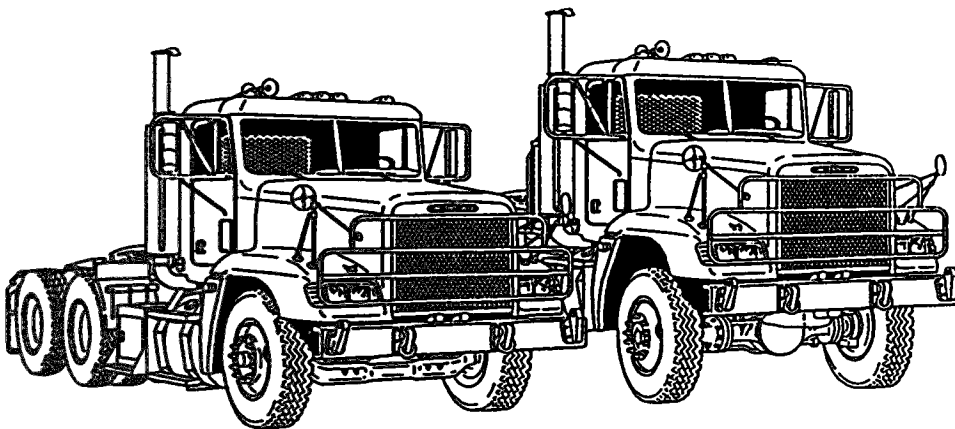


TECHNICAL MANUA

DIRECT AND GENERAL SUPPORT  
MAINTENANCE MANUAL  
FOR

TRUCK, TRACTOR, LINE HAUL  
52,000 GVWR, 6 X 4, M915A2  
(NSN 2320-01-272-5029)

TRUCK, TRACTOR, LIGHT EQUIPMENT  
TRANSPORTER (LET)  
68,000 GVWR, 6 X 6, W/WINCH, M916A1  
(NSN 2320-01-272-5028)



Approved for public release; distribution is unlimited.

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CHANGE  
NO. 1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington D.C., 30 December 1997

**DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL**  
**FOR**  
**TRUCK, TRACTOR LINE HAUL: 52,000 GVWR, 6 X 4, M915A2**  
**(NSN 2320-01-272-5029)**  
**TRUCK TRACTOR LIGHT EQUIPMENT TRANSPORTER (LET)**  
**68,000 GVWR, 6 X 6, W/WINCH, M916A1**  
**(NSN 2320-01-272-5028)**  
**TRUCK TRACTOR LIGHT EQUIPMENT TRANSPORTER (LET)**  
**68,000 GVWR, 6 X 6, W/WINCH, M916A2**  
**(NSN 2320-01-431-1163)**  
**TRUCK, DUMP, HEAVY, CHASSIS**  
**68,000 GVWR, 6 X 6, 14 CU YD, ON-OFF HIGHWAY**  
**M917A1 (NSN 3805-01-431-1165)**  
**M917A1 W/MCS (NSN 3805-01-432-8249)**

**VOLUME 2 OF 2**

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TM 9-2320-363-34-2, dated 17 June 1992, is changed as follows:

1. The manual title is changed to read as shown above.
2. Remove old pages and insert new pages.
3. New or changed material is indicated by a vertical bar in the margin

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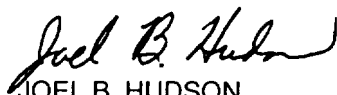
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4. File this change sheet in front of the publication for reference purposes.

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Official:

  
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Administrative Assistant to the  
Secretary of the Army  
04413

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General, United States Army  
Chief of Staff

Distribution:

To be distributed in accordance with IDN number 380905, Direct Support and General Support maintenance requirements for TM9-2320-363-34-2.



**WARNING**

## CARBON MONOXIDE POISONING CAN BE DEADLY

CARBON MONOXIDE IS A COLORLESS, ODORLESS, DEADLY POISONOUS GAS, WHICH, WHEN BREATHED, DEPRIVES THE BODY OF OXYGEN AND CAUSES SUFFOCATION. EXPOSURE TO AIR CONTAMINATED WITH CARBON MONOXIDE PRODUCE SYMPTOMS OF HEADACHE, DIZZINESS, LOSS OF MUSCULAR CONTROL, APPARENT DROWSINESS, OR COMA. PERMANENT BRAIN DAMAGE OR DEATH CAN RESULT FROM SEVERE EXPOSURE.

CARBON MONOXIDE OCCURS IN THE EXHAUST FUMES OF FUEL-BURNING HEATERS AND INTERNAL-COMBUSTION ENGINES AND BECOMES DANGEROUSLY CONCENTRATED UNDER CONDITIONS OF INADEQUATE VENTILATION. THE FOLLOWING PRECAUTIONS MUST BE OBSERVED TO ENSURE THE SAFETY OF PERSONNEL WHENEVER THE PERSONNEL HEATER, MAIN, OR AUXILIARY ENGINE OF ANY VEHICLE IS OPERATED FOR MAINTENANCE PURPOSES OR TACTICAL USE:

1. DO NOT operate engine of vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.
2. DO NOT idle engine for long periods without maintaining ADEQUATE VENTILATION in the personnel compartments.
3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.
4. BE ALERT at all times during vehicle operation for exhaust odors and exposure symptoms. If either is present: IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air; keep warm, DO NOT PERMIT EXERCISE; if necessary, administer artificial respiration (see FM 21-11).

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

**WARNING**

COMPRESSED AIR

To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

**WARNING**

Drycleaning solvent P-D-680 is toxic and flammable. 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 flash point is 100°-138 F (38 °-50° C). If you become dizzy while using cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.

**WARNING**

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

**WARNING**

Make sure lifting device is securely fastened and weight being lifted does not exceed capacity of lifting device. Failure to do so may cause personal injury.

**WARNING**

Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in serious injury to personnel.

**WARNING**

Spilled hydraulic fluid is very slippery. Wipe up any spilled fluid immediately. Failure to do so could result in serious injury to personnel.

**WARNING**

When servicing this vehicle, performing maintenance, or disposing of materials such as engine coolant, transmission fluid, lubricants, battery acids or batteries and CARC paint, consult your Unit/Local Hazardous Waste Disposal Center or safety office for local regulatory guidance. If further information is needed, please contact the Army Environmental Hotline at 1-800-872-3845.

**WARNING**

Failure to wear protective gloves could result in serious skin cuts due to sharp edges on evaporator coil fins.

**WARNING**

Refrigerant R-134a air conditioning system should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in a fire or explosion, which could cause personnel injury.

**WARNING**

Use care to prevent refrigerant from touching your skin or eyes, because liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness could result if you come in contact with liquid refrigerant.

**WARNING**

Do not remove air conditioner compressor oil fill plug without first recovering the system. Failure to recover the system could cause uncontrolled release of high-pressure refrigerant, which can freeze skin and eye tissue causing serious injury or blindness.



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M917A1 (NSN 3805-01-431-1165)  
M917A1 W/MCS (NSN 3805-01-432-8249)**

**VOLUME 2 OF 2**

**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 at the back of this manual direct to: Commander, US Army Tank-automotive and Armaments Command, ATTN: AMSTA-AC-NML, Rock Island, IL 61299-7630. A reply will be furnished to you. You may also provide DA Form 2028-2 information to TACOM via datafax or e-mail. TACOM's datafax number for AMSTA-AC-NML is DSN 793-0726 or Commercial (309) 782-0726 and the e-mail address is: amsta-ac-nml@ria-emh2.army.mil.

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## CHAPTER 12 ENGINE, FUEL, AND COOLING SYSTEM REPAIR INSTRUCTIONS

### **OVERVIEW**

This chapter illustrates and describes procedures for maintenance of the engine, fuel, and cooling system.

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## Section I. ENGINE REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the engine and related parts. A list of tasks contained in this section is shown below.

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---

## ENGINE INSTALLATION/REMOVAL FROM REPAIR STAND

---

This task covers: a. Installation b. Removal

---

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05  
 Adapter Plates, J35635-A  
 Load Rotor, J36130-812  
 Adapter Plate, J35636

#### Personnel Required: (2)

#### References:

TM 9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Fuel Pump Removed
TM 9-2320-363-20	Air Compressor Removed
TM 9-2320-363-20	Starter Removed
TM 9-2320-363-20	STE/ICE Differential Switch Removed

#### Equipment Condition (Cont):

Reference	Condition Description
TM 9-2320-363-20	Fuel Filter Adapters Removed
TM 9-2320-363-20	Electronic Control Module Removed

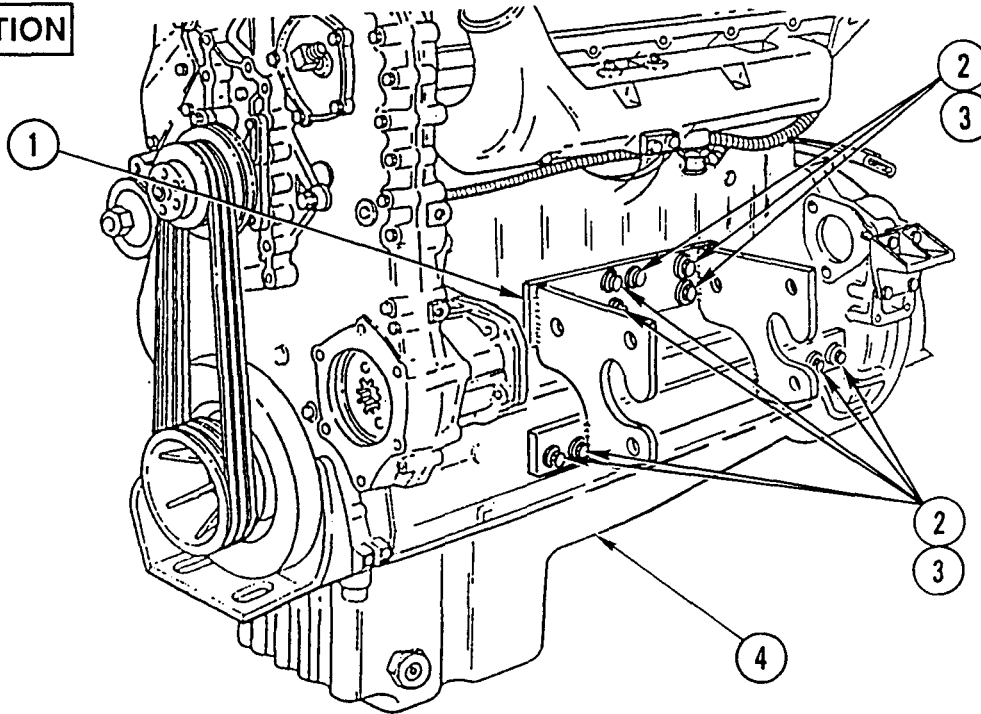
#### General Safety Instructions:

### WARNING

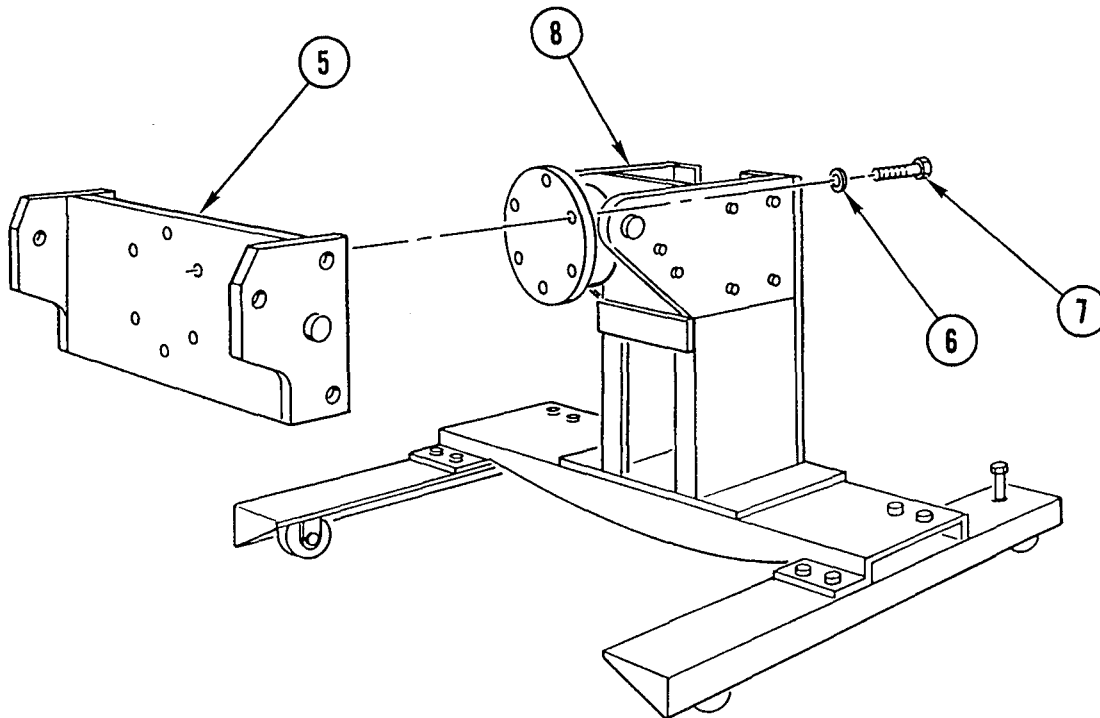
Engine weighs 2,850 lb (1294 kg). Use hoist with lifting capacity of 5,000 lb (2270 kg) to lift and support engine. Failure to do so could result in injury to personnel.

## ENGINE INSTALLATION/REMOVAL FROM REPAIR STAND (CONT)

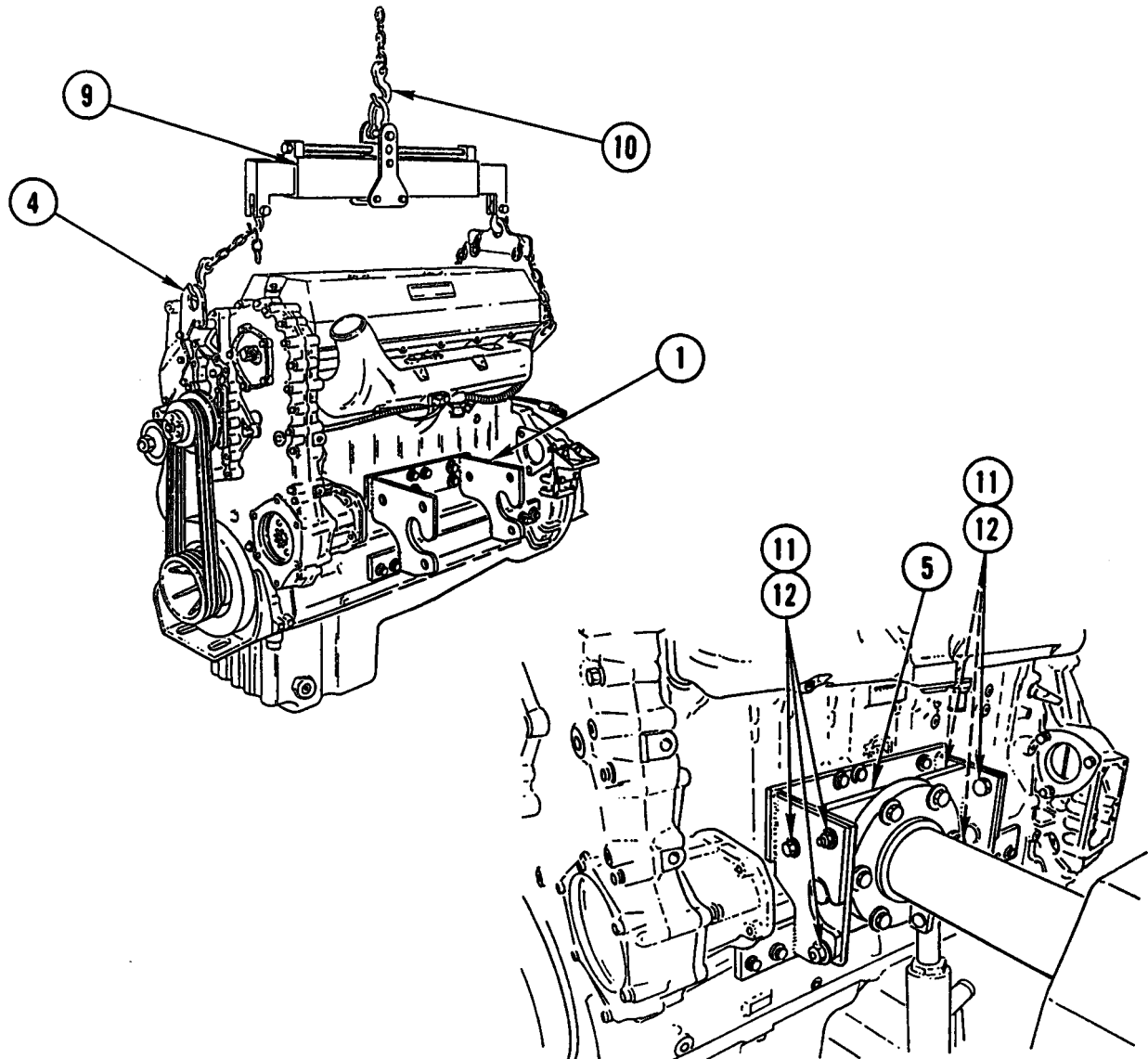
### INSTALLATION



1. INSTALL ENGINE HOLDING FIXTURE (1), NINE WASHERS (2), AND NINE SCREWS (3) ON LEFT SIDE OF ENGINE (4).



2. INSTALL ADAPTER PLATE (5), SIX WASHERS (6), AND SIX SCREWS (7) ON ENGINE STAND (8).



3. INSTALL LOAD ROTOR (9) ON HOIST (10).

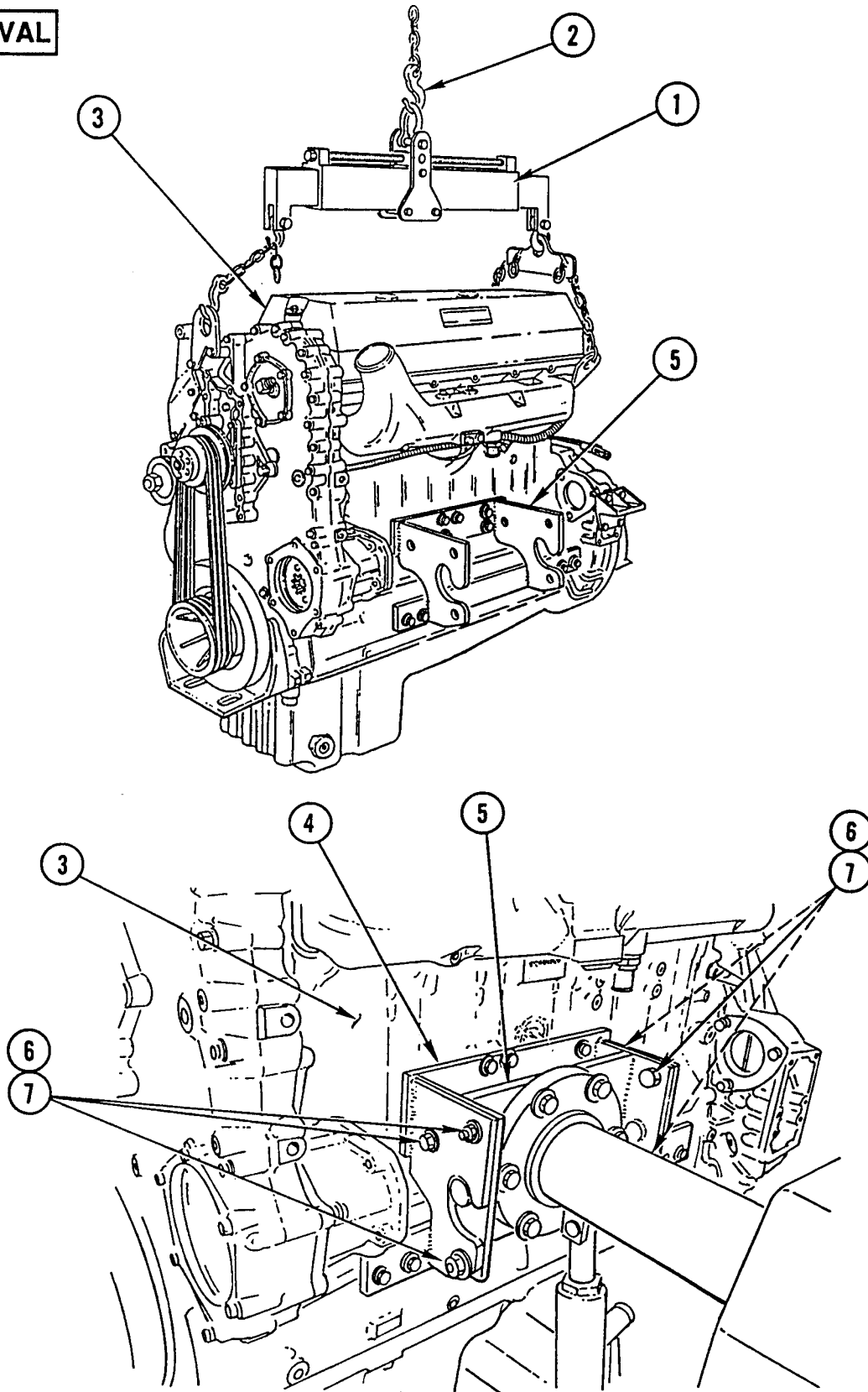
### WARNING

Engine weighs 2,850 lb (1294 kg). Use hoist with lifting capacity of 5,000 lb (2270 kg) to lift and support engine. Failure to do so could result in injury to personnel.

4. ATTACH LOAD ROTOR (9) TO ENGINE (4).
5. LIFT ENGINE (4) AND ATTACH ENGINE HOLDING FIXTURE (1) TO ADAPTER PLATE (5) USING SIX SCREWS (11) AND SIX NUTS (12).
6. REMOVE LOAD ROTOR (9) FROM ENGINE (4).
7. REMOVE LOAD ROTOR (9) FROM HOIST (10).

# ENGINE INSTALLATION/REMOVAL FROM REPAIR STAND (CONT)

## REMOVAL

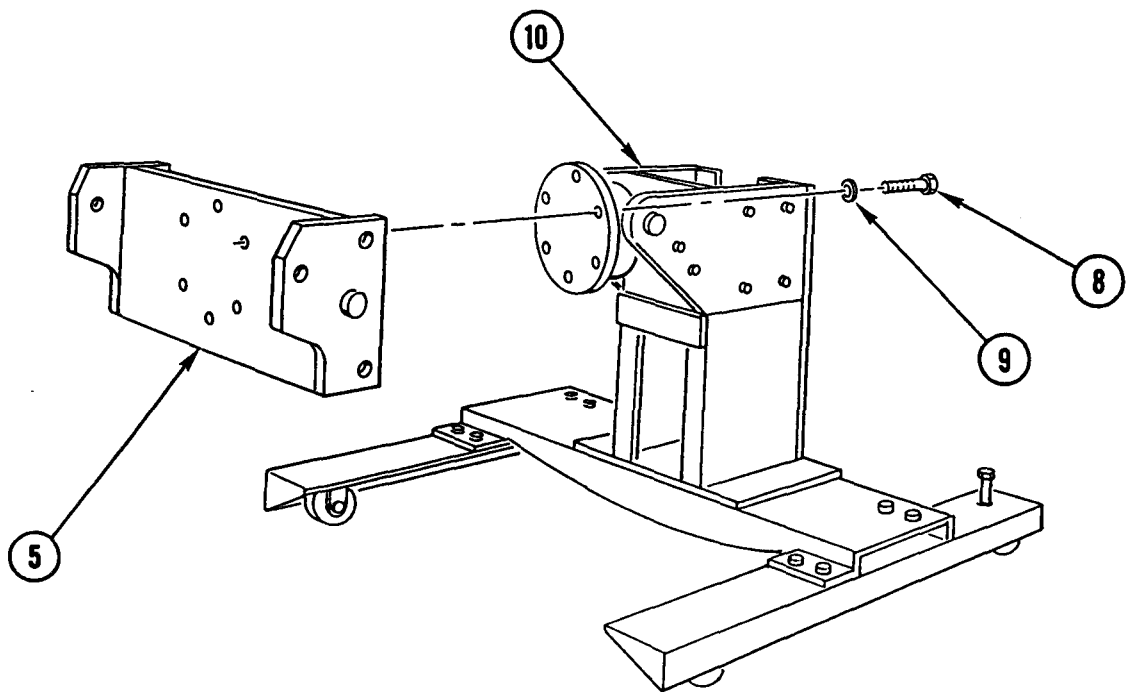


1. INSTALL LOAD ROTOR (1) ON HOIST (2).

**WARNING**

Engine weighs 2,850 lb (1294 kg). Use hoist with lifting capacity of 5,000 lb (2270 kg) to lift and support engine. Failure to do so could result in injury to personnel.

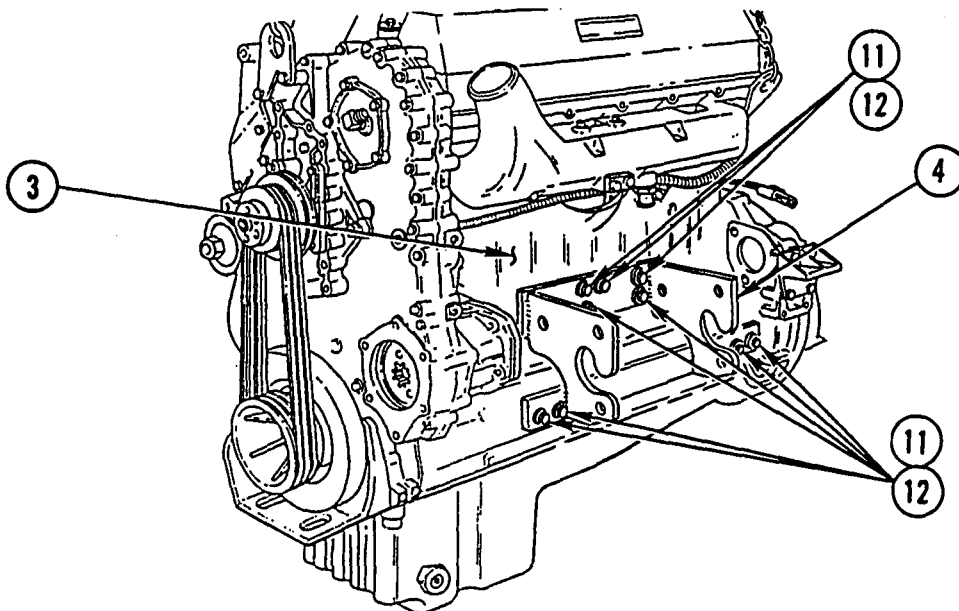
2. ATTACH LOAD ROTOR (1) TO ENGINE (3).
3. REMOVE ENGINE HOLDING FIXTURE (4) FROM ADAPTER PLATE (5) BY REMOVING SIX NUTS (6) AND SIX SCREWS (7).
4. LOWER ENGINE (3).
5. REMOVE LOAD ROTOR (1) FROM ENGINE (3).
6. REMOVE LOAD ROTOR (1) FROM HOIST (2).



7. REMOVE SIX SCREWS (8), SIX WASHERS (9), AND ADAPTER PLATE (5) FROM ENGINE STAND (10).

---

## ENGINE INSTALLATION/REMOVAL FROM REPAIR STAND (CONT)



8. REMOVE NINE SCREWS (11), NINE WASHERS (12), AND ENGINE HOLDING FIXTURE (4) FROM ENGINE (3).

### NOTE

#### Follow-on Maintenance:

- Install electronic control module (TM 9-2320-363-20).
- Install fuel filter adapters (TM 9-2320-363-20).
- Install STE/ICE differential switch (TM 9-2320-363-20).
- Install starter (TM 9-2320-363-20).
- Install air compressor (TM 9-2320-363-20).
- Install fuel pump (TM 9-2320-363-20).



## CYLINDER HEAD REPAIR

This task covers: a. Disassembly b. Inspection c. Cleaning d. Repair/Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Shop Equipment, SC 5180-95-CL-A62  
 Shop Equipment, SC 4910-95-CL-A63  
 Valve Seat Remover, J23479-460  
 Valve Seat installer, J33190  
 Valve Seat Collet, J23479-29  
 Valve Seat Installer, J34983  
 Cylinder Head Adapter Plate, J35636  
 Cylinder Block Adapter Plate, J35635-A  
 Dowel Installer Set, J36224  
 Plug Installer Set, J35653  
 Driver Handle, J7079-2  
 Valve Guide Remover, J34696-B  
 Valve Guide Installer, J33191 -A  
 Injector Tube Reconditioning Set, J33880  
 Pressure Test Kit, J36223-C  
 Cylinder Head Lifter, J35641  
 Spring Compressor, J35580

#### Materials/Parts:

Kit, Intake Valve (12)	P/N 23501576
Kit, Exhaust Valve (12)	P/N 23507504
Insert, Intake Valve (12)	P/N 8929127
Insert, Exhaust Valve (12)	P/N 8929126
Guide, Valve (24)	P/N 8929631
Key, Valve (48)	P/N 0984-C
Seal, Guide (24)	P/N 85.0691-9
Oil, Lubricating	Appendix B, Item 37

#### Materials/Parts (Cont):

Compound, Pipe Sealing	Appendix B, Item 15
Oil, Cutting	Appendix B, Item 36
Dye, Prussian Blue	Appendix B, Item 17
Sealant, Non-Hardening	Appendix B, Item 51

#### Equipment Condition:

Reference	Condition Description
Page 3-80	Cylinder Head Removed

#### General Safety Instructions:

### WARNING

- Valve guide is removed from cylinder head under force. Position heavy block of wood at angle, beneath guide, to deflect valve guide and prevent personal injury.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

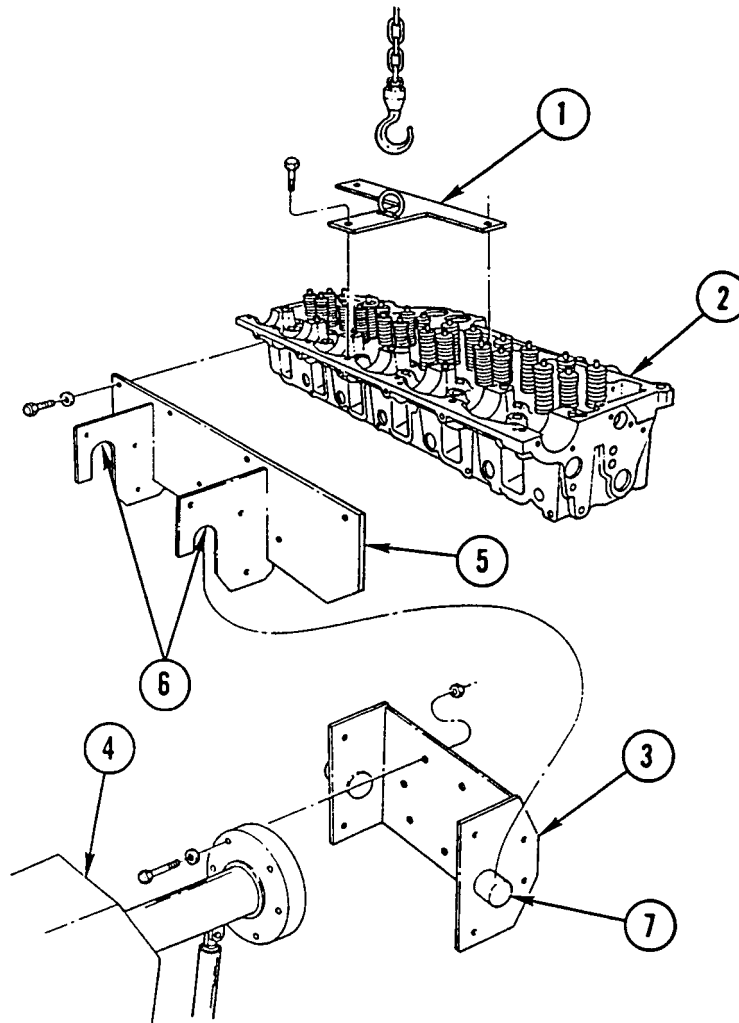
## CYLINDER HEAD REPAIR (CONT)

### General Safety Instructions (Cont):

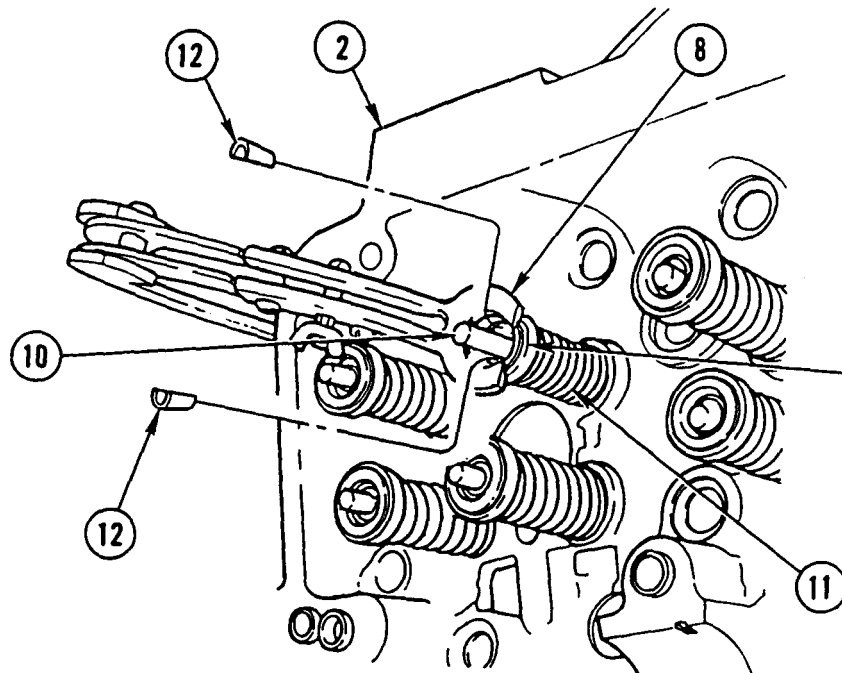
#### WARNING

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

### DISASSEMBLY

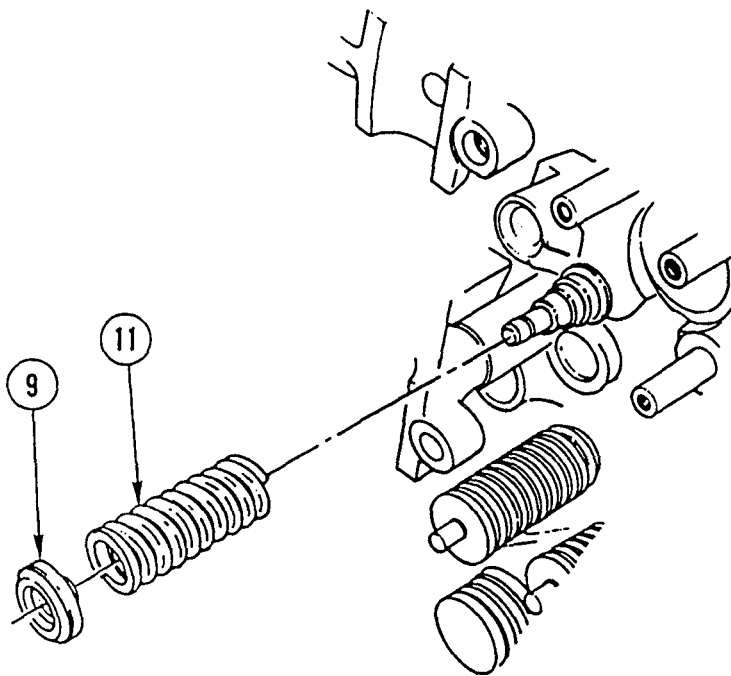


1. USING HARDWARE PROVIDED WITH CYLINDER HEAD LIFTER (1), INSTALL CYLINDER HEAD LIFTER (1) ON CYLINDER HEAD (2).
2. USING HARDWARE PROVIDED WITH ENGINE STAND ADAPTER PLATE (3), BOLT PLATE (3) TO ENGINE STAND (4).
3. USING BOLTS PROVIDED WITH ENGINE STAND ADAPTER PLATE (3), INSTALL CYLINDER HEAD ADAPTER PLATE (5) TO CYLINDER HEAD (2).
4. USING SUITABLE LIFTING DEVICE, LIFT AND MOUNT CYLINDER HEAD (2) AND ADAPTER PLATE (5) TO ENGINE STAND ADAPTER PLATE (3) BY ENGAGING SLOTS (6) IN CYLINDER HEAD ADAPTER PLATE (5) TO DOWELS (7) ON ENGINE STAND ADAPTER PLATE (3).
5. USING SIX BOLTS AND SIX NUTS PROVIDED WITH ENGINE STAND ADAPTER PLATE (3), SECURE ADAPTER PLATE (3) AND CYLINDER HEAD ADAPTER PLATE (5) TOGETHER.
6. REMOVE CYLINDER HEAD LIFTER (1).



7. POSITION CYLINDER HEAD (2) IN VERTICAL POSITION.
8. WITH LEGS OF VALVE SPRING COMPRESSOR JAW (8) ON VALVE ROTATOR (9) SURROUNDING STEM OF VALVE (10), WITH BOTTOM OF COMPRESSOR AGAINST FACE OF VALVE, COMPRESS VALVE SPRING (11).
9. REMOVE AND DISCARD VALVE KEYS (12).

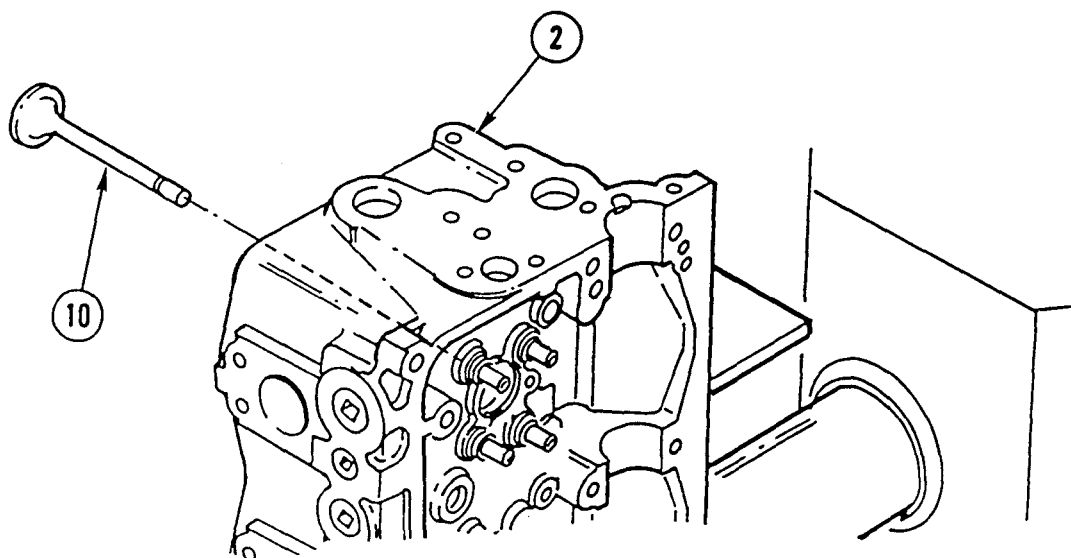
## CYLINDER HEAD REPAIR (CONT)



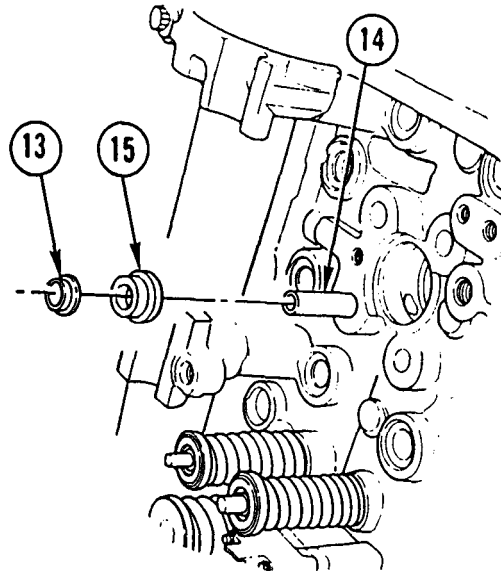
### NOTE

Tag parts prior to removal for possible reuse.

10. RELEASE AND REMOVE VALVE SPRING COMPRESSOR.
11. REMOVE VALVE ROTATOR (9) AND VALVE SPRING (11).



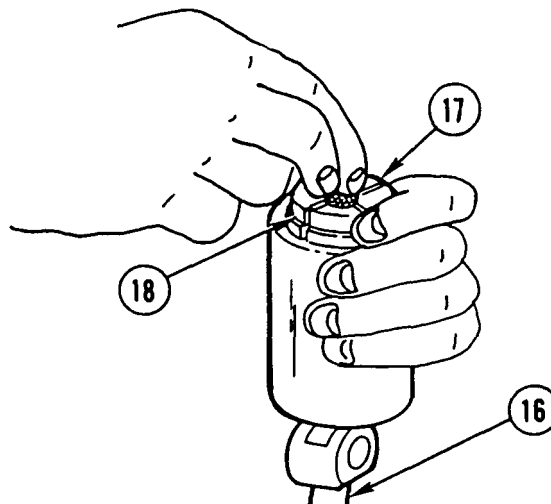
12. REMOVE VALVE (10) FROM FIRE DECK SIDE OF CYLINDER HEAD (2).



**NOTE**

Remove and discard valve stem oil seal whenever valve is removed.

13. REMOVE VALVE STEM OIL SEAL (13) FROM TOP OF VALVE GUIDE (14). DISCARD OIL SEAL.
14. REMOVE VALVE SPRING SEAT (15).

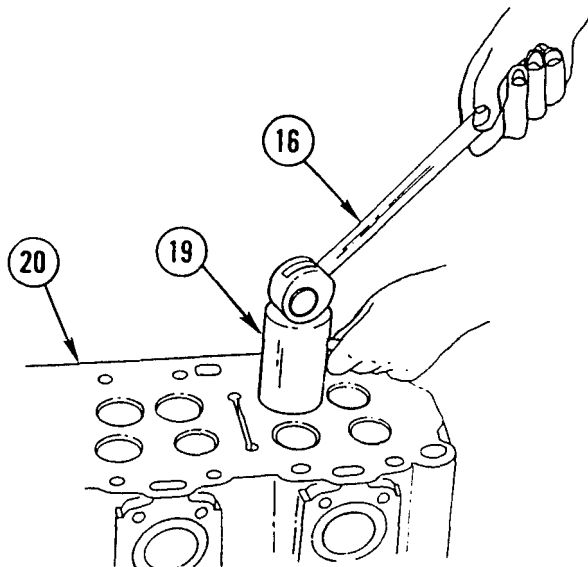


**NOTE**

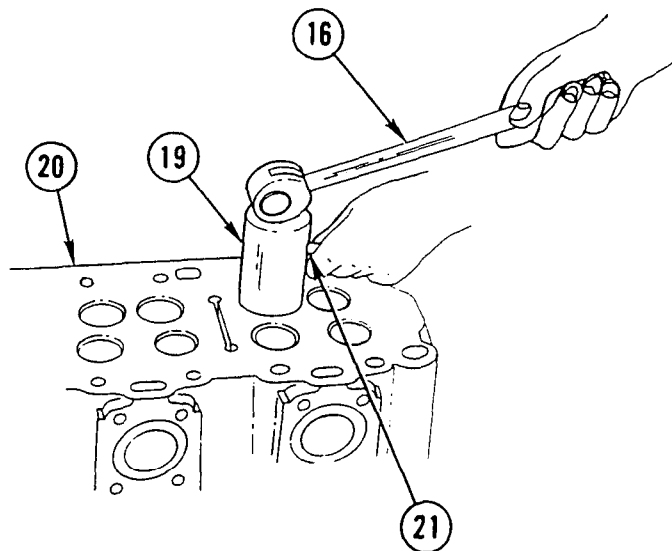
Procedure is the same for both intake and exhaust valve seat inserts. except different collet is used in valve seat remover tool.

15. POSITION CYLINDER HEAD FIRE DECK SIDE UP.
16. IF VALVE SEATS ARE WORN OR DAMAGED, PLACE VALVE SEAT REMOVER HANDLE (16) IN VERTICAL POSITION SO NO PRESSURE IS ON INTERNAL SPRING. ADJUST VALVE SEAT COLLET (17) OPENING BY TURNING TAPERED NUT (18) TO EXPAND OR REDUCE VALVE SEAT COLLET (17) OPENING UNTIL IT WILL SLIP THRU VALVE SEAT.

## CYLINDER HEAD REPAIR (CONT)



17. WITH VALVE SEAT REMOVER HANDLE (16) IN VERTICAL POSITION, INSERT VALVE SEAT COLLET PORTION OF VALVE SEAT REMOVER BODY (19) FULLY INTO VALVE SEAT.
18. HOLD VALVE SEAT REMOVER BODY (19) SQUARE WITH SURFACE OF CYLINDER HEAD FIRE DECK (20) AND PULL VALVE SEAT REMOVER HANDLE (16) UNTIL FIRM RESISTANCE IS FELT. HOLD HANDLE (16) IN THIS POSITION.

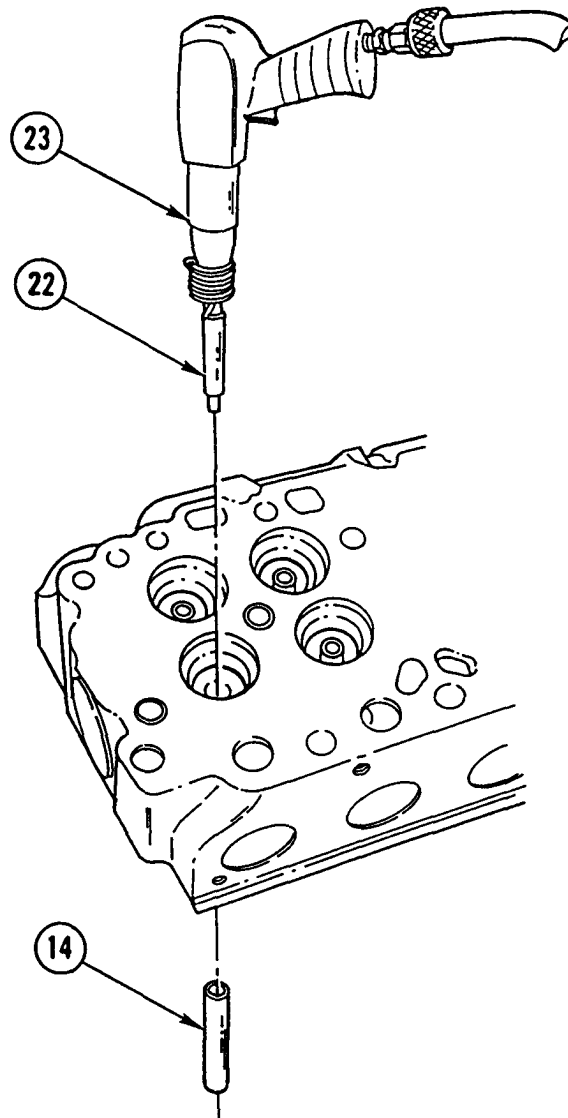


### **CAUTION**

Make sure valve seat remover body remains flat on cylinder head fire deck when moving collet handle to prevent damage to collet and to correct engagement of valve seat insert.

19. HOLD VALVE SEAT REMOVER HANDLE (16) DOWN. GRASP VALVE SEAT COLLET HANDLE (21) AND ROTATE BACK AND FORTH SEVERAL TIMES.

20. HOLD VALVE SEAT REMOVER BODY (19) FLAT ON CYLINDER HEAD FIRE DECK (20) AND PULL VALVE SEAT REMOVER HANDLE (16) DOWN UNTIL VALVE SEAT IS REMOVED.
21. RETURN VALVE SEAT REMOVER HANDLE (16) TO VERTICAL POSITION AND REMOVE VALVE SEAT FROM VALVE SEAT COLLET. DISCARD VALVE SEAT.



