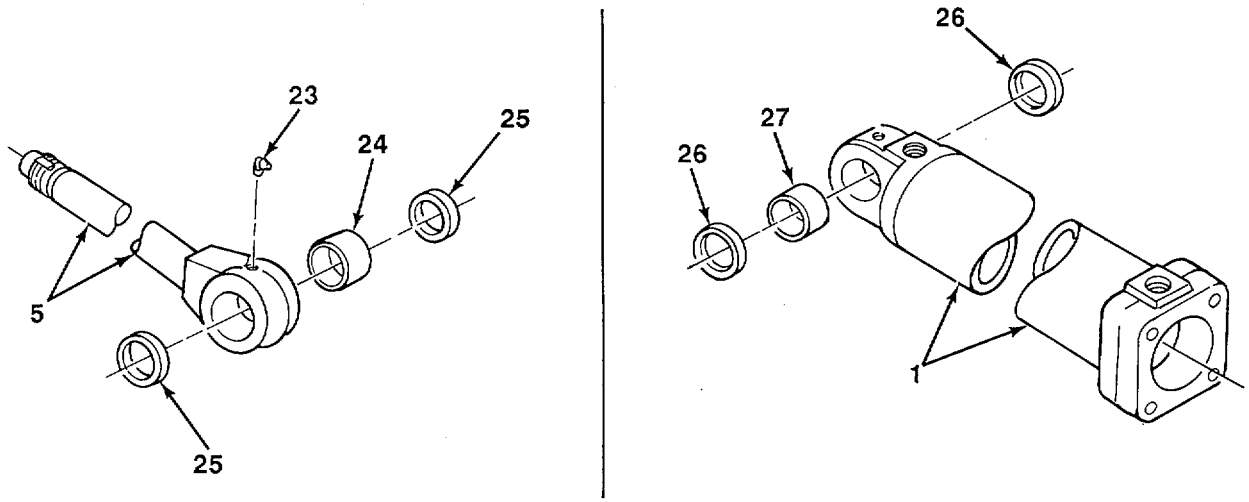
NOTE

Note position of seals and wear ring to aid during assembly.

9. Remove wiper seal (22), rod seal (21), wear ring (20), and buffer seal (19) from guide (9). Discard seals and wear ring.



10. Using arbor press, press two seals (25) and bushing (24) from rod (5). Discard seals.
11. Remove lubrication fitting (23) from rod (5). Discard lubrication fitting.
12. Using arbor press, press two seals (26) and bushing (27) from barrel (1). Discard seals.



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4-67. CARRIAGE TILT CYLINDER REPAIR (Con't).

b. CLEANING AND INSPECTION I

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with clean rags.
2. Inspect parts for cracks, wear, and damage. Replace damaged parts.
3. Inspect for bent or distorted rod and barrel. Replace damaged rod or barrel.
4. Inspect barrel for excessive scoring. Replace damaged barrel.

c. ASSEMBLY

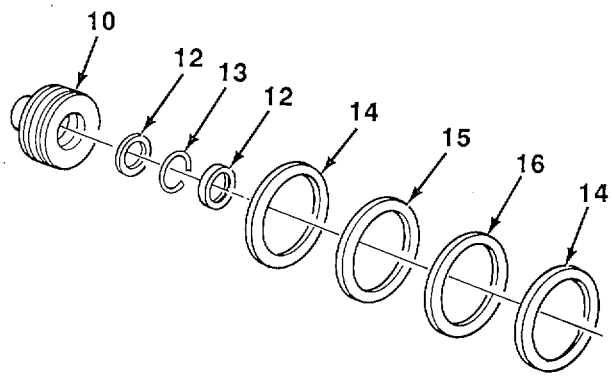
NOTE

Bushing must be centered with each seal firmly seated against bushing. Lips of seals must be facing outward.

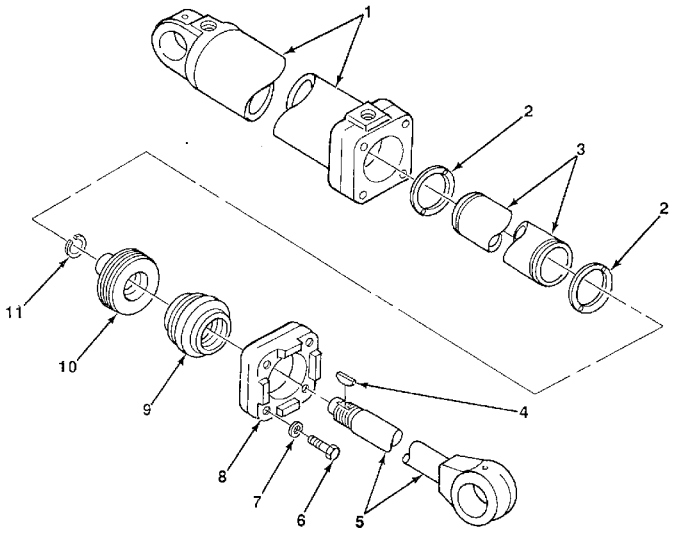
1. Using arbor press, press bushing (27) and two new seals (26) in barrel (1).
2. Using arbor press, press bushing (24) and two new seals (25) in rod (5).
3. Apply a coat of grease to two bushings (24 and 27) and four seals (25 and 26).
4. Install new lubrication fitting (23) on rod (5).
5. Install new rod seal (21) in guide (9) with lip of seal facing downward.
6. Install new wiper seal (22) in guide (9) with lip of seal facing upward.
7. Install new wear ring (20) in guide (9).
8. Install new buffer seal (19) in guide (9) with lip of seal facing upward.
9. Install two new preformed packings (17) and new backup ring (18) on guide (9).

4-67. CARRIAGE TILT CYLINDER REPAIR (Con't).

10. Apply a coat of petrolatum to preformed packing (13) and two new backup rings (12).
11. Install two new backup rings (12) and new preformed packing (13) on piston (10).
12. Install spacer (15), two new wear rings (14), and new piston seal (16) on piston (10). Ensure that gaps of wear rings are opposite each other.



13. Position retainer (8) on rod (5).
14. Apply a coat of petrolatum to inner and outer diameters of guide (9).
15. Position guide (9) on rod (5).
16. Install piston (1 O) on rod (5) until piston bottoms. Back off piston until first key slot in piston alines with key slot of rod.



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4-67. CARRIAGE TILT CYLINDER REPAIR (Con't).

17. Install key (4) and retaining ring (11) on rod (5).
18. Install two spacer rings (2) and extension tube (3) in barrel (1).
19. Apply a coat of petrolatum to outer surface of piston (10).
20. Aline piston (10) with barrel (1), and push piston and guide (9) into barrel.
21. Apply a coat of lubricating oil to threads of four screws (6).
22. Hold barrel (1) securely, and install retainer (8) on barrel with four washers (7) and screws (6). Torque screws to 660 lb.-ft. (895 N•m).

FOLLOW-ON TASKS:

- Install carriage tilt cylinder (see TM 10-3930-659-20).

4-68. LOCKING CONTROL VALVE REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Locking control valve removed (see TM 10-3930-659-20).
- One repair kit

Materials/Parts:
- Lubricating oil (Item 38, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Compressor unit (Item 16, Appendix E)

References:
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. DISASSEMBLY

1. Remove valve cartridge (1) from locking control valve (8).

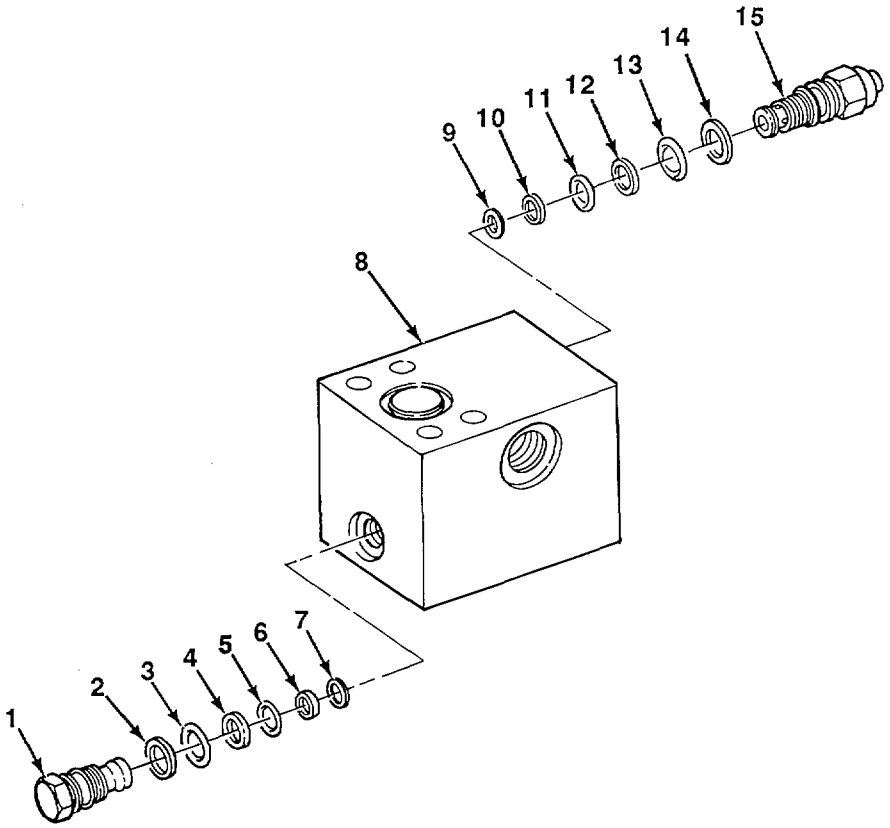
NOTE
Note position of seals and backup rings to aid during assembly.

2. Remove three backup rings (2, 4, and 6) and seals (3, 5, and 7) from valve cartridge (1). Discard seals and backup rings.
3. Remove valve cartridge (15) from locking control valve (8).

NOTE
Note position of seals and backup rings to aid during assembly.

4. Remove three backup rings (10, 12, and 14) and seals (9, 11, and 13) from valve cartridge (15). Discard seals and backup rings.

4-68. LOCKING CONTROL VALVE REPAIR (Con't).



b. CLEANING AND INSPECTION I

WARNING

- **Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.**

- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

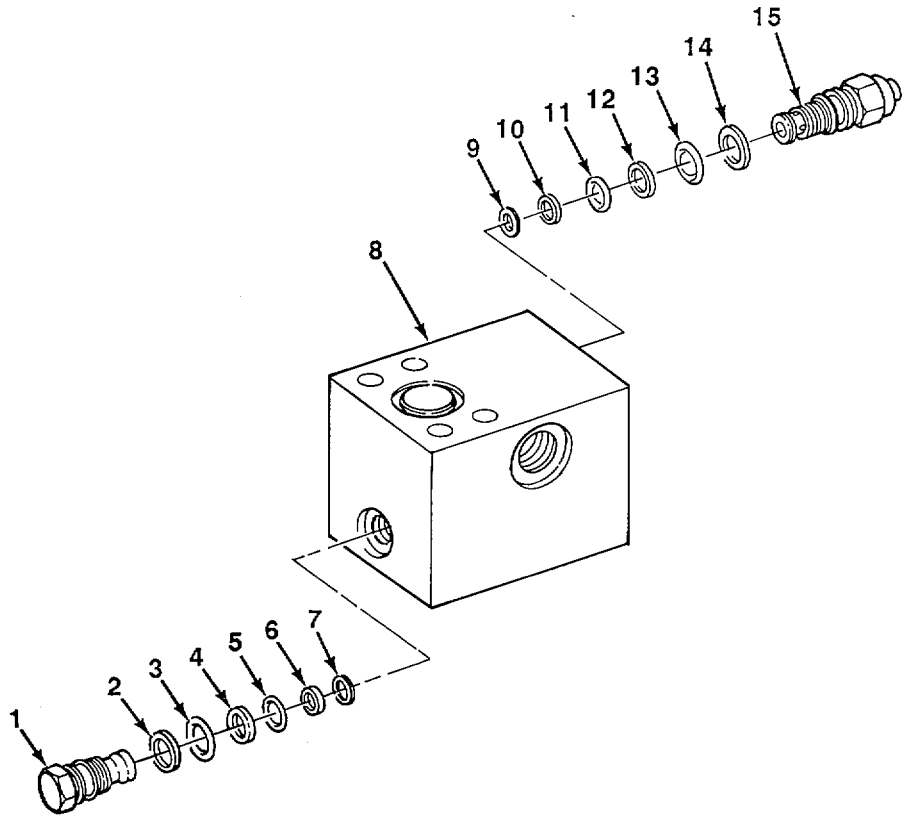
1. Clean metal parts with dry cleaning solvent and dry with compressed air.
2. Inspect parts for cracks, wear, and damage. Replace damaged parts.

TA708426

4-68. LOCKING CONTROL VALVE REPAIR (Con't).

c. ASSEMBLY

1. Install three new seals (9, 11, and 13) and new backup rings (10, 12, and 14) on valve cartridge (15).
2. Apply a coat of lubricating oil to surface of valve cartridge (15) and install valve cartridge in locking control valve (8).
3. Install three new seals (3, 5, and 7) and new backup rings (2, 4, and 6) on valve cartridge (1).
4. Apply a coat of lubricating oil to surface of valve cartridge (1) and install valve cartridge in locking control valve (8).



FOLLOW-ON TASKS:

- Install locking control valve (see TM 10-3930-659-20).

TA708427

4-69. FORK/BOOM ASSEMBLY MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Assembly
d. Installation

Initial Setup:

Equipment Conditions:
- Carriage tilt cylinder fully retracted (see TM 10-3930-659-10).
- Carriage assembly removed (see TM 10-3930-659-20).
- Fork spacing cylinder hoses and lines removed (see TM 10-3930-659-20).

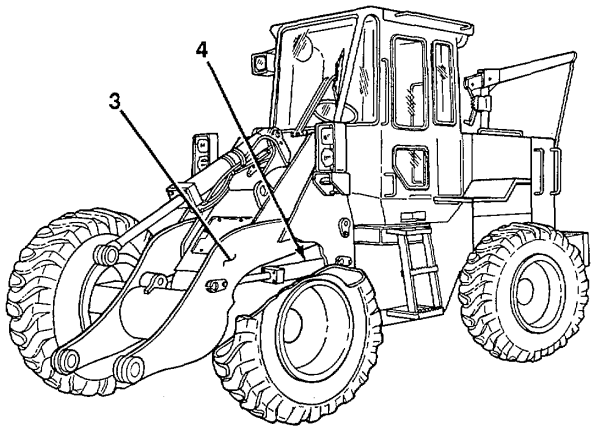
Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Hydraulic jack kit (Item 40, Appendix E)
- Eight seals

Personnel Required: Three

References:
- TM 10-3930-659-10
- TM 10-3930-659-20

a. REMOVAL I

1. Attach suitable lifting device to fork/boom assembly (3). Raise fork/boom assembly, engage boom lock (see TM 10- 3930-659-20), and support two lift cylinders (4) with wood blocks.



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4-69. FORK/BOOM ASSEMBLY MAINTENANCE (Con't).

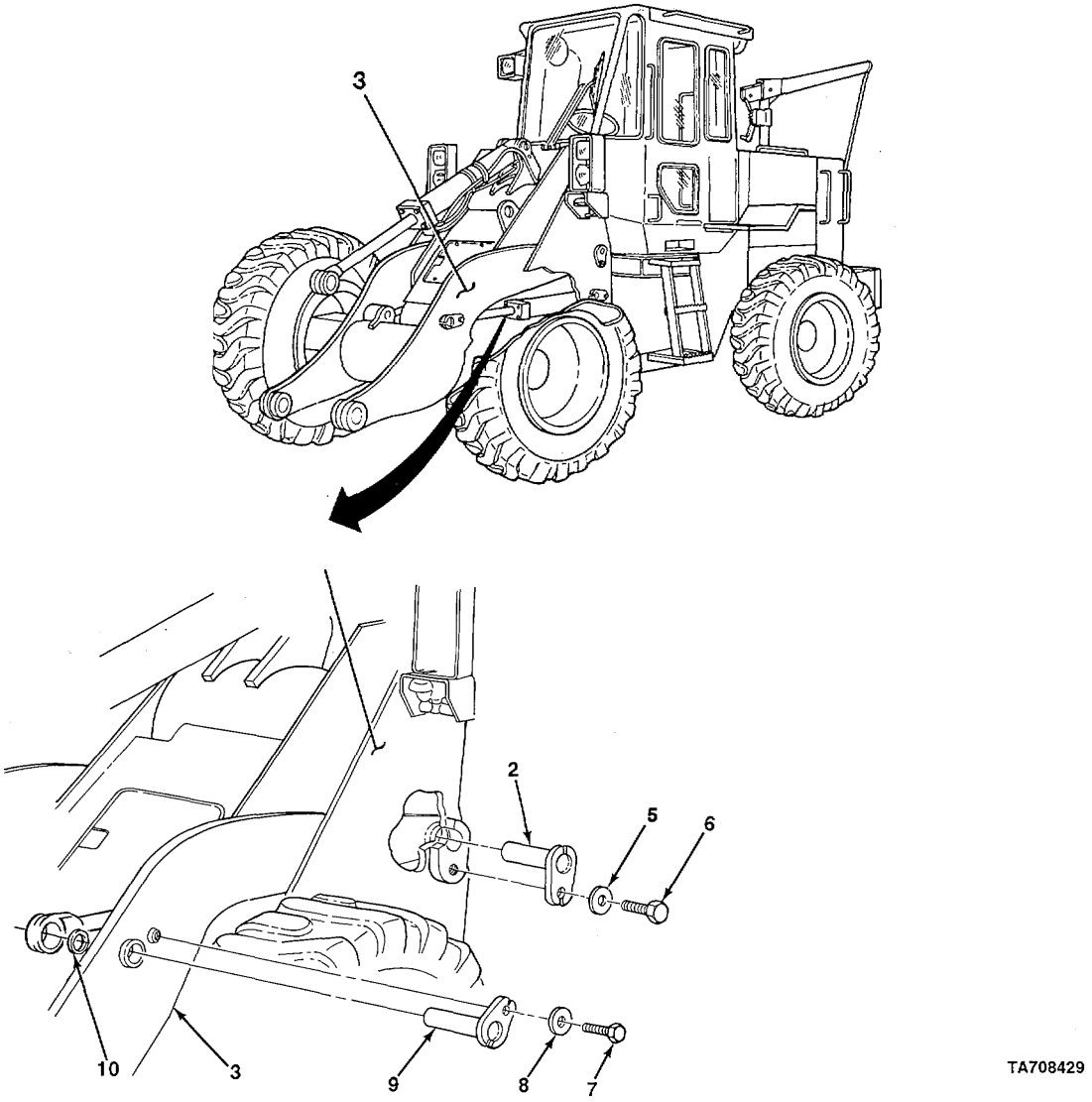
WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

Fork/boom assembly weighs 1020 lb (463 kg).

2. Remove two screws (7), washers (8), shims (10), and pins (9) from fork/boom assembly (3).
3. Remove two screws (6), washers (5), and pins (2) from fork/boom assembly (3) and loader frame (1).

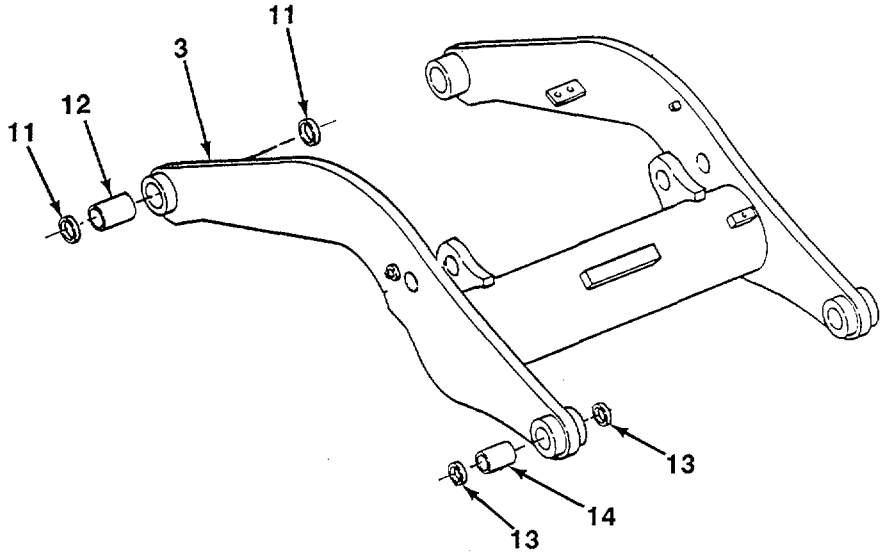


4-69. FORK/BOOM ASSEMBLY MAINTENANCE (Con't).

4. Remove fork/boom assembly (3) from loader frame (1) and move fork/boom assembly to safe work area.
5. Remove suitable lifting device from fork/boom assembly (3).

b. DISASSEMBLY

1. Using hydraulic jack kit, remove four seals (11) and two bushings (12) from fork/boom assembly (3). Discard seals.
2. Using hydraulic jack kit, remove four seals (13) and two bushings (14) from fork/boom assembly (3). Discard seals.



c. ASSEMBLY I

1. Using hydraulic jack kit, install two bushings (14) and four new seals (13) on fork/boom assembly (3).
2. Using hydraulic jack kit, install two bushings (12) and four new seals (11) on fork/boom assembly (3).

TA708430

4-69. FORK/BOOM ASSEMBLY MAINTENANCE (Con't).

d. INSTALLATION

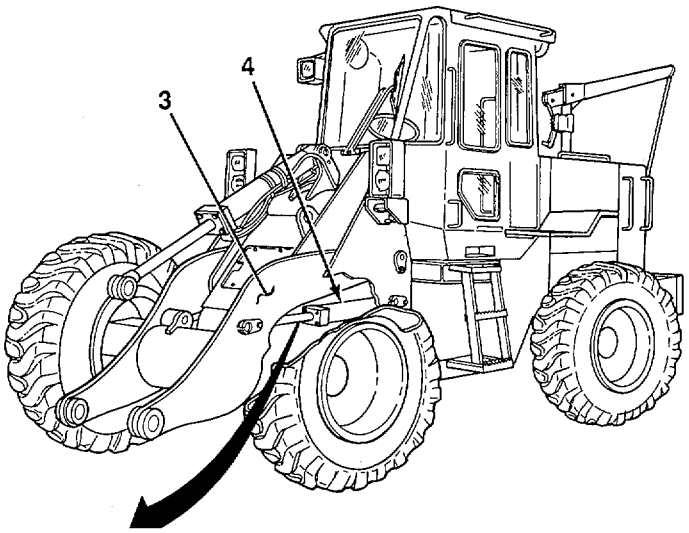
WARNING

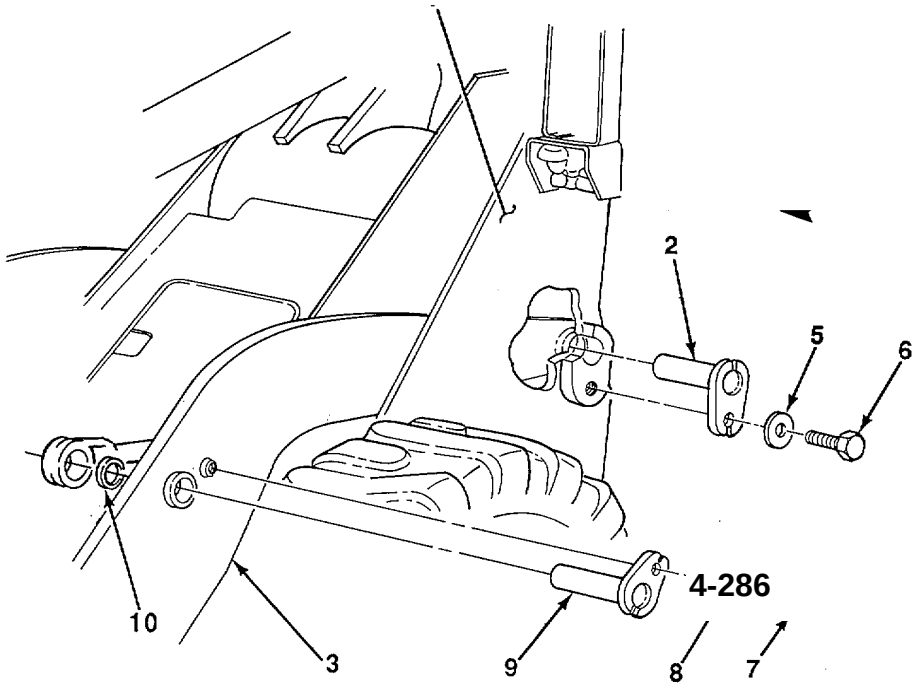
Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

Fork/boom assembly weighs 1020 lb (463 kg).

1. Attach suitable lifting device to fork/boom assembly (3) and position fork/boom assembly on loader frame (1).
2. Install two pins (2) on fork/boom assembly (3) and loader frame (1) with two washers (5) and screws (6).





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4-69. FORK/BOOM ASSEMBLY MAINTENANCE (Con't).

3. Install two shims (10) and pins (9) on fork/boom assembly (3) with two washers (8) and screws (7).

4. Remove wood blocks from two lift cylinders (4).

5. Remove suitable lifting device from fork/boom assembly (3).

6. Disengage boom lock (see TM 10-3930-659-20).

FOLLOW-ON TASKS:
- Install fork spacing cylinder hoses and lines (see TM 10-3930-659-20).
- Install carriage assembly (see TM 10-3930-659-20).
- Extend carriage tilt cylinder (see TM 10-3930-659-10).

4-70. FORK/BOOM CYLINDER REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Fork/boom cylinder removed (see TM 10-3930-659-20).

Tools/Test Equipment:

- General mechanic's tool kit (item 71, Appendix E)
- Torque wrench multiplier (Item 44, Appendix E)
- Arbor press (Item 47, Appendix E)
- Socket wrench set (Item 78, Appendix E)

Personnel Required: Two

References:
- TM 10-3930-659-20

Materials/Parts:
- Grease (Item 33, Appendix B)
- Lubricating oil (Item 40, Appendix B)
- Petrolatum (Item 42, Appendix B)
- Rags (Item 43, Appendix B)
  Dry cleaning solvent (Item 471, Appendix B)
- One lubrication fitting
- Two repair kits
- Four seals

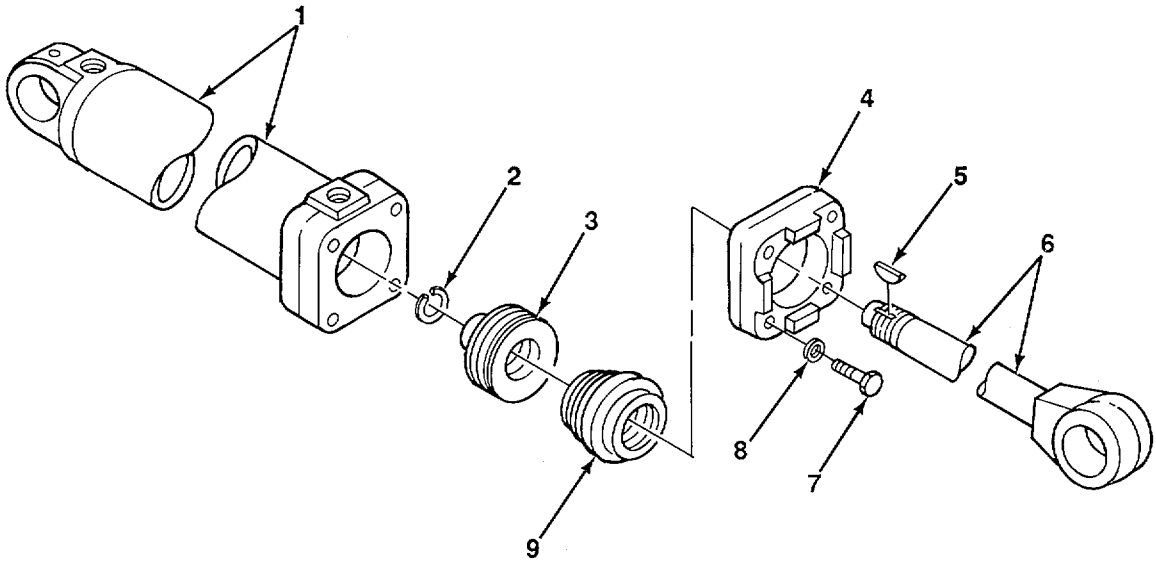
General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. DISASSEMBLY

1. Extend rod (6) fully from barrel (1).
2. Hold barrel (1) securely, and remove four screws (7) and washers (8) from retainer (4) and barrel.
3. Remove rod (6) from barrel (1).
4. Remove retaining ring (2), key (5), piston (3), guide (9), and retainer (4) from rod (6).

4-70. FORK/BOOM CYLINDER REPAIR (Con't).

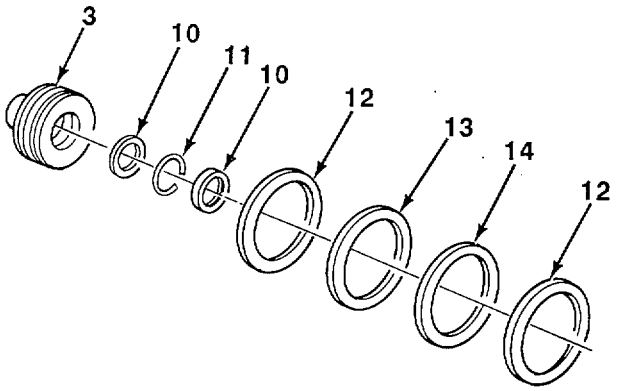


NOTE
Note position of wear rings, piston seal, and spacer to aid during assembly.

5. Remove two wear rings (12), piston seal (14), and spacer (13) from piston (3). Discard wear rings and piston seal.

NOTE
Note position of backup rings and preformed packing to aid during assembly.

6. Remove two backup rings (10) and preformed packing (11) from piston (3). Discard backup rings and preformed packing.



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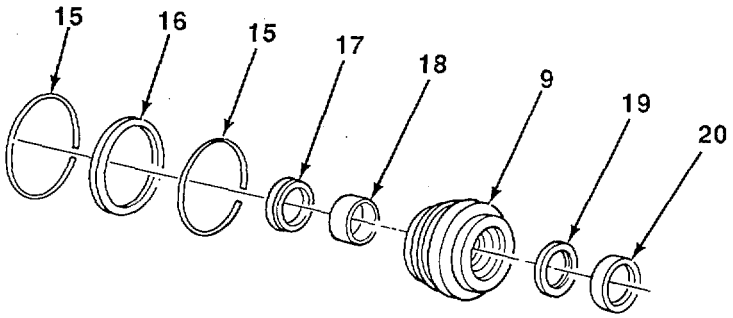
4-70. FORK/BOOM CYLINDER REPAIR (Con't).

NOTE
Note position of preformed packings and backup ring to aid during assembly.

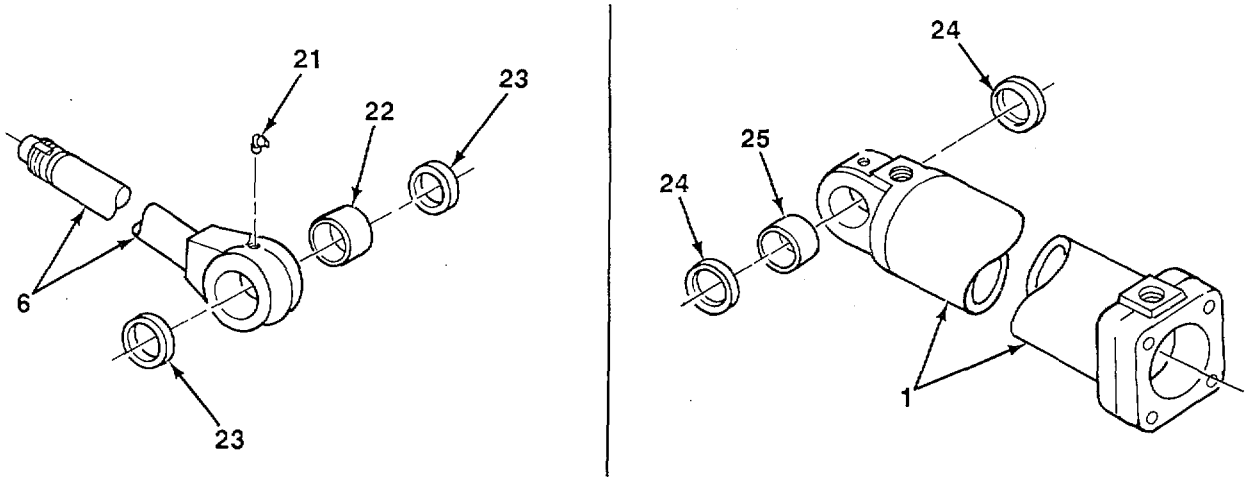
7. Remove two preformed packings (15) and backup ring (16) from guide (9). Discard preformed packings and backup ring.

NOTE
Note position of seals and wear ring to aid during assembly.

8. Remove wiper seal (20), rod seal (19), wear ring (18), and buffer seal (17) from guide (9). Discard seals and wear ring.



9. Using arbor press, press two seals (23) and bushing (22) from rod (6). Discard seals.
10. Remove lubrication fitting (21) from rod (6). Discard lubrication fitting.
11. Using arbor press, press two seals (24) and bushing (25) from barrel (1).



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4-70. FORK/BOOM CYLINDER REPAIR (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only In a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with clean rags.
2. Inspect parts for cracks, wear, and damage. Replace damaged parts.
3. Inspect for bent or distorted rod and barrel. Replace damaged rod or barrel.
4. Inspect barrel for excessive scoring. Replace damaged barrel.

c. ASSEMBLY

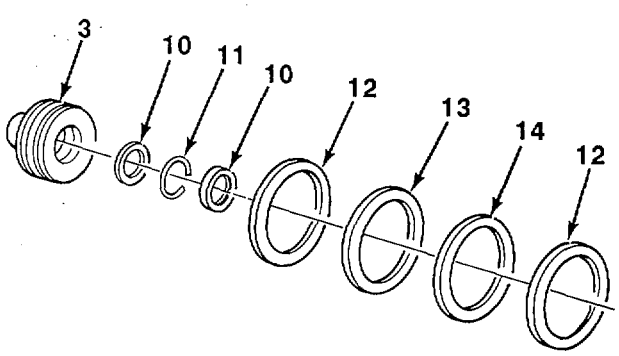
NOTE

Bushing must be centered with each seal firmly seated against bushing. Lips of seals must be facing outward.

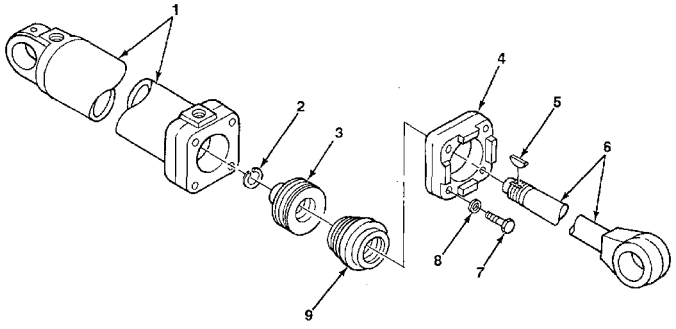
1. Using arbor press, press bushing (25) and two seals (24) in barrel (1).
2. Using arbor press, press bushing (22) and two new seals (23) in rod (6).
3. Apply a coat of grease to two bushings (22 and 25) and four seals (23 and 24).
4. Install new lubrication fitting (21) on rod (6).
5. Install new rod seal (19) in guide (9) with lip of seal facing downward.
6. Install new wiper seal (20) in guide (9) with lip of seal facing upward.
7. Install new wear ring (18) in guide (9).
8. Install new buffer seal (17) in guide (9) with lip of seal facing upward.
9. Install two new preformed packings (15) and new backup ring (16) in guide (9).

4-70. FORK/BOOM CYLINDER REPAIR (Con't).

10. Install two new backup rings (10) and new preformed packing (11) on piston (3).
11. Apply a coat of petrolatum to preformed packing (11) and two new backup rings (10).
12. Install spacer (13), two new wear rings (12), and new piston seal (14) on piston (3). Ensure that gaps of wear ring are opposite each other.



13. Position retainer (4) on rod (6).
14. Apply a coat of petrolatum to inner and outer diameters of guide (9).
15. Position guide (9) on rod (6).
16. Install piston (3) on rod (6) until piston bottoms. Back off piston until first key slot in piston alines with key slot of rod.



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4-70. FORK/BOOM CYLINDER REPAIR (Con't).

17. Install key (5) and retaining ring (2) on rod (6).
18. Apply a coat of petrolatum to outer surface of piston (3).
19. Aline piston (3) with barrel (1), and push piston and guide (9) into barrel.
20. Apply a coat of lubricating oil to threads of four screws (7).
21. Hold barrel (1) securely, and install retainer (4) on barrel with four washers (8) and screws (7). Torque screws to 660 lb.-ft. (895 N-m).

FOLLOW-ON TASKS:

- Install fork/boom cylinder (see TM 10-3930-659-20).

4-71. FORK SPACING CYLINDER REPAIR.

This Task Covers:
a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Fork spacing cylinder removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Arbor press (Item 47, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Grease (Item 33, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One locknut
- Two repair kits

- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. DISASSEMBLY

1. Push guide (6) into barrel (2) enough to expose retaining ring (13). Remove retaining ring.
2. Remove rod (12) from barrel (2).

NOTE
Note position of guide on rod to aid during assembly.

3. Remove locknut (3), piston (4), and guide (6) from rod (12). Discard locknut.

NOTE
Note position of preformed packing and backup ring to aid during assembly.

4. Remove preformed packing (9) and backup ring (10) from guide (6). Discard preformed packing.

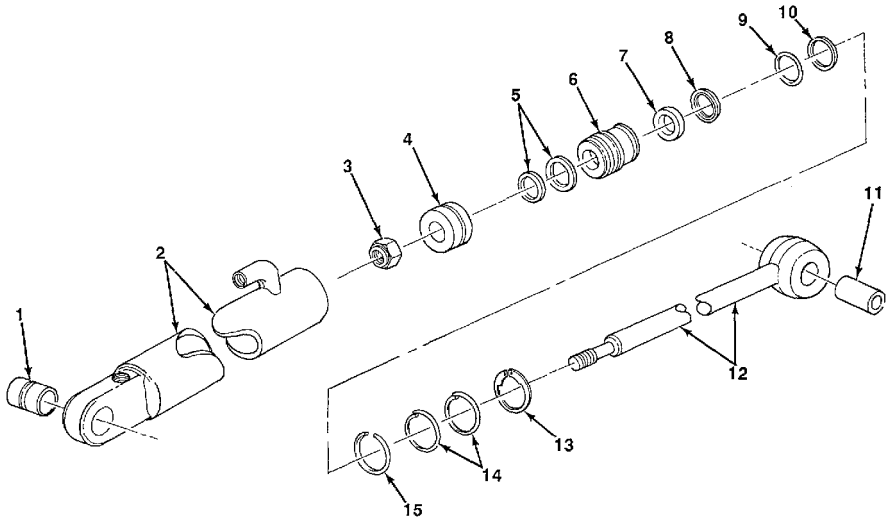
NOTE
Note position of filler ring to aid during assembly.

5. Remove filler ring (8) and seal (7) from guide (6). Discard filler ring and seal.

NOTE
Note position of buffer seals in groove of guide to aid during assembly. Buffer seals are stacked one above the other.

6. Remove two buffer seals (5) from guide (6). Discard buffer seals.

4-71. FORK SPACING CYLINDER REPAIR (Con't).



7. Remove retaining ring (15) and two wiper seals (14) from rod (12). Discard wiper seals.
8. Using arbor press, press bushing (11) from rod (12).
9. Using arbor press, press bushing (1) from barrel (2).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, Immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with clean rags.
2. Inspect parts for cracks, wear, and damage. Replace damaged parts.
3. Inspect for bent or distorted rod and barrel. Replace damaged rod or barrel.
4. Inspect barrel for excessive scoring. Replace damaged barrel.

TA708435

4-71. FORK SPACING CYLINDER REPAIR (Con't).

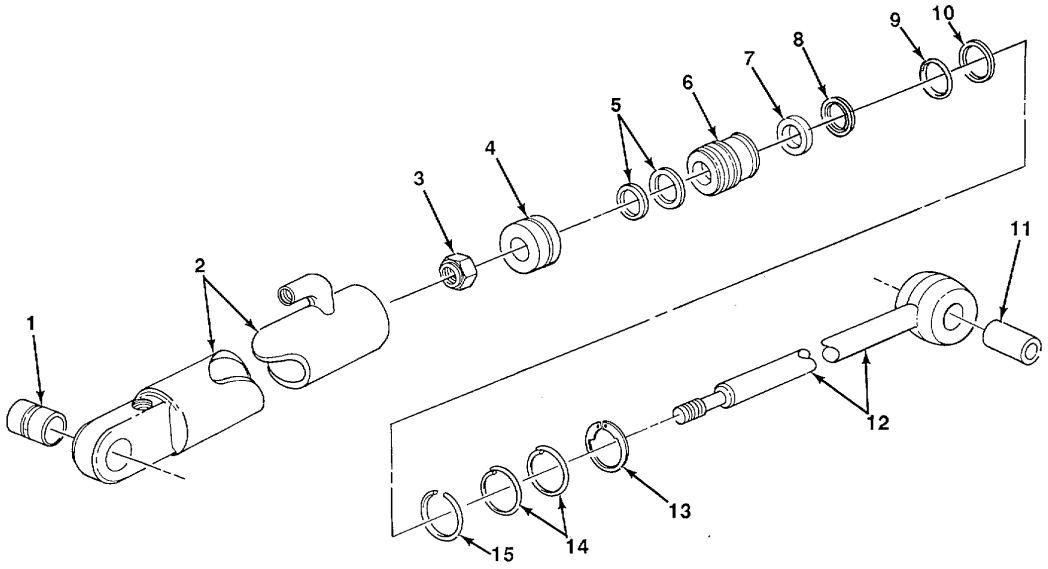
c. ASSEMBLY

1. Using arbor press, press bushing (1) in barrel (2).
2. Using arbor press, press bushing (11) in rod (12).

NOTE

Buffer seals should be stacked one above the other.

3. Install two new buffer seals (5) on guide (6).
4. Install new seal (7) in guide (6).
5. Install new filler ring (8) in guide (6) with lip of filler ring facing upward.
6. Install new preformed packing (9) and backup ring (10) on guide (6).



7. Install guide (6) and piston (4) on rod (12) with new locknut (3). Torque locknut to 37 lb.-ft. (50 Nom). Tighten locknut one-half turn.
8. Apply a coat of grease to outer surface of rod (12), guide (6), and piston (4).
9. Install rod (12) in barrel (2) and push piston (4) in barrel.
10. Push guide (6) in barrel (2) and install retaining ring (13).
11. Pull rod (12) and guide (6) outward from barrel (2), and install two new wiper seals (14) and retaining ring (15).

FOLLOW-ON TASKS:

- Install fork spacing cylinder (see TM 10-3930-659-20).

TA708436

4-72. HYDRAULIC RESERVOIR REPAIR.

This Task Covers: Repair

Initial Setup:

Equipment Conditions:
- Hydraulic reservoir removed (see TM 10-3930-659-20).

References:
- TM 9-237
- M 10-3930-659-20

REPAIR

Refer to TM 9-237 (Operator's Manual for Welding Theory and Application) for instructions on hydraulic reservoir repair.

FOLLOW-ON TASKS:

- Install hydraulic reservoir (see TM 10-3930-659-20).

Section XVI. AIR COMPRESSOR ASSEMBLY MAINTENANCE

4-73. AIR COMPRESSOR ASSEMBLY REPAIR.

This Task Covers:
a. Disassembly b. Assembly

Initial Setup:
Equipment Conditions:
- Air compressor assembly removed -• (see TM 10-3930659-20).

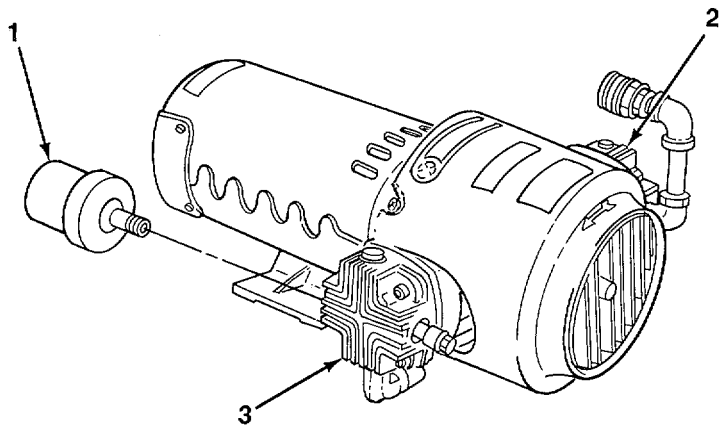
Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Puller kit (Item 50, Appendix E)

Materials/Parts:
- Antiseizing tape (Item 50, Appendix B)
- Four gaskets

References:
- TM 10-3930-659-20

a. DISASSEMBLY

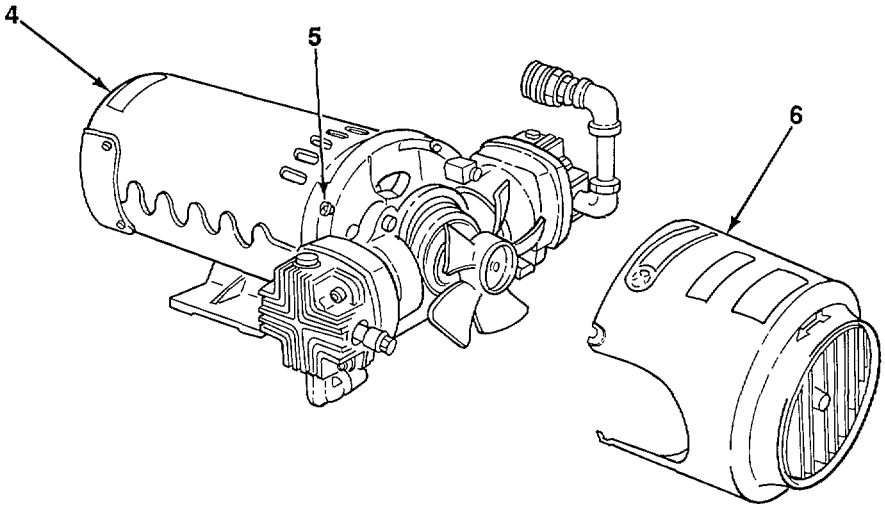
1. Remove two filter assemblies (1) from two cylinder heads (2 and 3).



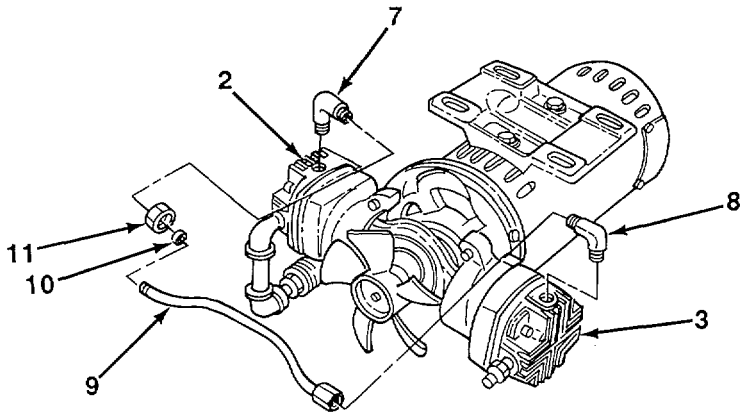
TA708407

4-73. AIR COMPRESSOR ASSEMBLY REPAIR (Con't).

2. Loosen four screws (5) and remove shroud (6) from motor (4).



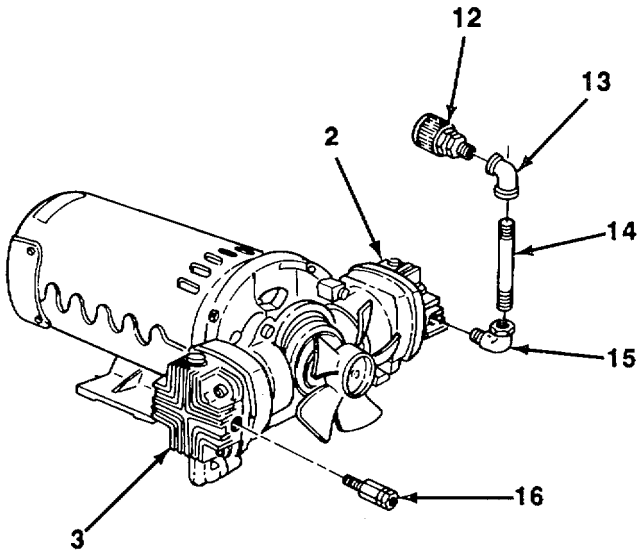
3. Remove line (9) and two elbows (7 and 8) from two cylinder heads (2 and 3).
4. If damaged, remove two nuts (11) and gaskets (10) from line (9). Discard gaskets.



TA708408

4-73. AIR COMPRESSOR ASSEMBLY REPAIR (Con't).

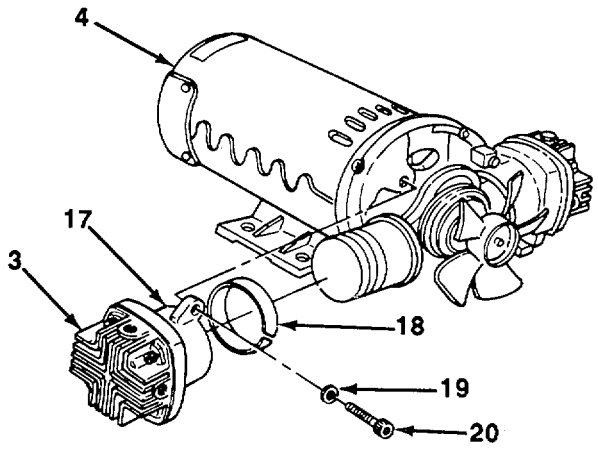
5. Remove relief valve (16) from cylinder head (3).
6. Remove coupling (12), elbow (13), nipple (14), and elbow (15) from cylinder head (2).



NOTE

Both cylinder heads are removed and disassembled the same way. One cylinder head is illustrated.

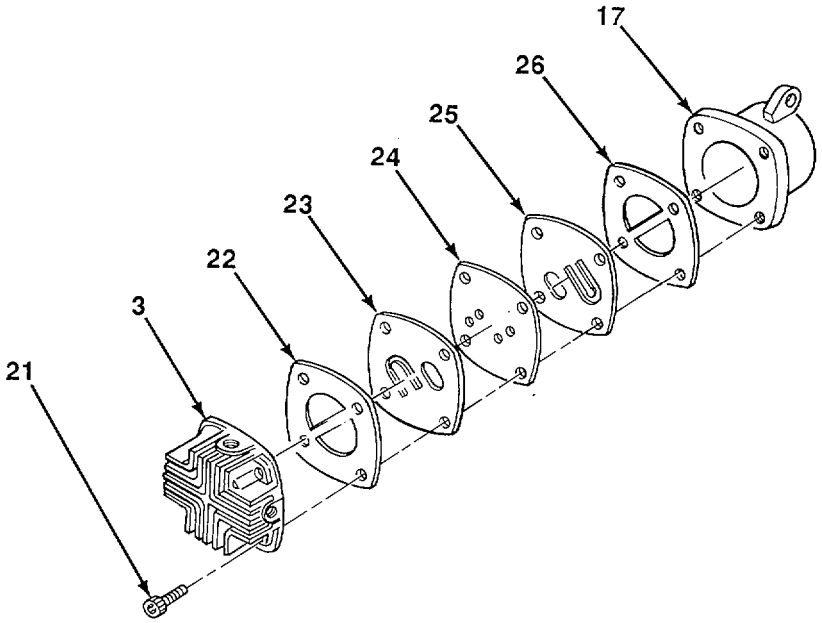
7. Remove two screws (20), washers (19), cylinder (17), and piston rider ring (18) from motor (4).
8. Mark cylinder head (3) and cylinder (17) to aid during assembly.



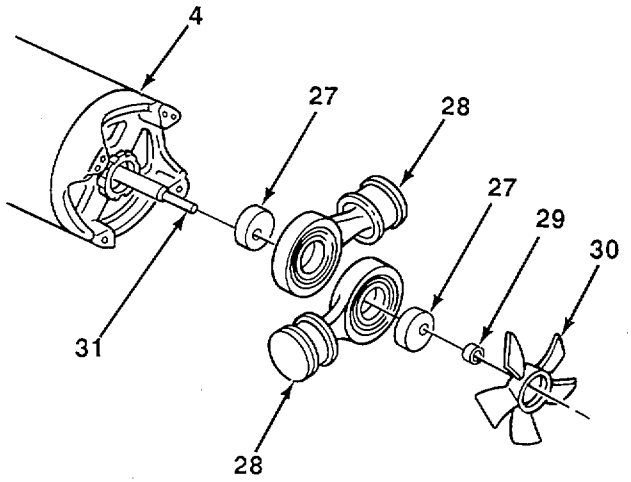
TA708409

4-73. AIR COMPRESSOR ASSEMBLY REPAIR (Con't).

9. Remove four screws (21), cylinder head (3), gasket (22), leaf plate (23), plate (24), leaf plate (25), and gasket (26) from cylinder (17). Discard gaskets.
10. Repeat steps 7 through 9 for cylinder head (2).



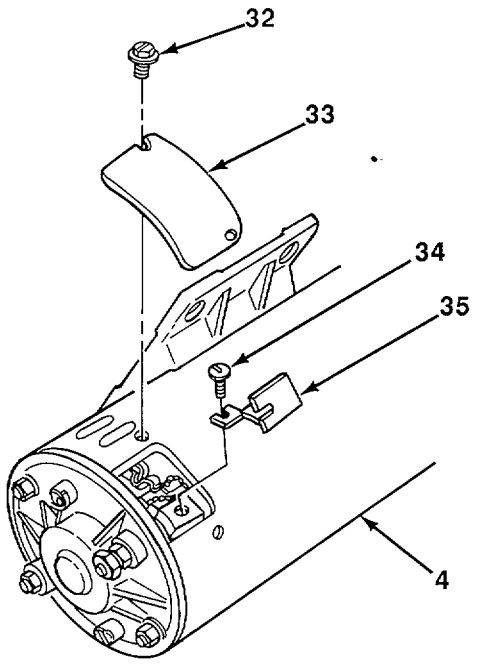
11. Remove band (29) and fan (30) from shaft (31).
12. Using puller kit, remove two pistons (28) and cams (27) from shaft (31).



TA708410

4-73. AIR COMPRESSOR ASSEMBLY REPAIR (Con't).

13. Remove two screws (32) and brush cover (33) from motor (4).
14 Remove screw (34) and brush (35) from motor (4).



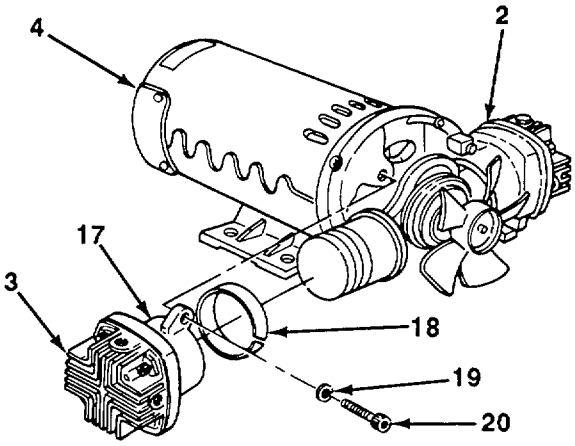
b. ASSEMBLY

1. Install brush (35) on motor (4) with screw (34).
2. Install brush cover (33) on motor (4) with two screws (32).
3. Install two cams (27) and pistons (28) on shaft (31).
4. Install fan (30) on shaft (31) with band (29).

NOTE

Both cylinder heads are assembled and installed the same way. One cylinder head is illustrated.

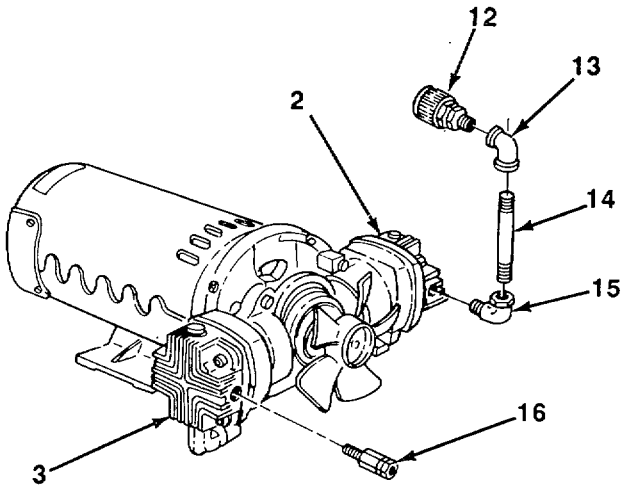
5. Install new gasket (26), leaf plate (25), plate (24), leaf plate (23), new gasket (22), and cylinder head (3) on cylinder (17) with four screws (21).
6. Install piston rider ring (18) and cylinder (17) on motor (4) with two washers (19) and screws (20).
7. Repeat steps 5 and 6 for cylinder head (2).



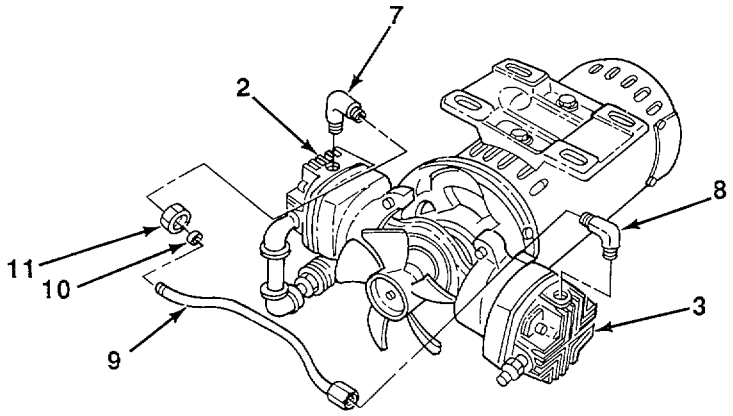
TA708411

4-73. AIR COMPRESSOR ASSEMBLY REPAIR (Con't).

8. Apply antiseizing tape to threads of elbow (15), nipple (14), and coupling (12).
9. Install elbow (15), nipple (14), elbow (13), and coupling (12) on cylinder head (2).
10. Apply antiseizing tape to threads of relief valve (16).
11. Install relief valve (16) on cylinder head (3).



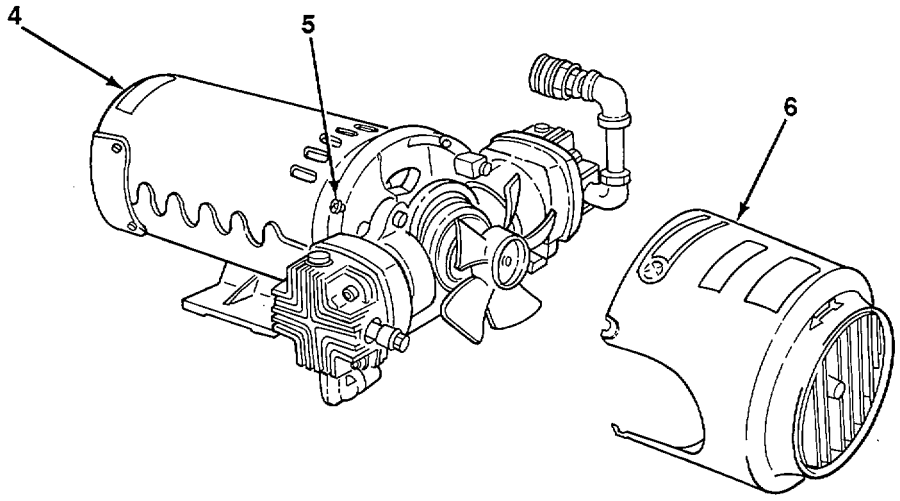
12. If removed, install two new gaskets (10) and nuts (11) on line (9).
13. Install two elbows (7 and 8) and line (9) on two cylinder heads (2 and 3).



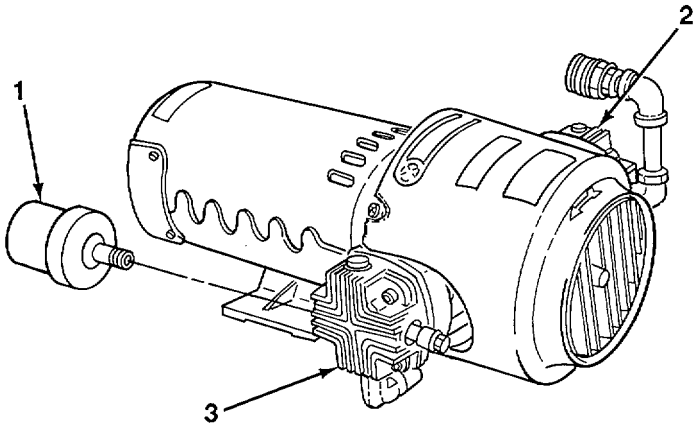
TA708412

4-73. AIR COMPRESSOR ASSEMBLY REPAIR (Con't).

14. Position shroud (6) on motor (4) and tighten four screws (5).



15. Install two filter assemblies (1) on two cylinder heads (2 and 3).



FOLLOW-ON TASKS:

- Install air compressor assembly (see TM 10-3930-659-20).

CHAPTER 5
GENERAL SUPPORT MAINTENANCE

Section I. ENGINE ASSEMBLY MAINTENANCE

5-1. ENGINE BLOCK MAINTENANCE.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Repair
d. Assembly

Initial Setup:

Equipment Conditions:

- Engine oil level gage tube removed (see TM 10-3930-659-20).
- Alternator bracket removed (see TM 10-3930-659-20).
- Fuel transfer pump removed (see TM 10-3930-659-20).
- Oil filter bypass valve removed (see paragraph 5-7).
- Engine oil cooler removed (see paragraph 4-16).
- Flywheel housing removed (see paragraph 4-10).
- Cylinder liners removed (see paragraph 5-2).
- Crankshaft removed (see paragraph 5-4).
- Camshaft removed (see paragraph 5-5).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Inside caliper micrometer r (Item 8, Appendix E)
- Steam cleaner (Item 14, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Machinist's steel rule (Item 56, Appendix E)
- Sharpening stone (Item 61, Appendix E)
- Die and tap threading set (Item 68, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:

- Lubricating oil (Item 39, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Nonelectrical wire (Item 59, Appendix B)
- Two preformed packings

Personnel Required: Two

References:

- TM 10-3930-659-20

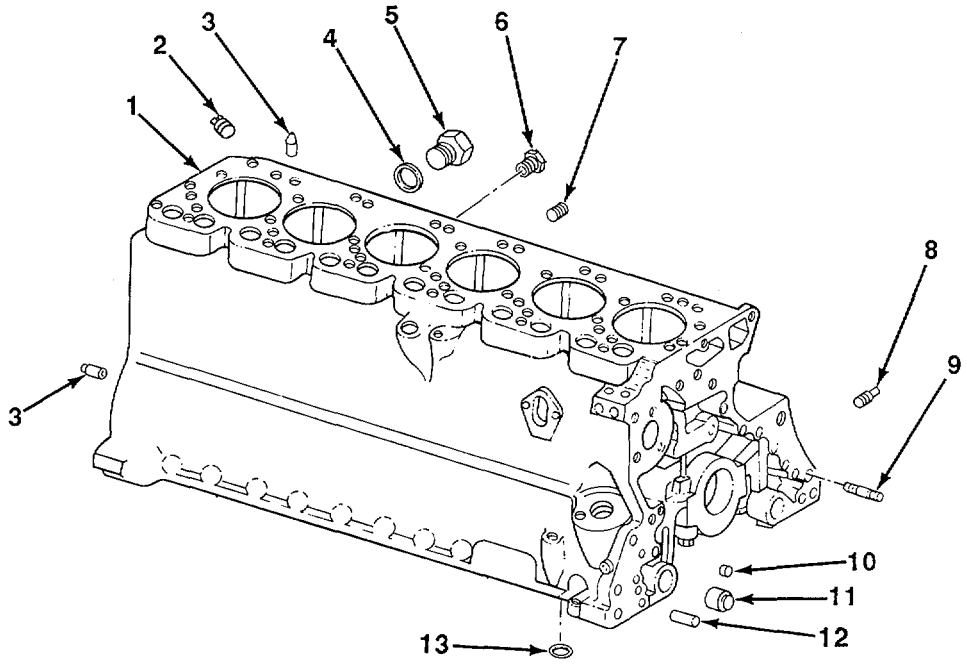
General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).
- Avoid contact with live steam.

a. DISASSEMBLY

1. Remove plug (5) and preformed packing (4) from engine block (1). Discard preformed packing.
2. Remove drain plug (6) from engine block (1).
3. If damaged, remove pipe plugs (2, 7, and 8), stud (9), and plug (10) from engine block (1).
4. If damaged, remove four dowel pins (3), two dowels (12), and bushing (11) from engine block (1).
5. Remove preformed packing (13) from engine block (1) oil port tube. Discard preformed packing.

5-1. ENGINE BLOCK MAINTENANCE (Con't).



b. CLEANING AND INSPECTION

WARNING

Avoid contact with live steam. Live steam can burn skin, cause blindness, and cause other serious injury. Be sure to wear protective apron, gloves, and safety goggles when using live steam.

1. Using steam cleaner, clean all internal passages, external holes, and recesses of engine block to remove corrosion, scaling, and debris.

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

2. Turn engine block so deposits will run out. Flush internal passages, external holes, and recesses with clean water and dry with compressed air.

5-1. ENGINE BLOCK MAINTENANCE (Con't).

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

3. Remove all gasket material from engine block with dry cleaning solvent and dry with clean rags.
4. Clean all metal parts with dry cleaning solvent and dry with clean rags.
5. Inspect six fluid restrictors (17) in engine block (1) for damage. Replace if damaged.

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

6. Clean six fluid restrictors (17) with nonelectrical wire and compressed air.

NOTE

Main bearing caps and thrust bearing cap must be Installed in correct numbered location with identifying arrow facing camshaft side of engine block.

7. Apply lubricating oil to threads of 12 screws (16). Install six main bearing caps (14) on engine block (1) with 12 washers (15) and screws. Torque screws to 85 lb.-ft. (115 N-m).