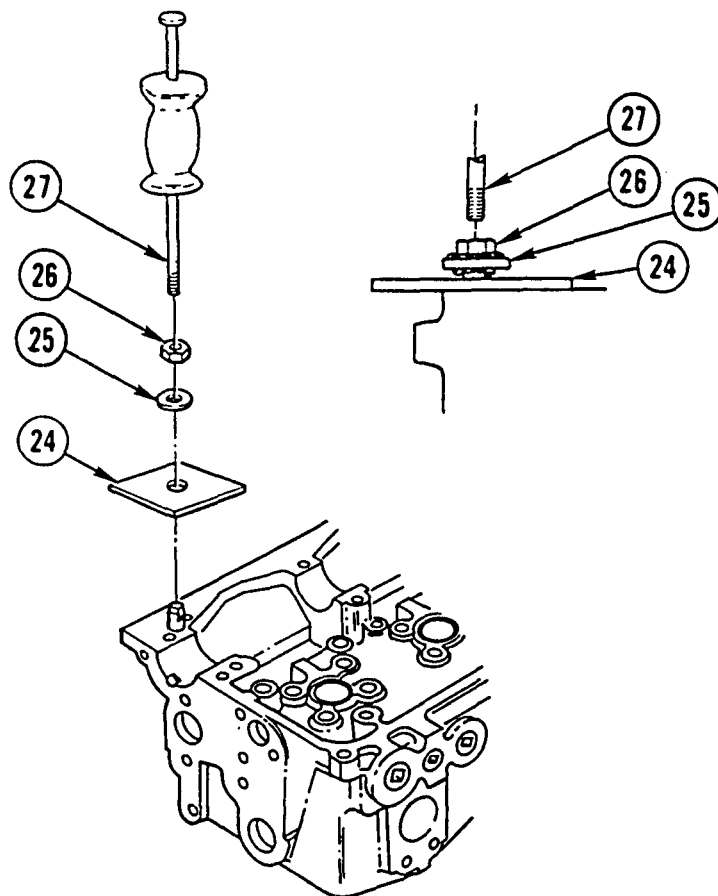
22. IF VALVE GUIDES (14) ARE WORN OR DAMAGED, INSTALL VALVE GUIDE REMOVER (22) IN AIR CHISEL (23) AND INSERT VALVE GUIDE REMOVER (22) INTO BOTTOM OF VALVE GUIDE (14) FROM FIRE DECK SIDE.

### WARNING

Valve guide is removed from cylinder head under force. Position heavy block of wood at angle, beneath guide, to deflect valve guide and prevent personal injury.

23. HOLD VALVE GUIDE REMOVER (22) VERTICAL TO CYLINDER HEAD FIRE DECK AND DRIVE VALVE GUIDE (14) DOWN UNTIL FREE. DISCARD VALVE GUIDE.

## CYLINDER HEAD REPAIR (CONT)

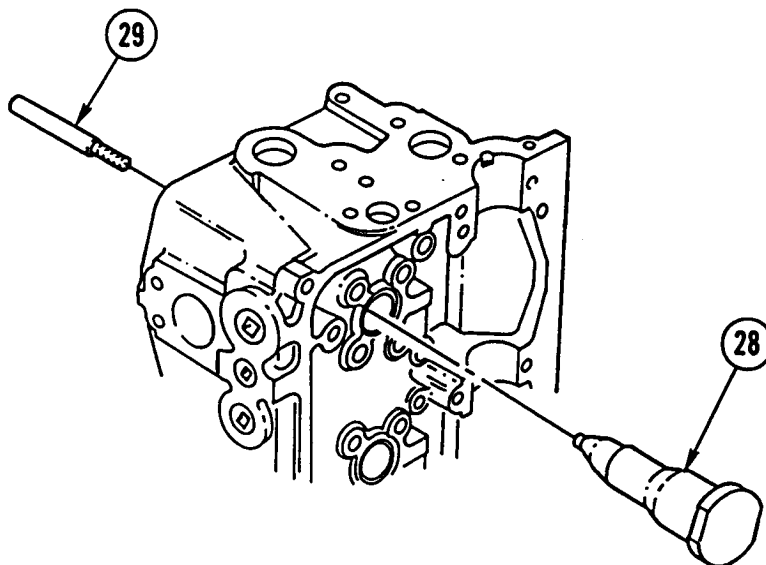


### NOTE

- Replace dowels and plugs only if necessary.
- Dowel removal procedure is the same for round, diamond, or hollow dowels.
- Cover exposed areas to guard against welding sparks.

24. FABRICATE PIECE OF SHEET BRASS (24) WITH HOLE LARGE ENOUGH TO FIT OVER DOWEL BEING REMOVED.
25. TACK-WELD FLAT WASHER (25) TO TOP OF DOWEL AS SHOWN.
26. TACK-WELD NUT (26) TO FLAT WASHER (25). MAKE SURE THREAD OF NUT (26) MATCHES THREAD OF SLIDE HAMMER SHAFT (27).
27. THREAD SLIDE HAMMER SHAFT (27) INTO NUT (26) AND REMOVE DOWEL.





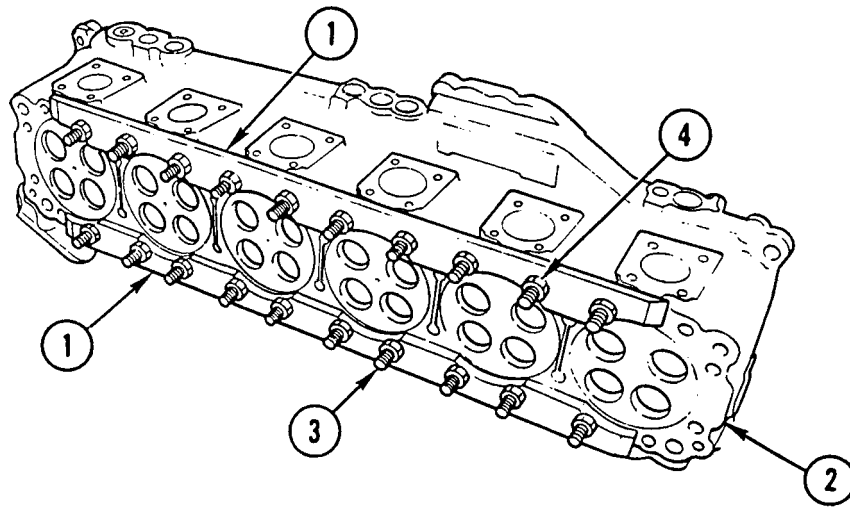
#### NOTE

Cylinder head repair conditions may warrant cylinder head pressure testing before complete head disassembly. Testing should be performed before injector tubes, cup plugs, and pipe plugs are removed. Refer to Inspection steps 1 thru 9 for testing.

28. IF WORN, DAMAGED, OR LEAKING, REPLACE INJECTOR TUBES BY PLACING INJECTOR TUBE INSTALLATION/REMOVAL TOOL (28) IN INJECTOR TUBE. INSERT PILOT (29) THRU SMALL OPENING OF INJECTOR TUBE AND THREAD PILOT INTO TAPPED HOLE IN END OF INSTALLATION/REMOVAL TOOL.
29. USING BRASS HAMMER OR FIBER MALLETT, TAP ON END OF PILOT (29). CAREFULLY DRIVE AND LIFT INJECTOR TUBE, INSTALLATION/REMOVAL TOOL (28), AND PILOT (29) FROM CYLINDER HEAD. IF INJECTOR TUBE O-RING IS NOT REMOVED WITH INJECTOR TUBE, REMOVE O-RING FROM CYLINDER HEAD CASTING AT UPPER END OF INJECTOR TUBE BORE. DISCARD INJECTOR TUBE AND O-RING SEAL.
30. REMOVE CUP PLUGS BY PIERCING WITH SCREWDRIVER OR CHISEL AND PRYING PLUG OUT OF HEAD.
31. UNSCREW PIPE PLUGS AND FUSE PLUG.

## CYLINDER HEAD REPAIR (CONT)

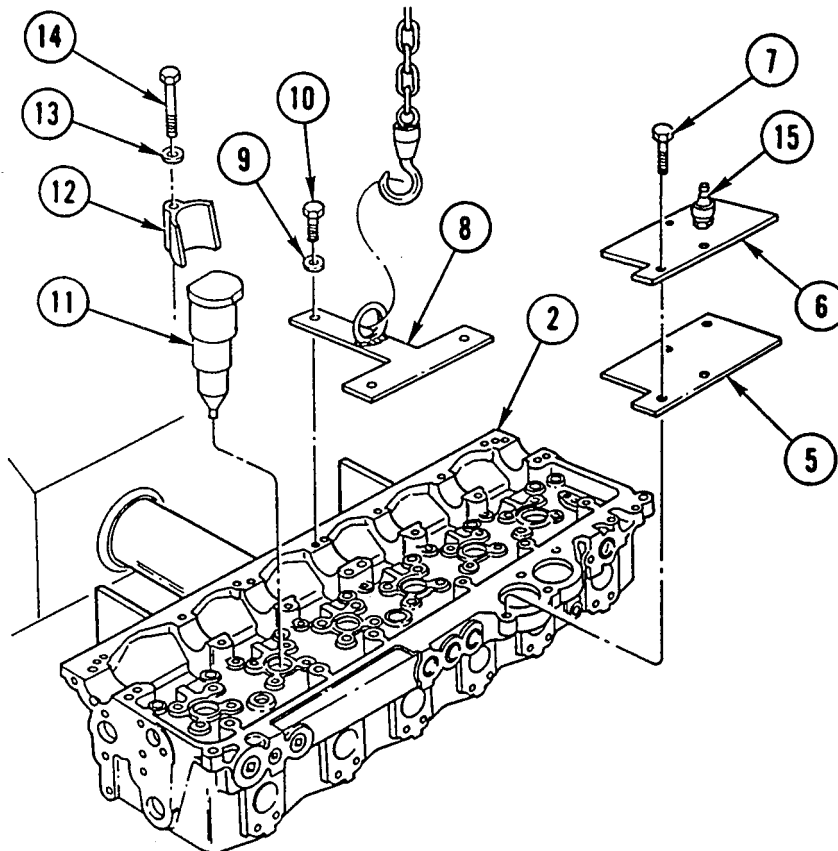
### INSPECTION



### NOTE

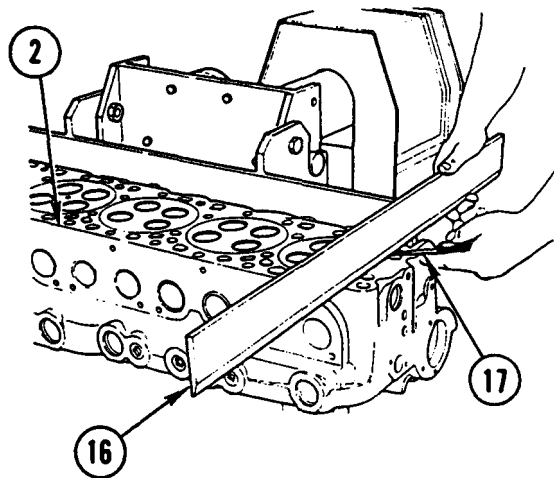
Make sure all cup plugs, pipe plugs, and injector tubes are installed before pressure testing cylinder head.

1. ATTACH TWO PRESSURE TEST KIT STRIPS (1) TO CYLINDER HEAD (2) FIRE DECK. INSTALL 20 CYLINDER HEAD BOLTS (3) THRU CYLINDER HEAD AND TEST KIT STRIPS (1). INSTALL AND TIGHTEN 20 NUTS (4) TO 10 LB-FT (14N.m).



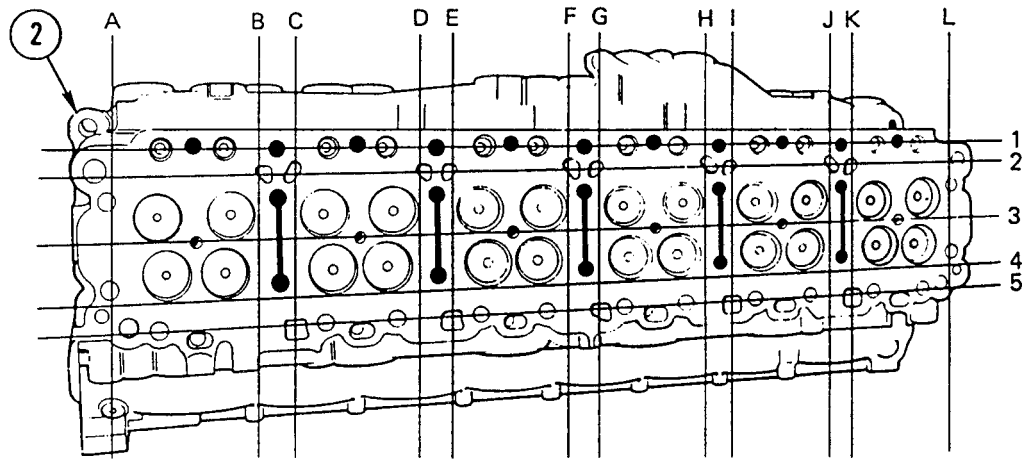
**NOTE**

- Leaking injector tubes must be replaced. Replace any pipe plug or cup plug where leakage is present.
  - Cylinder head must be pressure tested following replacement of any injector tubes, cup plugs, or pipe plugs.
2. INSTALL GASKET (5) AND PRESSURE TEST KIT THERMOSTAT COVER PLATE (6) ON CYLINDER HEAD (2) WITH BOLTS (7).
  3. INSTALL CYLINDER HEAD LIFTER (8), WASHER (9), AND BOLT (10).
  4. INSTALL PRESSURE TEST KIT DUMMY FUEL INJECTORS (11) IN INJECTOR BORES.
  5. INSTALL FUEL INJECTOR CLAMP (12), WASHER (13), AND HOLDDOWN BOLT (14), AND TIGHTEN TO 43-49 LB-FT(58-66 N.m).
  6. REMOVE CYLINDER HEAD (2) ASSEMBLY FROM CYLINDER HEAD (2) ADAPTER PLATE.
  7. APPLY 30 PSI (207 kPa) AIR PRESSURE TO THERMOSTAT COVER PLATE FITTING (15).
  8. INSTALL PIPE PLUGS IN TEMPPOINT AND IN AIR COMPRESSOR COOLANT PORT.
  9. IMMERSE CYLINDER HEAD (2) IN WATER HEATED TO 180°-200 F (82°-930 C). LEAVE CYLINDER HEAD (2) IN WATER FOR 20 MINUTES. WATCH FOR BUBBLES, INDICATING CRACK OR LEAK. IF CRACKED, REPLACE CYLINDER HEAD (2).

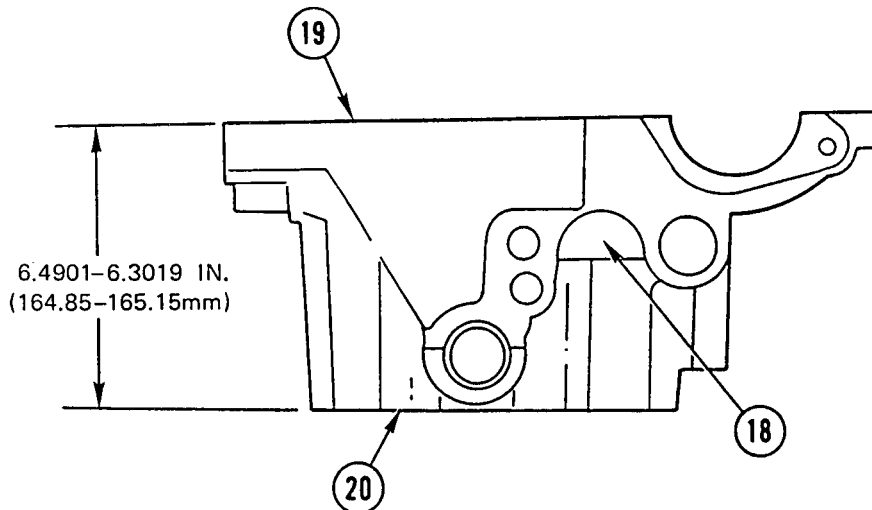


10. USING HEAVY STRAIGHTEDGE (16) AND FEELER GAGE (17), CHECK FOR WARPAGE OF CYLINDER HEAD (2) FIRE DECK

**CYLINDER HEAD REPAIR (CONT)**



11. CHECK CYLINDER HEAD (2) FIRE DECK FOR LONGITUDINAL WARPAGE IN 5 PLACES (1 THRU 5) AND TRANSVERSE WAR PAGE AT 12 PLACES (A THRU L). FIRE DECK MUST BE FLAT WITHIN 0.005 IN. (0.120 mm) FRONT-TO-REAR, AND 0.003 IN. (0.076 mm) SIDE-TO-SIDE. IF NOT, RESURFACE FIRE DECK.



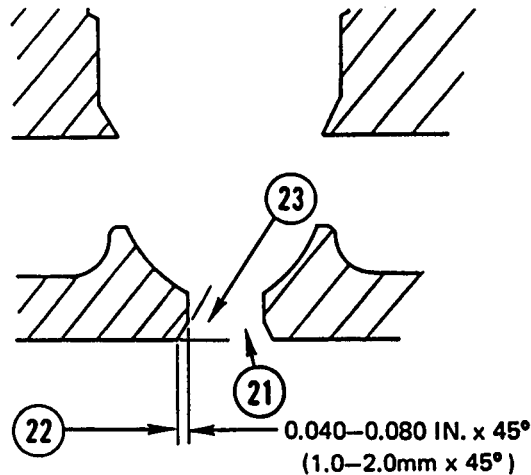
**CAUTION**

Maximum amount of resurfacing is 0.030 in. (0.762 mm). Limit resurfacing to 0.030 in. (0.762 mm). If exceeded, replace cylinder head to prevent damage to equipment.

**NOTE**

If cylinder head requires resurfacing, remove and discard injector tubes.

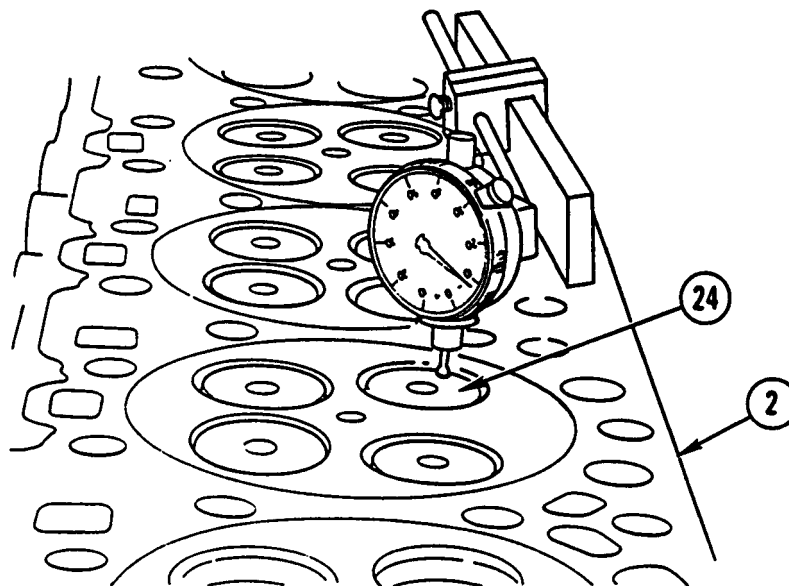
12. RECORD AMOUNT OF STOCK REMOVED FROM CYLINDER HEAD BY STAMPING AMOUNT REMOVED ON PAD (18) ON FRONT OF CYLINDER HEAD. MEASURE FROM TOP RAIL (19) TO FIRE DECK SURFACE (20). RESURFACE FINISH MUST BE 90 U IN. AA (2.3 UM AA).



**NOTE**

It may be necessary to restore injector tube counterbore when cylinder head is resurfaced.

13. MAKE SURE COUNTERSINK INJECTOR TUBE BORES (21) LAND WIDTH OF 0.040-0.080 IN. (1.0-2.0 mm) (22) X 45 DEGREES (23).

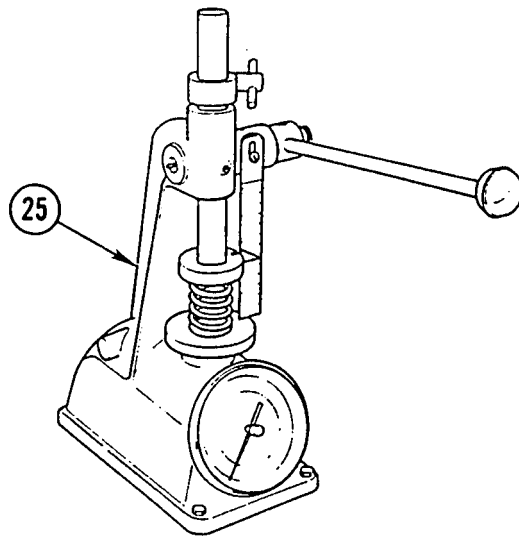


**NOTE**

If cylinder head fire deck has been resurfaced, valves must be seated deeper to restore valve head recess depth to specification limits. Do not grind new valve seat inserts for this purpose. Reduced-thickness valve seat inserts are available 0.010, 0.020, and 0.030 in. (0.254, 0.508, and 0.762 mm) shallower than standard.

14. MAKE SURE VALVE HEADS (24) ARE RECESSED FROM CYLINDER HEAD (2) FIRE DECK SURFACE BY 0.055-0.067 IN. (1.4-1.7 mm) MINIMUM. IF NOT, INSTALL REDUCED-THICKNESS VALVE SEAT INSERTS.

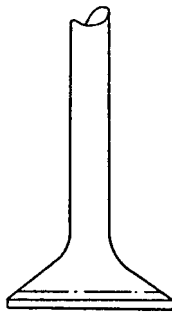
## CYLINDER HEAD REPAIR (CONT)



### NOTE

Replace rotator whenever spring is replaced.

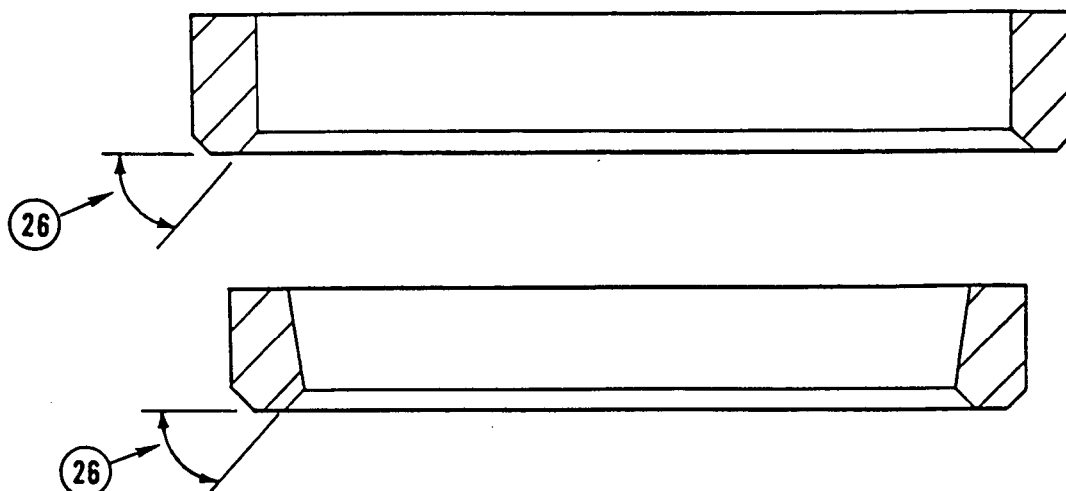
15. INSPECT VALVE SPRINGS AND REPLACE ANY THAT ARE PITTED OR CRACKED.
16. USE SUITABLE VALVE SPRING TESTER (25) TO TEST VALVE SPRINGS. REPLACE SPRING IF SPRING LOAD IS LESS THAN 67 LB (297 N) AT COMPRESSED LENGTH OF 2.648 IN. (67.25 mm).



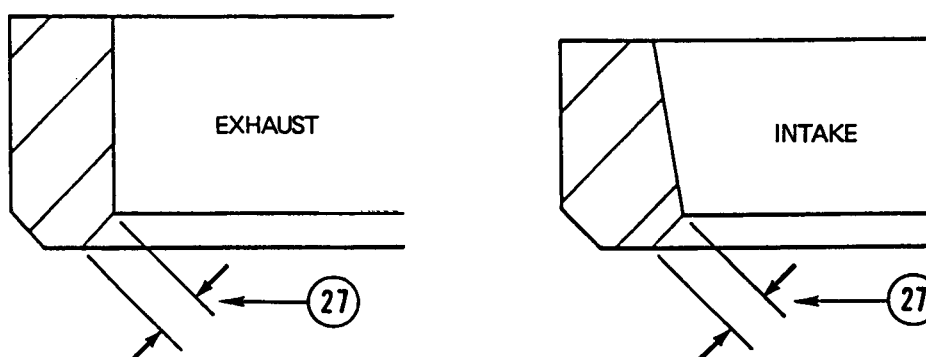
### NOTE

If suitable for reuse, valve may be refaced as long as after refacing, valve rim width is not less than 0.086 in. (2.19 mm) for intake valves and 0.094 in. (2.39 mm) for exhaust valves.

17. MAKE SURE VALVE STEMS ARE FREE FROM SCRATCHES OR SCUFF MARKS. VALVE FACES MUST BE FREE FROM RIDGES, CRACKS, AND PITTING. IF NECESSARY, REFACE VALVES OR INSTALL NEW VALVES. IF VALVE FACES ARE WARPED OR VALVE STEM IS BENT, REPLACE VALVES. MINIMUM VALVE STEM DIAMETER IS 0.342 IN. (8.679 mm).
18. INSPECT GUIDES FOR CRACKS, CHIPPING, SCORING, AND EXCESSIVE WEAR.
19. MEASURE VALVE GUIDE BORE WITH SMALL HOLE GAGE OR GAGE PIN, AND MEASURE VALVE STEM DIAMETER WITH MICROMETER. COMPARE MEASUREMENTS TO DETERMINE VALVE STEM CLEARANCE. IF CLEARANCE IS GREATER THAN 0.005 IN. (0.13 mm), VALVE GUIDE MUST

**NOTE**

New valve seat inserts are preground. Check for concentricity after installation. Do not grind new valve seat insert unless concentricity exceeds 0.002 in. (0.05 mm).

**20. MAKE SURE VALVE SEAT INSERT ANGLE (26) IS 31 DEGREES.**

21. MAKE SURE VALVE SEAT WIDTH (27) IS 0.084 IN. (2.14 mm) FOR INTAKE VALVES AND 0.091 IN. (2.31 mm) FOR EXHAUST VALVES.

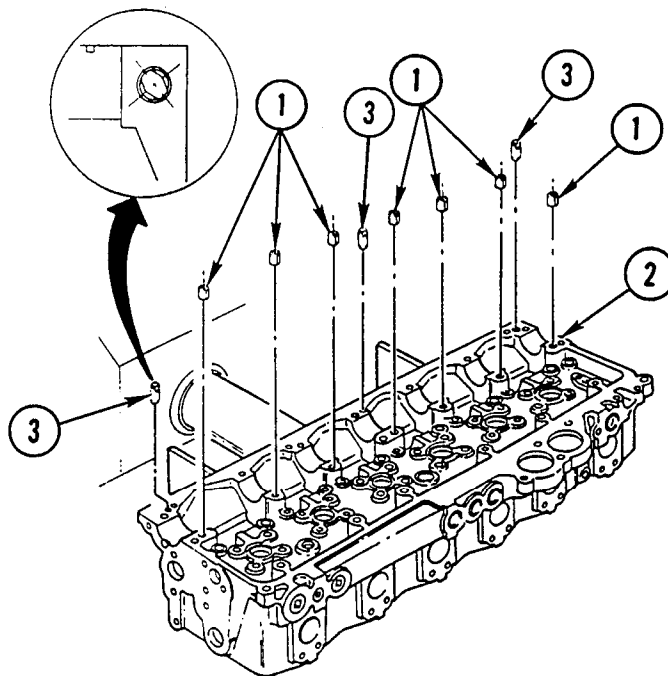
**CLEANING****WARNING**

- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

Clean all parts with solvent and dry with compressed air.

## CYLINDER HEAD REPAIR (CONT)

### REPAIR/ASSEMBLY



#### **NOTE**

Install new dowels and new plugs only if necessary.

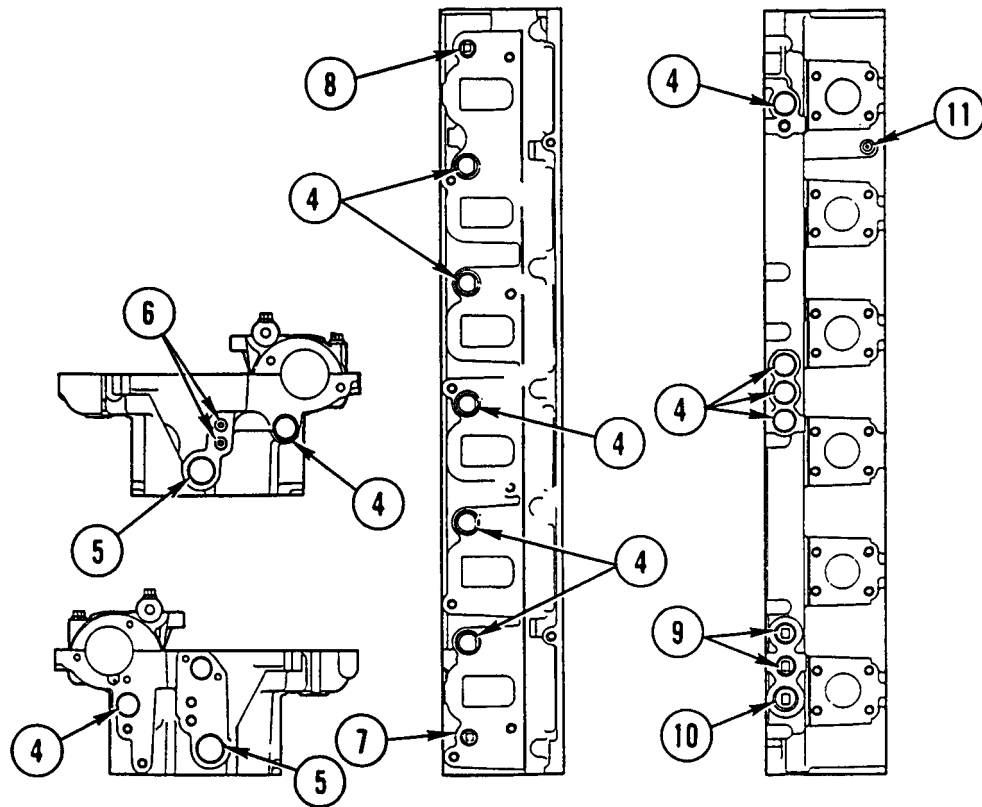
1. INSTALL SEVEN HOLLOW DOWELS (1) ON CYLINDER HEAD (2) TO HEIGHT OF 0.199 +0.010 IN. (5.0 +0.5 mm).

#### **CAUTION**

Make sure diamond dowels are correctly aligned. Failure to do so could result in engine failure.

2. INSTALL THREE DIAMOND DOWELS (3) TO HEIGHT OF 0.240 +0.010 IN. (6.1 +0.5 mm), ANGULAR ORIENTATION OF DIAMOND DOWELS MUST BE PARALLEL TO CENTERLINE THRU DOWEL HOLES WITHIN +4 DEGREES, AS SHOWN.



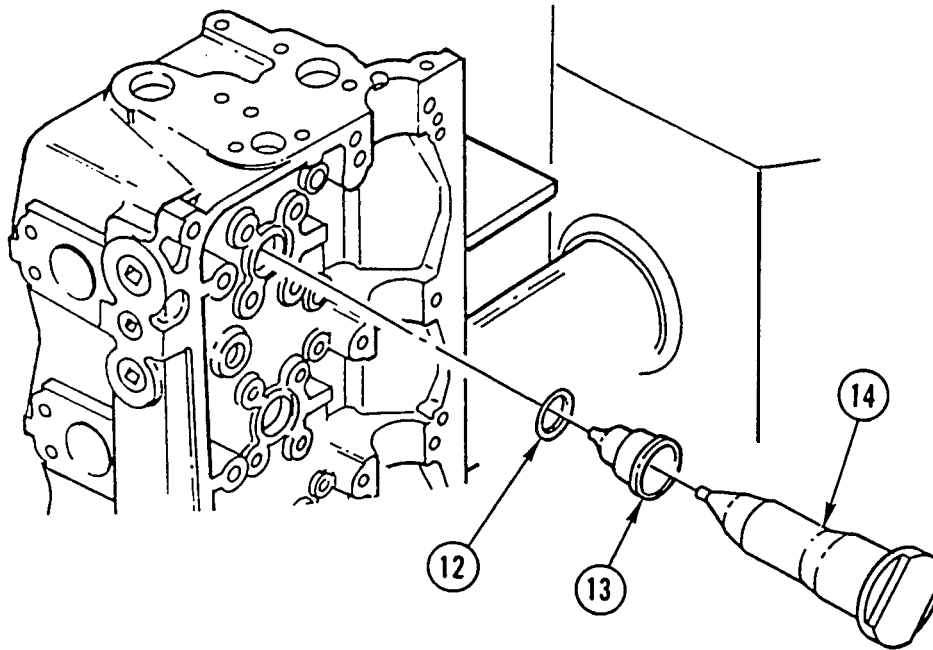


**NOTE**

- Coat outside sealing edges of cup plugs with non-hardening sealant.
- Coat pipe plugs with pipe sealant.

3. USING PLUG INSTALLER, INSTALL 11 CUP PLUGS (4) ON TOP, FRONT, AND REAR SIDES OF CYLINDER HEAD TO 0.098-0.118 IN. (2.5-3.0 mm) BELOW MACHINED SURFACE.
4. USING PLUG INSTALLER, INSTALL TWO CUP PLUGS (5) ON FRONT AND REAR SIDES OF CYLINDER HEAD.
5. INSTALL TWO SQUARE DRIVE PIPE PLUGS (6) ON FRONT SIDE OF CYLINDER HEAD, FLUSH-TO-BELOW SURFACE.
6. INSTALL CONNECTOR (7) ON LEFT REAR SIDE OF CYLINDER HEAD.
7. INSTALL ELBOW (8) ON LEFT FRONT SIDE OF CYLINDER HEAD.
8. INSTALL TWO PIPE PLUGS (9) ON RIGHT SIDE OF CYLINDER HEAD.
9. INSTALL PIPE PLUG (10) ON RIGHT SIDE OF CYLINDER HEAD.
10. INSTALL FUSE PLUG (11) ON RIGHT SIDE OF CYLINDER HEAD.

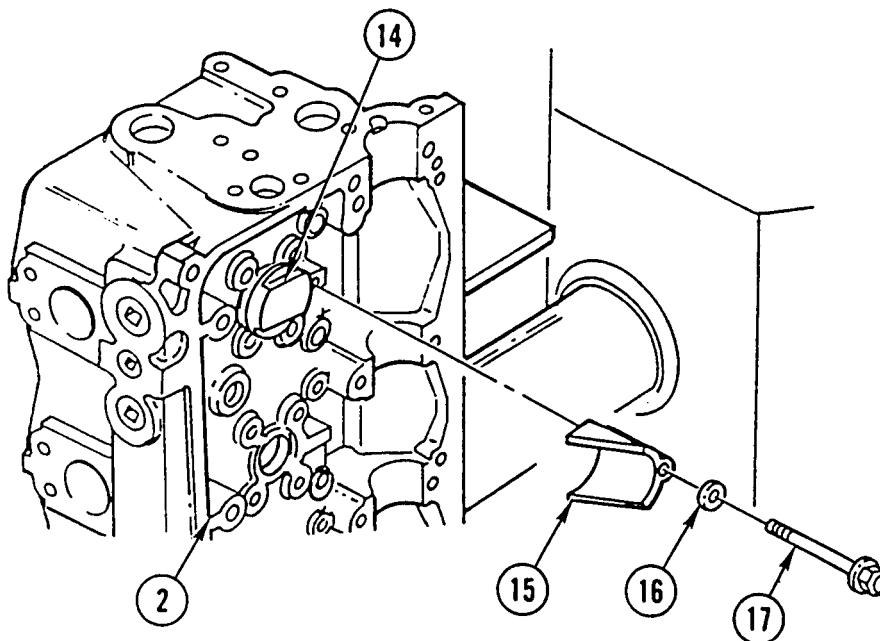
## CYLINDER HEAD REPAIR (CONT)



### NOTE

Do not lubricate outside of injector tube or inside cylinder head injector tube bore.

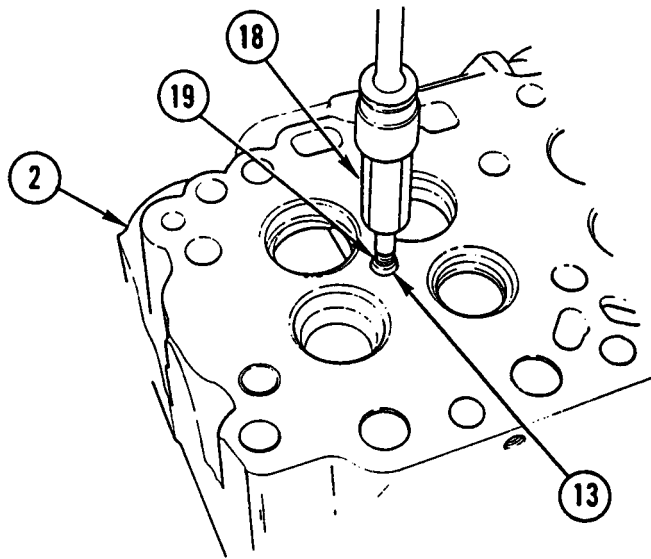
11. LUBRICATE NEW INJECTOR TUBE SEAL RING (12) WITH LUBRICATING OIL. INSTALL SEAL RING (12) OVER NEW INJECTOR TUBE (13) TO LIP.
12. INSTALL INJECTOR TUBE (13) ON INJECTOR TUBE RECON- DITIONING SET INSTALLER (14).



**NOTE**

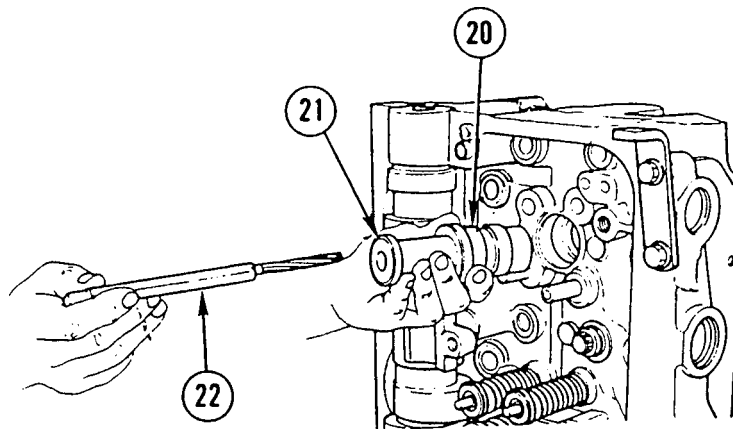
If injector tube falls off installer during installation, use injector tube reconditioning set tube remover pilot to retain injector tube on installer. Remove pilot after holddown clamp is installed and tightened.

13. INSTALL INJECTOR TUBE RECONDITIONING SET INSTALLER (14) WITH INJECTOR TUBE IN INJECTOR BORE. MAKE SURE TIP OF INJECTOR TUBE GOES THRU SMALL HOLE IN CYLINDER HEAD (2) FIRE DECK. TAP LIGHTLY ON END OF INSTALLER (14), IF NECESSARY, TO SEAT INJECTOR TUBE.
14. INSTALL INJECTOR HOLDDOWN CLAMP (15), WASHER (16), AND BOLT (17) OVER INJECTOR TUBE RECONDITIONING SET INSTALLER (14). TIGHTEN BOLT TO 43-49 LB-FT (58-66 N.m).



15. INSERT INJECTOR TUBE RECONDITIONING SET FLARING TOOL (18) THRU SMALL HOLE IN BOTTOM OF INJECTOR TUBE (13) AND ROTATE TOOL (18) TO ENGAGE THREADS (19) IN RECONDITIONING SET INSTALLER.
16. USING TORQUE WRENCH AND STANDARD 9/16-IN. SOCKET, THREAD FLARING TOOL (18) INTO INJECTOR TUBE RECONDITIONING SET INSTALLER UNTIL IT FLARES INJECTOR TUBE (13).
17. ROTATE FLARING TOOL (18) AND APPLY PRESSURE TO FLARE END OF INJECTOR TUBE FIRMLY AGAINST CYLINDER HEAD (2). DO NOT EXCEED 30 LB-FT (41 N.m).
18. REMOVE FLARING AND INSTALLER TOOLS. ENSURE PROPER FLARE.

## CYLINDER HEAD REPAIR (CONT)



### NOTE

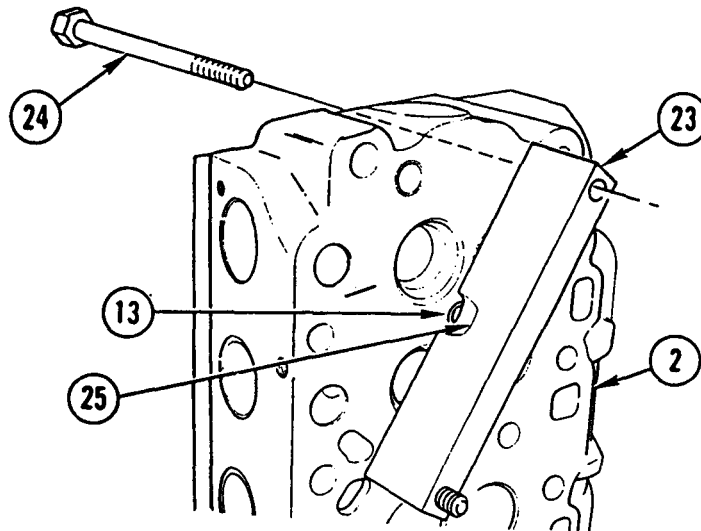
Turn reamer in clockwise direction only when inserting and with drawing reamer.

19. INSERT INJECTOR TUBE RECONDITIONING SET SEAT REAMER PILOT (20) INTO INJECTOR BORE UNTIL IT CONTACTS CYLINDER HEAD. INSERT RECONDITIONING SET SEAT TIP REAMER PILOT (21) INTO SEAT REAMER UNTIL IT BOTTOMS.
20. APPLY A FEW DROPS OF CUTTING OIL ON CUTTING EDGES OF INJECTOR TUBE RECONDITIONING SET TUBE TIP REAMER (22) AND INSTALL IN PILOT (21).
21. USE SPEED HANDLE WITH 7/16-IN. SOCKET TO TURN TUBE TIP REAMER (22) IN CLOCKWISE DIRECTION. USE LIGHT PRESSURE UNTIL REAMER (22) GOES COMPLETELY THRU END OF INJECTOR TUBE.

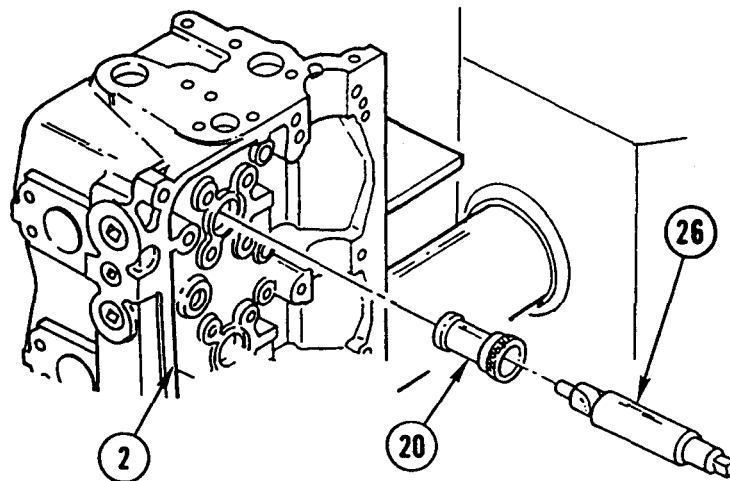
### WARNING

To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

22. REMOVE REAMER AND PILOT. BLOW OUT INJECTOR TUBE AND TIP WITH COMPRESSED AIR.



23. INSTALL INJECTOR TUBE RECONDITIONING SET STOP BLOCK (23) ON CYLINDER HEAD (2) FIRE DECK USING TWO CYLINDER HEAD BOLTS (24). DO NOT TIGHTEN BOLTS. POSITION CUTOUT PORTION (25) OF STOP BLOCK (23) BENEATH INJECTOR TUBE (13).



**CAUTION**

Be careful not to drop reconditioning set seat reamer into pilot or allow seat reamer to strike injector tube. Sharp cutting edges may gouge injector tube causing chatter marks in seat.

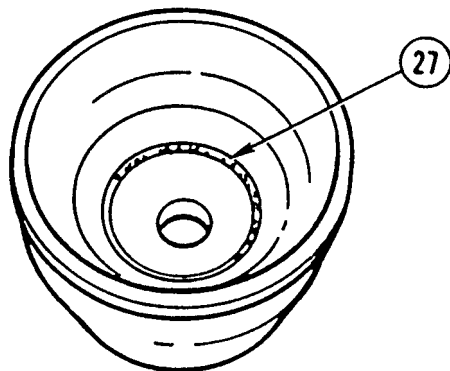
24. INSTALL INJECTOR TUBE RECONDITIONING SET SEAT REAMER PILOT (20) IN INJECTOR TUBE BORE UNTIL IT CONTACTS CYLINDER HEAD (2).

**CAUTION**

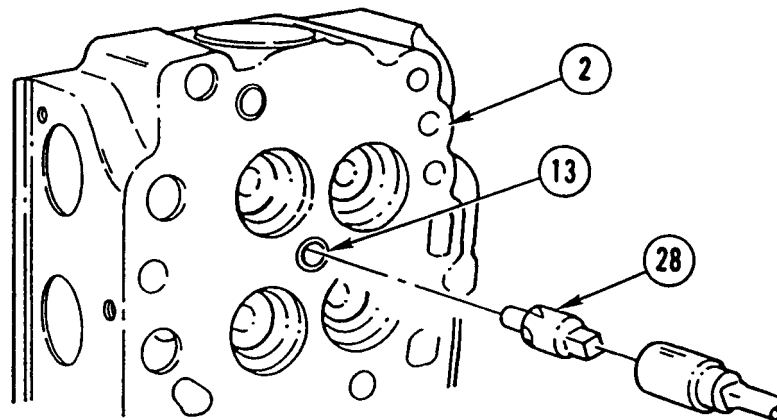
When using seat reamer, use only light pressure. Heavier pressure will result in chatter marks in seat.

25. APPLY A FEW DROPS OF CUTTING OIL ON EDGES OF INJECTOR TUBE RECONDITIONING SET SEAT REAMER (26) AND PLACE GENTLY IN PILOT (20).

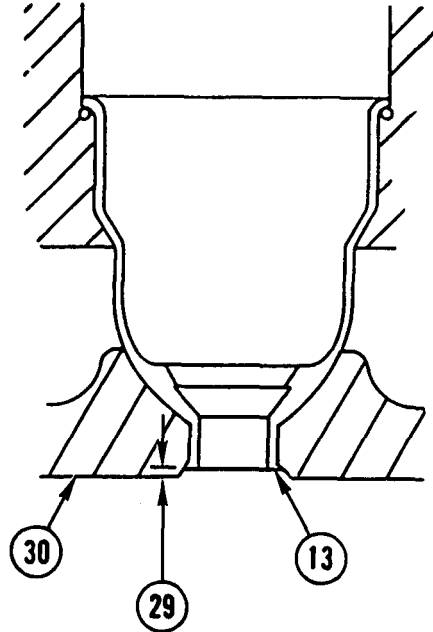
## CYLINDER HEAD REPAIR (CONT)



26. USING SPEED HANDLE WITH 12-POINT (23-mm) SOCKET, TURN INJECTOR TUBE RECONDITIONING SET SEAT REAMER IN CLOCKWISE DIRECTION. USE LIGHT PRESSURE UNTIL REAMER BOTTOMS AGAINST INJECTOR TUBE RECONDITIONING SET STOP BLOCK.
27. REMOVE REAMER AND PILOT. USING COMPRESSED AIR, CLEAN OUT INJECTOR TUBE.
28. INSPECT TUBE SEATING SURFACE FOR IRREGULARITIES OR CHATTER MARKS (27) IN SEATING SURFACE. IF IRREGULARITIES OR CHATTER MARKS ARE PRESENT, REMOVE AND REPLACE INJECTOR TUBE.

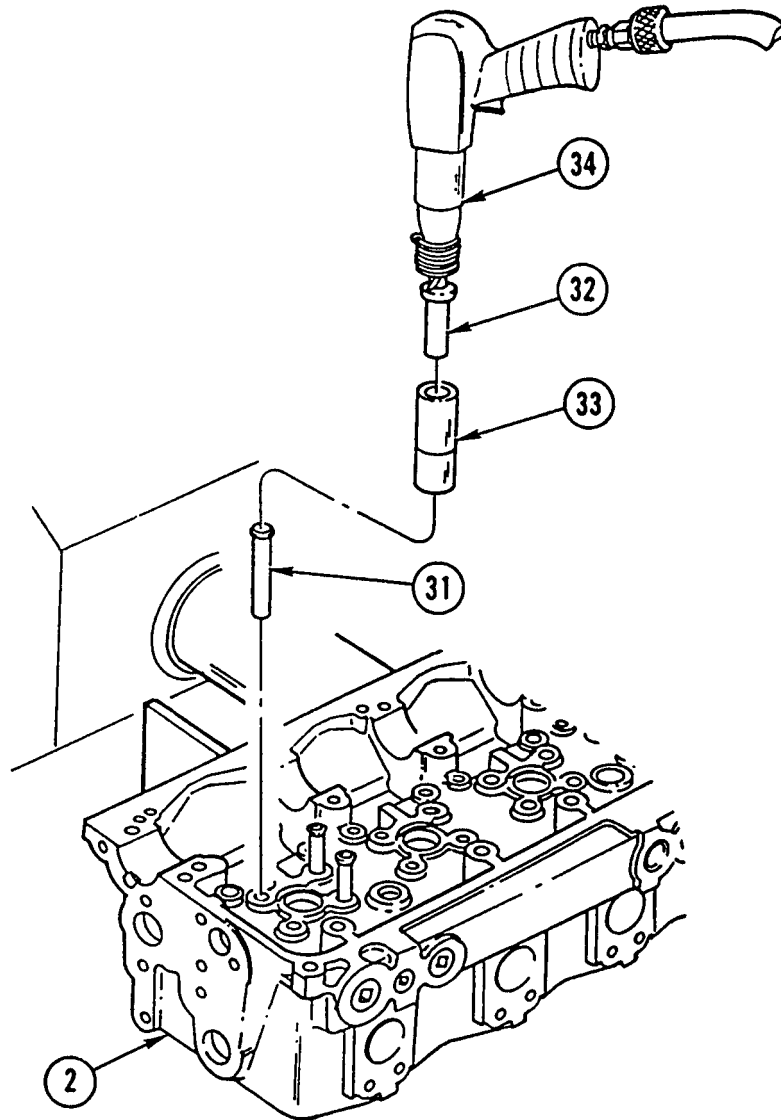


29. REMOVE TWO CYLINDER HEAD BOLTS AND INJECTOR TUBE RECONDITIONING SET STOP BLOCK FROM CYLINDER HEAD (2).
30. INSERT INJECTOR TUBE RECONDITIONING SET TIP REFINISHER (28) INTO INJECTOR TUBE (13).

**NOTE**

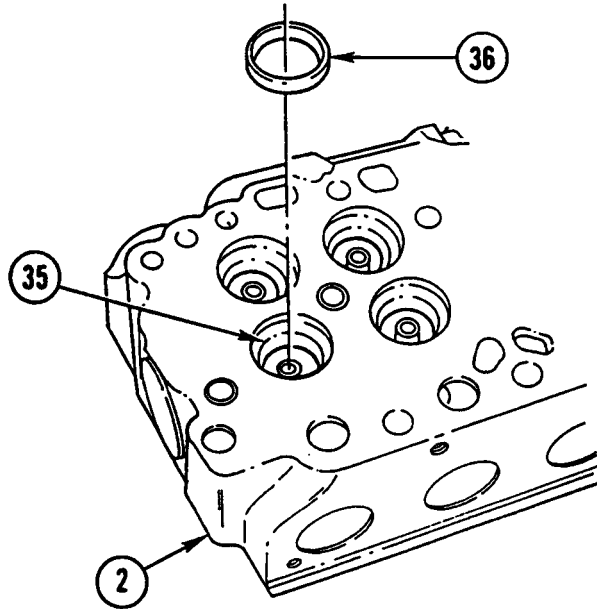
- Cylinder head repair conditions may warrant cylinder head pressure testing before complete head assembly. Testing should be performed before intake and exhaust valve components are installed.
  - Make sure all cup plugs, pipe plugs, and injector tubes are installed before pressure testing cylinder head. Refer to Inspection steps 1 thru 9 for testing.
31. USING 12-POINT (23-mm) SOCKET AND SPEED HANDLE, TURN INJECTOR TUBE RECONDITIONING SET TIP REFINISHER TO REMOVE EXCESS STOCK SO LOWER END OF INJECTOR TUBE (13) IS FROM FLUSH TO 0.003 IN. (0.076 mm) (29) BELOW FIRE DECK SURFACE (30) OF CYLINDER HEAD. REMOVE CHIPS FROM INJECTOR TUBE.

## CYLINDER HEAD REPAIR (CONT)



32. POSITION CYLINDER HEAD (2) FIRE DECK SIDE DOWN.
33. INSERT CHAMFERED END OF NEW VALVE GUIDE (31) INTO CYLINDER HEAD (2) WITH SEAL GROOVE UP.
34. INSERT DRIVER (32) INTO VALVE GUIDE INSTALLER (33). INSTALL ASSEMBLY OVER VALVE GUIDE (31). DRIVE VALVE GUIDE (31) INTO CYLINDER HEAD (2) WITH AIR CHISEL (34) UNTIL DRIVER (32) BOTTOMS.
35. CHECK PROTRUSION OF VALVE GUIDE (31) FROM CYLINDER HEAD (2). HEIGHT SHOULD BE 1.486 IN. (37.75 mm).

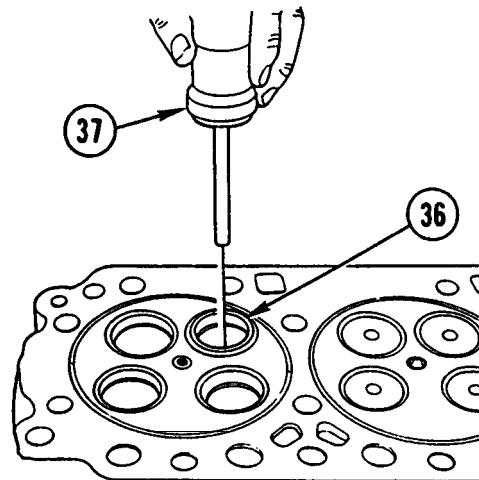




**NOTE**

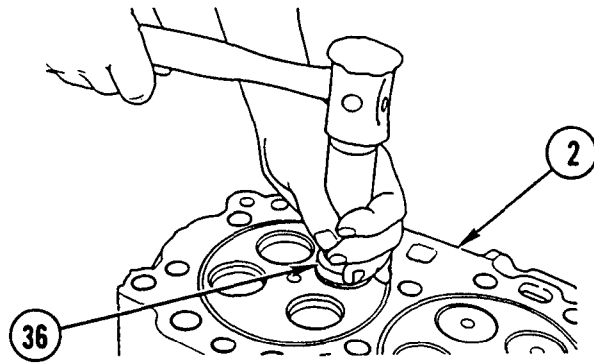
Procedure is the same for both intake and exhaust valve seat inserts except different tools are used.

- 36. POSITION CYLINDER HEAD (2) FIRE DECK SIDE UP.
- 37. MAKE SURE VALVE SEAT INSERT COUNTERBORE (35) IS CLEAN AND FREE OF CARBON DEPOSITS, BURRS, OR DAMAGE.
- 38. SEAT NEW VALVE SEAT INSERT (36) SQUARELY IN COUNTERBORE WITH VALVE SEAT FACING UP.

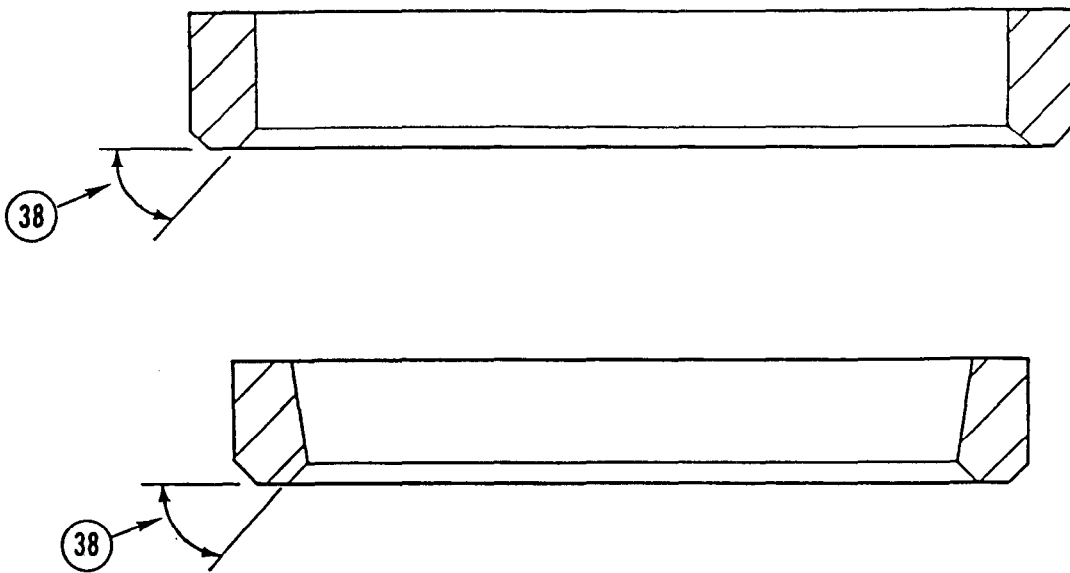


- 39. SEAT VALVE SEAT INSTALLER (37) ON VALVE SEAT INSERT (36).

**CYLINDER HEAD REPAIR (CONT)**



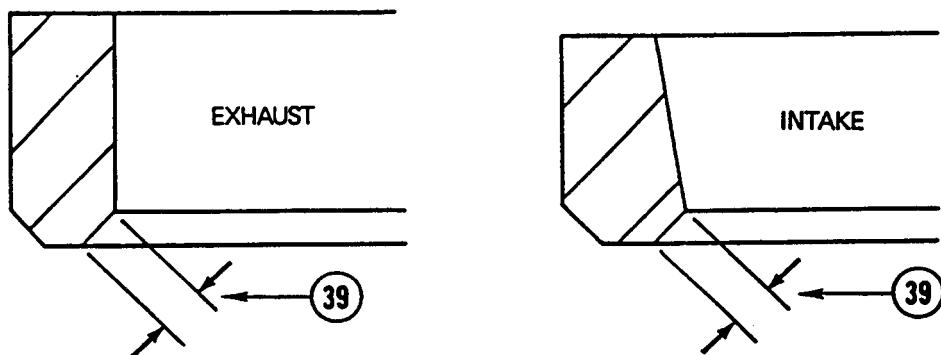
40. INSTALL VALVE SEAT INSERT (36) SOLIDLY IN VALVE SEAT IN CYLINDER HEAD (2).



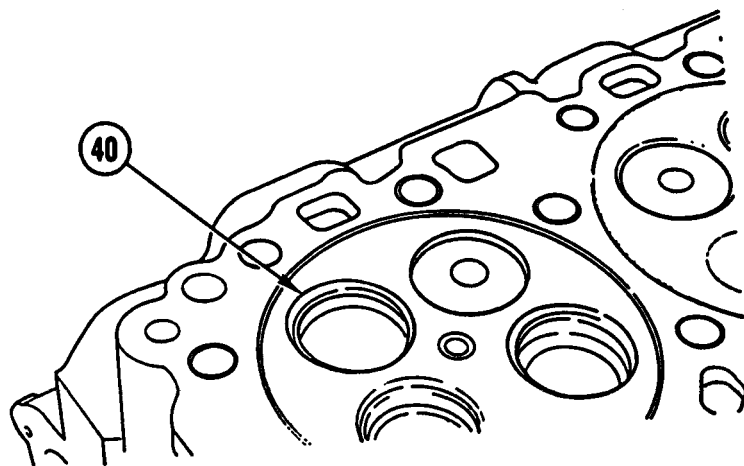
**NOTE**

New valve seat inserts are preground. Check for concentricity after installation. Do not grind new valve seat insert unless concentricity exceeds 0.002 in. (0.05 mm),

41. MAKE SURE VALVE SEAT INSERT ANGLE (38) IS 31 DEGREES.

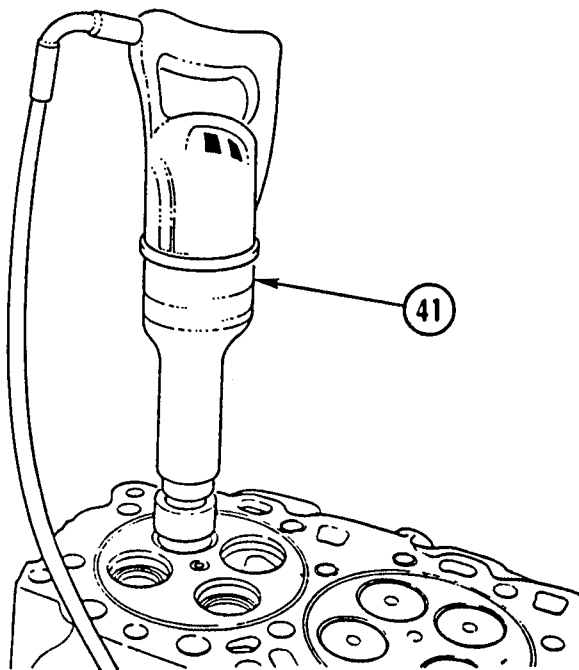


42. MAKE SURE VALVE SEAT WIDTH (39) IS 0.084 IN. (2.14 mm) FOR INTAKE VALVES AND 0.091 IN. (2.31 mm) FOR EXHAUST VALVES.



43. GRIND VALVE SEAT (40) LIGHTLY FOR FULL 360 DEGREES ONLY ENOUGH TO TRUE IT UP.

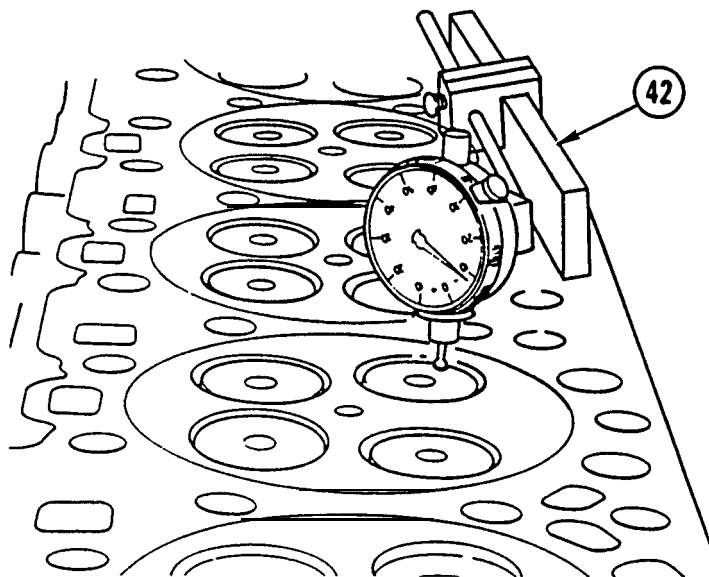
## CYLINDER HEAD REPAIR (CONT)



### NOTE

Eccentric grinding method is recommended for fine accurate finish. Grinding wheel contacts valve seat at only one point at any time, and micrometer feed permits controlled, fine adjustment.

44. GRIND VALVE SEATS TO 31-DEGREE ANGLE USING VALVE SEAT GRINDER (41).

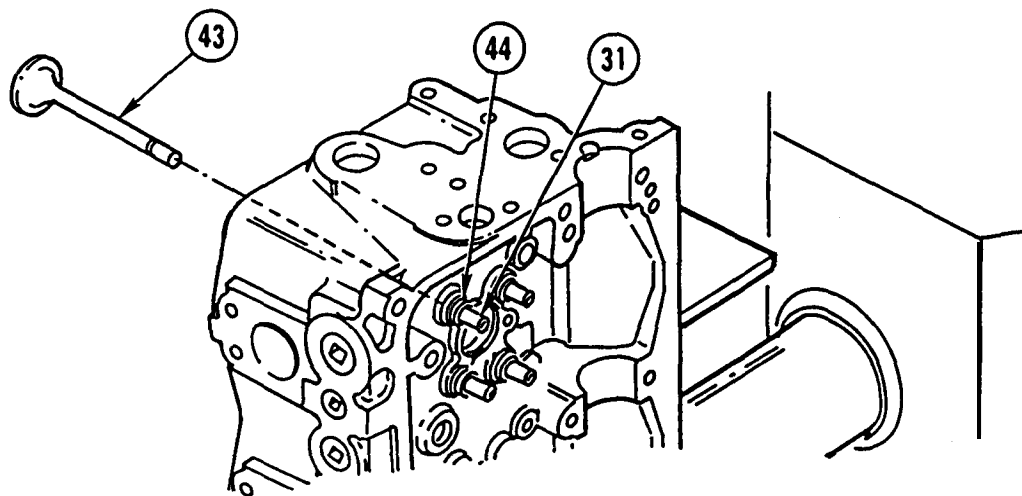


45. CLEAN VALVE SEAT THOROUGHLY. CHECK SEAT-TO-VALVE FACE CONTACT BY APPLYING LIGHT COAT OF PRUSSIAN BLUE PASTE TO VALVE SEAT LAND. INSERT VALVE IN GUIDE AND BOUNCE HEAD ON SEAT WITHOUT ROTATING VALVE. FULL 360-DEGREE CONTACT LINE SHOULD APPEAR CENTERED ON VALVE FACE.

**NOTE**

Reduced-thickness valve seat inserts are available 0.010, 0.020, and 0.030 in. (0.254, 0.508, and 0.762 mm) shallower than standard. When reduced-thickness inserts are used, install correspondingly thicker valve spring seats.

46. VALVE HEAD RECESS DEPTH FROM CYLINDER HEAD FIRE DECK IS INCREASED BY GRINDING VALVE SEAT. CHECK WITH SLED GAGE (42). REPLACE VALVE SEAT IF NOT BETWEEN 0.055-0.067 IN. (1.4-1.6 mm).



47. POSITION CYLINDER HEAD STEP.

**NOTE**

Intake valves have larger faces and are installed in guides on cam side of cylinder head. Smaller exhaust valves are installed in guides on thermostat side of cylinder head.

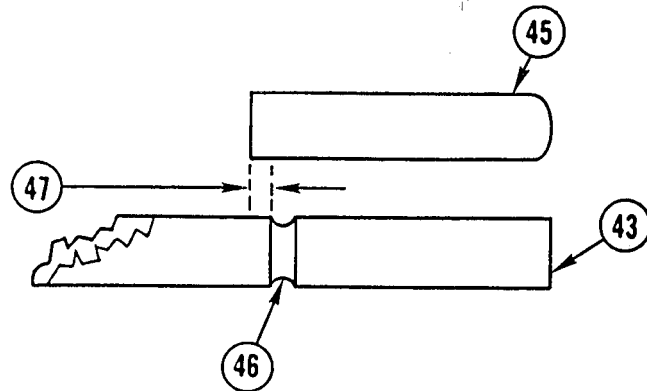
46. LUBRICATE VALVE STEM (43) WITH CLEAN ENGINE LUBRICATING OIL AND INSERT VALVE INTO VALVE GUIDE (31) FROM FIRE DECK SIDE OF CYLINDER HEAD.

**CAUTION**

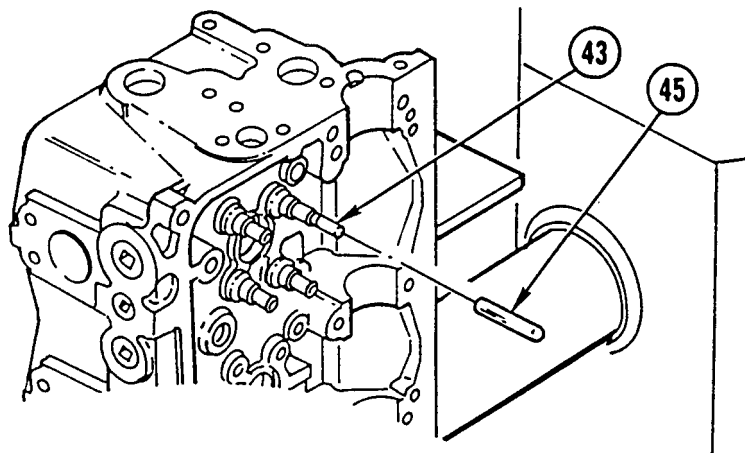
If other than standard valve seat has been installed, use correspondingly thicker valve spring seat. Failure to do so could result in damage to equipment.

49. INSTALL VALVE SPRING SEAT (44) OVER VALVE GUIDE (31) AND AGAINST TOP OF CYLINDER HEAD.

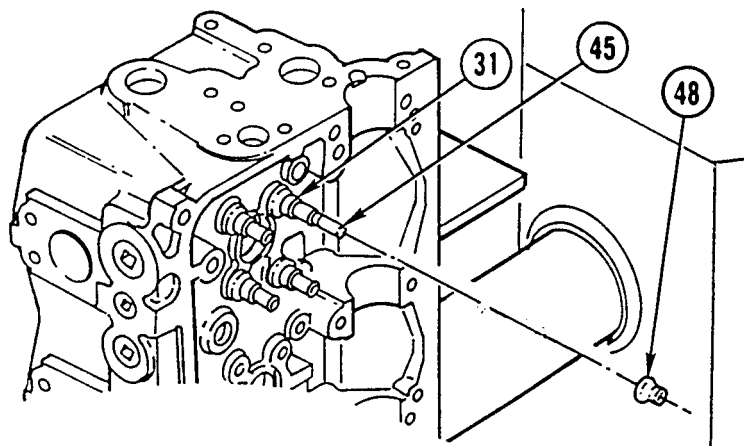
## CYLINDER HEAD REPAIR (CONT)



50. CHECK LENGTH OF PLASTIC VALVE KIT SEAL PROTECTOR CAP (45) RELATIVE TO VALVE LOCK GROOVE (46) ON VALVE STEM (43). IF SEAL PROTECTOR CAP EXTENDS MORE THAN 1/16 IN. (1.5 mm) (47) BEYOND GROOVE, TRIM OFF EXCESS.



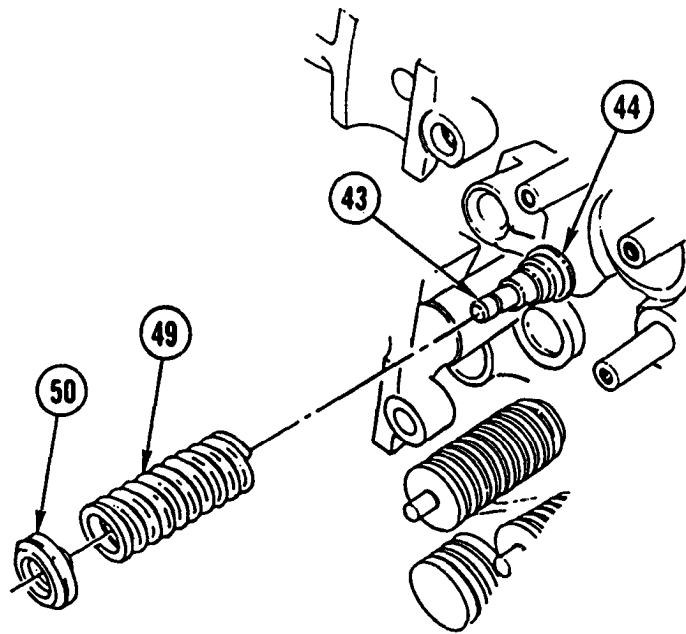
51. HOLD VALVE FACE AND INSTALL SEAL PROTECTOR CAP (45) ON VALVE STEM (43).



**NOTE**

Make sure all valve spring seats are in place before valve stem oil seals are installed. Install valve stem oil seal dry.

52. WIPE ANY OIL FROM OUTSIDE OF VALVE GUIDE (31). INSTALL NEW VALVE STEM OIL SEAL (48) OVER SEAL PROTECTOR CAP (45) AGAINST VALVE GUIDE (31). REMOVE SEAL PROTECTOR CAP (45).
53. PUSH VALVE STEM OIL SEAL (48) DOWN UNTIL SEAL LIP IS FULLY IN GROOVE ON VALVE GUIDE.

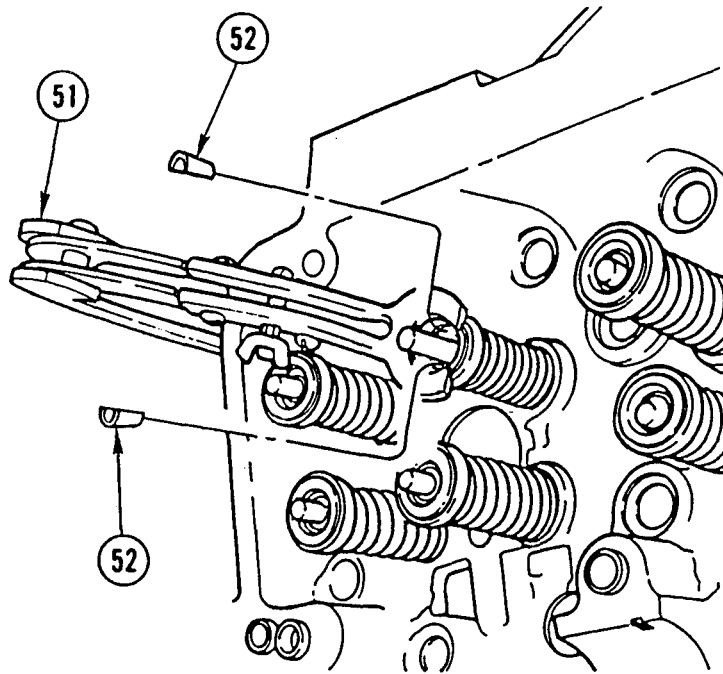


**CAUTION**

Position valve spring and rotator so valve lock grooves on valve stem do not contact oil seal. Failure to do so could result in damage to equipment.

54. INSTALL VALVE SPRING (49) AND VALVE ROTATOR (50) OVER VALVE STEM (43) AND AGAINST VALVE SPRING SEAT (44).

**CYLINDER HEAD REPAIR (CONT)**



**NOTE**

When compressing valve spring, valve rotator should not contact valve stem seal.

- 55. USING SUITABLE VALVE SPRING COMPRESSOR (51), COMPRESS VALVE SPRING ONLY ENOUGH TO INSTALL NEW VALVE KEY (52).

**NOTE**

Make sure valve key is in place and engaged in valve stem groove before releasing valve spring compressor.

- 56. INSTALL NEW VALVE KEYS (52).
- 57. REMOVE VALVE SPRING COMPRESSOR (51).
- 58. USING FIBER PLASTIC Mallet, STRIKE END OF VALVE STEMS SHARPLY TO SEAT VALVE KEYS (52).

**NOTE**

Follow-on Maintenance:  
Install cylinder head (page 3-80).



## CRANKSHAFT REPLACEMENT

This task covers: a. Removal b. Cleaning c. Inspection d. Repair e. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Crankshaft Gear Remover/installer, J35642  
 Hydraulic Ram and Pump, J35951-175

#### Materials/Parts:

Lubriplate 105	Appendix B, Item 35
International Compound No. 2	Appendix B, Item 29
Solvent, Drycleaning	Appendix B, Item 54
Plastigauge	Appendix B, Item 46
Rope, 1/2-In. Nylon	Appendix B, Item 49
Oil, Lubricating	Appendix B, Item 37

#### Personnel Required: (2)

#### References:

TM 9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
Page 3-148	Flywheel Housing Removed
Page 3-199	Oil Pump Removed
Page 12-141	Piston and Cylinder Assembly Removed
Page 12-93	Bull/Idler Gear Assembly Removed
TM 9-2320-363-20	Timing Reference Sensor (TRS) Removed
TM 9-2320-363-20	Synchronous Reference Sensor (SRS) Removed
Page 3-231	Crankshaft Oversize Front Oil Seal Removed

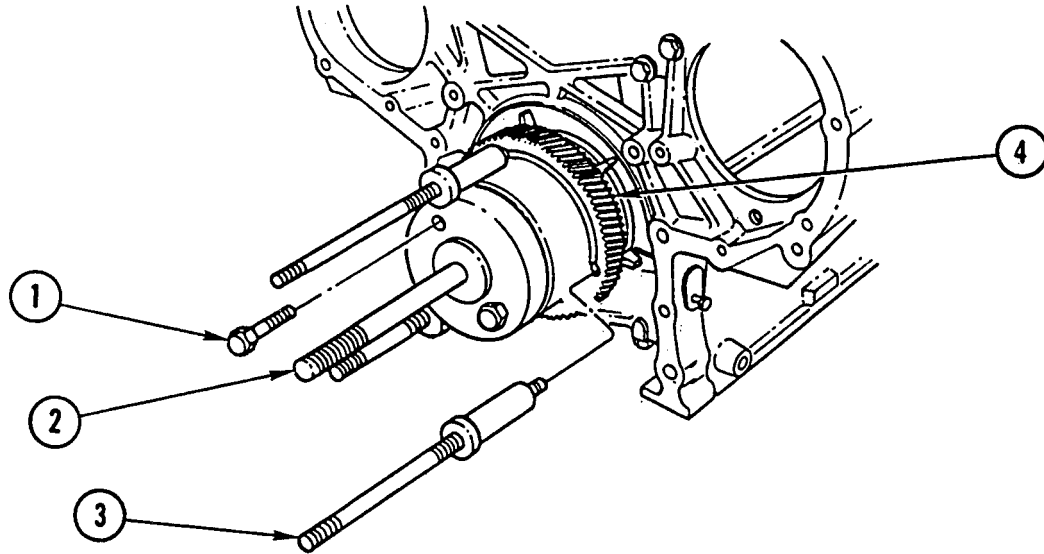
#### General Safety Instructions:

#### WARNING

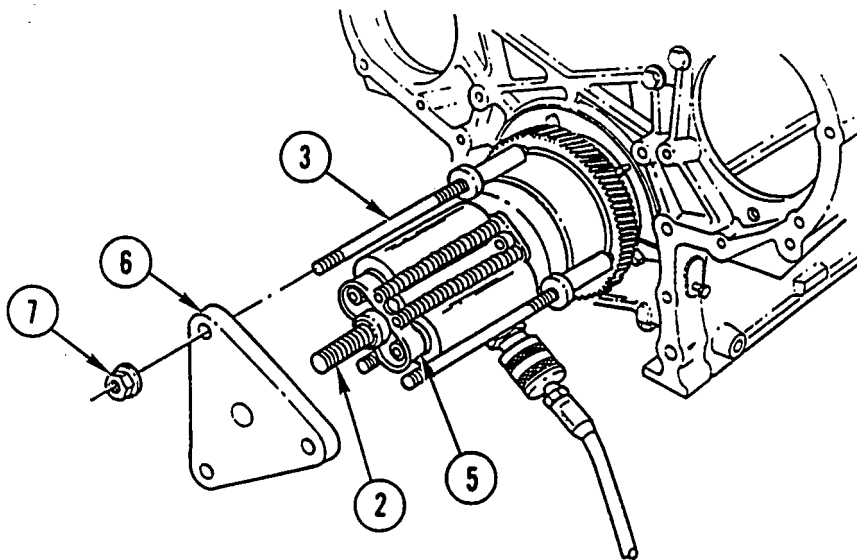
- Crankshaft weighs 408 lb (185.23 kg). Use suitable lifting device to lift and support crankshaft. Failure to do so could result in serious injury to personnel.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

## CRANKSHAFT REPLACEMENT (CONT)

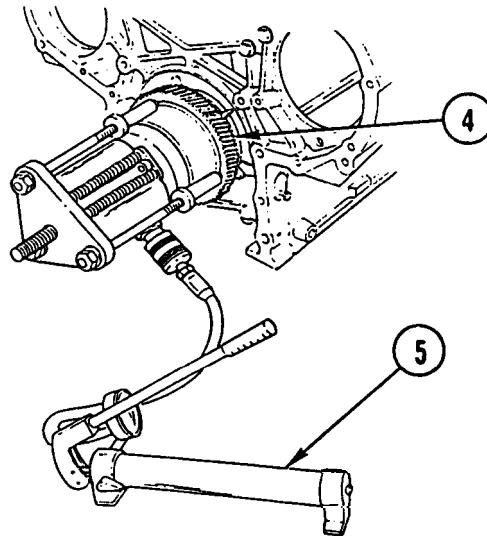
### REMOVAL



1. USING TWO CRANKSHAFT GEAR REMOVER/INSTALLER BOLTS (1), SECURE CRANKSHAFT GEAR REMOVER/INSTALLER BASE POST (2) TO END OF CRANKSHAFT. TIGHTEN TWO BOLTS (1) TO 140-150 LB-FT (190-203 N.m).
2. THREAD THREE CRANKSHAFT GEAR REMOVER/INSTALLER LEGS (3) INTO THREADED HOLES IN CRANKSHAFT TIMING GEAR (4), TIGHTEN THREE REMOVER/INSTALLER LEGS(3).



3. SLIDE HYDRAULIC RAM AND PUMP (5) OVER CENTER ROD OF REMOVER/INSTALLER BASE POST (2).
4. INSTALL CRANKSHAFT GEAR REMOVER/INSTALLER PRESSURE PLATE (6) ON THREE REMOVER/INSTALLER LEGS (3).
5. INSTALL THREE CRANKSHAFT GEAR REMOVER/INSTALLER RETAINING NUTS (7) ON REMOVER/INSTALLER LEGS (3). TIGHTEN THREE RETAINING NUTS (7) AGAINST REMOVER/INSTALLER PRESSURE PLATE (6). TIGHTEN THREE RETAINING NUTS (7) TO 43-54 LB-FT (58-73 N.m).

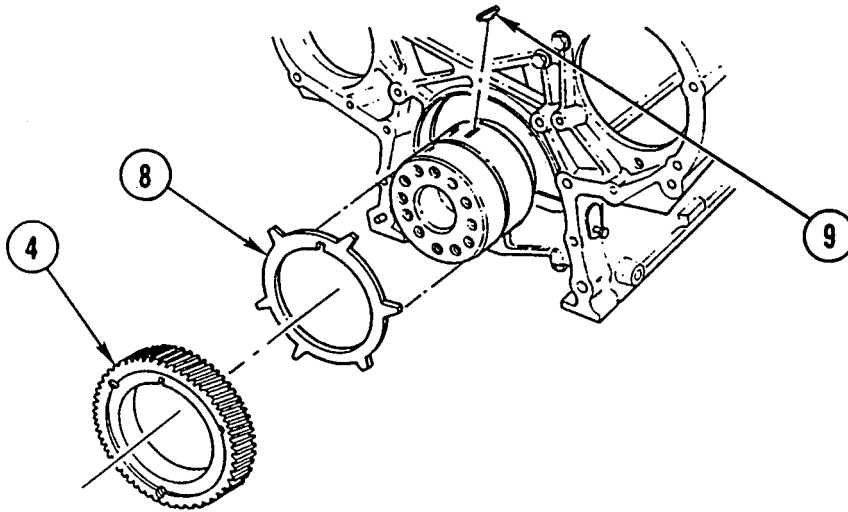


**NOTE**

Due to manufacturer's tolerances, as much as 9 tons of pressure may be required to remove crankshaft timing gear.

6. OPERATE HYDRAULIC RAM AND PUMP (5) TO PULL CRANKSHAFT TIMING GEAR (4) OFF CRANKSHAFT.
7. WHEN CRANKSHAFT TIMING GEAR (4) MOVES FREELY, RELEASE HYDRAULIC PRESSURE AND REMOVE CRANKSHAFT GEAR REMOVER/INSTALLER TOOL FROM CRANKSHAFT TIMING GEAR (4) AND CRANKSHAFT.

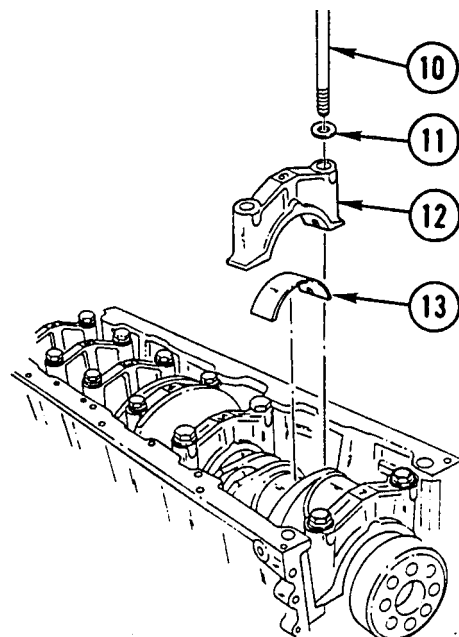
## CRANKSHAFT REPLACEMENT (CONT)



### **CAUTION**

Do not use sharp tools to pry on timing wheel or crankshaft timing gear. Use care to prevent damaging crankshaft seal contact surface when removing crankshaft timing gear and timing wheel from crankshaft.

8. REMOVE CRANKSHAFT TIMING GEAR (4) FROM CRANKSHAFT.
9. REMOVE TIMING WHEEL (8) FROM CRANKSHAFT,
10. REMOVE WOODRUFF KEY (9) FROM CRANKSHAFT.

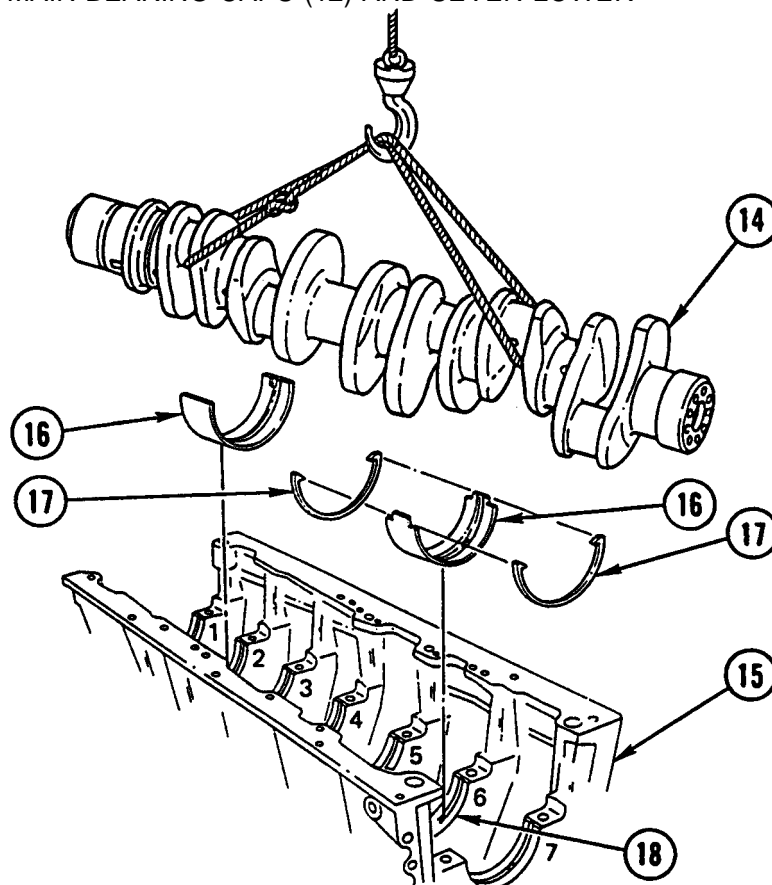


11. ROTATE ENGINE ON STAND SO CRANKSHAFT IS IN UP POSITION.
12. REMOVE MAIN BEARING CAP BOLTS (10) AND WASHERS (11).

**NOTE**

- Place upper main bearing shells and thrust washers with respective main bearing caps and lower main bearing shells. If reused, install upper and lower main bearing shells and thrust bearings in original positions.
- Main bearing caps are bored in position and stamped with position number. Caps must be installed in their original positions, with marked (numbered) side of each cap toward cooler (right) side of cylinder block.
- Slightest burr or particle of dirt between backs of No. 6 main bearing thrust washers and saddle or cap may decrease clearance between washer and crankshaft beyond specified limits.

13. REMOVE SEVEN MAIN BEARING CAPS (12) AND SEVEN LOWER MAIN BEARING SHELLS (13).



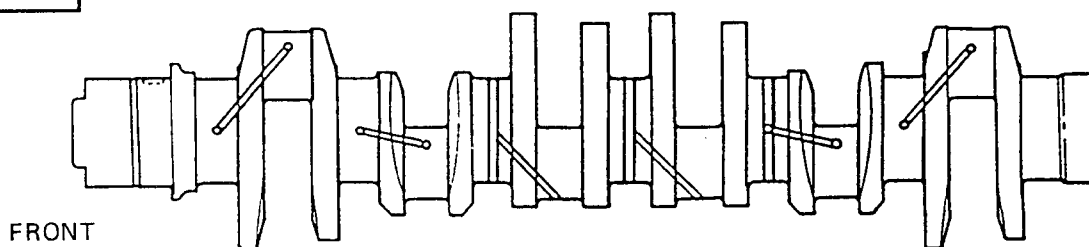
**WARNING**

Crankshaft weighs 408 lb (185.23 kg). Use suitable lifting device to lift and support crankshaft. Failure to do so could result in serious injury to personnel.

14. USING NYLON ROPE AND SUITABLE LIFTING DEVICE, LIFT CRANKSHAFT (14) FROM CYLINDER BLOCK (15).
15. REMOVE SEVEN UPPER MAIN BEARING SHELLS (16).
16. REMOVE TWO THRUST WASHERS (17) FROM SIDES OF MAIN BEARING SADDLE NO. 6 (18).

## CRANKSHAFT REPLACEMENT (CONT)

### CLEANING



#### WARNING

- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

1. CLEAN OUT CRANKSHAFT OIL PASSAGES WITH BORE BRUSH. CLEAN CRANKSHAFT, BEARINGS, AND MAIN BEARING CAPS WITH DRYCLEANING SOLVENT AND DRY WITH COMPRESSED AIR.
2. USE GENERAL CLEANING METHODS TO CLEAN ALL PARTS (PAGE 2-30).

### INSPECTION

#### CAUTION

Vibration damper must be replaced when crankshaft is replaced. Failure to do so could result in premature crankshaft failure.

#### NOTE

- Make sure all main bearing saddles and thrust bearing counterbores in cylinder block are clean.
  - Each upper main bearing shell is grooved with oil hole. Register oil hole in each upper main bearing shell with oil hole in each main bearing saddle of cylinder block.
  - Install main bearings in sets only. Do not mix old and new main bearing shells on same journal. If old bearings are installed, they must be installed in same journal they were removed from.
1. INSPECT CRANKSHAFT TIMING GEAR KEYWAY FOR EVIDENCE OF CRACKS OR WEAR AND REPLACE CRANKSHAFT IF EVIDENT.

2. INSPECT CRANKSHAFT FOR EVIDENCE OF OVERHEATING AND REPLACE CRANKSHAFT IF EVIDENT.
3. CHECK CRANKSHAFT JOURNAL SURFACES FOR SCORE MARKS OR IMPERFECTIONS. IF EXCESSIVELY SCORED, REPLACE CRANKSHAFT.

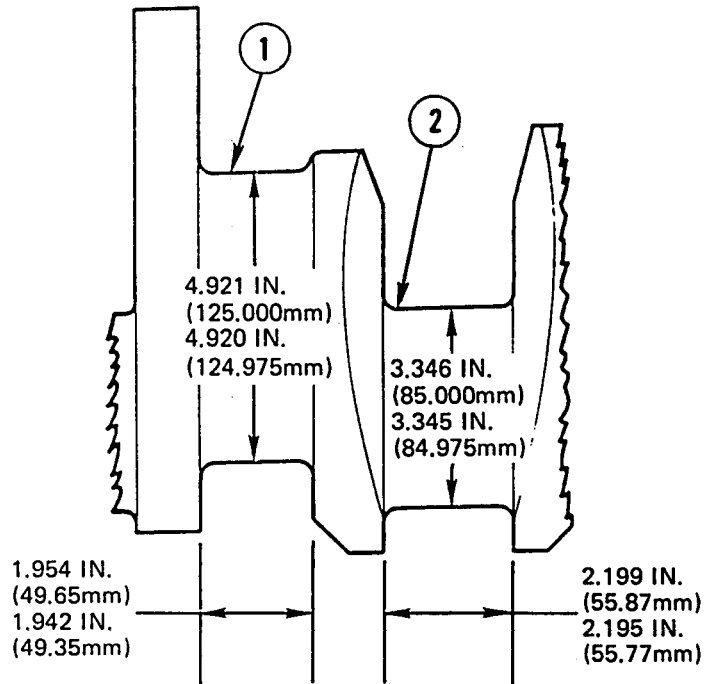
**NOTE**

If crankshaft oil seal contact surfaces are grooved, seal surface must be sleeved and oversized seal used.

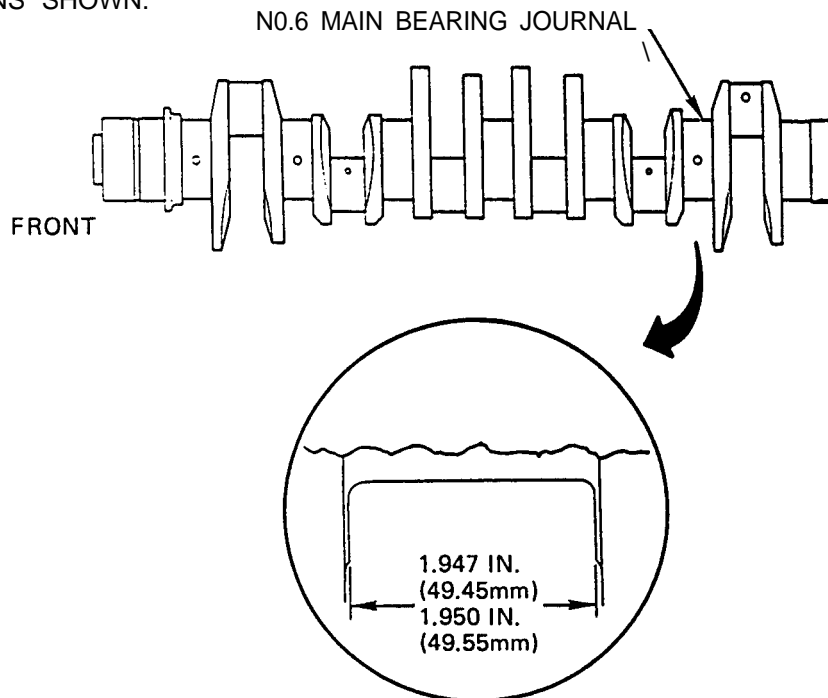
4. CHECK CRANKSHAFT THRUST SURFACES FOR EXCESSIVE WEAR OR GROOVING. IF EXCESSIVELY WORN, REPLACE CRANKSHAFT.
5. CHECK CRANKSHAFT TIMING GEAR FOR WORN OR CHIPPED TEETH. INSPECT TIMING WHEEL FOR BENT OR DAMAGED TEETH. REPLACE AS NECESSARY.
6. SUPPORT CRANKSHAFT FRONT AND REAR JOURNALS ON V-BLOCKS OR INVERTED ENGINE BLOCK WITH ONLY FRONT AND REAR UPPER BEARING SHELLS IN PLACE. CHECK INTERMEDIATE MAIN JOURNALS WITH DIAL INDICATOR FOR RUNOUT WHEN CRANKSHAFT IS ROTATED. REPLACE CRANKSHAFT IF RUNOUT IS GREATER THAN MAXIMUM SHOWN.