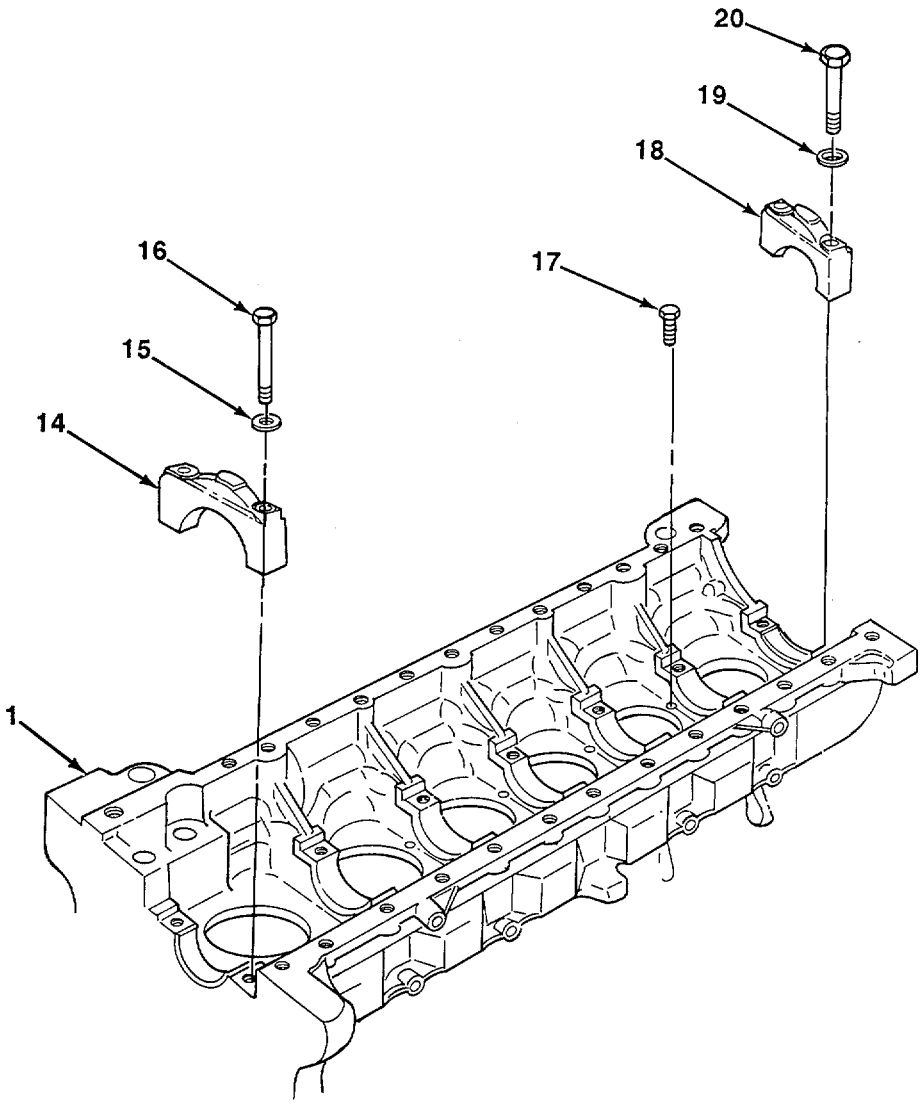
8. Apply lubricating oil to threads of two screws (20). Install thrust bearing cap (18) on engine block (1) with two washers (19) and screws. Torque screws to 85 lb.-ft. (115 N-m).

9. Using inside caliper micrometer, measure inside diameter of main bearing bores and thrust bearing bore. Measurement must be 3.325-3.326 in. (8.446-8.448 cm). If either main bearing bore or thrust bearing bore is not within specification, replace engine block (1).

10. Remove two screws (20), washers (19), and thrust bearing cap (18) from engine block (1).

11. Remove 12 screws (16), washers (15), and six main bearing caps (14) from engine block (1).

5-1. ENGINE BLOCK MAINTENANCE (Con't).



TA708121

5-1. ENGINE BLOCK MAINTENANCE (Con't).

NOTE

Perform steps 12 through 20 to check engine block main bearing bore alinement. New bearings and a new crankshaft are used to eliminate any error which might exist from using worn bearings or crankshaft.

12. Apply lubricating oil to six upper main bearings (26) and upper thrust bearing (25). Position upper main and thrust bearings on engine block (1). Ensure that tangs on upper bearings fit in locking grooves on engine block and oil holes in bearings aline with oil passages in engine block.
13. Apply lubricating oil to six lower main bearings (23) and lower thrust bearing (24). Position lower main bearings on six main bearing caps (14) and lower thrust bearing on thrust bearing cap (18). Ensure that tangs on lower bearings fit in locking grooves in main bearing caps and thrust bearing cap.

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

CAUTION

- **DO NOT install crankshaft by hand. Use a suitable lifting device or parts may be damaged.**
- **When installing crankshaft in engine block, ensure that crankshaft does not hit against engine block. Crankshaft hitting against engine block may damage parts.**
- **Ensure that bearing faces are not damaged when installing crankshaft.**

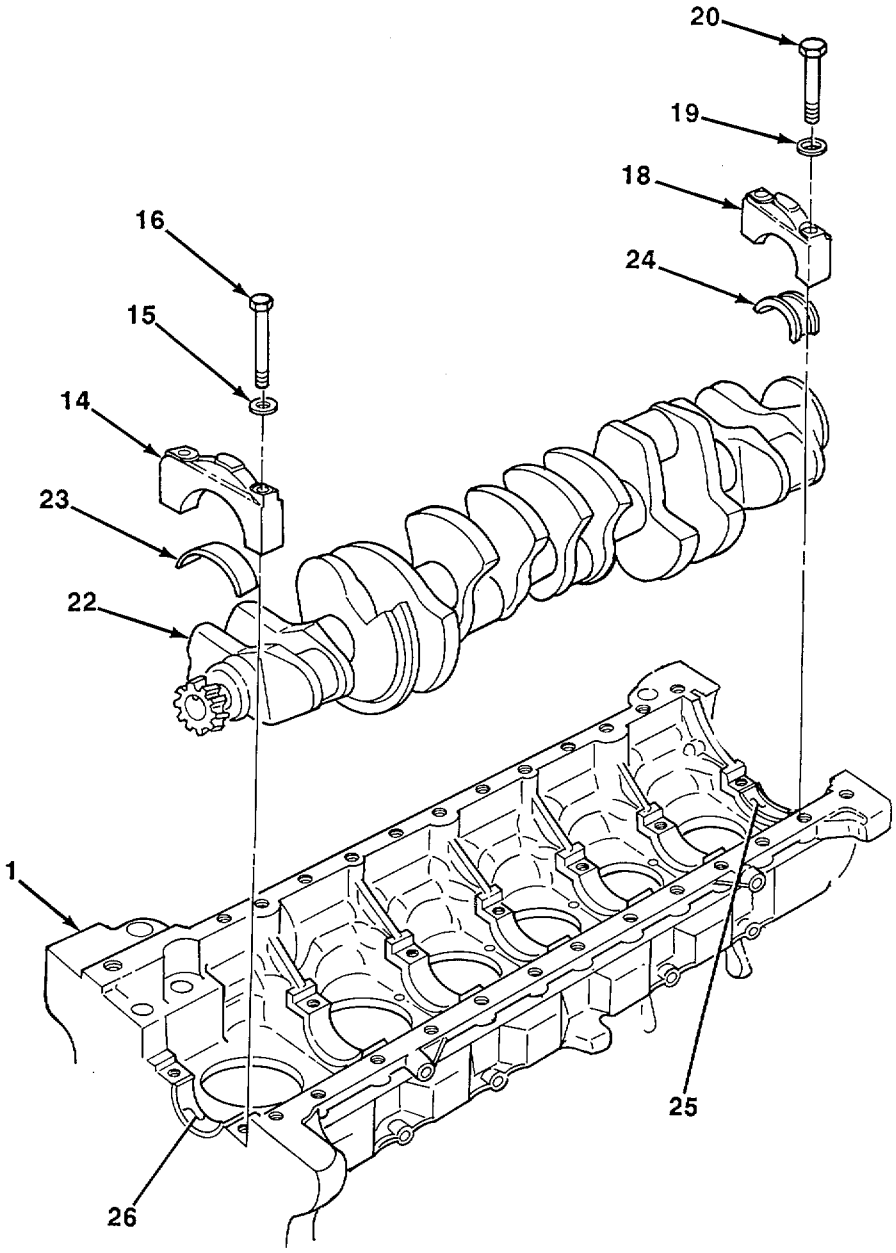
14. Using suitable lifting device, position new crankshaft (22) in engine block (1).

NOTE

Main bearing caps and thrust bearing cap must be installed in correct numbered location with indicator arrow facing camshaft side of engine block.

15. Apply lubricating oil to threads of 12 screws (16). Install six main bearing caps (14) on crankshaft (22) with 12 washers (15) and screws.
16. Apply lubricating oil to threads of two screws (20). Install thrust bearing cap (18) on crankshaft (22) with two washers (19) and screws.
17. Using hammer and wood block, tap crankshaft (22) to rear of engine block (1). Aline front flanges of upper and lower main and thrust bearings (23, 24, 25, and 26).
18. Using hammer and wood block, tap crankshaft (22) to front of engine block (1). Aline rear flanges of upper and lower main and thrust bearings (23, 24, 25, and 26).

5-1. ENGINE BLOCK MAINTENANCE (Con't).



TA708122

5-1. ENGINE BLOCK MAINTENANCE (Con't).

19. Torque 14 screws (16 and 20) to 85 lb.-ft. (115 N-m).

NOTE

Use bolt removed from crankshaft dampener to perform step 20.

20. Install bolt (21) on crankshaft (22) and turn crankshaft two full revolutions. Crankshaft must turn freely. If crankshaft does not turn freely, replace engine block (1).
21. Remove bolt (21) from crankshaft (22).
22. Remove two screws (20), washers (19), and thrust bearing cap (18) from engine block (1).
23. Remove lower thrust bearing (24) from thrust bearing cap (18).
24. Remove 12 screws (16), washers (15), and six main bearing caps (14) from engine block (1).
25. Remove six lower main bearings (23) from main bearing caps (14).

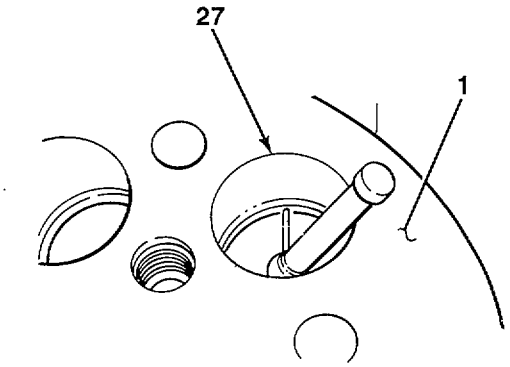
WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

CAUTION

Ensure that crankshaft is lifted straight out of engine block. Crankshaft hitting against engine block may damage parts.

26. Using suitable lifting device, remove crankshaft (22) from engine block (1).
27. Remove six upper main bearings (26) and upper thrust bearing (25) from engine block (1).
28. Using inside caliper micrometer, measure inside diameter of control cam bores (27). Measurement must be 1.248-1.250 in. (3.170-3.175cm). If measurement is greater than specification, replace engine block (1).



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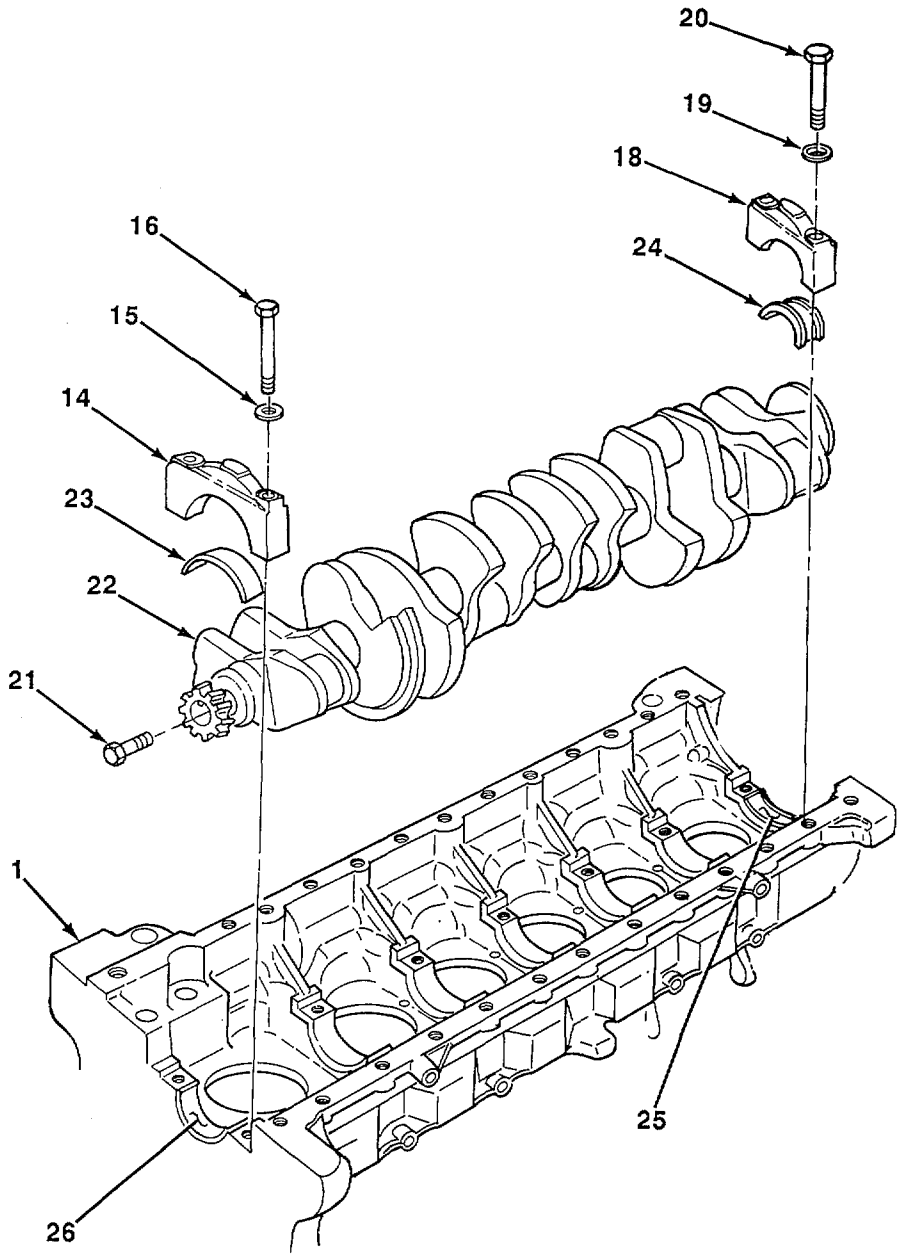
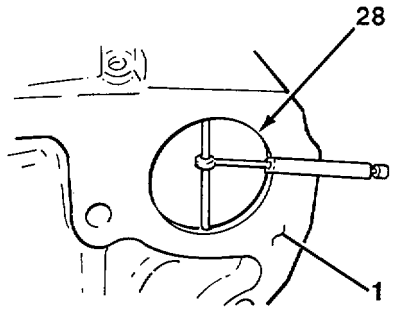
5-1. ENGINE BLOCK MAINTENANCE (Con't).

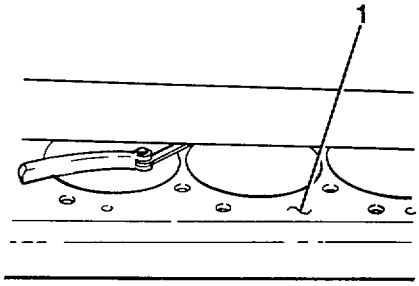


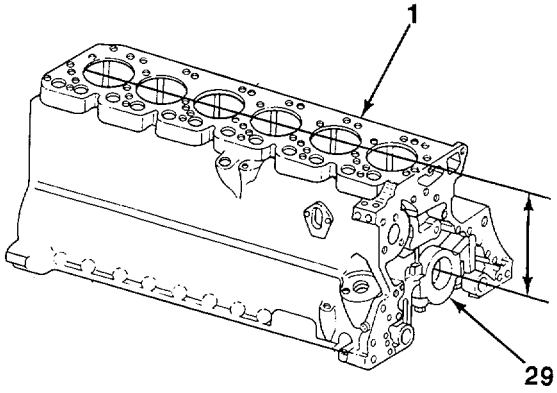
5-1. ENGINE BLOCK MAINTENANCE (Con't).

29. Using inside caliper micrometer, measure inside diameter of camshaft bore (28). Measurement must be 2.204-2.205 in. (5.598-5.601 cm). If measurement is greater than specification, replace engine block (1).



30. Using machinist's steel rule and feeler gage, measure flatness of engine block (1). Maximum allowable flatness variation is 0.003 in. (0.076 mm). If measurement is greater than specification, replace engine block.
31. Measure from top of engine block (1) to centerline of crankshaft bearing (29). Minimum allowable measurement is 11.889 in. (30.198 cm). If measurement is less than specification, replace engine block.





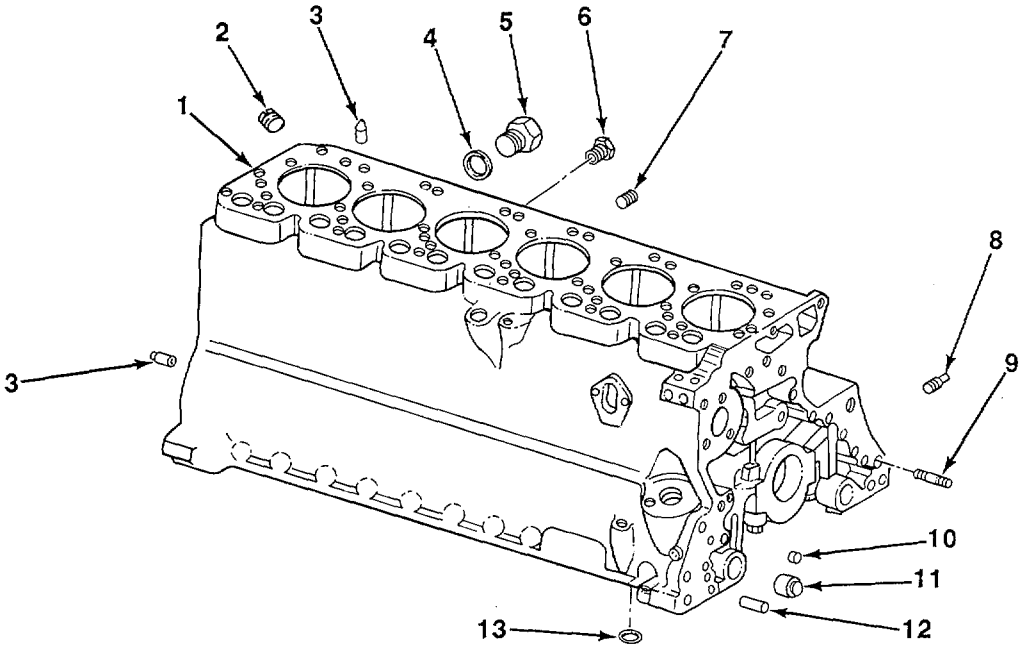
c. REPAIR

1. Repair damaged threads using die and tap threading set.
2. Remove high spots or burrs on gasket surfaces with a sharpening stone.

5-1. ENGINE BLOCK MAINTENANCE (Con't).

d. ASSEMBLY

1. Install new preformed packing (13) in engine block (1) oil port tube.
2. If removed, install four dowel pins (3), two dowels (12), and bushing (11) in engine block (1).
3. If removed, install plug (10), stud (9), and pipe plugs (2, 7, and 8) in engine block (1).
4. Install drain plug (6) in engine block (1).
5. Install new preformed packing (4) and plug (5) on engine block (1).



FOLLOW-ON TASKS:

- Install camshaft (see paragraph 5-5).
- Install crankshaft (see paragraph 5-4).
- Install cylinder liners (see paragraph 5-2).
- Install flywheel housing (see paragraph 4-10). TA708126
- Install engine oil cooler (see paragraph 4-16).
- Install oil filter bypass valve (see paragraph 5-7).
- Install engine oil level gage tube (see TM 10-3930-659-20).
- Install alternator bracket (see TM 10-3930-659-20).
- Install fuel transfer pump (see TM 10-3930-659-20).

5-2. CYLINDER LINERS MAINTENANCE.

This Task Covers:

a. Inspection
b. Repair
c. Removal
d. Installation

Initial Setup:

Equipment Conditions:
- Engine assembly removed from forklift truck (see paragraph 4-3).
- Cylinder head assembly removed (see paragraph 4-5).
- Engine oil pan removed (see paragraph 4-17).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Flywheel turning tool (Item 25, Appendix E)
- Depth gage micrometer (Item 27, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Piston gage (Item 30, Appendix E)
- Honing unit (Item 36, Appendix E)
- Puller kit (Item 49, Appendix E)
- Torque wrench, 0-175 lb.-ft. (item 81, Appendix E)

Materials/Parts:
- Scrub brush (Item 5, Appendix B)
  Lubricating oil (Item 39, Appendix B)
- Rags (Item 43, Appendix B)
  Dry cleaning solvent (Item 47, Appendix B)
- Nonelectrical wire (Item 59, Appendix B)
  Three preformed packings

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. INSPECTION

CAUTION

DO NOT rotate crankshaft until cylinder liners are secured with washers and screws. Failure to follow this caution may result in damage to parts.

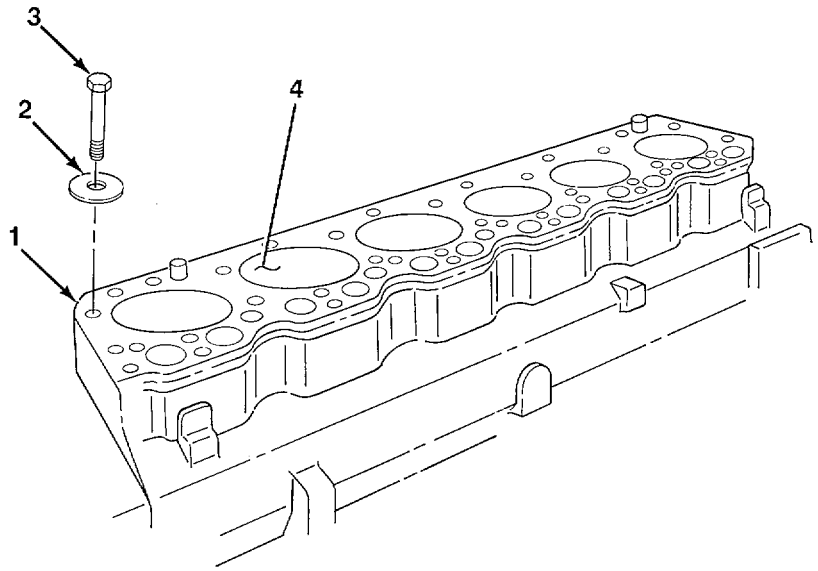
1. Install seven 8 in. thick washers (2) and Y2 x 13 UNC-2A screws (3) in engine block (1). Torque screws to 50 lb.-ft. (68 N•m).
2. Using honing unit, remove carbon from bores of six cylinder liners (4).

5-2. CYLINDER LINERS MAINTENANCE (Con't).

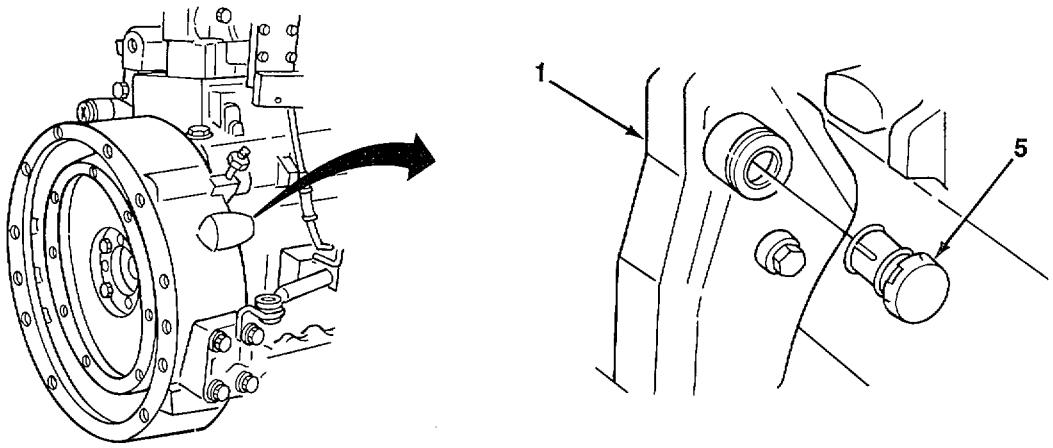
WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

3. Remove loose material from six cylinder liners (4) with compressed air.



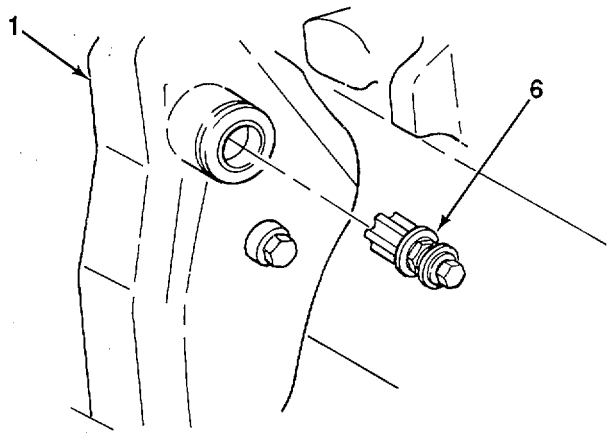
4. Remove plug (5) from engine (1).



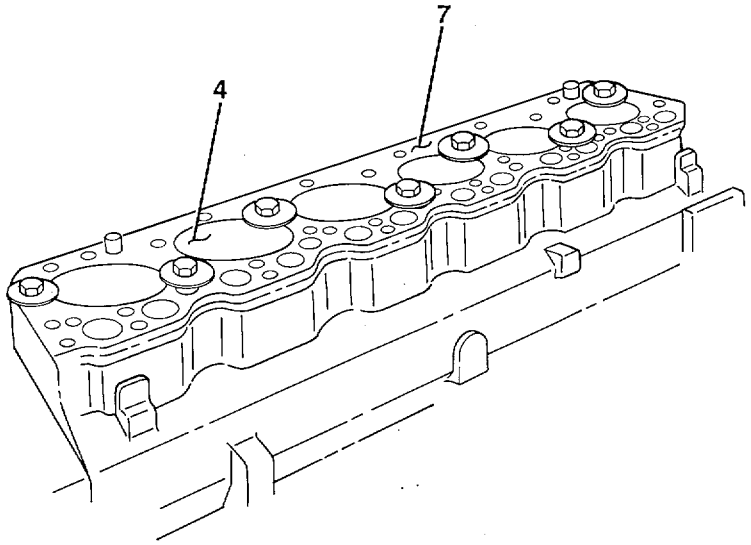
TA708127

5-2. CYLINDER LINERS MAINTENANCE (Con't).

5. Install flywheel turning tool (6) on engine (1).



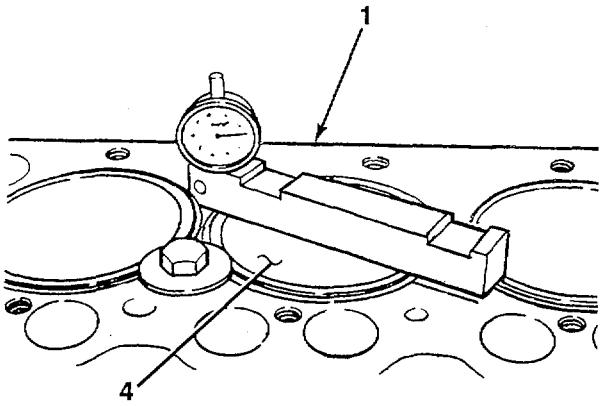
6. Using flywheel turning tool (6), rotate flywheel until each piston is at bottom of cylinder liner (4). Inspect cylinder head (7) for crosspatch pattern, pitting, and vertical scratches.



TA708128

5-2. CYLINDER LINERS MAINTENANCE (Con't).

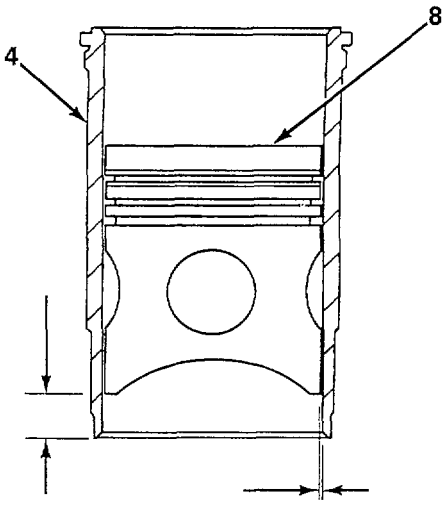
7. Using dial indicator and depth gage micrometer, measure and note height of cylinder liner (4) from engine (1). Measurement must be 0.0004-0.0040 in. (0.0102-0.1016 mm). Repeat step for remaining cylinder liners. Differences between measurements must not exceed 0.002 in. (0.051 mm).
8. Remove six pistons and connecting rods (see paragraph 5-3).
9. Inspect cylinder liners (4) for cracks, scoring, glazing, discoloration, and abnormal wear. If damaged, replace cylinder liners (see subparagraph c).



NOTE

Perform steps 10 through 16 for all six pistons and cylinder liners.

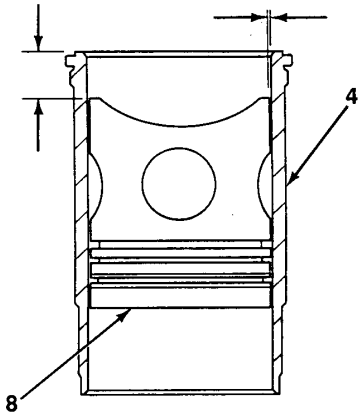
10. Insert piston (8) into same cylinder liner (4) as removed, and ensure that front markings of piston and cylinder liner are alined. Position piston so bottom edge is 1 in. (25.4 mm) from bottom of cylinder liner.
11. Using feeler gage, measure and note clearance between piston (8) and cylinder liner (4) at a point 900 from piston pin bore.
12. Rotate piston (8) 900 and repeat step 11. Difference between measurements in steps 11 and 12 is amount cylinder liner (4) is out-of-round. Maximum allowable out-of-round is 0.002 in. (0.051 mm).



TA708129

5-2. CYLINDER LINERS MAINTENANCE (Con't).

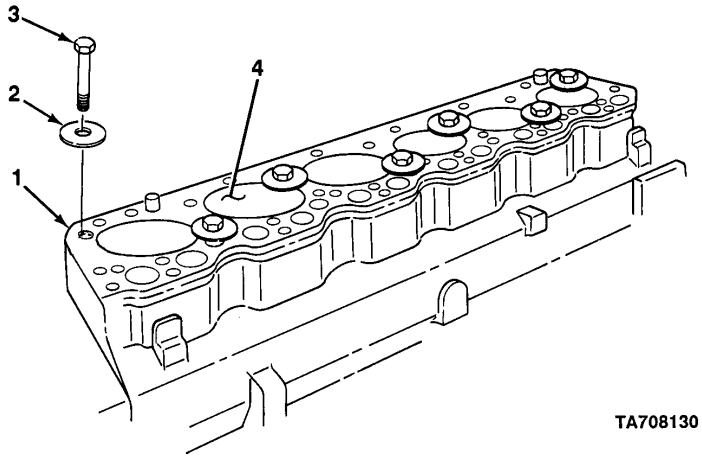
13. Remove piston (8) from cylinder liner (4) and insert piston upside down in cylinder liner. Position piston 1 in. (25.4 mm) below top of cylinder liner.
14. Using feeler gage, measure and note clearance between piston (8) and cylinder liner (4). Clearance must be 0.003-0.006 in. (0.076-0.152 mm).
15. Difference between measurements in steps 12 and 14 is cylinder liner taper. Cylinder liner taper must not exceed 0.002 in. (0.051 mm).
16. Remove piston (8) from cylinder liner (4).



NOTE

Perform steps 17 through 19 only if further inspection is required.

17. Remove seven screws (3) and washers (2) from engine block (1).
18. Remove cylinder liners (see subparagraph c).
19. Inspect outer surface of cylinder liners (4) for pitting and corrosion. Using nonelectrical wire and rule, measure depth of pitting or corrosion. Depth must not exceed one-half the wall thickness of cylinder liner. If depth exceeds specification, replace cylinder liner (see subparagraph c).



5-2. CYLINDER LINERS MAINTENANCE (Con't).

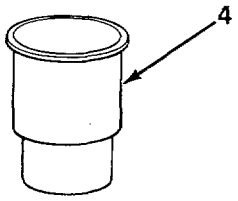
b. REPAIR

1. If glazing of cylinder liner is found, remove glaze with honing unit.

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

2. Clean cylinder liner (4) with dry cleaning solvent and a scrub brush. Dry with clean rags.



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5-2. CYLINDER LINERS MAINTENANCE (Con't).

c. REMOVAL

CAUTION

DO NOT remove cylinder liner from engine block unless damaged or removal is required to gain access to engine block. Damage to cylinder sleeve on engine block may result.

NOTE

Note position of cylinder liners. Cylinder liners must be installed in original positions.

1. Mark cylinder liner (4) to indicate front of engine block (1).
2. Using cylinder liner puller, remove cylinder liner (4) from engine block (1).

NOTE

Note position of preformed packings to aid during installation.

3. Remove one preformed packing (9) from cylinder liner (4) and two preformed packings (10) from engine block (1). Discard preformed packings.

5-2. CYLINDER LINERS MAINTENANCE (Con't).

d. INSTALLATION

CAUTION

• Engine block bore and counterbore must be clean or cylinder liner will not seat properly and damage to parts may result.

• DO NOT use excessive force when installing cylinder liner. Cylinder liner flange may be damaged.

1. Using wood block and ball-peen hammer, install cylinder liner (4) in engine block (1).
2. Using dial indicator and height gage, measure height of cylinder liner (4) from engine block (1) at four equally spaced points around cylinder liner. Measurement must not exceed 0.004 in. (0.102 mm).
3. Using cylinder liner puller, remove cylinder liner (4) from engine block (1).
4. Install new preformed packing (9) on cylinder liner (4).
5. Install two new preformed packings (10) in engine block (1). Ensure that preformed packings do not stick out of grooves in engine block.

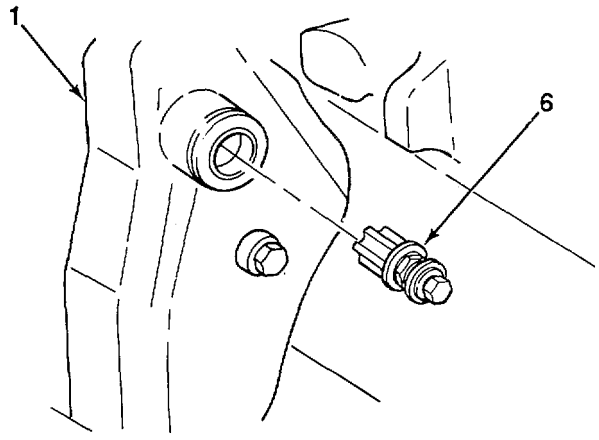
CAUTION

Install cylinder liner in engine block slowly. Failure to do so may twist preformed packings and cause damage to parts.

NOTE

Cylinder liners will extend above engine block more than normal because preformed packings have not been compressed.

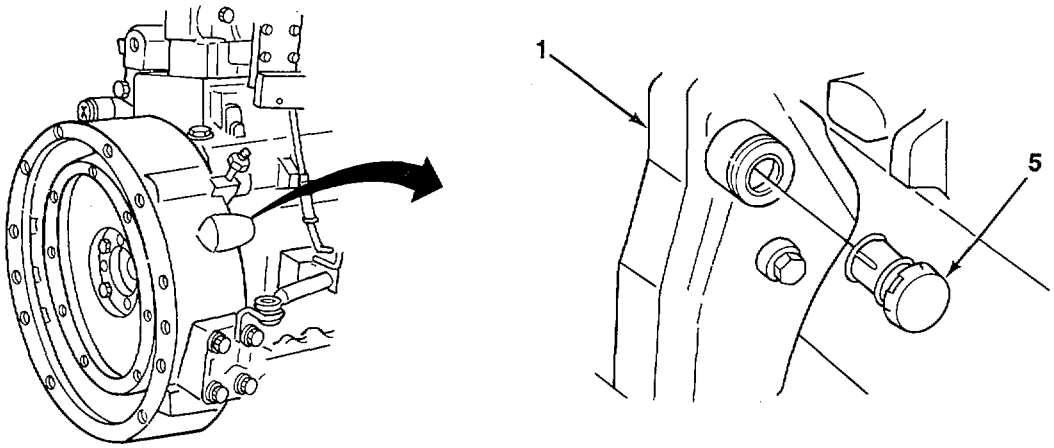
6. Apply lubricating oil to cylinder sleeve. Slide cylinder liner (4) in engine block (1).
7. Using wood block and ball-peen hammer, tap cylinder liner (4) into engine block (1).
8. Remove flywheel turning tool (6) from engine (1).



TA708133

5-2. CYLINDER LINERS MAINTENANCE (Con't).

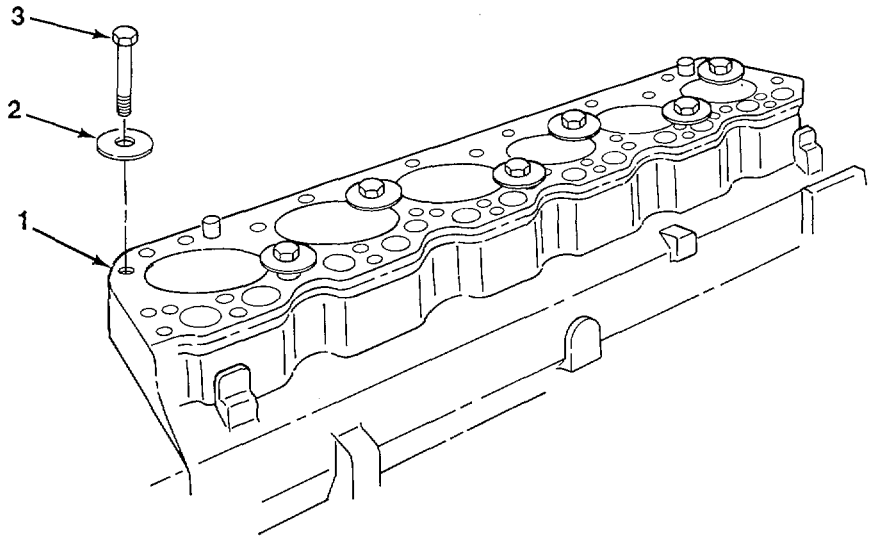
9. Install plug (5) on engine (1).



CAUTION

DO NOT rotate crankshaft until cylinder liners are secured with washers and screws. Failure to follow this caution may result in damage to parts.

10. Install seven /8 in. thick washers (2) and Y2 x 13 UNC-2A screws (3) in engine block (1). Torque screws to 50 lb.-ft. (68 N•m).



FOLLOW-ON TASKS:

- Install pistons and connecting rods (see paragraph 5-3).
- Install cylinder head assembly (see paragraph 4-5).
- Install engine oil pan (see paragraph 4-17).
- Install engine assembly in forklift truck (see paragraph 4-3).

TA708134

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Equipment Conditions:
- Engine assembly removed from forklift truck (see paragraph 4-3).
- Cylinder head assembly removed (see paragraph 4-5).
- Engine oil pan removed (see paragraph 4-17).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Inside caliper micrometer (Item 8, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Piston ring compressor (Item 15, Appendix E)
- Piston ring expander (Item 22, Appendix E)
- Flywheel turning tool (Item 25, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Ring groove wear gage (Item 32, Appendix E)
- Retaining ring pliers (Item 46, Appendix E)
- Arbor press (Item 47, Appendix E)
- Piston pin bushing remover and installer (Item 54, Appendix E)
- Flexible carbon scraper (item 57, Appendix E)
- Die and tap threading set (Item 68, Appendix E)
- Machinist's vise (Item 76, Appendix E)
- Torque wrench, 0-175 Ib.-ft. (Item 81, Appendix E)

Materials/Parts:
- Scrub brush (Item 5, Appendix B)
- Crocus cloth (Item 8, Appendix B)
- Carbon removing compound (Item 10, Appendix B)
- Lubricating oil (Item 39, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Nonelectrical wire (Item 59, Appendix B)
- Nonelectrical wire (Item 59 Appendix B)
- One piston ring kit
- Two bolts

Personnel Required: Two

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Carbon removing compound can cause serious burns and blindness. Use only with protective clothing.

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

NOTE

All six pistons and connecting rods are maintained the same way. One piston and connecting rod is illustrated.

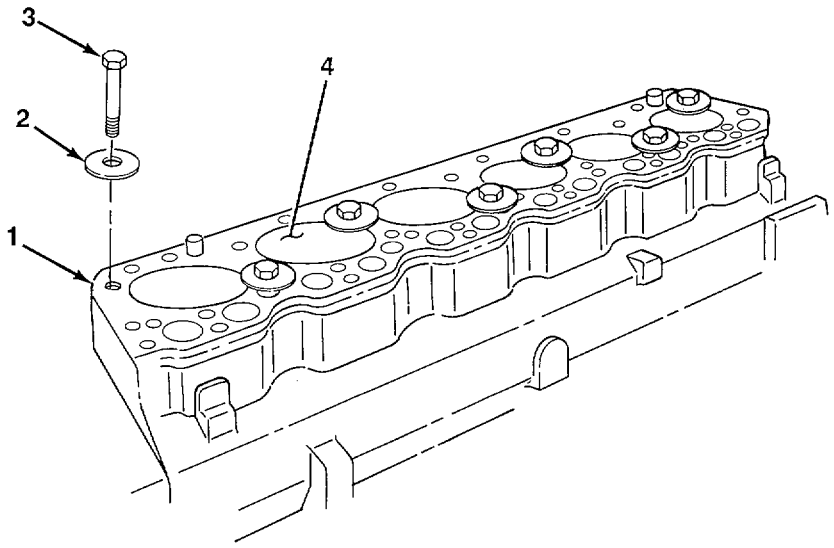
a. REMOVAL

CAUTION

DO NOT rotate crankshaft until cylinder liners are secured with washers and screws. Failure to follow this caution may result In damage to parts.

1. Install seven 1/8 in. thick washers (2) and 1/2 x 13 UNC-2A screws (3) in engine block (1). Torque screws to 50 lb.-ft. (68 N•m).

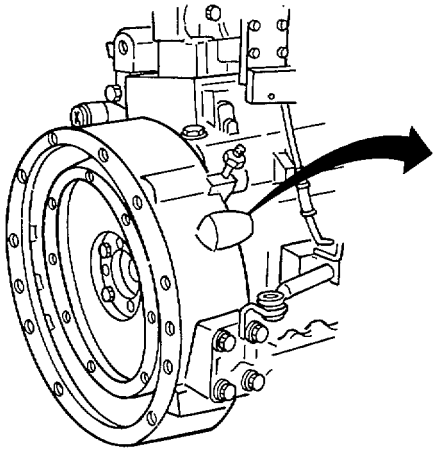
2. Using flexible carbon scraper, remove carbon ridge from cylinder liner (4).

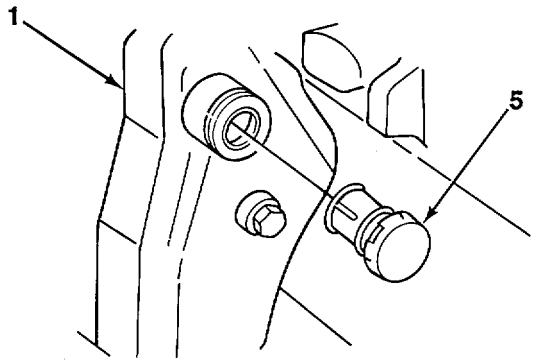


TA708135

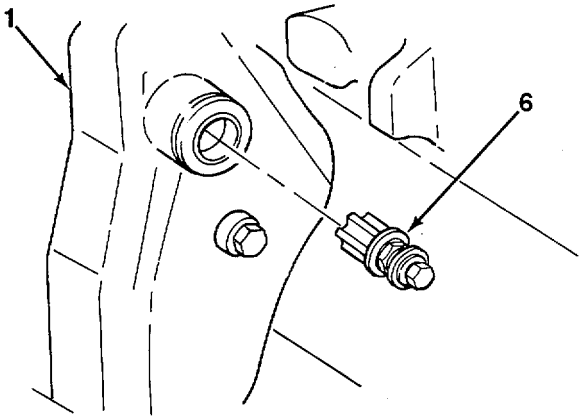
5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

3. Remove plug (5) from engine (1).





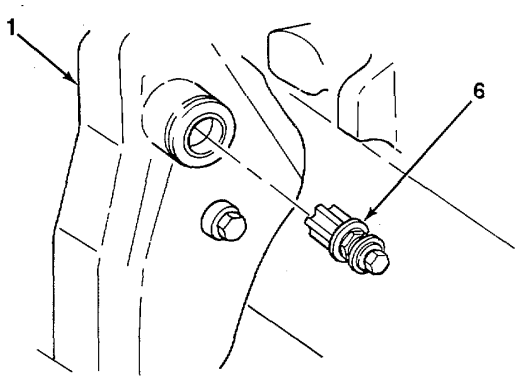
4. Install flywheel turning tool (6) on engine (1).



TA708136

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

5. Using flywheel turning tool (6), rotate flywheel until piston (10) is at bottom of stroke.



CAUTION

When removing main bearing cap, ensure that lower main bearing does not fall out of main bearing cap. If lower main bearing falls out, damage may occur.

6. Remove two bolts (7) and main bearing cap (8) from connecting rod (9). Discard bolts.

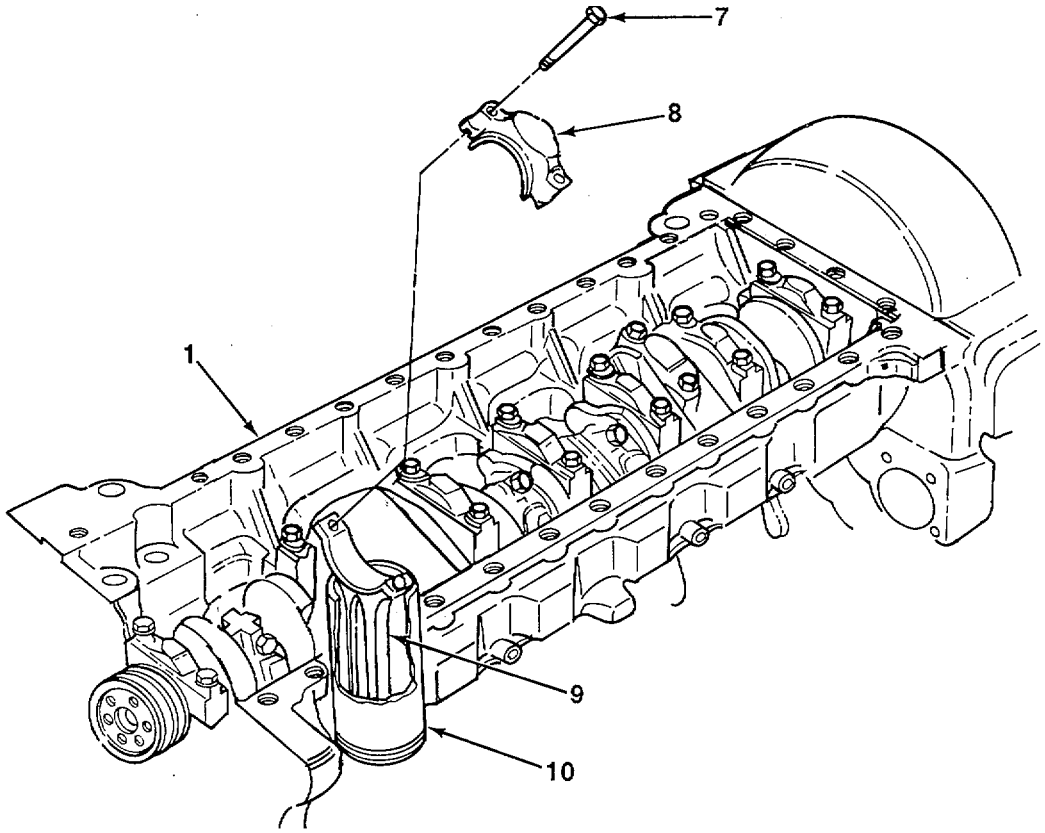
CAUTION

Note position of piston and connecting rod to aid during installation. Failure to Install in correct location may damage parts.

7. With the aid of an assistant, tap bottom of piston (10) and connecting rod (9) with a block of soft wood. Remove piston and connecting rod from top of engine block (1).

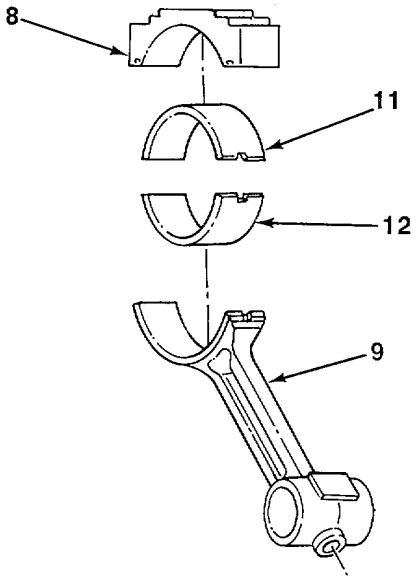
TA708137

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).



b. DISASSEMBLY

1. Remove lower main bearing (11) from main bearing cap (8).
2. Remove upper main bearing (12) from connecting rod (9).



TA708138

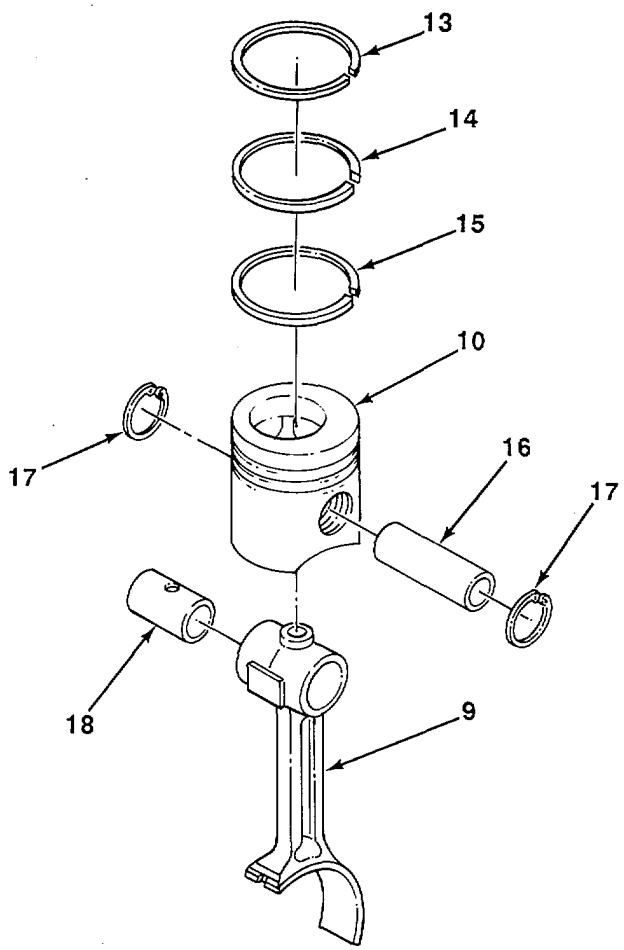
5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

3. Using piston ring expander, remove compression ring (13), oil control ring (14), and oil ring expander (15) from piston (10). Discard rings.
4. Remove two retaining rings (17) from piston (10).
5. Remove piston pin (16) from piston (10).
6. Remove piston (10) from connecting rod (9).

CAUTION

DO NOT remove piston pin bushing unless damaged. Removal may damage bushing.

7. Using arbor press and piston pin bushing remover and installer, remove piston pin bushing (18) from connecting rod (9).



c. CLEANING AND INSPECTION

WARNING

Carbon removing compound is a corrosive liquid. If splashed in eyes, it can cause blindness. If splashed on skin, it can cause serious burns. Always wear protective goggles or lenses, rubber apron, and rubber gloves. If accidentally splashed in eyes or on skin, flush with cool, clean water. Refer to FM 21-11 for first aid information and seek medical attention immediately.

1. Soak piston overnight in carbon removing compound. Using scrub brush, remove carbon from piston head and rinse with hot water.
2. Using scrub brush, clean piston ring grooves.

TA708139

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

WARNING

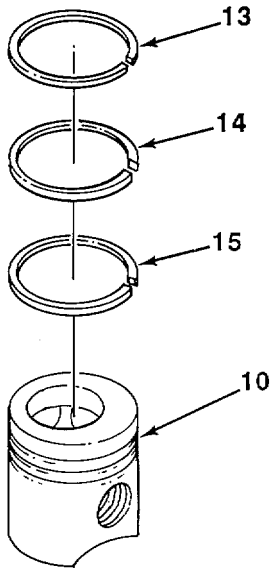
Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

3. Using nonelectrical wire, clean oil holes and flush clean with dry cleaning solvent. Dry thoroughly with clean rags.
4. Clean connecting rod, piston pin, and piston pin bushing with dry cleaning solvent, and dry thoroughly with clean rags.
5. Inspect upper and lower main bearings for cracks, grooves, rough spots, scratches, and breaks. Remove rough spots and minor scratches with crocus cloth. Replace upper and lower main bearings if otherwise damaged.
6. Inspect piston for cracks, scoring, and excessive wear or scorching. Replace piston if badly scored.
7. Using ring groove wear gage, measure compression ring groove. If shoulders of gage touch ring land, groove is excessively worn and piston must be replaced.

NOTE

Piston rings come in a kit. If one piston ring requires replacement, all piston rings (compression ring, oil control ring, and oil ring expander) must be replaced.

8. Using piston ring expander, install new compression ring (13), new oil control ring (14), and new oil ring expander (15) on piston (10).
9. Using feeler gage, measure compression ring (13) clearance. Clearance must not exceed 0.008 in. (0.203 mm).
10. Using piston ring expander, remove compression ring (13), oil control ring (14), and oil expander ring (15) from piston (10).

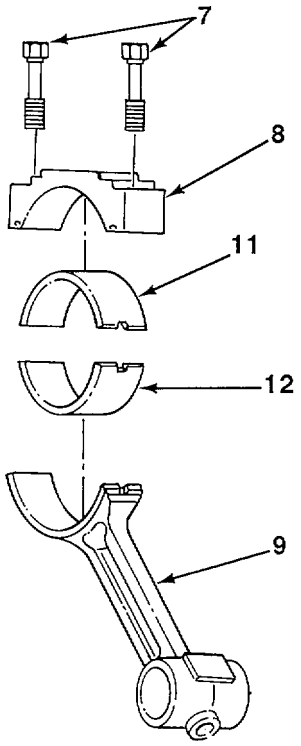


TA708140

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

11. Inspect piston pin bushing for cracks, breaks, and excessive wear. Using inside caliper micrometer, measure inside diameter of piston pin bushing. Inside diameter must be 1.626-1.627 in. (4.130-4.133 cm).
12. Inspect piston pin for cracks, bends, and breaks. Using outside caliper micrometer, measure outside diameter of piston pin. Outside diameter must be 0.624-0.625 in. (15.850-15.875 mm).
13. Subtract measurement taken in step 12 from measurement taken in step 11. Difference is piston pin-to-bushing clearance. Clearance must be 0.0008-0.0020 in. (0.0203-0.0508 mm).
14. Inspect connecting rod for cracks, breaks, and damaged threads. Repair damaged threads with die and tap threading set.

15. Place connecting rod (9) in vise with jaw caps.
16. Apply lubricating oil to threads of two bolts (7). Install main bearing cap (8) on connecting rod (9) with two bolts. Torque bolts to 55 lb.-ft. (75 N.m).
17. Using inside caliper micrometer, measure bore diameter of connecting rod (9) and main bearing cap (8). Diameter must be 2.750-2.752 in. (6.985-6.990 cm).
18. Remove two bolts (7) and main bearing cap (8) from connecting rod (9).
19. Slide upper main bearing (12) in place on connecting rod (9). Ensure that tang on upper main bearing fits in locking groove on connecting rod.
20. Slide lower main bearing (11) in place in main bearing cap (8). Ensure that tang on lower main bearing fits in locking groove on main bearing cap.
21. Apply lubricating oil to threads of two bolts (7). Install main bearing cap (8) on connecting rod (9) with two bolts. Torque bolts to 55 lb.-ft. (75 N.m).
22. Using inside caliper micrometer, measure bore diameter of lower and upper main bearings (11 and 12). Diameter must be 2.750-2.752 in. (6.985-6.990 cm).



23. Remove two bolts (7) and main bearing cap (8) from connecting rod (9).
24. Remove upper main bearing (12) from connecting rod (9) and lower main bearing (11) from main bearing cap (8).

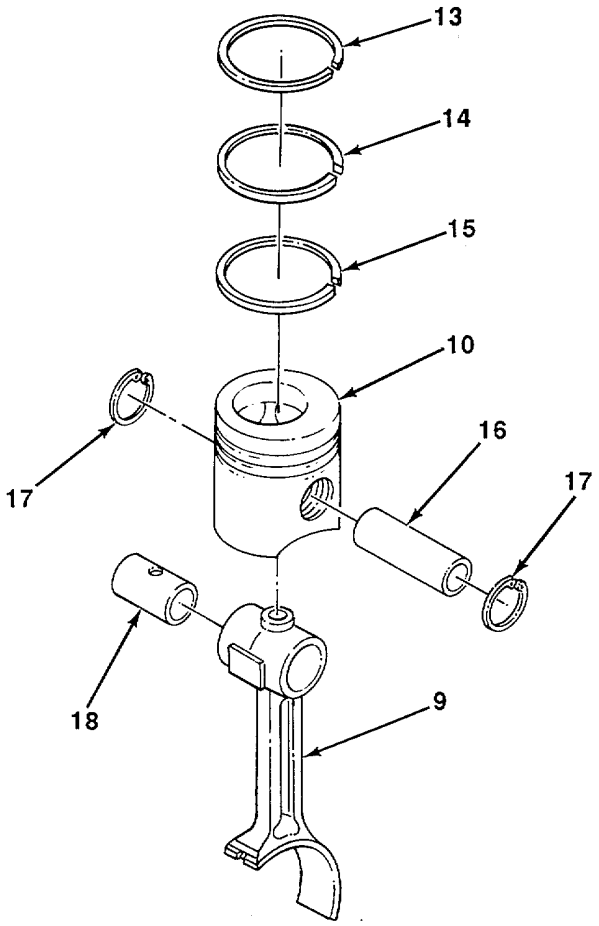
TA708141

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

d. ASSEMBLY

NOTE
Perform steps 1 and 2 only if piston pin bushing was removed.

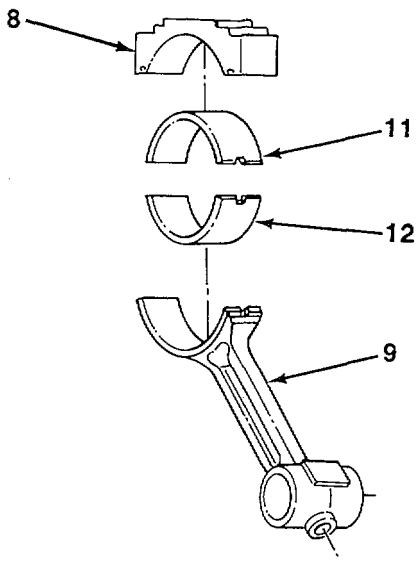
1. Using arbor press and piston pin bushing remover and installer, press piston pin bushing (18) in connecting rod (9). Ensure that oil holes are properly alined and piston pin-to-bushing clearance meets specifications (see subparagraph b).
2. Apply lubricating oil to piston pin (16).
3. Install piston (10) on connecting rod (9) with piston pin (16).
4. Using retaining ring pliers, install two retaining rings (17) on ends of piston pin (16).
5. Apply lubricating oil to oil ring expander (15), oil control ring (14), and compression ring (13).
6. Using piston ring expander, install oil ring expander (15), oil control ring (14), and compression ring (13) on piston (10) with dots or TOP facing up and oil ring gaps offset.



TA708142

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

7. Position upper main bearing (12) on connecting rod (9). Ensure that tang on upper main bearing fits in locking groove on connecting rod. Apply lubricating oil to upper main bearing.
8. Position lower main bearing (11) on main bearing cap (8). Ensure that tang on lower main bearing fits in locking groove on main bearing cap. Apply lubricating oil to lower main bearing.



e. INSTALLATION

1. Using flywheel turning tool, rotate flywheel until mating crankshaft journal for piston (10) and connecting rod (9) is accessible.
2. Apply lubricating oil to all mating surfaces of piston (10) and connecting rod (9).

CAUTION

- **Piston and connecting rod must be installed as noted during removal. Failure to do so may damage parts.**
- **Use care not to damage crankshaft journal when installing piston and connecting rod.**

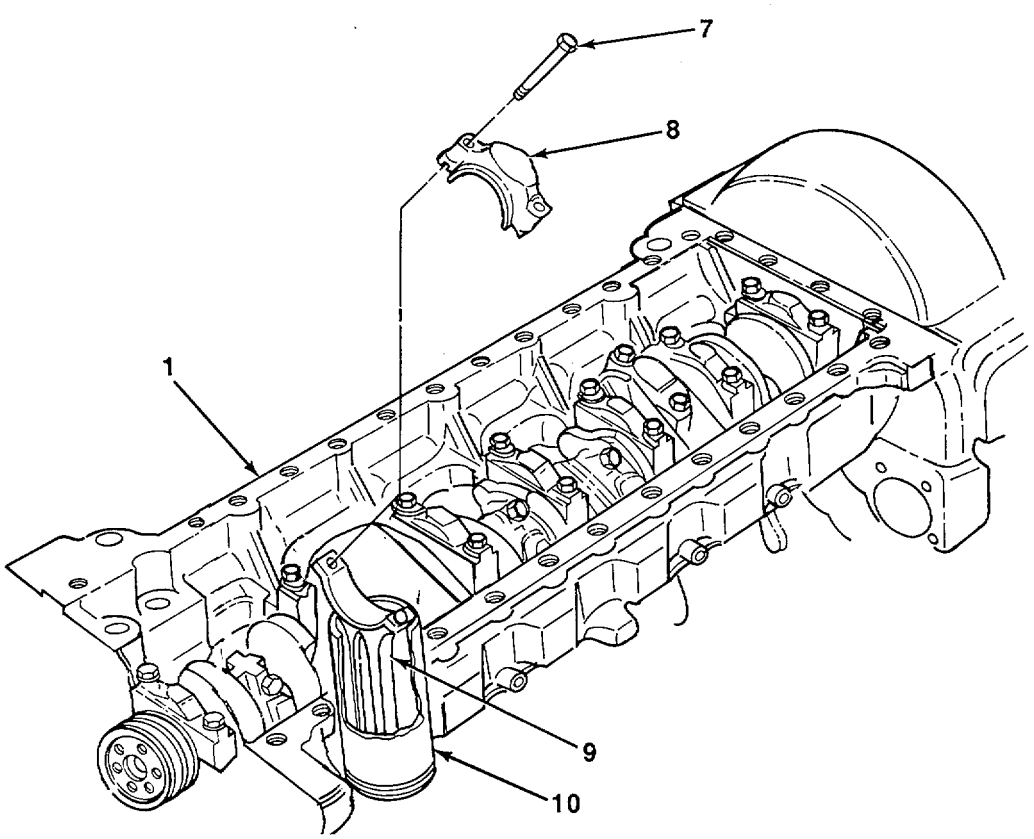
NOTE

Ensure that the word FRONT on piston faces front of engine block.

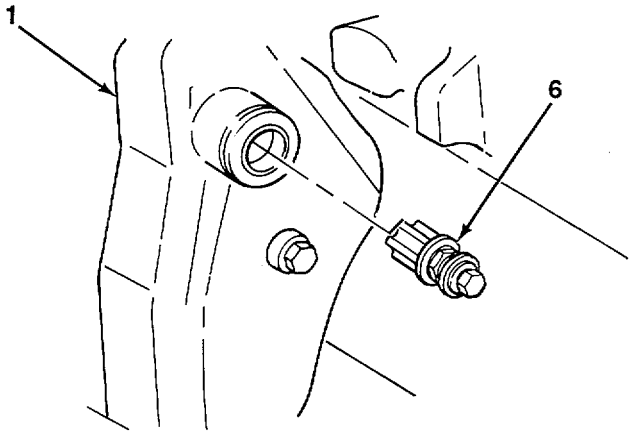
3. Using piston ring compressor and handle of hammer, tap piston (10) and connecting rod (9) in engine block (1).
4. Apply lubricating oil to threads of two new bolts (7).
5. Install main bearing cap (8) on connecting rod (9) with two bolts (7). Torque bolts to 55 lb.-ft. (75 N•m).

TA708143

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).



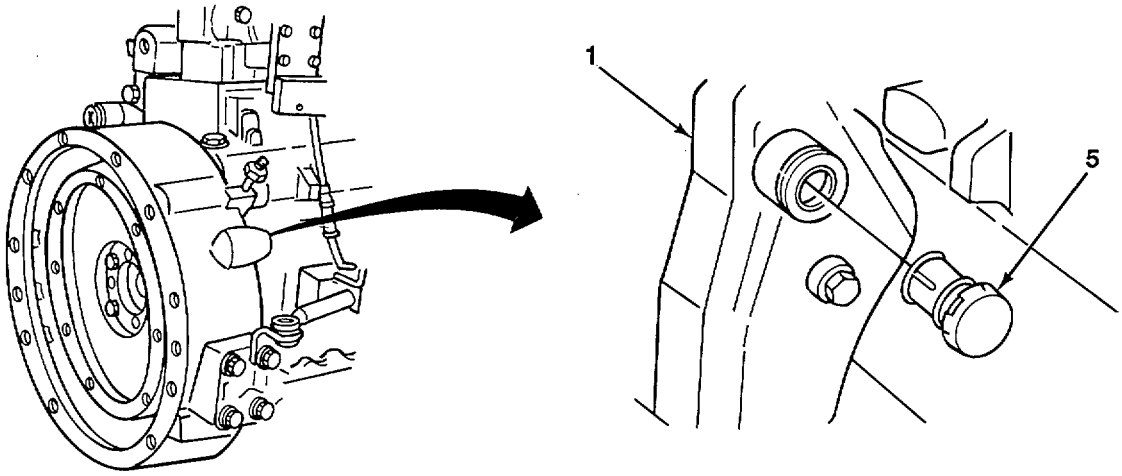
6. Remove flywheel turning tool (6) from engine (1).



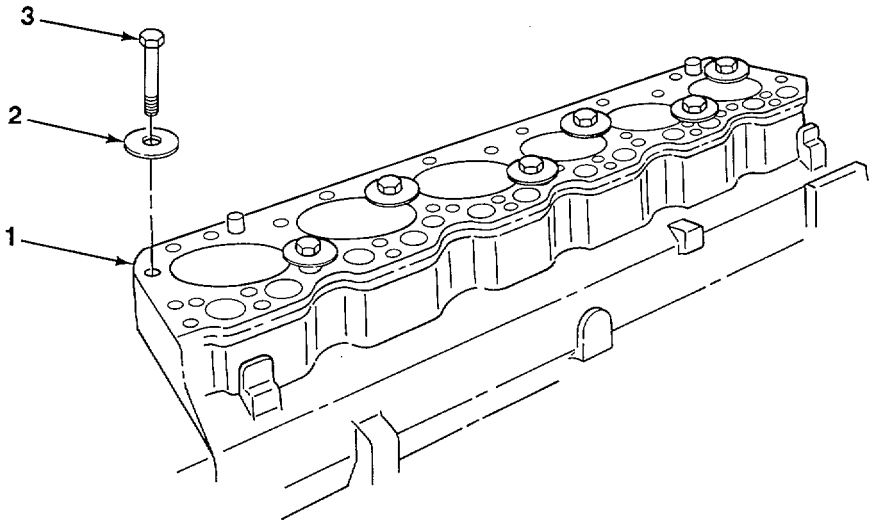
TA708144

5-3. PISTON, CONNECTING ROD, AND CONNECTING ROD BEARING MAINTENANCE (Con't).

7. Install plug (5) on engine (1).



8. Remove seven screws (3) and washers (2) from engine block (1).



FOLLOW-ON TASKS:

- Install engine oil pan (see paragraph 4-17).
- Install cylinder head assembly (see paragraph 4-5).
- Install engine assembly in forklift truck (see paragraph 4-3).

TA708145

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Cylinder block front plate removed (see paragraph 5-6).
- Pistons and connecting rods removed (see paragraph 5-3).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Wrecking bar (item 6, Appendix E)
- Inside caliper micrometer (Item 8, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Mechanical puller (Item 51, Appendix E)
- Stud remover and setter (Item 62, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

References:
- TM 9-214

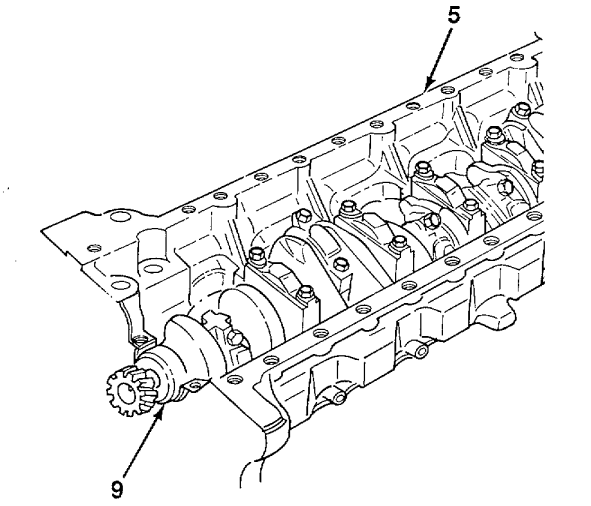
Materials/Parts:
- Crocus cloth (Item 8, Appendix B)
- Bearing clearance gage, blue (Item 31, Appendix B)
- Lubricating oil (Item 39, Appendix B)
- Lubricating oil (Item 40, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)

Personnel Required: Two

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. REMOVAL

1. Using wrecking bar and dial indicator, pry crankshaft (9) forward in engine block (5). Measure and note end play.
2. Remove flywheel housing (see paragraph 4-10).



TA708146

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

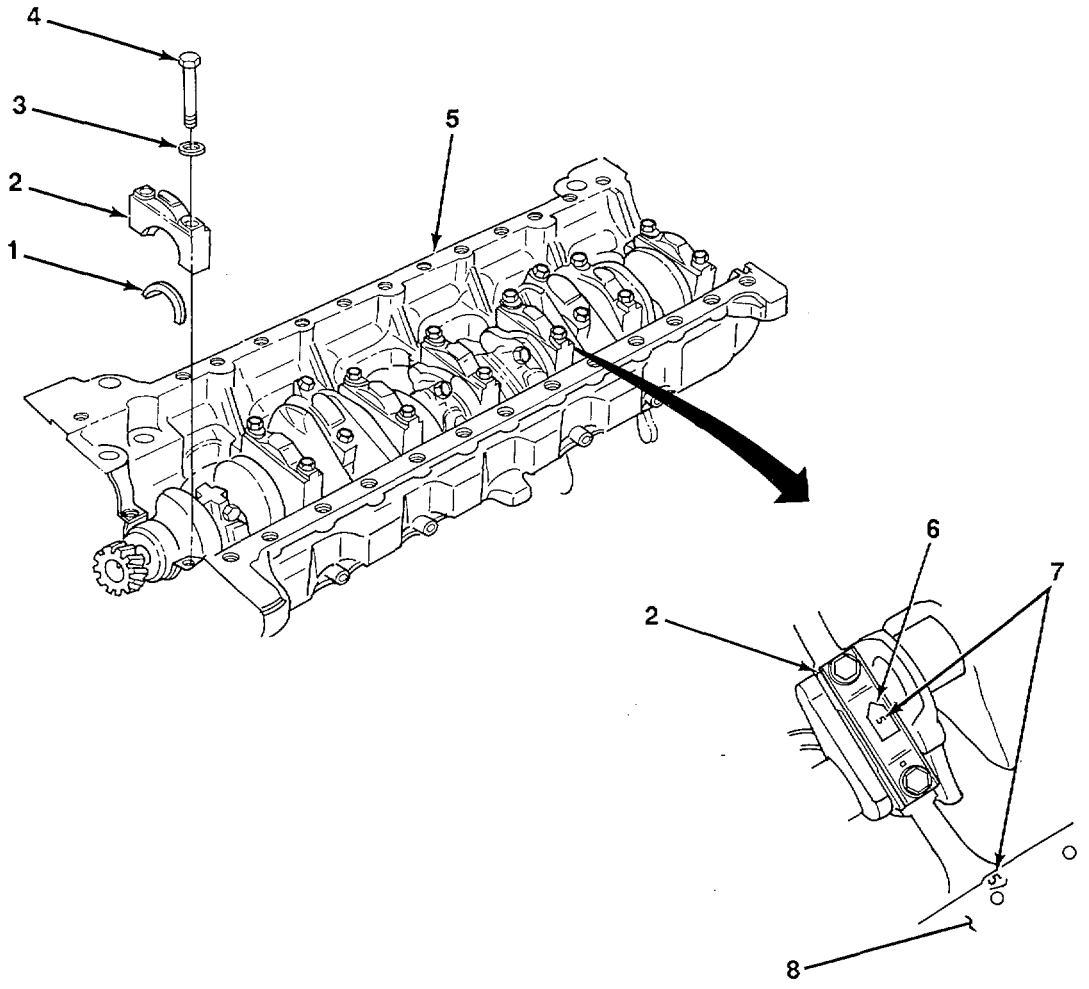
CAUTION

Note position of main and thrust bearings and bearing caps to aid during installation. Failure to install in correct location may damage parts.

NOTE

Engine assembly has six main bearing caps and one thrust bearing cap. All bearing caps are removed the same way. One main bearing cap Is illustrated.

3. Note identifying arrow (6) and numbers (7) on main bearing cap (2) and oil pan rail (8). If numbers are not present, mark main bearing cap and oil pan rail to aid during installation.



TA708147

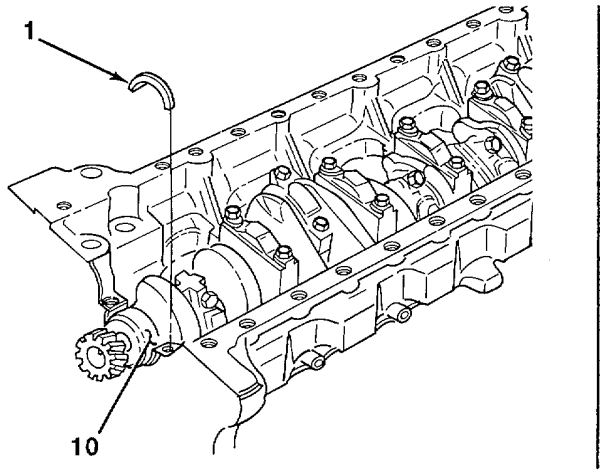
5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

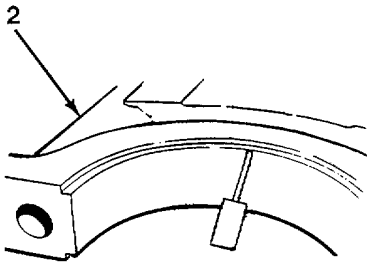
4. Remove two screws (4), washers (3), and main bearing cap (2) from engine block (5).
5. Remove lower main bearing (1) from main bearing cap (2).
6. Repeat steps 3 through 5 for remaining main bearing caps (2) and thrust bearing cap.
7. Using a clean rag, remove lubricating oil (Item 40, Appendix B) from lower main bearing (1) and matching main bearing journal (10).

NOTE

Use of bearing clearance gage will determine wear of bearing, but will not determine condition of bearing or journal.

8. Place strip of blue bearing clearance gage across width of main bearing cap (2) approximately X in. (6.35 mm) off center.
9. Position lower main bearing (1) on matching main bearing journal (10).

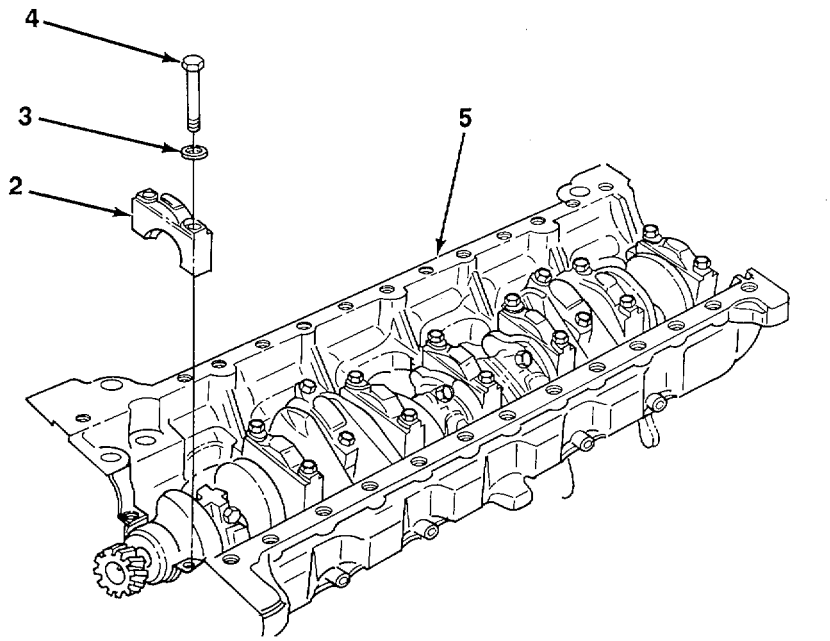




TA708148

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

10. Install main bearing cap (2) on engine block (5) with two washers (3) and screws (4). Torque screws to 85 lb.-ft. (115 N•m).
11. Remove two screws (4), washers (3), and main bearing cap (2) from engine block (5).
12. Measure width of blue bearing clearance gage on main bearing cap (2) with measuring strip. Width must be no greater than 0.006 in. (0.152 mm). If width is greater than specification, replace main and thrust bearings.



WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

CAUTION

Ensure that crankshaft is lifted straight out of engine block. Crankshaft hitting against engine block may damage parts.

13. Using suitable lifting device, remove crankshaft (9) from engine block (5).

TA708149

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

NOTE

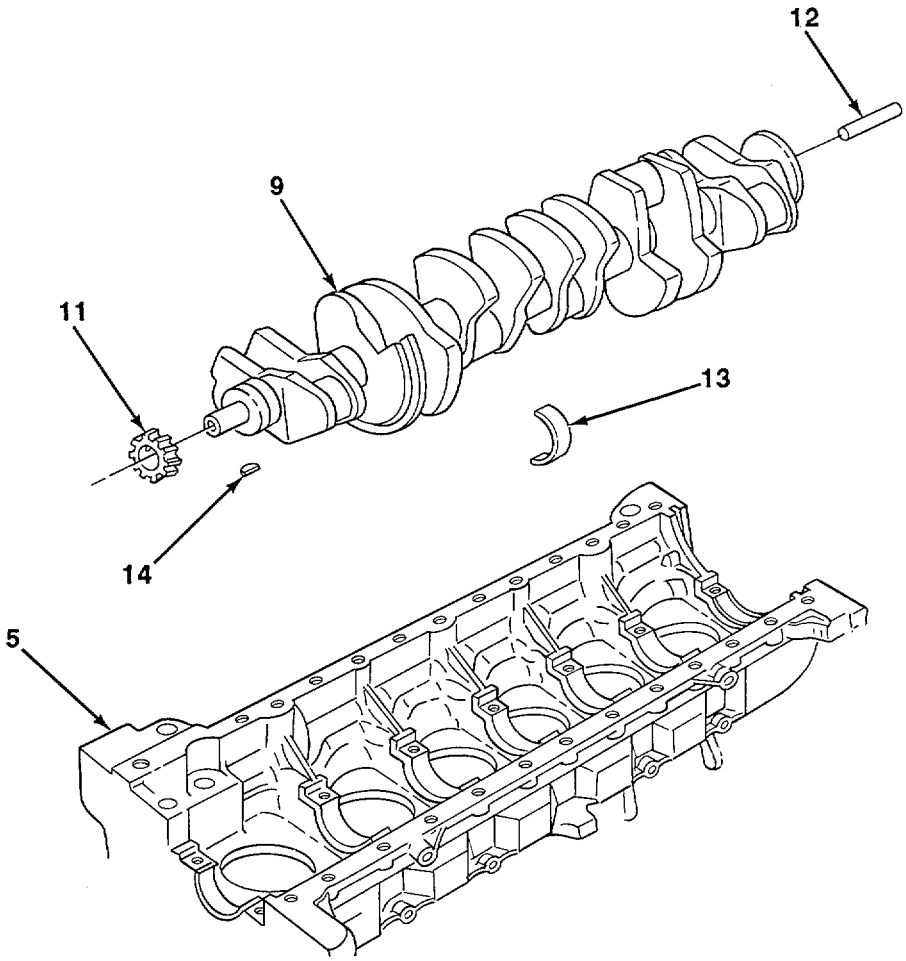
Upper main and thrust bearings are different sizes. Note location to aid during installation.

14. Remove seven upper main and thrust bearings (13).

CAUTION

DO NOT remove dowel pin unless damaged. Removal may damage parts.

15. Using stud remover and setter, remove dowel pin (12) from crankshaft (9).
16. Using mechanical puller, remove spur gear (11) from crankshaft (9).
17. Remove woodruff key (14) from crankshaft (9).



TA708150

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean crankshaft and bearing caps with dry cleaning solvent and clean rags.

WARNING

Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

2. Flush oil passages of crankshaft with dry cleaning solvent and dry with compressed air.
3. Inspect crankshaft for scoring and overheating. Replace crankshaft if damaged.
4. Inspect crankshaft and journals for deep scratches and cracks. Replace crankshaft if damaged.
5. Inspect crankshaft keyway for damage and cracks. Replace crankshaft if keyway is damaged or cracked.
6. Inspect rear oil seal contact surface for deep scratches. Replace crankshaft if scratches cannot be smoothed with crocus cloth.
7. Using outside caliper micrometer, measure and note diameter of each crankshaft main bearing journal at several locations. Diameter must be 3.1230-3.1240 in. (7.9324-7.9350 cm). If measurement is not within specification, replace crankshaft.
8. Subtract the smallest measurement from the largest measurement taken in step 7. Difference between the two measurements is out-of-round. Out-of-round must be no larger than 0.0030 in. (0.0762 mm). If out-of-round is not within specification, replace crankshaft.
9. Using outside caliper micrometer, measure and note diameter at 1 in. (25.4 mm) intervals along length of journal beginning at one end of each crankshaft main bearing journal. Difference between each measurement is taper. Taper must be no larger than 0.0001 in. (0.0003 mm) per 1 in. (25.4 mm) of crankshaft main bearing journal.

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

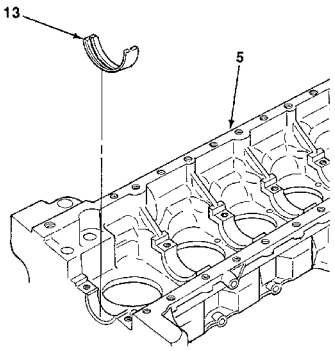
CAUTION

Upper main bearings and main bearing caps must be installed on engine block as noted during removal. Failure to do so may damage parts.

NOTE

Measurement of inside diameter of one main bearing is described in steps 10 through 18.

10. Position upper main bearing (13) on engine block (5). Ensure that tang on upper main bearing fits in locking groove on engine block.



TA708151

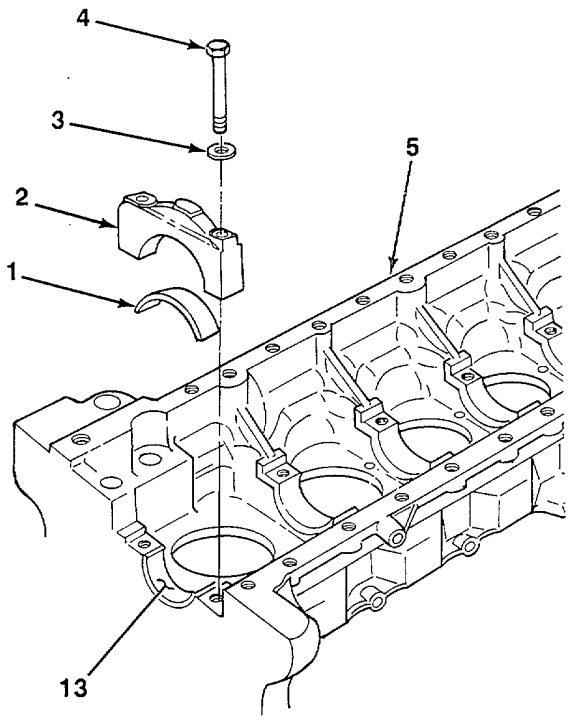
5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

11. Position lower main bearing (1) on main bearing cap (2). Ensure that tang on lower main bearing fits in locking groove on main bearing cap.

CAUTION

Main bearing caps and thrust bearing cap must be installed in correct numbered location with indicator arrow facing camshaft side of engine block.

12. Position main bearing cap (2) on engine block (5). Ensure that tangs on bearings fit in locking grooves on engine block.
13. Apply lubricating oil (Item 39, Appendix B) to threads of two screws (4). Install two washers (3) and screws on main bearing cap (2) and engine block (5). Torque screws to 85 lb.-ft. (115 N•m).
14. Using inside caliper micrometer, measure and note inside diameter of lower and upper main bearings (1 and 13). Diameter must be 3.125-3.127 in. (7.9387.943 cm).



15. Subtract largest crankshaft main bearing journal measurement taken in step 7 from measurement taken in step 14. Difference between the two measurements is clearance. Maximum clearance allowable is 0.006 in. (0.152 mm).

NOTE

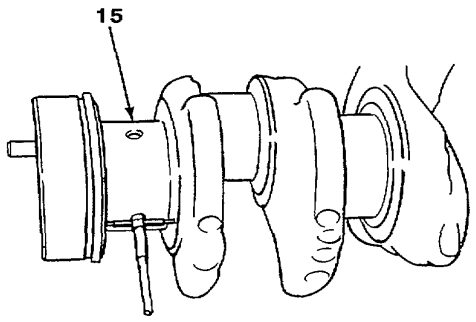
If one main or thrust bearing is replaced, all main and thrust bearings must be replaced.

16. If clearance is not within specification and mating main bearing journal is within specification, replace crankshaft and bearings.
17. Remove two screws (4), washers (3), and main bearing cap (2) from engine block (5). Remove lower main bearing (1) from main bearing cap.
18. Remove upper main bearing (13) from engine block (5).
19. Repeat steps 10 through 18 for remaining main bearings and thrust bearing.
20. If end play measurement taken in step 1 of subparagraph a is not within specification, replace crankshaft.

TA708152

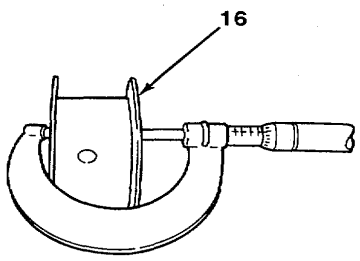
5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

21. Using inside caliper micrometer, measure width of thrust bearing journal (15).



22. Using outside caliper micrometer, measure width of thrust bearing (16).

23. Subtract measurement in step 22 from measurement taken in step 21. Difference between the two measurements is clearance. Maximum allowable clearance is 0.in. (0.381 mm).



TA708153

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

c. INSTALLATION

1. Install woodruff key (14) on crankshaft (9).
2. Heat spur gear (11) to 360°F (1820C) in accordance with TM 9-214.
3. Position spur gear (11) on crankshaft (9).
4. If removed, install dowel pin (12) on crankshaft (9) using stud remover and setter.
5. Position seven upper main and thrust bearings (13) on engine block (5). Ensure that tangs on bearings fit in locking grooves in engine block and oil holes in upper bearings line up with oil passages in engine block.
6. Apply lubricating oil (Item 39, Appendix B) to upper bearings (13) and crankshaft journals (10).

WARNING

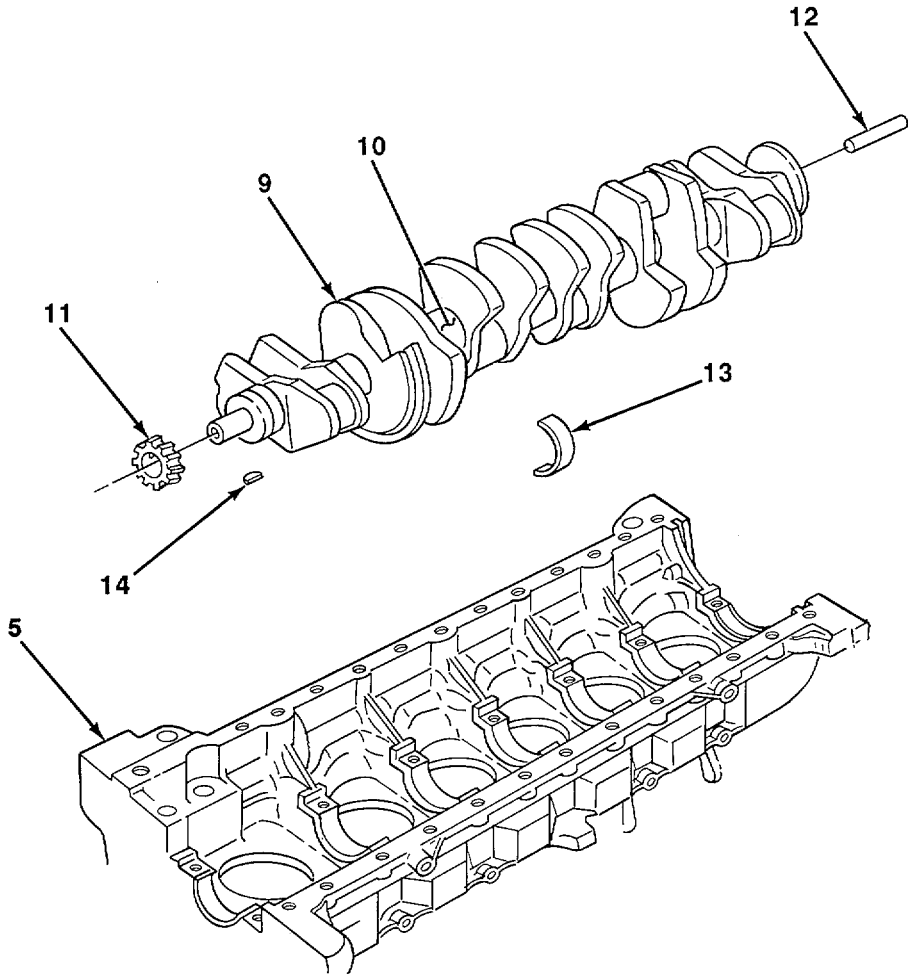
Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

CAUTION

- DO NOT install crankshaft by hand. Use a suitable lifting device or parts may be damaged.
- When installing crankshaft in engine block, ensure that crankshaft does not hit against engine block. Crankshaft hitting against engine block may damage parts.
- Ensure that bearing faces are not damaged when installing crankshaft.

7. Using a suitable lifting device, position crankshaft (9) in engine block (5).

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).



TA708154

5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

CAUTION

Main and thrust bearings and bearing caps must be installed as noted durina removal. Failure to do so may damage parts.

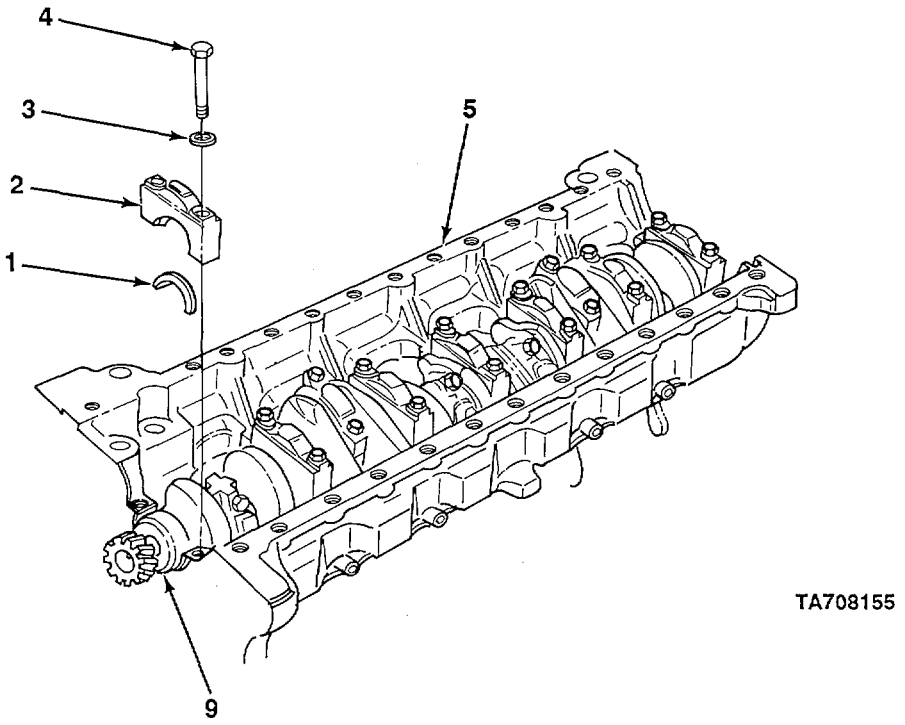
NOTE

Engine has six main bearing caps and one thrust bearing cap. All bearing caps are installed the same way. One main bearing cap is Illustrated.

8. Position lower main bearing (1) on main bearing cap (2). Ensure that tangs on lower main bearing fit in locking groove of main bearing cap and oil holes line up with oil passages. Coat parts with lubricating oil (Item 39, Appendix B).

9. Position main bearing cap (2) on engine block (5) and crankshaft (9).

10. Apply lubricating oil (Item 39, Appendix B) to threads of two screws (4).



5-4. ENGINE MAIN BEARINGS, THRUST BEARING, AND CRANKSHAFT REPLACEMENT (Con't).

11. Install two washers (3) and screws (4) on main bearing cap (2) and engine block (5).

12. Repeat steps 8 through 11 for remaining main bearing caps (2) and thrust bearing cap.

13. Using hammer and wood block, tap crankshaft (9) to rear of engine block (5). Aline front flanges of upper and lower main and thrust bearings.

14. Using hammer and wood block, tap crankshaft (9) to front of engine block (5). Aline rear flanges of upper and lower main and thrust bearings.

15. Torque screws (4) to 85 lb.-ft. (115 N.m).

FOLLOW-ON TASKS:

- Install flywheel housing (see paragraph 4-10).
- Install pistons and connecting rods (see paragraph 5-3).
- Install cylinder block front plate (see paragraph 5-6).

5-5. CAMSHAFT REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Fuel transfer pump removed (see TM 10-3930-659-20).
- Engine rocker arm assembly and pushrods removed (see paragraph 4-12).
- Engine front cover removed (see paragraph 4-14).
- Tappets removed (see paragraph 4-13).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Inside caliper micrometer (Item 8, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Flywheel turning tool (Item 25, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Arbor press (Item 47, Appendix E)
- Gear timing tool (Item 70, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:
- Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)

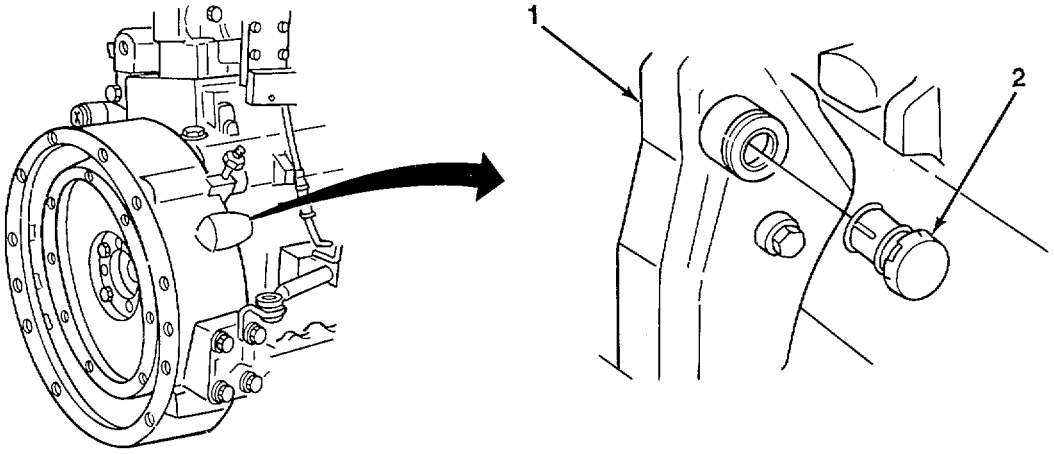
Personnel Required: Two

References:
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. REMOVAL

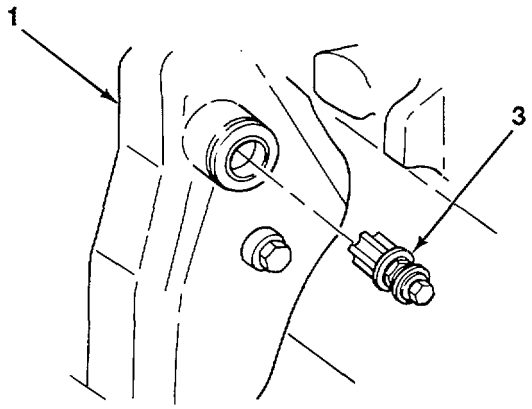
1. Remove plug (2) from engine (1).



TA708156

5-5. CAMSHAFT REPLACEMENT (Con't).

2. Install flywheel turning tool (3) on engine (1).



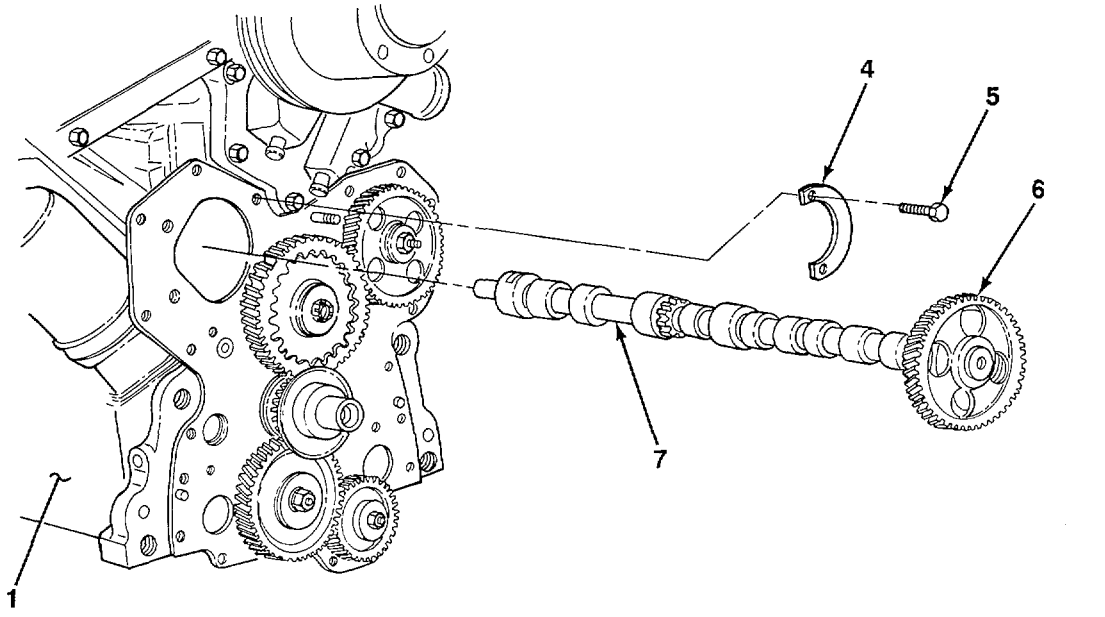
3. Using flywheel turning tool (3), rotate flywheel until two screws (5) are visible through holes in camshaft gear (6).

4. Remove two screws (5) from engine block (1).

CAUTION

DO NOT allow camshaft lobes to drag on bearing bore surfaces in engine block while removing camshaft. Failure to follow this warning may result in damage to bearing bore.

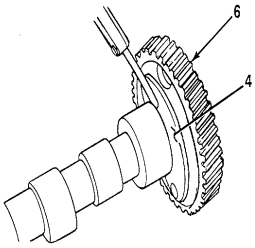
5. Remove camshaft (7) and thrust plate (4) from engine block (1).



TA708157

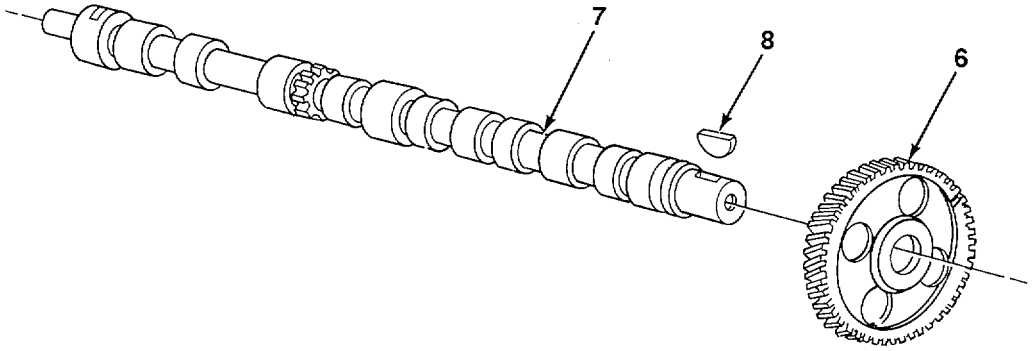
5-5. CAMSHAFT REPLACEMENT (Con't).

6. Using feeler gage, measure clearance between camshaft gear (6) and thrust plate (4). Clearance should be 0.003-0.009 in. (0.076-0.229 mm). If clearance is not within specification, replace thrust plate.



7. Using arbor press, remove camshaft gear (6) from camshaft (7).

8. Remove woodruff key (8) from camshaft (7).



TA708158

b. CLEANING AND INSPECTION I

WARNING

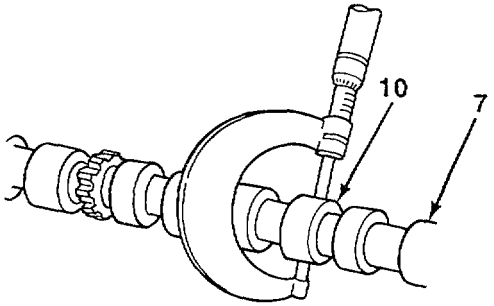
Dry cleaning solvent, P-D-680, is toxicand flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

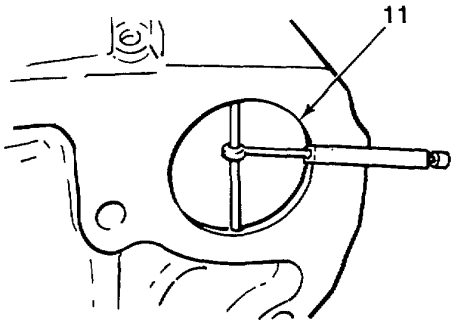
1. Clean parts with dry cleaning solvent and dry thoroughly with clean rags.

2. Inspect all parts for cracks, bends, and breaks. Replace damaged parts.

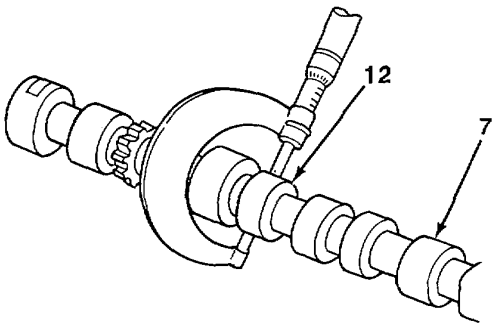
5-5. CAMSHAFT REPLACEMENT (Con't).

3. Using outside caliper micrometer, measure and note outside diameter of each bearing journal (10). Measurement must be 2.200-2.201 in. (5.588-5.591 cm). If bearing journal diameter is less than 2.199 in. (5.585 cm), replace camshaft (7).
4. Using inside caliper micrometer, measure and note inside diameter of bearing bore (11).
5. Subtract measurement taken in step 4 from measurement taken in step 3. Measurement must be 0.004-0.006 in. (0.102-0.152 mm). If measurement is greater than 0.007 in. (0.178 mm), replace camshaft (7).





6. Using outside caliper micrometer, measure and note outside diameter of each camshaft lobe (12) at highest and lowest points. Subtract lowest measurement from highest measurement to find camshaft lobe height. Camshaft lobe height must be 0.266-0.286 in. (6.756-7.264 mm). If measurement is not within specification, replace camshaft (7).

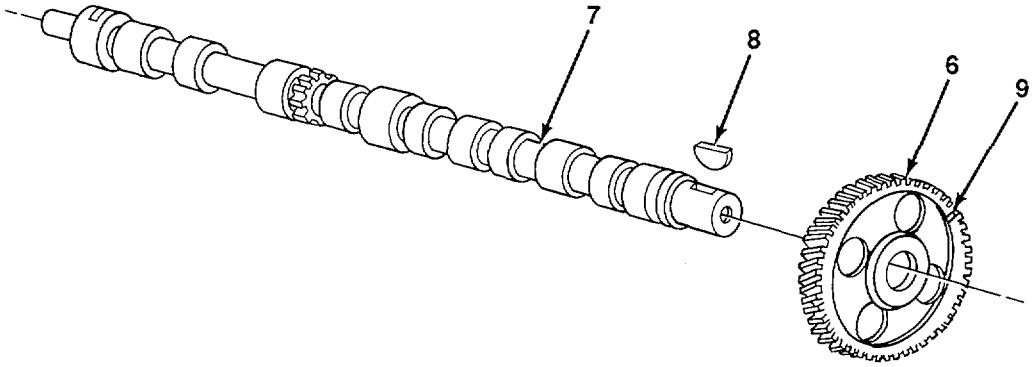


5-5. CAMSHAFT REPLACEMENT (Con't).

c. INSTALLATION

1. Install new woodruff key (8) on camshaft (7).

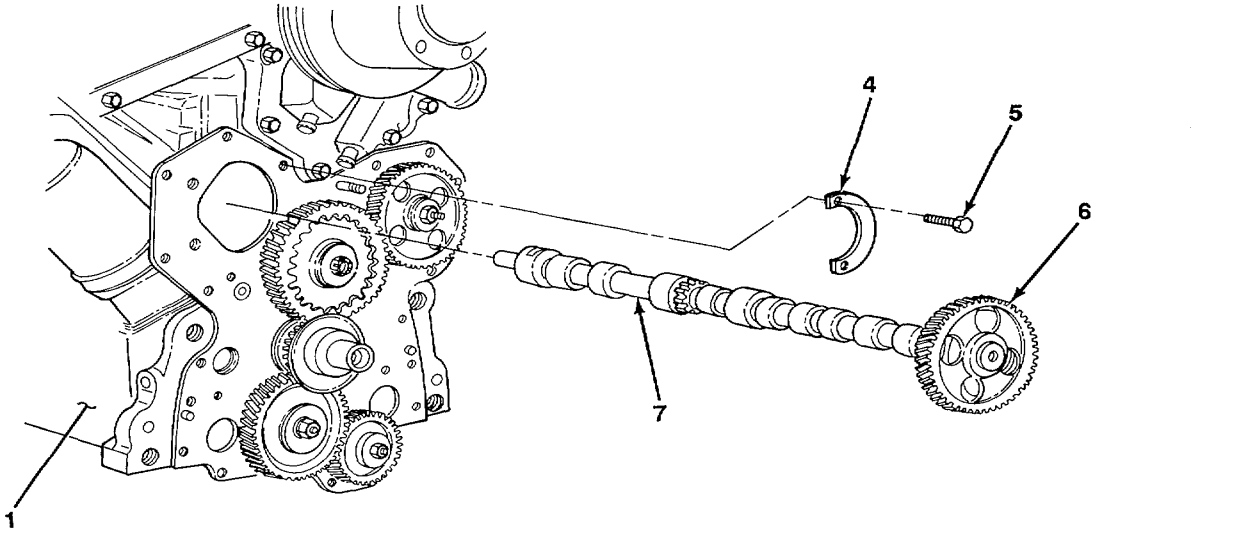
2. Install camshaft gear (6) on camshaft (7) with timing mark (9) facing away from camshaft until camshaft gear is flush with camshaft shoulder.



CAUTION

DO NOT allow camshaft lobes to drag on bearing surfaces in engine block while installing camshaft. Failure to follow this warning may result in damage to bearing bore.

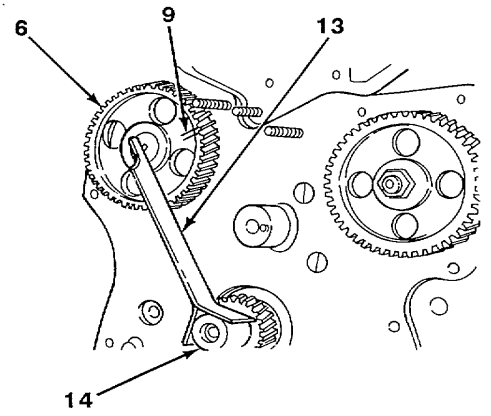
3. Apply a light coat of lubricating oil to camshaft (7).
4. Install thrust plate (4) and camshaft (7) on engine block (1) with two screws (5). Torque screws to 35 lb.-ft. (47 Nom).

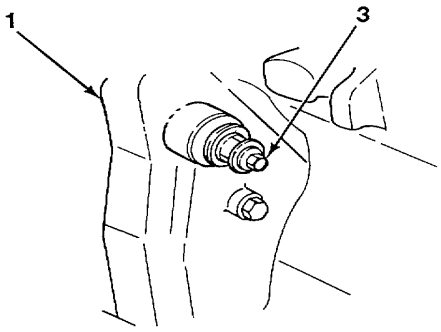


TA708160

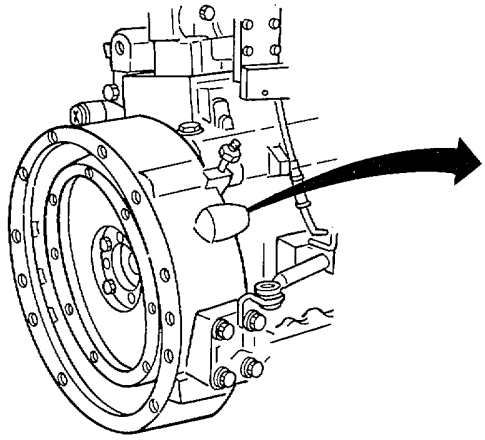
5-5. CAMSHAFT REPLACEMENT (Con't).

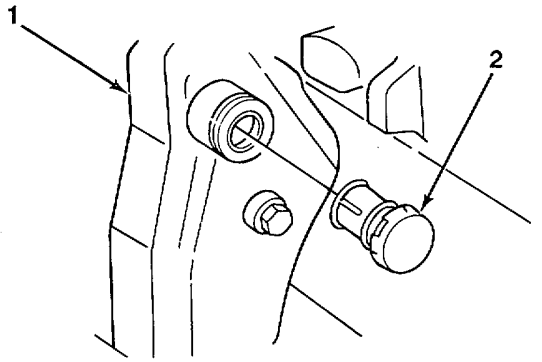
5. Position gear timing tool (13) on crankshaft (14) and over camshaft gear (6).
6. Using flywheel turning tool (3), rotate flywheel until camshaft timing mark (9) is under gear timing tool (13).
7. Remove flywheel turning tool (3) from engine (1).





8. Install plug (2) on engine (1).





FOLLOW-ON TASKS:

- Install tappets (see paragraph 4-13).
- Install engine front cover (see paragraph 4-14).
- Install engine rocker arm assembly and pushrods (see paragraph 4-12).
- Install fuel transfer pump (see TM 10-3930-659-20).

5-6. CYLINDER BLOCK FRONT PLATE REPLACEMENT.

This Task Covers:

a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:

- Idler gears removed (see paragraph 4-8).
- Engine oil pump and drive gear removed (see paragraph 4-19).
- Fuel injection pump and drive gear removed (see paragraph 4-24).
- Camshaft removed (see paragraph 5-5).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

Materials/Parts:

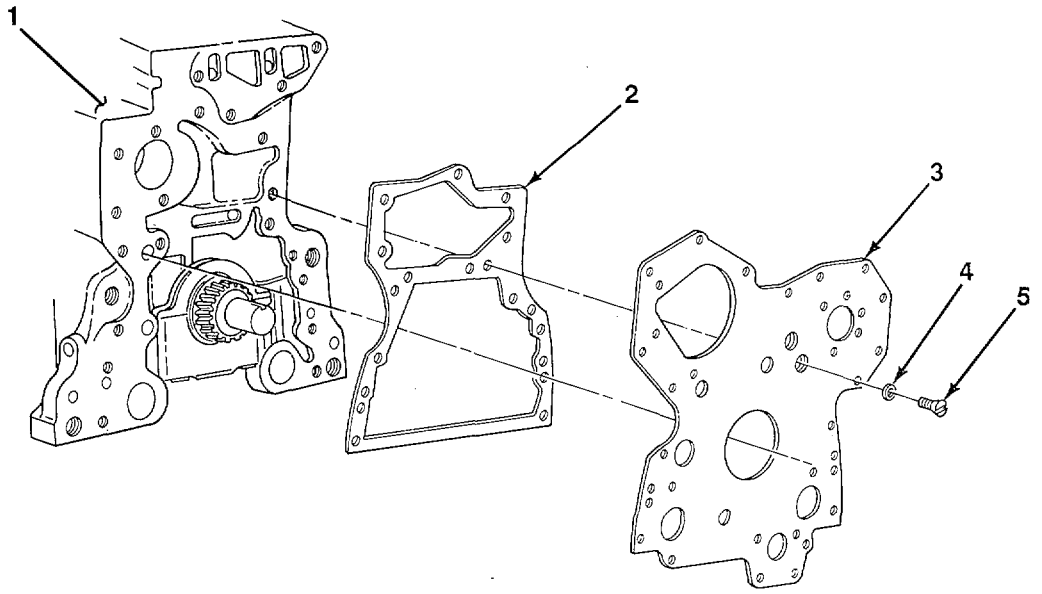
- Loctite adhesive (Item 2, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One gasket
- Five lockwashers

General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. REMOVAL

Remove five screws (5), lockwashers (4), cylinder block front plate (3), and gasket (2) from cylinder block (1). Discard lockwashers and gasket.



TA708162

5-6. CYLINDER BLOCK FRONT PLATE REPLACEMENT (Con't).

b. CLEANING AND INSPECTION I

WARNING

- **Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 1000F-1380F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.**

- **Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.**

Clean cylinder block front plate and cylinder block with dry cleaning solvent and dry with compressed air. Remove any remaining gasket material from cylinder block front plate and cylinder block.

c. INSTALLATION I

1. Apply a light coat of Loctite adhesive to cylinder block side of new gasket (2).

2. Install new gasket (2) and cylinder block front plate (3) on cylinder block (1) with five new lockwashers (4) and screws (5). Torque screws to 25 lb.-ft. (34 N-m).

FOLLOW-ON TASKS:

- Install camshaft (see paragraph 5-5).
- Install fuel injection pump and drive gear (see paragraph 4-24).
- Install engine oil pump and drive gear (see paragraph 4-19).
- Install idler gears (see paragraph 4-8).

5-7. OIL FILTER BYPASS VALVE REPLACEMENT.

This Task Covers:

a. Removal

b. Installation

Initial Setup:

Equipment Conditions:

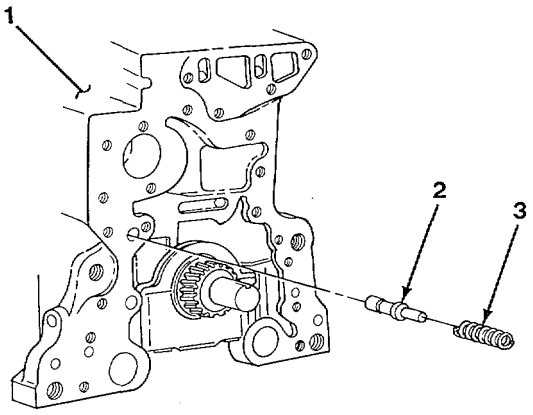
- Cylinder block front plate removed (see paragraph 5-6).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)

a. REMOVAL

Remove spring (3) and oil filter bypass valve (2) from cylinder block (1).



b. INSTALLATION

Install oil filter bypass valve (2) and spring (3) in cylinder block (1).

FOLLOW-ON TASKS:

- Install cylinder block front plate (see paragraph 5-6).

Section II. TURBOCHARGER MAINTENANCE

5-8. TURBOCHARGER TEST AND REPAIR.

This Task Covers:

a. Bearing Clearance and End Play Test
b. Disassembly
c. Assembly

Initial Setup:

Equipment Conditions:
- Turbocharger removed (see paragraph 4-25).

Tools/Test Equipment:
- One preformed packing
- General mechanic's tool kit (Item 71, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Machinist's vise (Item 76, Appendix E)
- Torque wrench, 0-300 Ib.-in. (Item 80, Appendix E)
- Turbocharger turbine wheel holding fixture (Figure C-3, Appendix C)

Materials/Parts:
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One locknut

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa).

a. BEARING CLEARANCE AND END PLAY TEST I

WARNING

- Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

- Compressed air used for cleaning or drying purposes, or for clearing restrictions, should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

5-8. TURBOCHARGER TEST AND REPAIR (Con't).

CAUTION

DO NOT spray dry cleaning solvent directly into compressor or turbine housing. Direct spray may damage parts.

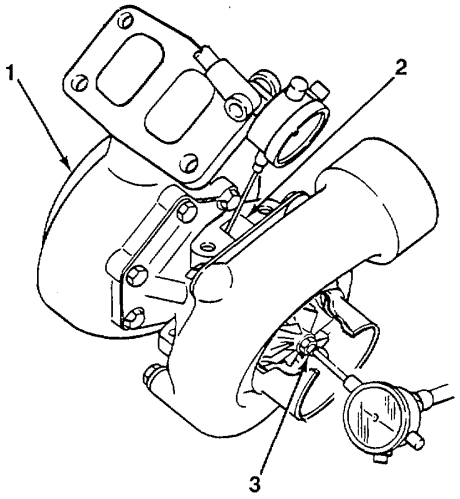
1. Clean exterior of turbocharger (1) with dry cleaning solvent. Dry thoroughly with compressed air.

2. Using dial indicator set, position indicator tip through center housing oil return (2) until it contacts wheel and shaft assembly (3). Zero dial indicator.

3. Hold wheel and shaft assembly (3) at both ends, and move up and down with equal pressure. Ensure that rotation is in same direction as dial indicator tip travels. Maximum allowable bearing clearance is 0.006 in. (0.152 mm).

4. Remove dial indicator from center housing oil return (2) and position so indicator tip rests on end of wheel and shaft assembly (3). Zero dial indicator.

5. Move wheel and shaft assembly (3) back and forth. Maximum allowable end play is 0.004 in. (0.102 mm).

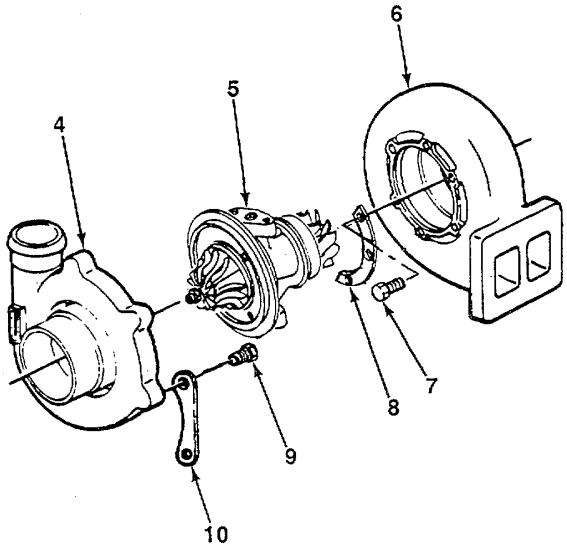


b. DISASSEMBLY

1. Mark turbine housing (6), compressor housing (4), and center housing (5) to aid during assembly.

2. Remove six screws (9), three lockplates (10), and compressor housing (4) from center housing (5).

3. Remove six screws (7), two lockplates (8), and center housing (5) from turbine housing (6).



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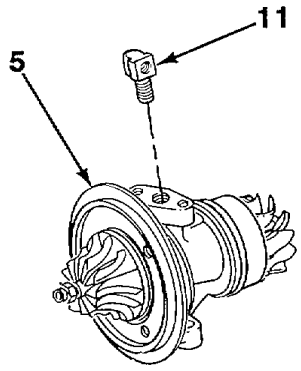
5-8. TURBOCHARGER TEST AND REPAIR (Con't).

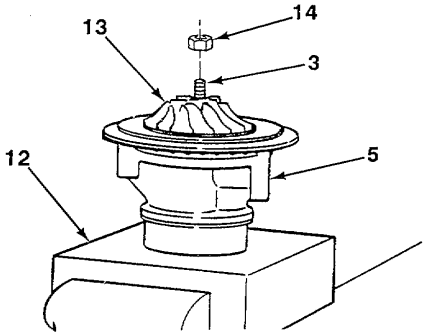
4. Remove elbow (11) from center housing (5).

5. Clamp turbocharger turbine wheel holding fixture (12) in vise. Install center housing (5) and wheel and shaft assembly (3) in holding fixture.

6. Remove locknut (14) and impeller (13) from wheel and shaft assembly (3). Discard locknut.

7. Remove center housing (5) from turbocharger turbine wheel holding fixture (12).



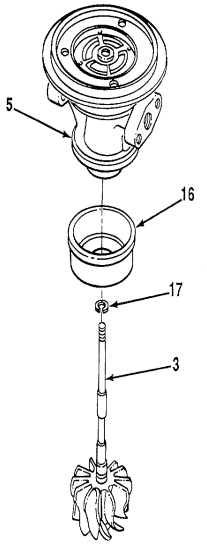


CAUTION

Use care to keep wheel and shaft assembly centered in thrust bearing when removing wheel and shaft assembly from center housing. Damage to parts may occur.

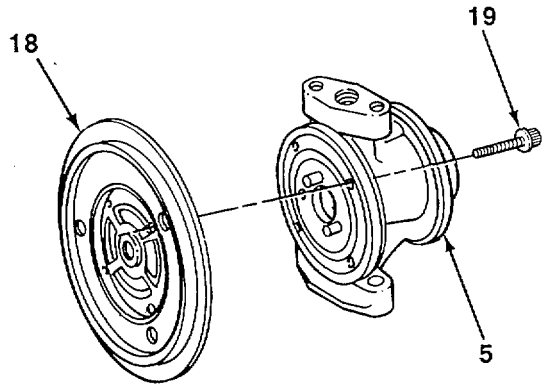
8. Remove wheel and shaft assembly (3) from center housing (5).

9. Remove piston ring (17) and wheel shroud (16) from wheel and shaft assembly (3).



5-8. TURBOCHARGER TEST AND REPAIR (Con't).

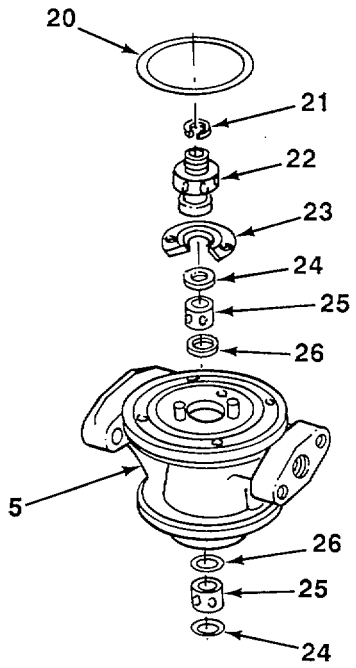
10. Remove four screws (19) and back plate assembly (18) from center housing (5).



11. Remove preformed packing (20) from center housing (5). Discard preformed packing.

12. Remove piston ring (21), thrust collar (22), and thrust bearing (23) from center housing (5).

13. Remove two outer retaining rings (24), bearings (25), and inner retaining rings (26) from center housing (5).



c. ASSEMBLY

1. Install two inner retaining rings (26), bearings (25), and outer retaining rings (24) in center housing (5).

2. Install thrust bearing (23) and thrust collar (22) in center housing (5) with piston ring (21).

3. Install new preformed packing (20) on center housing (5).

5-8. TURBOCHARGER TEST AND REPAIR (Con't).

4. Install back plate assembly (18) on center housing (5) with four screws (19).

5. Install wheel shroud (16) and piston ring (17) on wheel and shaft assembly (3).

CAUTION

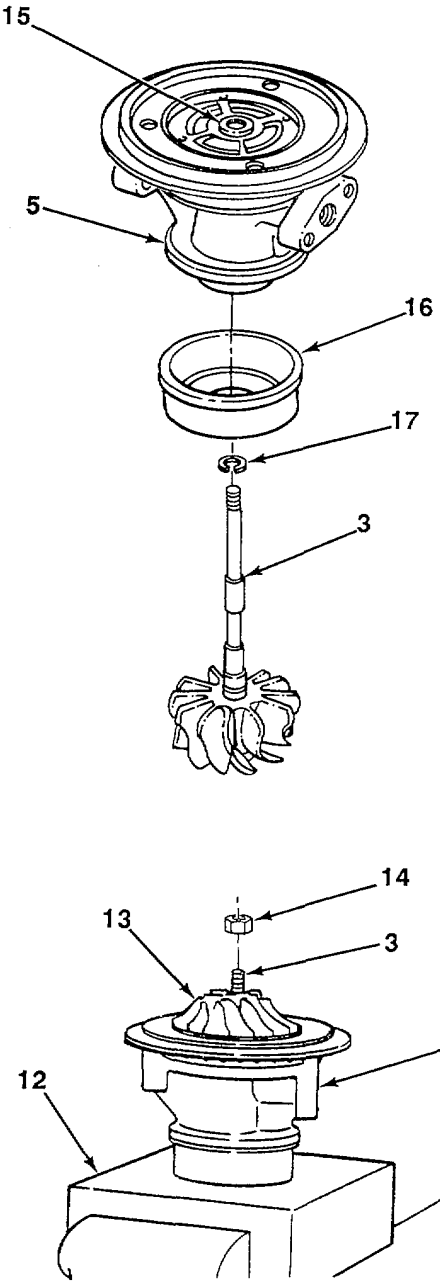
Use care when installing wheel and shaft assembly in center housing not to damage bearings installed in center housing. Improper installation can damage turbocharger assembly or bearings.

6. Install wheel and shaft assembly (3) on center housing (5) and thrust bearing (15).

7. Clamp turbocharger turbine wheel holding fixture (12) in vise. Install center housing (5) and wheel and shaft assembly (3) in holding fixture.

8. Install impeller (13) on wheel and shaft assembly (3) with new locknut (14).

9. Remove center housing (5) from turbocharger turbine wheel holding fixture (12).



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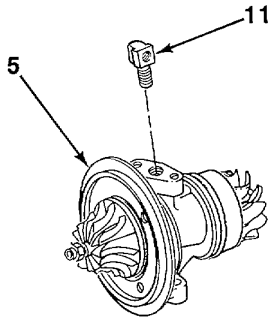
5-8. TURBOCHARGER TEST AND REPAIR (Con't).

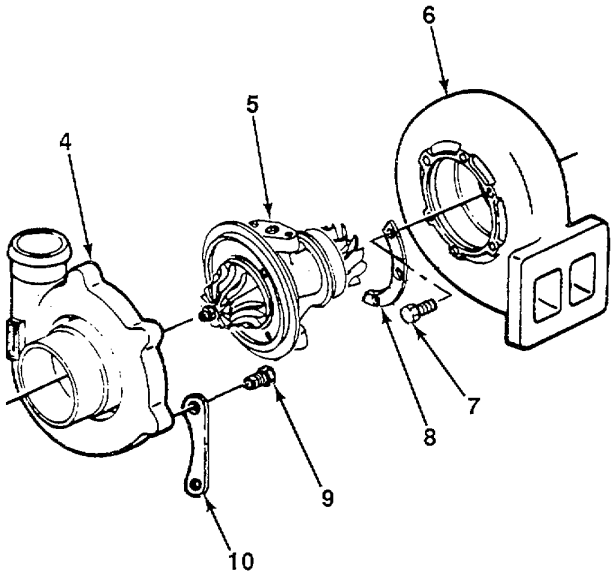
10. Install elbow (11) in center housing (5).



11. Install center housing (5) on turbine housing (6) with two lockplates (8) and six screws (7). Torque screws to 120 lb.-in. (14 N.m).

12. Install compressor housing (4) on center housing (5) with three lockplates (10) and six screws (9). Torque screws to 60 lb.in. (7 N.m).

13. Check bearing clearance and end play (see subparagraph a).



FOLLOW-ON TASKS:

- Install turbocharger (see paragraph 4-25).

Section III. TRANSMISSION MAINTENANCE

5-9. TRANSMISSION CONTROL VALVE MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Equipment Conditions:

- Neutral start switch removed (see TM 10-3930-659-20).
- Reverse warning alarm switch removed (see TM 10-3930-659-20).
- Low brake pressure switch removed (see TM 10-3930-659-20).
- Transmission assembly removed (see paragraph 4-40).

Tools/Test Equipment:

- General mechanic's tool kit (Item 71, Appendix E)

General Safety Instructions:

- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

Materials/Parts:

- Lubricating oil (Item 38, Appendix B)
- Petrolatum (Item 42, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Two shaft seals
- Four gaskets
- Four retaining rings
- Nine preformed packings

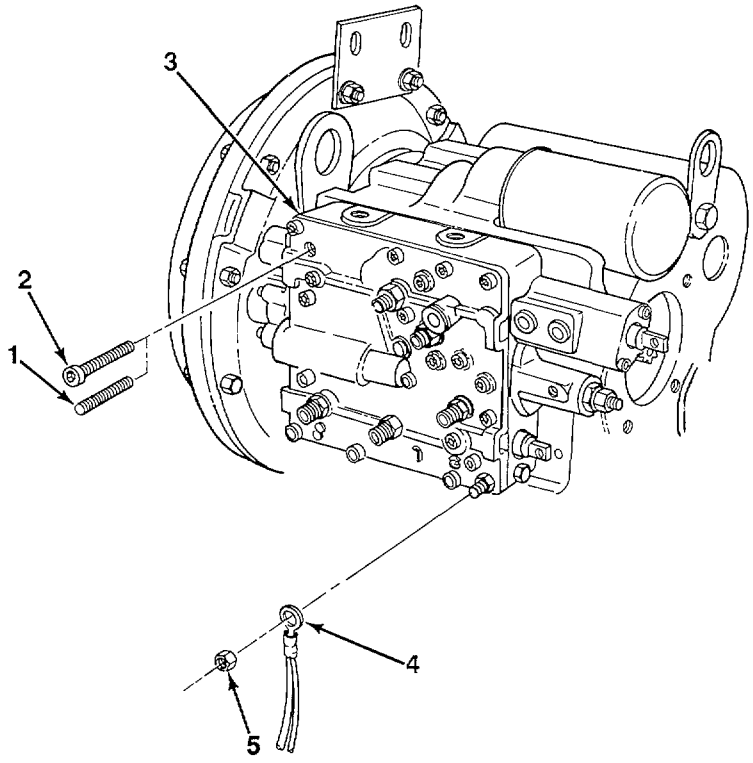
References:

- TM 10-3930-659-10
- TM 10-3930-659-20

5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

a. REMOVAL

1. Remove nut (5) and ground terminal lead (4) from transmission control valve (3).
2. Remove screw (2) from transmission control valve (3).
3. Cut head off 8 m x 80 mm screw (1) and install in location of screw (2).