Journal Supported On	Journals Measured	Maximum Runout: Total Indicator Reading
No. 1 and No. 7	No. 2	0.0030 in. (0.075 mm)
No. 1 and No. 7	No. 3	0.0051 in. (0.130 mm)
No. 1 and No. 7	No. 4	0.0060 in. (0.150 mm)
No. 1 and No. 7	No. 5	0.0051 in. (0.130 mm)
No. 1 and No. 7	No. 6	0.0030 in. (0.075 mm)

## CRANKSHAFT REPLACEMENT (CONT)

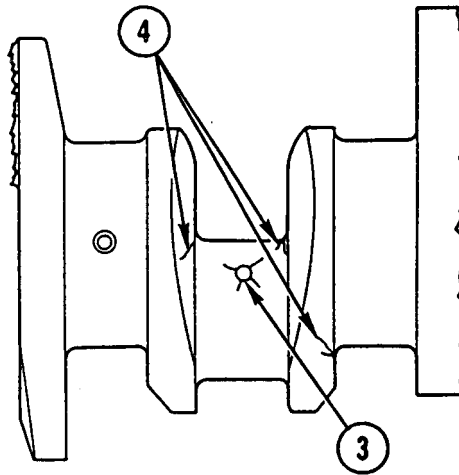


7. MEASURE ALL MAIN BEARING JOURNALS (1) AND CONNECTING ROD BEARING JOURNALS (2), AS SHOWN, AT SEVERAL PLACES ON CIRCUMFERENCE TO DETERMINE TAPER, OUT-OF-ROUND, AND JOURNAL DIAMETER. REPLACE CRANKSHAFT IF NOT WITHIN SPECIFICATIONS SHOWN.



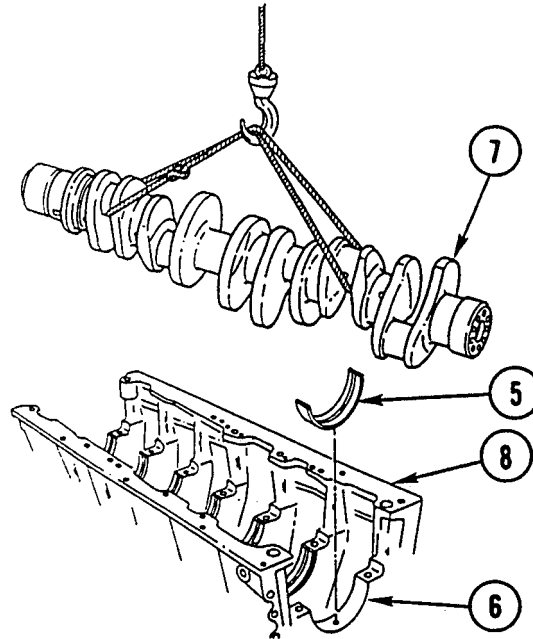
8. MEASURE CRANKSHAFT THRUST WASHER SURFACES AS SHOWN.





9. CHECK CRANKSHAFT FOR CRACKS WHICH START AT OIL HOLE (3) AND FOLLOW JOURNAL SURFACE AT ANGLE OF 45 DEGREES TO AXIS. REPLACE ANY CRANKSHAFT WITH SUCH CRACKS. DETERMINE PRESENCE OF CRACKS NOT VISIBLE TO EYE BY MAGNETIC PARTICLE, FLUORESCENT MAGNETIC PARTICLE, OR FLUORESCENT PENETRANT METHOD.
10. REPLACE CRANKSHAFT IF CIRCUMFERENTIAL FILLET CRACKS (4) AT CONNECTING ROD, OR FILLET CRACKS OR 45-DEGREE CRACKS (45 DEGREES TO AXIS OF CRANKSHAFT) AT MAIN BEARING JOURNAL, ARE EVIDENT.
11. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

## CRANKSHAFT REPLACEMENT (CONT)



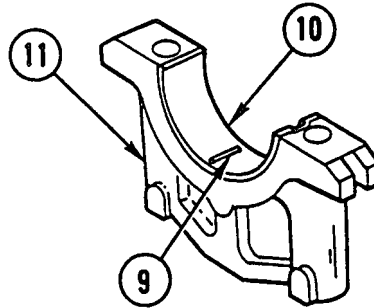
### NOTE

- Make sure all main bearing saddles and thrust bearing counterbores in cylinder block are clean.
  - Each upper main bearing shell is grooved with oil hole. Register oil hole in each upper main bearing shell with oil hole in each main bearing saddle of cylinder block.
  - Install main bearings in sets only. Do not mix old and new main bearing shells on same journal. If old bearings are installed, they must be installed in same journal they were removed from.
12. INVERT ENGINE BLOCK. INSTALL SEVEN UPPER MAIN BEARING SHELLS (5) IN CYLINDER BLOCK JOURNALS (6).
  13. WIPE OIL FROM BEARING SHELLS AND CRANKSHAFT JOURNALS TO BE CHECKED.

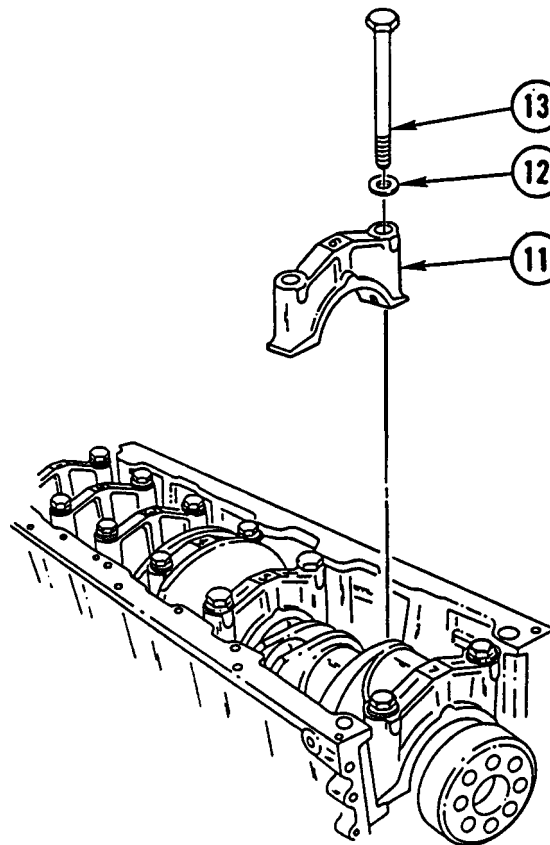
### WARNING

Crankshaft weighs 408 lb (185.23 kg). Use suitable lifting device to lift and support crankshaft. Failure to do so could result in serious injury to personnel.

14. USING NYLON ROPE AND SUITABLE LIFTING DEVICE, POSITION CRANKSHAFT (7) IN CYLINDER BLOCK (8) ON UPPER MAIN BEARING SHELLS (5).
15. USING STRIP OF PLASTIGAUGE. MEASURE BEARING CLEARANCES BETWEEN Crankshaft JOURNALS OF MAIN BEARINGS. PLASTIGAUGE TYPE PG-1 (GREEN) HAS CLEARANCE RANGE OF 0.001-0.003 IN. (0.0254-0.0762 mm). TYPE PR-21 (RED) HAS CLEARANCE RANGE OF 0.002-0.006 IN. (0.0508-0.01524 mm). TYPE PB-1 (BLUE) HAS CLEARANCE OF 0.004-0.009 IN. (0.1016-0.2286 mm).



16. PLACE PIECE OF PLASTIGAUGE (9) ALONG FULL WIDTH IN BEARING SHELL (10) IN MAIN BEARING CAP (11) ABOUT 1/4 IN. (6.35 mm) OFF CENTER.



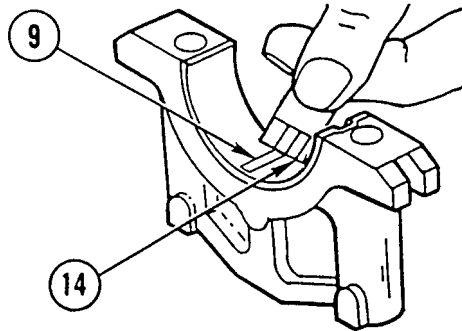
17. INSTALL SEVEN MAIN BEARING CAPS (11).
18. INSTALL 14 WASHERS (12) AND 14 MAIN BEARING CAP BOLTS (13). TIGHTEN MAIN BEARING CAP BOLTS TO 347-391 LB-FT (470-530 N.m).

**NOTE**

Flattened plastigauge will be found adhering to bearing shell or crankshaft.

19. REMOVE 14 MAIN BEARING CAP BOLTS (13) AND 14 WASHERS (12).

## **CRANKSHAFT REPLACEMENT (CONT)**



### **NOTE**

If worn crankshaft maximum connecting rod bearing journal to bearing shell clearance, with new shells, exceeds 0.005 in. (0.1270 mm), or if maximum main bearing journal to bearing shell clearance, with new shells, exceeds 0.0056 in. (0.1412 mm), replace crankshaft. Measurements of crankshaft should be accurate to nearest 0.0001 in. (0.0025 mm). If main bearing journal taper of used crankshaft exceeds 0.0015 in. (0.0381 mm), or if out-of-round clearance is greater than 0.001 in. (0.0254 mm), replace crankshaft.

20. COMPARE WIDTH OF FLATTENED PLASTIGAUGE (9) AT WIDEST POINT WITH GRADUATIONS ON ENVELOPE (14) AS SHOWN. NUMBER IN GRADUATION ON ENVELOPE (14) INDICATES BEARING CLEARANCE IN THOUSANDTHS OF IN. MULTIPLY READING OBTAINED (IN THOUSANDTHS) BY 25.4 TO OBTAIN METRIC SPECIFICATIONS. MEASURE EACH END OF PLASTIGAUGE (9). DIFFERENCE BETWEEN TWO READINGS IS APPROXIMATE AMOUNT OF TAPER.

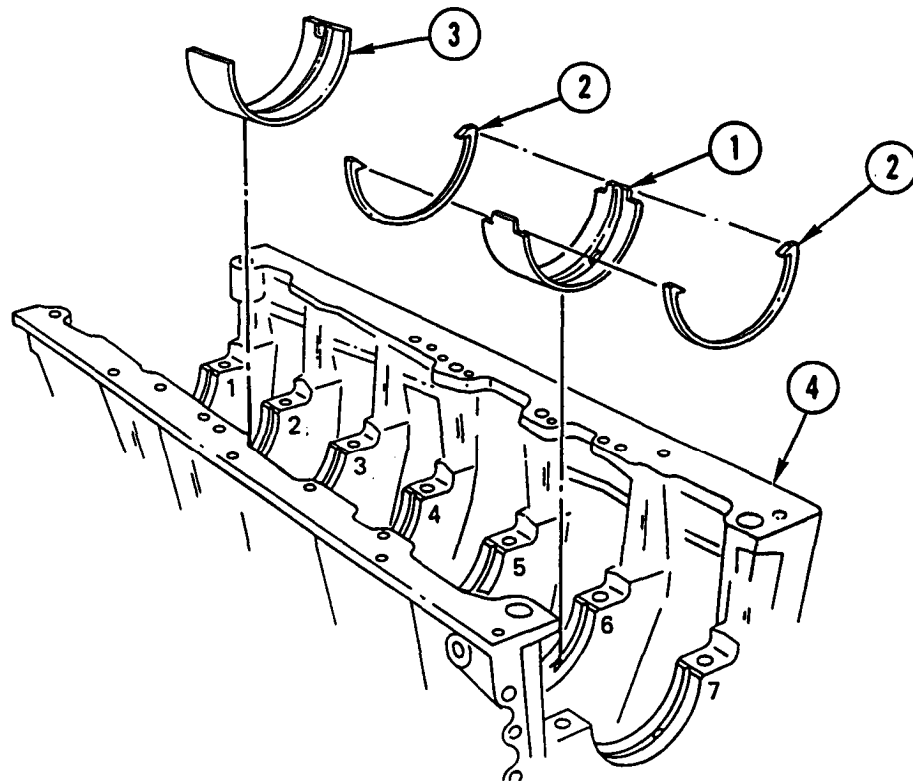
## **REPAIR**

### **NOTE**

- . Crankshaft failures are rare. When crankshaft cracks or breaks completely, thoroughly inspect for contributory factors. Unless abnormal conditions are discovered and corrected, crankshaft failure will be repeated.
- . When new or reground crankshaft is installed, all new main and connecting rod (upper and lower) bearing shells and thrust washers must also be installed.
- . If new crankshaft is to be installed, clean it to remove rust preventative and blow out oil passages with compressed air.
- . Replace vibration damper when installing new crankshaft.

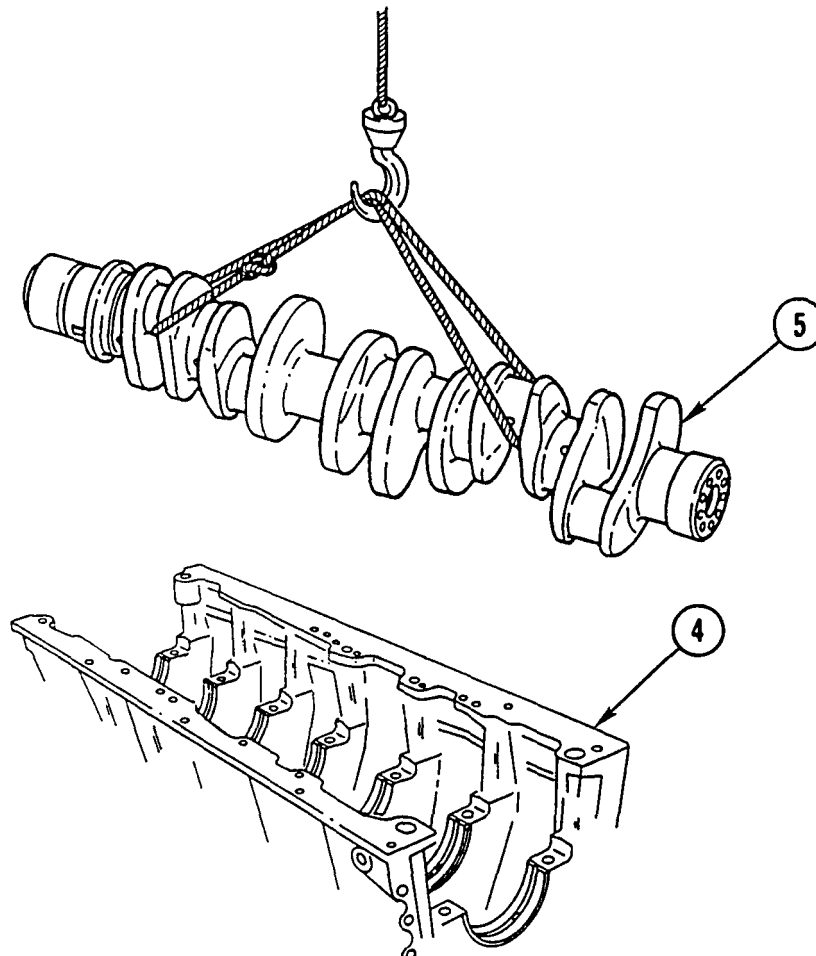
CRANKSHAFT IS REPAIRABLE ONLY TO MANUFACTURER'S SPECIFICATIONS IF INSPECTION CONDITIONS WARRANT. OTHERWISE, CRANKSHAFT REPLACEMENT IS REQUIRED.

## INSTALLATION



1. INSTALL NOTCHED UPPER MAIN BEARING SHELL (1) IN MAIN BEARING SADDLE NO. 6 WITH TANG OF MAIN BEARING SHELL (1) IN NOTCH AT PARTING LINE OF MAIN BEARING SADDLE NO. 6.
2. COAT BACKS OF TWO THRUST WASHERS (2), ON SIDE WITHOUT OIL GROOVES, WITH THIN FILM OF LUBRICATING OIL. INSTALL TWO THRUST WASHERS (2) IN COUNTERBORE ON EACH SIDE OF MAIN BEARING SADDLE NO. 6. ENGAGE TANGS ON ENDS OF TWO THRUST WASHERS (2) WITH NOTCHES ON ENDS OF NOTCHED UPPER MAIN BEARING SHELL (1).
3. INSTALL REMAINING UPPER MAIN BEARING SHELLS (3) IN MAIN BEARING SADDLES OF CYLINDER BLOCK (4) WITH TANGS ON UPPER MAIN BEARING SHELLS (1) IN NOTCHES AT PARTING LINE OF MAIN BEARING SADDLES.

## CRANKSHAFT REPLACEMENT (CONT)

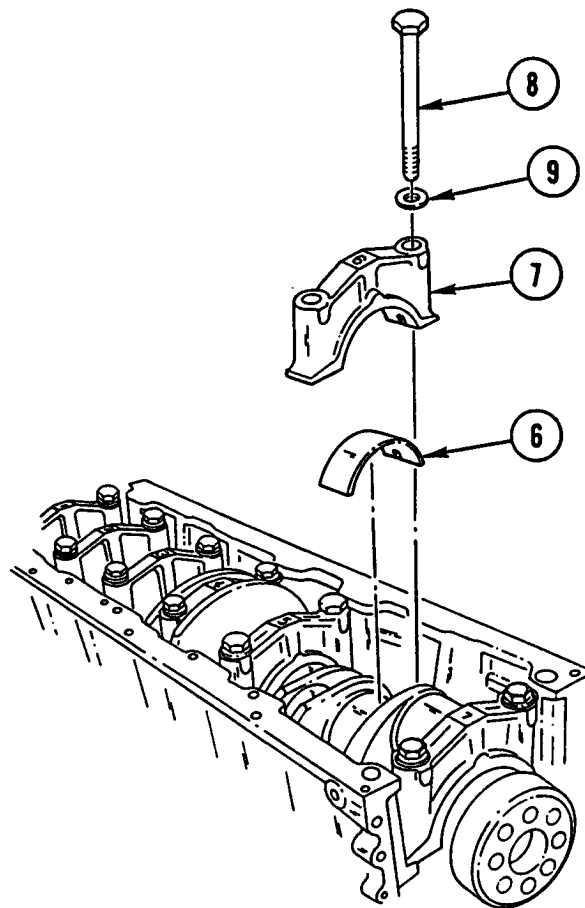


### **CAUTION**

Make sure thrust washers are not dislodged when positioning crankshaft. Failure to do so could result in damage to equipment.

### **NOTE**

- Make sure all crankshaft main bearing journals are clean.
  - Keyway on crankshaft goes to front of engine block.
4. COAT MAIN BEARING JOURNALS AND UPPER MAIN BEARING SHELLS WITH CLEAN ENGINE LUBRICATING OIL. USING NYLON ROPE AND SUITABLE LIFTING DEVICE, POSITION CRANKSHAFT (5) IN CYLINDER BLOCK (4) ON UPPER MAIN BEARING SHELLS.
  5. REMOVE NYLON ROPE.



**NOTE**

- Make sure saddles of main bearing caps are clean.
- Install main bearings in sets only. Do not mix old and new bearings on same journal. If old bearings are installed, they must be installed on same journal they were removed from.

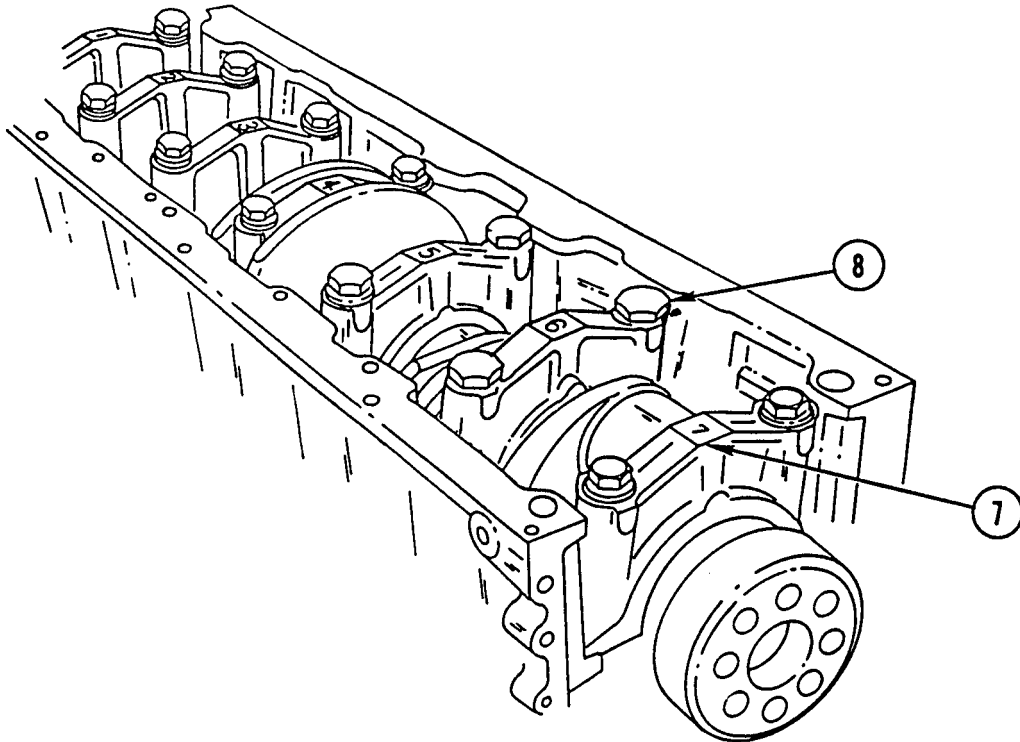
6. INSTALL MAIN BEARING SHELLS (6) IN MAIN BEARING CAPS (7) WITH TANG ON BEARING SHELLS (6) IN NOTCH AT BEARING CAPS (7) PARTING LINE. COAT LOWER MAIN BEARING SHELLS (6) WITH CLEAN ENGINE LUBRICATING OIL.

**NOTE**

Journal numbers stamped on main bearing caps should be read from oil cooler side of cylinder block beginning with front main bearing cap as No. 1. Note journal number and position main bearing cap and bearing on correct main bearing. Main bearing caps must be installed in their original positions.

7. APPLY SMALL AMOUNT OF INTERNATIONAL COMPOUND NO. 2 ON THREADS AND UNDERSIDES OF HEADS OF MAIN BEARING CAP BOLTS (8). INSTALL WASHER (9) ON EACH MAIN BEARING CAP BOLT (8).
8. INSTALL MAIN BEARING CAP BOLTS (8) HAND-TIGHT.

## CRANKSHAFT REPLACEMENT (CONT)



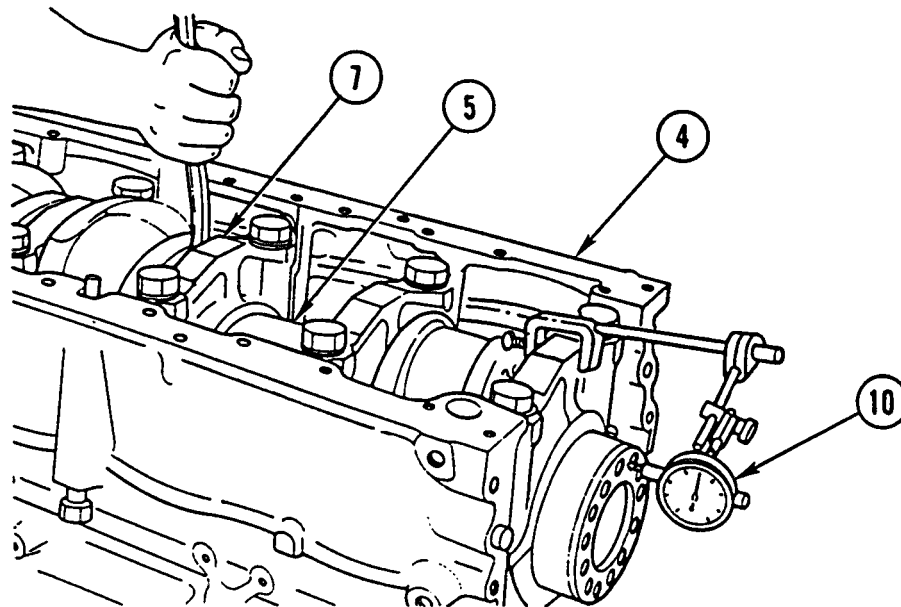
9. USING FIBER OR PLASTIC Mallet, STRIKE MAIN BEARING CAPS (7) SHARPLY TOWARD CRANKSHAFT.

### **NOTE**

Crankshaft will turn freely if bearings are installed properly and all main bearing cap bolts are tightened properly.

10. TIGHTEN ALL MAIN BEARING CAP BOLTS (8) TO 30-50 LB-FT (41-68 N.m). TURN CRANKSHAFT 1/8 TURN TO MAKE SURE CRANKSHAFT IS NOT BINDING WITHIN JOURNALS.
11. BEGINNING AT CENTER CAP (7) AND WORKING PROGRESSIVELY TOWARD EACH END, TIGHTEN ALL MAIN BEARING CAP BOLTS (8) TO 173-195 LB-FT (235-265 N.m). TURN CRANKSHAFT 1/8 TURN TO MAKE SURE CRANKSHAFT IS NOT BINDING WITHIN JOURNALS.
12. REPEAT TIGHTENING SEQUENCE AND TIGHTEN EACH MAIN BEARING CAP BOLT (8) TO 347-391 LB-FT (470-530 N.m). TURN CRANKSHAFT 1/8 TURN TO MAKE SURE CRANKSHAFT IS NOT BINDING WITHIN JOURNALS.



**NOTE**

Crankshaft end play is controlled by thrust washers located at No. 6 main bearing cap and saddle of engine. Oversize thrust washers are available to correct for excessive end play.

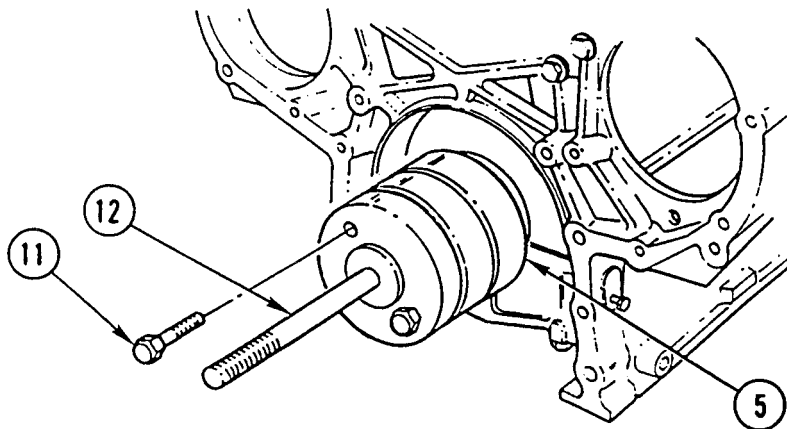
13. INSTALL DIAL INDICATOR (10) ON CYLINDER BLOCK (4) AS SHOWN.

**NOTE**

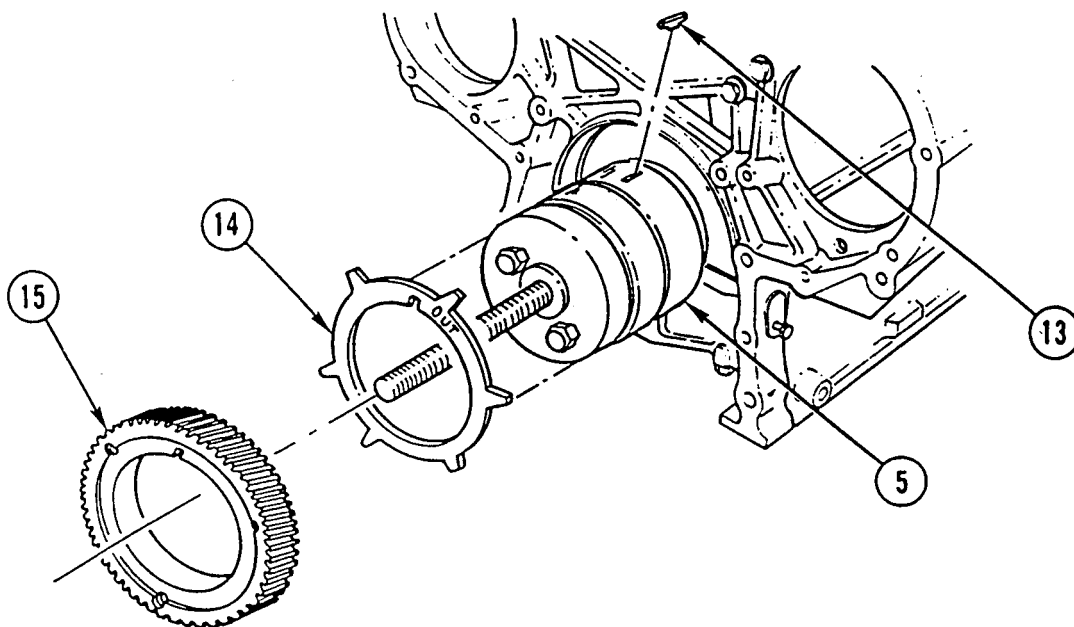
End play should be 0.004-0.017 in. (0.097-0.419 mm). Insufficient end play can be result of misaligned No. 6 main bearing, jammed upper thrust washer, or burr or dirt on inner face of one or more thrust washers.

14. USING LESS THAN 12-IN. PRY BAR, MOVE CRANKSHAFT (5) TOWARD DIAL INDICATOR (10) TO CHECK CRANKSHAFT END PLAY. KEEP CONSTANT PRESSURE ON PRY BAR AND ZERO POINTER ON DIAL INDICATOR (10).
15. REMOVE AND INSERT PRY BAR ON OTHER SIDE OF MAIN BEARING CAP (7). FORCE CRANKSHAFT IN OPPOSITE DIRECTION AND NOTE AMOUNT OF END PLAY ON DIAL INDICATOR (10).

## CRANKSHAFT REPLACEMENT (CONT)



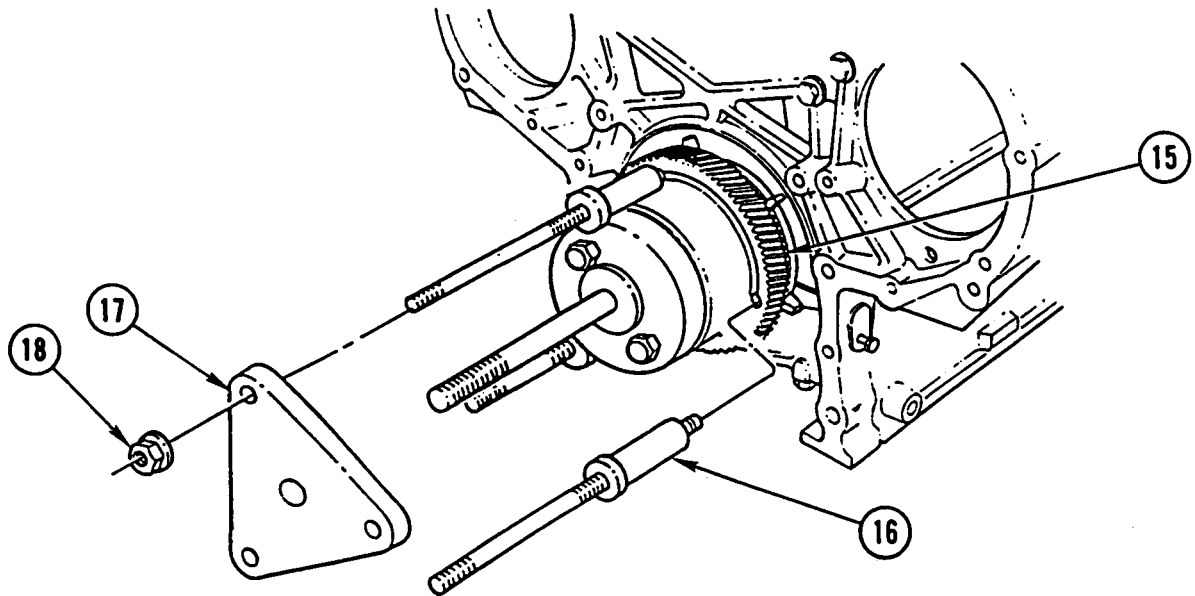
16. USING TWO CRANKSHAFT GEAR REMOVER/INSTALLER BOLTS (11), INSTALL CRANKSHAFT GEAR REMOVER/INSTALLER BASE POST (12) ON FRONT END OF CRANKSHAFT (5). TIGHTEN BOLTS (11) TO 140-150 LB-FT (190-203 N.m).



### NOTE

Make sure woodruff key is fully seated and is parallel to crankshaft surface.

17. INSTALL WOODRUFF KEY (13) IN KEYWAY. TAP KEY WITH PLASTIC Mallet OR BRASS HAMMER TO SEAT IT.
18. INDEX KEYWAY OF TIMING WHEEL (14) WITH WOODRUFF KEY (13) IN CRANKSHAFT (5). SLIDE TIMING WHEEL (14) ON CRANKSHAFT WITH WORD OUT ON TIMING WHEEL (14) FACING YOU. SLIDE TIMING WHEEL (14) ON AS FAR AS IT WILL GO BY HAND.
19. COAT BORE OF CRANKSHAFT TIMING GEAR (15) WITH FILM OF LUBRIPLATE 105. INDEX KEYWAY OF CRANKSHAFT TIMING GEAR (15) WITH WOODRUFF KEY. TAP CRANKSHAFT TIMING GEAR (15) WITH PLASTIC HAMMER OR FIBER Mallet TO MAKE SURE WOODRUFF KEY IS SEATED IN KEYWAY.

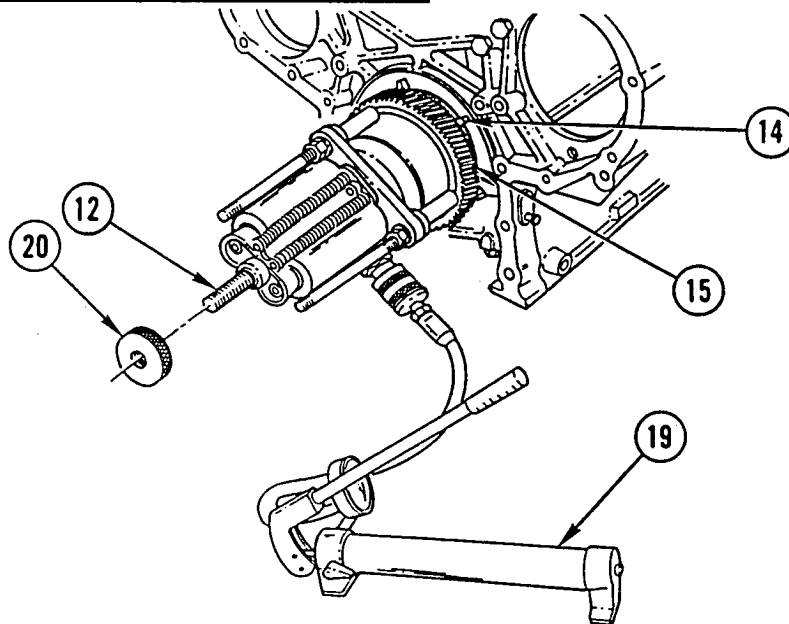


20. INSTALL THREE CRANKSHAFT GEAR REMOVER/INSTALLER LEGS (16) IN THREADED HOLES IN CRANKSHAFT TIMING GEAR (15). TIGHTEN THREE REMOVER/INSTALLER LEGS (16).
21. INSTALL CRANKSHAFT GEAR REMOVER/INSTALLER PRESSURE PLATE (17) ON THREE REMOVER/INSTALLER LEGS (16). SEAT REMOVER/INSTALLER PRESSURE PLATE (17) AGAINST REMOVER/INSTALLER LEG(16) FLANGES.
22. INSTALL THREE CRANKSHAFT GEAR REMOVER/INSTALLER RETAINING NUTS (18) ON THREE REMOVER/INSTALLER LEGS (16). THREAD RETAINING NUTS (18) PAST FIRST SET OF REMOVER/INSTALLER LEG (16) THREADS. SLIDE RETAINING NUTS (18) PAST UNTHREADED PORTION OF SHAFTS AND ENGAGE SECOND SET OF THREADS. TIGHTEN RETAINING NUTS (18).

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## CRANKSHAFT REPLACEMENT (CONT)

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23. INSTALL HYDRAULIC RAM AND PUMP (19) ON CRANKSHAFT GEAR REMOVER/INSTALLER BASE POST (12) THREADED ROD AS SHOWN. INSTALL REMOVER/INSTALLER STOP NUT (20) ON END OF REMOVER/INSTALLER BASE POST (12) THREADED ROD. TIGHTEN STOP NUT (20).

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### CAUTION

Make sure timing gear is indexed with woodruff key. Failure to do so could result in damage to equipment.

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### NOTE

Make sure timing wheel is firmly seated against crankshaft flange.

24. OPERATE HYDRAULIC RAM AND PUMP (19) TO PRESS CRANKSHAFT TIMING GEAR (15) ON CRANKSHAFT UNTIL TIMING GEAR (15) IS FIRMLY SEATED AGAINST TIMING WHEEL (14). OBTAIN MINIMUM FORCE OF 3.37 TONS (30 kN) WHEN PRESSING CRANKSHAFT TIMING GEAR (15) ON CRANKSHAFT.
25. REMOVE CRANKSHAFT GEAR REMOVER/INSTALLER TOOL.
26. MEASURE GEARLASH BETWEEN CRANKSHAFT TIMING GEAR AND BULL GEAR ASSEMBLY. GEARLASH MUST BE 0.002-0.007 IN. (0.051-0.178 mm).

### NOTE

Follow-on Maintenance:

- Install bull/idler gear assembly (page 12-93).
- Install flywheel housing (page 3-148).
- Install piston and cylinder assembly (page 12-141).
- Install oil pump (page 3-199).
- Install timing reference sensor (TM 9-2320-363-20).
- Install synchronous reference sensor (TM 9-2320-363-20).
- Install crankshaft oversize front oil seal (page 3-231).

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## CAMSHAFT DRIVE GEAR REPLACEMENT AND REPAIR

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This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Assembly  
f. Installation

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### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Ring, Seal	P/N 8929297
Ring, Seal	P/N 8929318
Adhesive	Appendix B, Item 2
Lubriplate 105	Appendix B, Item 35
Oil, Lubricating	Appendix B, item 37
Solvent, Drycleaning	Appendix B, Item 54

#### Equipment Condition:

Reference	Condition Description
Page 3-162	Camshaft and Bearings Removed
Page 12-93	Bull/idler Gear Removed

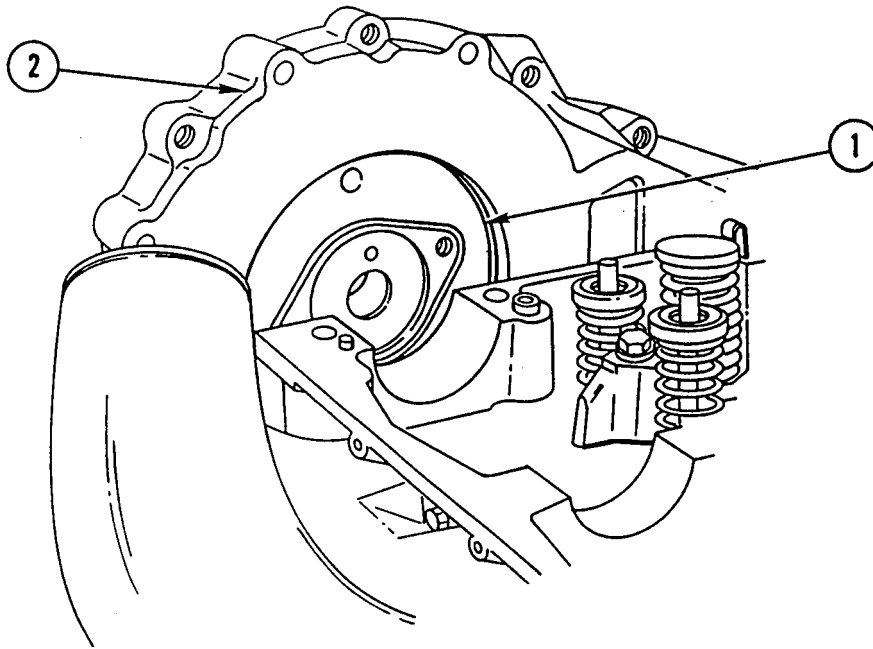
#### General Safety Instructions:

#### **WARNING**

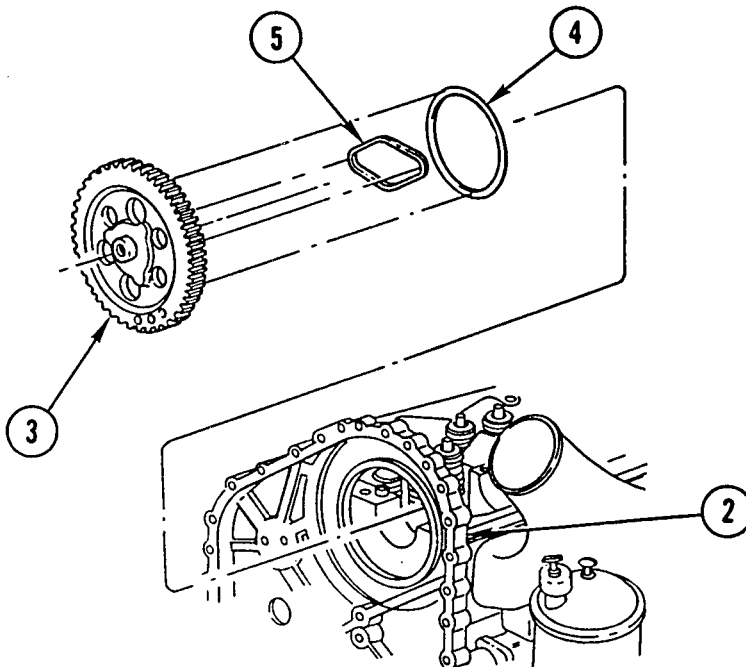
Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with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

## CAMSHAFT DRIVE GEAR REPLACEMENT AND REPAIR (CONT)

### REMOVAL



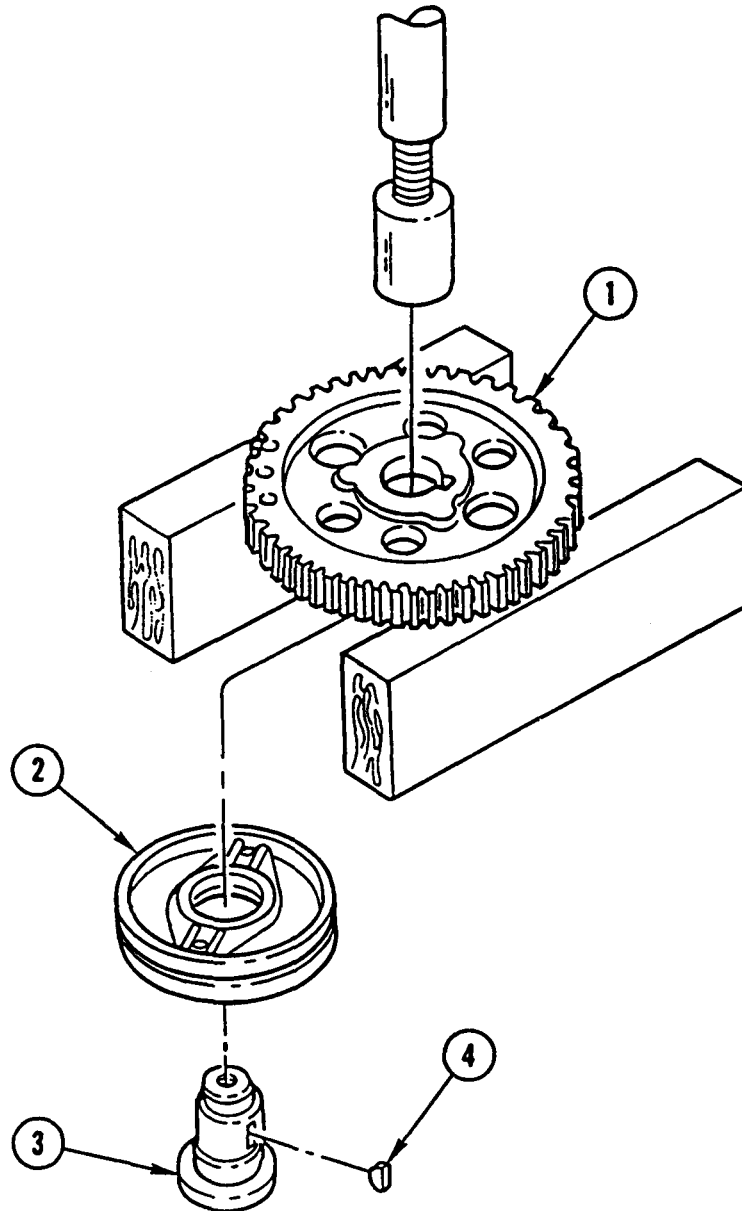
1. TAP REAR FACE OF CAMSHAFT GEAR ASSEMBLY (1) WITH FIBER OR PLASTIC MALLET UNTIL CAMSHAFT GEAR ASSEMBLY (1) IS FREE OF GEAR HOUSING (2).



2. REMOVE CAMSHAFT DRIVE GEAR ASSEMBLY (3), FROM GEAR HOUSING (2).

3. REMOVE AND DISCARD CAMSHAFT THRUST PLATE SEAL RING (4).
4. REMOVE AND DISCARD DIAMOND SHAPED SEAL (5).

**DISASSEMBLY**



1. SUPPORT CAMSHAFT DRIVE GEAR ASSEMBLY (1) WITH CAMSHAFT THRUST PLATE (2) FACING DOWN.
2. PRESS HUB (3) OUT OF CAMSHAFT DRIVE GEAR.
3. SEPARATE HUB (3) FROM CAMSHAFT THRUST PLATE (2).
4. REMOVE AND DISCARD KEY (4).

## CAMSHAFT DRIVE GEAR REPLACEMENT AND REPAIR (CONT)

### CLEANING

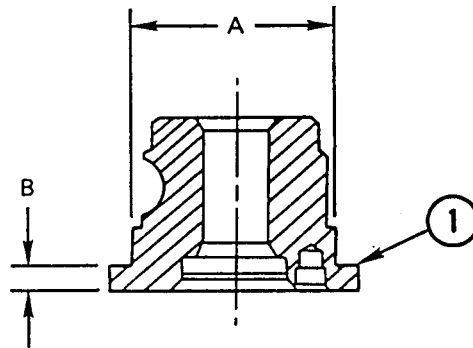
#### WARNING

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

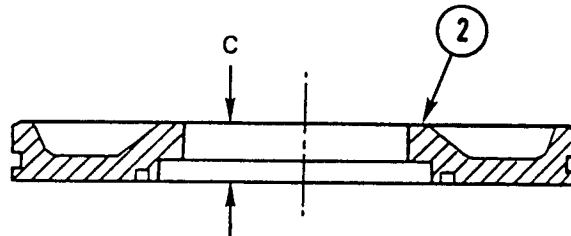
Clean parts with solvent and dry with compressed air.

### INSPECTION

1. INSPECT SEAL RING SEALING SURFACE OF GEAR HOUSING ASSEMBLY, THRUST PLATE, AND HEAD FOR CLEANLINESS, BURRS, OR DAMAGE.
2. INSPECT WOODRUFF KEY SLOT IN HUB AND DRIVE GEAR FOR EVIDENCE OF CRACKS OR WEAR. REPLACE CAMSHAFT DRIVE GEAR ASSEMBLY IF KEY SLOT IS DAMAGED.
3. INSPECT CAMSHAFT DRIVE GEAR TEETH FOR SCORING, PITTING, OR EXCESSIVE WEAR. IF SCORING, PITTING, OR EXCESSIVE WEAR IS EVIDENT, DISCARD GEAR.