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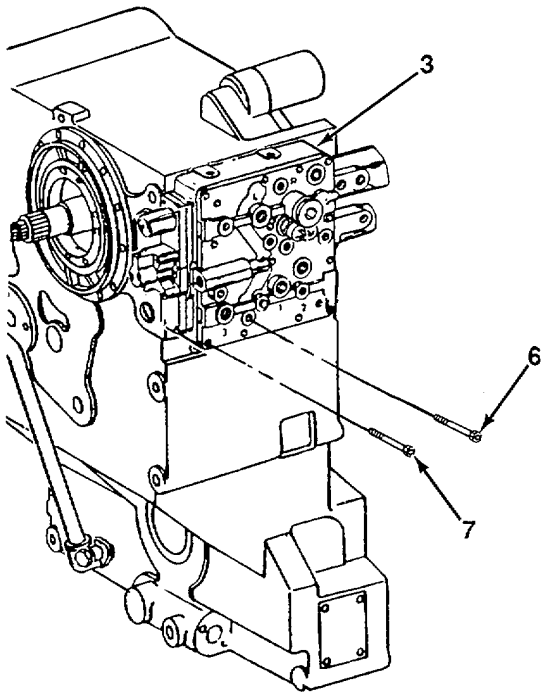
5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

4. Remove screw (7) and 12 screws (6) from transmission control valve (3).



5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

CAUTION

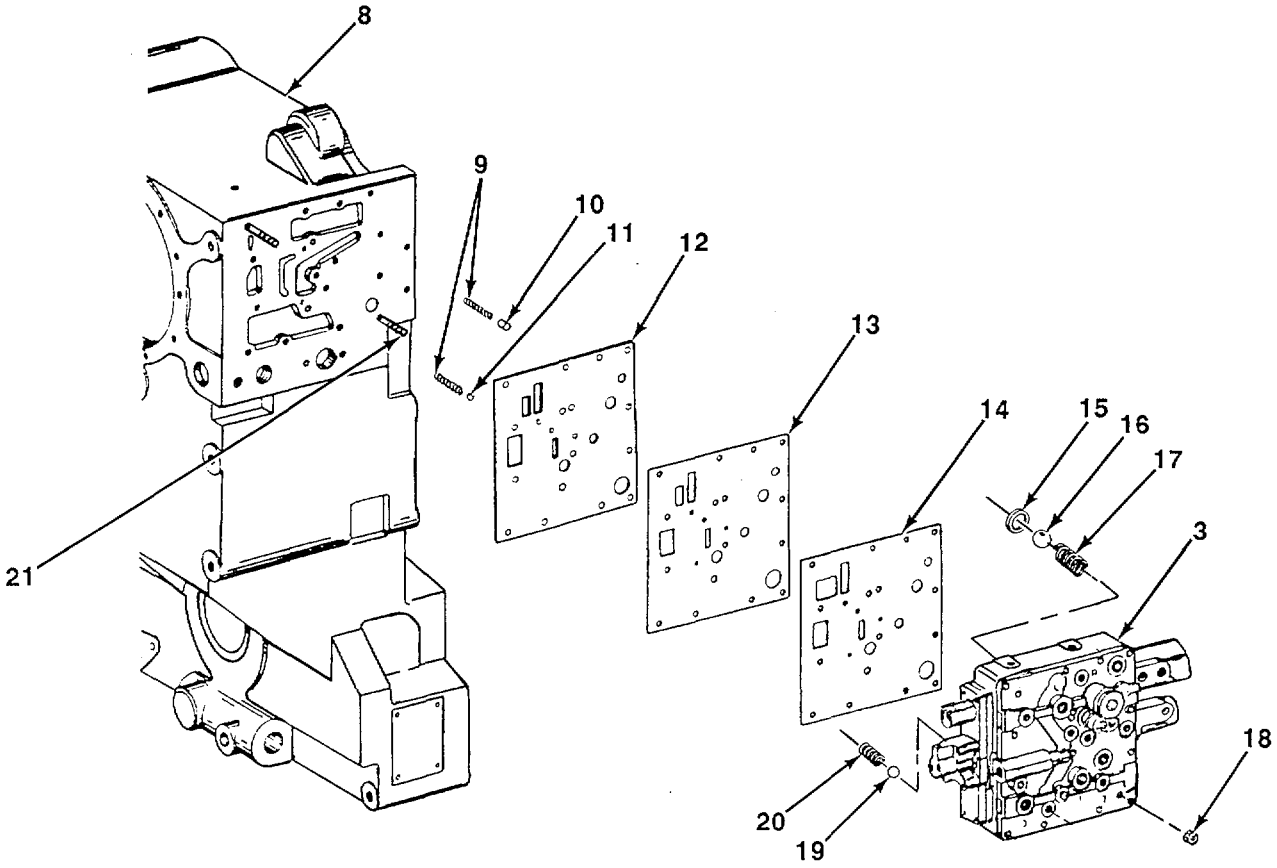
Use care when removing transmission control valve from transmission assembly. Springs, detent ball, and detent pin may fall out of transmission assembly, damaging parts.

5. Remove nut (18), transmission control valve (3), gasket (14), plate (13), and gasket (12) from transmission assembly (8). Discard gaskets.

6. Remove spring (20), detent ball (19), ring (15), check valve ball (16), and spring (17) from transmission control valve (3).

7. Remove detent pin (10), detent ball (11), and two springs (9) from transmission assembly (8).

8. If damaged, remove threaded stud (21) from transmission assembly (8).



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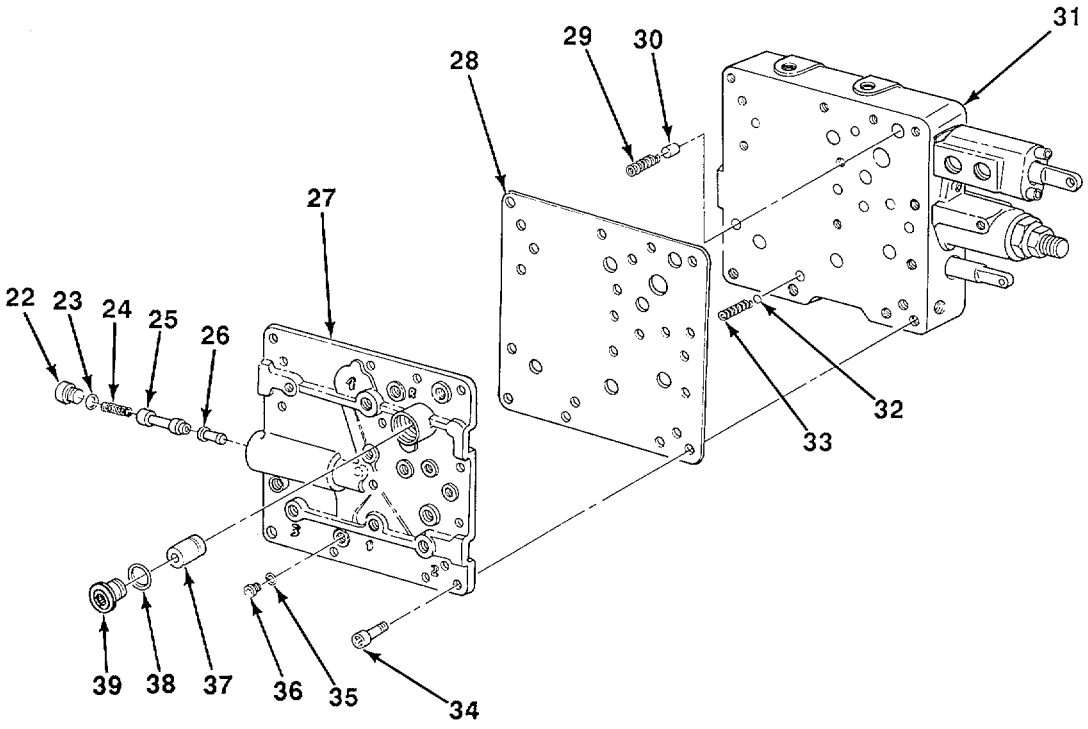
5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

b. DISASSEMBLY

CAUTION

Use care when separating plate from valve block. Springs, detent ball, and detent pin may be loose and could fall out of valve block, damaging parts.

1. Remove two screws (34), plate (27), and gasket (28) from valve block (31). Discard gasket.
2. Remove spring (29), detent pin (30), spring (33), and detent ball (32) from valve block (31).
3. Remove drain plug (39) and filter element (37) from plate (27).
4. Remove preformed packing (38) from drain plug (39). Discard preformed packing.
5. Remove screw plug (36) and preformed packing (35) from plate (27). Discard preformed packing.
6. Remove screw plug (22), spring (24), and two pistons (25 and 26) from plate (27).
7. Remove preformed packing (23) from screw plug (22). Discard preformed packing.



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5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

CAUTION

Cover is under spring tension. Use care when removing cover from valve block not to damage parts.

8. Remove four short screws (56), long screws (57), cover (40), and gasket (41) from valve block (31). Discard gasket.

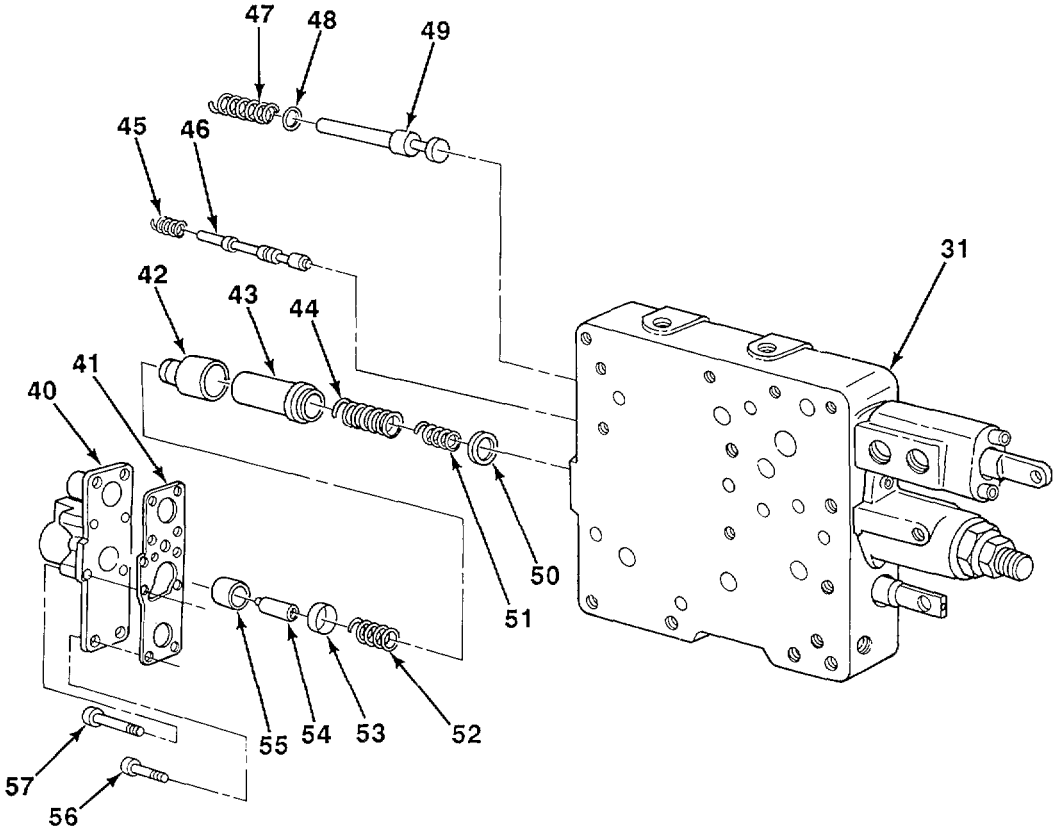
NOTE

Note the number and thickness of washers when removing to aid during assembly.

9. Remove spring (47), washer (48), and piston (49) from valve block (31).

10. Remove spring (45) and piston (46) from valve block (31).

11. Remove piston (55), needle roller (54), bushing (53), spring (52), bushing (42), piston (43), two springs (44 and 51), and washer (50) from valve block (31).



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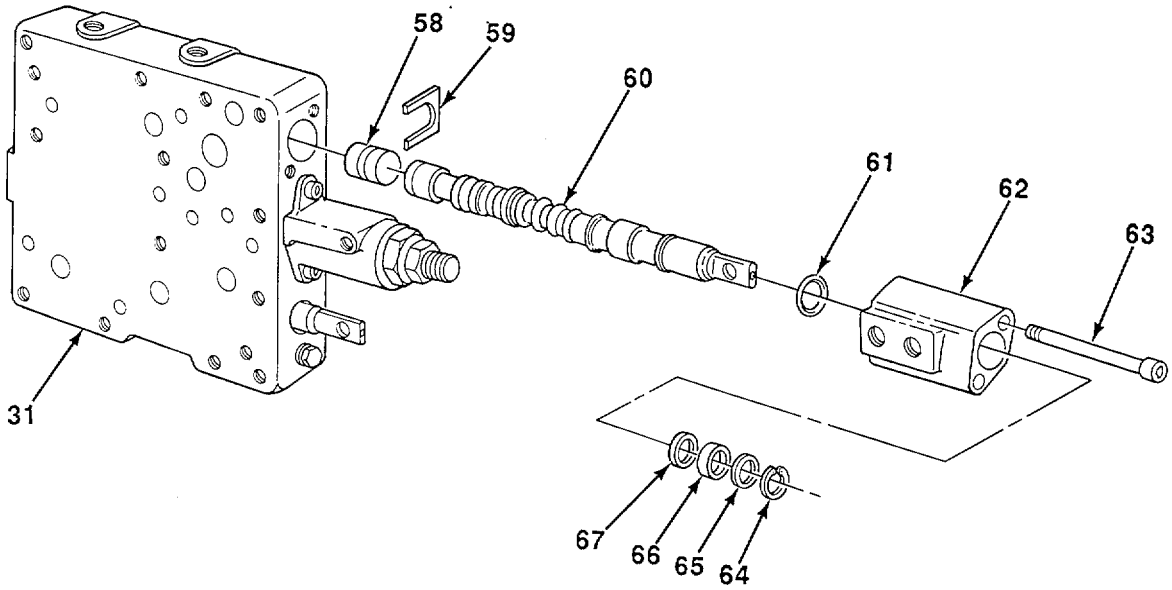
5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

12. Remove two screws (63) and cover (62) from valve block (31).

13. Remove preformed packing (61) from cover (62). Discard preformed packing.

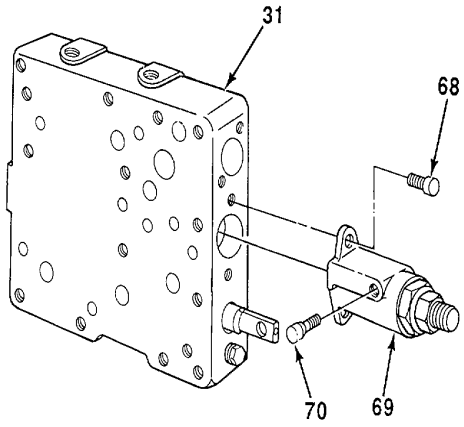
14. Remove retaining ring (64), washer (65), shaft seal (66), and washer (67) from cover (62). Discard retaining ring and shaft seal.

15. Remove clip (59) from piston (58) and valve block (31), and remove spool (60) and piston from valve block.



16. Remove two screws (68) and clutch cutoff valve (69) from valve block (31).

17. Remove breather (70) from clutch cutoff valve (69)



TA708252

5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

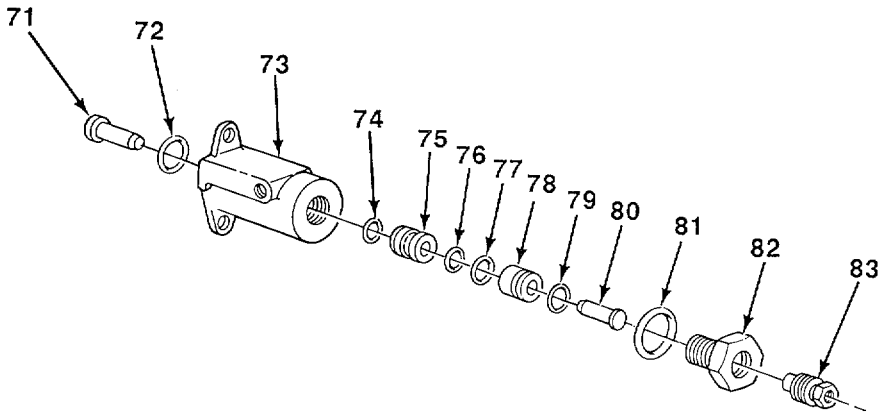
18. Remove piston (71) and preformed packing (72) from cylinder (73). Discard preformed packing.

19. Remove pilot orifice (83), vent plug (82), and piston (80) from cylinder (73).

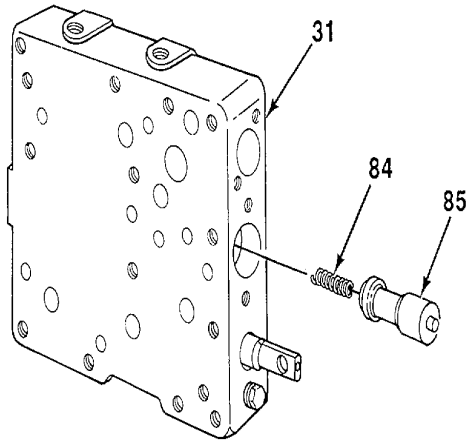
20. Remove preformed packing (81) from vent plug (82). Discard preformed packing.

21. Remove retaining ring (79), guide ring (78), preformed packing (77), and bushing (75) from cylinder (73). Discard retaining ring and preformed packing.

22. Remove two preformed packings (74 and 76) from bushing (75). Discard preformed packings.



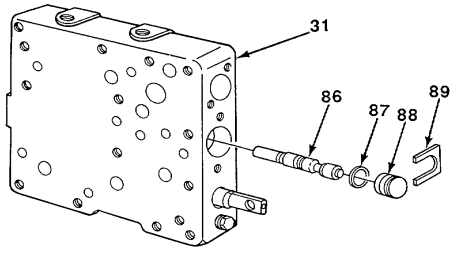
23. Remove piston (85) and spring (84) from valve block (31).



5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

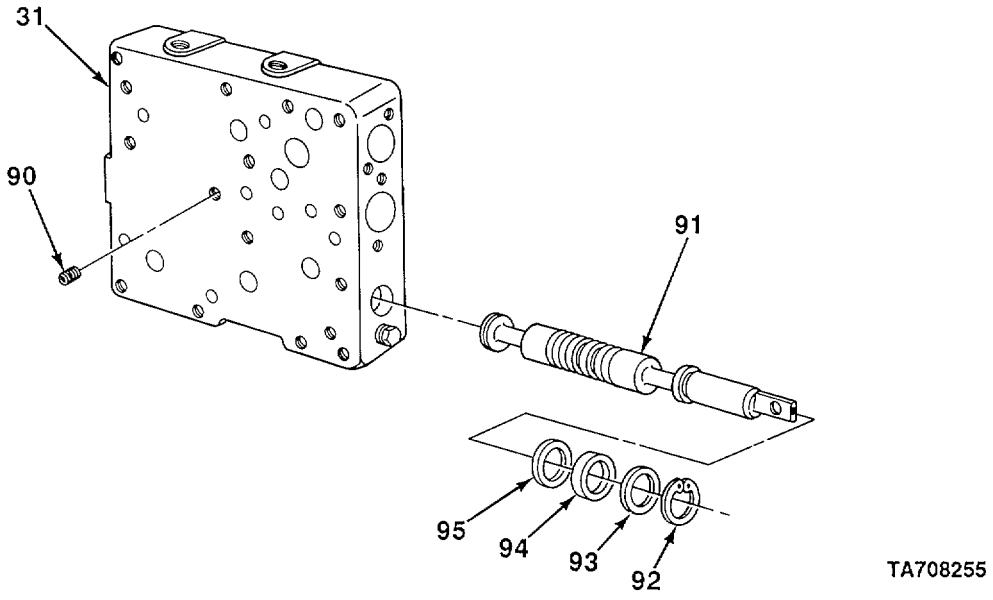
24. Remove clip (89) and piston (88) from valve block (31).

25. Remove retaining ring (87) and piston (86) from valve block (31). Discard retaining ring.



26. Remove retaining ring (92), washer (93), shaft seal (94), washer (95), and gearshaft valve (91) from valve block (31). Discard retaining ring and shaft seal.

27. Remove orifice (90) from valve block (31).



5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean all parts with dry cleaning solvent and dry with clean rags.

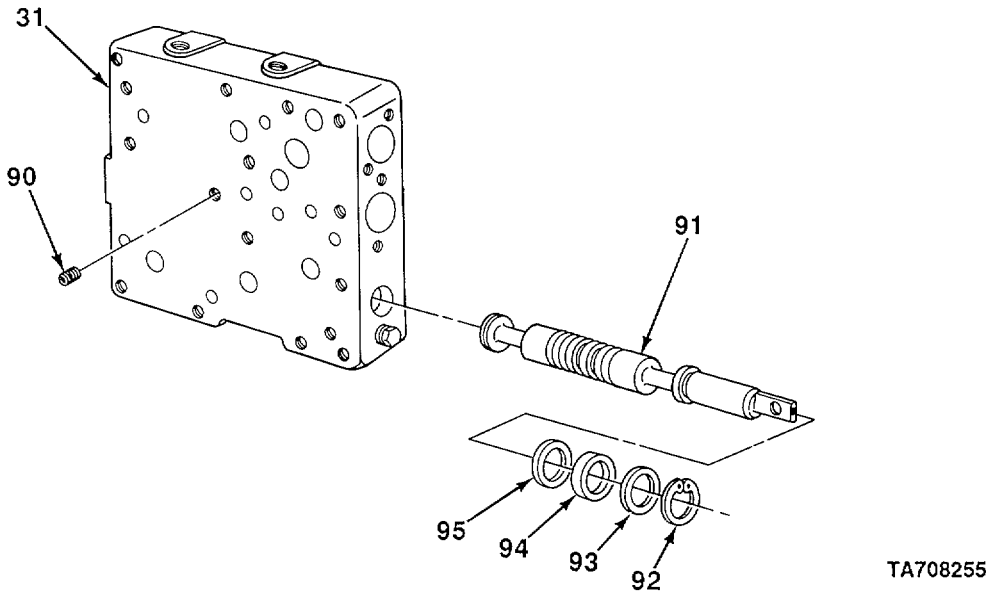
2. Inspect metal parts for cracks and breaks. Replace damaged parts.

d. ASSEMBLY

1. Install orifice (90) on valve block (31).

2. Apply a light coat of lubricating oil to gearshaft valve (91).

3. Position gearshaft valve (91) in valve block (31) and install washer (95), new shaft seal (94), washer (93), and new retaining ring (92).



5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

4. Apply a light coat of lubricating oil to piston (86).

5. Install piston (86) in valve block (31) with new retaining ring (87).

6. Apply a light coat of lubricating oil to piston (88).

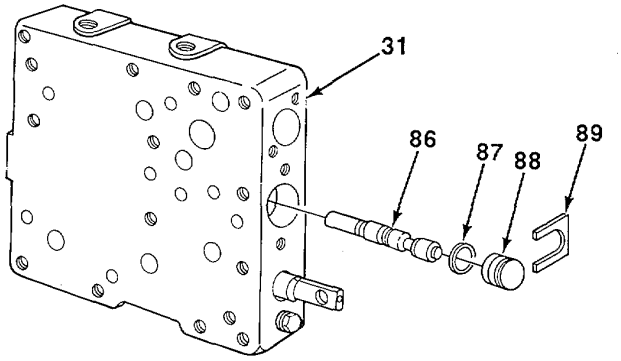
CAUTION

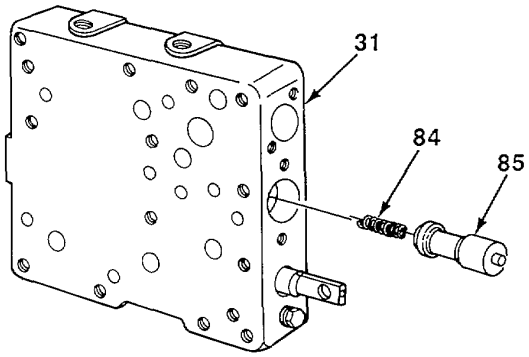
Ensure that clip is installed in groove of piston and in slot inside the face of valve block. Con- trol or function of clutch will fail to operate if clip is improperly installed.

7. Install piston (88) in valve block (31) with clip (89).

8. Apply a light coat of lubricating oil to piston (85) and spring (84).

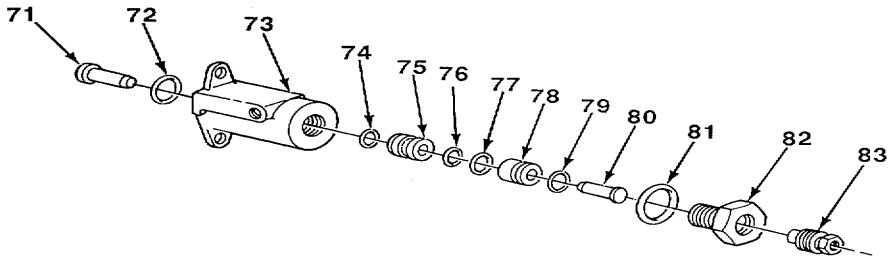
9. Install spring (84) and piston (85) in valve block (31).



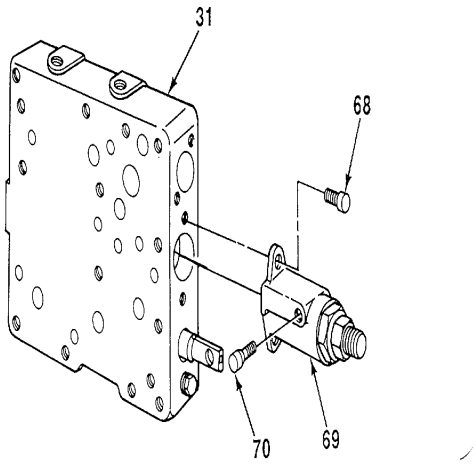


5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

10. Install two new preformed packings (74 and 76) on bushing (75).
11. Install new preformed packing (77) on guide ring (78).
12. Install bushing (75) and guide ring (78) on cylinder (73) with new retaining ring (79).
13. Install new preformed packing (81) on vent plug (82).
14. Install piston (80), vent plug (82), and pilot orifice (83) on cylinder (73).
15. Install new preformed packing (72) and piston (71) on cylinder (73).



16. Install breather (70) on clutch cutoff valve (69).
17. Install clutch cutoff valve (69) on valve block (31) with two screws (68).



5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

18. Apply a light coat of lubricating oil to piston (58) and valve block (31) bore.

CAUTION

Ensure that clip is installed in groove of piston and In slot inside the face of valve block. Shift control of clutch will fall to operate if clip Is Improperly Installed.

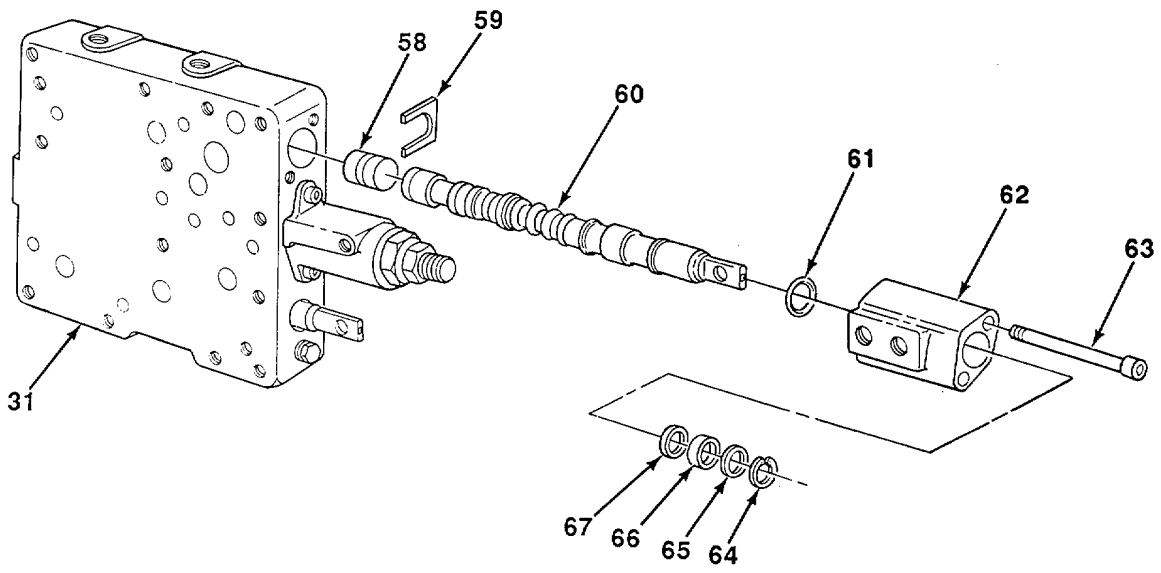
19. Install piston (58) in valve block (31) with clip (59).

20. Install spool (60) in valve block (31).

21. Install washer (67) tight against inside of cover (62).

22. Install new shaft seal (66), washer (65), and new retaining ring (64) on cover (62).

23. Install new preformed packing (61) and cover (62) on valve block (31) with two screws (63).



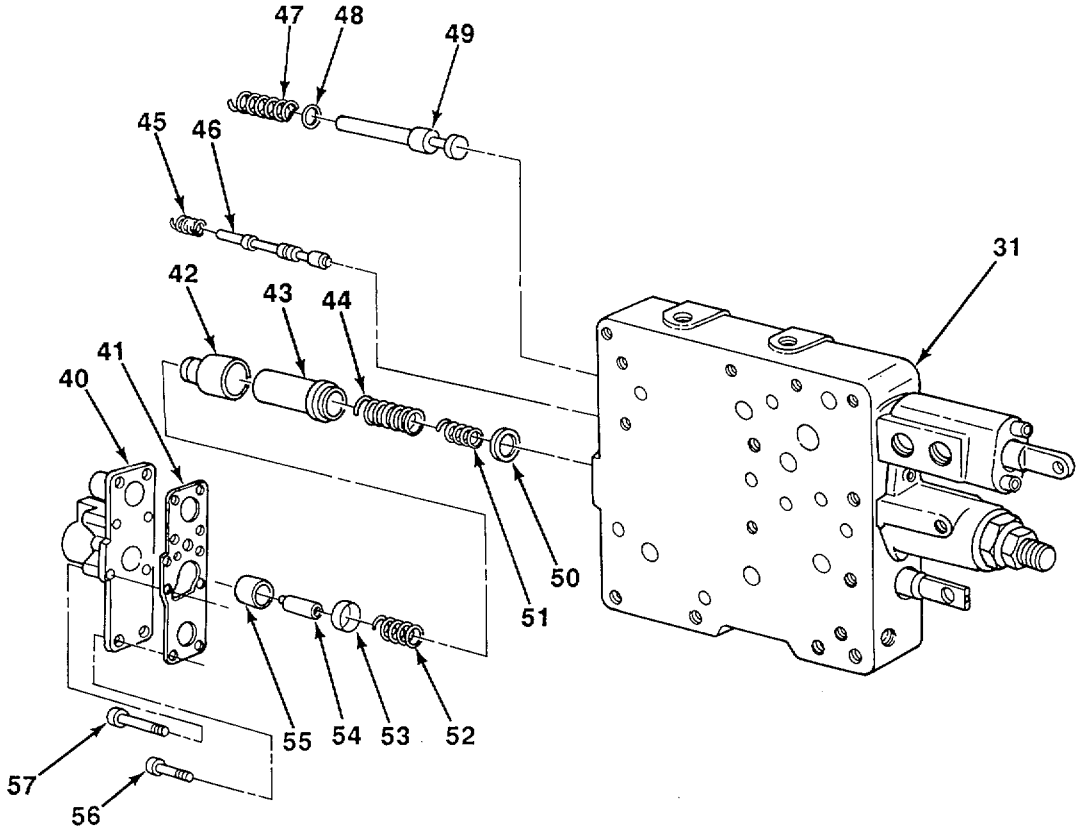
TA708258

5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

NOTE

Apply lubricating oil to all parts that are Installed In valve block.

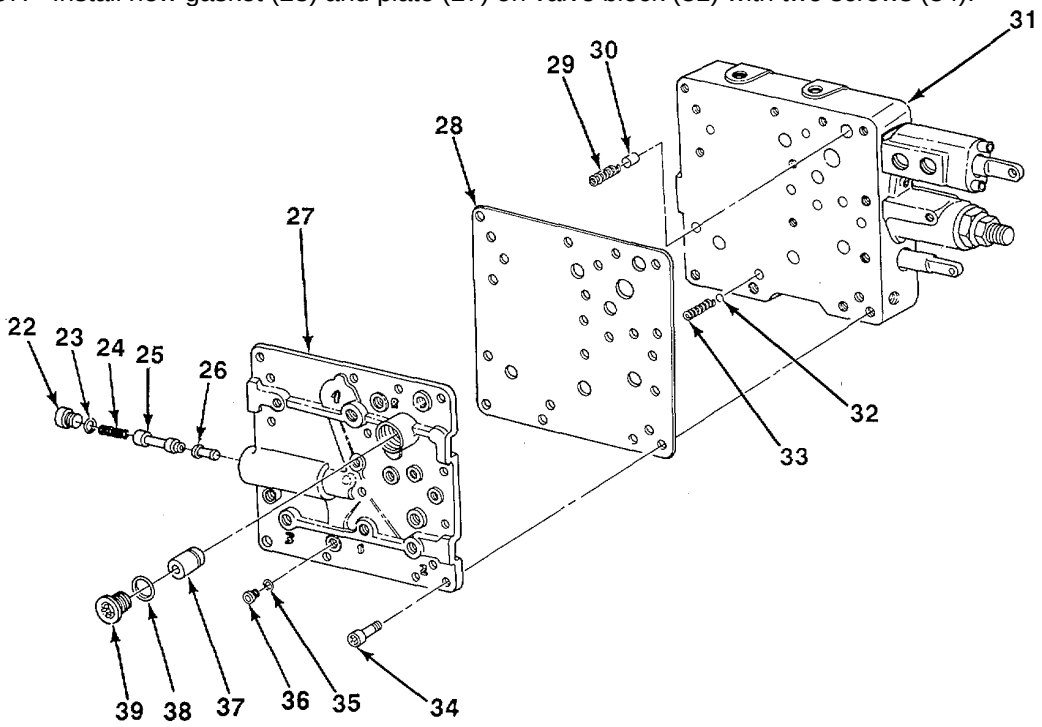
24. Install washer (50) on piston (43).
25. Seat two springs (44 and 51) in piston (43) and slide piston in valve block (31).
26. Apply petrolatum to needle roller (54).
27. Install piston (55), needle roller (54), bushing (53), spring (52), and bushing (42) in cover (40).
28. Install piston (46) and spring (45) in valve block (31).
29. Install piston (49), washer (48), and spring (47) in valve block (31).
30. Install new gasket (41) and cover (40) on valve block (31) with four long screws (57) and short screws (56).



TA708259

5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

31. Install new preformed packing (23) on screw plug (22).
32. Apply a coat of lubricating oil to piston (26).
33. Install two pistons (25 and 26), spring (24), and screw plug (22) in plate (27).
34. Install new preformed packing (35) on screw plug (36) and install screw plug in plate (27).
35. Install new preformed packing (38) on drain plug (39), and install filter element (37) and drain plug in plate (27).
36. Install detent ball (32), spring (33), detent pin (30), and spring (29) in valve block (31).
37. Install new gasket (28) and plate (27) on valve block (31) with two screws (34).



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5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

e. INSTALLATION

1. If removed, install threaded stud (21) in transmission assembly (8).

2. Install two springs (9), detent pin (10), and detent ball (11) in transmission assembly (8).

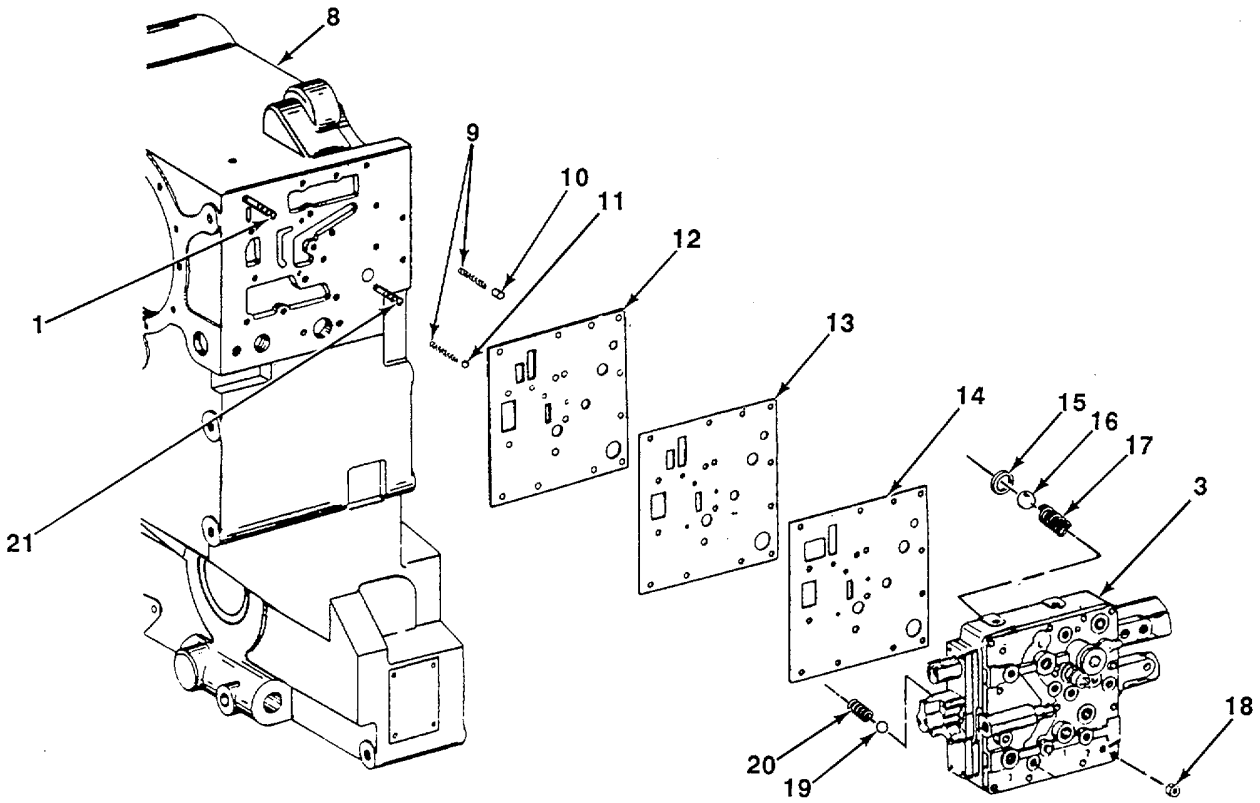
CAUTION

Ensure that detent pin, detent ball, and springs remain in place while performing steps 3 and 4. Parts may be damaged if they fall out of transmission assembly.

3. Install detent ball (19), spring (20), spring (17), check valve ball (16), and ring (15) on transmission control valve (3).

4. Install gasket (12), plate (13), gasket (14), and transmission control valve (3) on transmission assembly (8) with nut (18).

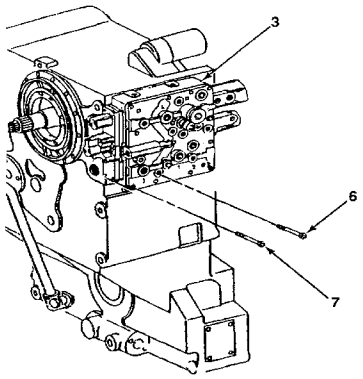
5. Remove screw (1) from transmission assembly (8).



TA708261

5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

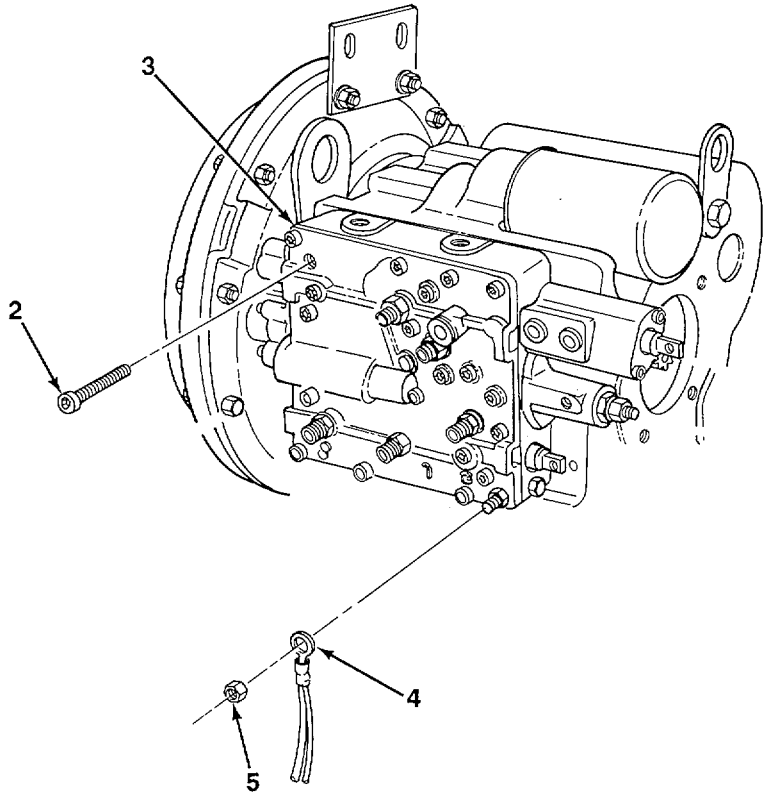
6. Install screw (7) and 12 screws (6) on transmission control valve (3).



5-9. TRANSMISSION CONTROL VALVE MAINTENANCE (Con't).

7. Install screw (2) on transmission control valve (3).

8. Install ground terminal lead (4) on transmission control valve (3) with nut (5).



FOLLOW-ON TASKS:

- Install transmission assembly (see paragraph 4-40).
- Install low brake pressure switch (see TM 10-3930-659-20).
- Install reverse warning alarm switch (see TM 10-3930-659-20).
- Install neutral start switch (see TM 10-3930-659-20).
- Fill transmission assembly with hydraulic fluid (see TM 10-3930-659-10).

TA708263

5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE.

This task covers:

a. Removal
b. Disassembly
c Cleaning and Inspection
d. Assembly
e Installation

INITIAL SETUP:

Equipment Conditions:
- Transmission input seal and bearing removed (see paragraph 4-43).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Depth gage micrometer (Item 27, Appendix E)
- Heat gun (Item 35, Appendix E)
- Retaining ring pliers (Item 46, Appendix E)
- Arbor press (Item 47, Appendix E)
- Mechanical puller (Item 51, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)
- Air deflector plate (Figure C-6, Appendix C)
- Transmission oil supply flange removal brackets (Figure C-7, Appendix C)

Materials/Parts:
- Sealing compound (Item 14, Appendix B)
- Lubricating oil (Item 38, Appendix B)
- Petrolatum (Item 42, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Two gaskets

References:
- TM 9-214

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Hot parts can cause severe burns. Always wear protective clothing (goggles/shield, gloves, etc.).

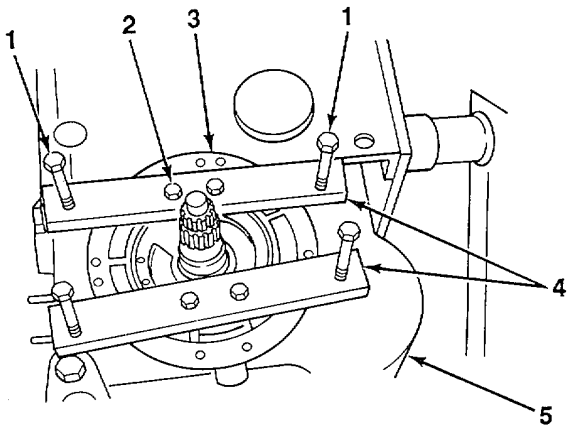
5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).

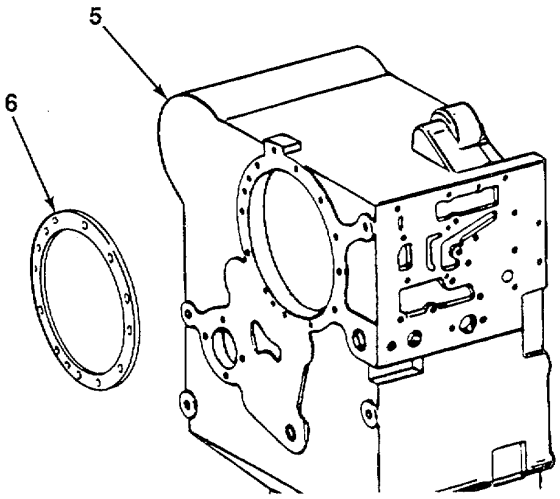
a. REMOVAL

NOTE

Use four screws removed from bearing cover to perform step 1.

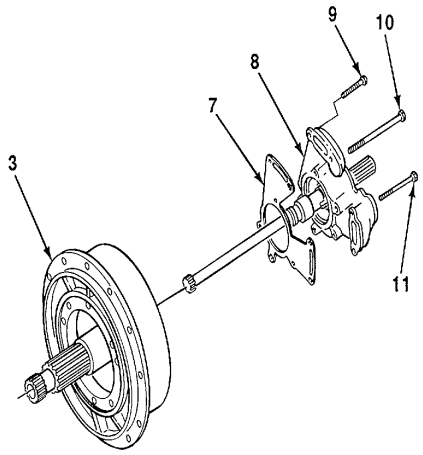
1. Install two transmission oil supply flange removal brackets (4) on oil feed flange (3) with four screws (2).
2. Install four screws (1) on two transmission oil supply flange removal brackets (4).
3. Slowly and evenly turn four 2 in. X 3 in. x 13 screws (1), and remove transmission oil feed flange (3) from transmission assembly (5).
4. Remove four screws (1), screws (2), and two transmission oil supply flange removal brackets (4) from transmission oil feed flange (3).
5. Remove gasket (6) from transmission assembly (5). Discard gasket.





5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).

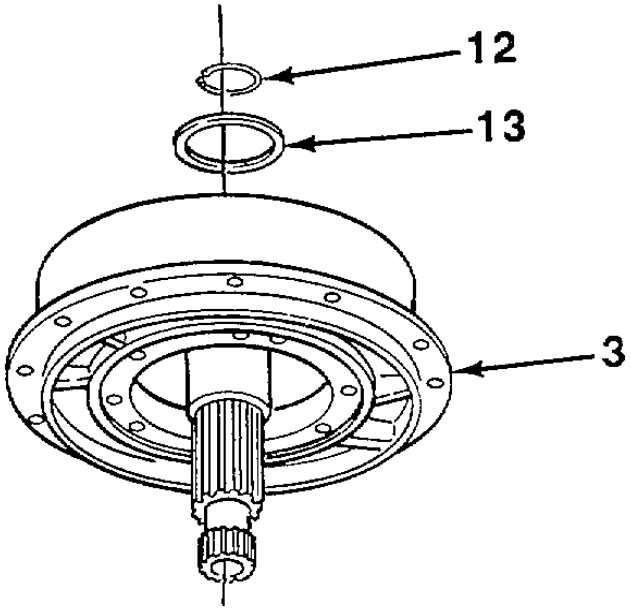
6. Remove four screws (9), two screws (10 and 11), gear pump (8), and gasket (7) from transmission oil feed flange (3). Discard gasket.

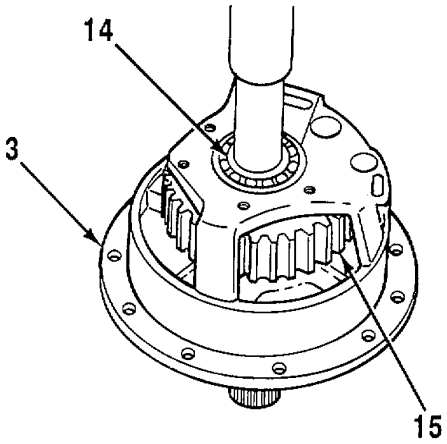


b. DISASSEMBLY

1. Remove retaining ring (12) and shim (13) from transmission oil feed flange (3).

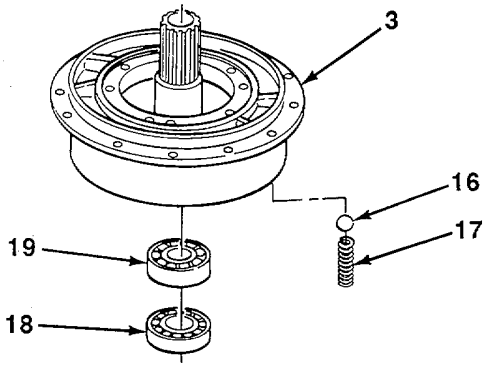
2. Using arbor press, press out input shaft (14) and remove input gear (15) from transmission oil feed flange (3).





5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).

3. Using mechanical puller, remove two bearings (18 and 19) from transmission oil feed flange (3).



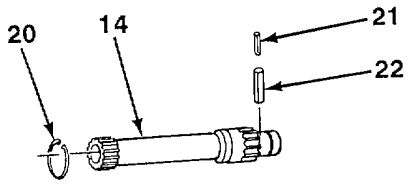
NOTE

Perform steps 4 through 6 only if parts are damaged.

4. Remove compression spring (17) and ball (16) from transmission oil feed flange (3).

5. Remove two pins (21 and 22) from input shaft (14). Discard pins.

6. Remove piston ring (20) from input shaft (14).



c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean all parts with dry cleaning solvent and dry with clean rags.

2. Inspect metal parts for cracks and breaks. Replace damaged parts.

3. Clean and inspect bearings in accordance with TM 9-214.

5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).

d. ASSEMBLY

NOTE

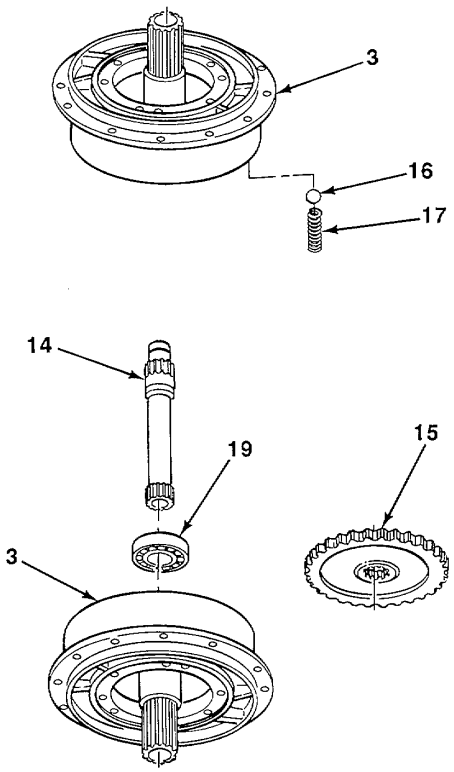
Perform steps 1 through 3 only if parts were removed.

1. Install piston ring (20) on input shaft (14).
2. Install two new pins (21 and 22) on input shaft (14).
3. Install ball (16) and compression spring (17) on transmission oil feed flange (3).
4. Using arbor press, install bearing (19) in transmission oil feed flange (3).
5. Apply lubricating oil to input shaft (14) and install input shaft in transmission oil feed flange (3). Push input shaft until end is even with bearing (19).

NOTE

Install input gear with long hub side toward gear pump side.

6. Install input gear (15) on transmission oil feed flange (3).



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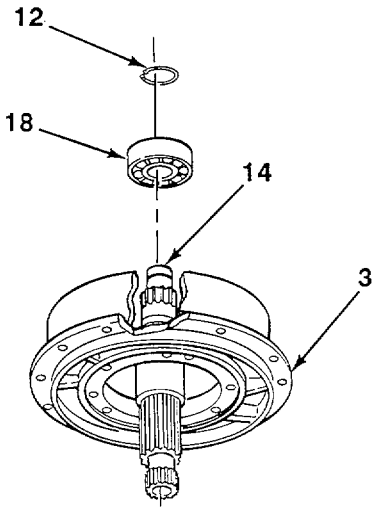
5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).

NOTE

Ensure that bearing is firmly seated against input gear.

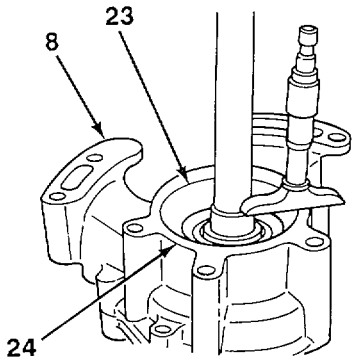
7. Using arbor press, install bearing (18) on transmission oil feed flange (3) and input shaft (14).

8. Install retaining ring (12) on input shaft (14). Ensure that retaining ring contacts bearing (18).



e. INSTALLATION

1. Using depth gage micrometer, measure and note distance from gear pump (8) surface (24) to bear- ing contact flange (23).

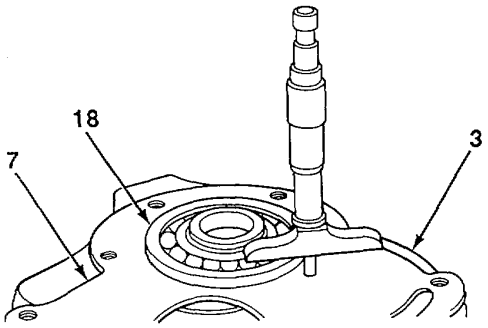


5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).

2. Install new gasket (7) on transmission oil feed flange (3).

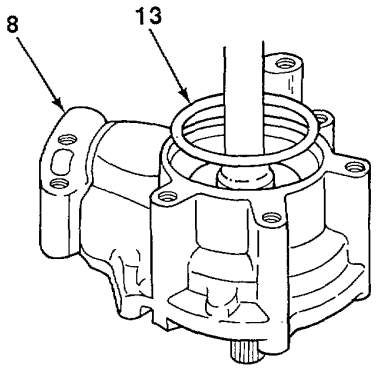
3. Using depth gage micrometer, measure and note distance from bearing (18) to gasket (7).

4. Subtract measurement taken in step 3 from measurement taken in step 1. Difference is end play. End play measurement must be 0.-0.020 in. (0.-0.508 mm). If end play is within specification, go to step 7.

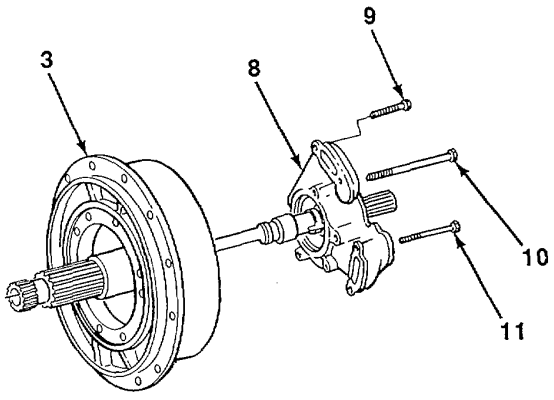


5. Apply a light coat of petrolatum to shim (13) and install shim on gear pump (8).

6. Repeat steps 1 through 4.



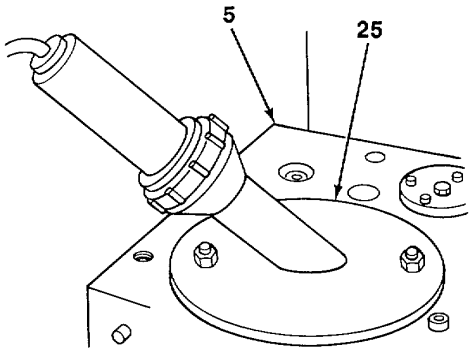
7. Install gear pump (8) on transmission oil feed flange (3) with four screws (9) and two screws (10 and 11). Torque screws to 18 lb.-ft. (24 N-m).



TA708269

5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).

8. Install air deflector plate (25) on transmission assembly (5).



WARNING

Wear protective clothing (goggles/shield, gloves, etc.) when heating parts and handling hot parts. Hot parts can cause severe burns.

CAUTION

DO NOT use a torch to heat transmission assembly housing. Housing may become warped and equipment damaged.

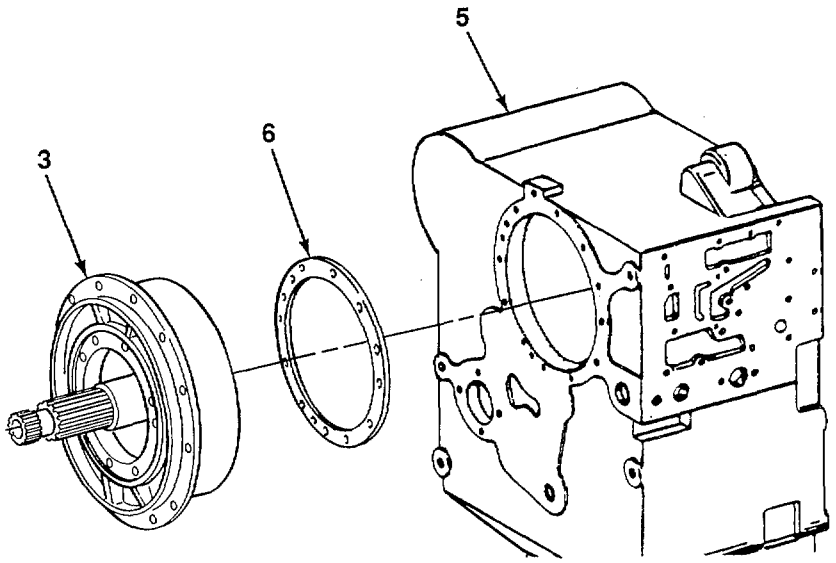
9. Insert heat gun into air deflector plate (25) and heat transmission assembly (5) for 30 minutes.
10. Remove air deflector plate (25) from transmission assembly (5).
11. Apply sealing compound to pressure and suction ports on transmission oil feed flange (3).

NOTE

Ensure that oil passages of transmission oil feed flange and transmission assembly are alined.

12. new gasket (6) and transmission oil feed flange (3) on transmission assembly (5).

5-10. TRANSMISSION OIL FEED FLANGE MAINTENANCE (Con't).



FOLLOW-ON TASKS:

- • Install transmission input seal and bearing (see paragraph 4-43).

TA708271

5-11. TRANSMISSION GEAR PUMP REPAIR.

This Task Covers:

a. Disassembly
b. Cleaning and Inspection
c. Assembly

Initial Setup:

Equipment Conditions:
- Transmission oil feed flange removed (see paragraph 5-10).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Retaining ring pliers (Item 46, Appendix E)
- Puller kit (Item 50, Appendix E)

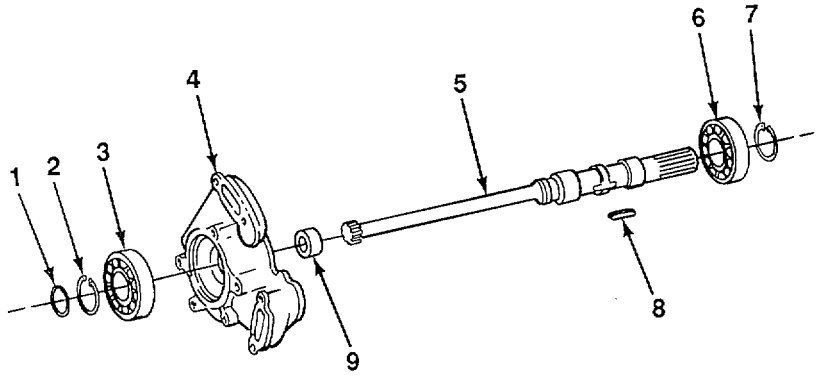
References:
- TM 9-214

Materials/Parts:
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One preformed packing
- One seal

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

a. DISASSEMBLY

1. Remove retaining ring (2) from output shaft (5).
2. Remove preformed packing (1) from bearing (3). Discard preformed packing.
3. Remove retaining ring (7) from output shaft (5).
4. Remove output shaft (5) from gear pump (4).
5. Using puller kit, remove bearing (3) from gear pump (4).
6. Remove bearing (6), key (8), and seal (9) from output shaft (5). Discard seal.



TA708272

5-11. TRANSMISSION GEAR PUMP REPAIR (Con't).

b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean all parts with dry cleaning solvent and dry with clean rags.
2. Inspect metal parts for cracks and breaks. Replace damaged parts.
3. Clean and inspect bearings in accordance with TM 9-214.

c. ASSEMBLYI

1. Heat bearing (6) in accordance with TM 9-214.
2. Install bearing (6) on output shaft (5) with closed side toward retaining ring (7).
3. Install key (8) on output shaft (5).
4. Install new seal (9) in groove on output shaft (5).
5. Aline key (8) with groove in bore of gear pump (4) and push output shaft (5) into gear pump until bearing (6) is firmly seated.
6. Install retaining ring (7) on output shaft (5). Ensure that retaining ring contacts bearing (6).
7. Heat bearing (3) in accordance with TM 9-214.
8. Install bearing (3) in gear pump (4), with closed side toward retaining ring (2), until bearing is firmly seated in gear pump.
9. new preformed packing (1) and retaining ring (2) on output shaft (5). Ensure that retaining ring contacts bearing (3).

FOLLOW-ON TASKS:

- • Install transmission oil feed flange (see paragraph 5-10).

5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Equipment Conditions:
- Transmission hydraulic hoses and fittings removed (see TM 10-3930-659-20).
- Transmission oil feed flange removed (see paragraph 5-10).

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Shaft alinement tool (Item 5, Appendix E)
- Compressor unit (Item 16, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Depth gage micrometer (Item 27, Appendix E)
- Soft hammer (Item 34, Appendix E)
- Heat gun (Item 35, Appendix E)
- Arbor press (Item 47, Appendix E)
- Puller kit (Item 50, Appendix E)
- Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)
- Transmission clutch pack compression tool (Figure C-5, Appendix C)

Materials/Parts:
- Petrolatum (Item 42, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Twine (Item 58, Appendix B)
- Four preformed packings

Personnel Required: Two

References:
- TM 9-214
- TM 10-3930-659-10
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Hot parts can cause severe burns. Always wear protective clothing (goggles/shield, gloves, etc.).

a. REMOVAL

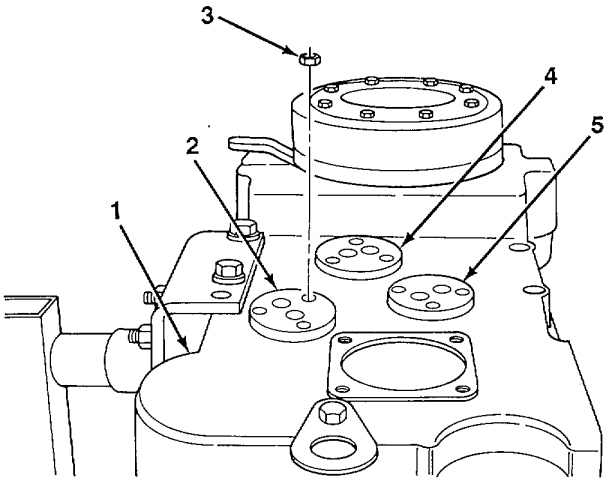
NOTE

- **First/forward, second/reverse, and third/fourth gear axles are removed the same way. First/forward gear axle is illustrated.**
- **It is not necessary to remove third/fourth gear axle if only performing maintenance on first/forward or second/reverse gear clutch packs.**

1. transmission assembly (1) in horizontal position, mark first/forward gear axle (2), second/reverse gear axle (5), and third/fourth gear axle (4) to aid during installation.

5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

2. Remove three nuts (3) from first/forward gear axle (2).

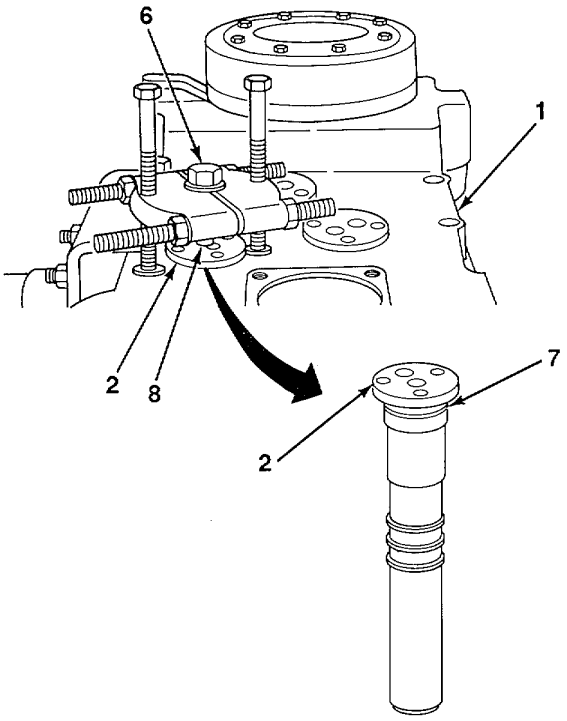


3. Install 16 M screw (6) in first/forward gear axle (2) fitting port (8).

4. Using puller kit, remove first/forward gear axle (2) from transmission assembly (1).

5. Remove preformed packing (7) from first/forward gear axle (2). Discard preformed packing.

6. Repeat steps 2 through 5 for second/reverse gear axle.



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5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

7. Turn transmission assembly (1) until transmission oil feed flange bore (16) is facing up and is horizontal.

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious Injury or death to personnel.

NOTE

- **Clutch pack weighs approximately 75 lb (34 kg).**
- **Lift clutch pack straight out of transmission assembly so that loose roller bearings are kept intact for individual inspection.**

8. Move second/reverse gear clutch pack (17) aside. Using suitable lifting device, remove first/forward gear clutch pack (15) from transmission assembly (1).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

- **Clutch pack weighs approximately 75 lb (34 kg).**
- **Lift clutch pack straight out of transmission assembly so that loose roller bearings are kept intact for individual inspection.**

9. Using suitable lifting device, remove second/reverse gear clutch pack (17) from transmission assembly (1).

NOTE

Perform steps 10 through 18 only if idler gear or third/fourth gear clutch pack is damaged.

10. Turn transmission assembly (1) until transmission oil feed flange bore (16) is vertical.

11. Remove four screws (9) from idler gear axle (10).

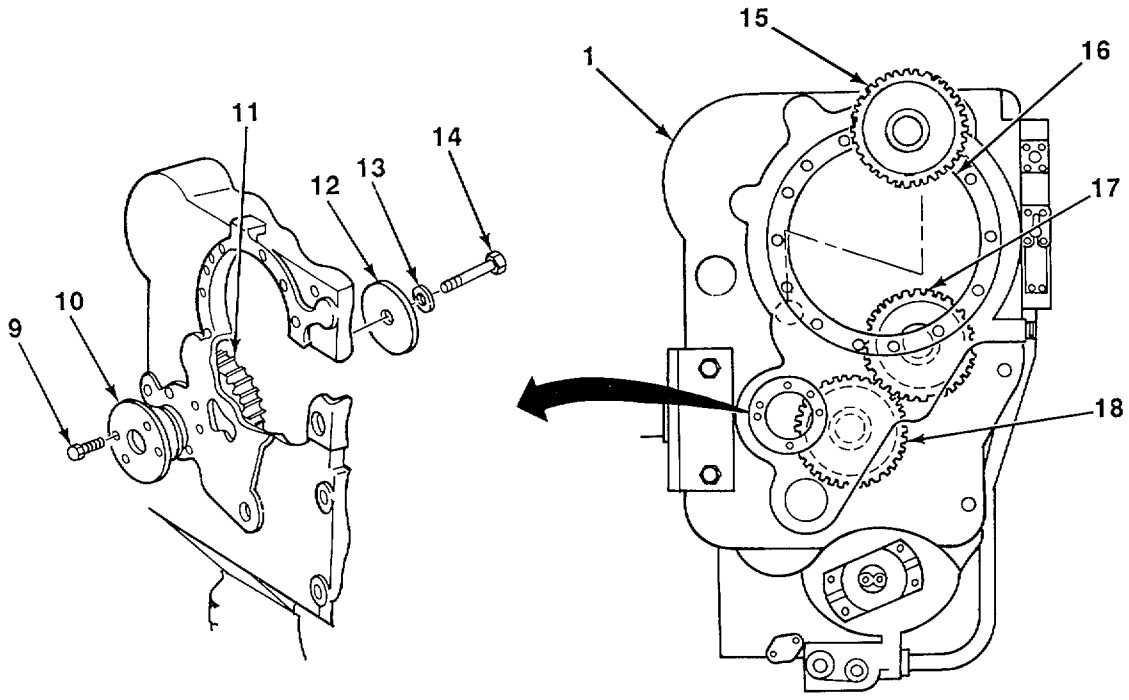
12. Remove screw (14) and washer (13) from idler gear (11).

NOTE

Keep idler gear and bearings upright until bearings are removed.

13. While assistant holds idler gear (11), tap idler gear axle (10) and remove idler gear axle, thrush washer (12), and idler gear from transmission assembly (1).

5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).



14. Repeat steps 2 through 5 for third/fourth gear axle.

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

- **Clutch pack weighs approximately 75 lb (34 kg).**
- **Lift clutch pack straight out of transmission assembly so that loose roller bearings are kept intact for individual inspection.**

15. Using suitable lifting device, remove third/fourth gear clutch pack (18) from transmission assembly (1).

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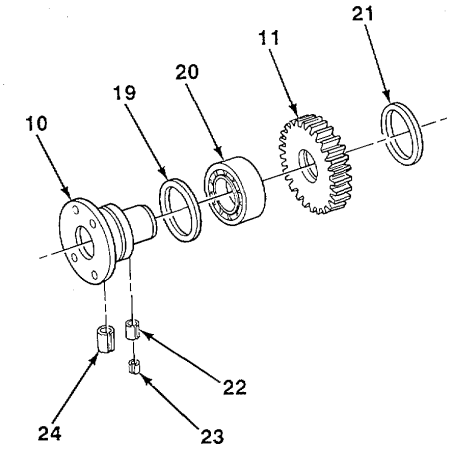
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

16. Remove preformed packing (19) from idler gear axle (10). Discard preformed packing.

17. If damaged, remove angle ring (21) and roller set (20) from idler gear (11).

18. If damaged, remove three springpins (22, 23, and 24) from idler gear axle (10). Discard springpins.

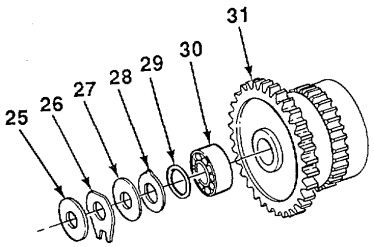


b. DISASSEMBLY

1. **First/Forward Gear Clutch Pack.**

   (a) Remove shim (25), three thrustwashers (26, 27, and 28), and ring (29) from forward gear spur gear (31).

   (b) Remove roller set (30) from forward gear spur gear (31).



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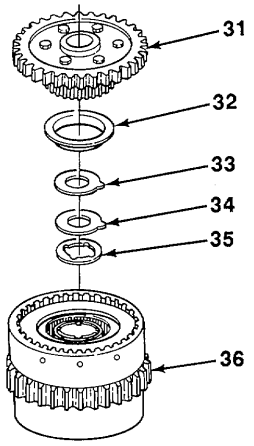
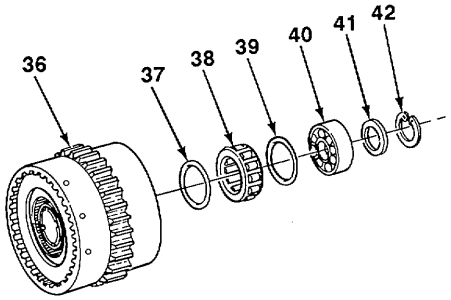
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(c) Remove forward gear spur gear (31) and three thrustwashers (33, 34, and 35) from first/forward gear disc carrier (36).

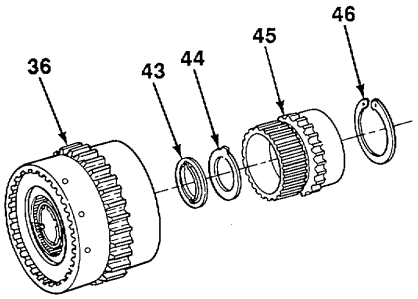
(d) If damaged, remove baffle ring (32) from forward gear spur gear (31).



(e) Remove retaining ring (42), preformed packing (41), bearing (40), angle ring (39), roller cage (38), and angle ring (37) from first/forward gear disc carrier (36). Discard preformed packing.



(f) Remove retaining ring (46), first gear spur gear (45), and two thrustwashers (43 and 44) from first/forward gear disc carrier (36).



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5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

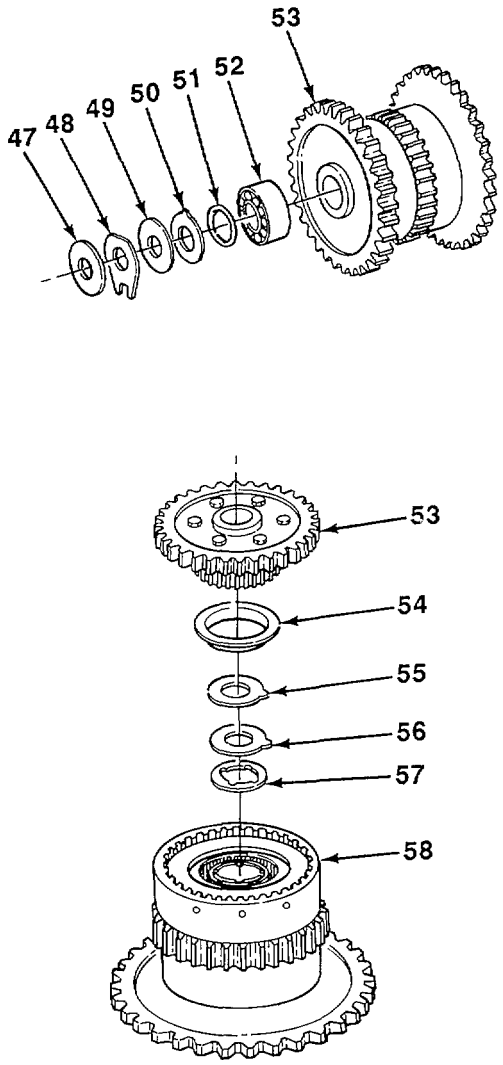
2. **Second/Reverse Gear Clutch Pack.**

(a) Remove shim (47), three thrustwashers (48, 49, and 50), and ring (51) from reverse gear spur gear (53).

(b) Remove roller set (52) from reverse gear spur gear (53).

(c) Remove reverse gear spur gear (53), two thrustwashers (55 and 56), and thrust disc (57) from second/reverse gear disc carrier (58).

(d) If damaged, remove baffle ring (54) from reverse gear spur gear (53).



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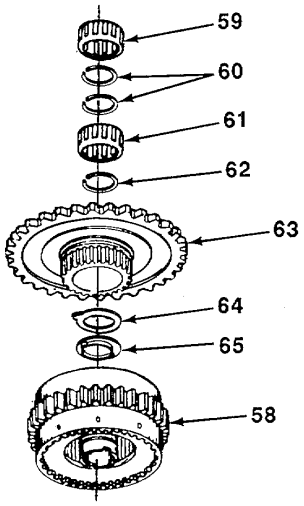
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(e) Remove second gear spur gear (63) and two thrustwashers (64 and 65) from second/reverse gear disc carrier (58).

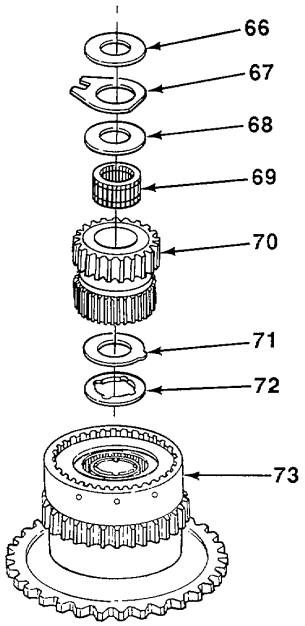
(f) Remove roller cage (59), two angle rings (60), roller cage (61), and angle ring (62) from second gear spur gear (63).



3. **Third/Fourth Gear Clutch Pack**.

(a) Remove shim (66), two thrustwashers (67 and 68), fourth gear spur gear (70), thrustwasher (71), and thrust disc (72) from third/ fourth gear disc carrier (73).

(b) Remove bearing cage (69) from fourth gear spur gear (70).



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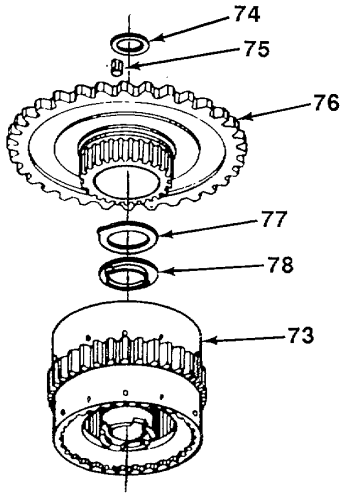
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(c) Remove third gear spur gear (76), thrustwasher (77), and thrust disc (78) from third/ fourth gear disc carrier (73).

(d) Remove angle ring (74) and 32 roller bearings (75) from third gear spur gear (76).



4. **Clutch Packs**.

NOTE

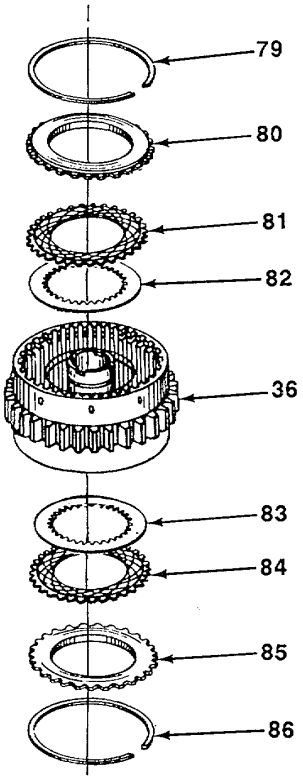
- **First/forward, second/reverse, and third/ fourth clutch packs are disassembled the same way, except number of clutch discs may vary. First/forward gear clutch pack is illustrated.**
- **Tie together parts removed from clutch pack to keep as a set.**

(a) Remove retaining ring (79) from first/forward gear disc carrier (36).

(b) Remove shim (80), 13 clutch discs (81), and 12 clutch plates (82) from first/forward gear disc carrier (36).

(c) Turn over first/forward gear disc carrier (36) and remove retaining ring (86).

(d) Remove shim (85), eight clutch discs (84), and seven clutch plates (83) from first/forward gear disc carrier (36).



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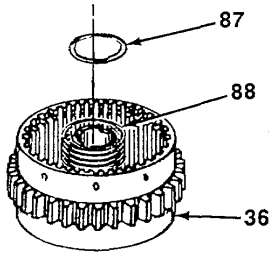
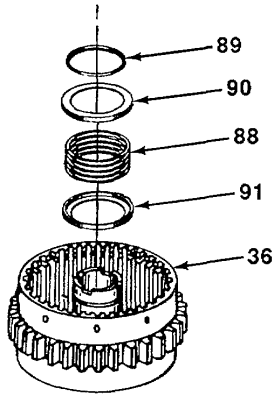
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

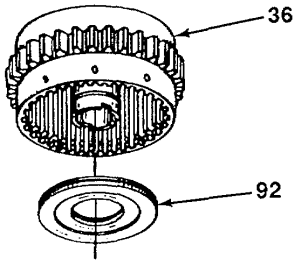
(e) Using transmission clutch pack compression tool and arbor press, compress spring (88) and remove guide ring (87) from first/ forward gear disc carrier (36).



(f) Remove guide ring (89), spring guide ring (90), spring (88), and spring guide ring (91) from first/forward gear disc carrier (36).



(g) Turn over first/forward gear disc carrier (36) and remove piston (92).



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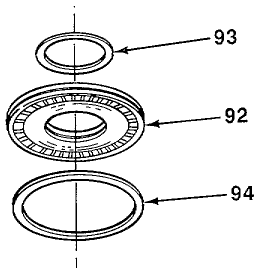
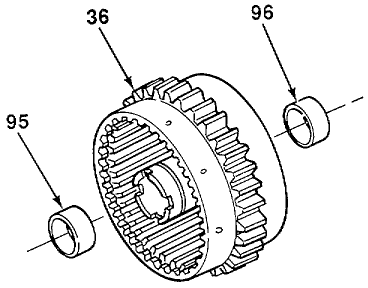
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(h) If damaged, remove two seal rings (93 and 94) from piston (92). Discard seal rings.



(i) Repeat steps (e) though (h) for other side of first/forward gear disc carrier (36).

(j) If damaged, remove two bearings (95 and 96) from first/forward gear disc carrier (36) using puller kit.



c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-59°C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean all parts with dry cleaning solvent and dry with clean rags.
2. Inspect metal parts for cracks and breaks. Replace damaged parts.
3. Clean and inspect bearings in accordance with TM 9-214.

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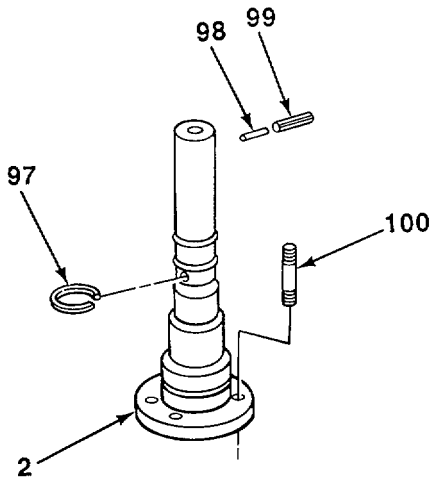
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

NOTE

First/forward, second/reverse, and third/fourth gear axles are inspected the same way. First/forward gear axle is illustrated.

4. Inspect three piston rings (97) on first/forward gear axle (2) for damage. Replace damaged piston rings.
5. Inspect four studs (100) for damage. Replace damaged studs.
6. Inspect lubrication orifices in first/forward gear axle (2) for restrictions. Clear restrictions.
7. Inspect pins (98 and 99) for damage. Replace damaged pins.
8. Repeat steps 4 through 7 for second/reverse and third/fourth gear axles.



d. ASSEMBLY

1. **Clutch Packs**.

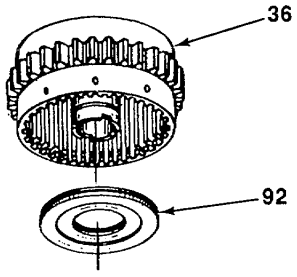
NOTE

First/forward, second/reverse, and third/fourth gear clutch packs are assembled the same way, except number of clutch discs may vary. First/forward gear clutch pack is illustrated.

(a) If removed, install two bearings (95 and 96) in first/forward gear disc carrier (36).

(b) If removed, install two new seal rings (93 and 94) on piston (92).

(c) Install piston (92) on first/forward gear disc carrier (36).



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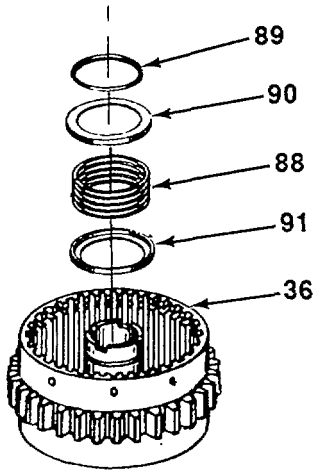
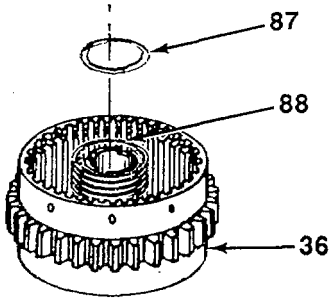
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(d) Position spring guide ring (91), spring (88), spring guide ring (90), and guide ring (89) in first/forward gear disc carrier (36).



(e) Using transmission clutch pack compression tool and arbor press, compress spring (88) and install guide ring (87) on first/forward gear disc carrier (36).

(f) Repeat steps (b) through (e) for other side of first/forward gear disc carrier (36).

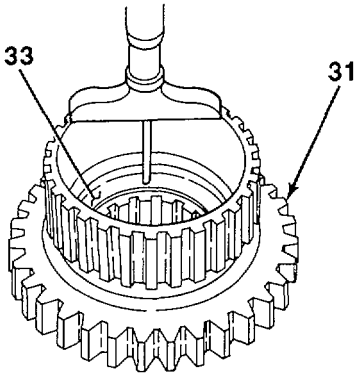


NOTE

Perform steps (g) through (r) only for first/forward and second/reverse gear clutch packs.

(g) Install thrustwasher (33) on forward gear spur gear (31).

(h) Using depth gage micrometer, measure and note distance from edge of forward gear spur gear (31) to thrustwasher (33).



5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(i) Install a 0.098 in. (2.489 mm) clutch plate (82) on first/forward gear disc carrier (36).

(j) Install a 0.078 in. (1.981 mm) clutch disc (81) on first/forward gear disc carrier (36).

(k) Position thrustwasher (35) on first/forward gear disc carrier (36).

(I) Using depth gage micrometer, measure and note distance from thrustwasher (35) to clutch plate (82).

(m) Remove clutch disc (81) and clutch plate (82) from first/forward gear disc carrier (36).

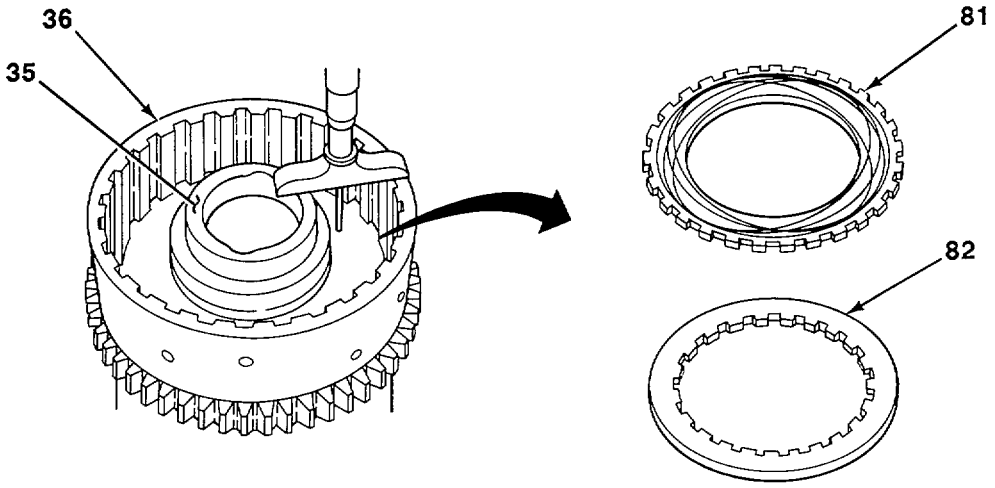
(n) Subtract measurement taken in step (I) from measurement taken in step (h). Difference is clutch pack overlap. Minimum allowable overlap is 0.090 in. (2.286 mm). If clutch pack overlap specification is met, go to step (s).

(o) Repeat steps (i) and 0).

(p) Install another clutch disc (81) next to first clutch disc.

(q) Repeat steps (k) and (I).

(r) If clutch pack overlap specification is still not met, compensate for additional clutch disc (81) by using a thinner shim at backing plate end of clutch pack.

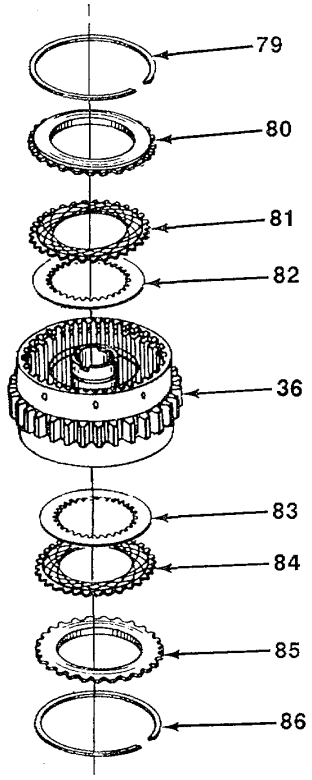


5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(s) Turn over first/forward gear disc carrier (36). Install seven clutch plates (83), eight clutch discs (84), shim (85), and retaining ring (86).

(t) Turn over first/forward gear disc carrier (36). Alternately install 12 clutch plates (82) and 13 clutch discs (81) on first/forward gear disc carrier (36).

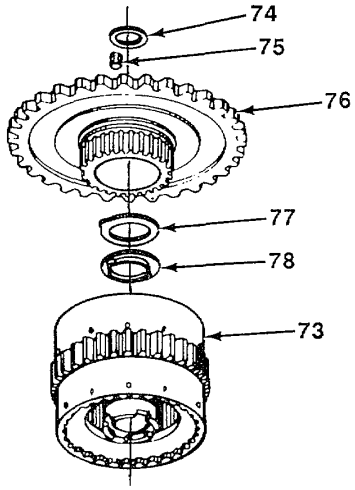
(u) Install shim (80) and retaining ring (79) on first/forward gear disc carrier (36).



2. **Third/Fourth Gear Clutch Pack.**

(a) Install 32 roller bearings (75) and angle ring (74) in third gear spur gear (76).

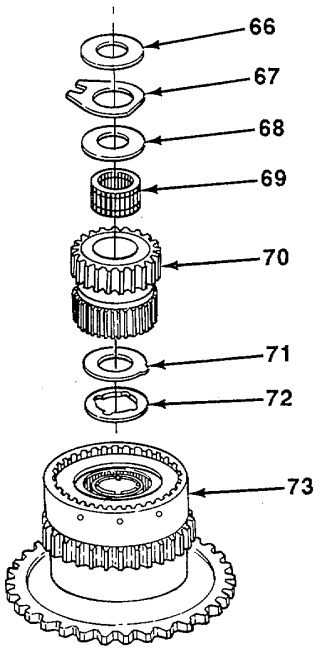
(b) Install thrust disc (78), thrustwasher (77), and third gear spur gear (76) on third/fourth gear disc carrier (73).



5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(c) Install bearing cage (69) on fourth gear spur gear (70).

(d) Install thrust disc (72), thrustwasher (71), fourth gear spur gear (70), two thrustwashers (67 and 68), and shim (66) on third/ fourth gear disc carrier (73).



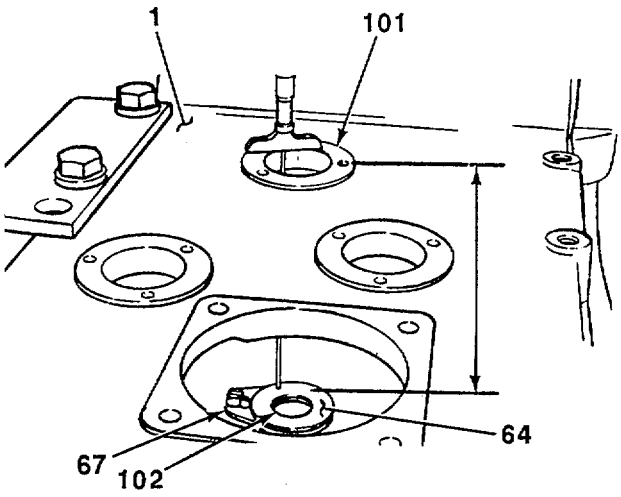
NOTE

Use thrust disc and thrustwasher from second/reverse gear clutch steps (e) through (g).pack to perform steps (e) through (g).

(e) Position thrust disc (67) on transmission assembly (1) over third/fourth gear clutch pack port (102).

(f) Position thrustwasher (64) on thrust disc (67).

(g) Using depth gage micrometer, measure and note distance from gasket flange surface (101) to thrustwasher (64).



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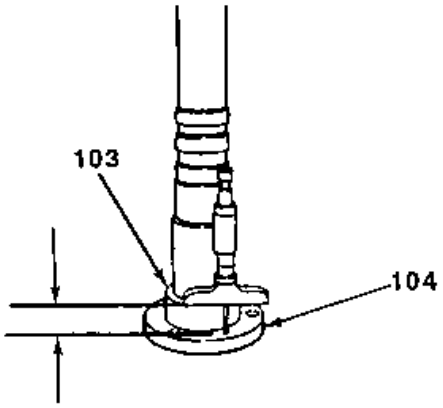
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

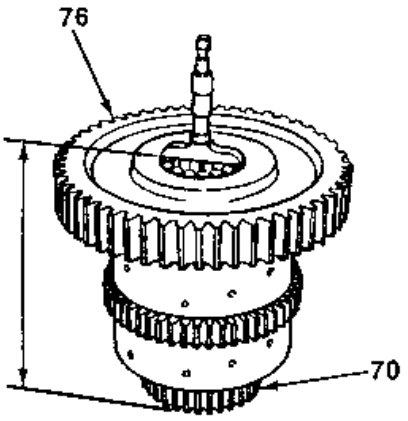
(h) Using depth gage micrometer, measure and note distance from axle flange (104) to bearing contact surface (103).



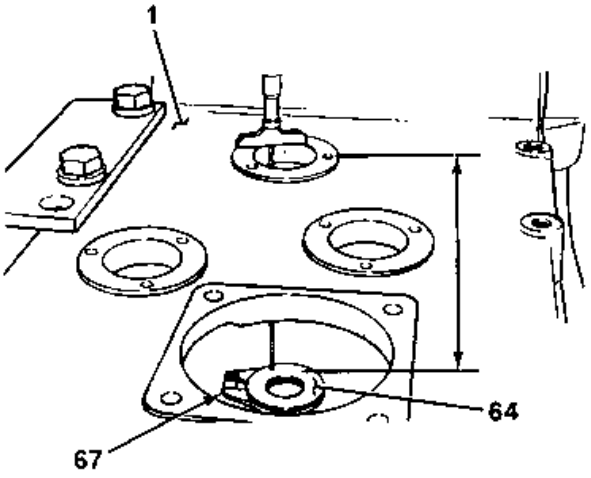
(i) Using depth gage micrometer, measure and note distance from third gear spur gear (76) to outer edge of fourth gear spur gear (70).

(j) Subtract measurement taken in step (g) from measurement taken in step (h) and note difference.

(k) Subtract measurement taken in step j) from measurement taken in step (i). Difference is clutch pack end play. Clutch pack end play must be 0.004-0.012 in. (0.1020.305 mm).



(l) Remove thrustwasher (64) and thrust disc (67) from transmission assembly (1). Repeat step (b).



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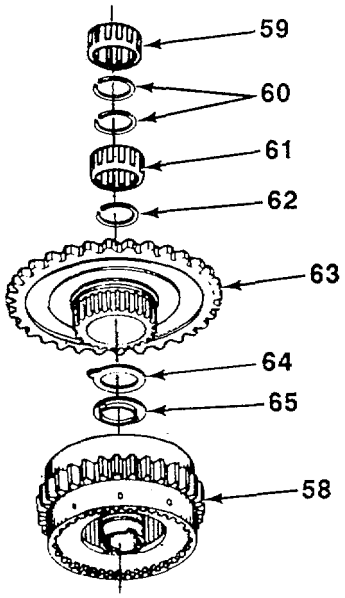
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

3. Second/Reverse Gear Clutch Pack.

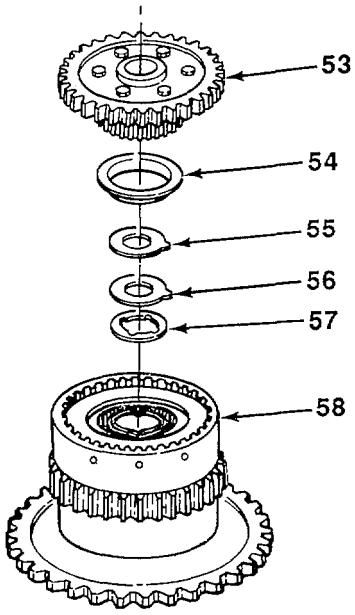
(a) Install angle ring (62), roller cage (61), two angle rings (60), and roller cage (59) on second gear spur gear (63).

(b) Install two thrust washers (64 and 65) and second gear spur gear (63) on second/ reverse gear disc carrier (58).



(c) If removed, install baffle ring (54) on reverse gear spur gear (53).

(d) Install thrust disc (57), two thrustwashers (55 and 56), and reverse gear spur gear (53) on second/reverse gear disc carrier (58).



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5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

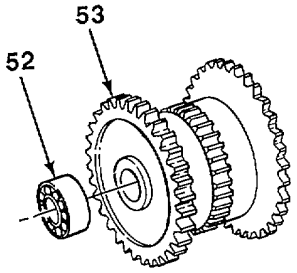
(e) Install roller set (52) on reverse gear spur gear (53).

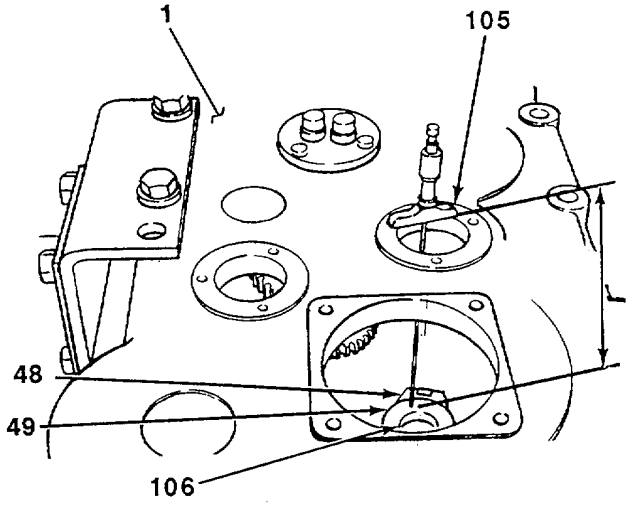
(f) Position thrustwasher (48) in transmission assembly (1) over second/reverse gear clutch pack port (106).

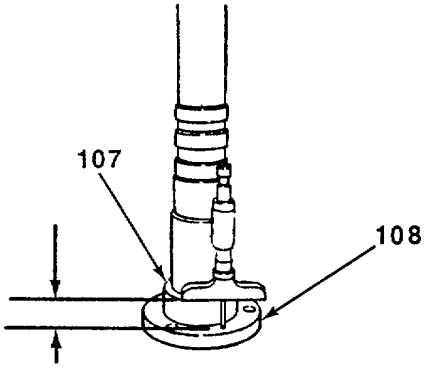
(g) Position thrustwasher (49) on thrustwasher (48).

(h) Using depth gage micrometer, measure and note distance from gasket flange surface (105) to thrustwasher (49).

(i) Using depth gage micrometer, measure and note distance from axle flange (108) to bearing contact surface (107).







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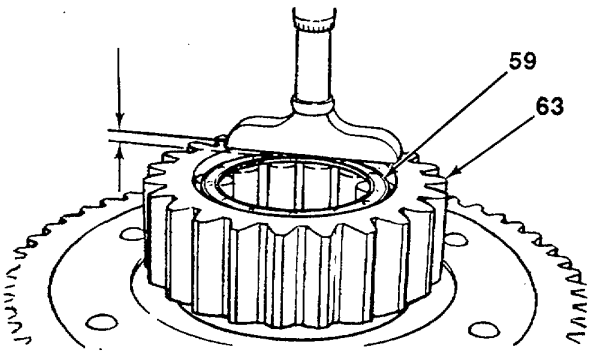
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

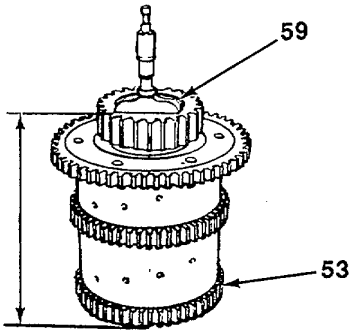
(j) Using depth gage micrometer, measure and note distance from roller cage (59) to second gear spur gear (63).



(k) Using depth gage micrometer, measure and note distance from roller cage (59) to reverse gear spur gear (53).

(l) Subtract measurement taken in step (i) from measurement taken in step (h) and note difference.

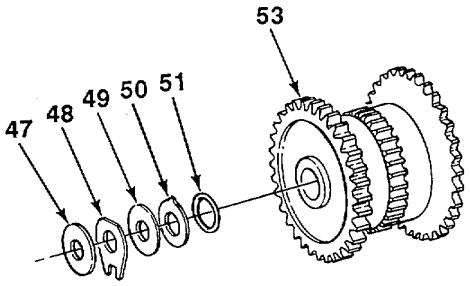
(m) Subtract measurement taken in step (k) from measurement taken in step (j) and note difference.



(n) Subtract measurement taken in step (m) from measurement taken in step (l). Difference is clutch pack end play. Clutch pack end play must be 0.004-0.012 in. (0.102- 0.305 mm).

(o) Remove two thrustwashers (48 and 49).

(p) Install ring (51), three thrustwashers (48, 49, and 50), and shim (47) on reverse gear spur gear (53).



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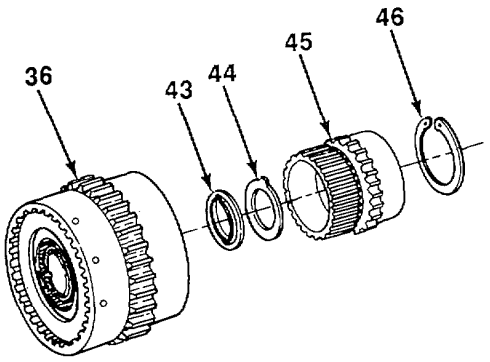
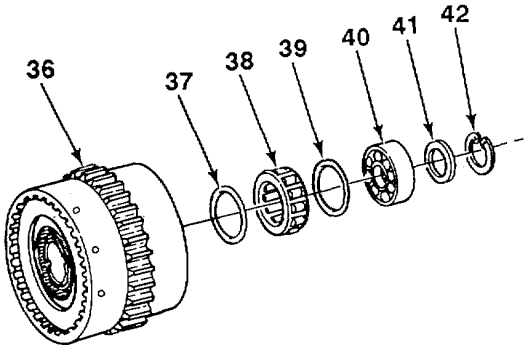
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

4. First/Forward Gear Clutch Pack.

(a) Install two thrustwashers (43 and 44) and first gear spur gear (45) on first/forward gear disc carrier (36) with retaining ring (46).

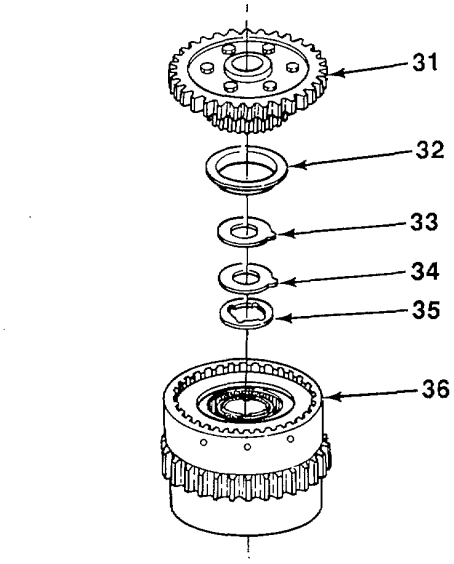


(b) Install angle ring (37), roller cage (38), angle ring (39), bearing (40), and new preformed packing (41) in first/forward gear disc carrier (36) with retaining ring (42).



(c) If removed, install baffle (32) on forward gear spur gear (31).

(d) Install three thrustwashers (33, 34, and 35) and forward gear spur gear (31) on first/forward gear disc carrier (36).



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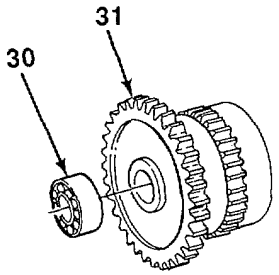
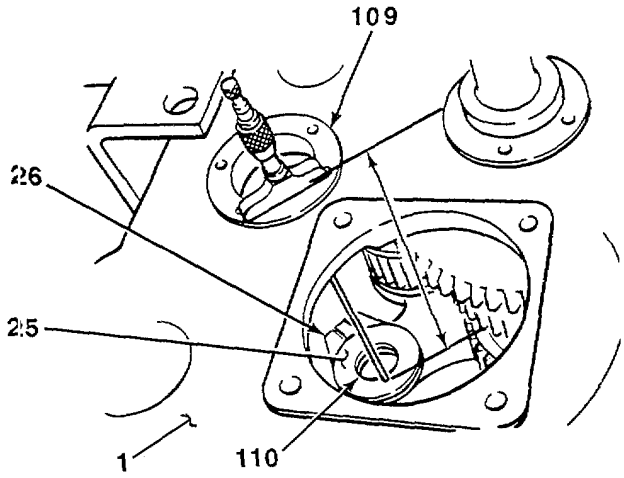
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

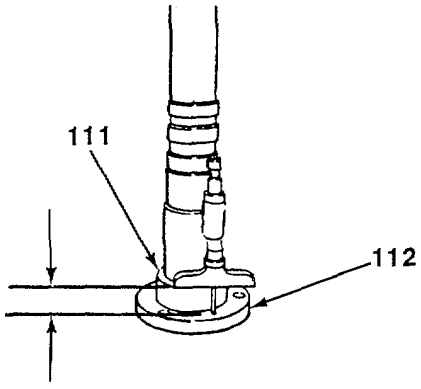
(e) Install roller set (30) on forward gear spur gear (31).



(f) Position thrustwasher (26) in transmission assembly (1) over first forward gear clutch pack port (110).
(g) Position shim (25) on thrustwasher (26).
(h) Using depth gage micrometer, measure and note distance from gasket flange surface (109) to shim (25).



(i) Using depth gage micrometer, measure and note distance from axle flange (112) to bearing contact surface (111).



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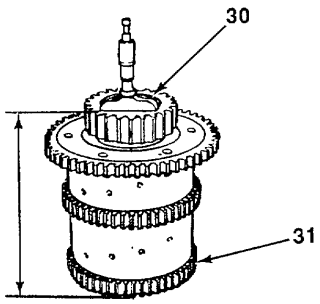
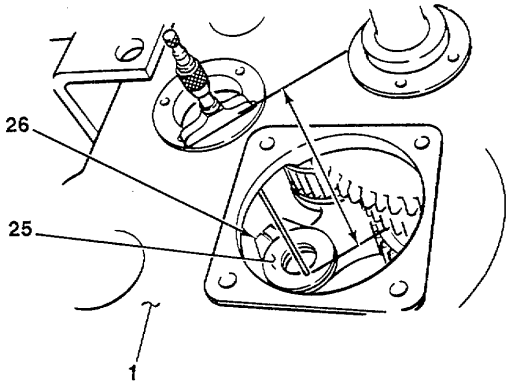
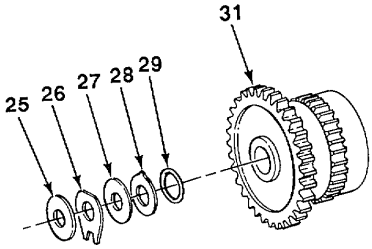
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

(j) Using depth gage micrometer, measure and note distance from face of bearing (30) to forward gear spur gear (31).
(k) Subtract measurement taken in step (i) from measurement taken in step (h) and note difference.
(l) Subtract measurement taken in step (k) from measurement taken in step a(). Difference is clutch pack end play. Clutch pack end play must be 0.004-0.012 in. (0.102- 0.305 mm).
(m) Remove shim (25) and thrustwasher (26) from transmission assembly (1).
(n) Install ring (29), three thrustwashers (26, 27, and 28), and shim (25) on forward gear spur gear (31).







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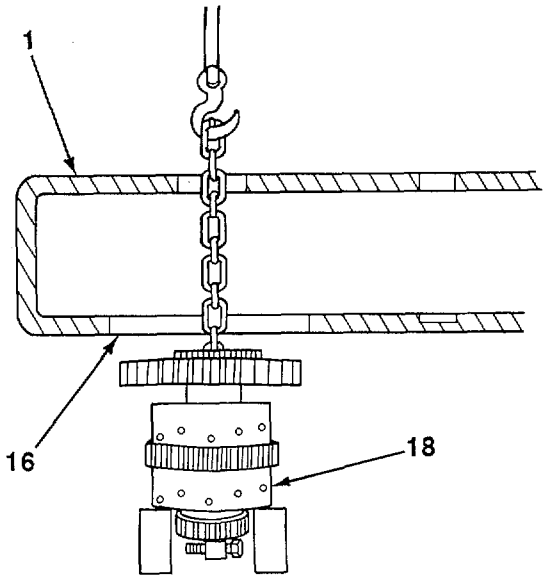
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

e. INSTALLATION

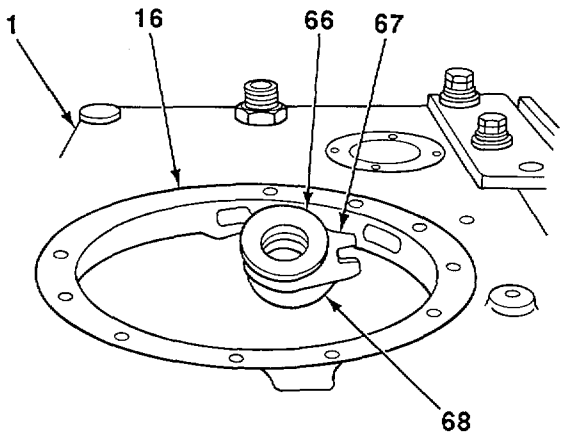
NOTE

Shims and thrustwashers are loose. Remove from clutch packs for later installation.

1. Using a suitable lifting device, insert third/fourth gear clutch pack (18) through transmission oil feed flange bore (16) in transmission assembly (1).
2. Aline third/fourth gear clutch pack (18) and install shaft alinement tool.



3. While holding shaft alinement tool, turn transmission assembly (1) until transmission oil feed flange bore (16) is pointing upward.
4. Lower shaft alinement tool and position two thrustwashers (67 and 68) and shim (66) in transmission assembly (1).
5. Using shaft alinement tool, hold shim (66) and two thrustwashers (67 and 68) in place, and turn transmission 180°.
6. Remove shaft alinement tool.



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5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

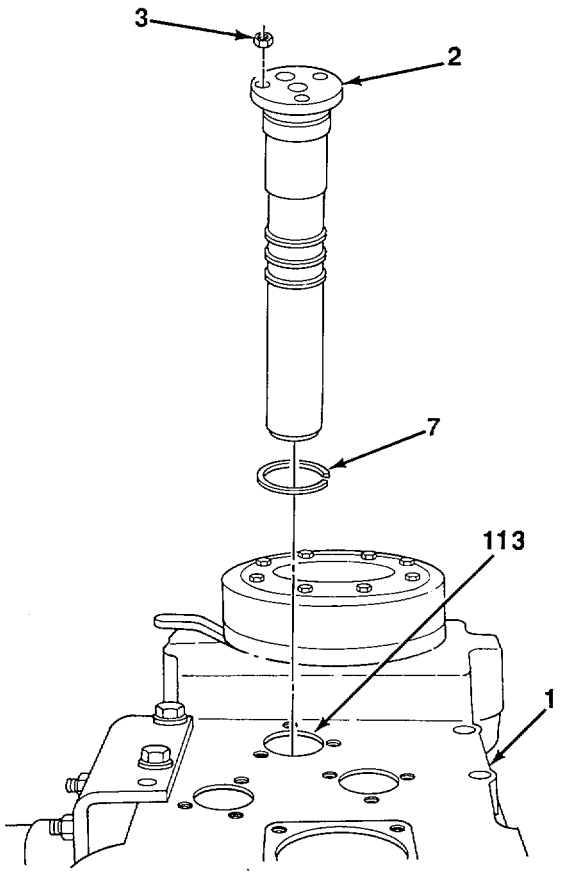
WARNING

Wear protective clothing (goggles/shield, gloves, etc.) when heating parts and handling hot parts. Hot parts can cause severe burns.

CAUTION

DO NOT use a torch to heat transmission assembly housing. Housing may become warped and equipment damaged.

7. Using a heat gun, heat third/fourth gear clutch pack bore (113) on both sides of transmission assembly (1) for 30 minutes.
8. Install new preformed packing (7) on first/forward gear axle (2).
9. Remove heat gun and install first/forward gear axle (2) on transmission assembly (1) with three nuts (3). Torque nuts to 18 lb.-ft. (25 N•m).



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5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

10. Install dial indicator inside transmission assembly (1) with indicator sensor resting on third gear spur gear (76).

CAUTION

Apply light leverage on pry bar. Too much leverage can cause transmission housing to distort.

11. Using pry bar, raise third/fourth gear clutch pack (18). Note reading on dial indicator.

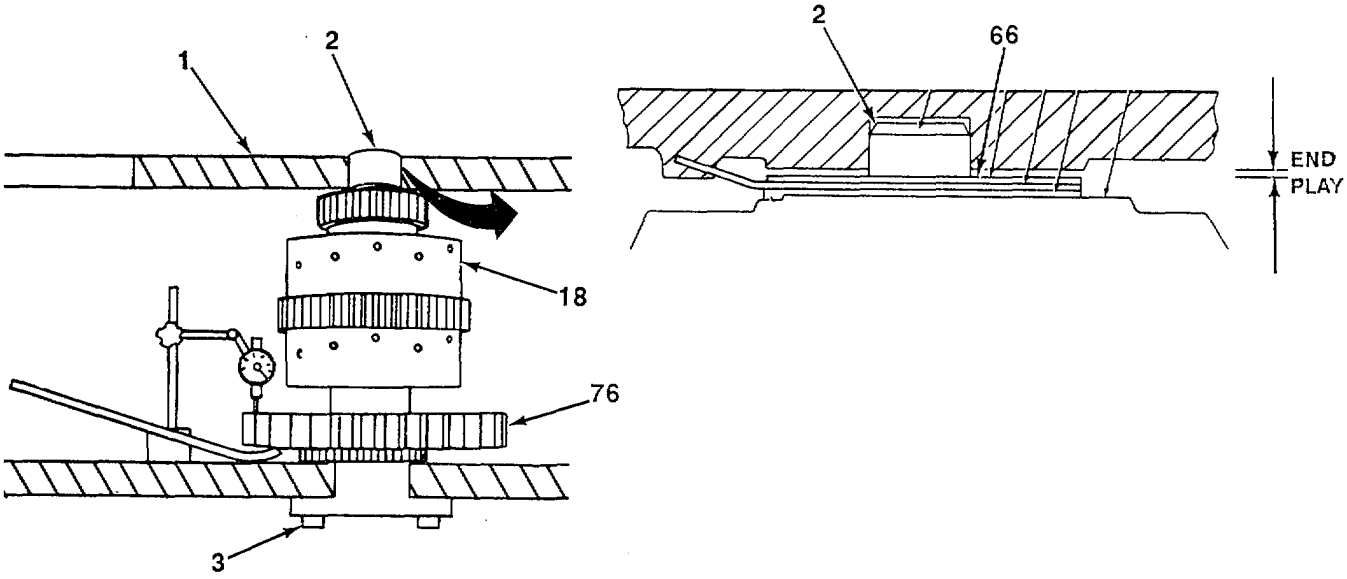
12. Repeat step 11 several times and note readings. End play must be between 0.004-0.012 (0.102-0.305 mm).

13. If end play meets specification, remove dial indicator and go to step 18.

14. If end play does not meet specification, size of shim (66) must be changed. Repeat steps 2 through 4 of subparagraph a, but only pull out first/forward gear axle (2) out just far enough to install a replacement shim.

15. Using a soft hammer, seat first/forward gear axle (2) and install three nuts (3). Torque nuts to 18 lb.-ft. (25 N•m).

16. Repeat steps 10 through 13.



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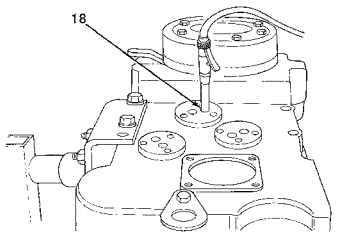
TA708296

5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

NOTE

An audible click should be heard when compressed air is introduced in clutch pack port.

17. Using compressed air, check third/fourth gear clutch pack (18) for piston function.

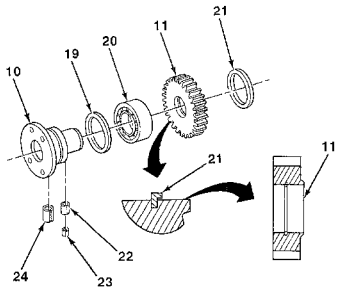


18. If removed, install three new spring pins (22, 23, and 24) in idler gear axle (10).

NOTE

Ensure that roller bearings do not extend beyond idler gear when angle ring is installed.

19. If roller set (20) was removed, apply petrolatum to 28 bearing rollers.
20. Install roller set (20) and angle ring (21) on upper idler gear (11).
21. Install new preformed packing (19) on idler gear axle (10).



TA708297

5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

NOTE

- **When positioning idler gear in transmission assembly, ensure that stepped side of idler gear is seated against transmission assembly.**
- **Use care when installing idler gear in transmission assembly not to dislodge bearing rollers.**

22. Position idler gear (11) in transmission assembly (1).

23. Install idler gear axle (10) in transmission assembly (1) and upper idler gear (11).

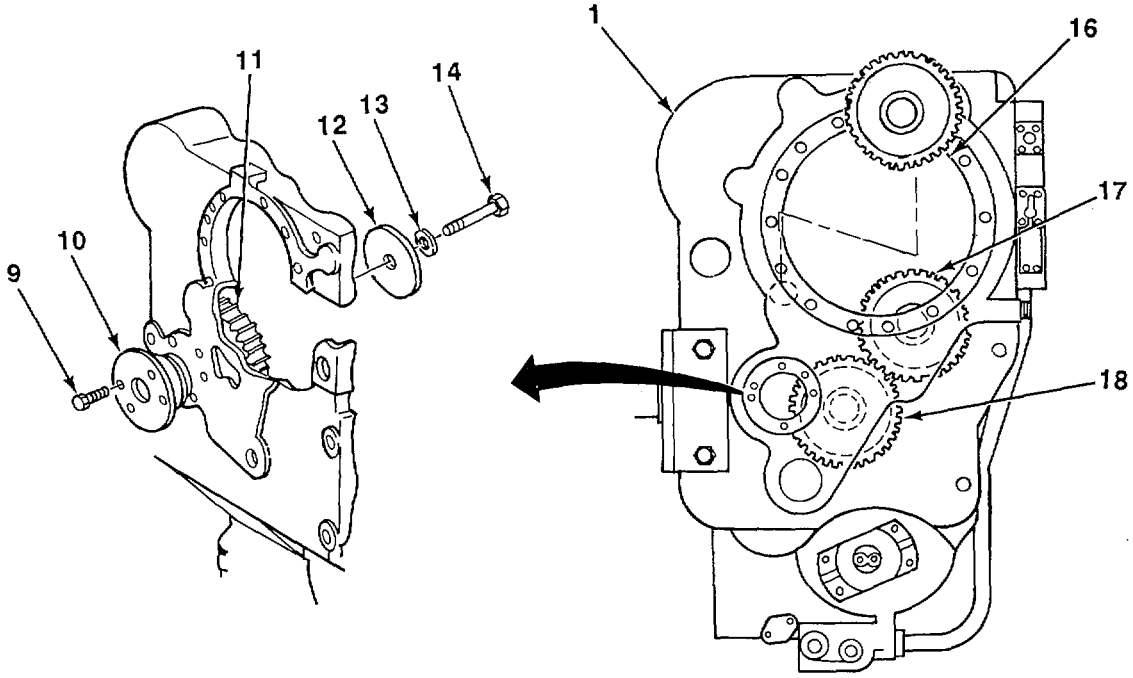
NOTE

Thrustwasher must be Installed with chamfer pointing away from Idler gear.

24. Install thrustwasher (12), washer (13), and screw (14) on idler gear (11). Torque screw to 35 lb.-ft. (48 N•m).

25. Install four screws (9) on idler gear axle (10). Torque screws to 18 lb.-ft. (24 N•m).

26. With transmission assembly (1) and transmission oil feed flange bore (16) facing up, and using a suitable lifting device, install second/reverse gear clutch pack (17) into transmission assembly.



TA708298

TA708298

5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

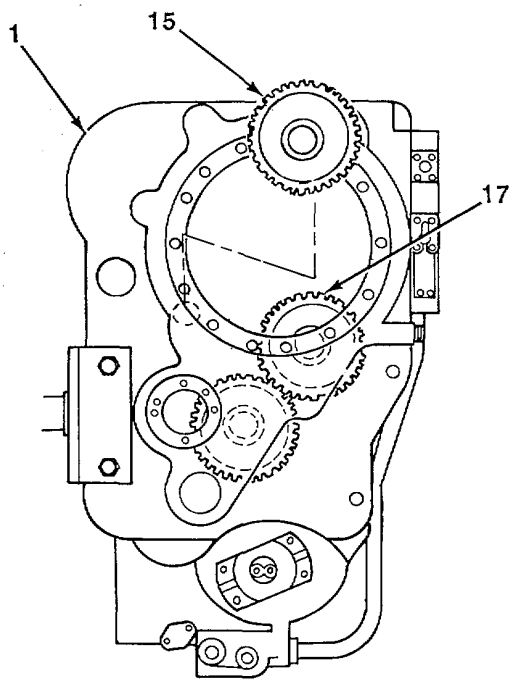
NOTE

Shims and thrustwashers are loose. Remove from clutch packs for later installation.

27. Move second/reverse gear clutch pack (17) as far left and down as possible to allow installation of first/forward gear clutch pack (15).

28. Using a suitable lifting device, install first/forward gear clutch pack (15) into transmission assembly (1).

29. Using shaft alinement tool, aline second/reverse gear clutch pack (17) with bores in transmission assembly (1).

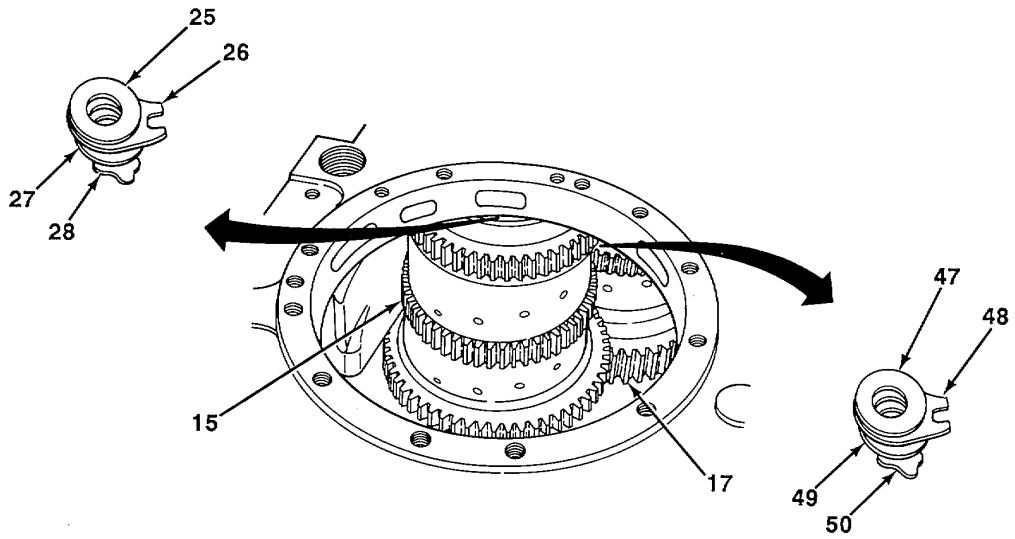


TA708299

5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

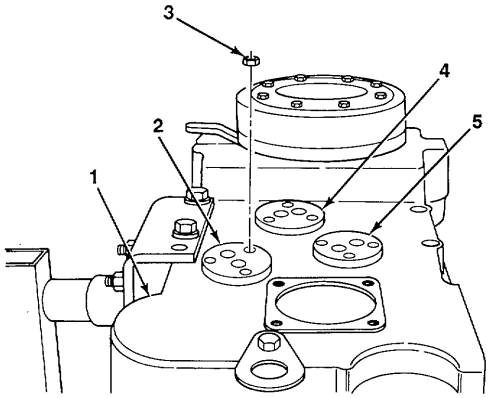
30. Repeat steps 2 through 9 to install thrustwashers (48, 49, and 50) and shim (47) on second/reverse gear clutch pack (17).

31. Repeat steps 2through 9 to install thrustwashers (26, 27, and 28) and shim (25) on first/forward gear clutch pack (15).



32. Turn transmission assembly (1) until first/forward gear axle (2), second/reverse gear axle (5), and third/fourth gear axle (4) are facing up. Rotate clutch packs while tapping on gear axles to seat gear axles.

33. Torque nine nuts (3) to 18 lb.-ft. (24 Nom).



TA708300

TA708300

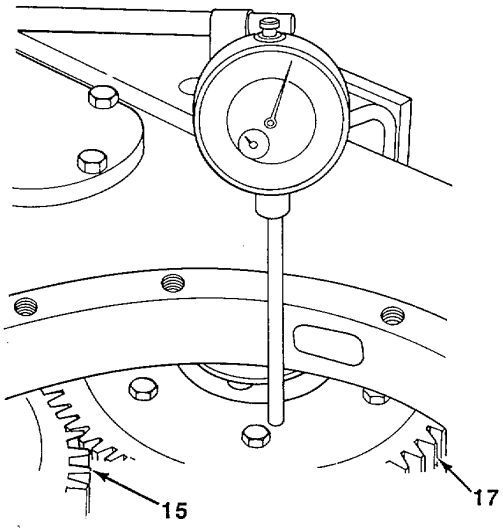
5-12. TRANSMISSION CLUTCH PACKS AND IDLER GEAR MAINTENANCE (Con't).

34. Position dial indicator on outside so that dial indicator sensor is resting against second gear spur gear.

35. Repeat steps 11 through 17 for second/reverse gear clutch pack (17).

36. Position dial indicator on outside so that dial indicator sensor is resting against forward gear spur gear.

37. Repeat steps 11 through 17 for first/forward gear clutch pack (15).



FOLLOW-ON TASKS:

- Install transmission oil feed flange (see paragraph 5-10).
- Install transmission hydraulic hoses and fittings (see TM 10-3930-659-20).
- Fill transmission assembly with hydraulic fluid (see TM 10-3930-659-10).

TA708301

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT.

This Task Covers:
a. Removal
b. Cleaning and Inspection
c. Installation

Initial Setup:

Equipment Conditions:
- Transmission clutch packs and idler gear removed (see paragraph 5-12).
- Parking brake removed (see TM 10-3930-659-20).

Tools/Test Equipment:
- Two preformed packings
- General mechanic's tool kit (Item 71, Appendix E)
- Electric drill, portable (Item 20, Appendix E)
- Twist drill set (Item 21, Appendix E)
- Depth gage micrometer (Item 27, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Soft hammer (Item 34, Appendix E)
- Retaining ring pliers (Item 46, Appendix E)
- Arbor press (Item 47, Appendix E)
- Puller kit (Item 50, Appendix E)
- Transmission output shaft pipe driver (Figure C-4, Appendix C)

Materials/Parts:
- Sealing compound (Item 14, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Two locking straps
- Two seals

*Three caps

References:
- TM 9-214
- TM 10-3930-659-20

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

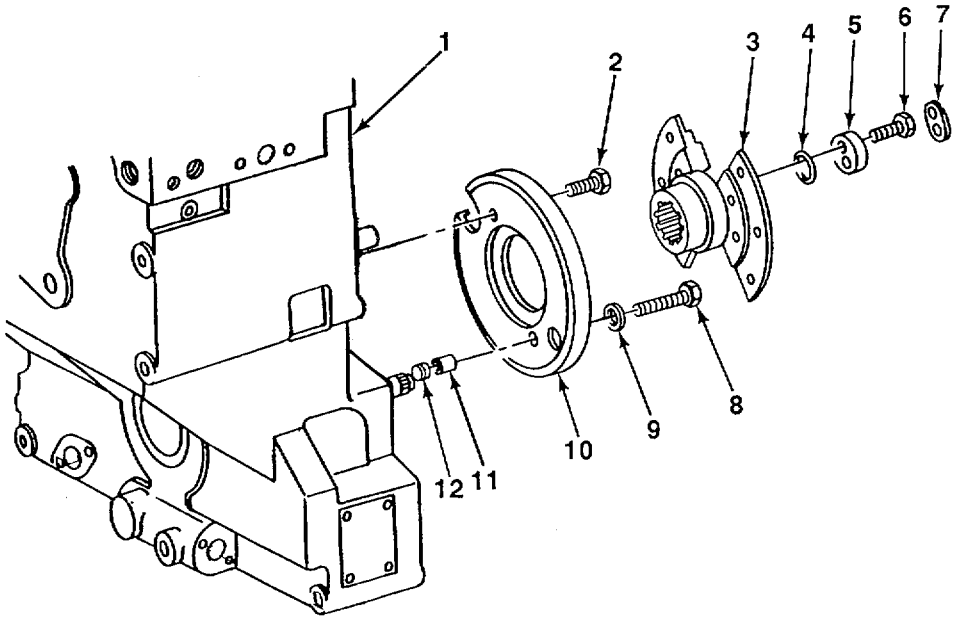
a. REMOVAL

1. Remove locking strap (7), two screws (6), spacer (5), and yoke (3) from transmission assembly (1). Discard locking strap.

2. Remove preformed packing (4) from yoke (3). Discard preformed packing.

3. Remove screw (2) from backing plate (10).

4. Remove screw (8), washer (9), backing plate (10), bushing (11), and setscrew (12) from transmission assembly (1).



TA708302

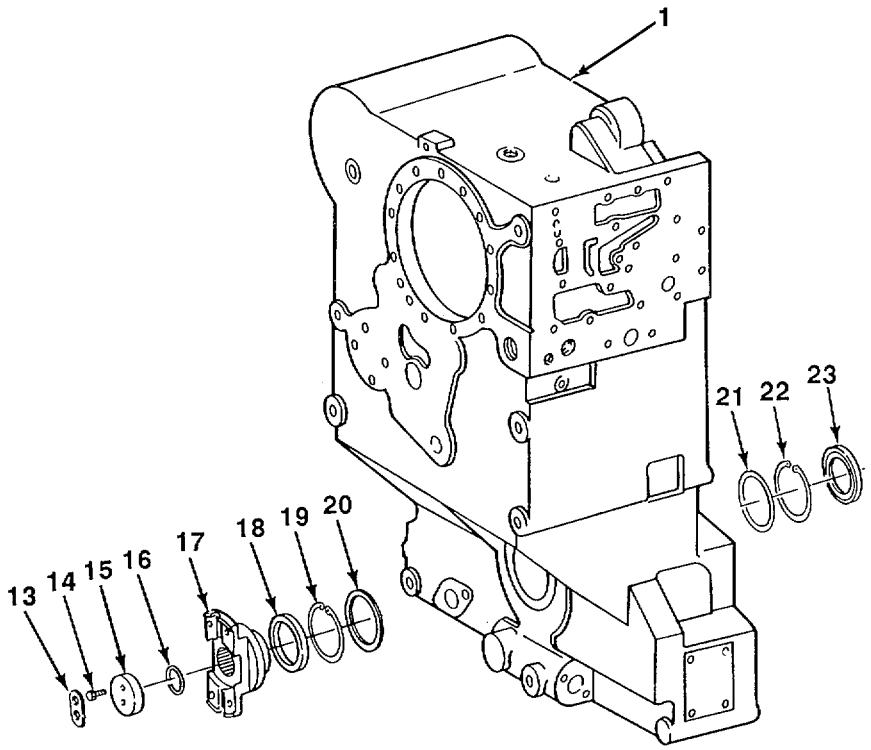
5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

5. Remove locking strap (13), two screws (14), spacer (15), and yoke (17) from transmission assembly (1). Discard locking strap.

6. Remove preformed packing (16) from yoke (17). Discard preformed packing.

7. Remove seal (18), retaining ring (19), and shim (20) from transmission assembly (1). Discard seal.

8. Remove seal (23), retaining ring (22), and shim (21) from transmission assembly (1). Discard seal.



TA708303

TA708303

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

9. Remove output shaft (26) from transmission assembly (1).

10. Remove retaining ring (25) from transmission assembly (1).

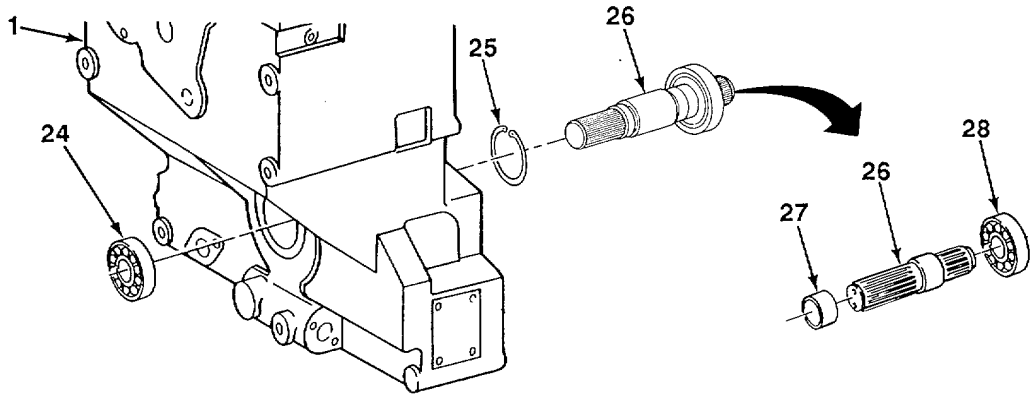
11. Remove pipe sleeve (27) from output shaft (26).

NOTE

Perform steps 12 and 13 only if bearings are damaged.

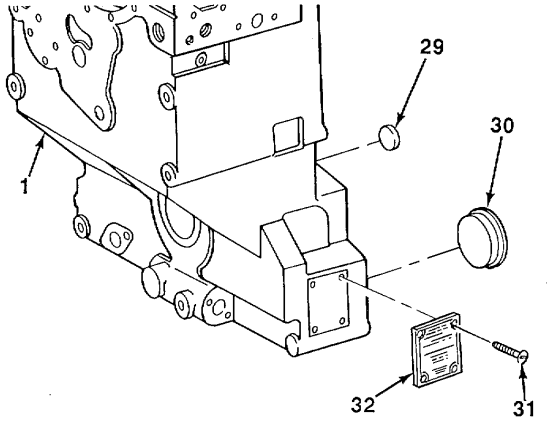
12. Using arbor press, remove bearing (28) from output shaft (26).