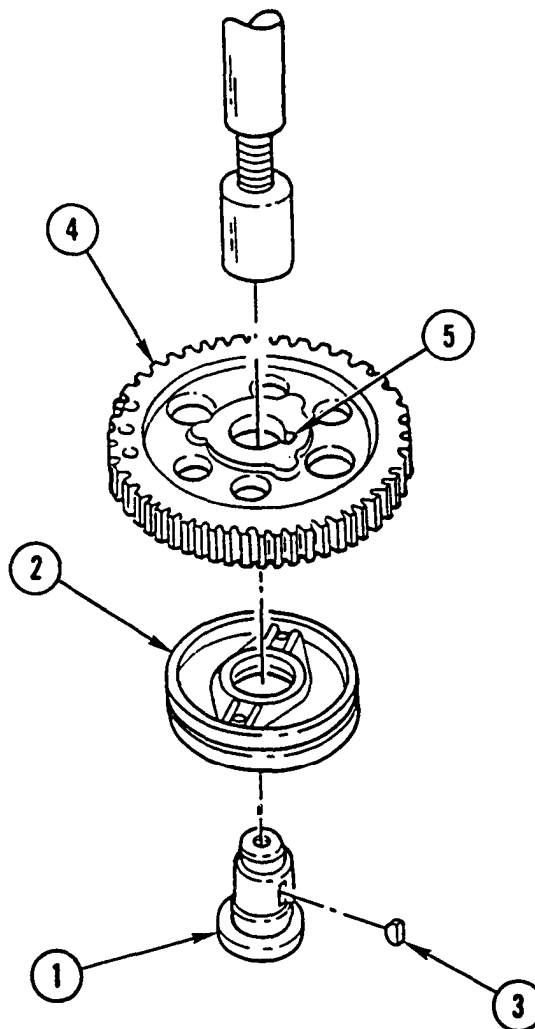


4. INSPECT CAMSHAFT DRIVE GEAR HUB (1) FOR SCORING, PITTING, OR GALLING. IF EXCESSIVE, DISCARD HUB. MEASURE DIAMETER (A). MINIMUM DIMENSION SHOULD BE 2.283 IN. (58.0 mm). MEASURE THRUST PLATE CONTACT AREA (B). MINIMUM DIMENSION SHOULD BE 0.253 IN. (6.45 mm). IF ANY DIMENSIONS ARE BELOW MINIMUM, DISCARD HUB.



5. INSPECT CAMSHAFT THRUST PLATE (2) FOR SCORING, PITTING, OR GALLING. IF SCORING, PITTING, OR GALLING IS EVIDENT, DISCARD THRUST PLATE. MEASURE THRUST PLATE CONTACT AREA (C). MINIMUM DIMENSION SHOULD BE 0.437 IN. (11.1 mm). IF MEASUREMENT IS BELOW MINIMUM, DISCARD THRUST PLATE.

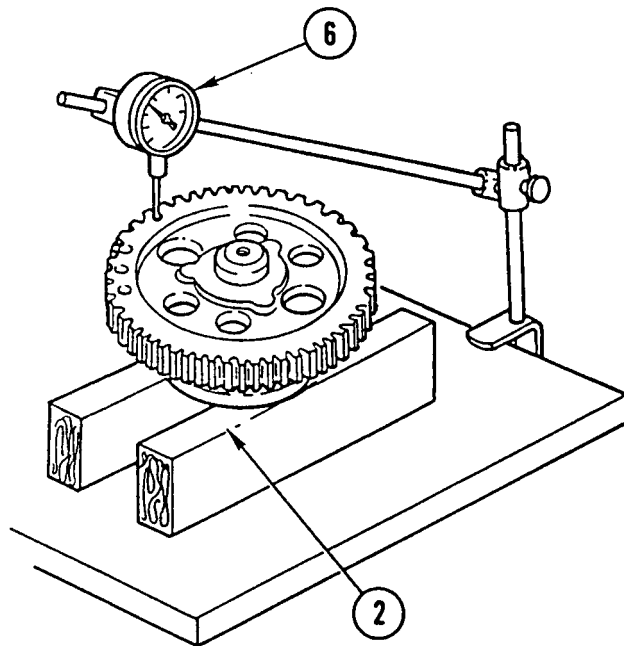


**ASSEMBLY****NOTE**

Minimum force of 4,500 lb (20 kN) must be obtained when pressing gear on hub. When pressing, only apply force to inner hub of gear.

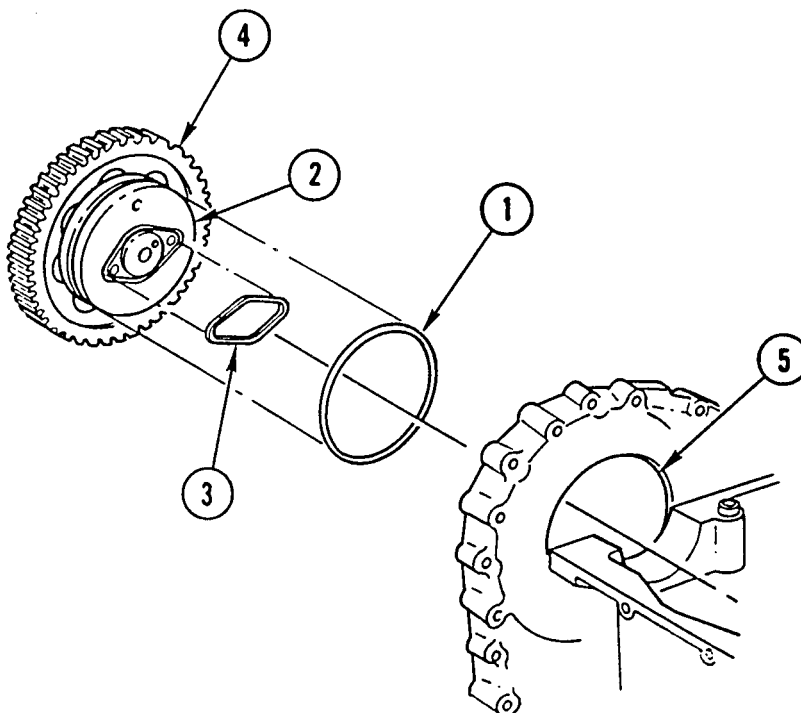
1. LUBRICATE CONTACT SURFACES OF DRIVE GEAR HUB(1) AND CAMSHAFT THRUST PLATE (2) WITH CLEAN ENGINE LUBRICATING OIL.
2. INSTALL DRIVE GEAR HUB (1) ON CAMSHAFT THRUST PLATE (2).
3. INSTALL NEW KEY (3) IN KEYWAY OF DRIVE GEAR HUB (1).
4. APPLY THIN FILM OF LUBRIPLATE 105 (OR EQUIVALENT) TO BORE OF CAMSHAFT DRIVE GEAR (4).
5. SUPPORT DRIVE GEAR HUB FROM ENGINE SIDE. ALINE KEYWAY (5) OF CAMSHAFT DRIVE GEAR WITH KEY (3) IN DRIVE GEAR HUB (1). PRESS CAMSHAFT DRIVE GEAR (4) ONTO DRIVE GEAR HUB (1) UNTIL GEAR IS FIRMLY SEATED AGAINST HUB SHOULDER.

## CAMSHAFT DRIVE GEAR REPLACEMENT AND REPAIR (CONT)



6. SUPPORT CAMSHAFT DRIVE GEAR THRUST PLATE (2), AS SHOWN. WITH DIAL INDICATOR (6), MEASURE CAMSHAFT DRIVE GEAR FACE RUNOUT JUST INBOARD OF DRIVE GEAR TEETH. ZERO DIAL INDICATOR. ROTATE DRIVE GEAR TWO FULL ROTATIONS. MAXIMUM ALLOWABLE TOTAL INDICATED RUNOUT IS 0.0045 IN. (0.114 mm).

## INSTALLATION



1. LUBRICATE NEW CAMSHAFT THRUST PLATE SEAL RING (1) WITH CLEAN ENGINE LUBRICATING OIL. INSTALL SEAL RING (1) ON THRUST PLATE (2).

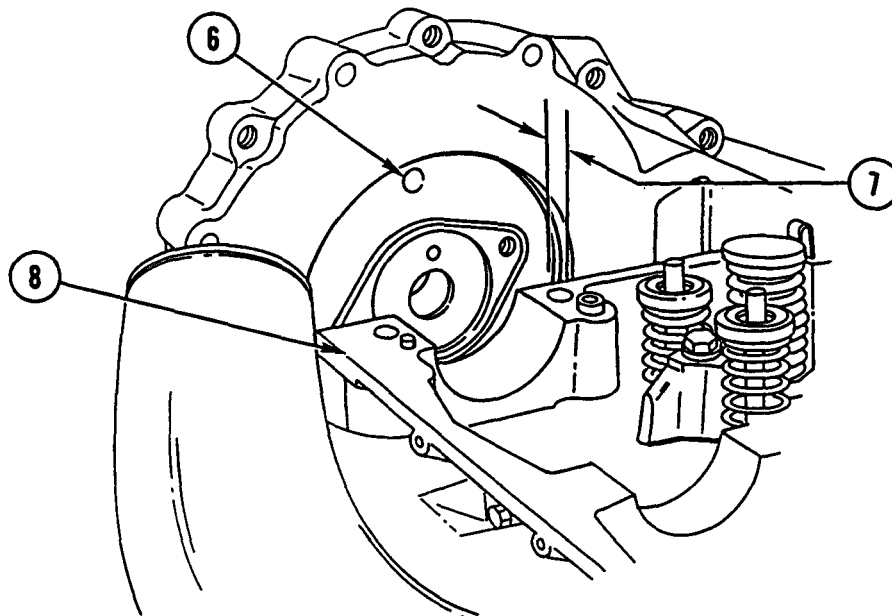
**WARNING**

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

**CAUTION**

Spray adhesive on diamond seal only, not on face of thrust plate. Failure to do so could result in damage to equipment.

2. SPRAY THIN COAT OF ADHESIVE ON ONE SIDE OF NEW DIAMOND SHAPED SEAL (3). INSTALL SEAL (3) ON ENGINE SIDE OF THRUST PLATE (2).
3. INSTALL CAMSHAFT DRIVE GEAR ASSEMBLY (4) IN GEAR HOUSING OPENING (5).



4. MAKE SURE DIMPLE (6) ON REAR FACE OF THRUST PLATE IS POSITIONED AT 12 O'CLOCK. IF NECESSARY, TAP CAMSHAFT DRIVE GEAR HUB TOWARD ENGINE WITH FIBER OR PLASTIC Mallet UNTIL REAR FACE OF THRUST PLATE IS 1/4 IN. (6.35 mm) (7) FROM FACE OF CYLINDER HEAD (8). MAKE SURE THRUST PLATE IS NOT TILTED IN BORE.

**NOTE**

Follow-on Maintenance:

- Install camshaft and bearings (page 3-162).
- Install bull idler gear (page 12-93).

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## GEAR HOUSING ASSEMBLY REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95 -CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Alinement Plug, J35651  
 Crankshaft Protector. J35994  
 Lifter, J35641  
 Caulking Gun, 805774

#### Equipment Condition:

Reference	Condition Description
Page 12-3	Engine Installed on Repair Stand
Page 3-162	Camshaft and Bearings Removed
TM 9-2320-363-20	Timing Reference Sensor (TRS) Removed
TM 9-2320-363-20	Synchronous Reference Sensor (SRS) Removed
Page 12-93	Bull/Idler Gear Assembly Removed
Page 12-99	Adjustable Idler Gear Assembly Removed
Page 12-61	Camshaft Drive Gear Removed

#### Materials/Parts:

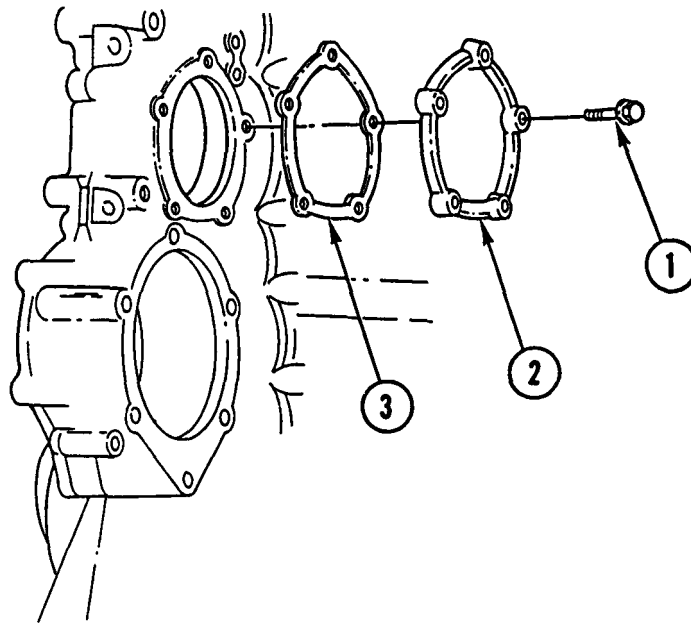
Ring, Seal	P/N 8929740
Gasket	P/N 8929130
Washer	P/N 5155596
Washer	P/N 5180370
Eliminator, Gasket	Appendix B, Item 18
Rope, 1/2-in. Nylon	Appendix B, Item 49

Personnel Required: (2)

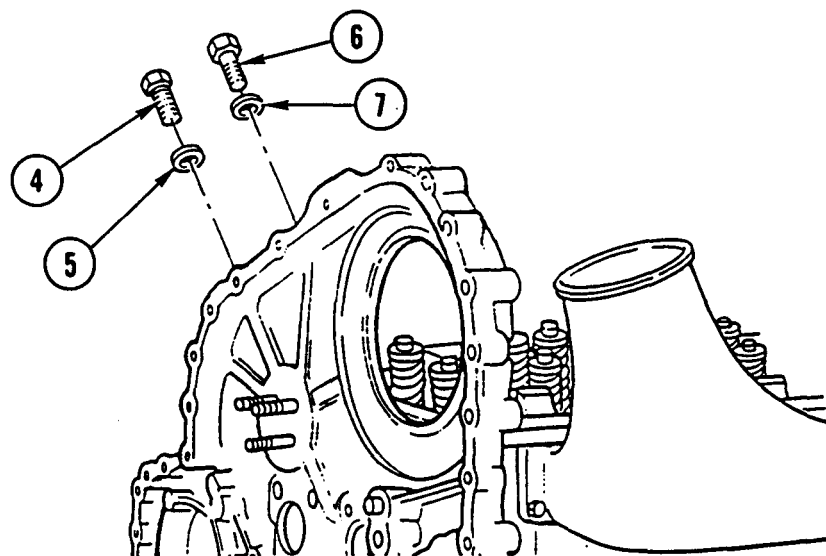
#### References:

TM 9-2320-363-20

**REMOVAL**

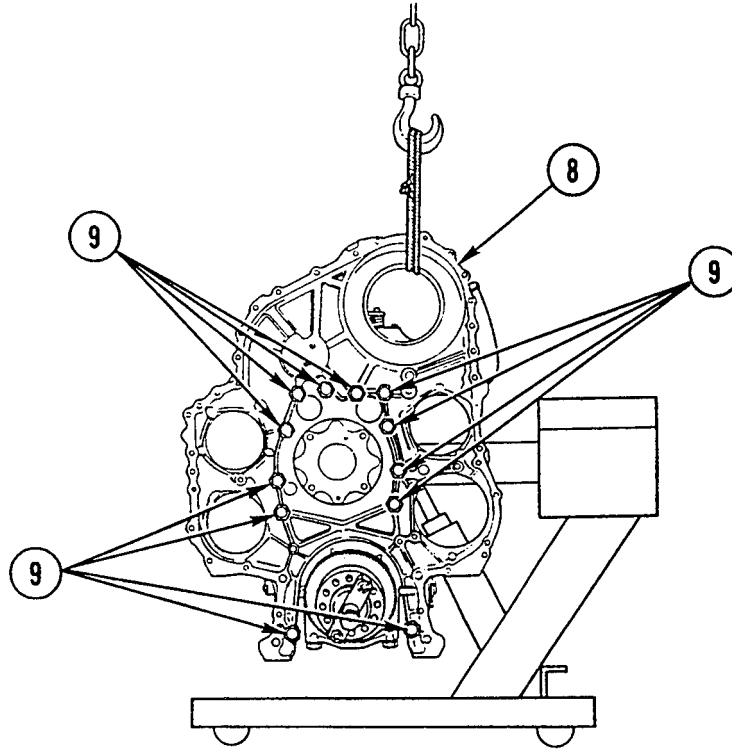


1. REMOVE FIVE BOLTS (1), ACCESSORY COVER (2), AND GASKET (3). DISCARD GASKET.

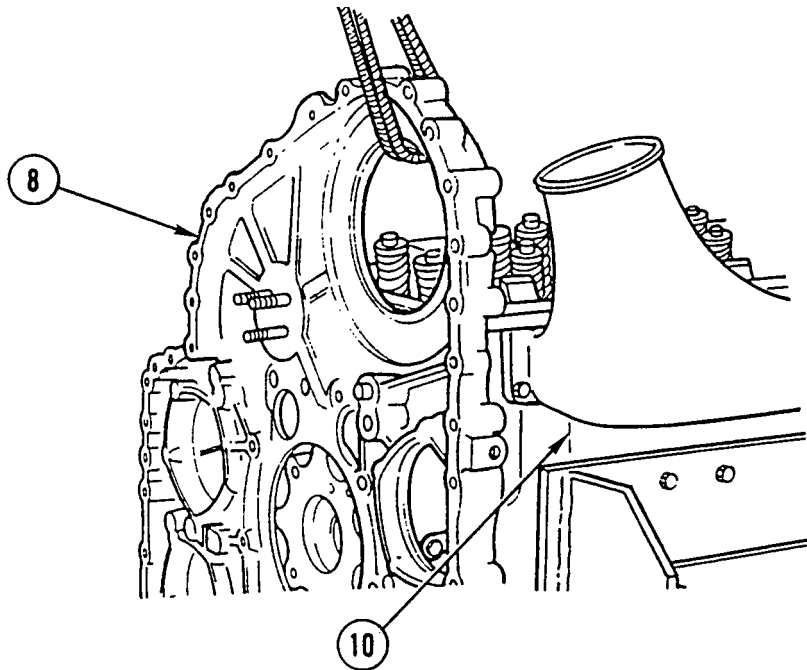


2. REMOVE BOLT (4) AND WASHER (5) FROM ADJUSTABLE IDLER GEAR OIL SUPPLY HOLE. DISCARD WASHER.
3. REMOVE BOLT (6) AND WASHER (7) FROM ADJUSTABLE IDLER GEAR HOLDING ACCESS HOLE. DISCARD WASHER.

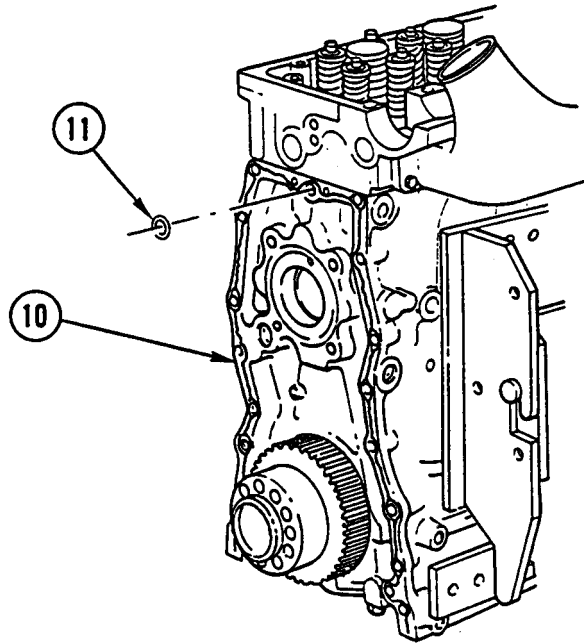
## GEAR HOUSING ASSEMBLY REPLACEMENT (CONT)



4. USING SUITABLE LIFTING DEVICE AND 1/2-IN. NYLON ROPE THRU CAMSHAFT THRUST PLATE OPENING, SUPPORT GEAR HOUSING ASSEMBLY (8) AND REMOVE 12 BOLTS (9).



5. USING FIBER OR PLASTIC Mallet, TAP REAR FACE OF GEAR HOUSING ASSEMBLY (8) TO LOOSEN GEAR HOUSING ASSEMBLY FROM CYLINDER BLOCK (10). REMOVE GEAR HOUSING ASSEMBLY (8).



6. REMOVE AND DISCARD SEAL RING (11) FROM COUNTERBORE AT TOP CENTER FRONT FACE OF CYLINDER BLOCK (10).
7. REMOVE ALL OLD GASKET ELIMINATOR FROM MATING SURFACES OF GEAR HOUSING ASSEMBLY AND CYLINDER BLOCK (10).

### **CLEANING**

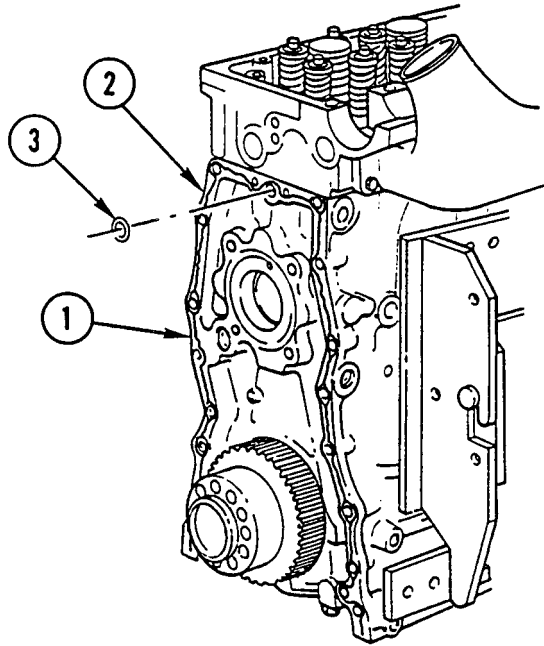
Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

Inspect all parts for wear or damage.

## GEAR HOUSING ASSEMBLY REPLACEMENT (CONT)

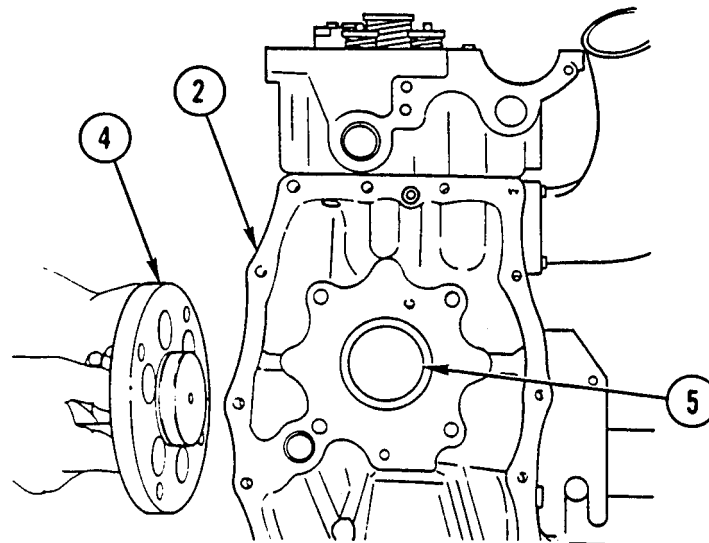
### INSTALLATION



#### CAUTION

Application of gasket eliminator to gear housing-to-block mating surfaces at top of cylinder block is critical to prevent damage to equipment.

1. USING CAULKING GUN, APPLY 1/16-IN. BEAD OF GASKET ELIMINATOR (1) TO CYLINDER BLOCK (2). SMOOTH BEAD AROUND BLOCK-TO-GEAR HOUSING OIL PASSAGE CAREFULLY TO AVOID CONTAMINATION OR PLUGGING OF OIL HOLE.
2. INSTALL NEW SEAL RING (3) IN COUNTERBORE ON TOP FRONT FACE OF CYLINDER BLOCK (2).

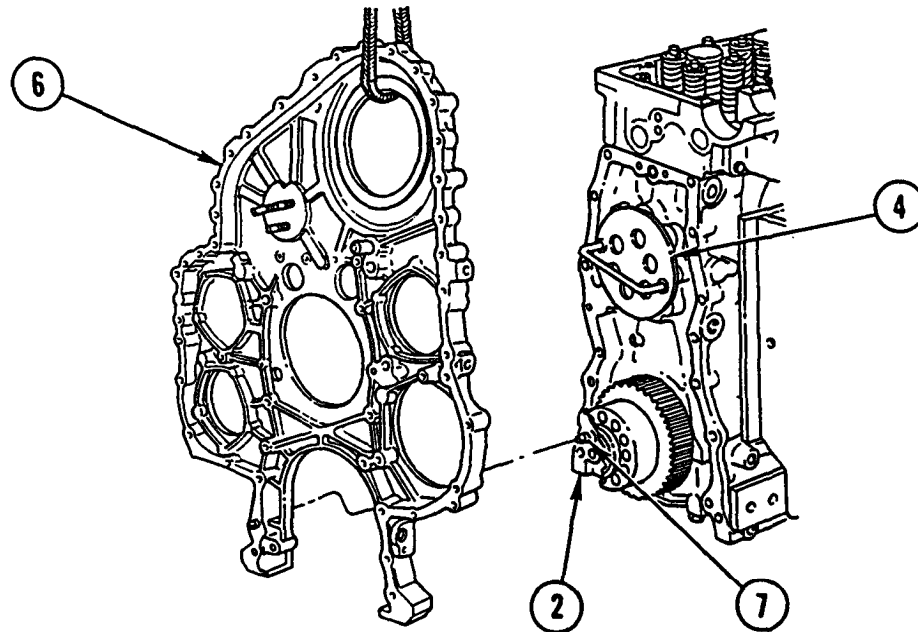




**CAUTION**

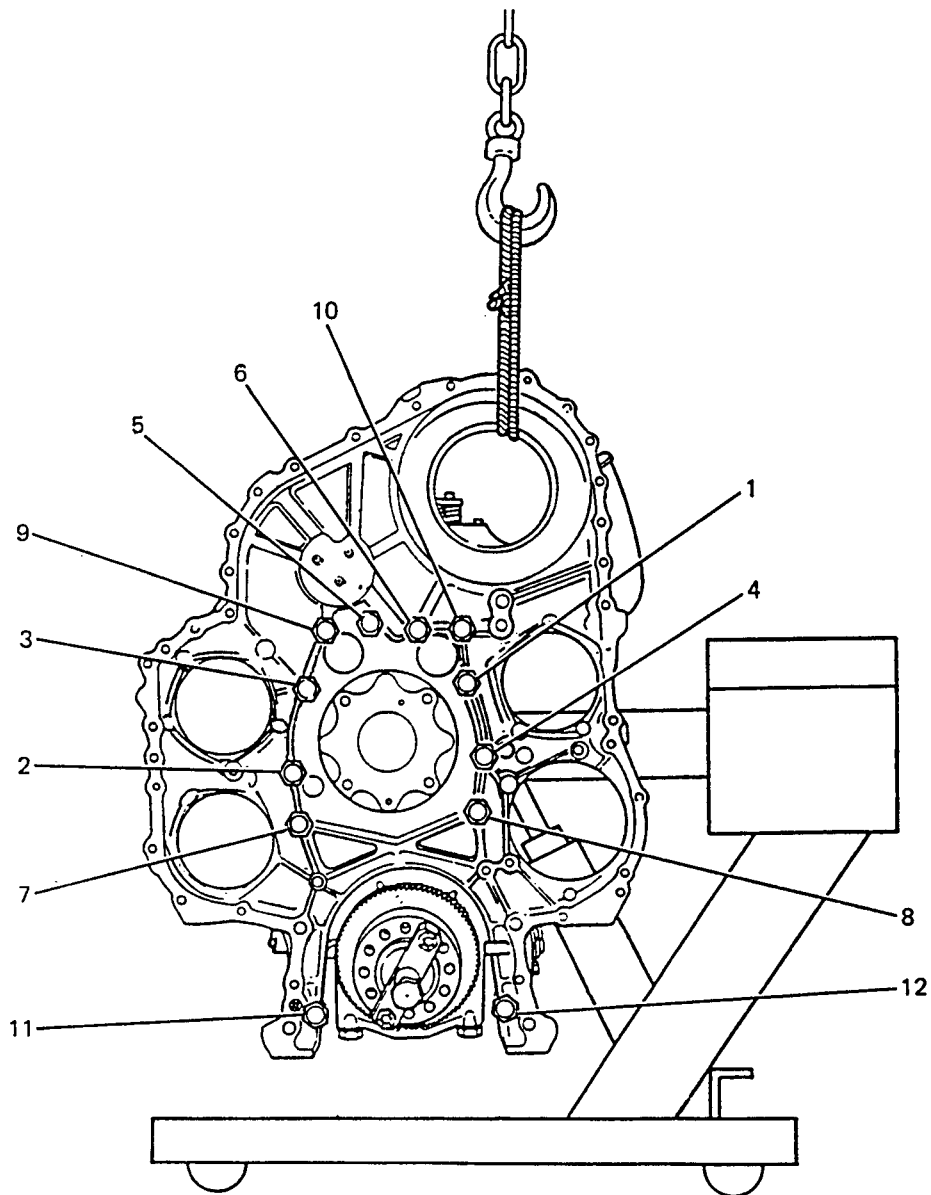
Bull/idler gear assembly recess must be clean and free of foreign material before installing gear case alignment plug to prevent damage to equipment.

3. INSTALL GEAR CASE ALIGNMENT PLUG (4) ON BULL/IDLER GEAR HUB RECESS (5) IN CYLINDER BLOCK (2).

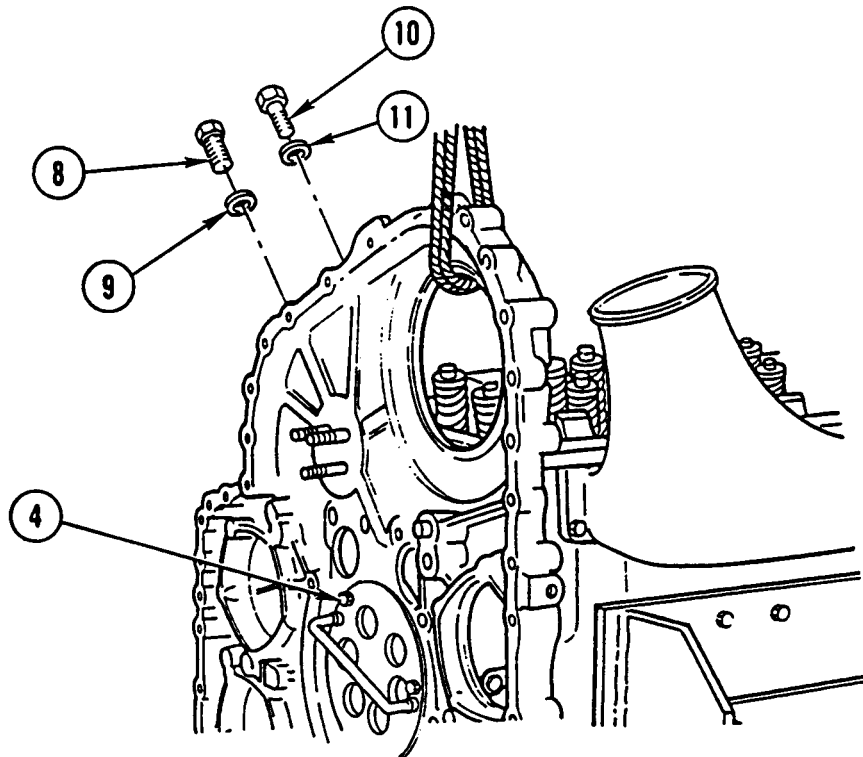


4. USING SUITABLE LIFTING DEVICE AND 1/2-IN. NYLON ROPE THRU CAMSHAFT THRUST PLATE OPENING, SUPPORT GEAR HOUSING ASSEMBLY (6). POSITION BULL/IDLER GEAR HUB OPENING IN GEAR CASE OVER GEAR CASE ALIGNMENT PLUG (4).
5. INDEX HOLE IN GEAR HOUSING ASSEMBLY (6) LEFT LEG WITH DIAMOND DOWEL (7) IN LOWER LEFT CORNER OF CYLINDER BLOCK (2). SEAT GEAR HOUSING ASSEMBLY (6) FIRMLY AGAINST CYLINDER BLOCK (2).

## GEAR HOUSING ASSEMBLY REPLACEMENT (CONT)

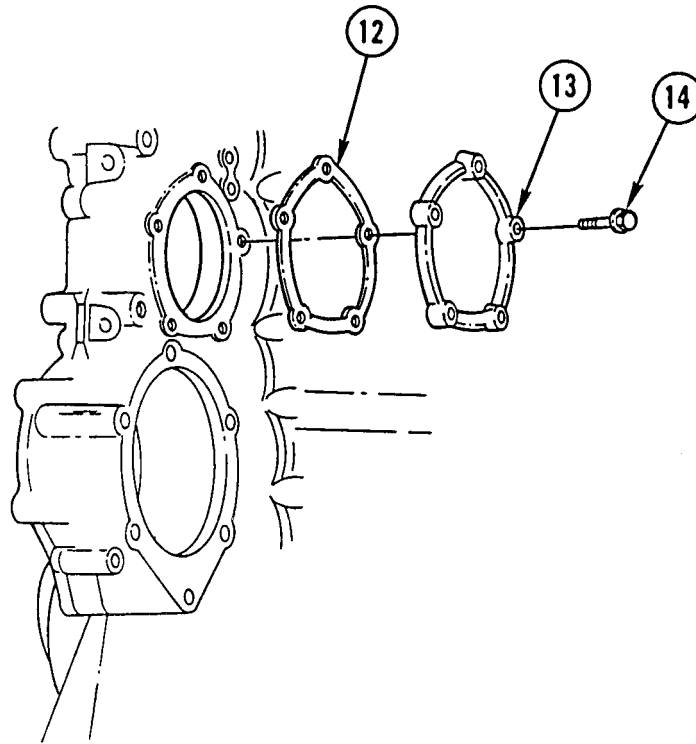


6. INSTALL THREE SHORTER BOLTS IN LOCATIONS 5, 6, AND 9.
7. INSTALL NINE LONGER BOLTS IN LOCATIONS 1 THRU 4, 7, 8, AND 10 THRU 12.
8. TIGHTEN BOLTS TO 43-54 LB-FT (58-73 N.m) IN SEQUENCE SHOWN.



9. REMOVE GEAR CASE ALINEMENT PLUG (4).
10. INSTALL BOLT (8) AND NEW WASHER (9) IN ADJUSTABLE IDLER GEAR OIL SUPPLY HOLE. TIGHTEN BOLT TO 15-19 LB-FT (20-26 N.m).
11. INSTALL BOLT (10) AND NEW WASHER (11) IN ADJUSTABLE IDLER GEAR HOLDING ACCESS HOLE. TIGHTEN BOLT TO 43-54 LB-FT (58-73 N.m).

## GEAR HOUSING ASSEMBLY REPLACEMENT (CONT)



### **NOTE**

Make sure all old gasket material is removed from mating surface of accessory cover and gear housing assembly.

12. POSITION NEW GASKET (12) AND ACCESSORY COVER (13) ON GEAR HOUSING ASSEMBLY.
13. INSTALL FIVE BOLTS (14). TIGHTEN BOLTS IN STAR PATTERN TO 22-28 LB-FT (30-38 N.m).

### **NOTE**

Follow-on Maintenance:

- Install camshaft drive gear (page 12-61).
- Install adjustable idler gear assembly (page 12-99).
- Install bull/idler gear assembly (page 12-93).
- Install synchronous reference sensor (SRS) (TM 9-2320-363-20).
- Install timing reference sensor (TRS) (TM 9-2320-363-20).
- Install camshaft and bearings (page 3-162).

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## CYLINDER BLOCK ASSEMBLY REPAIR

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This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Dowel Installer Set, J36224  
 Plug Installer Set, J35653  
 Pressure Test Kit, J36223-C  
 Eye Bolts, J35595  
 Driver Handle, J7079-2

#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Electronic Control Module Removed
TM 9-2320-363-20	Engine Wiring Harness Removed
TM 9-2320-363-20	Fuel Filter Adapters Removed

#### Materials/Parts:

Plug, cup (2)	P/N 5139988
Seal	P/N 8929740
Plug, cup (5)	P/N 5139991
Oil, Lubricating	Appendix B, Item 37
Sealant, Non-Hardening	Appendix B, Item 51
International Compound No. 2	Appendix B, Item 29
Preventive, Rust	Appendix B, Item 47

TM 9-2320-363-20	Oil Pressure and Oil Temperature Sending Units Removed
TM 9-2320-363-20	Oil Cooler, Core, and Oil Filter Adapter Removed
TM 9-2320-363-20	Oil Dipstick and Tube Removed
TM 9-2320-363-20	Oil Fill Tube Removed
TM 9-2320-363-20	Oil Bypass Fitter Adapter and Tube Removed
Page 3-80	Cylinder Head Removed
Page 12-141	Piston and Cylinder Assembly Removed
Page 12-41	Crankshaft Removed
Page 12-68	Gear Housing Assembly

#### Personnel Required: (2)

#### References:

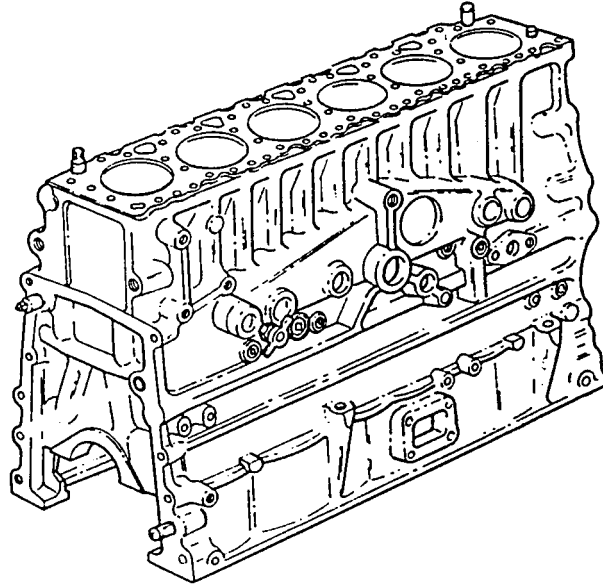
TM 9-2320-363-20  
 TM 9-237

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## CYLINDER BLOCK ASSEMBLY REPAIR (CONT)

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### DISASSEMBLY

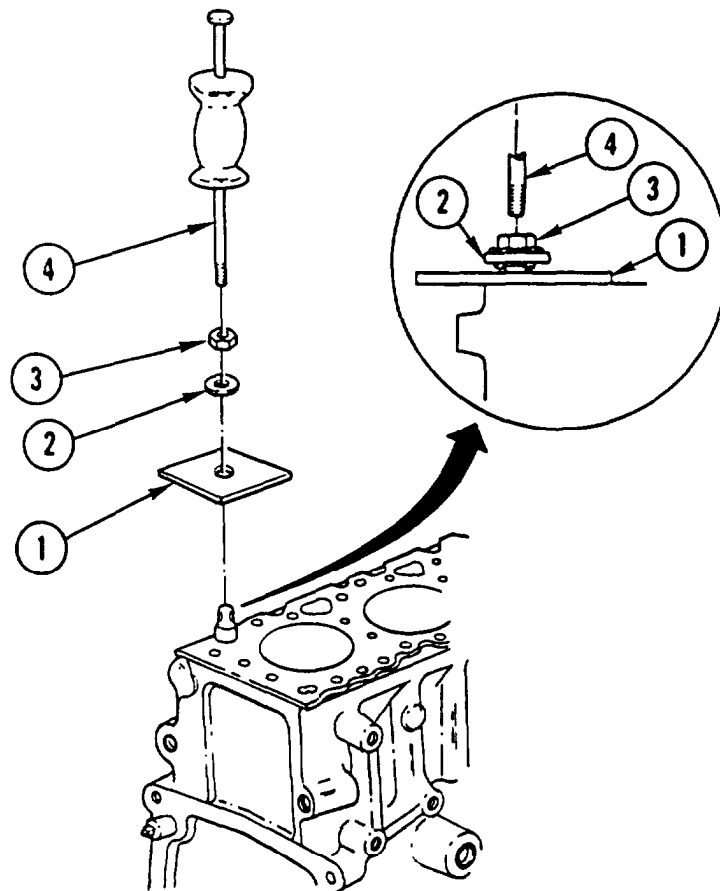


RIGHT SIDE - REAR

#### NOTE

- Cylinder block repair conditions may warrant cylinder block pressure testing before complete block disassembly. Perform testing before removing cylinder liners, cup plugs, and pipe plugs. (Refer to Cylinder Block Pressure Testing, page 12-88).
- Determine left and right sides of cylinder block by viewing cylinder block from rear (flywheel housing end).

1. POSITION CYLINDER BLOCK TO VIEW RIGHT SIDE.



**NOTE**

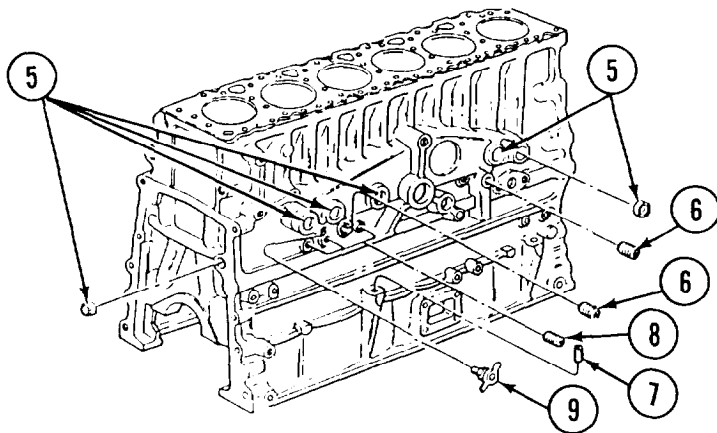
- Procedure is the same for round, diamond, or hollow dowels.
  - Replace dowels and plugs only if necessary.
  - Cover exposed areas to guard against welding sparks.
2. IF DAMAGED, REMOVE DOWELS BY FABRICATING A PIECE OF SHEET BRASS (1) WITH HOLE LARGE ENOUGH TO FIT OVER DOWEL BEING REMOVED.
  3. TACK-WELD FLAT WASHER (2) TO TOP OF DOWEL AS SHOWN.

**NOTE**

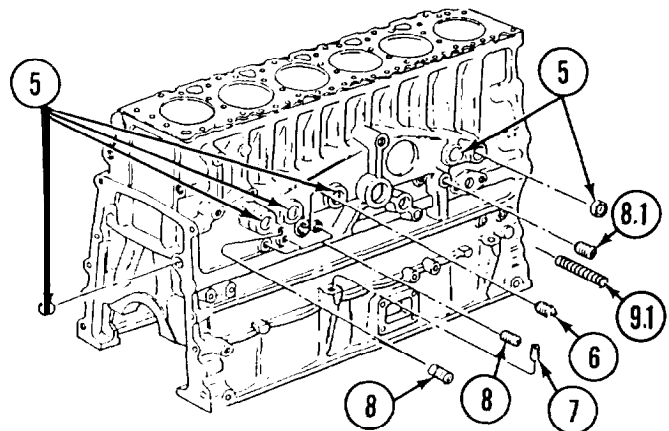
Make sure thread of nut matches thread of slide hammer shaft.

4. TACK-WELD NUT (3) TO FLAT WASHER (2).
5. THREAD SLIDE HAMMER SHAFT (4) INTO NUT AND REMOVE DOWEL.

**CYLINDER BLOCK ASSEMBLY REPAIR (CONT)**



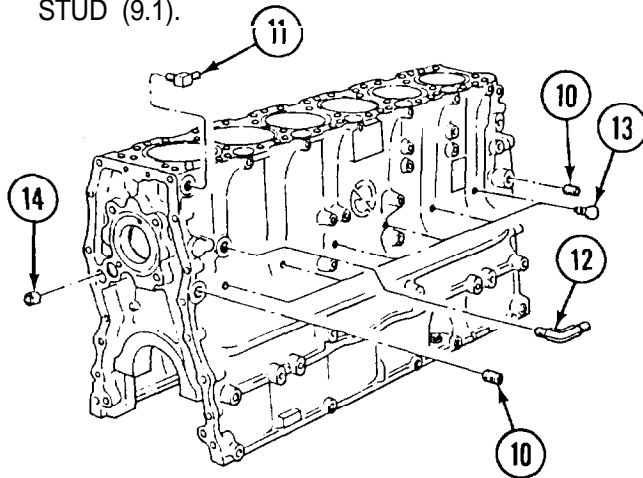
M915A2 AND M916A1



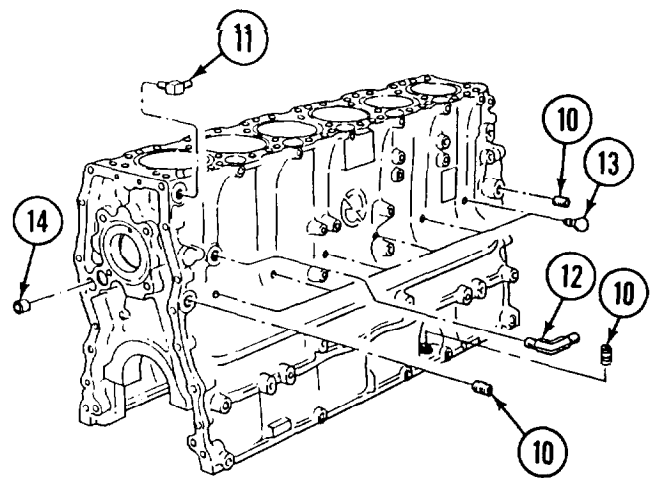
ALL EXCEPT AND M916A1

RIGHT SIDE - REAR

6. IF DAMAGED, PIERCE CUP PLUG(S) (5) WITH SCREWDRIVER OR CHISEL. REMOVE AND DISCARD PLUG(S).
7. ON M915A2 AND M916A1, REMOVE SIX PIPE PLUGS (6, 7, AND 8) AND DRAINCOCK (9).
- 7.1. ON ALL EXCEPT M915A2 AND M916A1. REMOVE SEVEN PIPE PLUGS (6,7,8, AND 8.1) AND STUD (9.1).



M915A2 AND M916A1



ALL EXCEPT M915A2 AND M916A1

LEFT SIDE - FRONT

8. POSITION CYLINDER BLOCK TO VIEW LEFT SIDE.
9. REMOVE TWO (M915A2 AND M916A1) OR THREE (ALL EXCEPT M915A2 AND M916A1) PIPE PLUGS (10).
10. REMOVE AIR COMPRESSOR OIL SUPPLY LINE ELBOW (11).

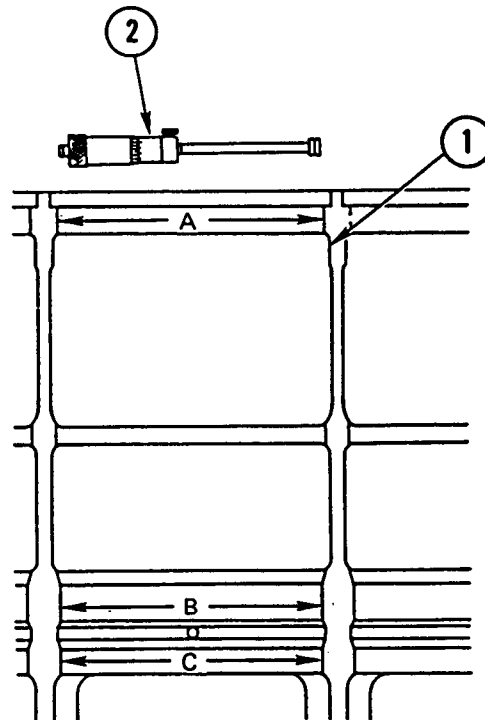


11. IF INSTALLED, REMOVE AIR COMPRESSOR COOLANT SUPPLY ELBOW (12).
12. REMOVE SIX WEEP HOLE PLUGS (13).
13. PIERCE CUP PLUG (14) WITH SCREWDRIVER OR CHISEL. REMOVE AND DISCARD PLUG.