13. Using puller kit, remove bearing (24) from transmission assembly (1).



14. Remove two caps (30) and cap (29) from transmission assembly (1). Discard caps.

15. If plate (32) is damaged, remove four pins (31) and plate from transmission assembly (1). Discard pins.

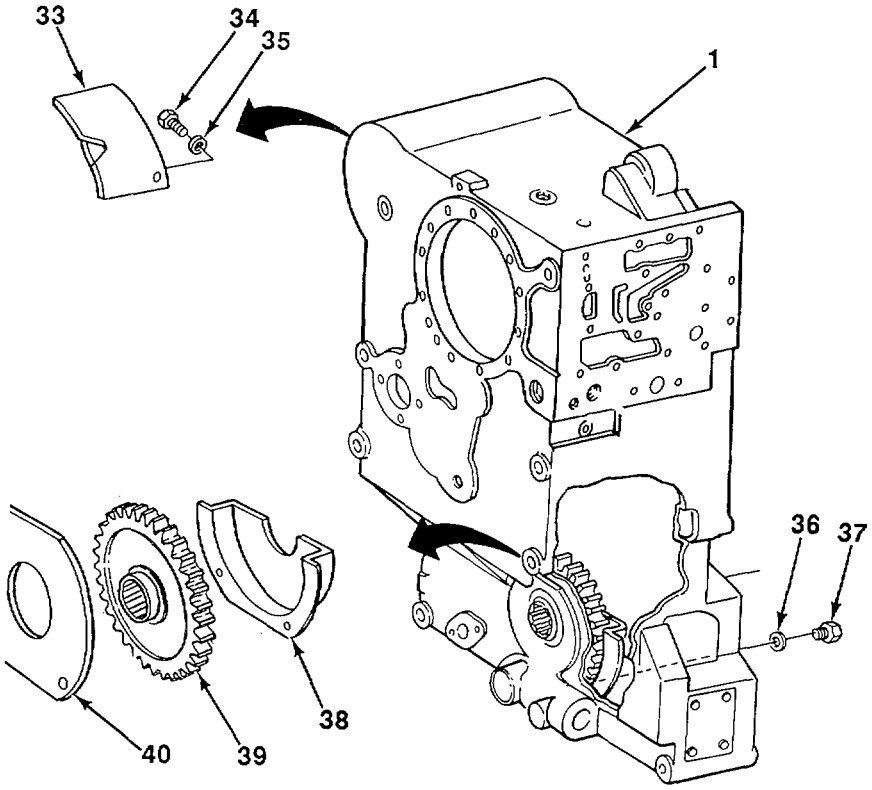


TA708304

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

16. Remove two screws (37), washers (36), inner oil shield (38), input gear (39), and oil shield (40) from transmission assembly (1).

17. If oil shield (33) is damaged, remove screw (34), washer (35), and oil shield from transmission assembly (1).



TA708305

TA708305

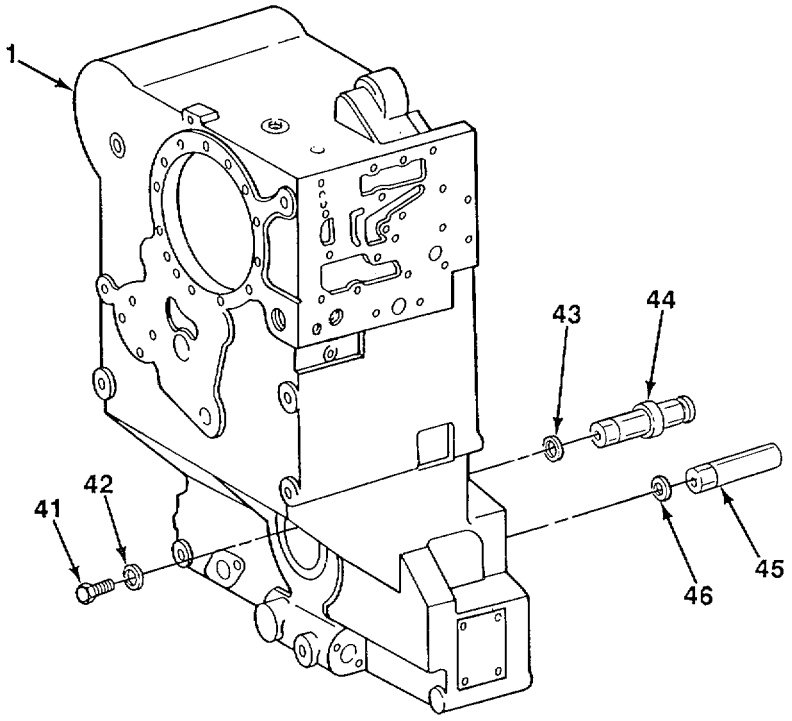
5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

NOTE

Perform steps 18 and 19 only if pins are damaged.

18. Remove two screws (41), washers (42), and pins (44 and 45).

19. Remove two preformed packings (43 and 46) from pins (44 and 45). Discard preformed packings.



b. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point Is 100°F-138°F (380C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean parts with dry cleaning solvent and dry with clean rags.

2. Clean and inspect bearings in accordance with TM 9-214.

3. Inspect metal parts for cracks and breaks. Replace damaged parts.

4. Inspect output shaft splines for nicks and damage. Replace nicked or damaged output shaft.

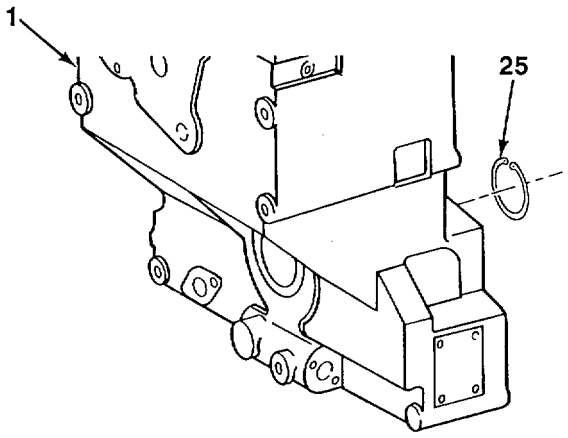
TA708306

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

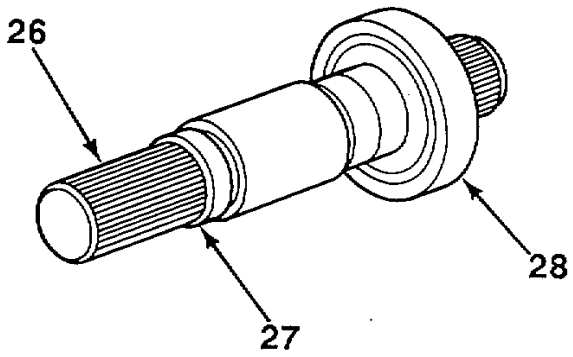
C. INSTALLATION

NOTE
Perform steps 1 through 3 only if pins were removed.

1. Install two new preformed packings (43 and 46) on pins (44 and 45).
2. Apply sealing compound to threads of two screws (41).
3. Install two pins (44 and 45) in transmission assembly (1) with two washers (42) and screws (41).
4. Install retaining ring (25) in transmission assembly (1).



5. If removed, install bearing (28) on output shaft (26) using arbor press.
6. Install pipe sleeve (27) on output shaft (26).

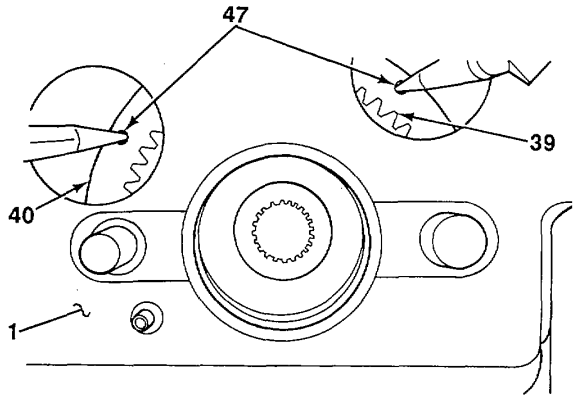


TA708307

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

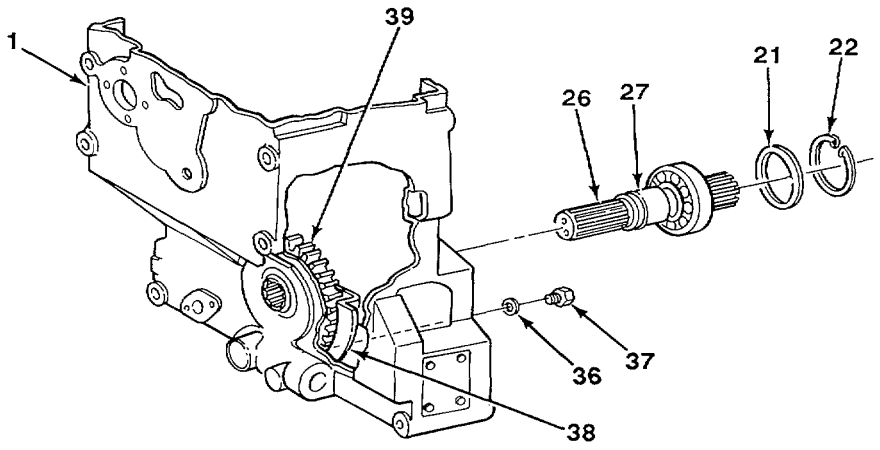
7. Position oil shield (40) inside transmission assembly (1) and aline two mounting holes (47) with holes in transmission assembly.

8. Position input gear (39) in front of oil shield (40).



9. Install output shaft (26) into transmission assembly (1) until pipe sleeve (27) contacts input gear (39).

10. Install shim (21) and retaining ring (22) on output shaft (26).



TA708308

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

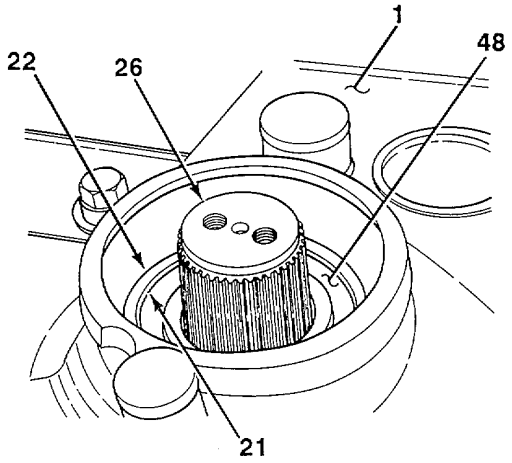
11. Using depth gage micrometer, measure and note distance from top of output shaft (26) to bearing contact surface (48).

12. Using depth gage micrometer, measure and note distance from top of output shaft (26) to retaining ring (22).

13. Subtract measurement taken in step 12 from measurement taken in step 11. Difference is end play. End play must be 0. -0.020 in. (0.3050.508 mm). If measurement is within specification, go to step 15.

14. Remove retaining ring (22) and shim (21) from transmission assembly (1). Replace shim with new shim thickness required to meet end play specification in step

13. Install new shim and retaining ring on transmission assembly.



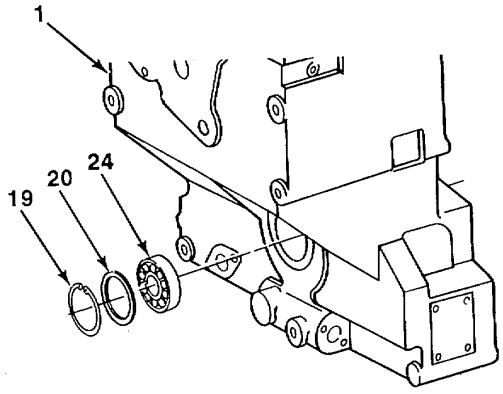
15. Install inner oil shield (38) on transmission assembly (1) with two washers (36) and screws (37). Torque screws to 36 lb.-ft. (49 N-m).

16. Remove retaining ring (22), shim (21), and output shaft (26) from transmission assembly (1).

17. Using transmission output shaft pipe driver, install bearing (24), shim (20), and retaining ring (19) on transmission assembly (1).

18. Using feeler gage, check for gap between bearing (24) and retaining ring (19). If no gap exists, go to step 22.

19. Remove retaining ring (19) and shim (20) from transmission assembly (1). Replace shim with new shim thickness required to eliminate gap. Install new shim and retaining ring on transmission assembly.



TA708309

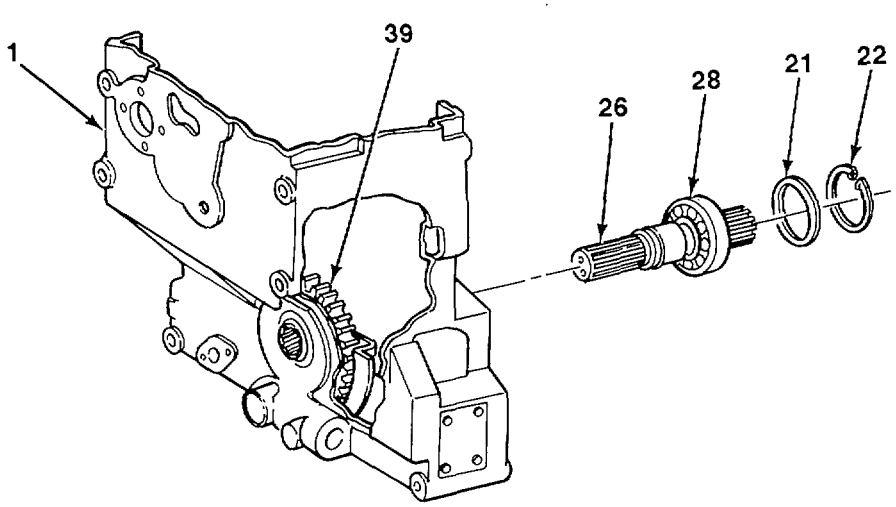
5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

20. Install output shaft (26) on transmission assembly (1).

21. Install shim (21) and retaining ring (22) on transmission assembly (1).

22. Using feeler gage, check for gap between bearing (28) and retaining ring (22). If no gap exists, go to step 26.

23. Remove retaining ring (22) and shim (21) from transmission assembly (1). Replace shim with new shim thickness required to eliminate gap. Install new shim and retaining ring on transmission assembly.



CAUTION

Mark transmission output shaft pipe driver X in. (15.9 mm) from end. DO NOT install seals deeper than % in. (15.9 mm). Failure to follow this caution may damage seals.

24. Using soft hammer and transmission output shaft pipe driver, install seals (18 and 23) in transmission assembly (1).

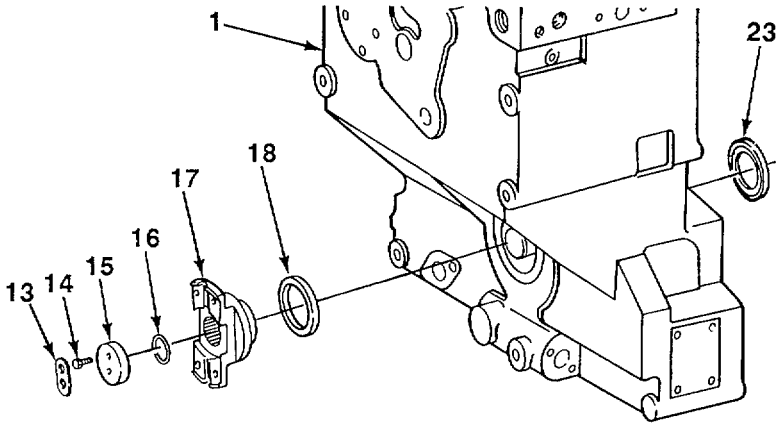
25. Install new preformed packing (16) on yoke (17).

26. Install yoke (17) and spacer (15) on transmission assembly (1) with two screws (14).

27. Install new locking strap (13) on two screws (14).

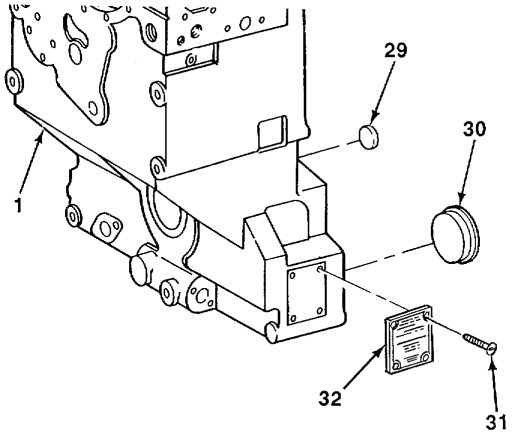
TA708310

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).



28. If removed, install plate (32) on transmission assembly (1) with four new pins (31).

29. Install new cap (29) and two new caps (30) on transmission assembly (1).



TA708311

5-13. TRANSMISSION OUTPUT SHAFT ASSEMBLY REPLACEMENT (Con't).

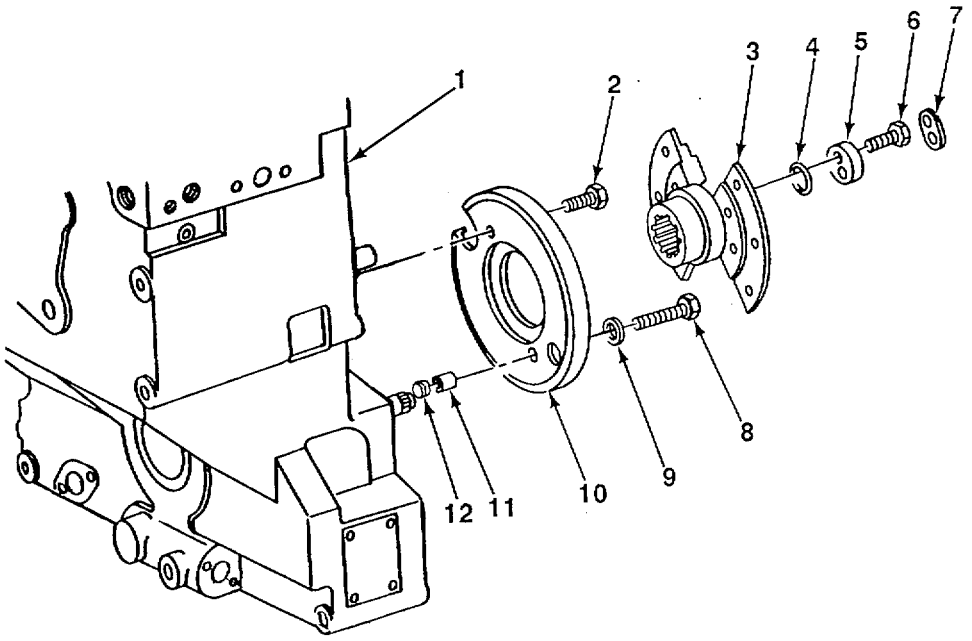
30. Install setscrew (12), bushing (11), and backing plate (10) on transmission assembly (1) with washer (9) and screw (8).

31. Install screw (2) on backing plate (10).

32. Install new preformed packing (4) on yoke (3).

33. Install yoke (3) on transmission assembly (1) with spacer (5) and two screws (6).

34. Install new locking strap (7) on two screws (6).



FOLLOW-ON TASKS:

- Install parking brake (see TM 10-3930-659-20).
- Install transmission clutch packs and idler gear (see paragraph 5-12).

TA708312

Section IV. AXLE MAINTENANCE

5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR.

This Task Covers:

a. Axle Housing Disassembly
b. Planetary Carrier Disassembly
c. Cleaning and Inspection
d. Planetary Carrier Assembly
e. Axle Housing Assembly

INITIAL SETUP:

Equipment Conditions:
- Axle housing assembly removed (see paragraph 4-50)
- Service brake disc removed (see paragraph 4-51)

Tools/Test Equipment:

Tools/Test Equipment:
- Rags (Item 43, Appendix B)
- General mechanic's tool kit (Item 71, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Feeler gage (Item 28, Appendix E)
- Hydraulic jack, 10 ton (Item 39, Appendix E)
- Torque wrench multiplier (Item 44, Appendix E)
- Retaining ring pliers (Item 46, Appendix E)
- Arbor press (Item 47, Appendix E)
- Puller kit (Item 50, Appendix E)
- Torque wrench, 0-600 Ib.-ft (Item 82, Appendix E)
- Axle adjusting tool (Figure C-9, Appendix C)

Materials/Parts:
- Silicone sealing compound (Item 17, Appendix B)
- Grease (Item 33, Appendix B)
- Lead (Item 35, Appendix B)
- Petrolatum (Item 42, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- Three seals

Personnel Required: Two

References:
- TM 9-214

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame Use only in a well-ventilated area.

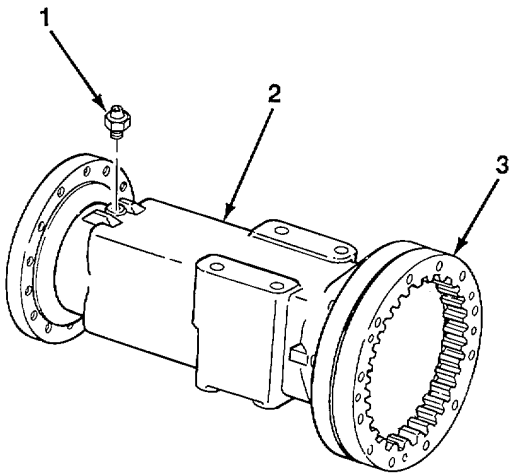
5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

NOTE

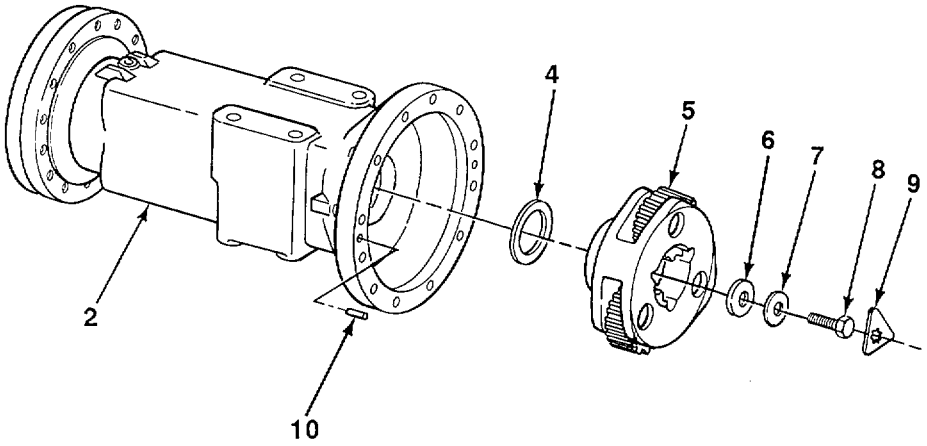
All four axle housings and planetary carriers are repaired the same way. One axle housing and one planetary carrier assembly are illustrated.

a. AXLE HOUSING DISASSEMBLY

1. Remove ring gear (3) from axle housing (2).
2. If damaged, remove lubrication fitting (1) from axle housing (2).



3. If damaged, remove two pins (10) from axle housing (2).
4. Remove plate (9) from planetary carrier (5).
5. Remove screw (8), planetary carrier (5), washer (7), and two shims (4 and 6) from axle housing (2).



TA708347

5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

6. Position axle housing (2) in vertical position, and install axle adjusting tool (11) on axle housing with two % in. x 32 in. bolts (17) and % in. nuts (16).

7. Attach suitable lifting device to axle adjusting tool (11) and raise lifting device enough to support weight of axle housing (2).

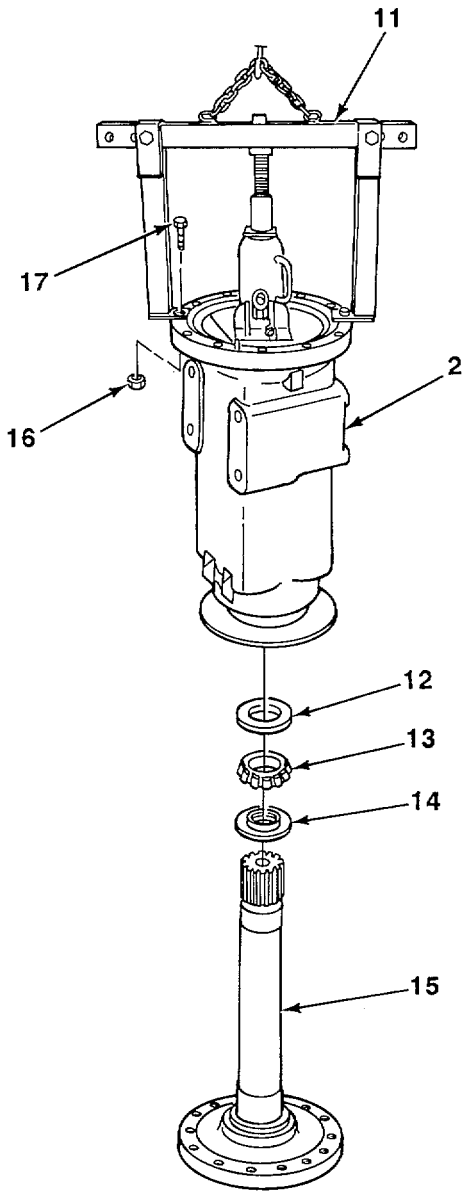
8. Position hydraulic jack on axle housing (2) with wood blocks between bottom of hydraulic jack and axle shaft (15).

9. Using hydraulic jack, push axle shaft (15) away from axle housing (2). Remove hydraulic jack.

10. Using axle adjusting tool (11), lift axle housing (2) from axle shaft (15).

11. Remove two nuts (16), bolts (17), and axle adjusting tool (11) from axle housing (2).

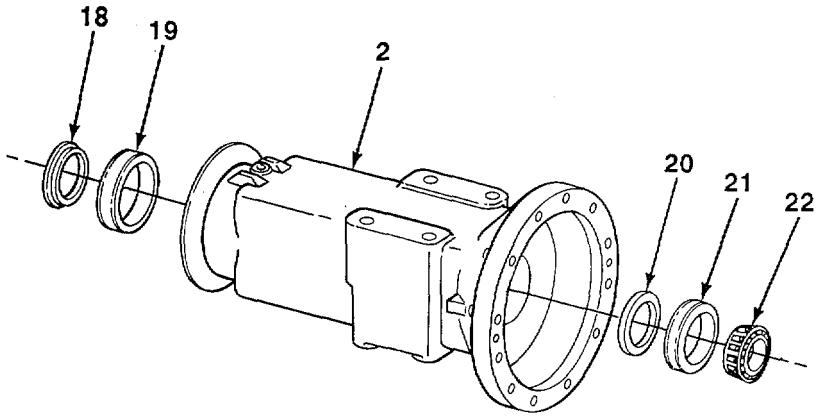
12. Using puller kit, remove outer seal (14), bearing cone (13), and seal (12) from axle shaft (15). Discard seals.



TA708348

5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

13. Using puller kit, remove bearing cone (22) from axle housing (2).
14. Using puller kit, remove sleeve (18) and two bearing cups (19 and 21) from axle housing (2).
15. Remove Inner seal (20) from axle housing (2). Discard seal.

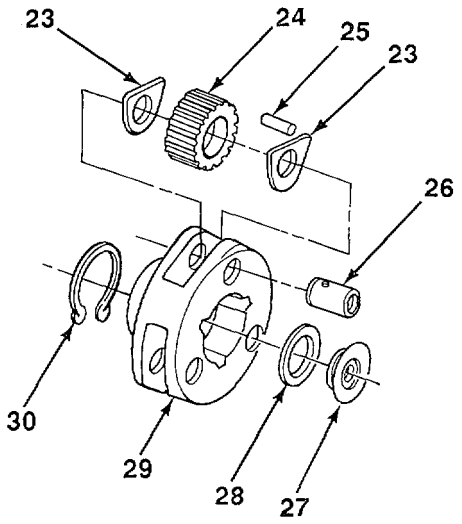


b. PLANETARY CARRIER DISASSEMBLY

1. Remove retaining ring (30) from planetary carrier housing (29).

NOTE
Mark gear components to aid during installation. DO NOT mix components of one gear with components of other gears.

2. Using arbor press, press out shaft (26), gear (24), two plates (23), and 33 roller bearings (25) from planetary carrier housing (29).
3. Repeat step 2 for other two gears (24).
4. Remove shouldered washer (27) and washer (28) from planetary carrier housing (29).



TA708349

5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with a clean rag.
2. Inspect axle shaft for cracks, bends, and distortion. Replace damaged axle shaft.
3. Inspect gear teeth for burrs, chips, and missing teeth. Replace damaged gear.
4. Clean and inspect bearings in accordance with TM 9-214.

d. PLANETARY CARRIER ASSEMBLY

1. Install washer (28) and shouldered washer (27) in planetary carrier housing (29).
2. Apply petrolatum to 33 roller bearings (25) and install roller bearings on gear (24).
3. Install gear (24) and two plates (23) in planetary carrier housing (29) with shaft (26). Ensure that groove in shaft is, toward long hub of planetary carrier housing.
4. Repeat steps 2 and 3 for other two gears (24).
5. Install retaining ring (30) on planetary carrier housing (29).

5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

e. AXLE HOUSING ASSEMBLY I

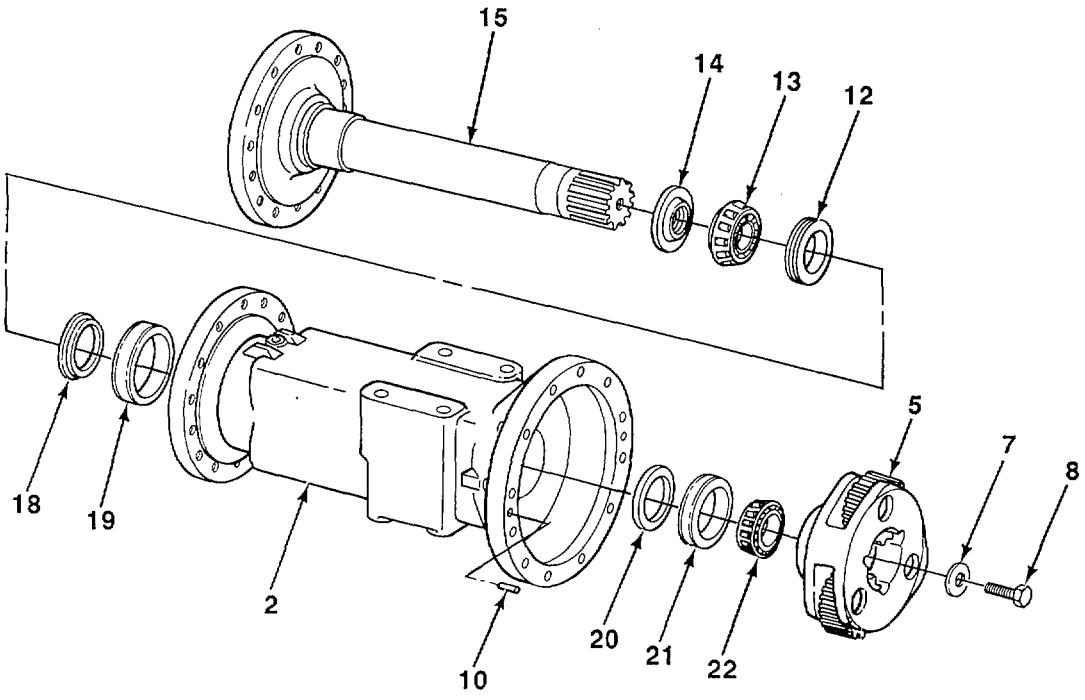
1. Apply silicone sealing compound to outside diameter of new inner seal (20).
2. Install inner seal (20) in axle housing (2), with spring side toward inside of axle housing, until flush with bottom of axle housing bore.
3. Install bearing cup (21) in axle housing (2) until seated against shoulder of axle housing.

NOTE
When installing outer seal, THIS SIDE OUT must face axle flange.

4. Install new outer seal (14) on axle shaft (15) until flush with bearing cone shoulder on axle shaft.
5. Press bearing cone (13) on axle shaft (15) until seated against bearing cone shoulder.
6. Pack outer seal (14) and bearing cone (13) with grease.

NOTE
Install seal with sealing lip away from bearing cone.

7. Install new seal (12) on axle shaft (15) until seated against bearing cone (13).
8. Apply grease to face of sealing lip of seal (12).
9. Install bearing cup (19) in axle housing (2) until seated against shoulder of axle housing.



TA708350

5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

10. Install sleeve (18) in axle housing (2).
11. If removed, install two pins (10) on axle housing (2).
12. Install axle shaft (15) in axle housing (2).
13. Position axle housing (2) in vertical position.
14. Heat bearing cone (22) to a maximum of 3000F (149°C) in accordance with TM 9-214.
15. Press bearing cone (22) on axle shaft (15).
16. Install washer (7) on bearing cone (22).
17. Install planetary carrier (5) on axle shaft (15).

NOTE

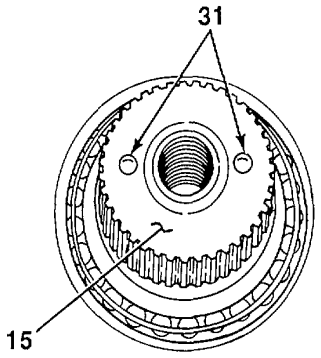
As torque is being applied, stop after every 100 lb.-ft. (136 N.m) and turn axle approximately three revolutions to ensure that bearing cups and cones are properly seated.

18. Install screw (8) on planetary carrier (5). Torque screw in increments of 100 lb.-ft. (136 Norm) until final torque of 607 lb.-ft. (823 Norm) is reached.
19. Loosen screw (8) completely. Tap axle flange with hammer to ensure that there is no preload on bearings.

NOTE

Rolling drag torque must be measured with axle housing In vertical position.

20. Measure and note rolling drag torque of axle shaft (15) with screw (8) loosened (see TM 9-214). Rolling drag torque should not exceed 16 lb.-ft. (22 Nom).
21. Remove screw (8) and planetary carrier (5).
22. Place two 0.3-0.4 in. (7.6-10.2 mm) pieces of lead (31) on end of axle shaft (15) 1800 apart. Use grease to hold lead in place.

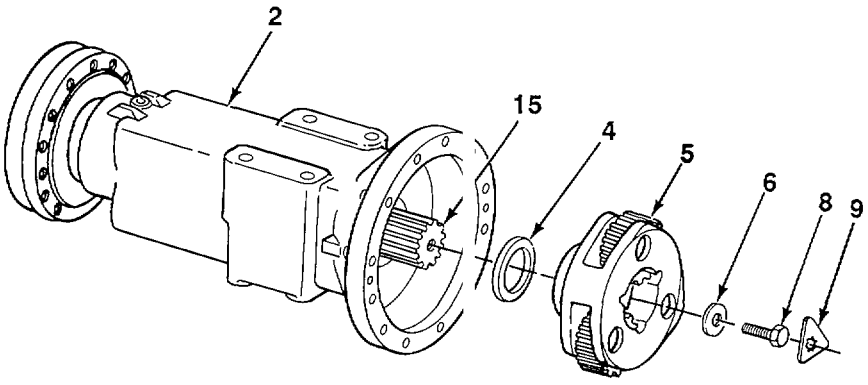


5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

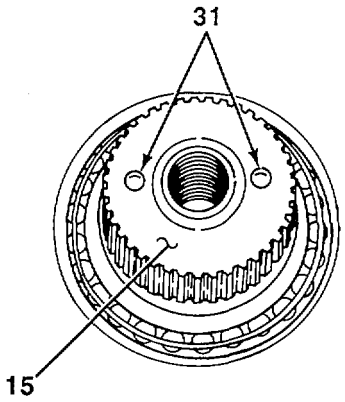
23. Install planetary carrier (5) on axle shaft (15) with screw (8). Torque screw to 145 lb.-ft. (197 N.m).

24. Rotate planetary carrier (5) at least three times and check the rolling drag torque (see TM 9-214). Torque must increase 6-12 Ib.-ft. (8-16 N-m) over reading recorded in step 20. If rolling drag torque is within specification, go to step 31.

25. Remove planetary carrier (5) from axle shaft (15).



26. Using outside caliper micrometer, measure thickness of two flattened pieces of lead (31). Average thickness of two pieces is required shim pack size.



NOTE

When adding shims, lift axle housing and tap ax a flange to remove any preload on bearings.

27. Install two shims (4 and 6), in sizes determined in step 2(, with thickest shim next to axle shaft (15).

28. Install planetary carrier (5) on axle shaft (15) with screw (I). Torque screw to 670 Ib.-ft. (909 Nem).

29. Rotate axle housing (2) three times and check rolling drag torque (see TM 9-214). Rolling drag torque must be 6-12 Ib.-ft. (8-16 Nnm) over reading made in step 20. If rolling drag torque is within specification, go to step 31.

5-14. AXLE HOUSING AND PLANETARY CARRIER ASSEMBLY REPAIR (Con't).

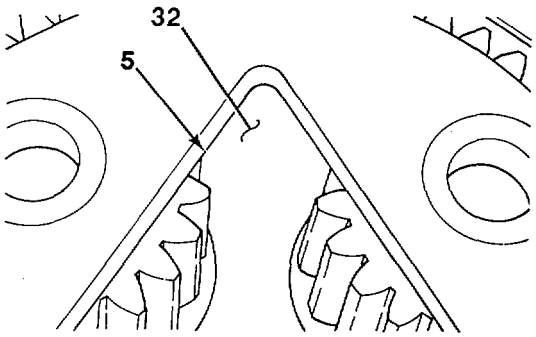
NOTE

Adding or deleting a 0.005 in. (0.127 mm) shim will change rolling drag torque by approximately 6 lb.-ft. (8 N.m). If adding shims, lift axle housing and tap axle flange to remove any preload on bearings.

3 . Adjust two shims (4 and 6) as necessary.

3 . Apply grease to both sides of plate (9) and install plate over screw (8).

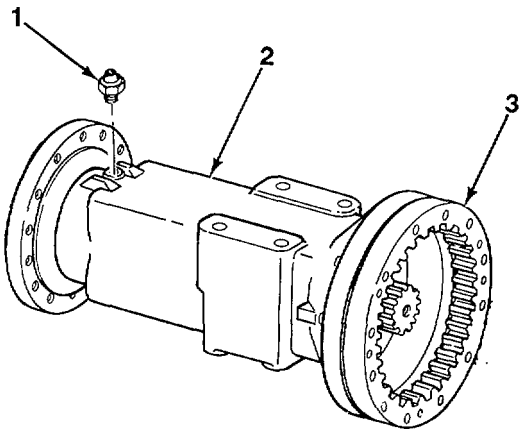
3 . Using feeler gage, measure gap between plate tang (32) and closest edge in pocket of planetary carrier (5). Minimum gap allowed is 0.02 in. (0.51 mm).



3 . Apply silicone sealing compound to axle housing (2).

3 . Install ring gear (3) on axle housing (2).

3 . If removed, install lubrication fitting (1) on axle housing (2).



FOLLOW-ON TASKS:

- Install service brake disc (see paragraph 4-51).
- Install axle housing assembly (see paragraph 4-50).

TA708353

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

INITIAL SETUP:

Equipment Conditions:
- Front axle assembly removed (see paragraph 4-47).
- Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
- General mechanic's tool kit (Item 71, Appendix E)
- Outside caliper micrometer (Item 9, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Arbor press (Item 47, Appendix E)
- Machinist's vise (Item 76, Appendix E)
- Torque wrench, 0-600 lb.-ft. (Item 82, Appendix E)
- Axle yoke holding tool (Figure C-8, Appendix C)
- TM 9-214

Materials/Parts:
- Prussian blue dye (Item 24, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One cotter pin
- One seal
- Two preformed packings

Personnel Required: Two

References:

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Prussian blue dye is poisonous, and can cause serious burn, and dizziness. Use only in a well-ventilated area.

a. REMOVAL

1 Remove six screws (1) and washers (2) from front input quill assembly (4) and differential housing (3).

WARNING

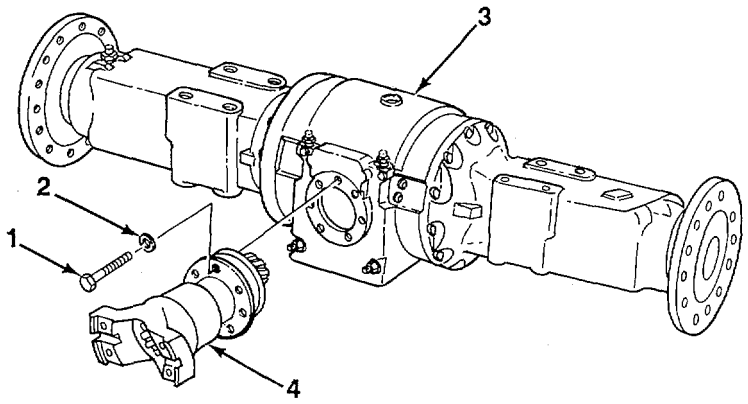
Use extreme caution when handling heavy parts. lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow tl is warning may cause serious injury or death to personnel.

NOTE
Front input quill assembly weighs approximately 70 lb (32 kg).

2 Remove front input quill assembly (4) from differential housing (3).

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

b. DISASSEMBLY

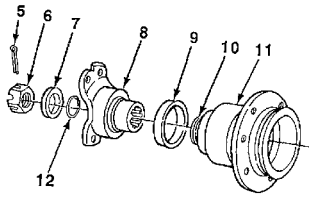


1 Place front axle yoke (8) in machinist's vise with vise jaw caps or axle yoke holding tool.

NOTE
Torque on nut is approximately 300 lb.-ft. (407 N.m).

2 Remove cotter pin (5) and nut (6) from pinion shaft (10). Discard cotter pin.

3 Remove spacer (7), preformed packing (12), front axle yoke (8), and seal (9) from front input quill (11). Discard preformed packing and seal.



TA708354

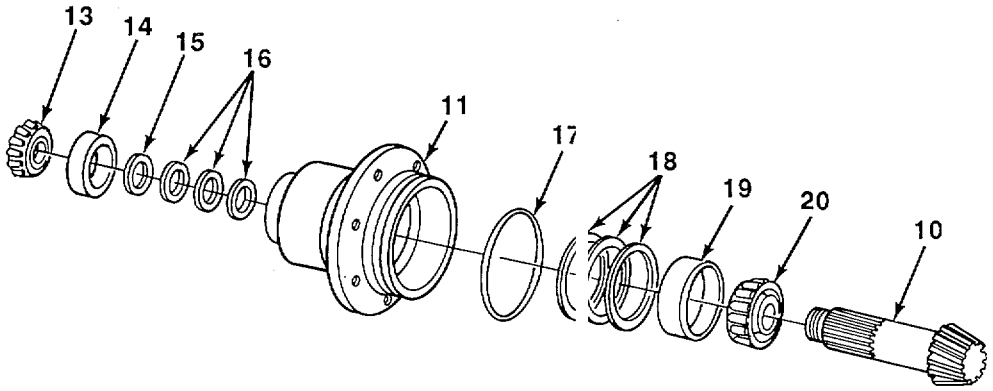
5-15. FRONT AXLE YOKE, INPUT QUILL, AND P NION SHAFT MAINTENANCE (Con't).

4 Using arbor press, press pinion shaft (10) from front input quill (11).

5 Remove bearing cone (13) from front input quill (11).

NOTE
Number of shims may vary. Note number of shims to aid during assembly.

6 Remove washer (15) and shim packs (16 and 18) from pi ion shaft (10).



NOTE
- **Perform steps 7 and 8 only if components are damaged.**
- **Bearing cone and bearing cups a e press-fitted.**

7 Using arbor press, press bearing cone (20) from pinion shaft (10).

8 Using arbor press, press two bearing cups (14 and 19) from front input quill (11).

9 Remove preformed packing (17) from front input quill (11 Discard preformed packi ng.

c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, Is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1 Clean parts with dry cleaning solvent and dry with a clean rag.

TA708355

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

2 Clean and inspect bearings in accordance with TM 9-214.

NOTE

Pinion shaft and ring gear are a matched set. If pinion shaft is damaged, ring gear MUST also be replaced (see paragraph 5-17).

3 Inspect pinion shaft gear teeth for burrs and damage. Replace damaged pinion shaft and ring gear.

4 Inspect pinion shaft for cracks, bends, and distortion. Replace damaged pinion shaft and ring gear.

5 Inspect front input quill for cracks and damage. Replace damaged front input quill.

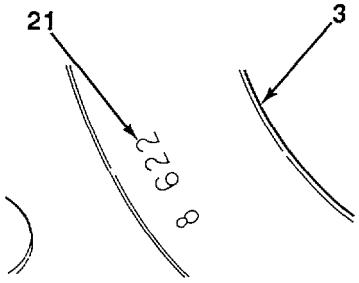
d. ASSEMBLY

1. **Front Cone Point Adjustment.**

NOTE

Dimension in step (a) is distance between differential crossbore and front input quill mounting surface on differential housing.

(a). Note dimension (21) stamped on mounting surface of differential housing (3).

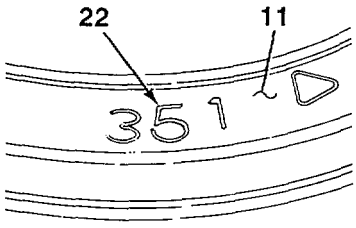


NOTE

Dimension in step (b) is distance between face of flange on front input quill and bearing cup set.

(b). Note dimension (22) stamped on face of front input quill (11).

(c). Add dimension from step (a) to dimension from step (b) and note total dimension.



TA708356

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

NOTE

• Perform steps (d) and (e) only if bearing cone and bearing cup were removed.

• Bearing cone and bearing cup are press-fitted.

(d). Using arbor press, press bearing cone (20) on pinion shaft (10).

(e). Using arbor press, press bearing cup (19) over bearing cone (20).

(f). Using outside caliper micrometer, measure and note width of bearing cone (20) and bearing cup (19).

(g). Locate and note etched dimension on bevel pinion (23). Add this dimension to measurement taken in step (f).

(h). Add 0.0015 in. (0.0381 mm) to sum noted in step (g). Subtract this measurement from measurement taken in step (c).. Measurement is required shim pack size.

2 **Pinion Shaft End Play Adjustment**.

NOTE

• Perform step (a) only if bearing cup was removed.

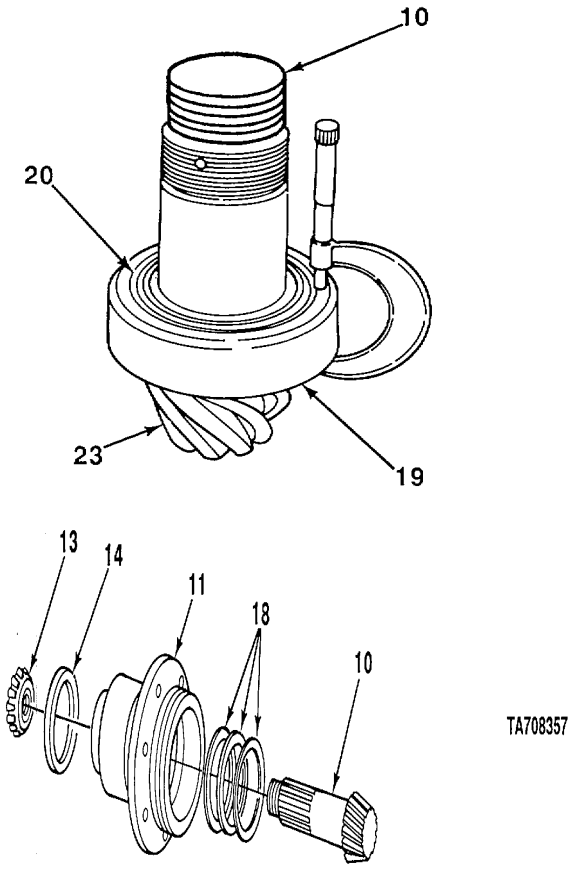
• Bearing cup is press-fitted.

(a). Using arbor press, press bearing cup (14) into front input quill (11).

(b). shim pack (18) on pinion shaft (10).

(c) Press pinion shaft (10) into front input quill (11).

(d) Press bearing cone (13) on pinion shaft (10).



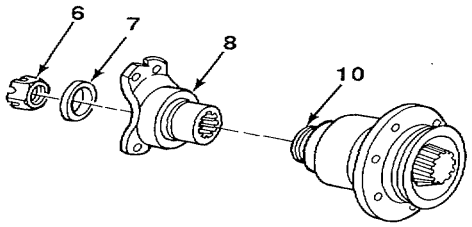
5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

NOTE
Steps (e) and (f) will seat bearing cone on pinion shaft.

(e). Install front axle yoke (8), spacer (7), and nut (6) on pinion shaft (10).

(f). Secure front axle yoke (8) in machinist's vise or axle yoke holding tool and torque nut (6) to 445 lb.-ft. (603 N-m).

(g). Remove nut (6), spacer (7), and front axle yoke (8) from pinion shaft (10).

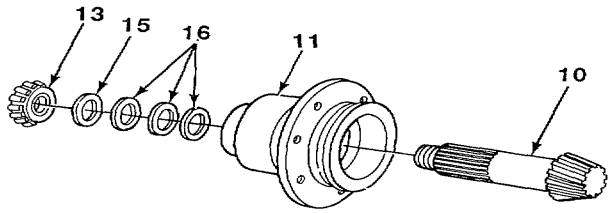


(h). Using arbor press, press pinion shaft (10) from front input quill (11) and remove bearing cone (13).

(i). Install shim pack (16) and washer (15) on pinion shaft (10).

(a). Using arbor press, press pinion shaft (10) into front input quill (11).

(k). Using arbor press, press bearing cone (13) on pinion shaft (10).



TA708358

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

NOTE
Steps (l) and (m) will seat bearing cone on pinion shaft.

(l) Install front axle yoke (8), spacer (7), and nut (6) oh pinion shaft (10).

(m) Secure front axle yoke (8) in machinist's vise or axle yoke holding tool and torque nut (6) to 445 lb. ft. (603 Nom).

(n) Loosen nut (6) to less than 200 lb. ft. (271 N-m).

(o) Torque nut (6) to 225-300 lb.ft. (305- 407 Nom).

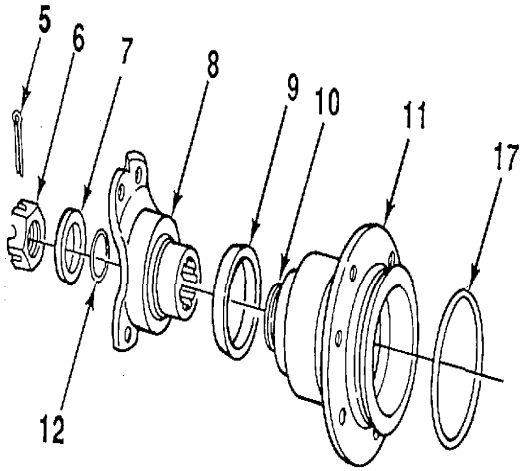
(p). Turn pinion shaft (10) several times using 2-4 lb.-ft. (3-5 Nrm) force on front axle yoke (8) end of pinion shaft.

(q). Using dial indicator, measure end play using upward force of 23-68 lb (102-302 N) force. End play must be 0.001-0.003 in. (0.025-0.076 mm). Adjust shims until proper measurement is reached.

(r). Torque nut (6) so that new cotter pin (5) can be installed, but do not install cotter pin.

(s) Mark nut (6) and pinion shaft (10).

(t) Remove nut (6), spacer (7), and front axle yoke (8) from pinion shaft (10).



(u). Apply lubricating oil to pinion shaft (10).

(v). Install new seal (9), front axle yoke (8), new preformed packing (12), spacer (7), and nut (6) on pinion shaft (10). Torque nut to mark made in step (s). Torque should be 225-300 lb.-ft. (305-407 N-m).

(w) Install new cotter pin (5).

(x) Install new preformed packing (17) on front input quill (11).

TA708359

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

e. INSTALLATION

WARNING

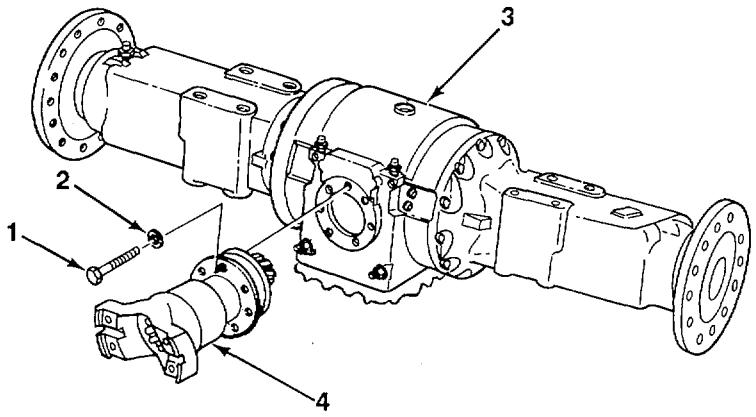
Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

Front input quill assembly weighs approximately 70 lb (32 kg).

1 Install front input quill assembly (4) on differential housing (3) with six washers (2) and screws (1). Torque screws to 37 lb.-ft. (50 N-m). Turn screws an additional one-quarter turn.

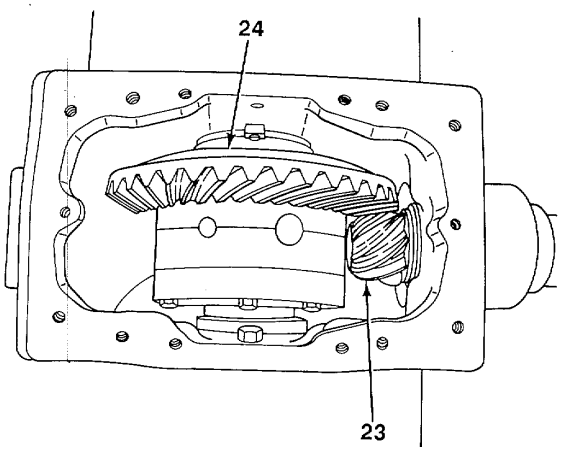
2 Remove differential cover (see paragraph 5-17).



TA708360

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

3 Using dial indicator, check backlash between ring gear (24) and bevel pinion (23). Ring gear to bevel pinion backlash must be 0.007-0.015 in. (0.178-0.381 mm). If backlash is within specification, go to step 5.

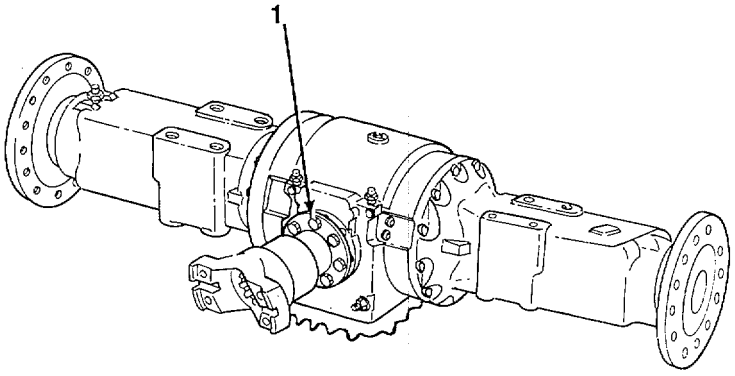


NOTE

- Moving shims from left to right (as viewed from the pinion shaft) increases backlash.
- Moving shims from right to left (as viewed from the pinion shaft) decreases backlash.

4 Move shims from one side of differential to other side to set backlash (see paragraph 5-17).

5 Torque screws (1) to 85 lb.-ft. (115 Nom).



TA708361

5-15. FRONT AXLE YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

6 Measure length (26) of tooth pattern (25).

7 Tooth pattern (25) must start 0.12-0.52 in. (3.05-13.21 mm) from toe end of bevel pinion (23).

WARNING

Prussian blue dye is poisonous and can burn skin on contact. Always wear protective goggles and gloves, and use only in a well-ventilated area. Overexposure to Prussian blue dye can cause serious heart and skin problems, dizziness, and unconsciousness if not handled properly.

8 Apply a light coat of Prussian blue dye to several teeth of ring gear (24).

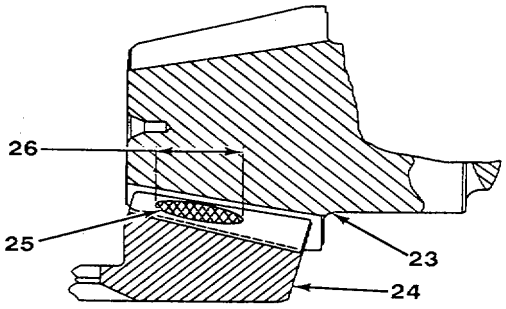
9 Roll bevel pinion (23) and ring gear (24) back and forth six times to obtain good tooth contact pattern (25).

10 . Repeat steps 8 and 9 in three locations, 1200 apart. If tooth pattern (25) is still not within specification, add or delete shims as necessary (see paragraph 5-17).

11 . Clean Prussian blue dye from bevel pinion (23) and ring gear (24).

12 . Apply a light coat of lubricating oil to teeth of bevel pinion (23) and ring gear (24).

13 . Install differential cover (see paragraph 5-17).



TA708362

FOLLOW-ON TASKS:

- Install front axle assembly (see paragraph 4-47).

5-16. REAR AXLE FRONT OSCILLATING SUPPI)RT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

INITIAL SETUP:

Equipment Conditions:
- Rear axle assembly removed (see paragraph 4-48)

Tools/Test Equipment:
- General mechanic's tool kit (Item 71, Appendix E)
- Outside caliper micromer micromer (Item 9, Appendix E)
- Vise jaw caps (Item 12, Appendix E)
- Dial indicator set (Item 19, Appendix E)
- Arbor press (Item 47, Appendix E)
- Puller kit (Item 50, Appendix E)
- Machinist's vise (Item 76, Appendix E)
- Torque wrench, 0-600 lb.-ft (Item 82, Appendix E)
- Axle yoke holding tool (Figure C-8, Appendix C)

Materials/Parts:
Prussian blue dye (Item 24, Appendix B)
- Lubricating oil (Item 38, Appendix B)
- Rags (Item 43, Appendix B)
- Dry cleaning solvent (Item 47, Appendix B)
- One cotter pin
- Two preformed packings
- Three seals

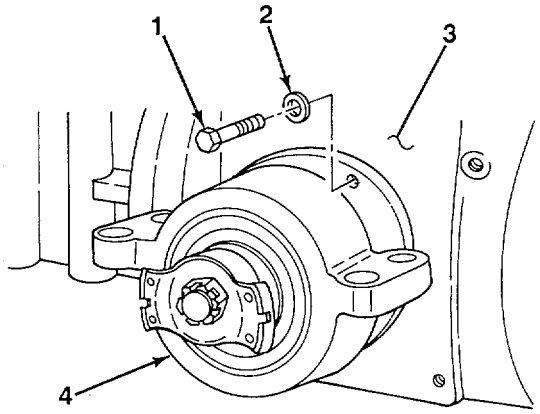
Personnel Required: Two

Reference
- TM 9-214

General Safety Instructions:
- Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.
- Prussian blue dye is poisonous, and can cause serious burr s and dizziness. Use only in a well-ventilated area.

a. REMOVAL

1 Remove six screws (1) and washers (2) from front input quill assembly (4) and differential housing (3).



TA708363

5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

WARNING

Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE
Front input quill assembly weighs approximately 120 lb (54 kg).

2 Remove front input quill assembly (4) from differential housing (3).

b. DISASSEMBLY

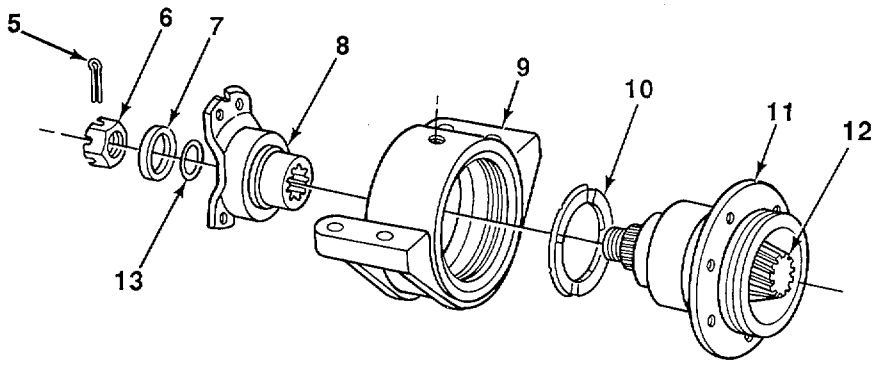
1 Position rear axle front oscillating support yoke (8) in machinist's vise with vise Jaw caps or axle yoke holding tool.

NOTE
Torque on nut is approximately 300 lb.-ft. (407 Nom).

2 Remove cotter pin (5) and nut (6) from pinion shaft (12). Discard cotter pin.

3 Remove rear axle front oscillating support yoke (8), spacer (7), and preformed packing (13) from pinion shaft (12). Discard preformed packing.

4 Remove support (9) and thrustwasher (10) from front input quill (11).



TA708364

5-16. REAR AXLE FRONT OSCILLATING SUPP 3RT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

5 Using puller kit, remove seal (14) from front input quill (11). Discard seal.

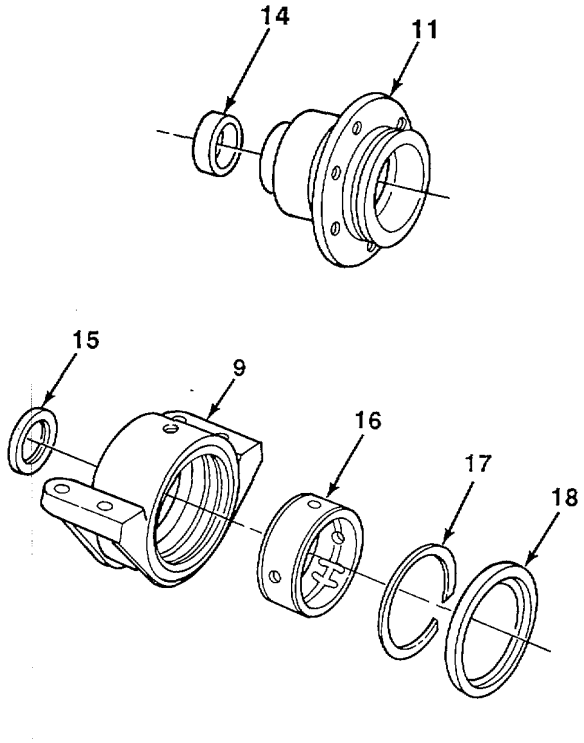
6 Using puller kit, remove small seal (15) and large seal (18) from support (9). Discard seals.

7 Remove retaining ring (17) from support (9).

CAUTION

Use care to prevent damage to support bore when removing bushing.

8 If damaged, remove bushing (16) from support (9).



NOTE
Bearing cone will remain with pinion shaft when removed.

9 Using arbor press, press pinion shaft (12) from front input quill (11) by pressing on threaded end of pinion shaft.

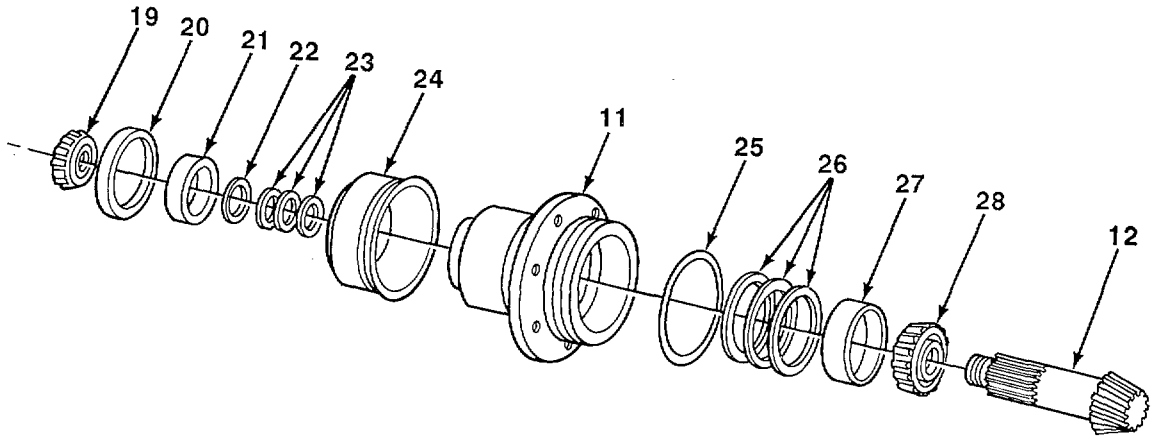
10 .Using arbor press, press bearing cone (19) from front input quill (11).

NOTE
Number of shims may vary. Note number of shims to aid during assembly.

11 Remove washer (22) and shim pack (23) from pinion shaft (12).

TA708365

5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).



NOTE
- Perform steps 12 through 14 only if components are damaged.
- Bearing cone and bearing cups are press-fitted.

12 Using arbor press, press two bearing cups (20 and 27) from front input quill (11).

NOTE
Number of shims may vary. Note number of shims to aid during assembly.

13 . Remove shim pack (26) from front input quill (11).

14 . Using arbor press, press bearing cone (28) from pinion shaft (12).

15 . Remove preformed packing (25) from front input quill (11). Discard preformed packing.

CAUTION
Use care not to damage surface of front input quill when removing wear sleeves.

16. If damaged, remove wear sleeves (21 and 24) from front input quill (11).

TA708366

5-16. REAR AXLE FRONT OSCILLATING SUPPC RT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors DO NOT use near open flame or excessive heat. The solvent's flash point is 1)0°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your ;yes and get medical aid.

1 Clean parts with dry cleaning solvent and dry with a clear rag.

2 Clean and inspect bearings in accordance with TM 9-214

NOTE

Pinion shaft and ring gear are a matched set. If 3inion shaft is damaged, ring gear MUST also be replaced (see paragraph 5-17).

3 Inspect pinion shaft gear teeth for burrs and damage. Replace damaged pinion shaft and ring gear.

4 Inspect pinion shaft for cracks, bends, and distortion. Replace damaged pinion shaft and ring gear.

5 Inspect front input quill for cracks and damage. Replace damaged front input quill.

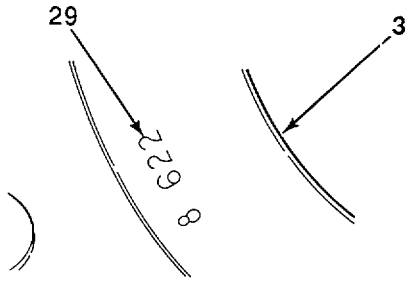
d. ASSEMBLY

1 **Rear Cone Point Adjustment**.

NOTE

Dimension in step (a) is distance between differential crossbore and front input quill mounting surface on differential housing.

(a). Note dimension (29) stamped on mounting surface of differential housing (3).



TA708367

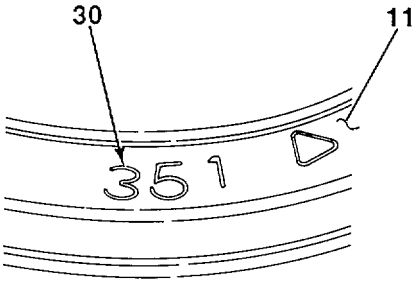
5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

NOTE

Dimension in step (b) is distance between face of flange on front input quill and bearing cup set.

(b) Note dimension (30) stamped on face of front input quill (11).

(c) Add dimension from step (a) to dimension from step (b) and note total dimension.