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

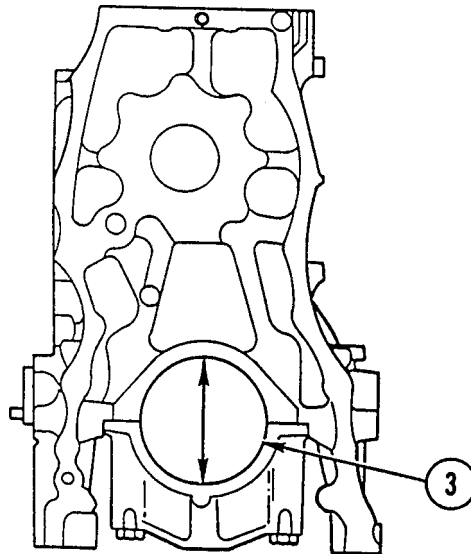


1. MEASURE EACH CYLINDER BORE (1) USING INSIDE MICROMETER (2).
2. MEASURE EACH CYLINDER BLOCK BORE FOR FOLLOWING DIMENSIONS AT LOCATIONS A, B, AND C ON AXIS 90 DEGREES APART. DIMENSIONS ARE AVERAGE GAGE READINGS AT EACH LOCATION. TAPER AND OUT-OF-ROUND SHOULD NOT EXCEED 0.001 IN. (0.0254 mm):

LOCATION	DIMENSION
A	5.868-5.871 IN. (149.050-149.120 mm)
B	5.750-5.753 IN. (146.050-146.120 mm)
C	5.750-5.753 IN. (146.050-146.120 mm)

3. IF ANY OF ABOVE MEASUREMENTS ARE EXCEEDED, REPLACE CYLINDER BLOCK.

## CYLINDER BLOCK ASSEMBLY REPAIR (CONT)



**NOTE**

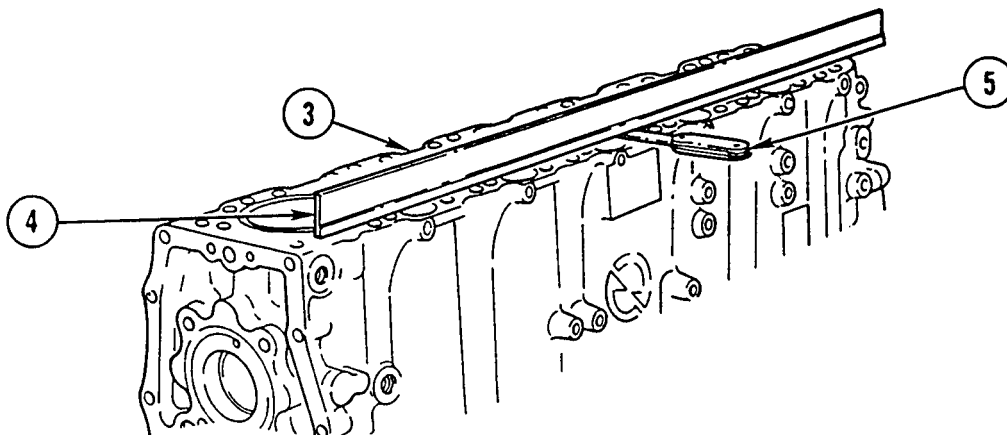
Perform step 4 before gaging main bearing bores.

4. INSTALL MAIN BEARING CAPS IN ORIGINAL POSITIONS. LUBRICATE CAP BOLT THREADS AND HEAD CONTACT SURFACES WITH SMALL AMOUNT OF INTERNATIONAL COMPOUND NO. 2. INSTALL AND TIGHTEN MAIN CAP BOLTS TO 347-391 LB-FT (470-530 N.m).

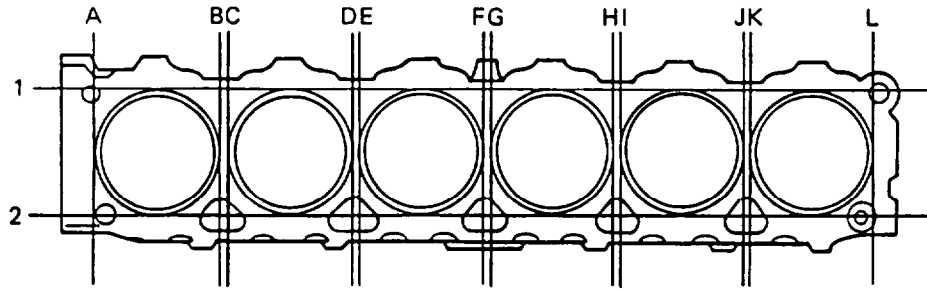
**NOTE**

Replace engine block if not within specification.

5. MEASURE EACH CRANKSHAFT MAIN BEARING BORE (3) IN VERTICAL AXIS WITH INSIDE MICROMETER. DIMENSION SHOULD BE 5.235-5.237 IN. (132.994-133.031 mm). IF DIMENSION EXCEEDS LIMITS, REPLACE CYLINDER BLOCK.



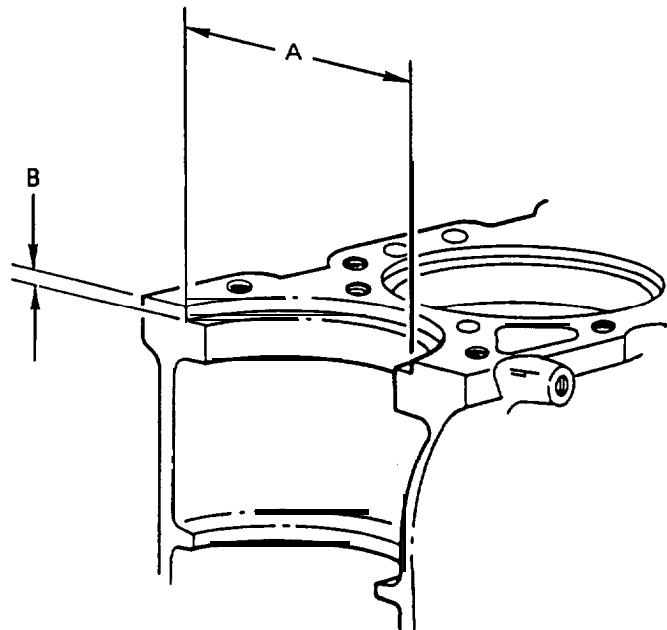
6. CHECK CYLINDER BLOCK DECK (4) FOR FLATNESS WITH STRAIGHTEDGE (5) AND FEELER GAGE (5).



**NOTE**

Camshaft is mounted in cylinder head; therefore, resurfacing of block and/or head affects position of camshaft in relation to adjustable idler gear and gear train. Limit resurfacing on cylinder block to maximum of 0.01 in. (0.25 mm). Limit resurfacing on block and head to combined total of 0.03 in. (0.75 mm). If limits are exceeded, replace cylinder block.

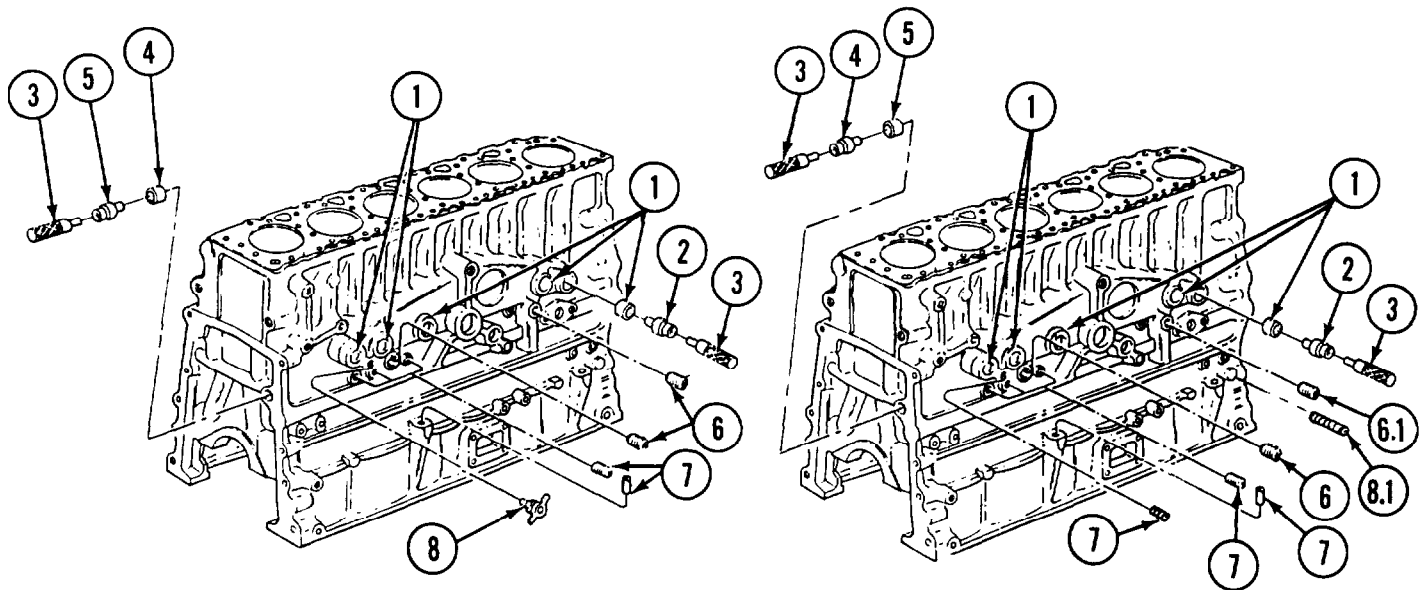
7. CHECK FRONT-TO-REAR FLATNESS, NEXT TO CYLINDER LINER FLANGES ON BOTH SIDES, AND SIDE-TO-SIDE FLATNESS BETWEEN LINER FLANGES, AS SHOWN. DECK MUST BE FLAT WITHIN 0.005 IN. (0.120 mm) FRONT-TO-REAR AND 0.003 IN. (0.076 mm) SIDE-TO-SIDE. IF NOT, RESURFACE CYLINDER BLOCK.
8. SPRAY MACHINED SURFACES WITH ENGINE LUBRICATING OIL IF CYLINDER BLOCK IS NOT TO BE USED IMMEDIATELY. SPRAY OR DIP CYLINDER BLOCK IN POLAR-TYPE RUST PREVENTIVE FOR EXTENDED STORAGE.



9. MEASURE CYLINDER LINER COUNTERBORE DIAMETER (A) AND DEPTH (B). DIAMETER SHOULD BE 6.186-6.191 IN. (157.15-157.25 mm). DEPTH SHOULD BE 0.3514-0.3533 IN. (8.9246-8.9746 mm).

CYLINDER BLOCK ASSEMBLY REPAIR (CONT)

ASSEMBLY

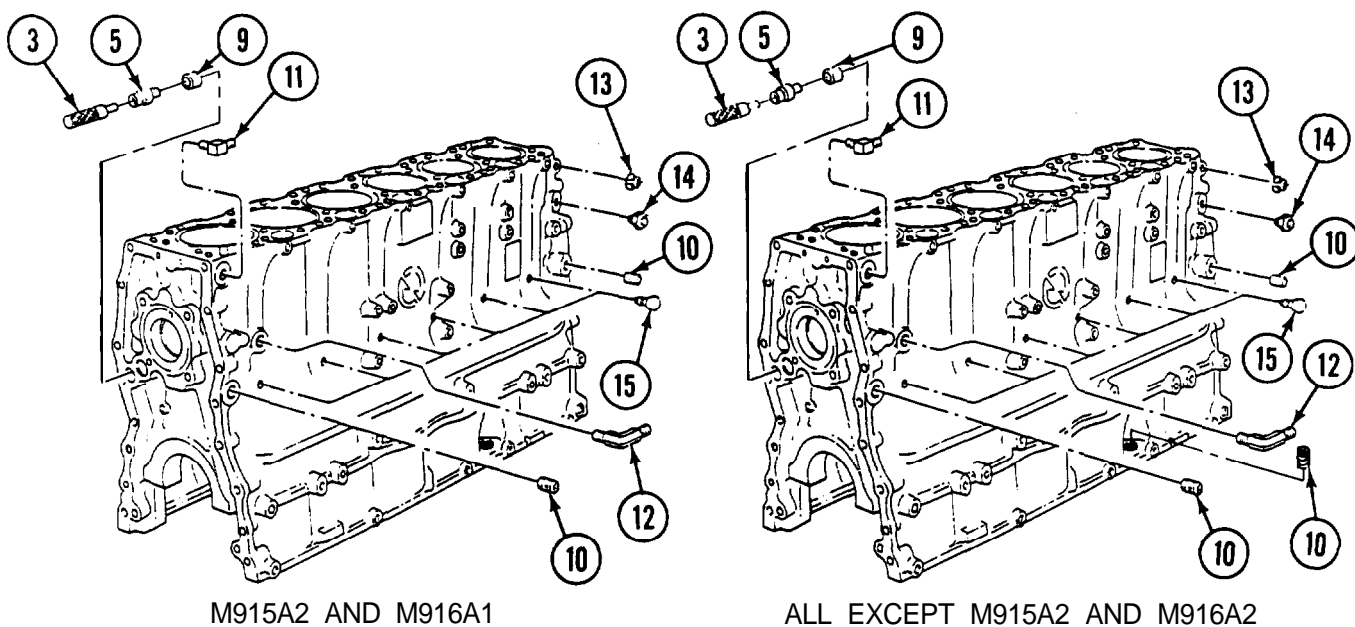


M915A2 AND M916A1

ALL EXCEPT M915A2 AND M916A1

RIGHT SIDE - REAR

1. COAT OUTSIDE SEALING EDGE OF FIVE 1-1/2-IN. DIAMETER CUP PLUGS (1) WITH NON-HARDENING SEALANT. USING SINGLE-SIDE PLUG INSTALLER (2) AND HANDLE (3), INSTALL FIVE CUP PLUGS (1) TO 0.098-0.118-IN. (2.5-3.0 mm) BELOW MACHINED SURFACES ON RIGHT SIDE OF CYLINDER BLOCK.
2. COAT OUTSIDE SEALING EDGE OF 1-IN. CUP PLUG (4) WITH NON-HARDENING SEALANT. USING SMALL END OF DOUBLE-ENDED PLUG INSTALLER (5) AND DRIVER HANDLE (3), INSTALL CUP PLUG (4) 0.098-0.118 IN.(2.5-3.0 mm) BELOW MACHINED SURFACE OF REAR OF CYLINDER BLOCK.
3. INSTALL TWO 3/8-IN. PIPE PLUGS (6) (M915A2 AND M916A1) OR PIPE PLUG (6) AND PIPE PLUG (6.1) (ALL EXCEPT M915A2 AND M916A1).
4. INSTALL FOUR 1/4-IN. PIPE PLUGS (7) (M915A2 AND M916A1) OR FIVE PIPE PLUGS (7) ( ALL EXCEPT M915A2 AND M916A1).
5. INSTALL DRAINCOCK (8) (M915A2 AND M916A1) OR STUD (8.1) (ALL EXCEPT M915A2 AND M916A1).



M915A2 AND M916A1

ALL EXCEPT M915A2 AND M916A2

## LEFT SIDE-FRONT

6. POSITION CYLINDER BLOCK TO VIEW LEFT SIDE.
7. COAT OUTSIDE SEALING EDGE OF 1-IN. CUP PLUG (9) WITH NON-HARDENING SEALANT. USING SMALL END OF DOUBLE-ENDED PLUG INSTALLER (5) AND HANDLE (3) INSTALL CUP PLUG (9) 0.098-0.118-IN. (2.5-3.0 mm) BELOW MACHINED SURFACE OF FRONT OF CYLINDER BLOCK.
8. INSTALL TWO 3/8-IN. PIPE PLUGS (10) (M915A2 AND M916A1) OR THREE PLUGS (10) (ALL EXCEPT M915A2 AND M916A1).

**NOTE**

Cylinder block repair conditions may warrant cylinder block pressure testing before complete block assembly. Perform testing after installing cylinder liners, cup plugs, and pipe plugs. (Refer to Cylinder Block Pressure Testing, page 12-88).

9. INSTALL AIR COMPRESSOR OIL SUPPLY LINE ELBOW (11).
10. INSTALL AIR COMPRESSOR COOLANT SUPPLY ELBOW (12).

**NOTE**

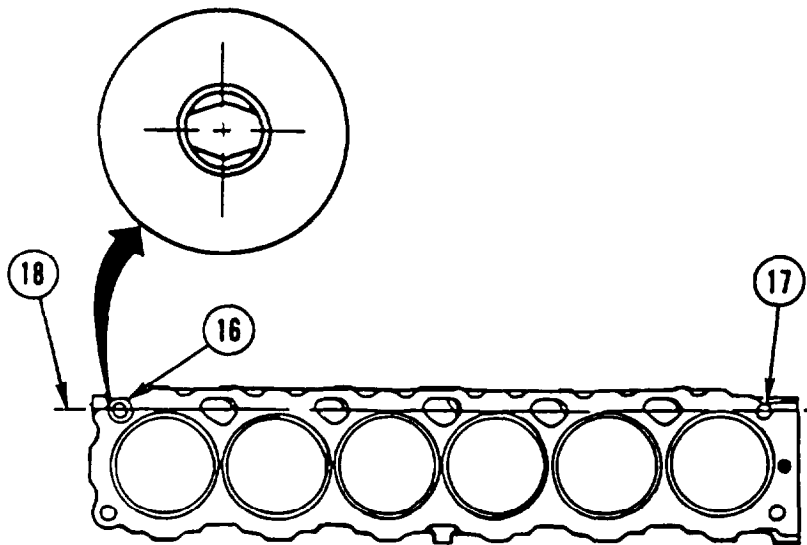
If cylinder block is not being placed in service, perform steps 11 thru 15.

11. INSTALL 1/4-IN. PIPE PLUGS IN TAPPED HOLES FOR OIL PRESSURE SENSOR (13) AND OIL TEMPERATURE SENSOR (14).
12. INSTALL 1/4-IN. PIPE PLUG IN PLACE OF AIR COMPRESSOR OIL SUPPLY LINE ELBOW (11).
13. INSTALL 1/2-IN. PIPE PLUG IN PLACE OF AIR COMPRESSOR COOLANT SUPPLY ELBOW (12).
14. INSTALL SIX WEEP HOLE PLUGS (15).
15. SPRAY OR DIP CYLINDER BLOCK IN POLAR-TYPE RUST PREVENTIVE FOR EXTENDED STORAGE.

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**CYLINDER BLOCK ASSEMBLY REPAIR (CONT)**

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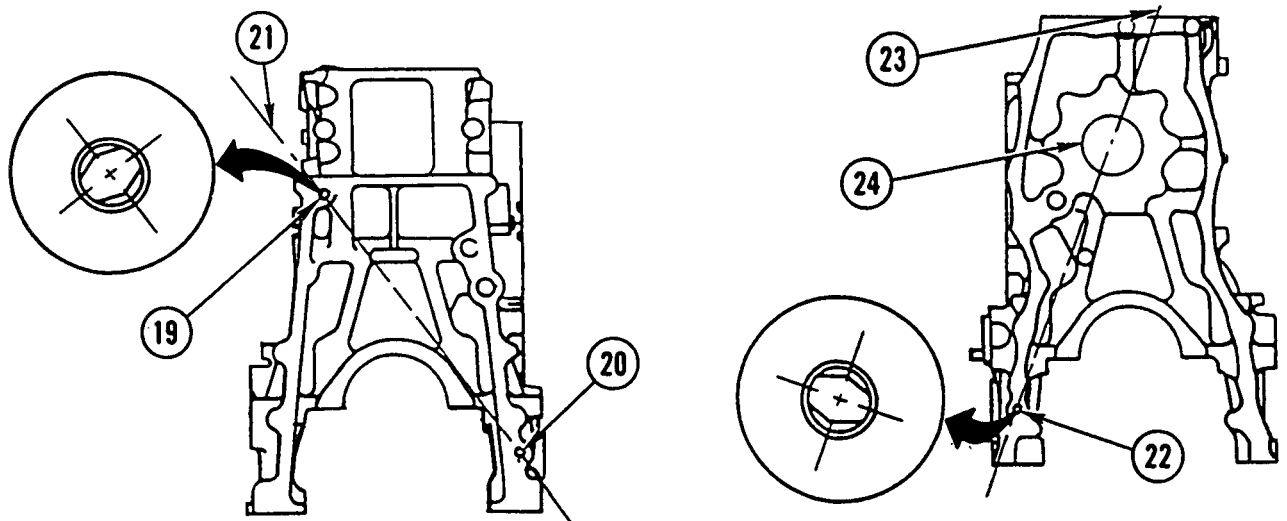
**CAUTION**

Make sure diamond dowels are correctly aligned. Orientation is critical to component alignment. Failure to correctly align diamond dowels could result in engine failure.

**NOTE**

If new cylinder block is being placed in service, perform steps 16 thru 21.

16. USING DOWEL INSTALLER, INSTALL DIAMOND DOWEL (16) AND ROUND DOWEL (17) IN CYLINDER BLOCK FIRE DECK TO HEIGHT OF 0.472 0.020 IN. (12.0 0.5 mm). ANGULAR ORIENTATION OF DIAMOND DOWEL MUST BE PERPENDICULAR TO CENTERLINE (18) THRU ROUND AND DIAMOND DOWELS WITHIN 4 DEGREES.



17. USING DOWEL INSTALLER, INSTALL DIAMOND DOWEL (19) AND ROUND DOWEL (20) IN REAR FACE OF CYLINDER BLOCK TO HEIGHT OF  $0.472 \pm 0.020$  IN. ( $12.0 \pm 0.5$  mm). ANGULAR ORIENTATION OF DIAMOND DOWEL MUST BE PERPENDICULAR TO CENTERLINE (21) THRU ROUND AND DIAMOND DOWELS WITHIN  $\pm 4$  DEGREES.
18. USING DOWEL INSTALLER, INSTALL DIAMOND DOWEL (22) IN FRONT FACE OF CYLINDER BLOCK TO HEIGHT OF  $0.472 \pm 0.020$  IN. ( $12.0 \pm 0.5$  mm). ANGULAR ORIENTATION OF DIAMOND DOWEL MUST BE PERPENDICULAR TO CENTERLINE (23) THRU BULL GEAR PILOT BORE (24) AND DIAMOND DOWEL WITHIN 4 DEGREES.
19. INSTALL AIR COMPRESSOR OIL SUPPLY LINE ELBOW.
20. INSTALL AIR COMPRESSOR COOLANT SUPPLY ELBOW.
21. INSTALL SIX WEEP HOLE PLUGS.
22. PERFORM CYLINDER BLOCK PRESSURE TESTING, PAGE 12-88.

#### NOTE

##### Follow-on Maintenance:

- Install crankshaft (page 12-41).
- Install piston and cylinder assembly (page 12-141).
- Install cylinder head (page 3-80).
- Install gear housing assembly (page 12-68).
- Install oil cooler, core, and oil filter adapter (TM 9-2320-363-20).
- Install oil bypass filter adapter and tube (TM 9-2320-363-20).
- Install oil fill tube (TM 9-2320-363-20).
- Install oil dipstick and tube (TM 9-2320-363-20).
- Install bypass filter adapter (TM 9-2320-363-20).
- Install fuel pump and lines (TM 9-2320-363-20).
- Install fuel filter adapters (TM 9-2320-363-20).
- Install electronic control module (TM 9-2320-363-20).
- Install engine wiring harness (TM 9-2320-363-20).
- Install oil temperature and oil pressure sending units (TM 9-2320-363-20).

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## CYLINDER BLOCK PRESSURE TESTING

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This task covers: Testing

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### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05  
Pressure Test Kit, J36223-C  
Eye Bolts, J35595  
Cylinder Lock Tester, J29006-5  
Cylinder Lock Adapter, J38768  
Screw, 8929129

#### Materials/Parts:

Plug, Pipe P/N 8923916

#### Personnel Required: (2)

#### Equipment Condition:

#### Reference

#### Condition Description

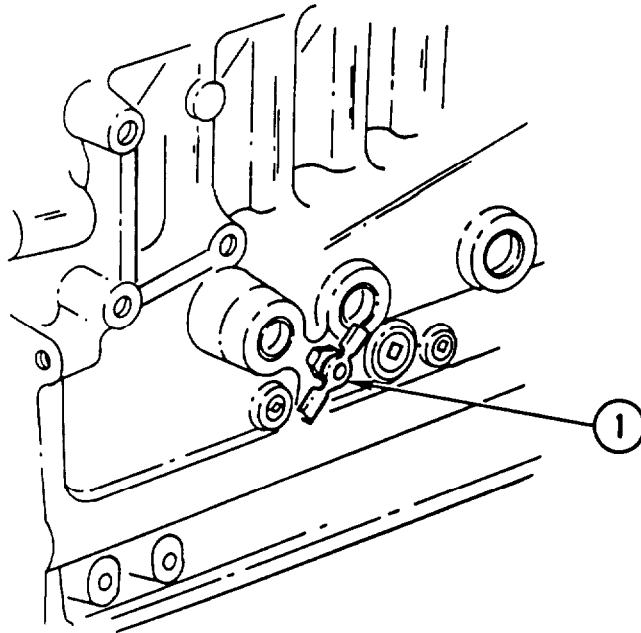
All components removed from cylinder block except necessary cup plugs, pipe plugs, and cylinder liners used for pressure testing.

#### General Safety Instructions:

#### **WARNING**

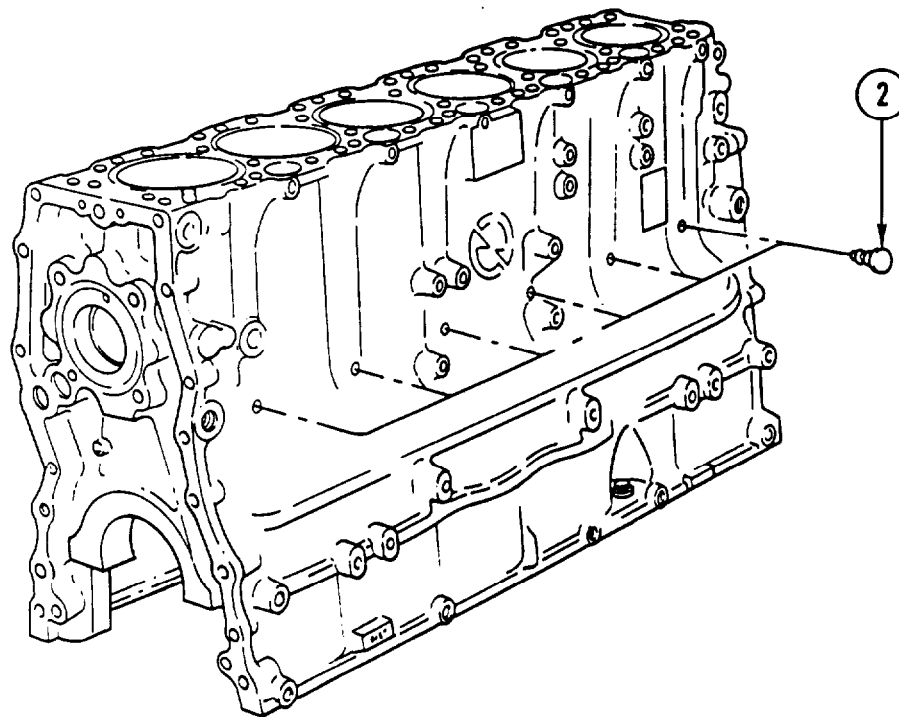
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.
- To prevent injury when working with steam or chemical solvents, wear adequate protective clothing (face shield, rubber apron, gloves, boots, etc.) and work in well-ventilated area.



**TESTING**

M915A2 AND M916A1

MAKE SURE DRAINCOCK (1) (M915A2 AND M916A1 ONLY) IS IN CLOSED POSITION.

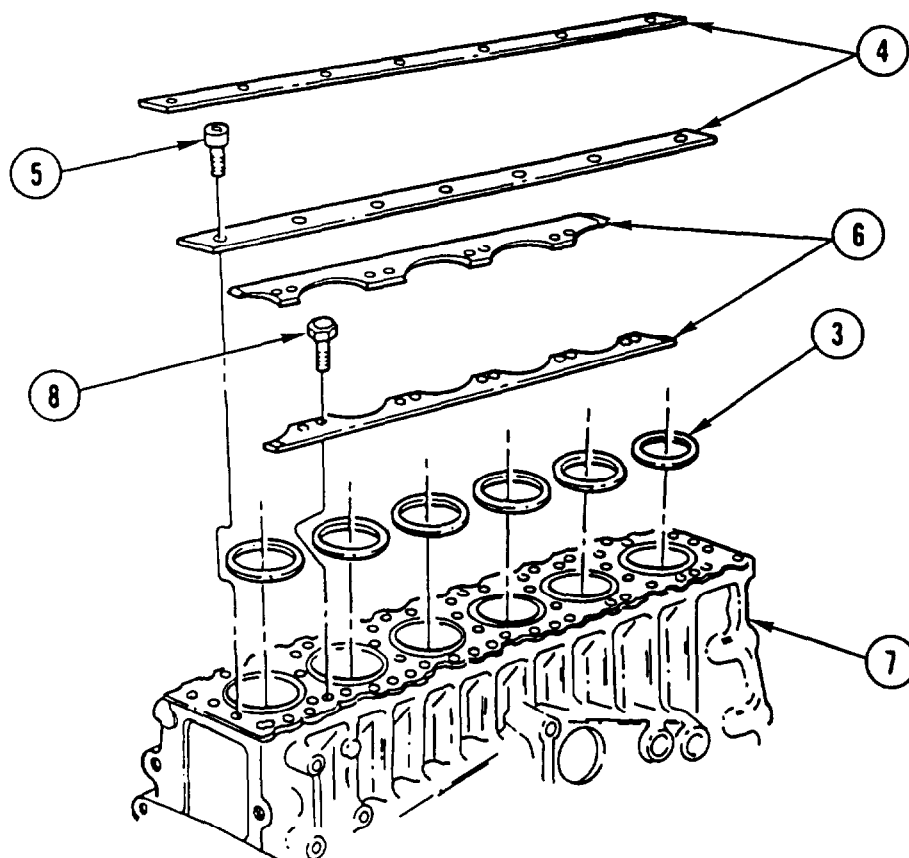


2. IF PRESENT, REMOVE SIX WEEP HOLE PLUGS (2).

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**CYLINDER BLOCK PRESSURE TESTING (CONT)**

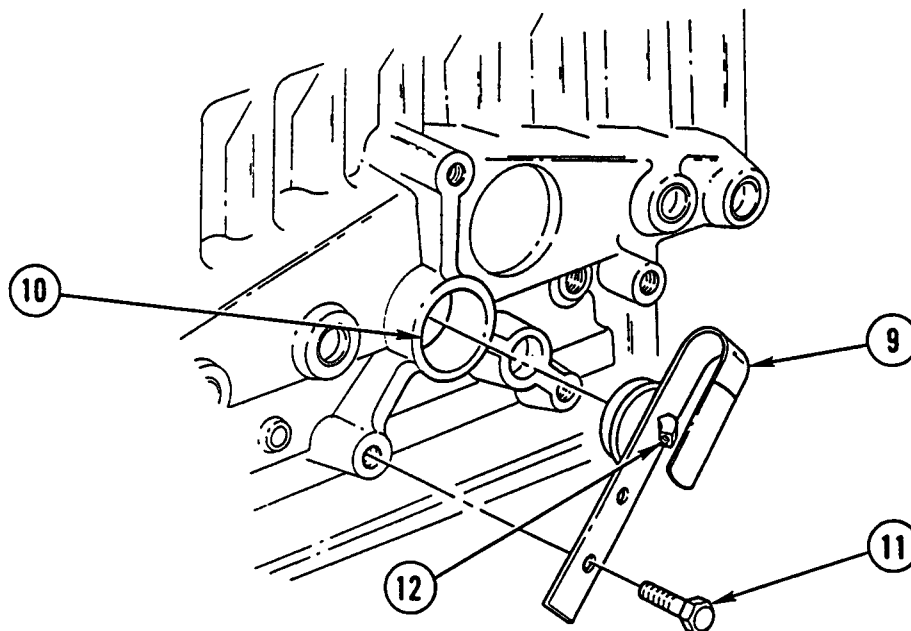
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**NOTE**

- Make sure all hose connectors and elbows are removed from block and holes are properly plugged.
- Make sure all cup plugs and pipe plugs are in place.
- Make sure all cylinder lines, cylinder liner seal rings, and crevice seals are in place.

3. FROM CYLINDER BLOCK PRESSURE TEST KIT, POSITION SIX TEST RINGS (3) ON TOP OF CYLINDER LINER FLANGES. INSTALL TWO TEST RING RETAINING STRIPS (4).
4. INSTALL 14 BOLTS (5) AND TIGHTEN TO 170-175 LB-FT (230-237 N.m).
5. POSITION 2 OUTSIDE SEALING STRIPS (6) ON CYLINDER BLOCK (7) WITH RUBBER SURFACE AGAINST CYLINDER BLOCK (7). INSTALL 20 BOLTS (8) AND TIGHTEN TO 10 LB-FT (14 N.m).



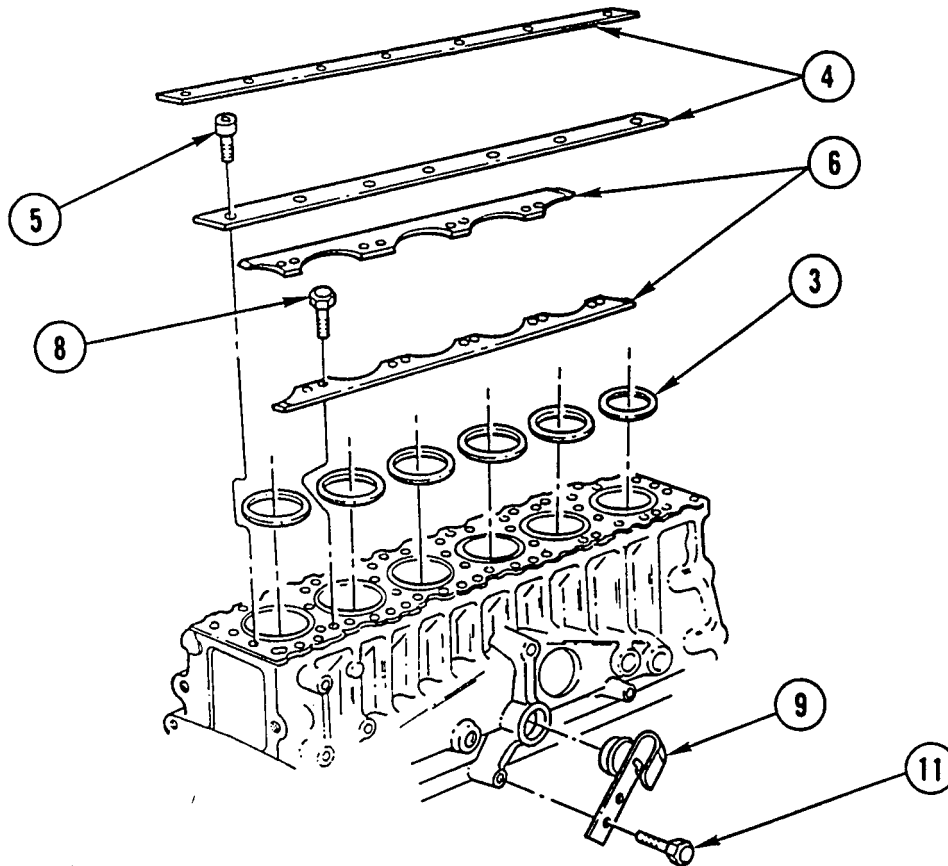
6. INSTALL WATER MANIFOLD COVER (9) IN OIL COOLER NECK OPENING (10). USE BOLT (11) SUPPLIED TO SECURE WATER MANIFOLD COVER (9).
7. ATTACH AIR LINE TO FITTING (12) ON UPPER MANIFOLD COVER.

**WARNING**

To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

8. APPLY 20 PSI (138 kPa) AIR PRESSURE TO CYLINDER BLOCK USING ATTACHED AIR LINE.
9. SPRAY CYLINDER BLOCK WITH SOAP SOLUTION AND OBSERVE SOLUTION FOR BUBBLES, INDICATING CRACKS OR LEAKS. IF CRACKS ARE DETECTED, REPLACE CYLINDER BLOCK.
10. REMOVE AIR SUPPLY LINE.

## CYLINDER BLOCK PRESSURE TESTING (CONT)



11. REMOVE 20 BOLTS (8) AND 2 OUTSIDE SEALING STRIPS (6).
12. REMOVE 14 BOLTS (5), 2 TEST RING RETAINING STRIPS (4), AND 6 TEST RINGS (3).
13. REMOVE BOLT (11) AND WATER MANIFOLD COVER (9).
14. BLOW OUT ALL PASSAGES AND BOLT HOLES WITH COMPRESSED AIR.

## BULL/IDLER GEAR REPLACEMENT

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

### INITIAL SETUP

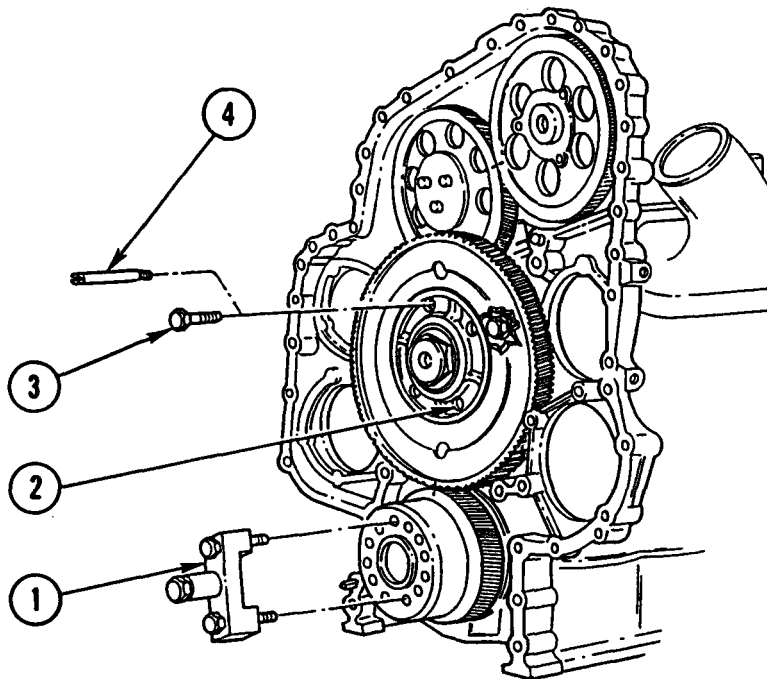
#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Guide Stud (2), J35785  
 Crankshaft Protector, J35994  
 Engine Barring Tool, J36237

#### Equipment Condition:

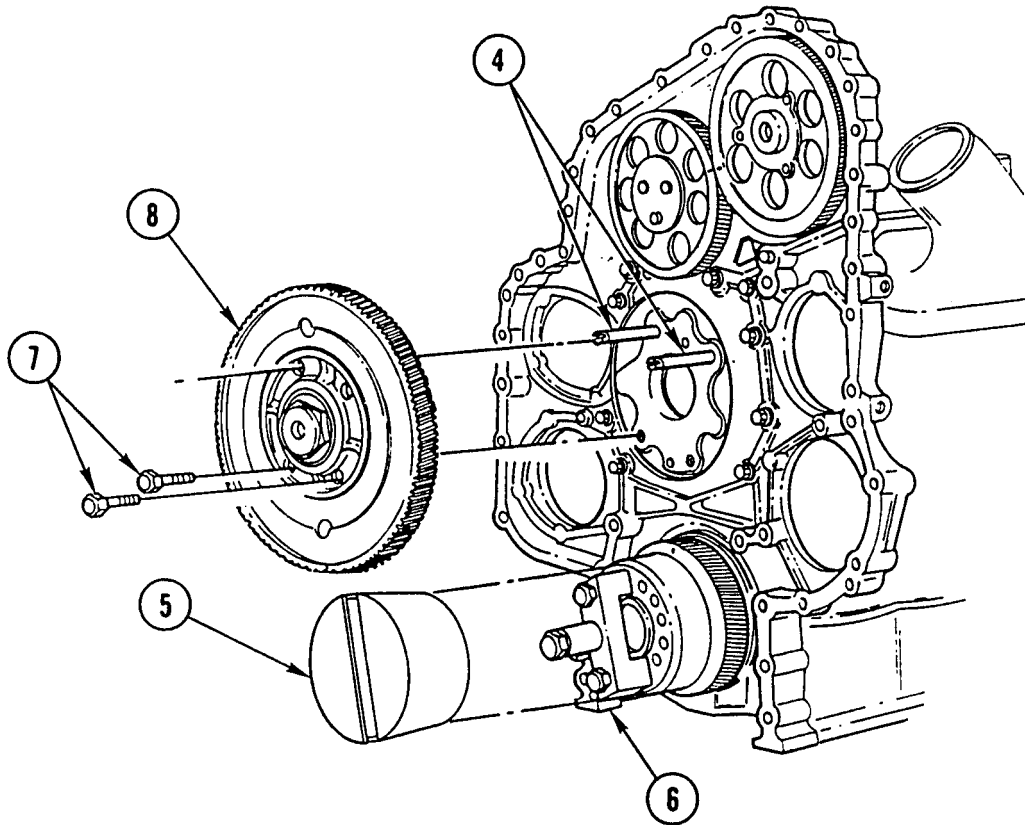
Reference	Condition Description
Page 3-116	Gear Case Cover Removed
Page 3-183	Rocker Arm Assemblies Removed
Page 12-3	Engine Installed on Repair Stand

### REMOVAL



1. INSTALL ENGINE BARRING TOOL (1) ON FRONT END OF CRANKSHAFT. BAR ENGINE OVER UNTIL FOUR ACCESS HOLES (2) IN BULL/IDLER GEAR LINE UP WITH FOUR BOLTS (3) IN CYLINDER BLOCK.
2. REMOVE TWO UPPER BOLTS (3) AND INSTALL TWO GUIDE STUDS (4).

## **BULL/IDLER GEAR REPLACEMENT (CONT)**



3. INSTALL CRANKSHAFT PROTECTOR (5) ON END OF CRANKSHAFT OVER ENGINE BARRING TOOL (6).
4. REMOVE TWO LOWER BOLTS (7).

### **CAUTION**

Do not allow bull/idler gear to come in contact with cranksaft oil seal contact surface. Oil leaks may result if this surface is scratched.

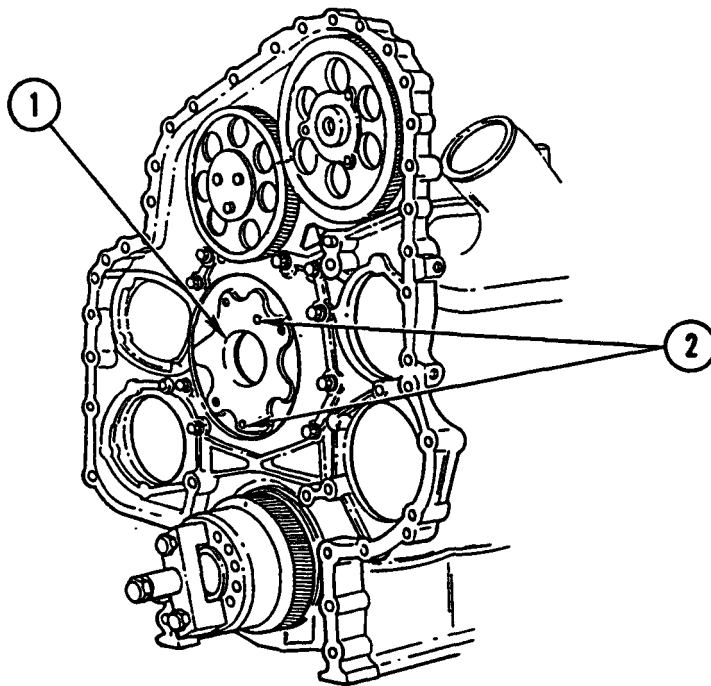
### **NOTE**

Bull/idler gear will rotate slightly as it is being removed.

5. GRASP BULL/IDLER GEAR (8) AND PULL OUT OF CYLINDER BLOCK RECESS.
6. REMOVE TWO GUIDE STUDS (4).

**CLEANING**

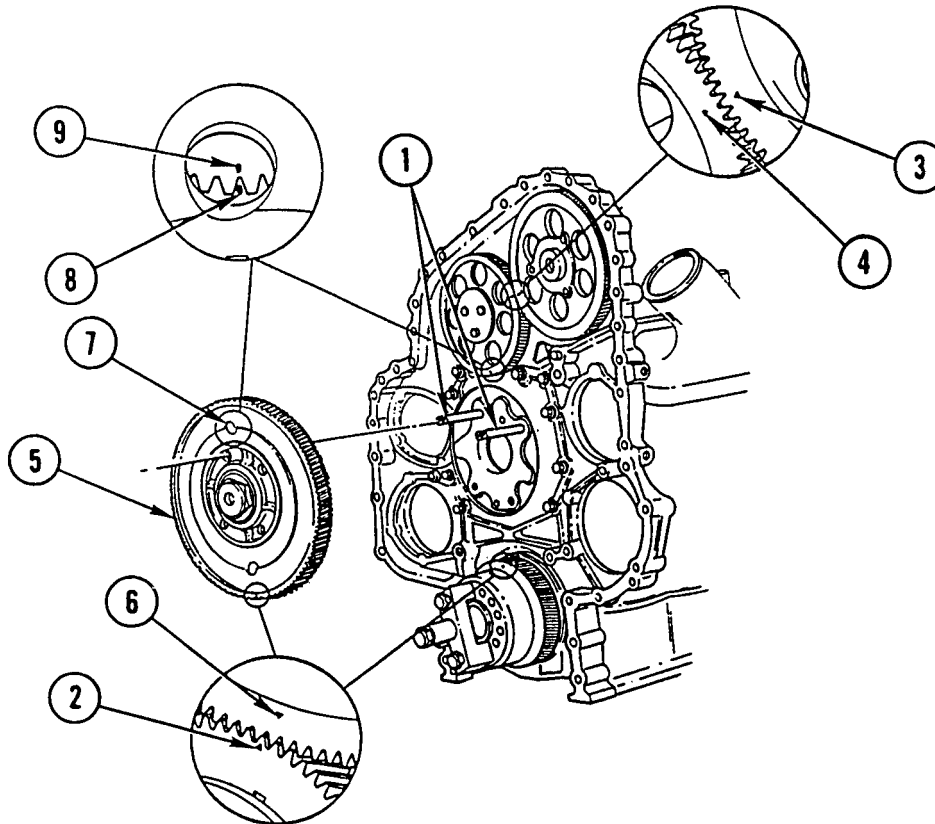
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

1. INSPECT BULL/IDLER GEAR RECESS (1) IN CYLINDER BLOCK. MAKE SURE SURFACES ARE CLEAN AND FREE OF FOREIGN MATERIAL OR DAMAGE AND THAT TWO LUBRICATION HOLES (2) ARE CLEAR.
2. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

## BULL/IDLER GEAR REPLACEMENT (CONT)

### INSTALLATION



#### **CAUTION**

Make sure all timing marks are aligned as shown. Failure to do so will result in engine damage.

1. INSTALL TWO GUIDE STUDS (1) IN TWO UPPER BULL/IDLER GEAR BOLT HOLES.
2. BAR ENGINE OVER UNTIL CRANKSHAFT TIMING GEAR TIMING MARK (2) IS AT 12 O'CLOCK POSITION.
3. ALINE TIMING MARK (3) ON CAMSHAFT DRIVE GEAR WITH TIMING MARK (4) ON ADJUSTABLE GEAR.

#### **CAUTION**

Do not allow bull/idler gear to come in contact with crankshaft oil seal contact surface. Oil leaks may result if this surface is scratched.

4. INSTALL BULL/IDLER GEAR (5) ON TWO GUIDE STUDS (1). SLIDE ASSEMBLY TOWARD ENGINE. BUT DO NOT ENGAGE ANY GEARS.

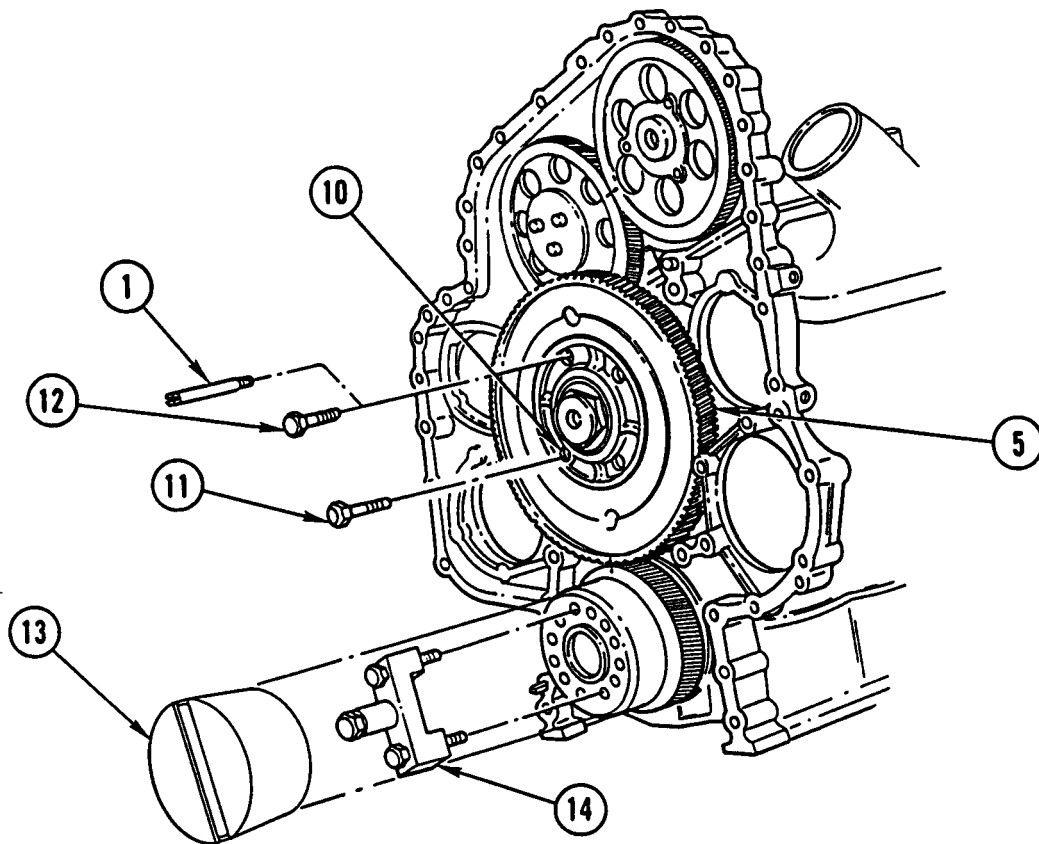


5. ALINE TIMING MARK (6) ON BULL/IDLER GEAR WITH TIMING MARK (2) ON CRANKSHAFT TIMING GEAR. ENGAGE BULL/IDLER GEAR AND CRANKSHAFT TIMING GEAR ONLY ENOUGH TO PREVENT ROTATION OF BULL/IDLER GEAR.

**NOTE**

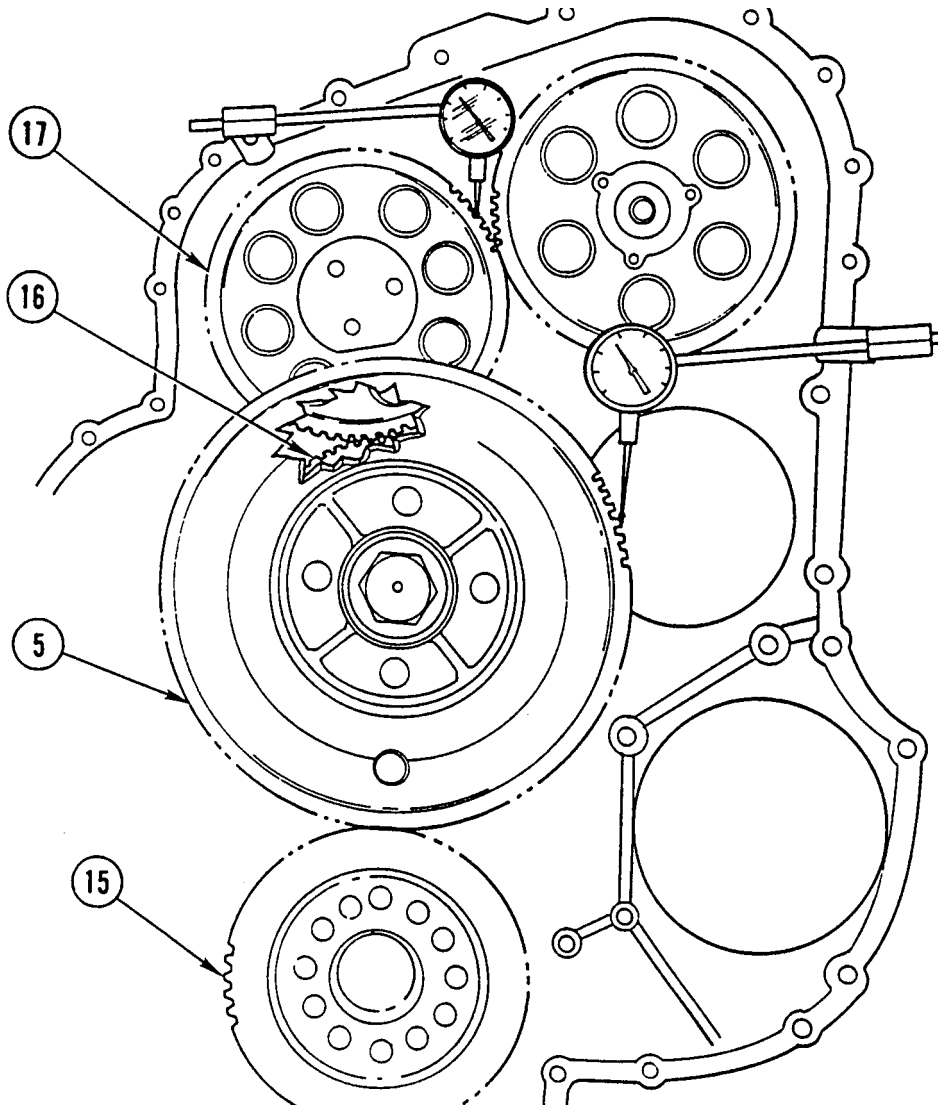
Slight rotation of adjustable idler gear may be necessary to aline timing marks.

6. LOOKING THRU VIEWING HOLE (7) IN BULL/IDLER GEAR, ALINE TIMING MARK (8) ON ADJUSTABLE IDLER GEAR WITH TIMING MARK (9) ON CAMSHAFT IDLER GEAR.
7. SLIDE BULL/IDLER GEAR TOWARD ENGINE, ENGAGING ADJUSTABLE GEAR AND SEAT ASSEMBLY IN RECESS OF GEAR CASE AND CYLINDER BLOCK.



8. WORKING THRU TWO ACCESS HOLES (10) IN BULL/IDLER GEAR (5), INSTALL TWO MOUNTING BOLTS (11) THRU HUB AND INTO CYLINDER BLOCK. TIGHTEN BOLTS HAND-TIGHT.
9. REMOVE TWO GUIDE STUDS (1) AND INSTALL TWO MOUNTING BOLTS (12). TIGHTEN BOLTS TO 75-86 LB-FT (101-116 N.m).
10. REMOVE CRANKSHAFT PROTECTOR (13) AND ENGINE BARRING TOOL (14).

## BULL/IDLER GEAR REPLACEMENT (CONT)



11. MEASURE GEAR LASH BETWEEN CRANKSHAFT TIMING GEAR (15) TO BULL/IDLER GEAR (5). ALLOWABLE LASH IS 0.002-0.007 IN. (0.051-0.178 mm).
12. MEASURE GEAR LASH BETWEEN CAMSHAFT IDLER GEAR (16) TO ADJUSTABLE IDLER GEAR (17). ALLOWABLE LASH IS 0.002-0.007 IN. (0.051-0.178 mm).

### NOTE

Follow-on Maintenance:  
Install rocker arm assemblies (page 3-183).  
Install gear case cover (page 3-116).

## ADJUSTABLE IDLER GEAR REPLACEMENT

This task covers: a. Removal b. Cleaning c. Inspection d. Installation e. Adjustment

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Cam/Idler Lash Adjuster, J35596  
 Magnetic Base Dial Indicator, J7872  
 Engine Barring Tool, J36237

#### Materials/Parts:

Solvent, Drycleaning      Appendix B, Item 54  
 Oil, Lubricating          Appendix B, Item 37

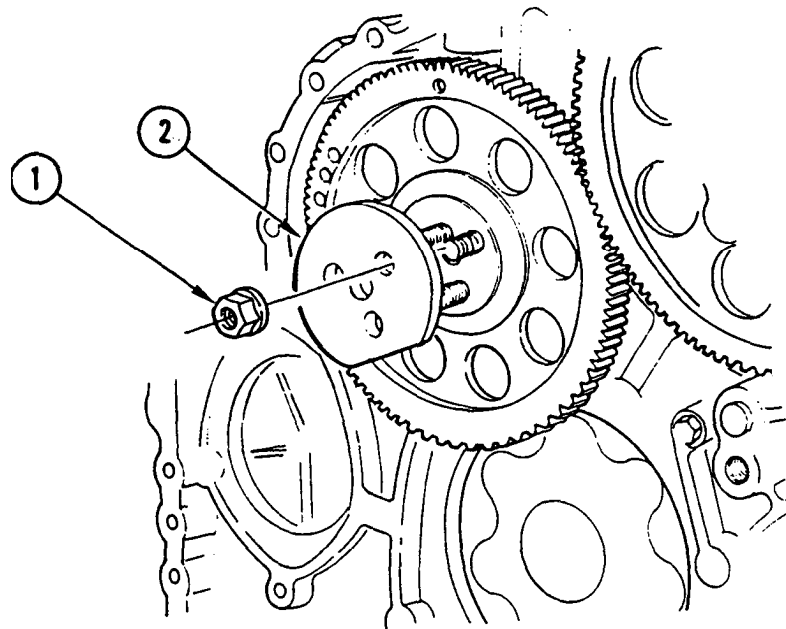
#### Equipment Condition:

Reference	Condition Description
Page 3-183	Rocker Arm Assemblies Removed
Page 12-3	Engine Installed on Repair Stand
Page 12-93	Bull/Idler Gear Removed

#### General Safety Instructions:

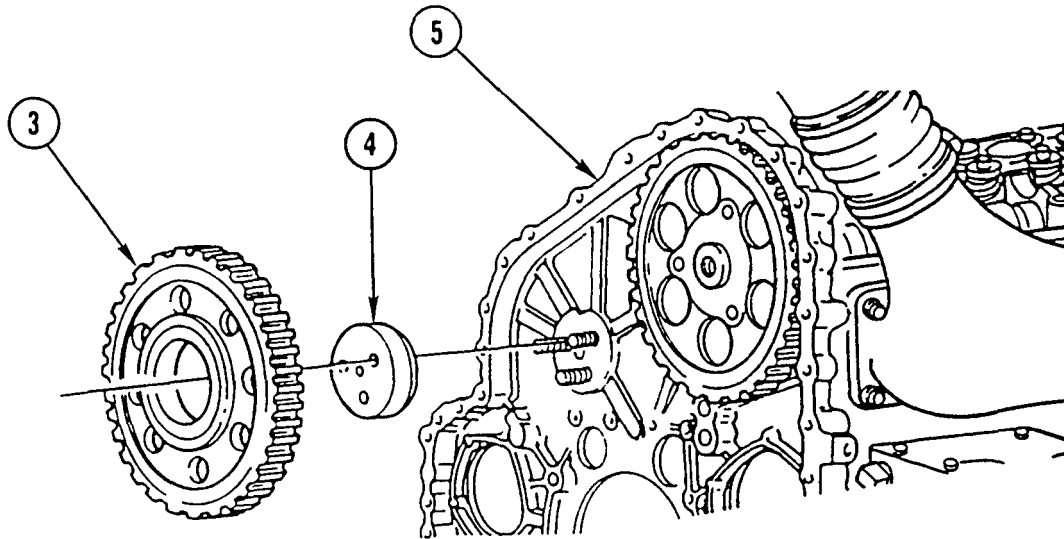
**WARNING**  
 To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

### REMOVAL



1. REMOVE THREE NUTS (1) AND RETAINING PLATE (2).

## ADJUSTABLE IDLER GEAR REPLACEMENT (CONT)



2. REMOVE ADJUSTABLE IDLER GEAR (3) AND HUB (4) FROM GEAR HOUSING ASSEMBLY (5).

### **CLEANING**

#### **WARNING**

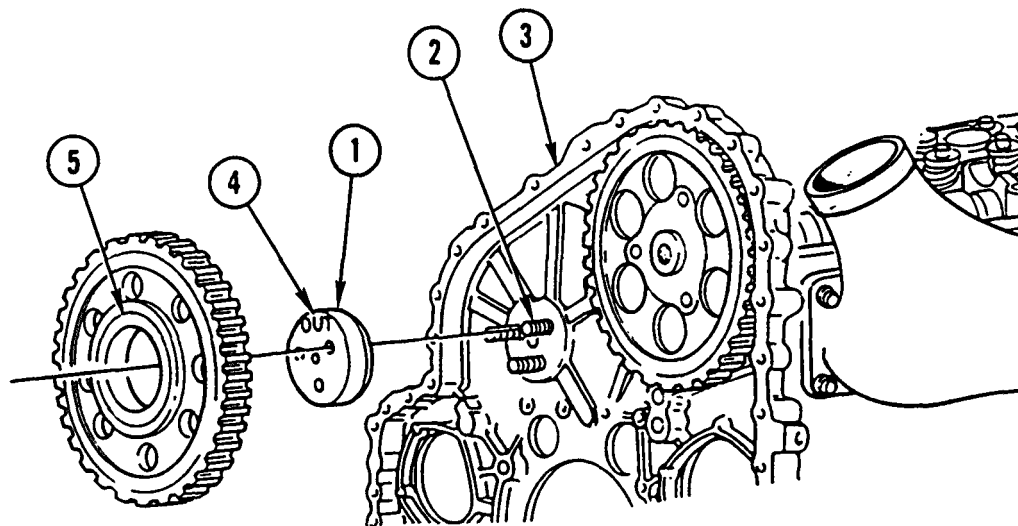
To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

1. WASH ADJUSTABLE IDLER GEAR, HUB, AND RETAINING PLATE THOROUGHLY IN CLEAN SOLVENT AND DRY WITH COMPRESSED AIR.
2. USE GENERAL CLEANING METHODS TO CLEAN ALL PARTS (PAGE 2-30).

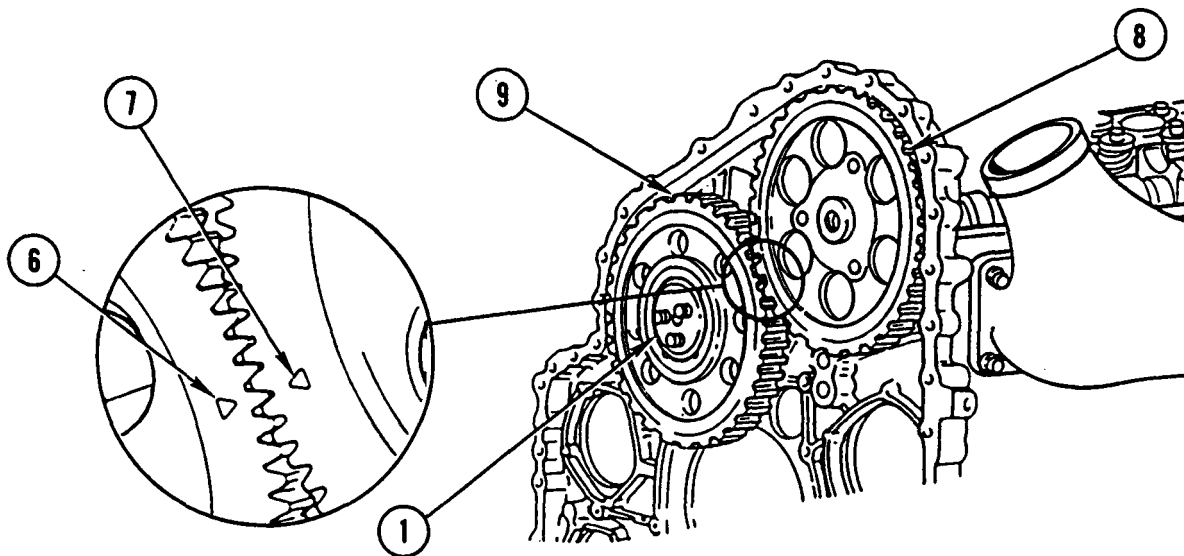
### **INSPECTION**

1. EXAMINE ADJUSTABLE IDLER GEAR TEETH FOR SCORING, PITTING, AND WEAR. IF DAMAGED OR WORN, REPLACE ADJUSTABLE IDLER GEAR. INSPECT OTHER GEAR TRAIN GEARS.
2. INSPECT CONTACT SURFACE OF HUB FOR SCORING OR EVIDENCE OF OVERHEATING (BLUE DISCOLORATION). REPLACE HUB IF IT HAS BEEN OVERHEATED. CHECK LUBRICATION HOLE AND GEAR CASE GALLERY FOR BLOCKAGE. SLIGHT IRREGULARITIES IN HUB CONTACT SURFACE MAY BE REMOVED WITH FINE STONE OR EMERY CLOTH.
3. INSPECT BUSHING CONTACT SURFACE FOR SIGNS OF SCORING, DISCOLORATION DUE TO OVERHEATING, OR EXCESSIVE WEAR. ALLOWABLE CLEARANCE BETWEEN BUSHING AND HUB IS 0.0013-0.0030 IN. (0.035-0.078 mm). REPLACE GEAR AND BUSHING AS ASSEMBLY IF CLEARANCE IS MORE THAN ALLOWABLE, OR IF SURFACE OF BUSHING IS SCORED OR HAS BEEN OVERHEATED.

**INSTALLATION**



1. INSTALL HUB (1) ON THREE STUDS (2) IN GEAR HOUSING ASSEMBLY (3). WORD "OUT" (4) STAMPED ON HUB (1) MUST BE AT TOP AND FACING FORWARD. LUBRICATE HUB (1) AND ADJUSTABLE IDLER GEAR BUSHING (5) WITH CLEAN ENGINE LUBRICATING OIL.



**CAUTION**

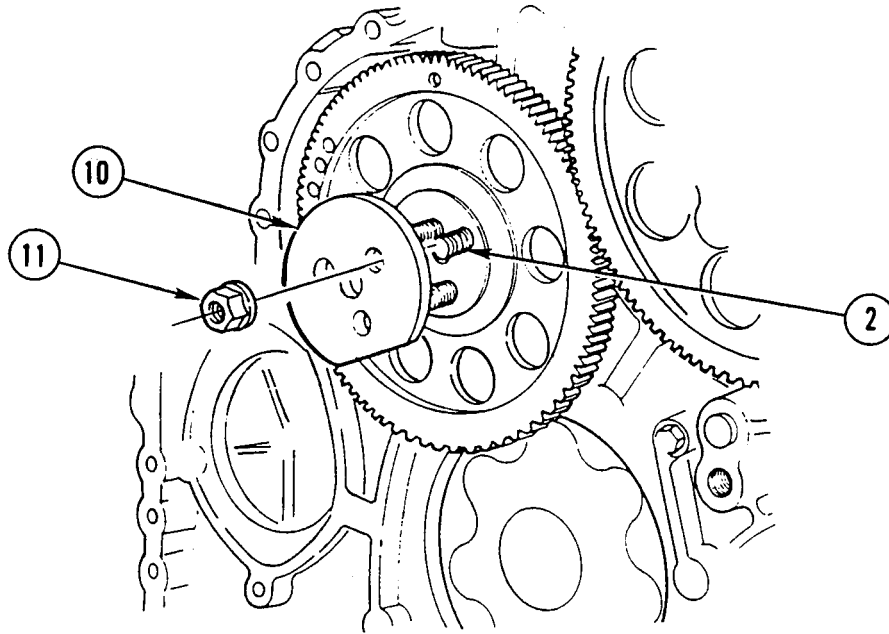
Two timing marks are on adjustable idler gear. Diamond shaped mark must align with diamond mark on camshaft drive gear. Other mark should be between 5 and 6 o'clock to prevent damage to equipment.

**NOTE**

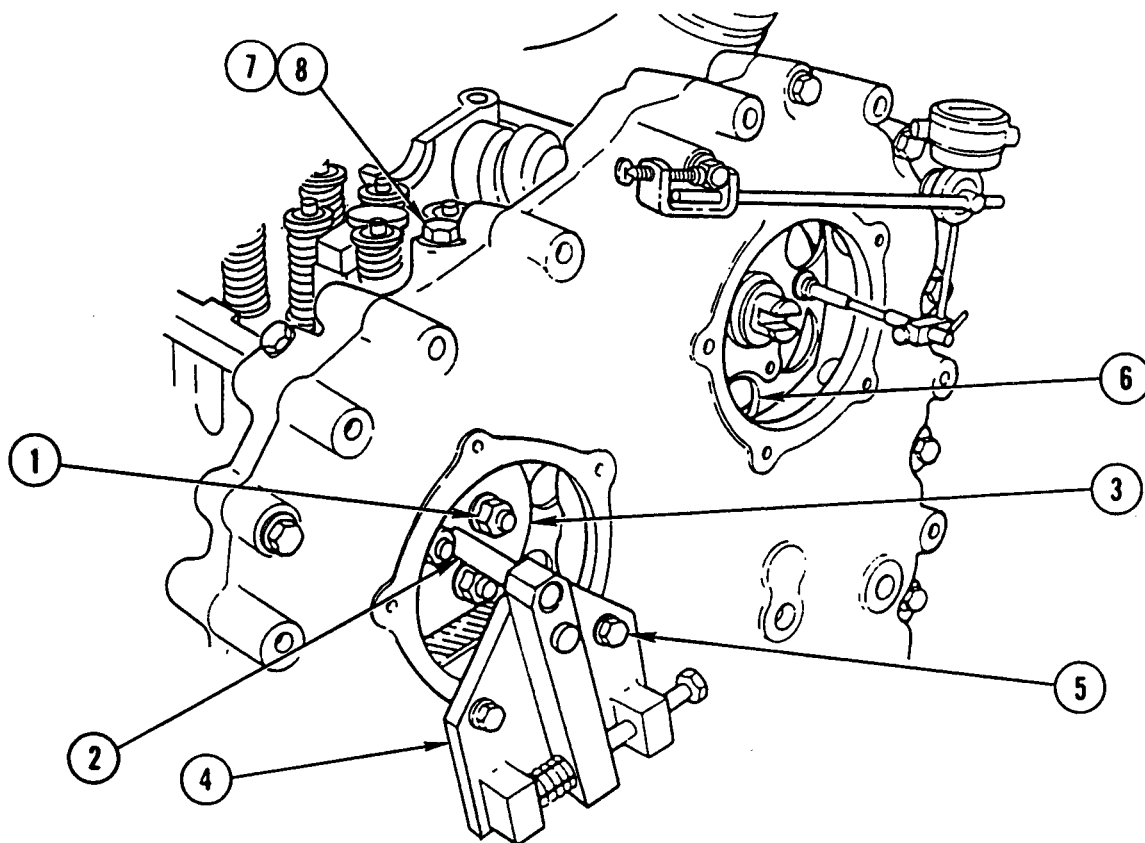
Make sure timing marks on adjustable idler gear are facing outward.

2. ALINE ADJUSTABLE IDLER GEAR DIAMOND TIMING MARK (6) WITH DIAMOND TIMING MARK (7) ON CAMSHAFT DRIVE GEAR (8) AND INSTALL ADJUSTABLE IDLER GEAR (9) ON HUB (1).

## ADJUSTABLE IDLER GEAR REPLACEMENT (CONT)



3. INSTALL RETAINING PLATE (10) ON THREE STUDS (2) WITH RELIEF PORTION OF PLATE (10) DOWN.
4. INSTALL THREE NUTS (11) ON THREE STUDS (2). TIGHTEN TO 42-49 LB-FT (57-67 N.m).
5. INSTALL BULL/IDLER GEAR ASSEMBLY (PAGE 12-93).
6. MEASURE GEAR LASH BETWEEN ADJUSTABLE IDLER GEAR AND BULL/IDLER GEAR ASSEMBLY. GEAR LASH SHOULD BE 0.001-0.010 IN. (0.025-0.254 mm).
7. INSTALL GEAR CASE COVER (PAGE 3-116) WITHOUT FAN DRIVE SUPPORT.
8. MEASURE GEAR LASH BETWEEN ADJUSTABLE IDLER GEAR AND CAMSHAFT DRIVE GEAR. USING CAM/IDLER LASH ADJUSTER, GEAR LASH SHOULD BE 0.001-0.010 IN. (0.025-0.254 mm). READING IS ONE-HALF OF ACTUAL MEASUREMENT. MULTIPLY READING BY 2 TO DETERMINE SPECIFICATION.

**ADJUSTMENT**

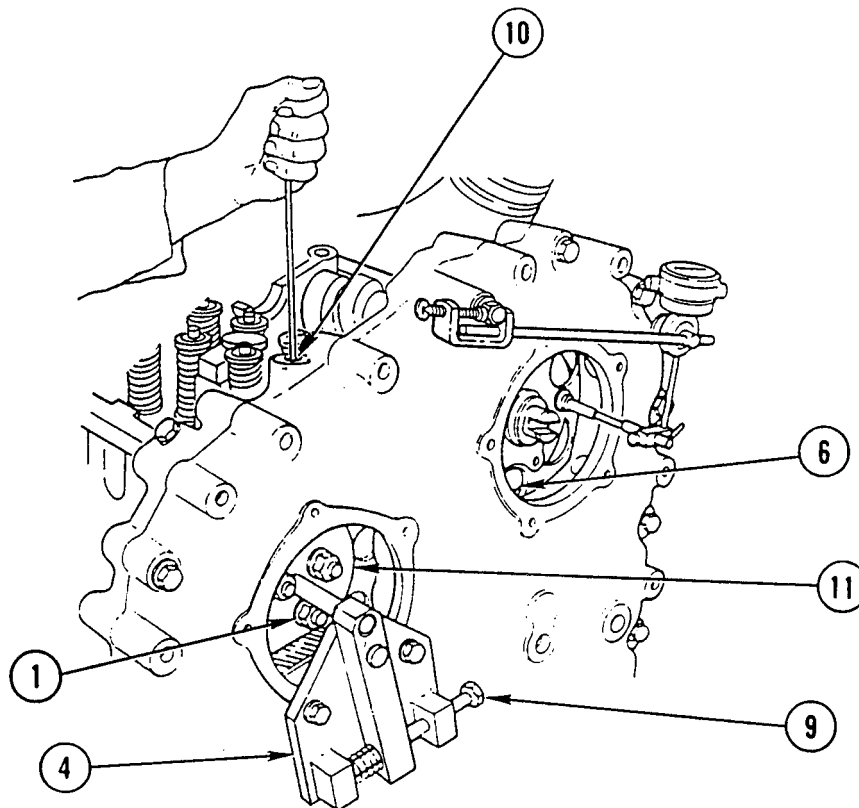
1. LOOSEN THREE NUTS (1) UNTIL HAND-TIGHT.
2. INSERT DOWEL PORTION OF CAM/IDLER LASH ADJUSTER (2) IN CENTER HOLE OF RETAINING PLATE (3).
3. SECURE ENGINE BARRING TOOL (4) TO BOTTOM OF ACCESS COVER OPENING WITH TWO ACCESS COVER BOLTS (5). TIGHTEN BOLTS TO 20 LB-FT (28 N.m).
4. INSTALL CAM/IDLER LASH PEDESTAL IN THREADED HOLE IN LEG OF CAMSHAFT DRIVE GEAR (6).

**NOTE**

Make sure dial indicator rests squarely on pedestal flat.

5. MOUNT DIAL INDICATOR SO STEM OF INDICATOR RESTS ON SCRIBED LINE OF PEDESTAL FLAT.
6. REMOVE BOLT (7) AND WASHER (8).

## ADJUSTABLE IDLER GEAR REPLACEMENT (CONT)



7. TURN ADJUSTING SCREW (9) CLOCKWISE TO MOVE ADJUSTABLE IDLER GEAR TOWARD CAMSHAFT DRIVE GEAR (6) UNTIL THERE IS ZERO LASH.
8. INSERT SCREWDRIVER THRU ACCESS BOLT HOLE (10) AND ENGAGE ADJUSTABLE IDLER GEAR TOOTH (11) TO DETERMINE GEAR LASH.
9. APPLY PRESSURE ON SCREWDRIVER TO HOLD ADJUSTABLE IDLER GEAR IN COUNTERCLOCKWISE DIRECTION AND ATTEMPT TO MOVE CAMSHAFT DRIVE GEAR (6) BY HAND. WATCH DIAL INDICATOR POINTER. IF THERE IS ZERO LASH, POINTER WILL NOT MOVE.

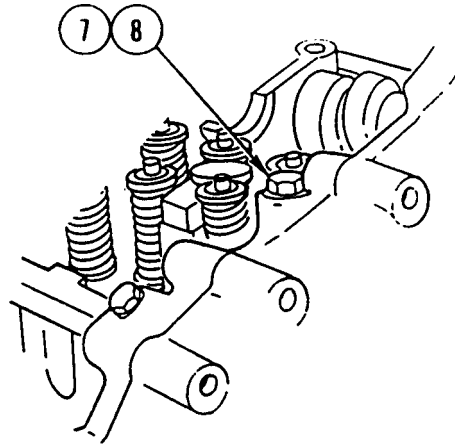
### NOTE

Gear lash reading obtained on cam/idler lash pedestal is one-half actual gear lash. Reading on dial indicator must be doubled to determine if specification is met.

10. WHEN ZERO LASH IS OBTAINED, TURN ADJUSTING SCREW (9) APPROXIMATELY 1-1/2 TURNS COUNTERCLOCKWISE OR UNTIL CORRECT GEAR LASH IS OBTAINED.
11. BAR ENGINE TO CHECK ADJUSTABLE IDLER GEAR LASH ON CAMSHAFT DRIVE GEAR (6) AT 3, 6, 9, AND 12 O'CLOCK POSITIONS.
12. WHEN GEAR LASH IS 0.002-0.007 IN. (0.051-0.178 mm) AT ALL FOUR POSITIONS, TIGHTEN TWO TOP NUTS (1) TO 42-49 LB-FT (57-67 N.m).



13. REMOVE CAM/IDLER LASH ADJUSTER (4) AND TIGHTEN LOWER NUT TO 42-49 LB-FT (57-67 N.m).
14. REMOVE GEAR LASH PEDESTAL FROM CAMSHAFT DRIVE GEAR (6).



15. INSTALL WASHER (8) AND BOLT (7). TIGHTEN BOLT TO 75-86 LB-FT (101-116 N.m).

**NOTE**

Follow-on Maintenance:

- Install rocker arm assemblies (page 3-183).
- Install bull/idler gear (page 12-93).
- Remove engine from repair stand (page 12-3).

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## ACCESSORY DRIVE REPAIR

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This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Service Set, J36024-1A  
 Gear Lash Checker, J38662

#### Materials/Parts:

Seal, Oil	P/N V484156VG
Bearing, Ball	P/N BBA194940
Bearing, Needle	P/N JH-2216

#### Materials/Parts (Cont):

Nut, Lock	P/N 11509584
Oil, Lubricating	Appendix B, Item 37
Lubriplate 105	Appendix B, Item 35

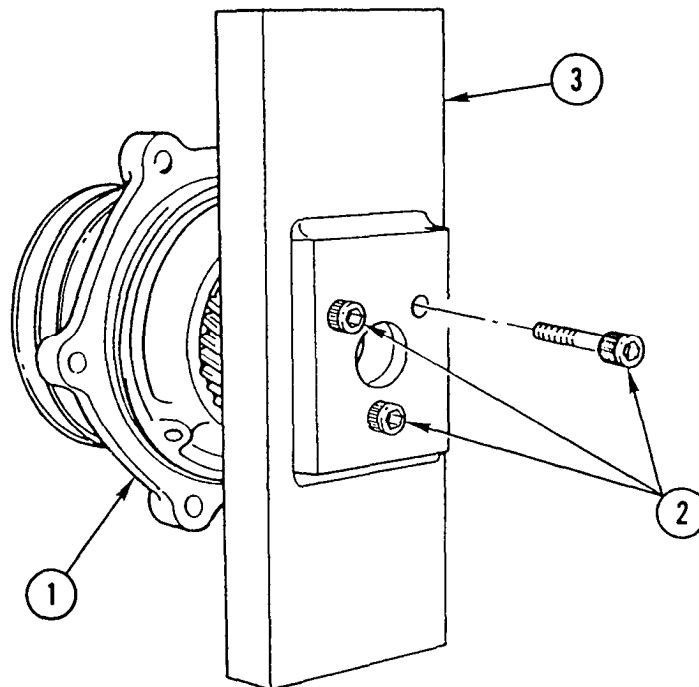
#### Equipment Condition:

Reference	Condition Description
Page 3-126	Accessory Drive Removed

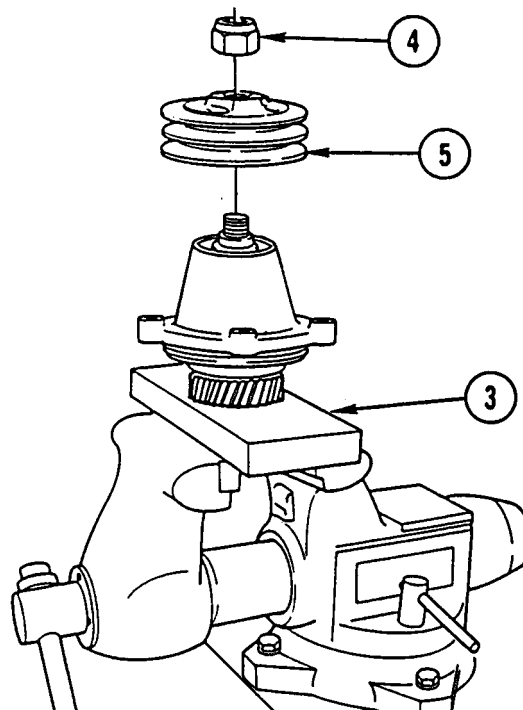
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### DISASSEMBLY

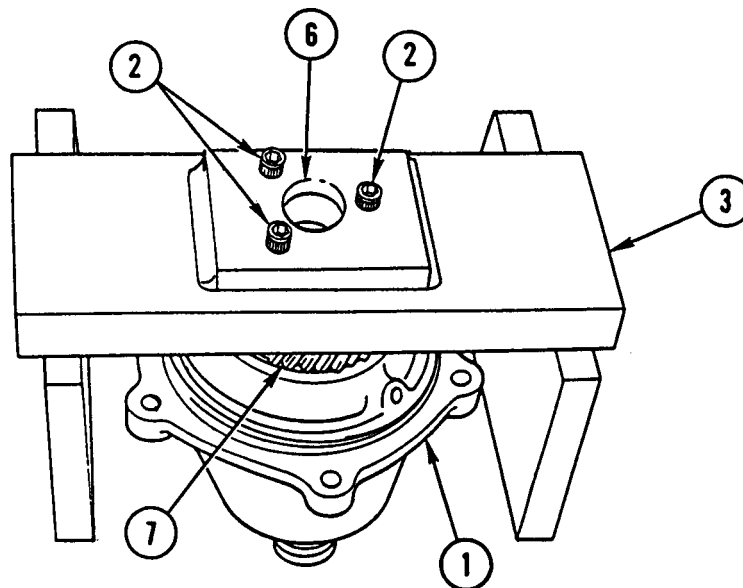
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1. INSTALL ACCESSORY DRIVE ASSEMBLY (1) AND THREE FIXTURE SCREWS (2) ON SERVICE SET HOLDING FIXTURE (3).

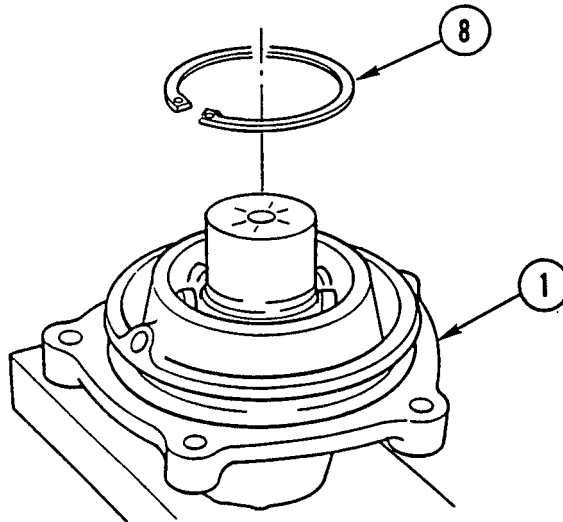


2. PLACE SERVICE SET HOLDING FIXTURE (3) IN VISE AND REMOVE ACCESSORY DRIVE PULLEY LOCK NUT (4). DISCARD LOCK NUT.
3. REMOVE ACCESSORY DRIVE PULLEY (5) BY TAPPING WITH RUBBER HAMMER OR FIBER Mallet. REMOVE SERVICE SET HOLDING FIXTURE (3) FROM VISE.

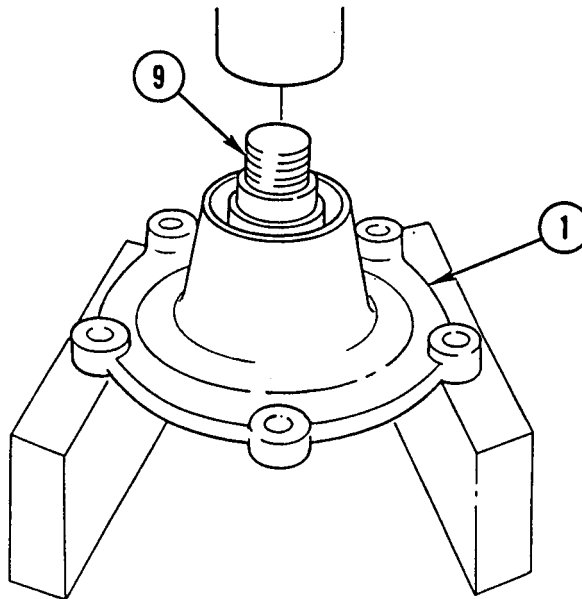


4. POSITION ACCESSORY DRIVE ASSEMBLY (1) ON PRESS BED WITH SERVICE SET HOLDING FIXTURE (3) SUPPORTED. USING HYDRAULIC PRESS, APPLY PRESSURE THRU HOLDING FIXTURE ACCESS HOLE (6) AND PRESS ACCESSORY DRIVE ASSEMBLY (1) OUT OF ACCESSORY DRIVE GEAR (7). REMOVE THREE SCREWS (2) AND ACCESSORY DRIVE GEAR (7).

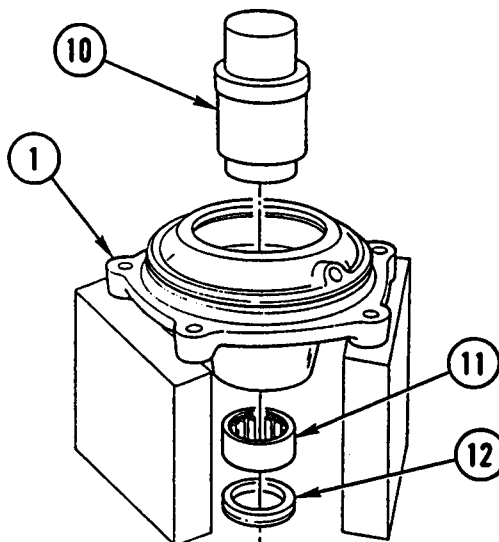
## ACCESSORY DRIVE REPAIR (CONT)



5. REMOVE SNAP RING (8) FROM ACCESSORY DRIVE ASSEMBLY (1),



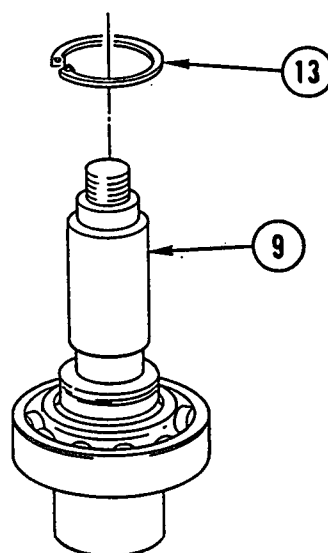
6. TURN ACCESSORY DRIVE ASSEMBLY (1) OVER AND SUPPORT ON MACHINED SURFACE. USING PRESS, APPLY PRESSURE TO PULLEY END OF ACCESSORY DRIVE SHAFT AND BEARING ASSEMBLY (9). REMOVE ACCESSORY DRIVE SHAFT AND BEARING ASSEMBLY (9) FROM ACCESSORY DRIVE ASSEMBLY (1).



**NOTE**

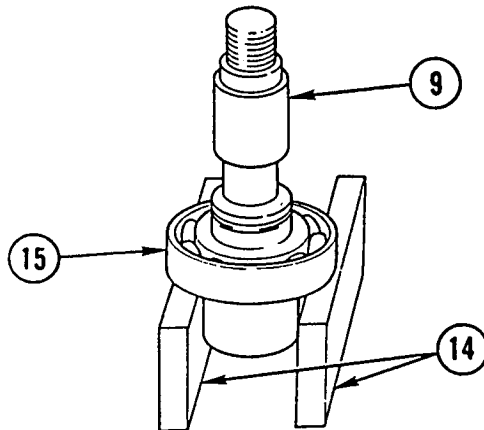
Word INSTALL and an arrow are etched on needle bearing remover/installer to aid in installation. Be sure to place needle bearing identification numbers up against needle bearing remover/installer.

7. TURN ACCESSORY DRIVE ASSEMBLY (1) OVER AND SUPPORT ON ATTACHING BOLT BOSSES. PLACE LONG END OF SERVICE SET NEEDLE BEARING REMOVER/INSTALLER (10) IN ACCESSORY DRIVE ASSEMBLY (1) AGAINST NEEDLE BEARING (11). APPLY PRESSURE TO NEEDLE BEARING REMOVER/INSTALLER (10) AND REMOVE AND DISCARD NEEDLE BEARING (11) AND OIL SEAL (12).



8. REMOVE SNAP RING (13) FROM ACCESSORY DRIVE SHAFT AND BEARING ASSEMBLY (9).

## ACCESSORY DRIVE REPAIR (CONT)



9. PLACE TWO STEEL PRESS PLATES (14) UNDER BALL BEARING ASSEMBLY (15) OUTER RACE. APPLY PRESSURE TO TOP OF ACCESSORY DRIVE SHAFT AND BEARING ASSEMBLY (9) AND REMOVE AND DISCARD BALL BEARING ASSEMBLY (15).

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

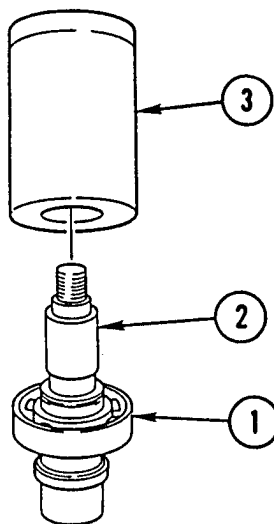
### **INSPECTION**

Inspect all parts for wear or damage.

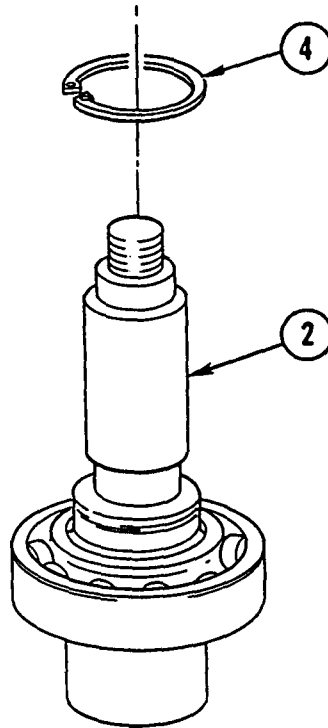
### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

### **ASSEMBLY**



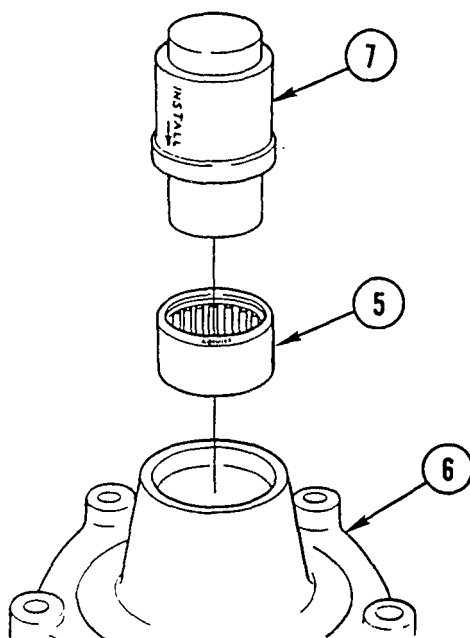
1. PLACE NEW BALL BEARING ASSEMBLY (1) ON ACCESSORY DRIVE SHAFT (2). PLACE SMALL OPENING OF SERVICE SET BEARING INSTALLER (3) OVER BALL BEARING ASSEMBLY (1) INNER RACE. PRESS UNTIL BALL BEARING ASSEMBLY (1) BOTTOMS AGAINST SHOULDER OF ACCESSORY DRIVE SHAFT (2).



**NOTE**

- Make sure tapered side of snap ring is installed away from bearing.
  - Make sure snap ring is fully seated in groove of accessory drive shaft.
2. INSTALL SNAP RING (4) IN GROOVE OF ACCESSORY DRIVE SHAFT (2).

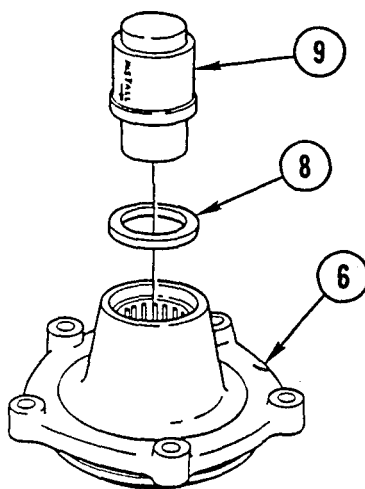
## ACCESSORY DRIVE REPAIR (CONT)



### NOTE

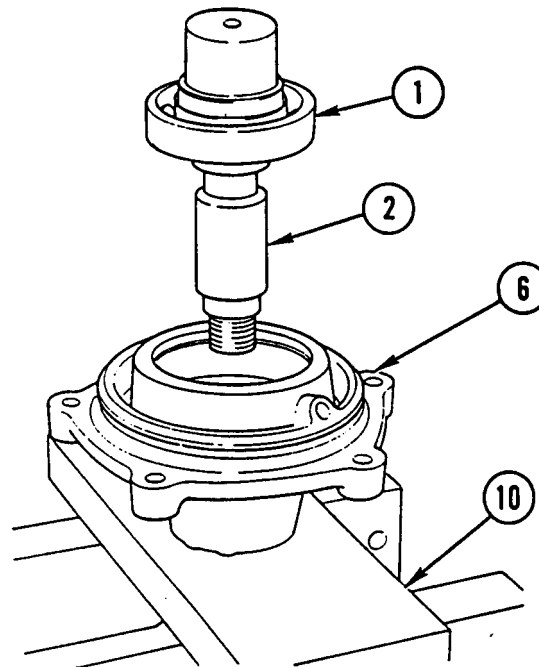
Word **INSTALL** and an arrow are etched on needle bearing installer/remover to aid in installation. Be sure to place needle bearing identification numbers up against needle bearing installer/remover.