NOTE

- Perform steps (d) and (e) only if bearing cone and bearing cup were removed.
- Bearing cone and bearing cups are press-fitted.

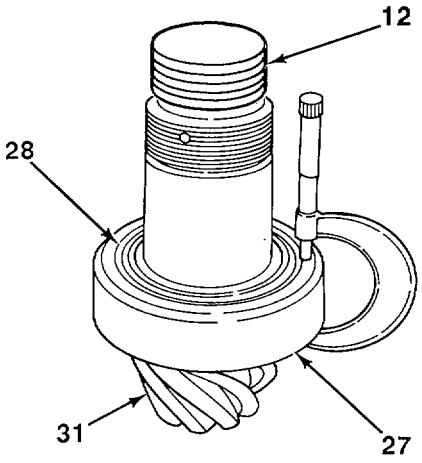
(d) Using arbor press, press bearing cone (28) on pinion shaft (12).

(e) Using arbor press, press bearing cup (27) over bearing cone (28).

(f) Using outside caliper micrometer, measure and note width of bearing cone (28) and bearing cup (27).

(g) Locate and note etched dimension on bevel pinion (31). Add this dimension to measurement taken in step (f).

(h) Add 0.0015 in. (0.0381 mm) to sum noted in step (g). Subtract this measurement from measurement taken in step (c). Measurement is required shim pack size.



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5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

2. Pinion Shaft End Play Adjustment.

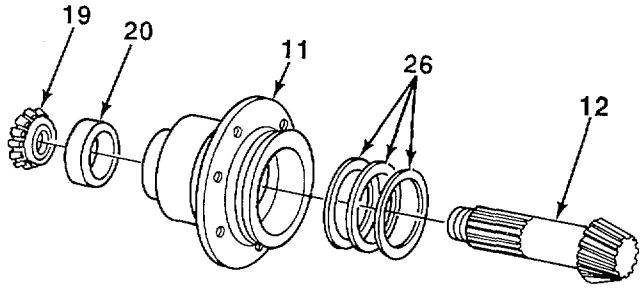
NOTE
- Perform step (a) only if bearing cup was removed.
- Bearing cup is press-fitted.

(a) Using arbor press, press bearing cup (20) into front input quill (11).

(b) Install shim pack (26) on pinion shaft (12).

(c) Press pinion shaft (12) into front input quill (11).

(d) Press bearing cone (19) on pinion shaft (12).

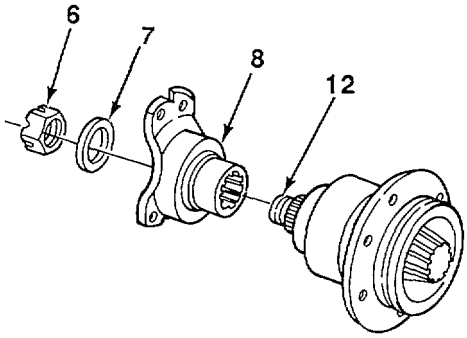


NOTE
Steps (e) and (f) will seat bearing cone on pinion shaft.

(e) Install rear axle front oscillating support yoke (8), spacer (7), and nut (6) on pinion shaft (12).

(f) Secure rear axle front oscillating support yoke (8) in machinist's vise or axle yoke holding tool and torque nut (6) to 445 lb.-ft. (603 N•m).

(g) Remove nut (6), spacer (7), and rear axle front oscillating support yoke (8) from pinion shaft (12).



(h) Using arbor press, press pinion shaft (12) out of front input quill (11) and remove bearing cone (19).

(i) Install shim pack (23) and washer (22) on pinion shaft (12).

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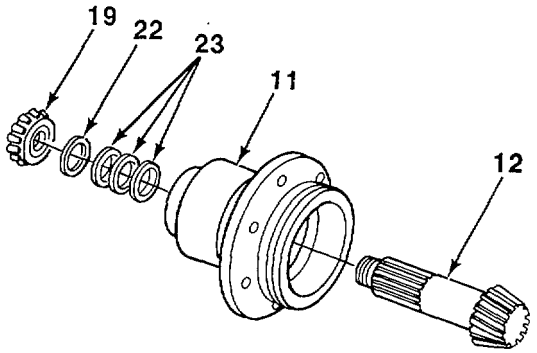
5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

(j) Using arbor press, press pinion shaft (12) into front input quill (11).

(k) Using arbor press, press bearing cone (19) on pinion shaft (12).



NOTE

Steps (I) and (m) will seat bearing cone on pinion shaft.

(I) Install rear axle front oscillating support yoke (8), spacer (7), and nut (6) on pinion shaft (12).

(m) Secure rear axle front oscillating support yoke (8) In machinist's vise c-: oes yoke holding tool and torque nut (6) to 445 lb.-ft. (603 N.m).

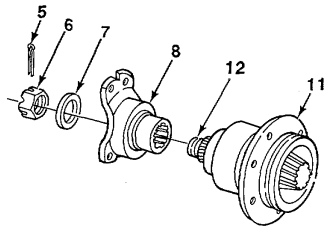
(n) Loosen nut (6) to less than 200 lb.-ft. (271 Nom).

(o) Torque nut (6) to 225-300 lb.-ft. (305407 N-m).

(p) Turn pinion shaft (12) several times using 2-4 lb.-ft. (3-5 Nom) force on rear axle front oscillating support yoke (8) end of pinion shaft.

(q) Using dial indicator, measure end play using upward force of 23-68 lb (102-302 i4) force. End play must be 0.001-0.003 in. (0.025-0.076 mm). Adjust shims until proper measurement is reached.

(r) Torque nut (6) so that new cotter pin (5) can be installed, but do not install cotter pin.



(s) Mark nut (6) and pinion shaft (12).

(t) Remove nut (6), spacer (7), and rear axle front oscillating support yoke (8) from pinion shaft (12).

(u) Apply lubricating oil to pinion shaft (12).

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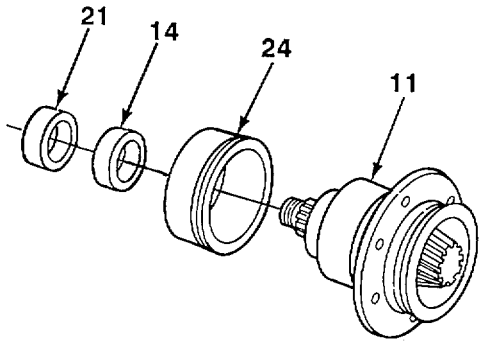
5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

(v) If removed, install wear sleeve (21) on front input quill (11).

(w) Install new seal (14) on front input quill (11).

(x) If removed, install wear sleeve (24) on front input quill (11).



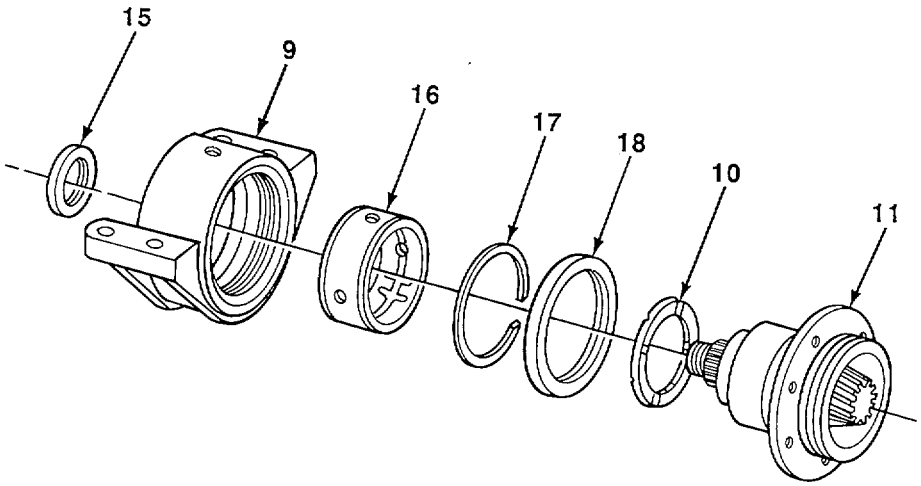
(y) Install thrustwasher (10) on front input quill (11).

(z) If removed, install bushing (16) in support (9).

(aa) Install retaining ring (17) in support (9).

(ab) Install new large seal (18) and new small seal (15) into support (9).

(ac) Install support (9) on front input quill (11).



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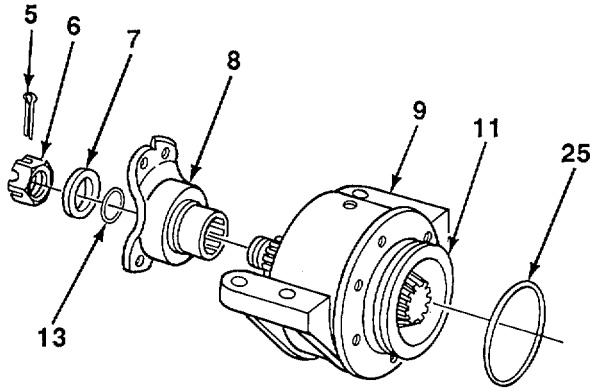
5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

(ad) Install rear axle front oscillating support yoke (8) and new preformed packing (13) on support (9) with spacer (7) and nut (6). Torque nut to mark made in step (s). Torque should be 225-300 lb.-ft. (305-407 N•m).

(ae) Install new cotter pin (5).

(af) Install new preformed packing (25) on front input quill (11).



e. INSTALLATION

WARNING

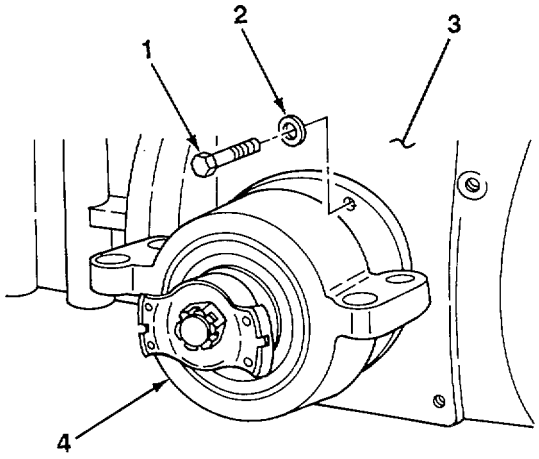
Use extreme caution when handling heavy parts. Lifting device is required when parts weigh over 50 lb (23 kg) for a single person lift, over 100 lb (45 kg) for a two person lift, and over 150 lb (68 kg) for a three or more person lift. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause serious injury or death to personnel.

NOTE

Front input quill assembly weighs approximately 120 lb (54 kg).

1. Install front input quill assembly (4) into differential housing (3) with six washers (2) and screws (1). Torque screws to 37 lb.-ft. (50 Nom). Turn screws an additional one-quarter turn.

2. Remove differential cover (see paragraph 5-17).



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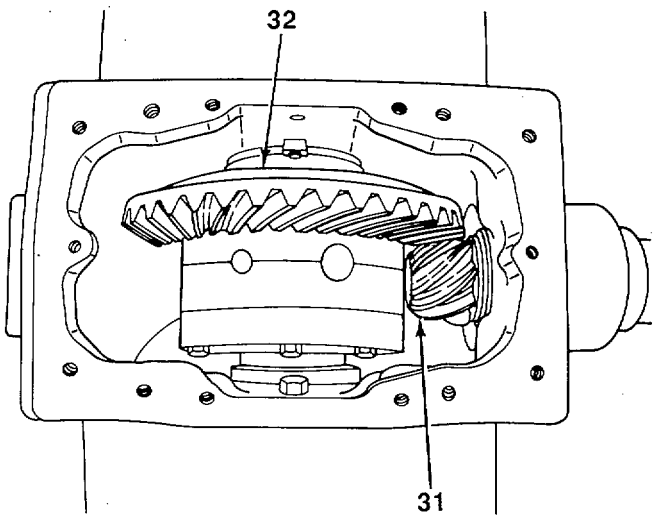
5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

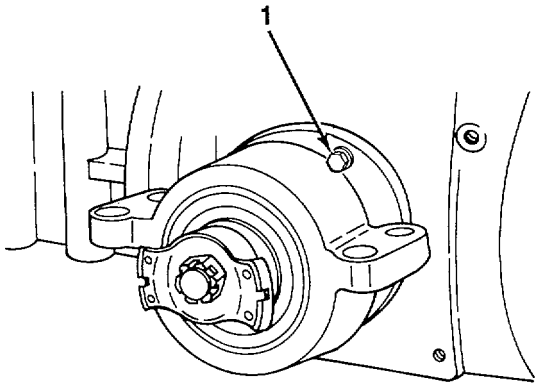
3. Using dial indicator, check backlash between ring gear (32) and bevel pinion (31). Ring gear to bevel pinion backlash must be 0.007-0.015 in. (0.178-0.381 mm). If backlash is within specification, go to step 5.



NOTE

- Moving shims from left to right (as viewed from pinion shaft) increases backlash.
- Moving shims from right to left (as viewed from pinion shaft) decreases backlash.

4. Move shims from one side of differential to other side to set backlash (see paragraph 5-17).
5. Torque screws (1) to 85 lb.-ft. (115 N•m).



TA708373

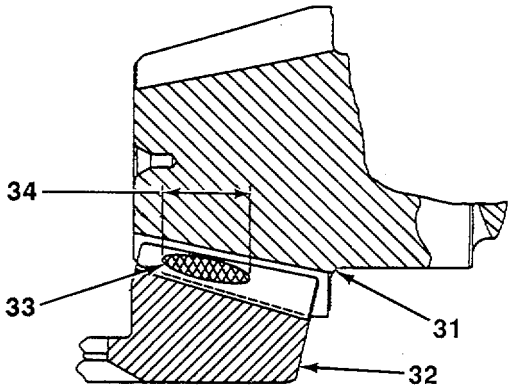
5-16. REAR AXLE FRONT OSCILLATING SUPPORT YOKE, INPUT QUILL, AND PINION SHAFT MAINTENANCE (Con't).

6. Measure length (34) of tooth pattern (33).
7. Tooth pattern (33) must start 0.12-0.52 in. (3.05-13.21 mm) from toe end of bevel pinion (31).

WARNING

Prussian blue dye is poisonous and can burn skin on contact. Always wear protective goggles and gloves, and use only in a well-ventilated area. Overexposure to Prussian blue dye can cause serious heart and skin problems, dizziness, and unconsciousness if not handled properly.

8. Apply a light coat of Prussian blue dye to several teeth of ring gear (32).
9. Roll bevel pinion (31) and ring gear (32) back and forth six times to obtain good tooth contact pattern (33).
10. Repeat steps 8 and 9 in three locations, 1200 apart. If tooth pattern (33) is still not within specification, add or delete shims as necessary (see paragraph 5-17).
11. Clean Prussian blue dye from bevel pinion (31) and ring gear (32).
12. Apply a light coat of lubricating oil to teeth of bevel pinion (31) and ring gear (32).
13. Install differential cover (see paragraph 5-17).



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FOLLOW-ON TASKS:
• Install rear axle assembly (see paragraph 4-48).

5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE.

This Task Covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Assembly
e. Installation

Initial Setup:

Equipment Conditions:
• Axle assembly removed (see paragraph 4-47 or 4-48).

• General mechanic's tool kit (Item 71, Appendix E)
• Wrecking bar (Item 6, Appendix E)
• Dial indicator set (Item 19, Appendix E)
• Mechanical force gage, 0-500 gr (Item 29, Appendix E)
• Retaining ring pliers (Item 46, Appendix E)
• Arbor press (Item 47, Appendix E)
• Puller kit (Item 50, Appendix E)
• Torque wrench, 0-175 lb.-ft. (Item 81, Appendix E)

References:

•·TM 9-214

Materials/Parts:
• Sealing compound (Item 15, Appendix B)
• Silicone sealing compound (Item 17, Appendix B)
• Petrolatum (Item 42, Appendix B)
• Rags (Item 43, Appendix B)
• Dry cleaning solvent (Item 47, Appendix B)
• Twine (Item 58, Appendix B)
• One gasket (rear differential assembly)
• Two preformed packings (front differential assembly)

Personnel Required: Two

General Safety Instructions:
• Dry cleaning solvent is flammable and must not be used near open flame. Use only in a well-ventilated area.

NOTE

Front and rear differential assemblies are maintained in a similar way. Rear differential is illustrated. Differences are noted where applicable.

a. REMOVAL

1. Remove right axle housing (see paragraph 4-50).
2. Remove left axle housing (see paragraph 4-50).
3. Remove front axle yoke or rear axle front oscillating support yoke, front input quill, and pinion shaft (see paragraph 5-15 or 5-16).

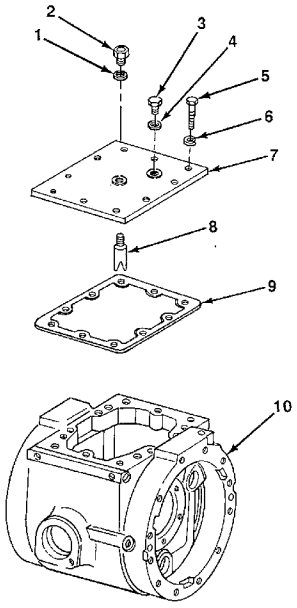
5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

b. DISASSEMBLY

NOTE

• Perform steps 1 through 3 for rear differential only.
• Perform steps 4 through 6 for front differential only.

1. Remove breather (3), washer (4), and breather tube (8) from rear differential cover (7).
2. Remove plug (2) and washer (1) from rear differential cover (7).
3. Remove ten screws (5), washers (6), rear differential cover (7), and gasket (9) from rear differential housing (10). Discard gasket.

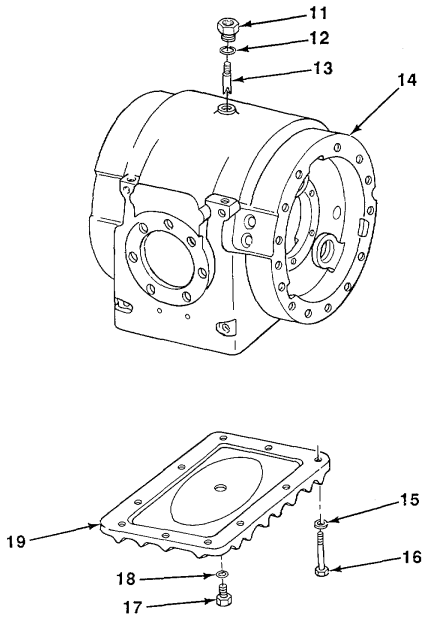


TA708375

REAR DIFFERENTIAL ASSEMBLY

5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

4. Remove breather (11), preformed packing (12), and breather tube (13) from front differential housing (14). Discard preformed packing.
5. Remove plug (17) and preformed packing (18) from front differential cover (19). Discard preformed packing.
6. Remove ten screws (16), washers (15), and front differential cover (19) from front differential housing (14).



FRONT DIFFERENTIAL ASSEMBLY

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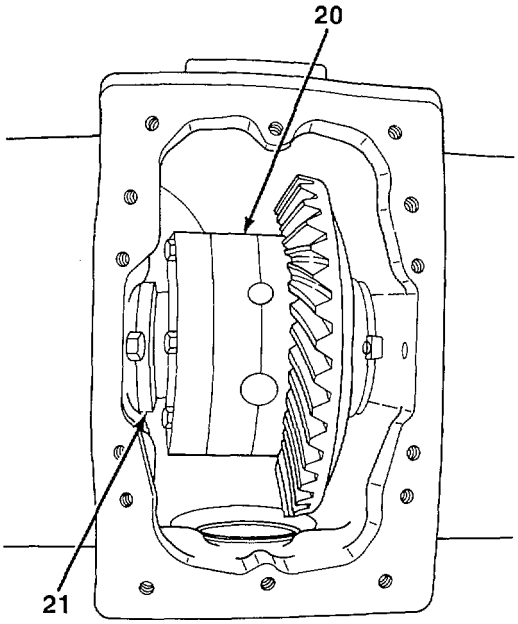
5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

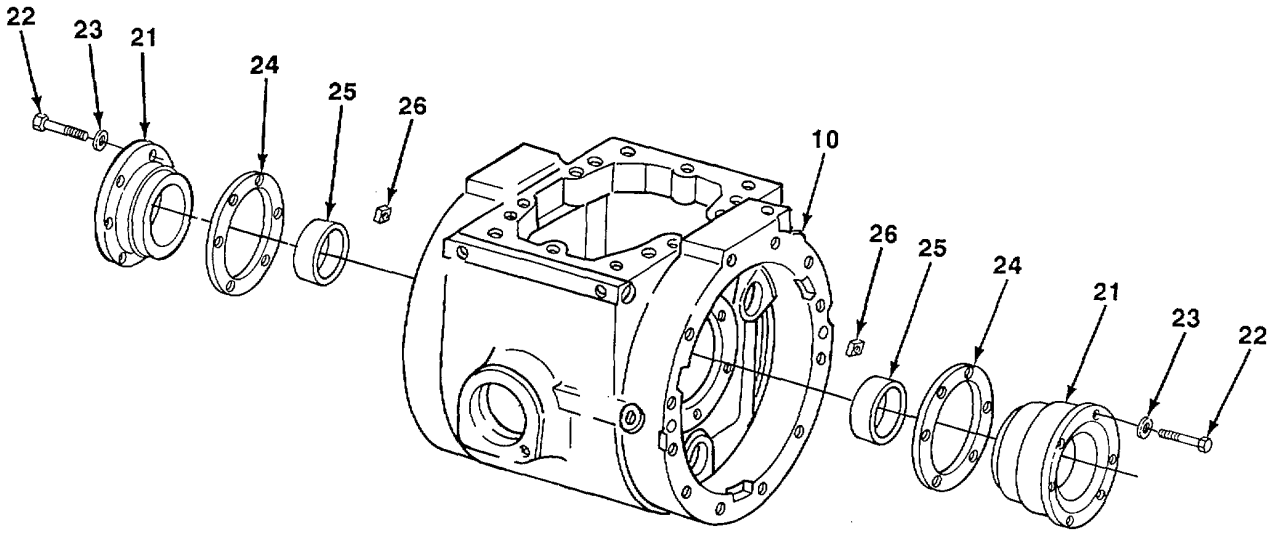
7. Using suitable lifting device, lift rear differential assembly (20) enough to remove weight from bearing quills (21).



NOTE

Mark shims and respective bearing quills to aid during assembly.

8. Remove 12 nuts (26), screws (22), washers (23), two bearing quills (21), bearing cups (25), and shims (24) from rear differential housing (10).



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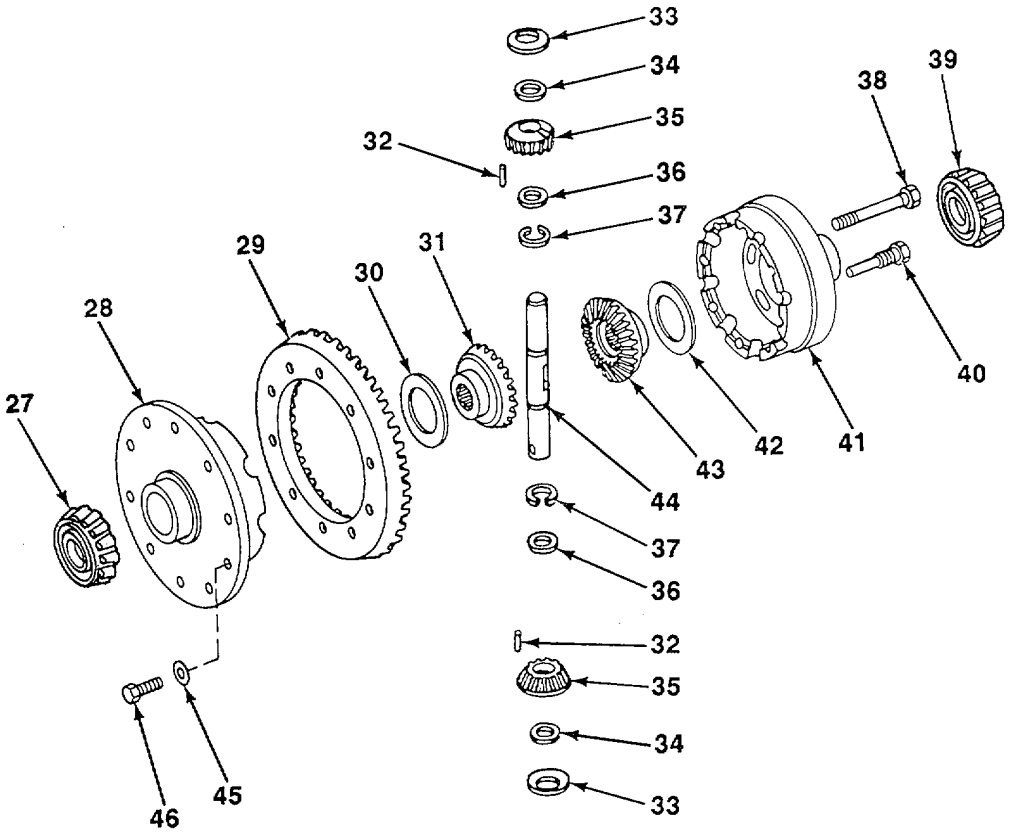
5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

9. Using puller kit, remove two bearing cones (27 and 39) from housing (28) and cover (41).

NOTE

Note location of short screw to aid during assembly.

10. Remove eight screws (38), short screw (40), and cover (41) from housing (28).
11. Remove two thrustwashers (30 and 42), shaft (44), and two bevel gears (31 and 43) from housing (28).
12. Remove four thrustwashers (33 and 34), two pinions (35), 26 needle bearings (32), two thrustwashers (36), and retaining rings (37) from shaft (44).
13. Install cover (41) on housing (28) with four screws (38) evenly spaced apart.
14. Place assembly on end with ring gear (29) facing up.
15. Insert wrecking bar through shaft bore in housing (28) and cover (41).



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5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

16. Remove ten screws (46), washers (45), and ring gear (29) from housing (28).
17. Remove four screws (38) and cover (41) from housing (28).

c. CLEANING AND INSPECTION

WARNING

Dry cleaning solvent, P-D-680, is toxic and flammable. Always wear protective goggles and gloves, and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and DO NOT breathe vapors. DO NOT use near open flame or excessive heat. The solvent's flash point is 100°F-138°F (38°C-590C). If you become dizzy while using cleaning solvent, immediately get fresh air and medical help. If solvent contacts eyes, immediately wash your eyes and get medical aid.

1. Clean metal parts with dry cleaning solvent and dry with a clean rag.
2. Clean and inspect bearings in accordance with TM 9-214.

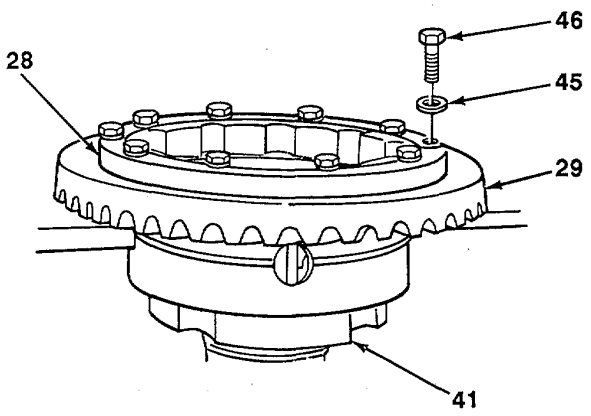
NOTE

Pinion shaft and ring gear are a matched set. If ring gear is damaged, pinion shaft MUST also be replaced (see paragraph 5-15 or 5-16).

3. Inspect ring gear for burrs, chips, and missing teeth. Replace damaged ring gear and pinion shaft.
4. Inspect bevel gears and pinions for burrs, chips, and missing teeth. Replace damaged bevel gears orpinions.
5. Inspect shaft for cracks, bends, and distortion. Replace damaged shaft.
6. Inspect thrustwashers for distortion and excessive wear. Replace damaged thrustwashers.
7. Inspect housing and cover for cracks, dents, and damage. Replace damaged housing or cover.

d. ASSEMBLY

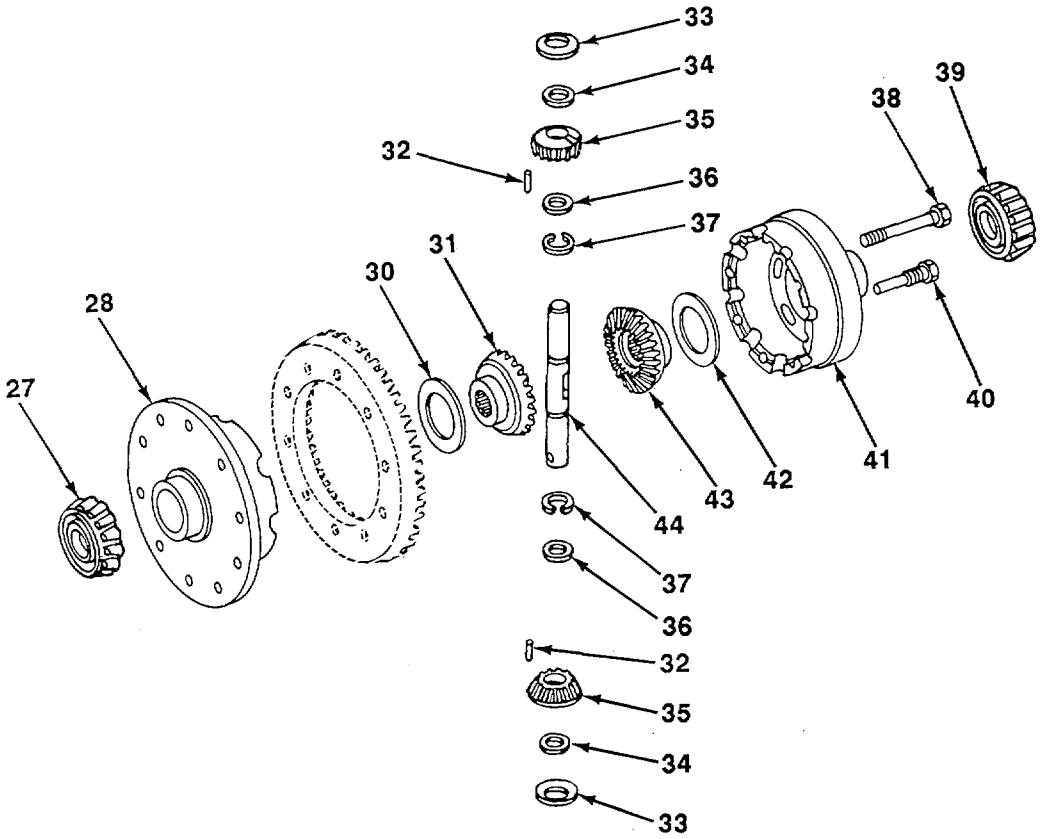
1. Apply sealing compound (Item 15, Appendix B) to threads of ten screws (46).
2. Heat ring gear (29) to a maximum of 300°F (149°C) in accordance with TM 9-214.
3. Install ring gear (29) on housing (28) with ten washers (45) and screws (46). Tighten screws in a crisscross pattern, repeating tightening pattern three times. Torque screws to 110 lb.-ft. (149 N•m).



TA708379

5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

4. Heat two bearing cones (27 and 39) to a maximum of 300°F (1490C) in accordance with TM 9-214.
5. Install bearing cone (27) on housing (28) until tight against housing.
6. Install bearing cone (39) on cover (41) until tight against cover.
7. Install 26 needle bearings (32) in two pinions (35). Apply petrolatum to needle bearings.



8. Install two retaining rings (37), two thrustwashers (36), pinions (35), and four thrustwashers (33 and 34) on shaft (44).
9. Install thrustwasher (30) and bevel gear (31) on housing (28).
10. Position shaft (44) in housing (28).
11. Install thrustwasher (42) and bevel gear (43) in cover (41).
12. Install cover (41) on housing (28) with eight screws (38) and short screw (40). Torque screws to 37 lb.-ft. (50 N•m). Turn screws an additional one-quarter turn clockwise.

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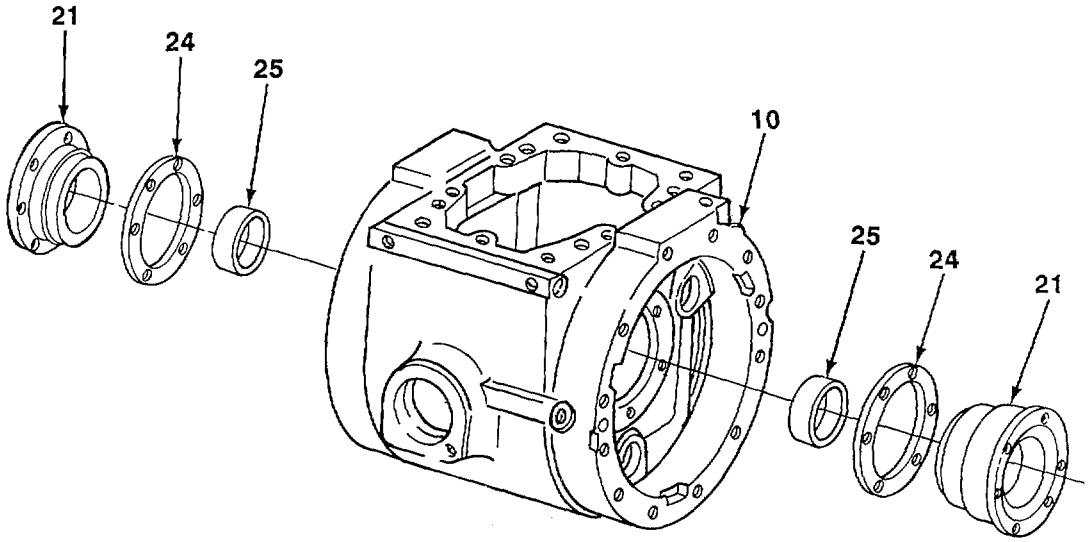
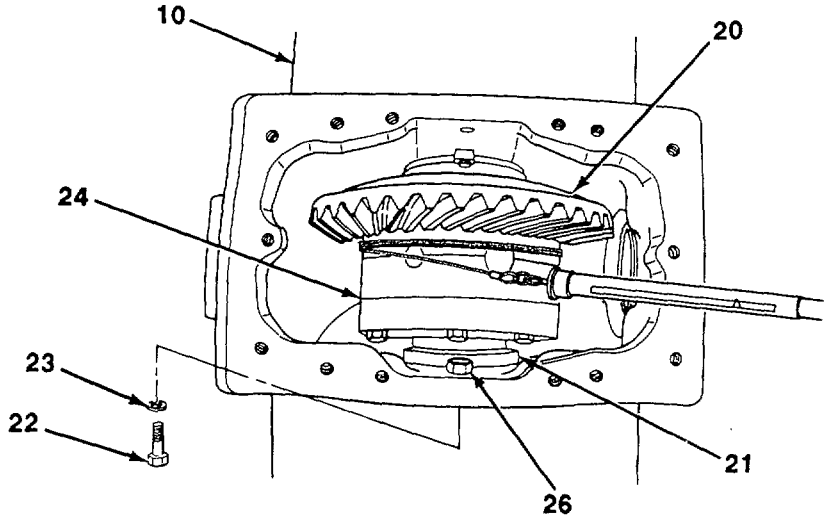
5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

13. Using arbor press, press two bearing cups (25) into two bearing quills (21).
14. Position two shims (24) on bearing quills (21) and insert bearing quills into rear differential housing (10).



15. Using suitable lifting device, install rear differential assembly (20) into rear differential housing (10). Lift rear differential assembly enough to remove weight from bearing quills (21).
16. Install 12 washers (23) and screws (22) in two bearing quills (21) and rear differential housing (10) with 12 nuts (26). Torque screws to 37 lb.-ft. (50 N•m). Turn screws an additional one-quarter turn clockwise.



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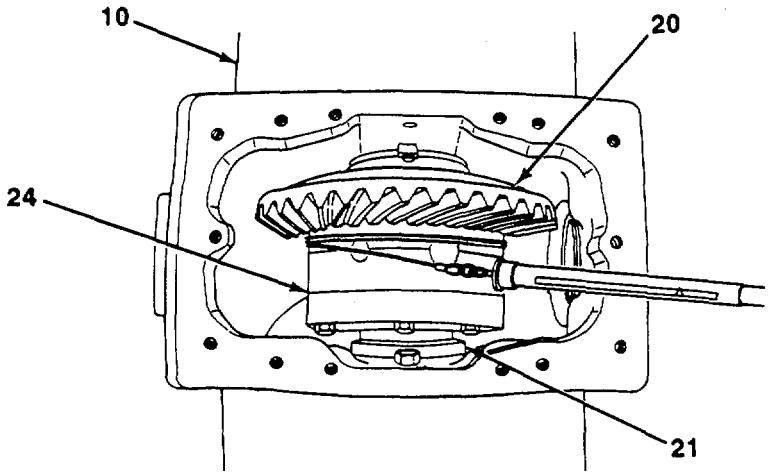
5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

17. Remove lifting device from rear differential assembly (20).
18. Using dial indicator, check differential preload. Differential preload must be 0.002-0.004 in. (0.050-0.101 mm).
19. Rotate rear differential assembly (20) a minimum of two times. Using a mechanical force gage and twine wrapped around center of rear differential assembly, measure rolling drag torque. Steady pulling force should be 2.1-7.8 lb (9.3-34.7 N) force.
20. Add shims (24) to bearing quills (21) to reduce rolling drag torque or remove shims from bearing quills to increase rolling drag torque.



NOTE

- Perform steps 21 through 25 for front differential only.
- Perform steps 25 through 27 for rear differential only.

21. Apply silicone sealing compound (Item 17, Appendix B) to edge of front differential cover (19).
22. Install front differential cover on front differential housing (14) with ten washers (15) and screws (16). Torque screws to 55 lb.-ft. (75 N•m).
23. Install new preformed packing (18) and plug (17) on front differential cover (19).

NOTE

Position breather tube so that notch in bottom is parallel to axle shaft.

24. Install breather tube (13), new preformed packing (12), and breather (11) into front differential housing (14).

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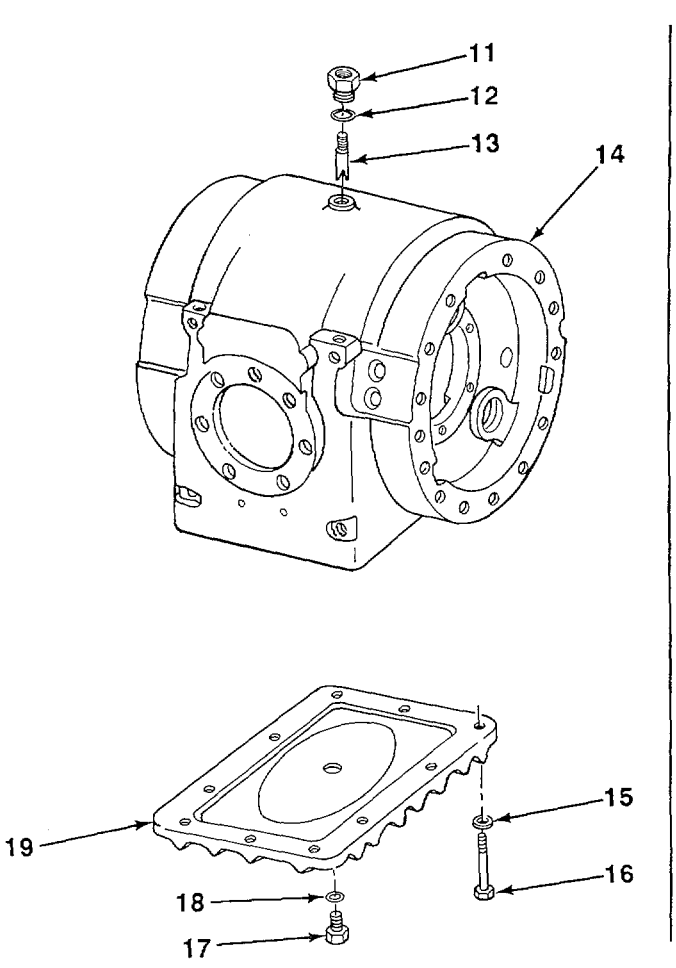
5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

25. Install new gasket (9) and rear differential cover (7) on rear differential housing (10) with ten washers (6) and screws (5). Torque screws to 55 lb.-ft. (75 N•m).
26. Install washer (1) and plug (2) on rear differential cover (7).

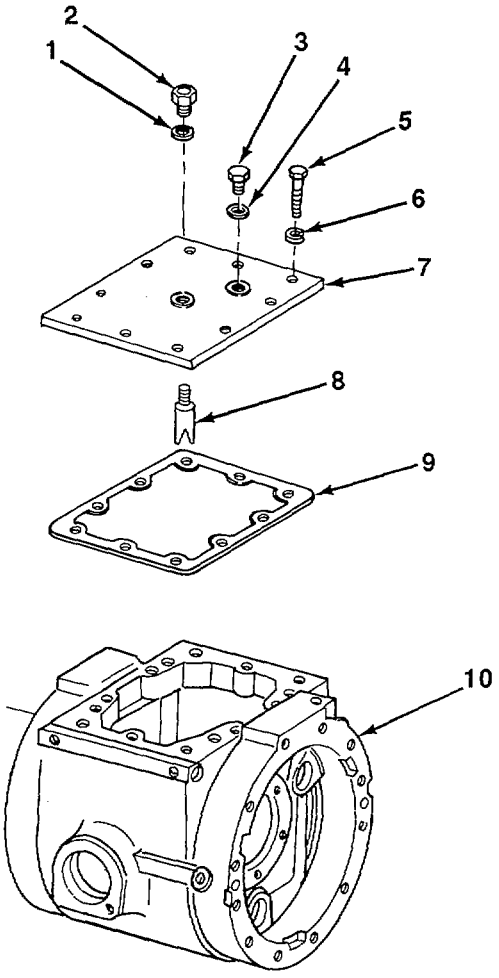
NOTE

Position breather tube so that notch in bottom is parallel to axle shaft.

27. Install breather tube (8), washer (4), and breather (3) into rear differential cover (7).



FRONT DIFFERENTIAL ASSEMBLY



REAR DIFFERENTIAL ASSEMBLY

TA708383

5-17. DIFFERENTIAL ASSEMBLY MAINTENANCE (Con't).

e. INSTALLATION

1. Install front axle yoke or rear axle front oscillating support yoke, front input quill, and pinion shaft (see paragraph 5-15 or 5-16).
2. Install left axle housing (see paragraph 4-50).
3. Install right axle housing (see paragraph 4-50).

FOLLOW-ON TASKS:

- Install axle assembly (see paragraph 4-47 or 4-48).

Section V. FRAME MAINTENANCE

5-18. FRAME REPAIR.

Refer to TM 9-237 (Operator's Manual for Welding Theory and Application) for instructions on frame repair.

APPENDIX A
REFERENCES

A-1. SCOPE.

This appendix lists all forms, field manuals, technical bulletins, technical manuals, and other publications referenced in this manual and those that apply to the Direct Support and General Support Maintenance of the M554E Forklift Truck.

A-2. PUBLICATION INDEX.

DA Pam 25-30, Consolidated Index of Army Publications and Blank Forms, should be consulted frequently for latest changes or revisions and for new publications relating to materiel covered in this technical manual.

A-3. FORMS.

Refer to DA Pam 738-750, The Army Maintenance Management System (AMMS), for instructions on the use of maintenance forms.

Equipment Inspection and Maintenance Worksheet.....DA Form 2404
Equipment Log Assembly (Records).....DA Form 2408
Maintenance Request Form.....DA Form 2407
Preventive Maintenance Schedule and Record ..... DD Form 314
Processing and Deprocessing Record for Shipment, Storage and Issue of
Vehicles and Spare Engines..... DD Form 1397
Product Quality Deficiency Report .....SF Form 368
Recommended Changes to Equipment Technical Publications ..... DA Form 2028-2
Recommended Changes to Publications and Blank Forms.....DA Form 2028
Report of Discrepancy (ROD) .....SF Form 364

A-4. FIELD MANUALS.

Camouflage.....FM 20-3
First Aid for Soldiers.....FM 21-11
NBC Contamination Avoidance.....FM 3-3
NBC Decontamination.....FM 3-5
NBC Protection.....FM 3-4
Railway Operating and Safety Rules.....FM 55-21

A-5. TECHNICAL BULLETINS.

Color, Marking and Camouflage Painting of Military Vehicles, Construction Equipment, and Materials Handling Equipment ..... TB 43-0209
Elimination of Combustibles from Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks TB 750-1047
Purging, Cleaning and Coating Interior Ferrous and Terne Sheet Vehicle Fuel Tanks..... TB 43-0212
Warranty Program for Forklift, Adverse Terrain, 10,000 Lb Capacity, Diesel Engine Driven, MHE-268 (NSN 3930-01-298-5737) .....TB 10-3930-659-14

A-6. TECHNICAL MANUALS.

Cooling Systems: Tactical Vehicles ..... TM 750-254
Direct Support and General Support Maintenance Manual Including Repair Parts and Special Tools List for Simplified Test Equipment for Internal Combustion Engines, Reprogrammable (STE/ICE-R) (NSN 4910-01-222-6589) ..... TM 9-4910-571-34&P
Inspection, Care and Maintenance of Antifriction Bearings.....TM 9-214
Maintenance, Direct and General Support Level: Generator Assembly ..... TM 9-2920-225-34
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) for Tester, Diesel Fuel Injector Nozzle and Connector Set..... TM 9-4910-409-12
Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tools List for Simplified Test Equipment for Internal Combustion Engines (STE/ICE) (NSN 4910-01-124-2554) ..... TM 9-4910-571-12&P
Operator's Manual for Truck, Forklift: Adverse Terrain, 10,000 Lb Capacity, M544E (NSN 3930-01-301-8250)..... TM 10-3930-659-10
Operator's Manual for Welding Theory and Application.....TM 9-237
Operator's, Unit, Direct Support, and General Support Maintenance Manual for Care, Maintenance, Repair and Inspection of Pneumatic Tires and Inner Tubes ..... TM 9-2610-200-14
Operator's, Unit, Intermediate Direct Support and Intermediate 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
Railcar Loading Procedures .....TM 55-601
Storage and Materials Handling ..... TM 743-200-1
Unit Maintenance Manual for Truck, Forklift: Adverse Terrain, 10,000 Lb Capacity, M544E (NSN 3930-01-301-8250)..... TM 10-3930-659-20

A-6. TECHNICAL MANUALS (Con't).

Unit, Direct Support, and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools Lists) for Truck, Forklift: Adverse Terrain, 10,000 Lb Capacity, M544E (NSN 3930-01-301-8250).....TM 10-3930-659-24P

A-7. OTHER PUBLICATIONS.

Army Logistics Readiness and Sustainability.....AR 700-138
Army Medical Department Expendable/Durable Items .....CTA 8-100
Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items) .....CTA 50-970
Lubrication Order: Truck, Forklift: Adverse Terrain, 10,000 Lb Capacity, M544E (NSN 3930-01-301-8250).....LO 10-3930-659-12

APPENDIX B
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

B-1. SCOPE.

This appendix lists expendable/durable supplies and materials you will need to operate and maintain the M544E Forklift Truck. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

B-2. EXPLANATION OF COLUMNS.

a. Column (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the "Initial Setup" of maintenance paragraphs or narrative instructions to identify the material needed (e.g., Dry cleaning solvent, Item 47, Appendix B).

b. Column (2)-Level. This column identifies the lowest level of maintenance that requires the listed item.

C- Operator/Crew
O - Unit Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

c. Column (3)- National Stock Number. This is the National Stock Number assigned to the item. Use it to request or requisition the item.

d. Column (4) -Description. Indicates the Federal Item Name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity (CAGE) Code in parentheses followed by the part number, if applicable.

e. Column (5)-Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in., pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
1	O		ADHESIVE: General Purpose, Type I (19203) 829899	
		8040-00-262-9028	1 Pint Can	pt
2	O		ADHESIVE: Loctite (05972) 312-31	
		8040-01-024-6991	50 Milliliter Bottle	ml
3	C		ANTIFREEZE: Ethylene Glycol, Inhibited, Heavy-duty, Single Package (81349) MIL-A-46153	
		6850-00-181-7929	1 Gallon Can	gl
		6850-00-181-7933	5 Gallon Can	gl
		6850-00-181-7940	55 Gallon Drum	gl
4	O		BARRIER MATERIAL: Greaseproof-waterproofed, Flexible (81349) MIL-B-121	
		8135-00-171-0930	100 Yard Roll	yd
5	O	7920-00-061-0038	BRUSH: Scrub (83421) 7920-00-061-0038	ea
6	O	7920-00-900-3577	BRUSH: Wire (17987) 15SS	ea
7	O	CLOTH: Abrasive	(83421) 5350-00-187-6294	
		5350-00-187-6294	50 Yard Roll	yd
8	O		CLOTH: Abrasive, Crocus (58536) A-A-1206	
		5350-00-221-0872	Package of 50	ea
9	F		CLOTH: Abrasive, 180 Grit (58536) A-A-1048	
		5350-00-192-5051	Package of 50	ea
10	F		COMPOUND: Carbon Removing (OAD61) CARB-N-R1D	
		6850-01-085-1423	13 Ounce Can	oz

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
11	C		COMPOUND: Cleaning, Windshield (81348) O-C-1901	
		6850-00-926-2275	1 Pint Bottle (81349) O-C-1901	pt
		6850-01-347-0073	1 Gallon Can	gl
12	O		COMPOUND: Dishwashing, Hand (83421) 7930-00-899-9534	
		7930-00-899-9534	5 Gallon Can	gl
13	F		COMPOUND: Gasket Forming (77247) 98D	
		5330-00-151-6659	1 Pint Can	pt
14	F		COMPOUND: Sealing (05972) 592-31	
		8030-01-054-0740	50 cc Bottle	cc
15	F		COMPOUND: Sealing (80064)1756371	
		8030-00-252-3391	11 Ounce Tube	oz
16	O		COMPOUND: Silicone (19203) 801362	
		6850-00-880-7616	8 Ounce Tube	oz
17	O		COMPOUND: Silicone, Sealant, RTV (11862)1052914	
		8030-01-159-4844	10/1 Ounce Tube	oz
18	O		CONDUIT: Nonmetallic, Flexible, 0.25 Inch Inner Diameter (81348) HHT791	
		5975-00-335-2588	15 Foot Roll	ft

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
19	O		CONDUIT: Nonmetallic, Flexible, 0.50 Inch Inner Diameter (06090) CONVOLEX-1/2	
		5975-00-275-1960	15 Foot Roll	ft
20	O		CONDUIT: Nonmetallic, Flexible, 0.75 Inch Inner Diameter (11862)8919356	
		5975-01-191-9851	15 Foot Roll ft	
21	O		CONDUIT: Nonmetallic, Flexible, 1.00 Inch Inner Diameter (80378) CVC2597-32-48	
		5975-00-275-1962	15 Foot Roll	ft
22	O		CONDUIT: Nonmetallic, Flexible, 1.25 Inch Inner Diameter (81482) C10000-080	
		5975-01-203-0263	15 Foot Roll	ft
23	O		DETERGENT: General Purpose, Liquid (83421) 7930-00-282-9699	
		7930-00-282-9699	1 Gallon Can	gl
24	F		DYE: Prussian Blue (81349) MIL-P-30501	
		8010-00-652-3626	1 Ounce Tube	oz
25	O		FLUID: Hydraulic, Fire Resistant (81349) MIL-H-46170	
		9150-00-111-6256	1 Quart Can qt	
26	C		FLUID: Hydraulic, Petroleum Base (81349) MIL-H-6083	
		9150-00-935-9807	1 Quart Can	qt
		9150-00-935-9809	5 Gallon Can	gl
		9150-00-935-9810	55 Gallon Drum	gl

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
27	O		FLUX: Soldering (58536) A-A-51145 TY I1 FORM A	
		3439-00-255-9935	1 Pound Can lb	
28	C		FUEL OIL, DIESEL: DF-2, Regular (81348) VV-F-800 GRADEDF2RE	
		9140-00-286-5295	5 Gallon Can	gl
		9140-00-286-5296	55 Gallon Drum, 16 Gage	gl
		9140-00-286-5297	55 Gallon Drum, 18 Gage	gl
29	H		GAGE: Bearing Clearance, 0.001-0.003 Inch, Green (77220) PG-1	
		5210-00-640-6177	Box of 12	ea
30	H		GAGE: Bearing Clearance, 0.002-0.006 Inch, Red (77220) PLASTIGAGEPR1	
		5210-00-640-6178	Box of 12	ea
31	H		GAGE: Bearing Clearance, 0.004-0.009 Inch, Blue (77220) PLASTIGAGEPB1	
		5210-00-640-6176	Box of 12	ea
32	O		GLOVES: Barbed Wire Handlers (12036) 27-600	
		8145-01-309-0848	1 Pair	pr
33	C		GREASE: Automotive and Artillery, GAA (81349) MIL-G-10924	
		9150-01-197-7693	14 Ounce Cartridge	oz
		9150-01-197-7690	134 Pound Can	lb
		9150-01-197-7689	6Y Pound Can	lb
		9150-01-197-7692	35 Pound Can	lb
34	O		INHIBITOR: Corrosion, Liquid Cooling System (81349) MIL-A-53009	
		6850-01-160-3868	1 Quart Can	qt

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
35	H		LEAD: Pig (81348) QQ-C-40	
		9650-00-264-5050	5 Pound Cake	lb
36	F		NITROGEN: Technical (18876) 7910373	
		6830-00-134-3709	12 Cubic Foot Cylinder	ea
37	F		OIL: Lubricating, Engine, PE-10-1 (81349) MIL-L-21260	
		9150-00-111-3199	5 Gallon Can	gl
		9150-00-111-0208	55 Gallon Drum	gl
38	C		OIL: Lubricating, Engine, OE/HDO 10 (81349) MIL-L-2104	
		9150-00-189-6727	1 Quart Can	qt
		9150-00-186-6668	5 Gallon Can	gl
		9150-00-191-2772	55 Gallon Drum	gl
39	C		OIL: Lubricating, Engine, OE/HDO 30 (81349) MIL-L-2104	
		9150-00-186-6681	1 Quart Can	qt
		9150-00-188-9858	5 Gallon Can	gi
		9150-00-189-6729	55 Gallon Drum	gi
40	F		OIL: Lubricating, General Purpose, PL-M (81349) MIL-L-3150	
		9150-00-231-2361	1 Quart Can	qt
41	F		OIL: Lubricating, General Purpose, Preservative, PL-S (81348) V-VL-800	
		9150-00-231-6689	1 Quart Can	qt
42	F		PETROLATUM: Technical (81348) V-V-P236	
		9150-00-250-0933	½ Pound Can	lb

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
43	C		RAG: Wiping (64067) 7920-00-205-1711	
		7920-00-205-1711	50 Pound Bale	lb
44	O		SEAL: Antipilferage (62142)15262	
		5340-00-391-4240	Package of 100	ea
45	O		SEALANT: Adhesive, Silicon Rubber, RTV Type I, Clear (80244) MIL-A-46106 TY1	
		8040-00-833-9563	Adhesive Kit	kt
46	O		SOLDER: Lead Alloy (81348) QQ-S-571	
		3439-00-247-6921	1 Pound Bar	lb
		3439-00-265-7102	1 Pound Spool	lb
47	C		SOLVENT: Dry Cleaning, Type II (81349) P-D-680	
		6850-00-110-4498	1 Pint Can	pt
		6850-00-664-5685	1 Quart Can	qt
		6850-00-281-1985	1 Gallon Can	gl
		6850-00-274-5421	5 Gallon Can	gl
		6850-00-285-8012	55 Gallon Drum	gl
		6850-00-331-3350	55 Gallon Drum	gl
48	O		STRAP: Tie-down, Electrical Components (96906) MS3367-1-9	
		5975-00-074-2072	Box of 100	ea
49	O		TAG: Marker (64067) 9905-00-537-8954	
			9905-00-537-8954 Bundle of 50	ea
50	O		TAPE: Antiseizing, ½ Inch Width (81755) P5025-2R	
		8030-00-889-3535	260 Inch Roll	in.

Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (Con't)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION PART NO. AND FSCM	(5) UNIT OF MEAS.
51	O		TAPE: Duct, 2 Inch Width (39428) 1791K70	
		5640-00-103-2254	60 Yard Roll	yd
52	O		TAPE: Insulation, Electrical, 1/2 Inch Width (58536) A-A-2094	
		5970-00-198-8621	85 Foot Roll	ft
53	O		TAPE: Pressure Sensitive Adhesive, 2 Inch Width (81349) MIL-T-23397	
		7510-00-473-9513	60 Yard Roll	yd
54	F		THINNER: Paint Products (81348) TT-T-291	
		8010-00-290-4079	1 Quart Can	qt
		8010-00-242-2089	1 Gallon Can	gl
		8010-00-558-7026	5 Gallon Can	gl
		8010-00-246-6116	55 Gallon Drum	gl
55	O		TRICHLOROTRIFLUOROETHANE: Technical (22527) T-180	
		6830-01-325-5586	4 Liter Can	i
56	O	5970-00-815-1295	TUBING: Heat Shrinkable (81349) M23053/5-106-0	ft
57	O	4720-00-414-5072	TUBING: Nonmetallic, Plastic, Clear, 0.315 Inch Inner Diameter (61501) S50HL3-8X1-2X50	ft
58	H	4020-00-291-5901	TWINE: Fibrous (58536) A-A-1 451	lb
59	O		WIRE: Nonelectrical (81346) ASTM A641	
		9505-00-596-0191	5 Pound Coil	lb

APPENDIX C
ILLUSTRATED LIST OF MANUFACTURED ITEMS

Section I. INTRODUCTION

C-1. SCOPE.

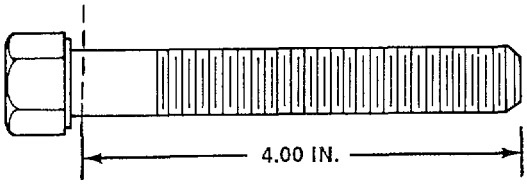
a. This appendix includes complete instructions for making items authorized to be manufactured or fabricated.

b. A cross-reference index is provided for easy location of the item to be manufactured and its fabrication criteria.

c. All bulk materials needed for manufacture of an item are listed by National Stock Number (NSN), part number, or specification number in the manufacturing instructions. All dimensions given are in standard units.

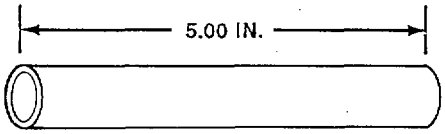
Table C-1. Manufactured Items Cross-reference Index.

Section II. MANUFACTURING INSTRUCTIONS



1. Make guide stud from NSN 5305-00-071-1782, Part Number MS90725-129.
2. Cut off screw head so that stud length is 4 in. (10 cm).
3. Remove any burrs from stud.

Figure C-1. Flywheel Guide Stud.

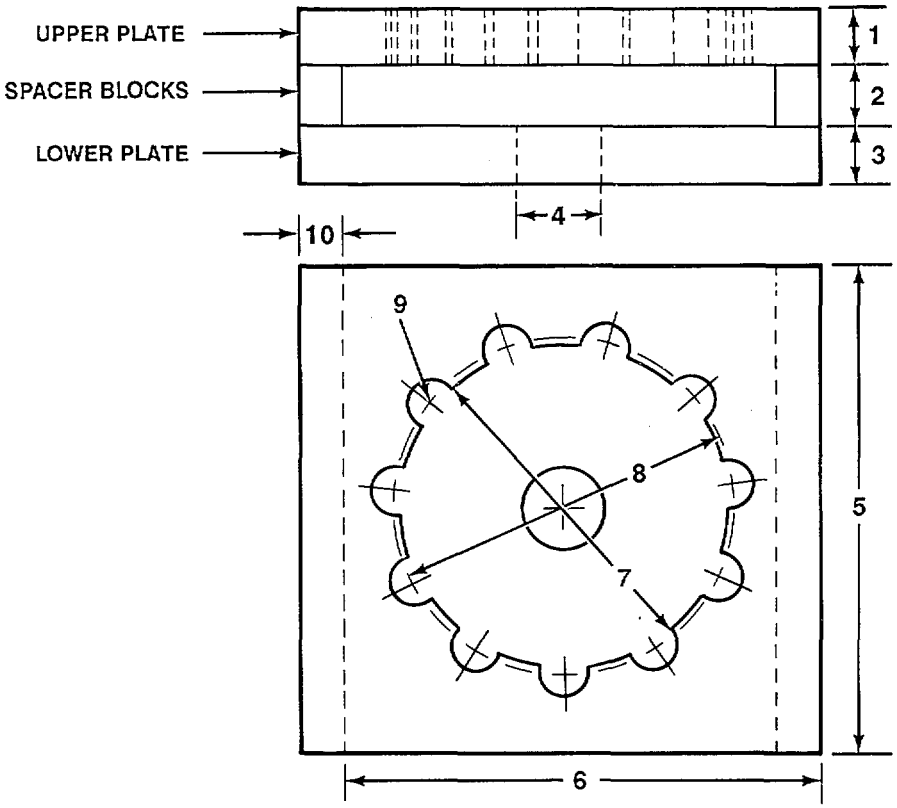


1. Make pipe driver from NSN 4710-01-305-5471, Part Number ASTM A335.
2. Cut pipe to 5 in. (12.7 cm) length.
3. Cut ends of pipe square.
4. Remove any burrs from pipe.

Figure C-2. Fuel Injection Pump Pipe Driver.

TA708030

Section II. MANUFACTURING INSTRUCTIONS (Con't)



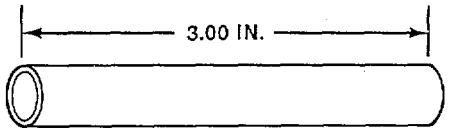
1. 0.75 in. Thick
2. 0.75 in. Thick
3. 0.75 in. Thick
4. 1.50 in. Diameter Hole
5. 6.50 in.
6. 6.50 in.
7. 2.50 in. Diameter
8. 2.75 in. Diameter
9. 0.38 in. Diameter (11 Places, Equally Spaced)
10. 1.00 in.

1. Make holding fixture from either hardwood or aluminum.
2. Depending on material used, weld, glue, or nail together upper plate, spacer blocks, and lower plate.

Figure C-3. Turbocharger Turbine Wheel Holding Fixture.

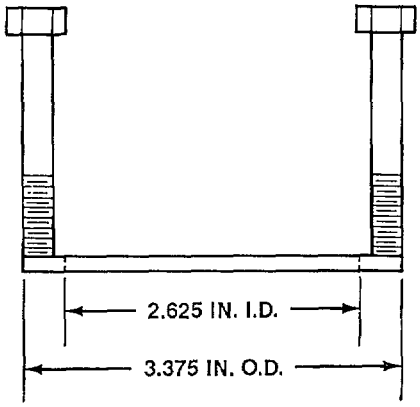
TA708031

Section II. MANUFACTURING INSTRUCTIONS (Con't)



1. Make pipe driver from NSN 4710-01-162-2488, Part Number MIL-T-8808.
2. Cut tube to 3 in. (7.6 cm) length.
3. Remove any burrs from tube.

Figure C-4. Transmission Output Shaft Pipe Driver.

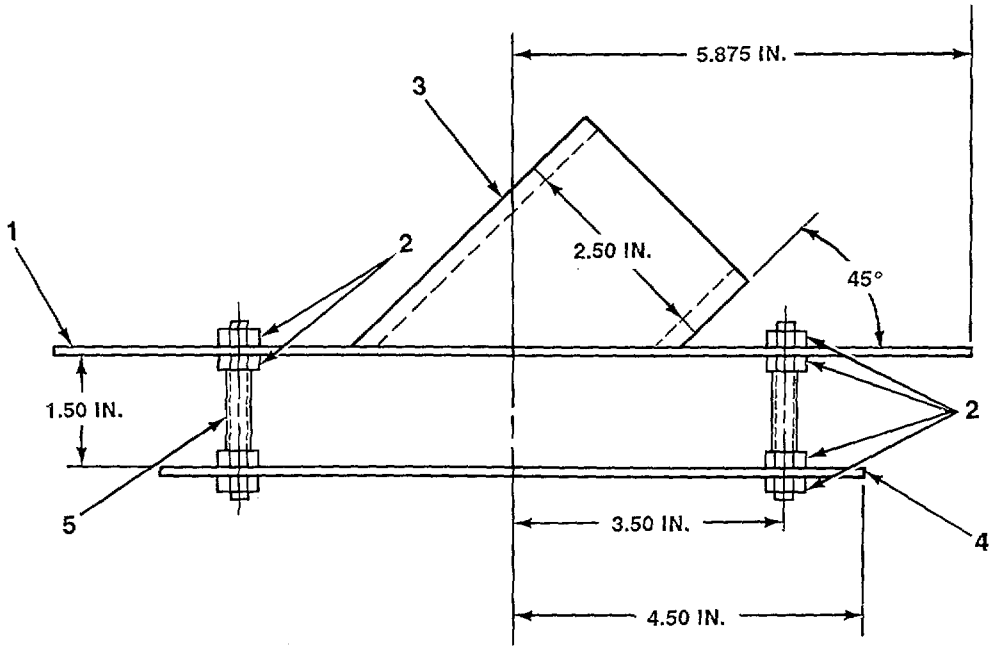


1. Make from flatwasher Part Number 24H1635 and two 38 in. X 2 in. capscrews NSN 5305-00-782-9489, Part Number B1821BH038C200N.
2. Weld capscrews to flatwasher, parallel to each other.

Figure C-5. Transmission Clutch Pack Compression Tool.

TA708032

Section 1I. MANUFACTURING INSTRUCTIONS (Con't)



1. 11.75 in. Diameter Sheet Metal Plate
2. 1/4 in. Hex Nut
3. 2.50 in. I.D. x 4.25 in. Long Pipe
4. 9.00 in. Diameter Sheet Metal Plate
5. 0.25 in. x 2.00 in. Full Threaded Rod

1. Make from sheet metal NSN 9515-00-204-4602, Part Number MS14465H011; metallic pipe NSN 4710-00-027-7474, Part Number B241-69; screw NSN 5305-00-071-2233, Part Number MS90725-18; and hex nut NSN 5310-00-761-6882, Part Number MS15967.

2. Cut hole in sheet metal plates to match pipe.

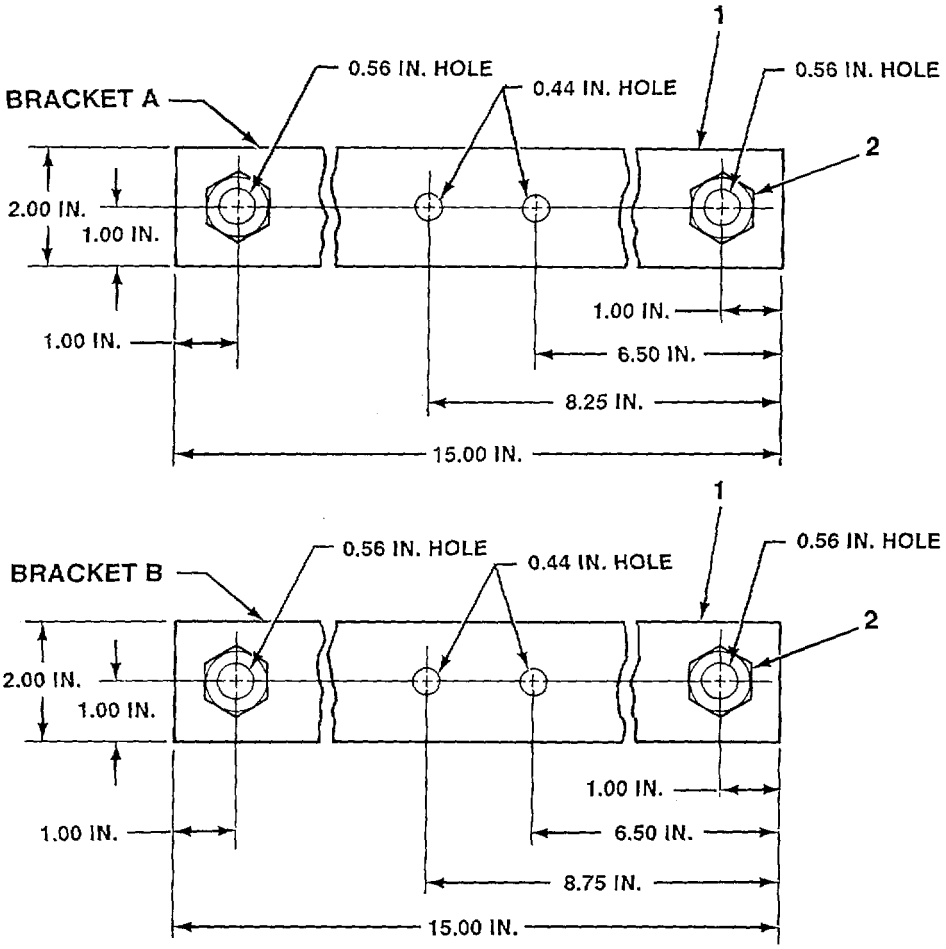
3. Cut off screw head so that stud length is 2 in. (5 mm).

4. Weld as illustrated.

Figure C-6. Air Deflector Plate.

TA708033

Section II. MANUFACTURING INSTRUCTIONS (Con't)



1. Mild Bar Steel (2.00 in. x 15 00 in. x 1.00 in.)
2. 1/4 in. Hex Nut

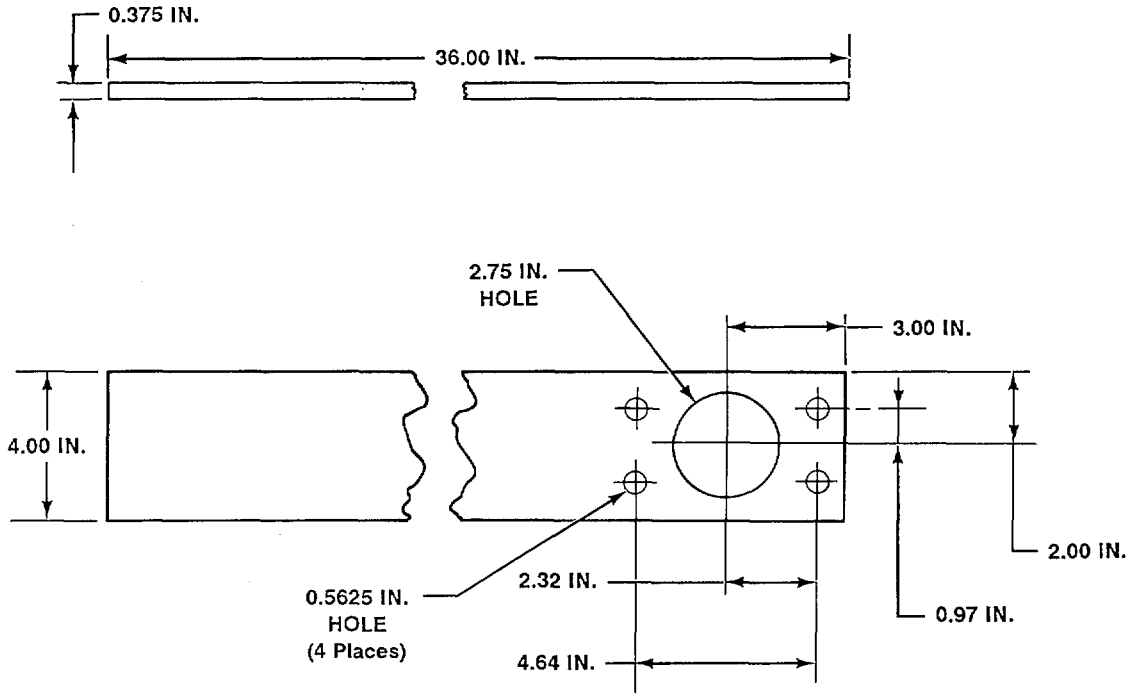
1. Make each bracket from 2 in. x 15 in. x 1 in. 1020 mild bar steel and two X2 in. hex nuts NSN 5310-00-768-0318, Part Number MS51967-14.

2. Weld nuts to brackets.

Figure C-7. Transmission Oil Supply Flange Removal Brackets.

TA708034

Section II. MANUFACTURING INSTRUCTIONS (Con't)

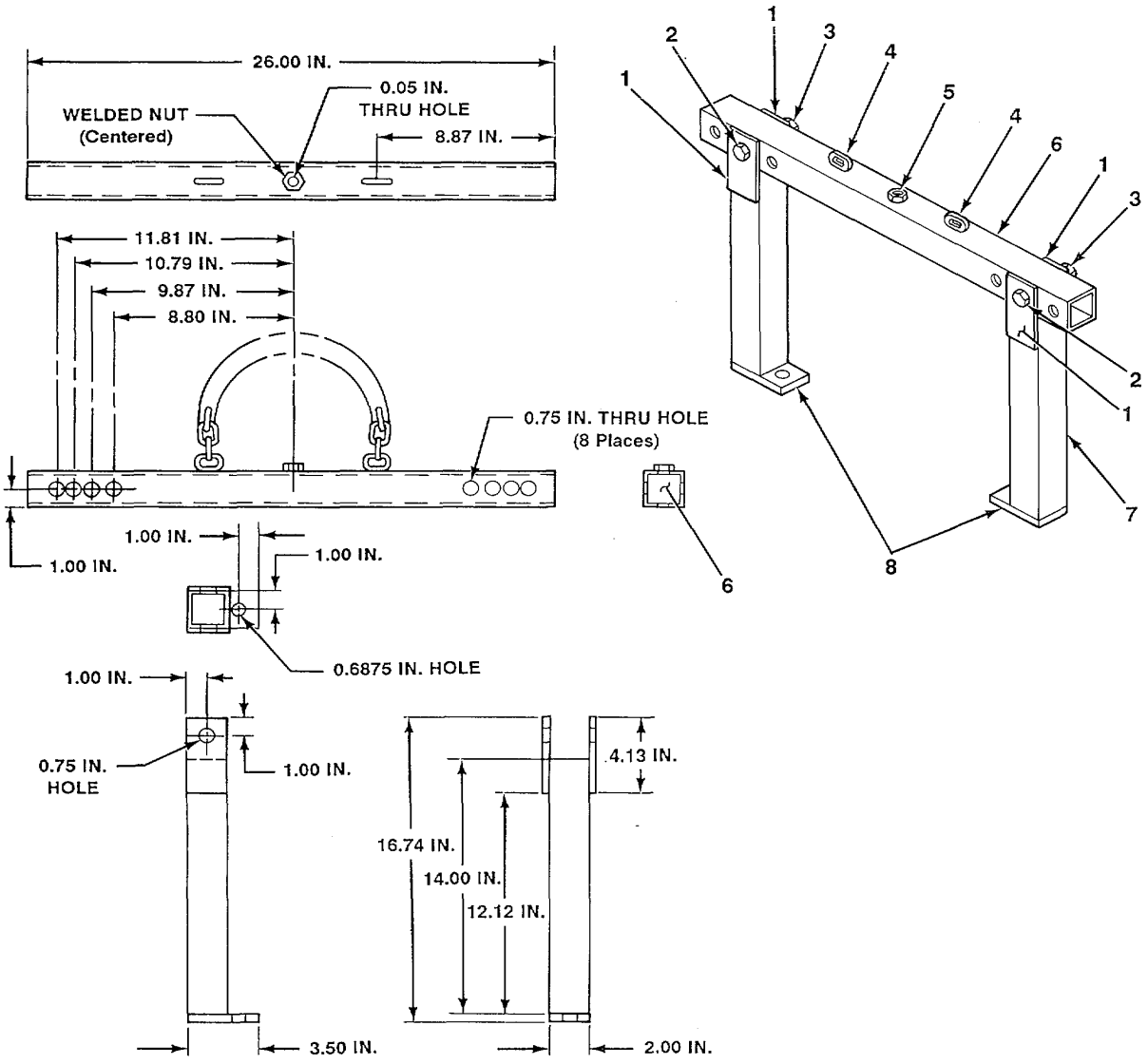


Make holding tool from flat steel.

Figure C-8. Axle Yoke Holding Tool.

TA708035

Section II. MANUFACTURING INSTRUCTIONS (Con't)



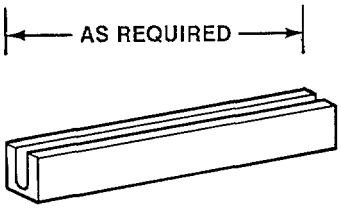
1. 5/8 in. x 3/ in. Capscrew (2 Places)
2. 5/8 in. X 3 12 in. Capscrew (2 Places)
3. 5/8 in. Hex Nut (2 Places)
4. 0.25 in. x 1.00 in. x 1.38 In. Steel Chain Link (2 Places)
5. 3/8 in. Hex Nut
6. Bar (0.1875 in. x 2.00 in. x 2.00 in. Square Tubing)
7. Leg (0.1875 in. x 2 00 in. x 2.00 in. Square Tubing, 2 Places)
8. Mounting Flange (O 50 in. x 2.00 in. Wide Flat Steel, 2 Places)

TA708036

1. Make from steel chain NSN 4010-00-492-3976, Part Number NAS1048-4-34; hex nut NSN 5310-00-732-0558, Part Number MS51967-8; capscrew NSN 5305-00-724-7247, Part Number B1821 BH063C350N; and hex nut NSN 5310-00-763-8920, Part Number MS51967-20.

2. Weld as illustrated at nut, chain links, mounting flanges, and connecting flanges.

Figure C-9. Axle Adjusting Tool.



Make seal from Part Number T62560.

Figure C-10. Nonmetallic Seal.

TA708037

APPENDIX D
TORQUE LIMITS

D-1. SCOPE.

This appendix lists standard torque values, as shown in Table D-1, and provides general information for applying torque. Special torque values and tightening sequences are indicated in the maintenance procedures for applicable components.

D-2. GENERAL.

a. Always use the torque values listed in Table D-1 when the maintenance procedure does not give a specific torque value.

b. Unless otherwise indicated, standard torque tolerance shall be t 10%.

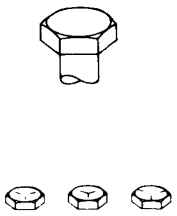
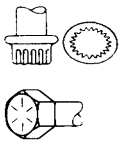
c. Torque values listed are based on clean, dry threads. Reduce torque by 10% when engine oil is used as a lubricant. Reduce torque by 20% if new plated capscrews are used.

d. Capscrews threaded into aluminum may require reductions in torque of 30% or more of Grade 5 capscrews torque. Capscrew threaded into aluminum must also attain two capscrew diameters of thread engagement.

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 D-1. Torque Limits.

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	
Capscrew Head Markings Manufacturer's marks may vary These are all SAE Grade 5 (3 line)									
Capscrew Body Size Inches – Thread		Torque lb.-ft. (N•m)		Torque lb.-ft. (N•m)		Torque lb.-ft. (N•m)		Torque lb.-ft. (N•m)	
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)

TA708038

APPENDIX E
TOOL IDENTIFICATION LIST

Section I. INTRODUCTION

E-1. GENERAL.

This appendix lists tools you will need to maintain the M544E Forklift Truck. This listing is for informational purposes only and is not authority to requisition the tools. Common tools are found in the supply catalogs and special tools are found in TM 10-3930-659-24P

E-2. DEFINITION OF COLUMNS.

a. **Column (1) Item Number**. This number is assigned to the entry in the listing and is referenced in the "Initial Setup" of maintenance paragraphs or narrative instructions to identify the tool needed (e.g., General mechanic's tool kit, Item 71, Appendix E).

b. **Column (2) Item Name**. Indicates the tool or tool set name and, if required, a description to identify the tool.

c. **Column (3) National Stock Number**. This is the National Stock Number (NSN) assigned to the tool. Use it to request or requisition the tool.

d. **Column (4) (CAGE) Part Number**. When no NSN is available, a Commercial and Government Entity (CAGE) Code followed by a part number will be used where possible.

e. **Column (5) Reference**. Indicates the technical manual or supply catalog in which the tool can be found.

Section II. TOOL IDENTIFICATION LIST

(1) ITEM NUMBER	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
1	Adapter		(75160) JT03103	TM 10-3930-659-24P
2	Adapter		(75160) JT05491	TM 10-3930-659-24P
3	Adapter		(75160) JT05687,	TM 10-3930-659-24P
4	Adapter		(75160) JT05690	TM 10-3930-659-24P
5	Alinement Tool, Shaft		(06012) JDG588	TM 10-3930-659-24P

Section II. TOOL IDENTIFICATION LIST (Con't)

(1) ITEM NUMBER	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
6	Bar, Wrecking	5120-00-224-1393	(55719) NPB124	SC 4910-95-A31
7	Bracket, Lifting		(06021) JT01748	TM 10-3930-659-24P
8	Caliper, Micrometer, Inside: 2-12 in. range	5210-00-221-1921	(80244) GGG-C-105 TY2CL2	SC 4910-95-A31
9	Caliper Set, Micrometer, Outside: 0-152.4 mm	5210-01-117-0468	(81345) GGG-C-105	SC 4910-95-A31
10	Caliper, Vernier: English and metric measure-ments, 0-6 in. and 0-150 mm	5210-01-113-1548	(55719) CM6420	SC 4910-95-A31
11	Cap		(75160) 38H1142	TM 10-3930-659-24P
12	Caps, Vise Jaw: 4 in.	5120-00-221-1506	(81348) GGG-C-137	SC 4910-95-A31
13	Charging Kit, Nitrogen Accumulator	4930-01-046-7109	(19200) 12252157	TM 10-3930-659-24P
14	Cleaner, Steam	4940-00-186-0027	(94774) 200-AO	SC 4910-95-A31
15	Compressor, Piston Ring	5120-00-250-6055	(53781) NT5	SC 4940-95-CL-B02
16	Compressor Unit	4310-00-542-4566	(81349) MIL-C-52980	SC 4910-95-CL-A62
17	Connector	4730-01-234-0016	(30780) 4M10X1F80X5S	TM 10-3930-659-24P
18	Coupler, Quick		(06021) JT01608	TM 10-3930-659-24P
19	Dial Indicator Set	5210-00-794-9178	(33287) J5959-01	SC 4910-95-A31
20	Drill, Electric, Portable	5130-00-293-1849	(81348) W-D-661	SC 4910-95-A31
21	Drill Set, Twist	5133-01-047-0258	(55719) DBM-125B	SC-4910-95-A31
22	Expander, Piston Ring: 2-7 in. range	5120-00-857-3190	(55719) PRS-8	SC 4910-95-A31
23	Filter, Adapter	5120-01-334-7013	(06021) JDG596	TM 10-3930-659-24P
24	Flowmeter, Hydraulic	4920-01-079-5263	(97403) 13221E6829	TM 10-3930-659-24P
25	Flywheel Turning Tool	5120-01-335-5827	(45225) JDE81-1	TM 10-3930-659-24P

Section II. TOOL IDENTIFICATION LIST (Con't)

(1) ITEM NUMBER	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
26	Front Oil Seal Driver, Crankshaft: with handle		(06021) JD250	TM 10-3930-659-24P
27	Gage, Depth, Micrometer	5210-00-619-4045	(57163) 445BZ-6RL	SC 4940-95-CL-B02
28	Gage, Feeler: 0.05-1.00 mm	5210-01-045-3526	(81205) F71371	SC 4910-95-A31
29	Gage, Force, Mechanical: 0-500 gr	5210-01-018-2832	(08292) L20	SC 4910-95-A31
30	Gage, Piston	5210-01-351-5114	(05331) P90918	TM 10-3930-659-24P
31	Gage, Pressure: 0-5000 psi	4940-01-086-8756	(97403)13221 E6828	TM 10-3930-659-24P
32	Gage, Ring Groove Wear		(06021) JDE-62	TM 10-3930-659-24P
33	Grinding Machine, Valve Face	4910-00-540-4679	(35472) K403CM	SC 4940-95-CL-B02
34	Hammer, Hand: soft head	5120-01-071-5356	(61711) 57-530	SC 4910-95-A31
35	Heat Gun	3439-01-037-7268	(78976) 6966C	TM 10-3930-659-24P
36	Honing Unit: 3/4-2 in. capacity	5130-00-991-0700	(77335) 71-363	SC 4910-95-A31
37	Hose Assembly	4720-00-449-6636	(01276) FG2074AEE1200	TM 10-3930-659-24P
38	Inserter and Remover, Seal	5120-01-334-7012	(06021) JT30040	TM 10-3930-659-24P
39	Jack, Dolly-Type, Hydraulic: 10 ton capacity	4910-00-289-7233	(36251) 93660	SC 4910-95-A31
40	Jack Kit, Hydraulic, Hand: 20 ton capacity	120-00-595-8387	(58536) A-A-312	SC 4910-95-A31
41	Key Set, Socket Head Screw	5120-00-935-4641	(74445) 56011	SC 4910-95-A31
42	Lifter, Valve Spring	5120-00-239-8686	(81348) GGG-L-350	SC 4940-95-CL-B02
43	Multimeter, Digital	6625-01-139-2512	(80058) AN/PSM-45	SC 4910-95-CL-A01
44	Multiplier, Torque Wrench: 1200 lb.-ft. maximum	5120-00-169-2986	(92059) PD1201	SC 4910-95-A31

Section II. TOOL IDENTIFICATION LIST (Con't)

(1) ITEM NUMBER	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
45	Oiler, Hand	4930-00-554-6778	(81348) GGG-0-591	SC 4940-95-CL-B02
46	Pliers, Retaining Ring	5120-00-293-0045	(79136) 0300	SC 4910-95-A31
47	Press, Arbor	3444-00-449-7295	(80244) A-A-51194	SC 4910-95-A31
48	Puller, Fuel Injection Nozzle		(06021) JDE-38	TM 10-3930-659-24P
49	Puller Kit: cylinder liner	5120-01-346-0983	(75160) D01073AA	TM 10-3930-659-24P
50	Puller Kit: universal, gear and bearing	5180-00-423-1596	(45225) PE12	SC 4910-95-A31
51	Puller, Mechanical gear and bearing	5120-00-378-4293	(45225) 1043	SC 4910-95-A31
52	Puller, Valve Seat		(06021) JDE41296	TM 10-3930-659-24P
53	Removal Tool, Fuel Injection Pump Shaft		(06021) JDE303	TM 10-3930-659-24P
54	Remover and Installer, Piston Pin Bushing		(06021) JDE286	TM 10-3930-659-24P
55	Riveter, Blind Hand 3/32 in., 1/8. in., 5/32 in., and 3/16 in. diameters	5120-00-017-2849	(10054) 250K	SC 4910-95-CL-A74
56	Rule, Steel, Machinist's: 12 in.	5210-00-234-5224	(81348) GGG-R-791	SC 4940-95-CL-B02
57	Scraper, Carbon Flexible	5110-00-251-6481	(55719) CS1	SC 4910-95-A31
58	Simplified Test Equipment for Internal Combustion Engines (STE/ICE)	4910-00-124-2554	(49671) 2389409	TM 9-4910-571-34&P
59	Socket Set, Impact: 34 in. drive	5130-01-117-0466	(55719) 4151MMY	SC 4910-95-A31
60	Soldering Gun	3439-00-542-0396	(97049) 8200G3	SC 4910-95-A31
61	Stone, Sharpening	5345-00-161-9695	(06565) JB8	SC 4910-95-A31
62	Stud Remover and Setter	5120-00-596-0980	(47805) 4515	SC 4910-95-A31

Section II. TOOL IDENTIFICATION LIST (Con't)

(1) ITEM NUMBER	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
63	Tee		(75160) 38H1030	TM 10-3930-659-24P
64	Test Set, Armature	6625-00-238-1459	(81349) MIL-T-594TYPEB	SC 4910-95-CL-A01
65	Test Stand, Automotive Generator and Starter	4910-00-767-0218	(81349) MILT4544	SC 4910-95-CL-A01
66	Tester, Cylinder Compression	4910-00-250-2423	(81349) MIL-T-13011B	SC 4940-95-CL-B02
67	Tester, Spring	4910-01-138-8259	(33287) J-22738-02	TM 10-3930-659-24P
68	Threading Set, Die and Tap	5180-00-448-2362	(81348) GGG-T-330	SC 4910-95-A31
69	Timing Pin	5315-01-321-6068	(75160) JDE81-4	TM 10-3930-659-24P
70	Timing Tool, Gear	5120-01-353-1121	(06021) JD254	TM 10-3930-659-24P
71	Tool Kit, General Mechanic's: Automotive	5180-00-177-7033	(50980) SC 5180-90-N26	SC 5180-90-N26
72	Tool Kit, Window Glass Installation	5180-00-329-3318	(55899) 201-1021	TM 10-3930-659-24P
73	Trestle, Motor Vehicle Maintenance: 7 ton capacity	4910-00-251-8013	(79805) 306	SC 4910-95-A31
74	Union		(75160) 38H1272	TM 10-3930-659-24P
75	Union		(75160) 38H1278	TM 10-3930-659-24P
76	Vise, Machinist's	5120-00-293-1439	(79416) 504M2	SC 4910-95-A31
77	Wrench Set, Combination	5120-01-119-0010	(80204) B107.9-1978 TY3	SC 4910-95-A31
78	Wrench Set, Socket: 3/4 in. drive	5120-00-204-1999	(81348) GGG-W-641	SC 4910-95-A31
79	Wrench, Spanner: 5-12 in. circular diameter	5120-00-293-0316	(45225) 7308	SC 4940-95-CL-B02
80	Wrench, Torque: 1/2 in. drive, 0-300 lb.-in. capacity	5120-00-247-2536	(26848) F3001	SC 4910-95-A31

Section II. TOOL IDENTIFICATION LIST (Con't)

(1) ITEM NUMBER	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
81	Wrench, Torque: 2 in. drive, 0-175 lb.-ft. Capacity	5120-00-640-6364	(58536) A-A-2411	SC 4910-95-A31
82	Wrench, Torque: 3/4 in. drive, 0-600 lb.-ft. capacity	5120-00-221-7983	(55719) TE602A	SC 4910-95-A31

APPENDIX F
WIRING DIAGRAMS

F-1. SCOPE.

This appendix provides wiring diagrams of each electrical circuit on the M544E Forklift Truck. This appendix should be used as a reference when performing electrical maintenance and STE/ICE troubleshooting.

F-2. WIRING DIAGRAMS.

WARNING

When troubleshooting an electrical malfunction or when performing electrical maintenance, ALWAYS place battery disconnect switch in OFF position. Failure to follow this warning may create a spark and explosion, resulting in serious injury or death to personnel.

Table F-1. Wiring Diagram Cross-reference Index.

F-2. WIRING DIAGRAMS (Con't).

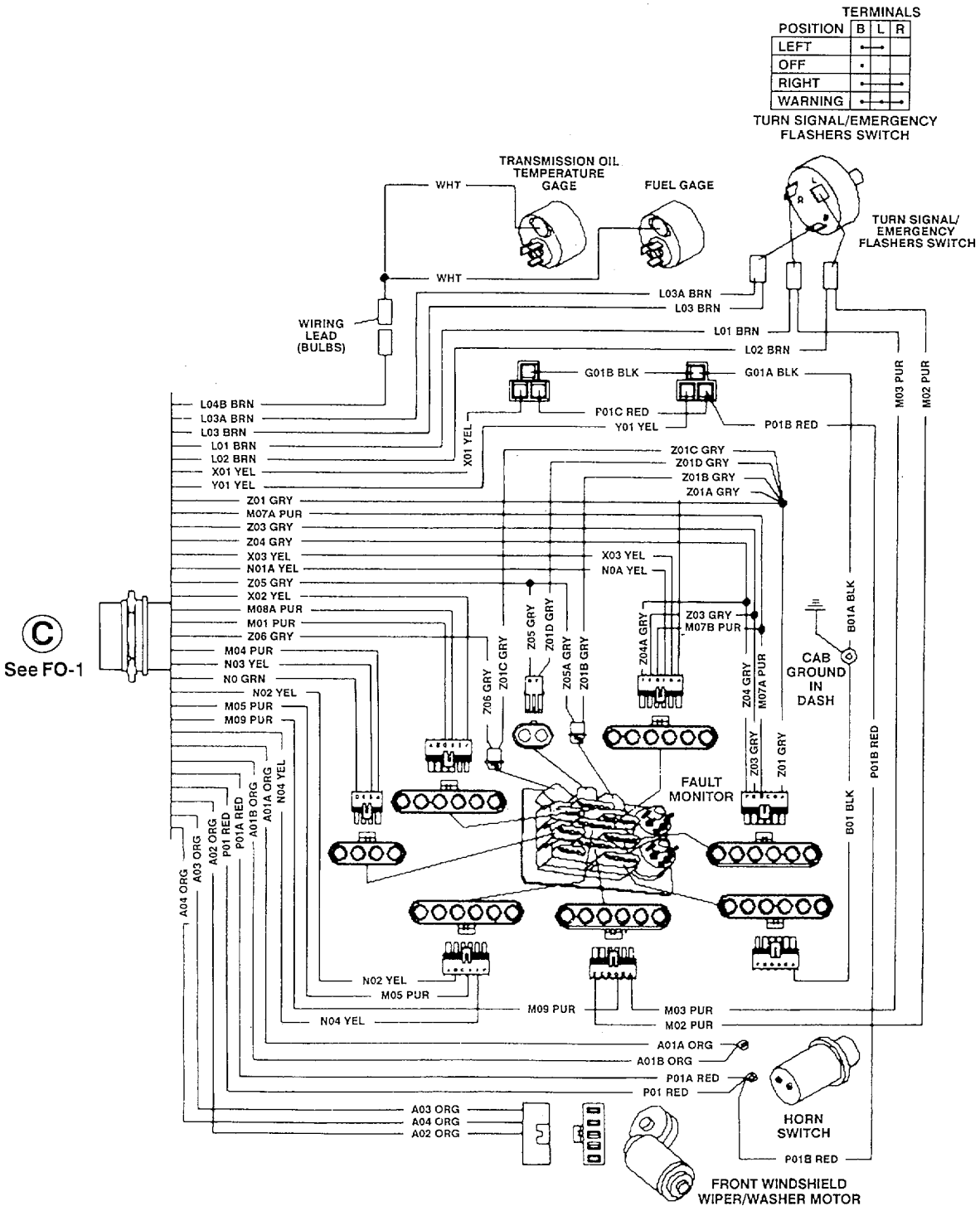


Figure F-1. Fault Monitor and Dash Wiring Diagram.

TA708039

F-2. WIRING DIAGRAMS (Con't).

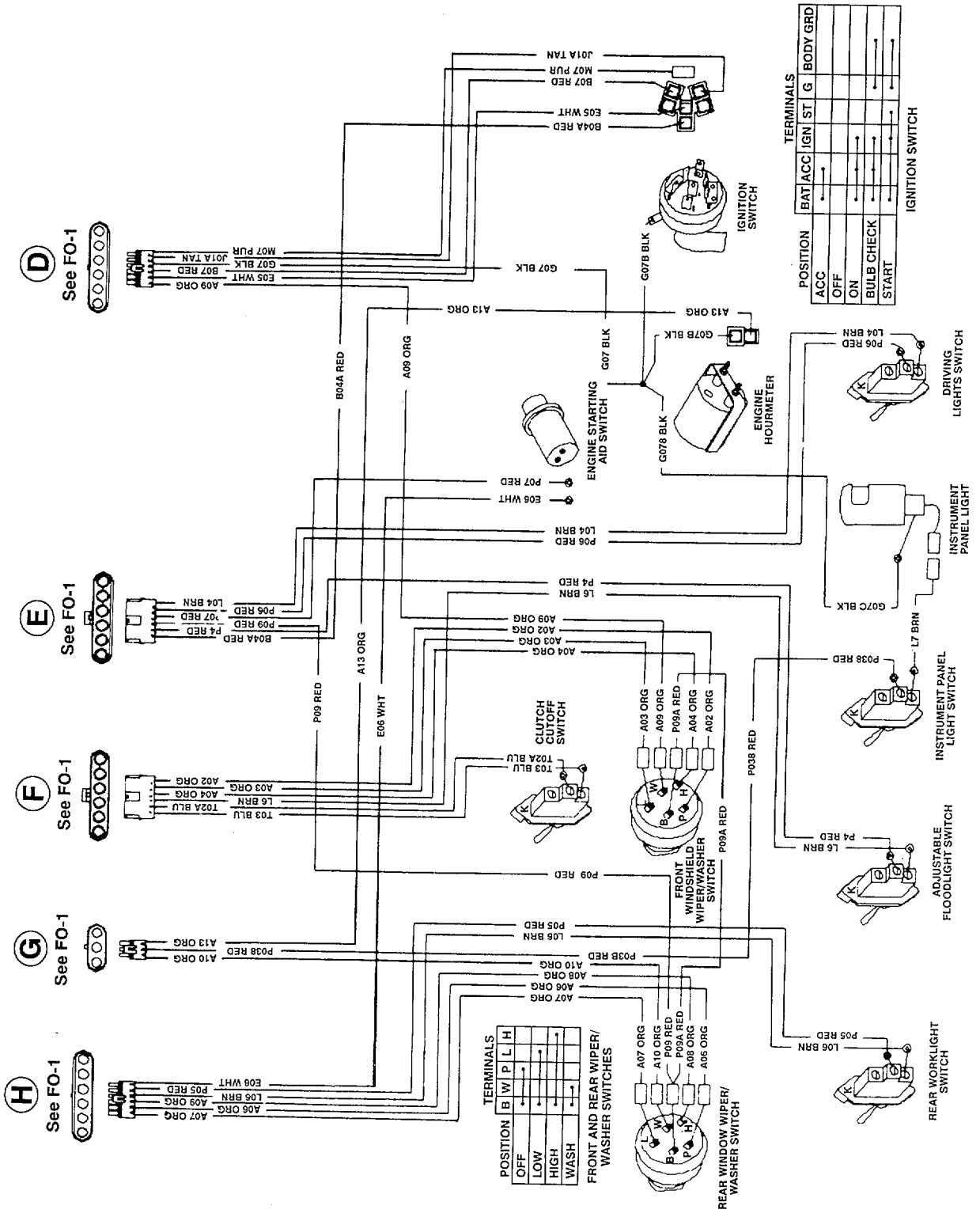


Figure F-2. Right Panel Wiring Diagram.

TA708040

F-2. WIRING DIAGRAMS (Con't).

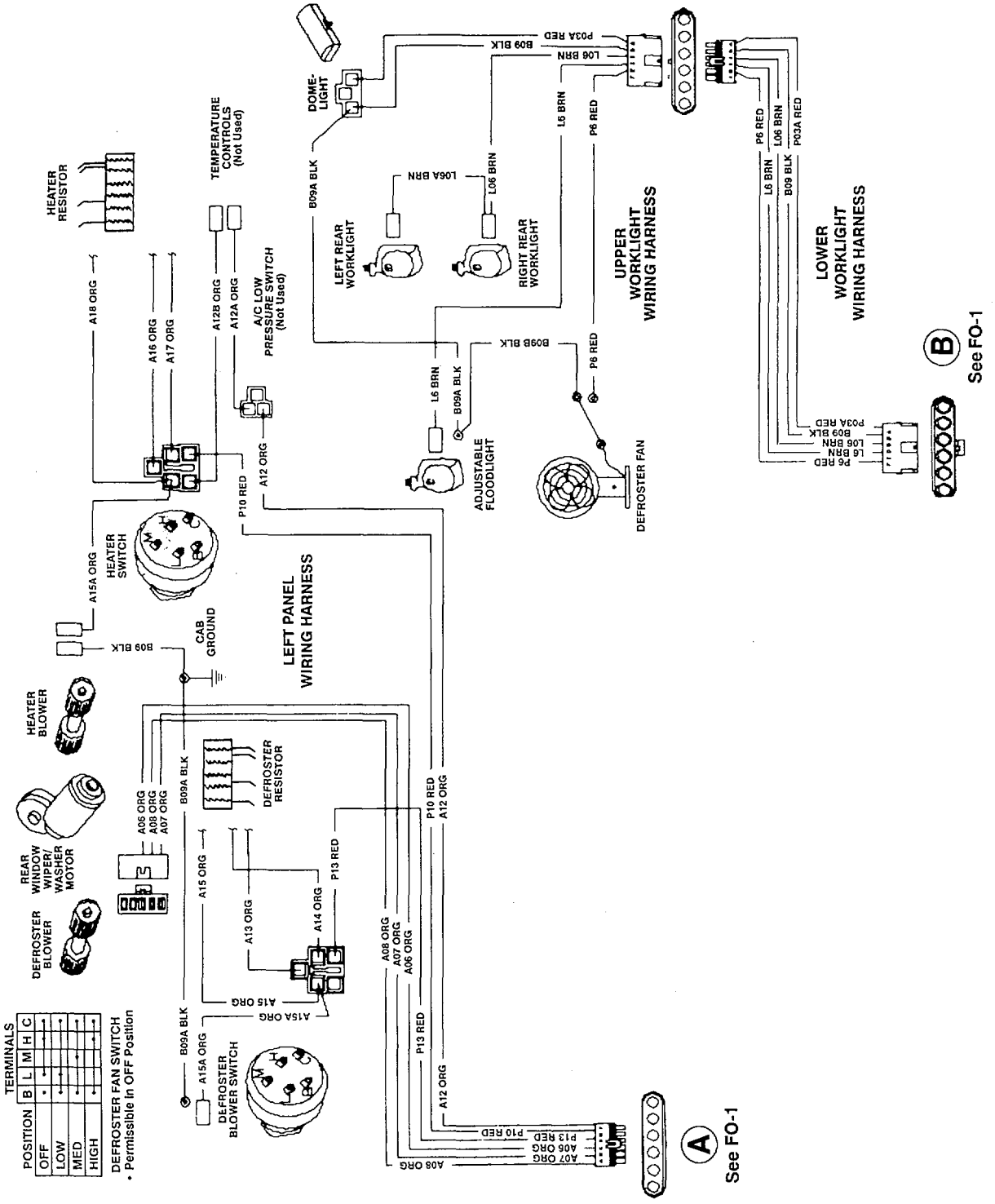


Figure F-3. Left Panel, Upper Worklight, and Lower Worklight Wiring Diagram.

TA708041

F-2. WIRING DIAGRAMS (Con't).

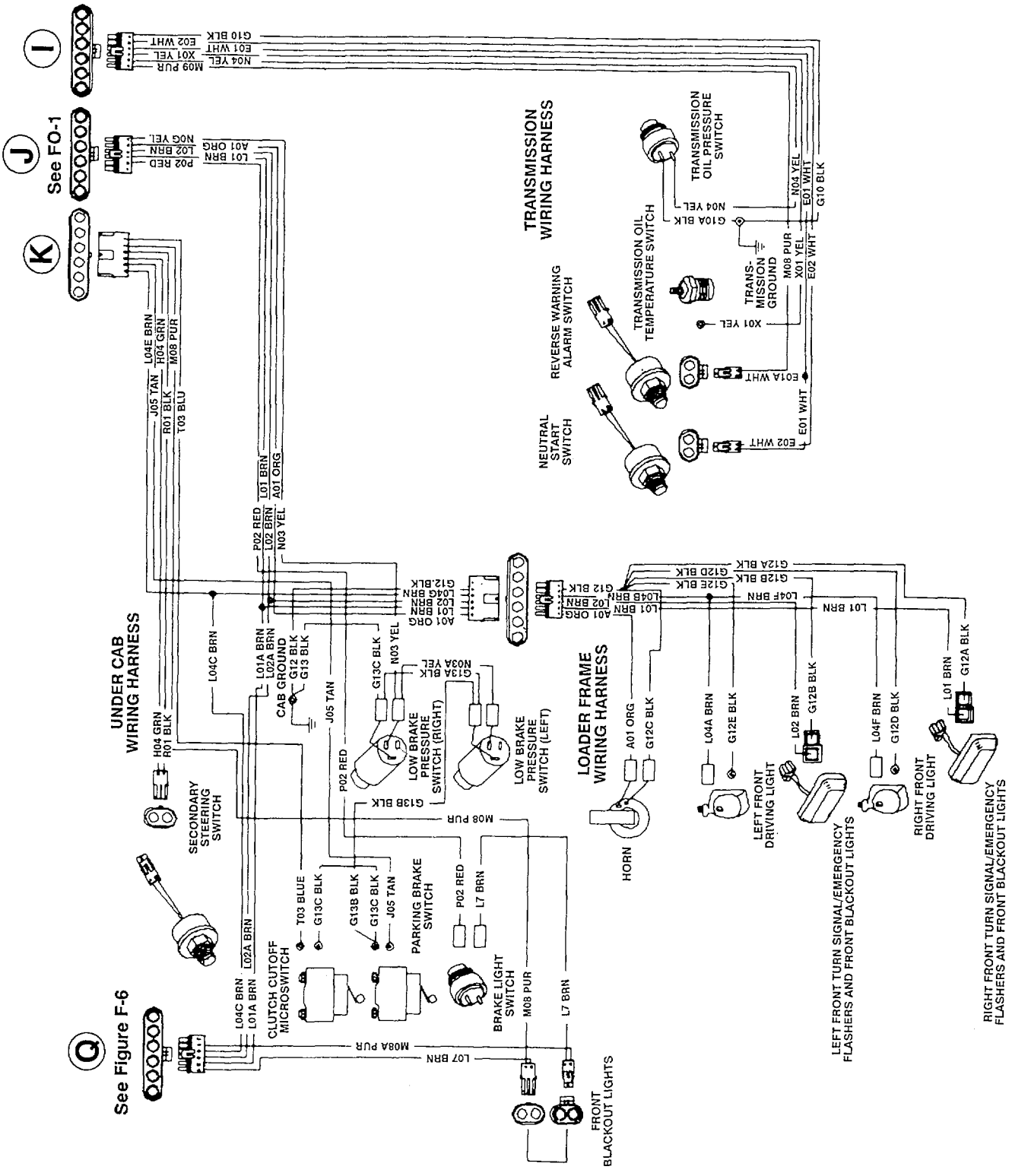


Figure F-4. Transmission, Loader Frame, and Under Cab Wiring Diagram.

TA708042

F-2. WIRING DIAGRAMS (Con't).

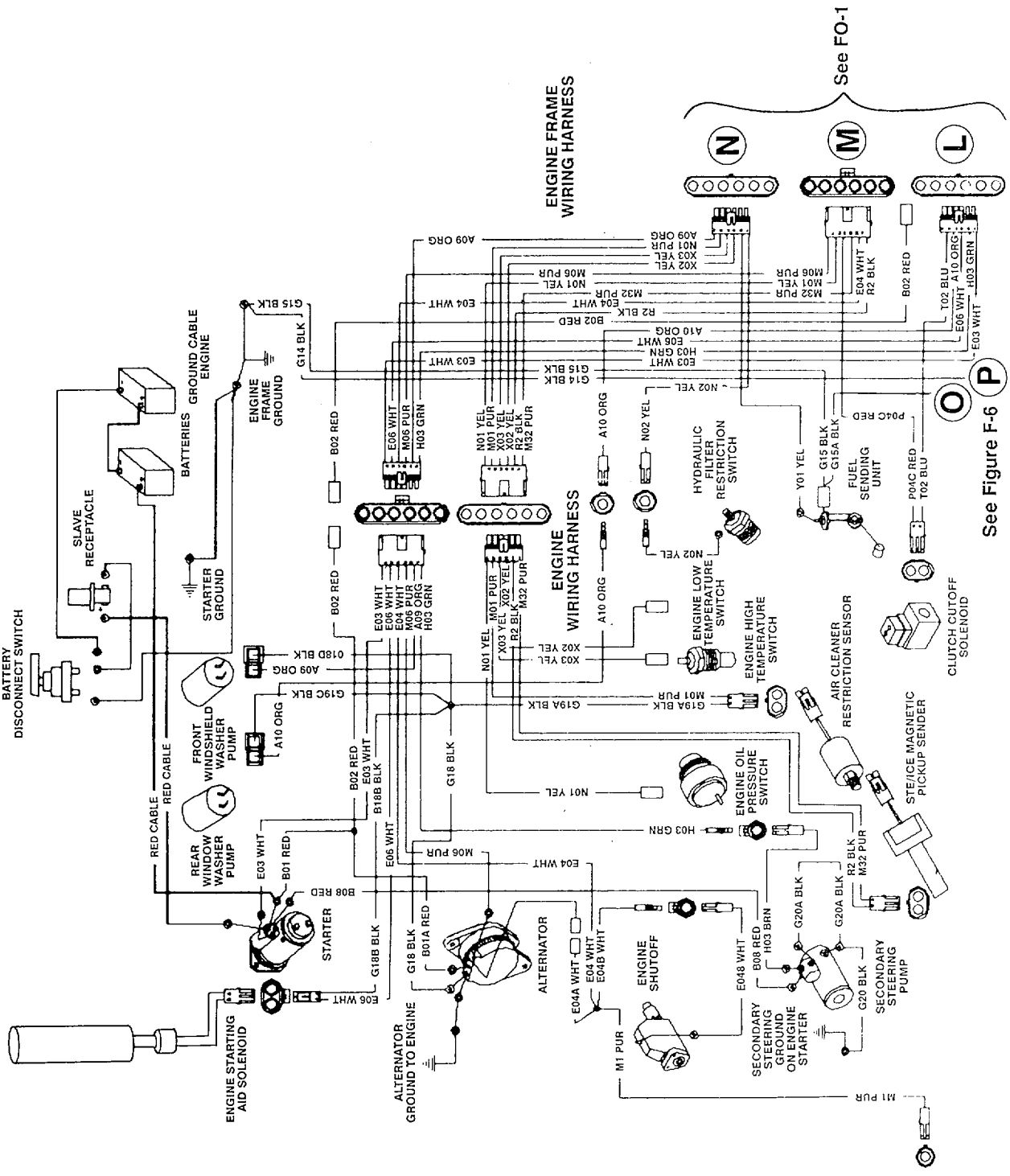


Figure F-5. Engine and Engine Frame Wiring Diagram.

TA708043

F-2. WIRING DIAGRAMS (Con't).

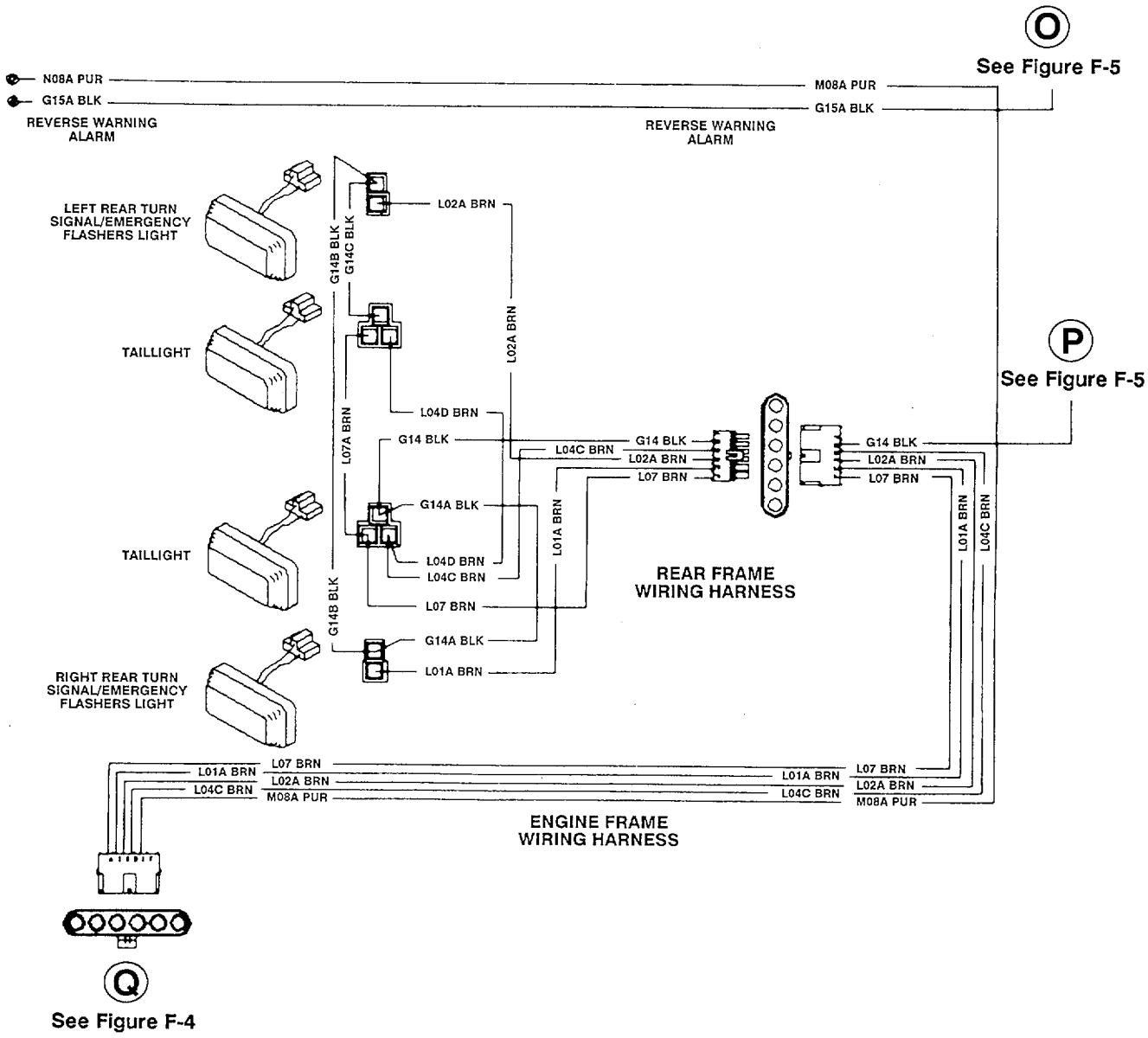


Figure F-6. Rear Frame and Engine Frame Wiring Diagram.

TA708044

F-2. WIRING DIAGRAMS (Con't).

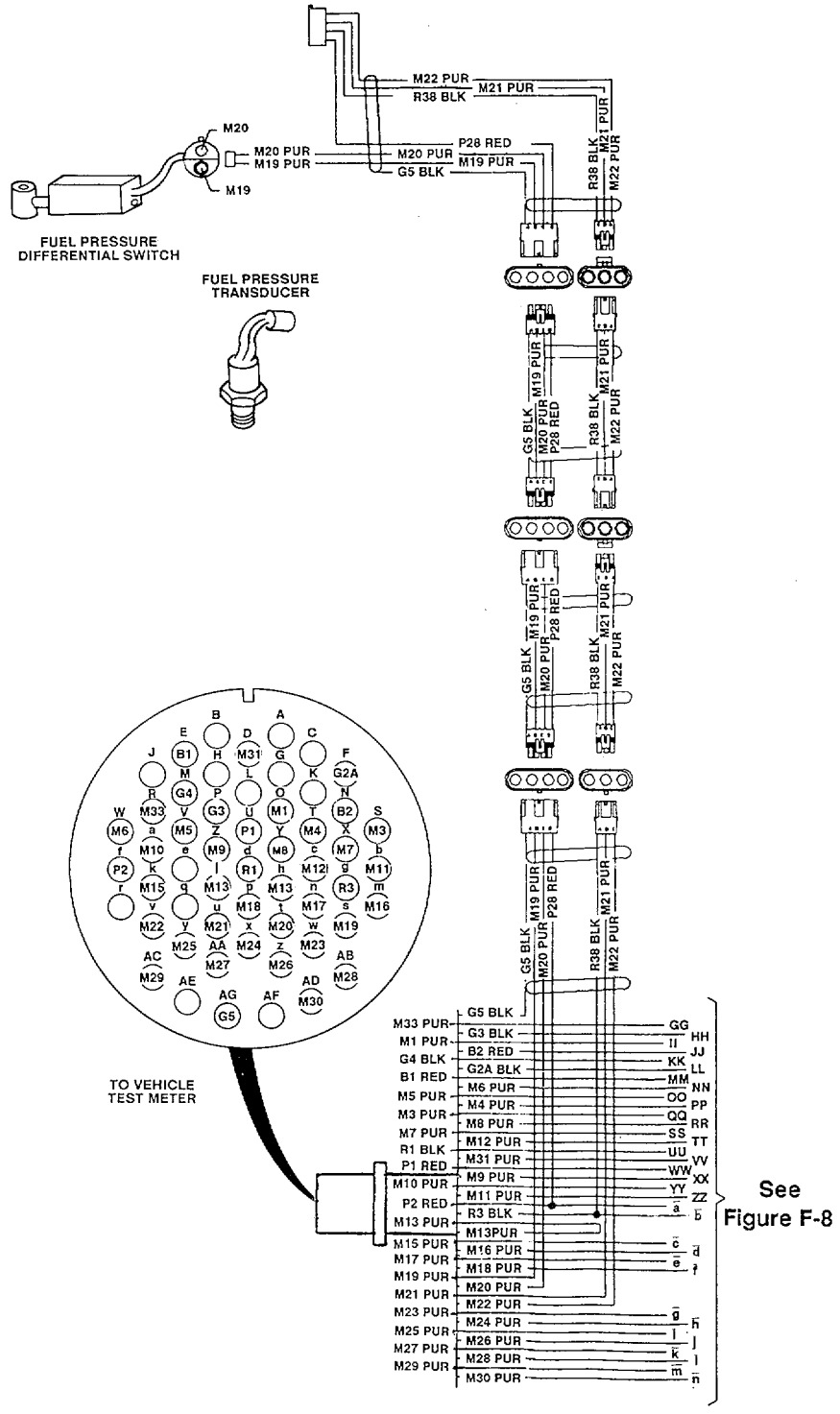


Figure F-7. STE/ICE Load Center Wiring Diagram.

TA708045

F-2. WIRING DIAGRAMS (Con't).

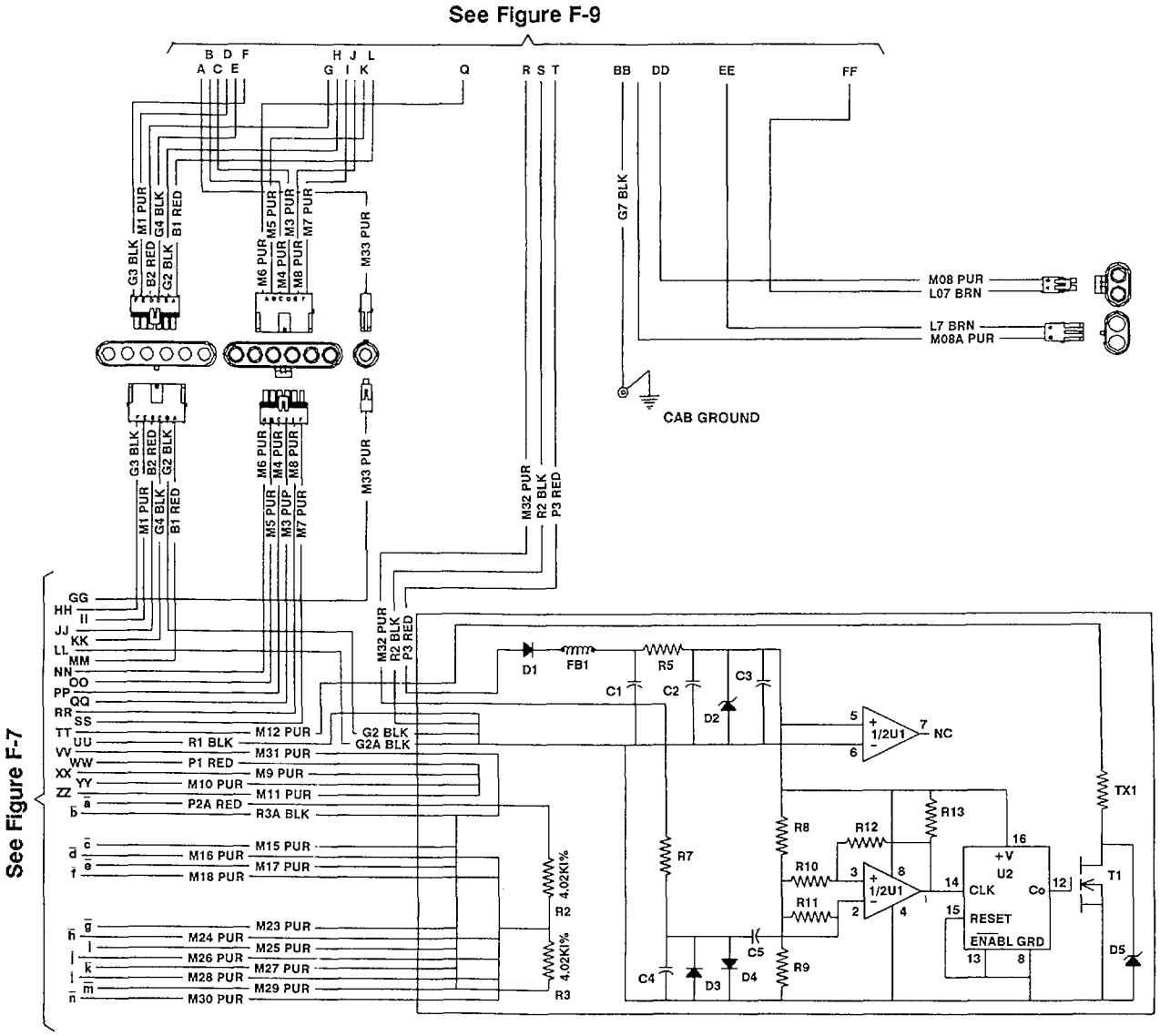


Figure F-8. STE/ICE Resistor Wiring Diagram.

TA708046

F-2. WIRING DIAGRAMS (Con't).

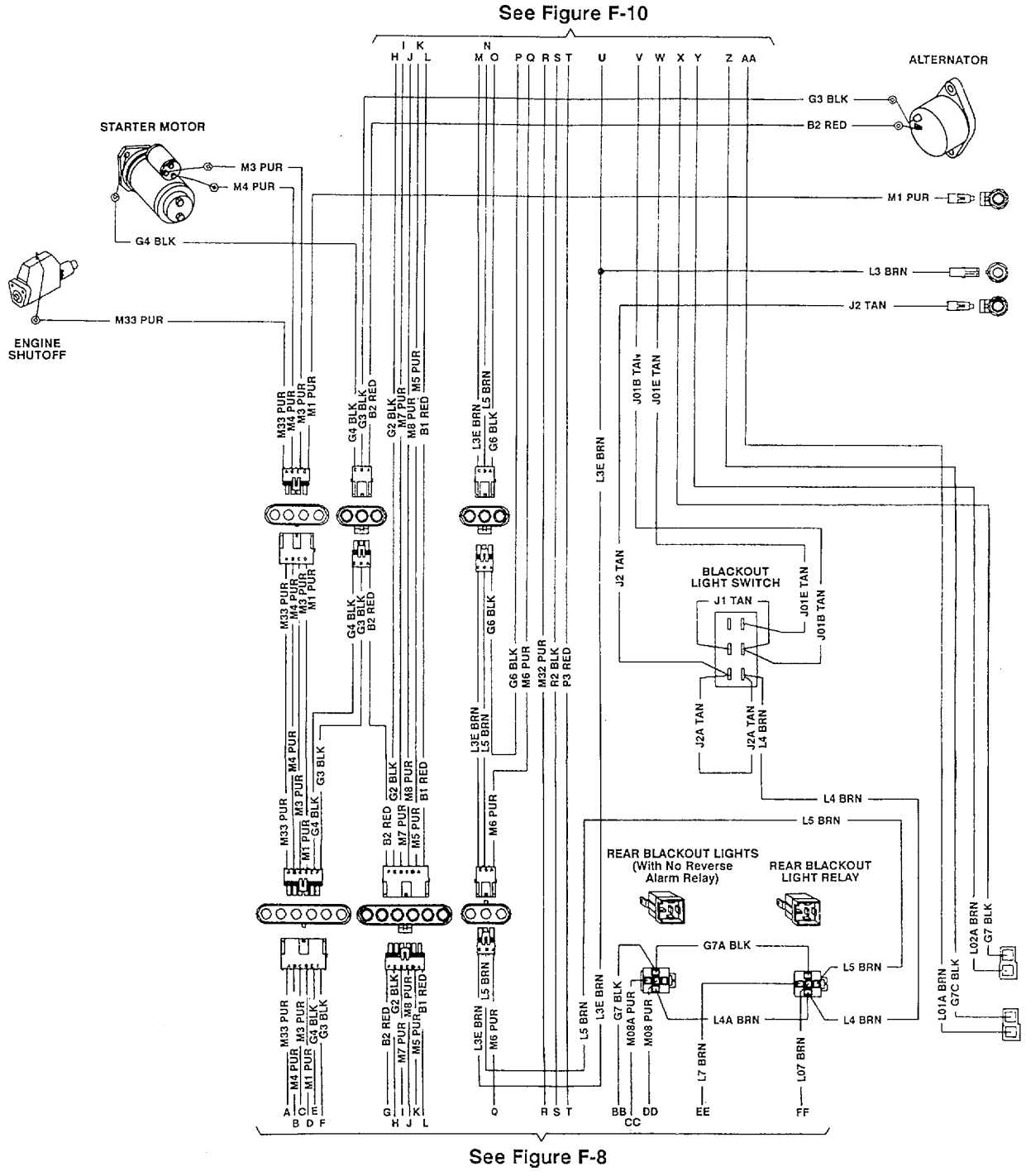


Figure F-9. STE/ICE Starter Motor and Alternator Wiring Diagram.

TA708047

F-2. WIRING DIAGRAMS (Con't).

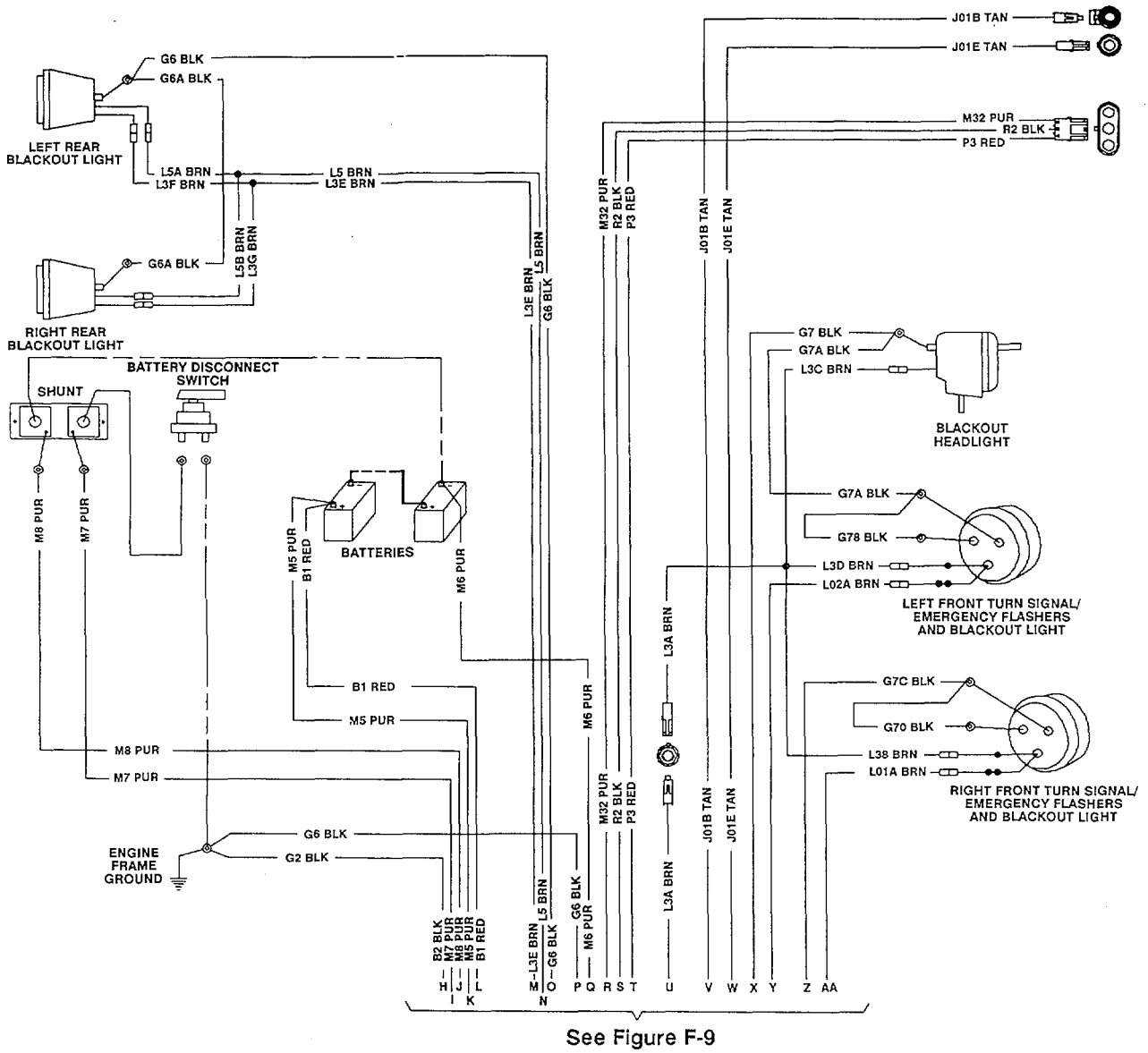


Figure F-10. STE/ICE Batteries and Blackout Lights Wiring Diagram.

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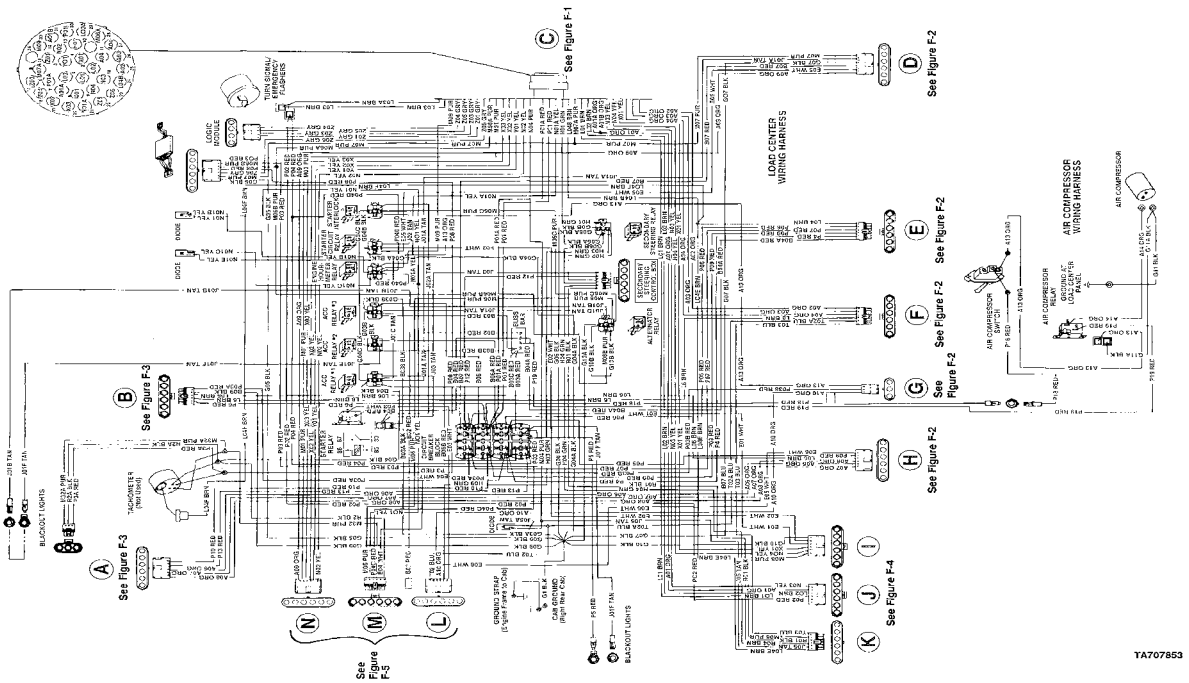

Figure FO-1. Load Center and Air Compressor Wiring Diagram

FP-1/(FP-2 Blank)

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
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Chief of Staff

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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 = 1,000 Millimeters = 39.37 Inches
1 Kilometer = 1,000 Meters = 0.621 Miles

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 = 0.386 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

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1,000 Milliliters = 33.82 Fluid Ounces

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°

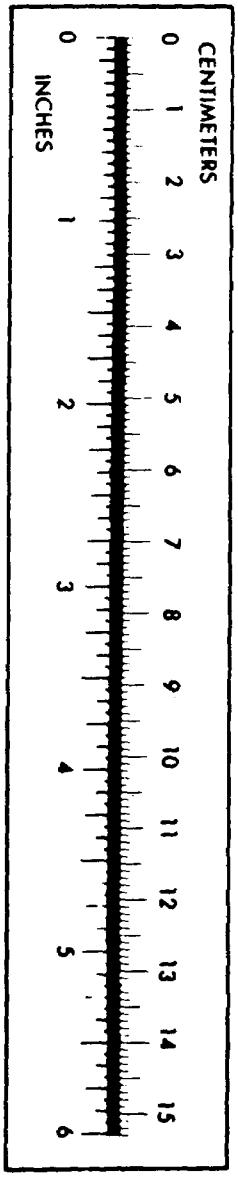
WEIGHTS

1 Gram = 0.001 Kilograms = 1,000 Milligrams = 0.035 Ounces
1 Kilogram = 1,000 Grams = 2.2 Lb.
1 Metric Ton = 1,000 Kilograms = 1 Megagram = 1.1 Short Tons

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square 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 Square 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
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square 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 Square Inch	0.145
Kilometers Per Liter	Miles Per Gallon	2.354
Kilometers Per Hour	Miles Per Hour	0.621



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