3. INSTALL NEW NEEDLE BEARING (5) IN ACCESSORY DRIVE HOUSING (6). USING LONG END OF SERVICE SET NEEDLE BEARING INSTALLER/REMOVER (7), PRESS NEEDLE BEARING (5) INTO ACCESSORY DRIVE HOUSING (6) FLUSH TO 0.02 IN. (0.5 mm) BELOW BOTTOM OF OIL SEAL COUNTERBORE.

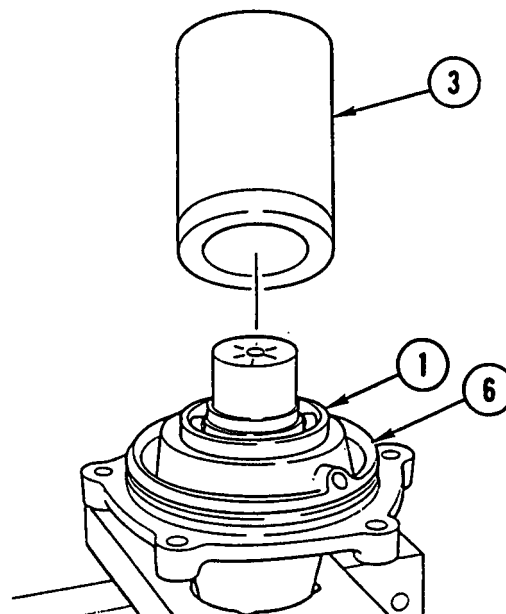




4. INSTALL NEW OIL SEAL (8) IN ACCESSORY DRIVE ASSEMBLY HOUSING (6). USING SERVICE SET SEAL INSTALLER (9) AND PLASTIC HAMMER OR FIBER Mallet, INSTALL OIL SEAL (8) FLUSH TO 0.01 IN. (0.25 mm) BELOW FACE OF ACCESSORY DRIVE ASSEMBLY HOUSING (6).

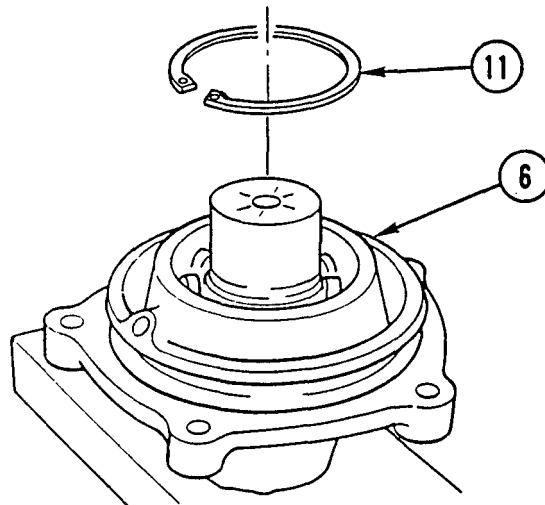


5. SUPPORT SERVICE SET HOLDING FIXTURE (10) ON TWO STEEL PLATES AND PLACE ACCESSORY DRIVE ASSEMBLY HOUSING (6) IN SERVICE SET HOLDING FIXTURE (10) HOLE. LUBRICATE BALL BEARING ASSEMBLY (1) WITH CLEAN ENGINE LUBRICATING OIL AND INSTALL ACCESSORY DRIVE SHAFT (2) AND BALL BEARING ASSEMBLY (1) IN ACCESSORY DRIVE ASSEMBLY HOUSING (6).



6. USING WIDE END OF SERVICE SET BEARING INSTALLER (3), PRESS ON BALL BEARING ASSEMBLY (1) OUTER RACE UNTIL BALL BEARING ASSEMBLY (1) IS SEATED AGAINST SHOULDER OF ACCESSORY DRIVE ASSEMBLY HOUSING (6).

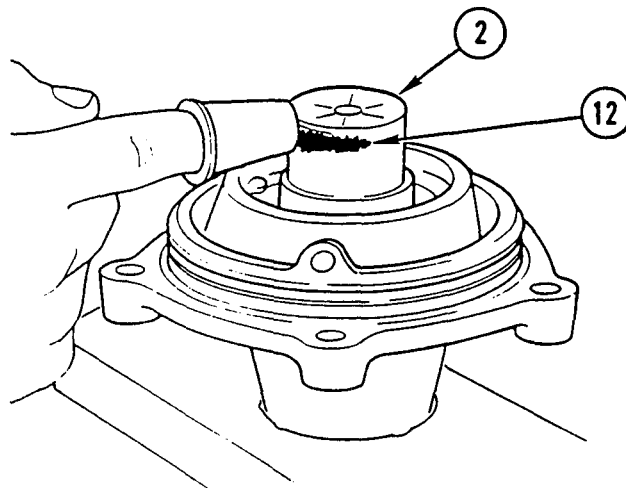
## ACCESSORY DRIVE REPAIR (CONT)



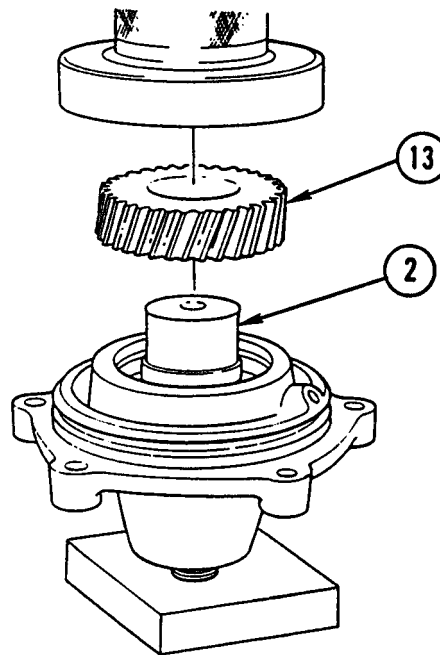
### NOTE

- Make sure tapered side of snap ring is installed away from bearing.
- Make sure snap ring is fully seated in groove of accessory drive assembly.

7. INSTALL SNAP RING (11) IN GROOVE OF ACCESSORY DRIVE ASSEMBLY (6).



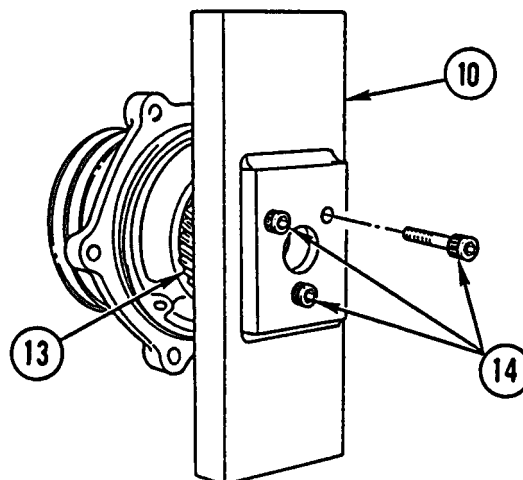
8. APPLY THIN FILM OF LUBRIPLATE 105 (12) TO DRIVE GEAR END OF ACCESSORY DRIVE SHAFT (2).



**NOTE**

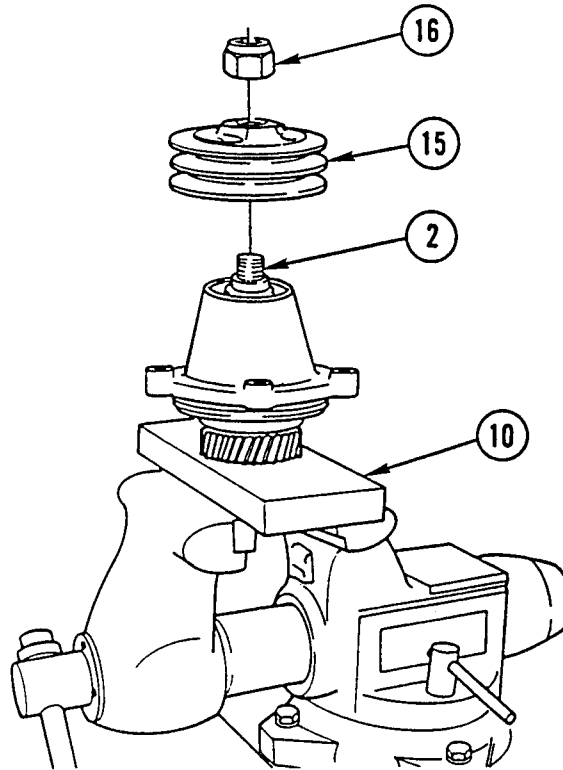
Support opposite end of accessory drive shaft on press bed when pressing gear on shaft.

9. PLACE ACCESSORY DRIVE GEAR (13) ON ACCESSORY DRIVE SHAFT (2) WITH CHAMFERED END OF BORE TOWARD ACCESSORY DRIVE SHAFT (2). USING PRESS, INSTALL ACCESSORY DRIVE GEAR (13) UNTIL ACCESSORY DRIVE GEAR (13) IS FLUSH WITH END OF ACCESSORY DRIVE SHAFT (2). OBTAIN MINIMUM PRESS LOAD OF 4,000 LB (17.8 kN).



10. INSTALL SERVICE SET HOLDING FIXTURE (10) AND THREE FIXTURE SCREWS (14) ON ACCESSORY DRIVE GEAR (13).

## ACCESSORY DRIVE REPAIR (CONT)

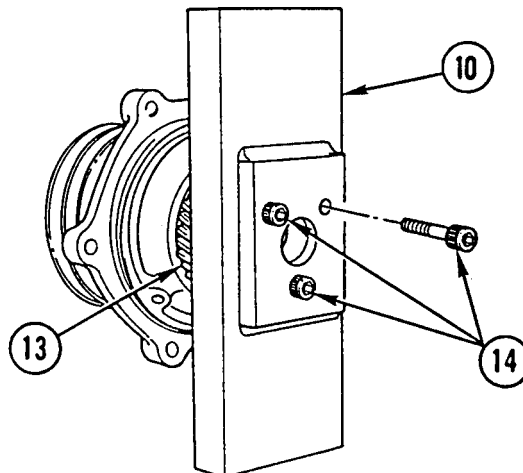


11. INSTALL SERVICE SET HOLDING FIXTURE (10) IN VISE.

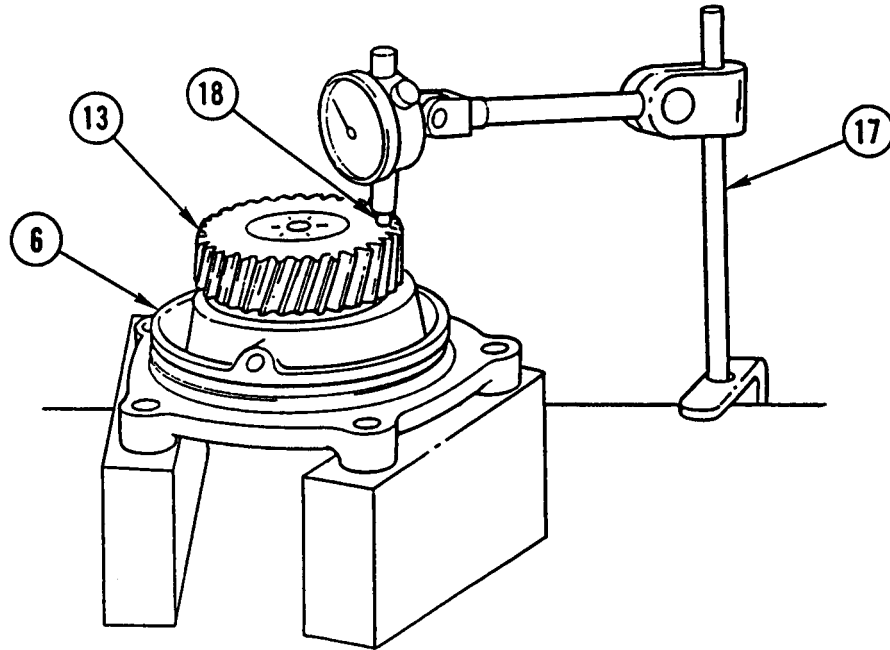
### NOTE

If necessary, use narrow opening end of service set bearing installer to seat accessory drive pulley. If pressing is necessary, support opposite gear end of accessory drive shaft.

12. INSTALL ACCESSORY DRIVE PULLEY (15) ON ACCESSORY DRIVE SHAFT (2).
13. INSTALL NEW ACCESSORY DRIVE PULLEY LOCK NUT (16) AND TIGHTEN TO 162-184 LB-FT (220-250 N.m).



14. REMOVE SERVICE SET HOLDING FIXTURE (10) FROM VISE AND REMOVE THREE FIXTURE SCREWS (14) FROM ACCESSORY DRIVE GEAR (13).



15. SUPPORT ACCESSORY DRIVE ASSEMBLY (6) AS SHOWN. POSITION DIAL INDICATOR (17) SO INDICATOR STEM (18) RESTS ON FACE OF ACCESSORY DRIVE GEAR (13) JUST INBOARD OF ACCESSORY DRIVE GEAR (13) TEETH.

**NOTE**

As accessory drive gear is rotated, dial indicator needle may register to left and right of zero. Total amount of dial indicator needle movement gives total indicated runout (TIR).

16. ZERO DIAL INDICATOR. ROTATE ACCESSORY DRIVE GEAR (13) TWO FULL ROTATIONS. ALLOWABLE TIR IS 0.0015 IN. (0.04 mm).

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## AIR COMPRESSOR REPAIR

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This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

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### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05  
Holding Fixture, Appendix C, Item 2  
Remover/Installer Tool, J25447-B

#### Materials/Parts:

Kit, Cylinder Head Maintenance	P/N 107516
Kit, Piston Ring	P/N 107639
Kit, Crankshaft Bearing	P/N 107969
Kit, Piston and Rod	P/N 107967
Bolt (2)	
Oil, Lubricating	Appendix B, Item 37

#### References:

TM 9-2320-363-20

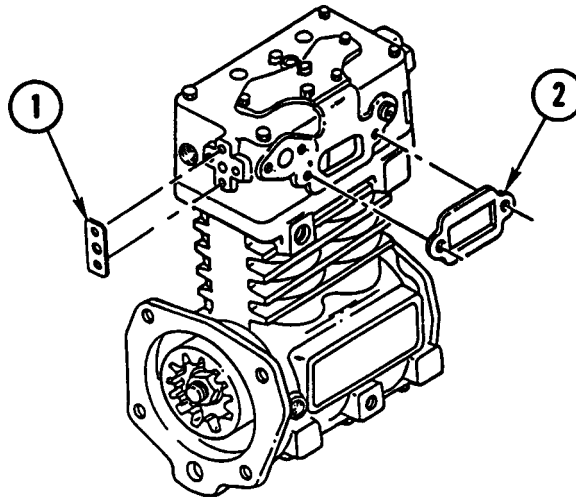
#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Air Compressor, Removed

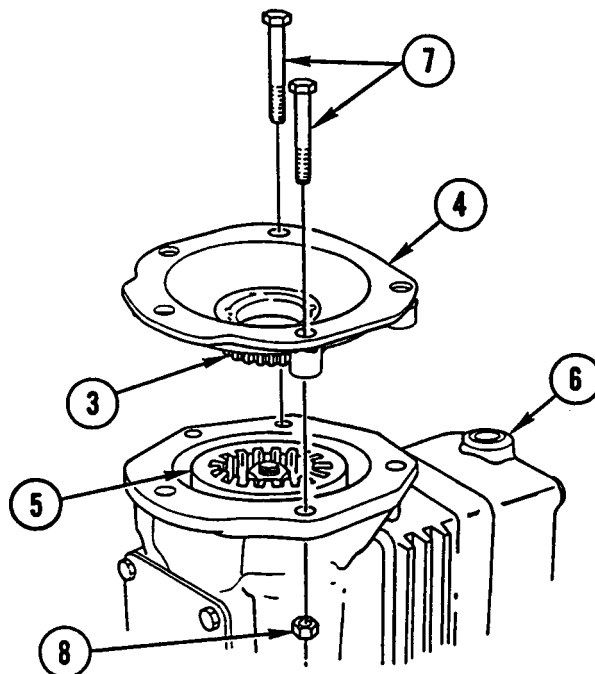
#### General Safety Instructions:

#### **WARNING**

Unloader cover plate is under spring tension. Remove capscrew bolts slowly to prevent personal injury.

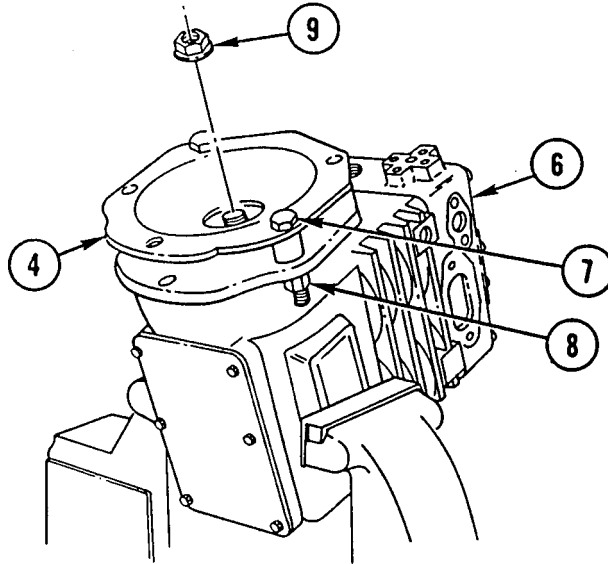
**DISASSEMBLY**

1. IF INSTALLED, REMOVE TWO GASKETS (1 AND 2). DISCARD GASKETS.

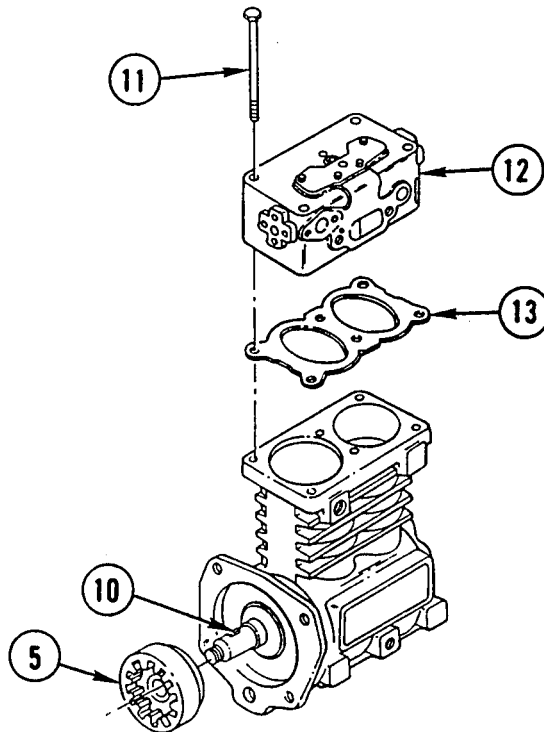


2. ENGAGE TEETH (3) OF HOLDING FIXTURE (4) WITH AIR COMPRESSOR DRIVE HUB (5). ALINE SPACER LEGS OF HOLDING FIXTURE (4) WITH MOUNTING BOLT HOLES IN FLANGE FACE OF AIR COMPRESSOR (6). INSTALL TWO BOLTS (7), TWO NUTS (8), AND HOLDING FIXTURE (4) ON FLANGE FACE OF AIR COMPRESSOR (6).

## AIR COMPRESSOR REPAIR (CONT)



3. SECURE AIR COMPRESSOR (6) IN SUITABLE SOFT-JAWED VISE AND REMOVE DRIVE HUB RETAINING NUT (9).
4. REMOVE TWO NUTS (8), TWO BOLTS (7), AND HOLDING FIXTURE (4).
5. REMOVE AIR COMPRESSOR (6) FROM VISE.



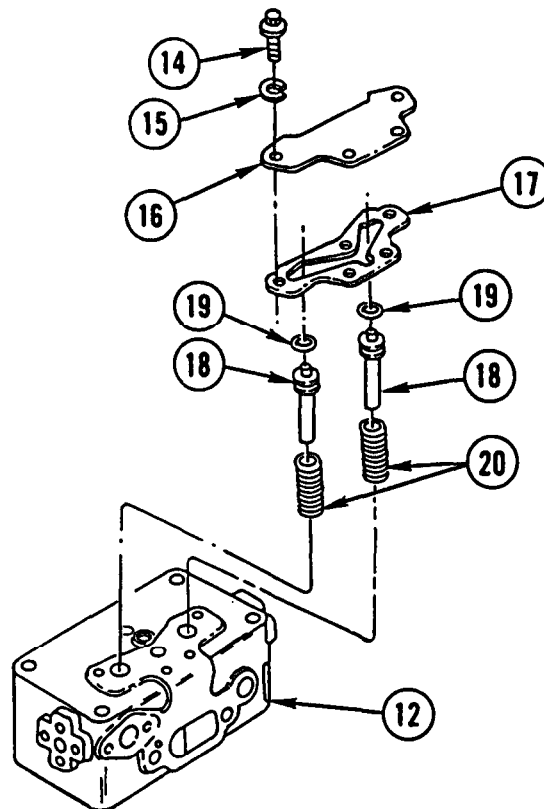
6. REMOVE HUB (5) AND KEY (10).



**NOTE**

It may be necessary to tap cylinder head with fiber or plastic mallet to break cylinder head gasket seal.

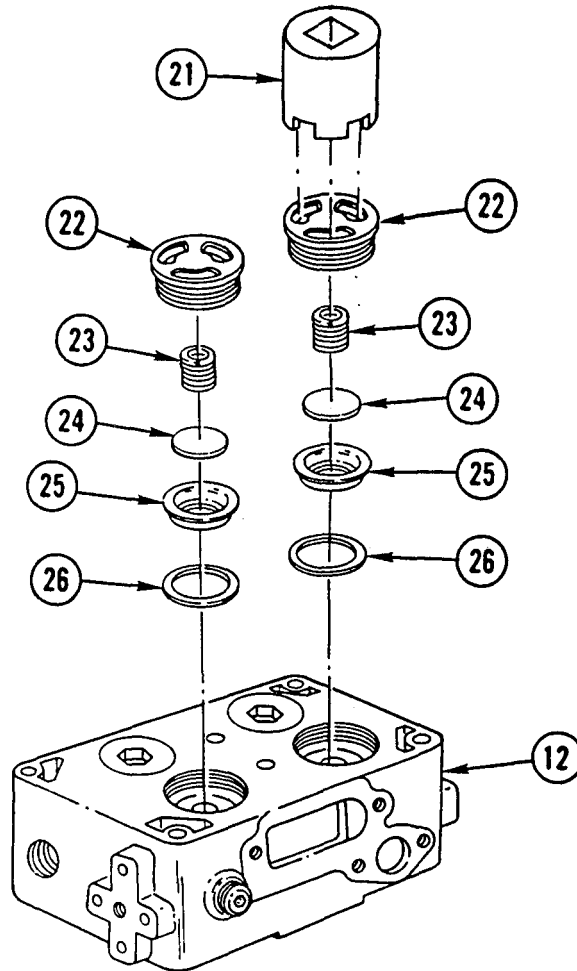
7. REMOVE SIX CAPSCREW HEAD BOLTS (11), CYLINDER HEAD (12), AND CYLINDER HEAD GASKET. DISCARD CYLINDER HEAD GASKET.

**WARNING**

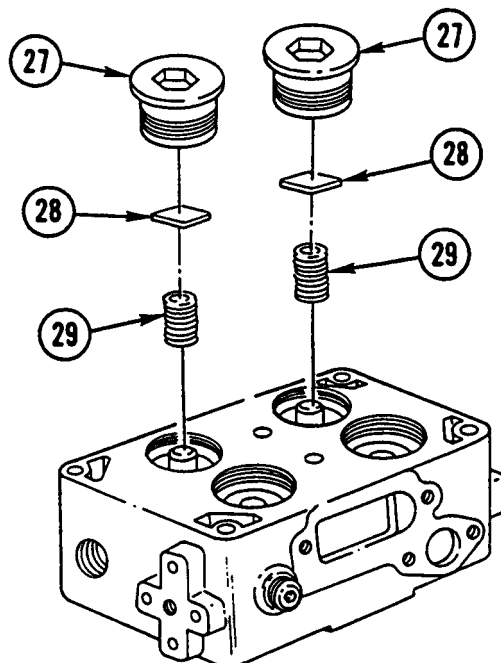
Unloader cover plate is under spring tension. Remove capscrew bolts slowly to prevent personal injury.

8. PLACE CYLINDER HEAD (12) ON BENCH, DECK SIDE DOWN, AND REMOVE FOUR CAPSCREW BOLTS (14) AND FOUR LOCK WASHERS (15). DISCARD LOCK WASHERS.
9. REMOVE UNLOADER COVER PLATE (16) AND GASKET (17). DISCARD GASKET.
10. REMOVE UNLOADER PISTON (18), SEAL RING (19), AND UNLOADER SPRING (20) FROM EACH BORE.

## AIR COMPRESSOR REPAIR (CONT)

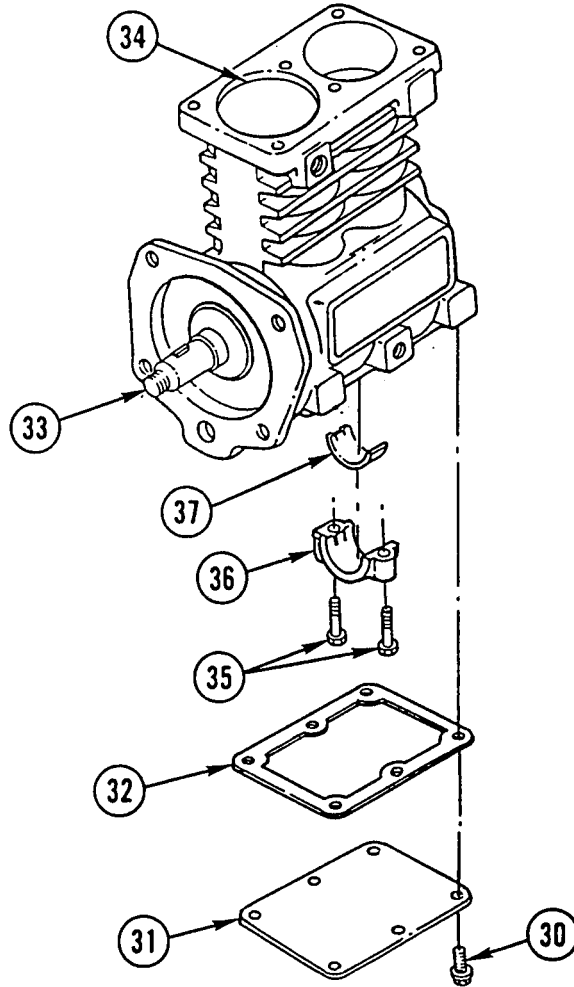


11. PLACE CYLINDER HEAD (12) ON BENCH, DECK SIDE UP, AND INSERT REMOVER/INSTALLER TOOL (21) IN INLET VALVE STOP (22). REMOVE INLET VALVE STOP (22).
12. REMOVE INLET VALVE SPRING (23), INLET VALVE (24), INLET VALVE SEAT (25), AND COPPER GASKET (26) FROM BORE. DISCARD GASKET.
13. REPEAT STEPS 11 AND 12 FOR OTHER INLET VALVE (22).



14. REMOVE DISCHARGE VALVE SEAT (27).
15. REMOVE DISCHARGE VALVE (28) AND SPRING (29) FROM BORE.
16. REPEAT STEPS 14 AND 15 FOR OTHER DISCHARGE VALVE (27).

## AIR COMPRESSOR REPAIR (CONT)

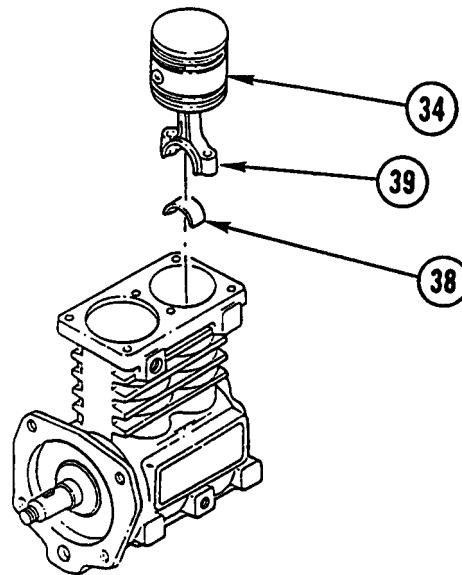


17. REMOVE SIX CAPSCREW BOLTS (30), CRANKCASE COVER (31), AND GASKET (32). DISCARD GASKET.
18. ROTATE CRANKSHAFT (33) UNTIL CONNECTING ROD AND PISTON ASSEMBLY (34) IS AT BOTTOM OF ITS TRAVEL.

### **CAUTION**

Connecting rod caps are not interchangeable and must be kept with connecting rods to prevent damage to equipment.

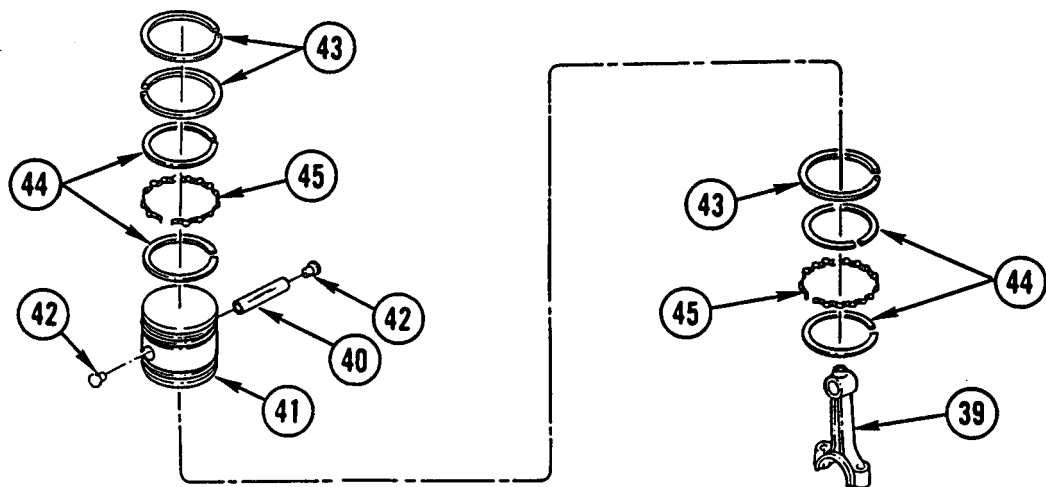
19. REMOVE TWO CONNECTING ROD BOLTS (35), CONNECTING ROD CAP (36), AND BEARING INSERT (37). DISCARD BEARING INSERT.



**CAUTION**

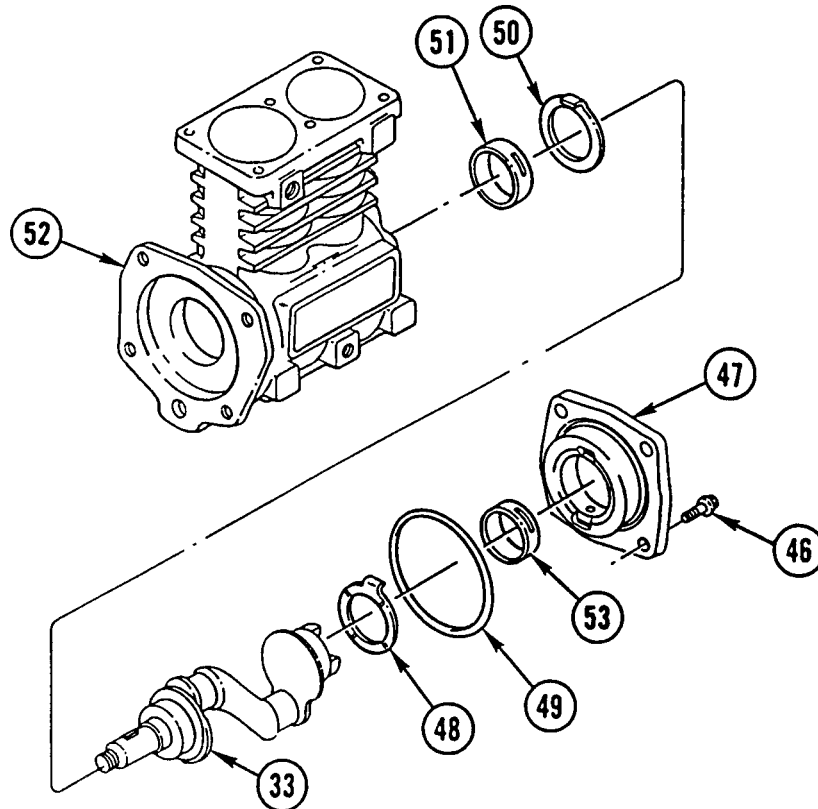
Mark or tag pistons and note location in air compressor prior to removal to prevent premature air compressor failure during assembly.

20. REMOVE CONNECTING ROD AND PISTON ASSEMBLY (34) FROM CYLINDER BORE.
21. REMOVE CONNECTING ROD BEARING INSERT (38) FROM CONNECTING ROD (39). DISCARD BEARING INSERT.



22. PUSH WRIST PIN (40) OUT OF PISTON (41) AND CONNECTING ROD (39).
23. PULL PLASTIC WRIST PIN BUTTON (42) FROM EACH END OF WRIST PIN (40).
24. REMOVE THREE PISTON RINGS (43).
25. REMOVE FOUR OIL CONTROL RINGS (44) AND TWO OIL RING EXPANDERS (45).

## AIR COMPRESSOR REPAIR (CONT)



26. REMOVE TWO CAPSCREW BOLTS (46) AND REAR COVER (47).
27. REMOVE CRANKSHAFT REAR THRUST WASHER (48) FROM REAR COVER (47).
28. REMOVE SEAL RING (49) FROM GROOVE IN REAR COVER (47).
29. PULL CRANKSHAFT (33) TO REAR AND REMOVE.
30. REMOVE CRANKSHAFT FRONT THRUST WASHER (50).

### **CAUTION**

Be careful when removing crankshaft front sleeve bearing to prevent damaging bearing bore and thrust washer mounting surface.

31. USING BRASS DRIFT AND HAMMER, REMOVE CRANKSHAFT FRONT SLEEVE BEARING BY TAPPING AROUND INSIDE EDGE OF SLEEVE, DRIVING CRANKSHAFT FRONT SLEEVE BEARING (51) TOWARD AIR COMPRESSOR MOUNTING FLANGE (52).

**CAUTION**

Be careful when removing rear crankshaft sleeve bearing to prevent damaging bearing bore.

32. USING BRASS DRIFT AND HAMMER, REMOVE REAR CRANKSHAFT SLEEVE BEARING (53) BY TAPPING AROUND INSIDE EDGE OF SLEEVE, DRIVING CRANKSHAFT REAR SLEEVE BEARING (53) AWAY FROM FUEL PUMP MOUNTING FLANGE.

**CLEANING**

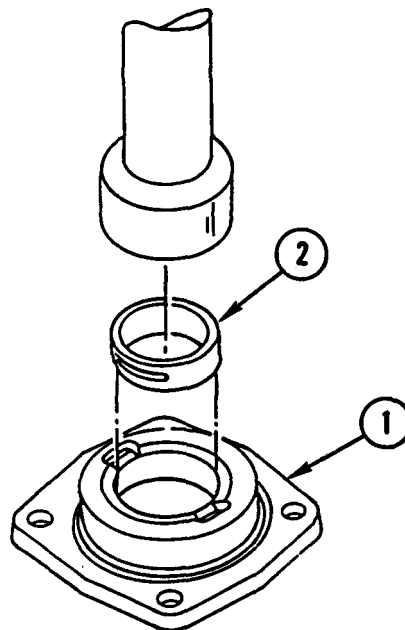
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect drive shaft for galling, pitting, cracks, or other damage. Replace if damaged.

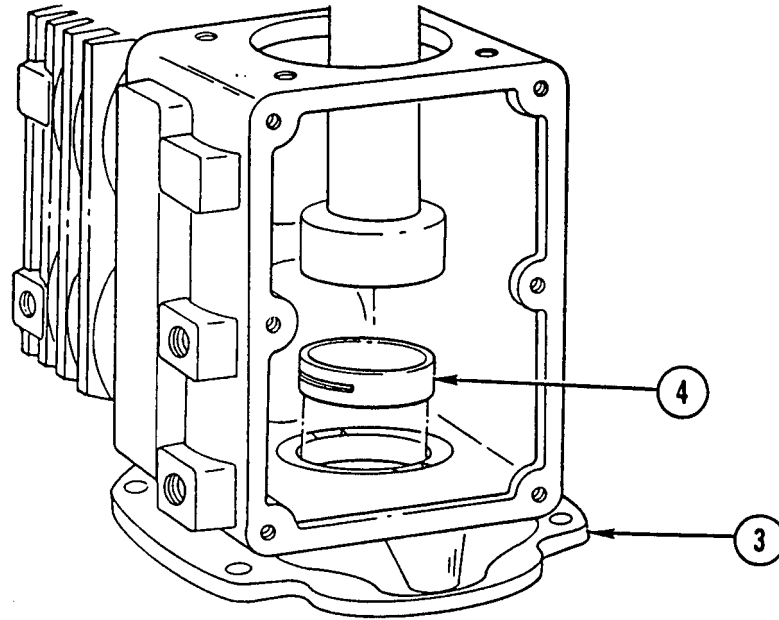
**REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

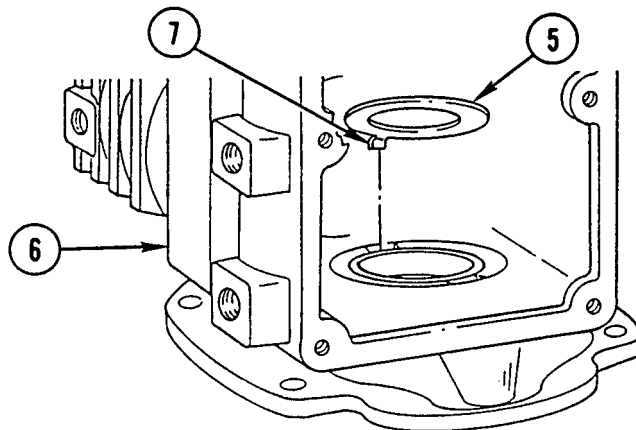
**ASSEMBLY**

1. POSITION REAR COVER (1) FACE DOWN ON PRESS BED.
2. POSITION CRANKSHAFT REAR SLEEVE BEARING (2) IN BORE OF REAR COVER (1) WITH SLOT IN REAR SLEEVE BEARING (2) PERPENDICULAR TO CRANKSHAFT VERTICAL CENTERLINE.
3. PRESS CRANKSHAFT REAR SLEEVE BEARING (2) IN BORE OF REAR COVER (1) FLUSH WITH THRUST WASHER SEAT.

## AIR COMPRESSOR REPAIR (CONT)



4. POSITION AIR COMPRESSOR FLANGE (3) FACE DOWN ON PRESS BED.
5. POSITION CRANKSHAFT FRONT SLEEVE BEARING (4) IN BORE OF AIR COMPRESSOR FLANGE (3) WITH SLOT IN FRONT SLEEVE BEARING (4) PERPENDICULAR TO CRANKSHAFT VERTICAL CENTERLINE.
6. PRESS CRANKSHAFT FRONT SLEEVE BEARING (4) IN BORE OF AIR COMPRESSOR FLANGE (3) FLUSH WITH MACHINED SURFACE.

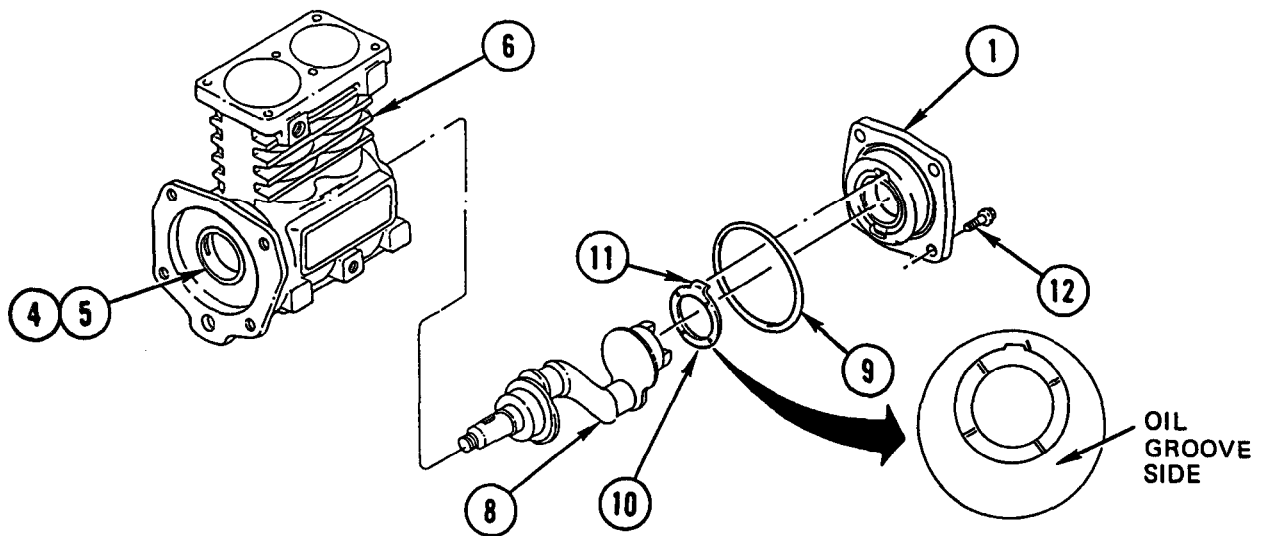


### NOTE

Oil groove side of crankshaft front thrust washer should be positioned toward crankshaft shoulders.

7. COAT SMOOTH SIDE OF CRANKSHAFT FRONT THRUST WASHER (5) WITH THIN FILM OF CLEAN ENGINE LUBRICATING OIL AND POSITION FRONT THRUST WASHER (5) IN MACHINED SEAT INSIDE FRONT OF AIR COMPRESSOR BODY (6). ENGAGE TANG (7) IN PASSAGE ABOVE BORE IN AIR COMPRESSOR BODY (6).





**CAUTION**

Be careful not to dislodge crankshaft front thrust washer when installing crankshaft to prevent damage to equipment.

8. INSERT CRANKSHAFT (8) THRU CRANKSHAFT FRONT THRUST WASHER (5) AND CRANKSHAFT FRONT SLEEVE BEARING (4) UNTIL FRONT SHOULDER OF CRANKSHAFT (8) CONTACTS CRANKSHAFT FRONT THRUST WASHER (5).
9. INSTALL SEAL RING (9) IN GROOVE OF REAR COVER (1).

**NOTE**

Oil groove side of crankshaft rear thrust washer should be positioned toward crankshaft shoulders.

10. COAT SMOOTH SIDE OF CRANKSHAFT REAR THRUST WASHER (10) WITH THIN FILM OF CLEAN ENGINE LUBRICATING OIL AND POSITION REAR THRUST WASHER (10) IN MACHINED SEAT IN REAR COVER (1). ENGAGE TANG (11) IN NOTCH AT TOP OF SEAT IN REAR COVER (1).

**CAUTION**

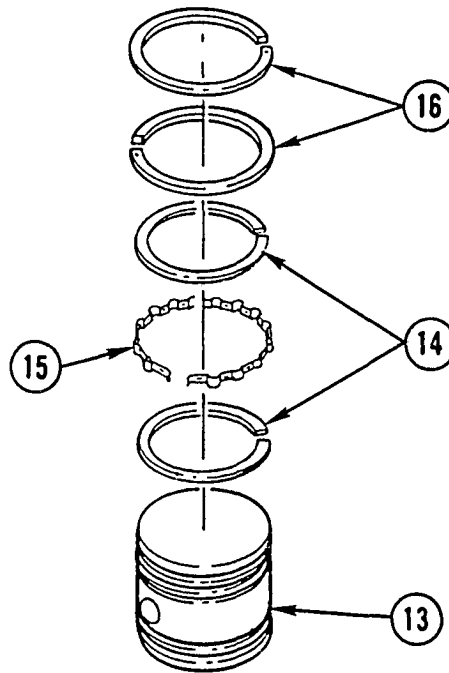
Be careful not to dislodge crankshaft rear thrust washer when positioning rear cover on crankshaft. Make sure oil drain hole in rear cover is at bottom to prevent damage to equipment.

**NOTE**

Make sure old gasket material is removed from mating surfaces of rear cover and air compressor body.

11. POSITION REAR COVER (1) ON CRANKSHAFT (8) AGAINST AIR COMPRESSOR BODY (6).
12. ALINE CAPSCREW BOLT (12) HOLES IN REAR COVER (1) AND AIR COMPRESSOR BODY (6). INSTALL TWO CAPSCREW BOLTS (12). TIGHTEN BOLTS TO 175-225 LB-IN. (20-25 N.m).

## AIR COMPRESSOR REPAIR (CONT)



### NOTE

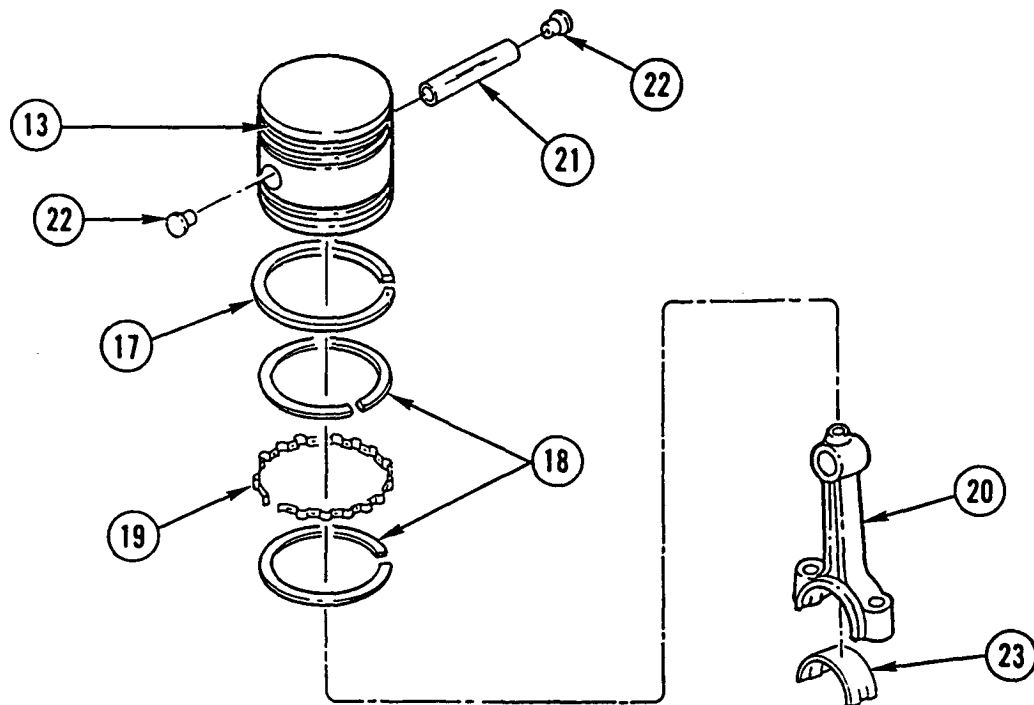
Oil rings may be installed with either side up.

13. WITH DOME OF PISTON (13) UP, INSTALL TWO OIL RINGS (14) IN UPPER OIL RING GROOVE OF PISTON (13).
14. INSTALL OIL RING EXPANDER (15) IN OIL RING GROOVE BETWEEN OIL RINGS (14).

### CAUTION

Dot appearing on one side of second and top piston rings, 30 degrees from ring gap, indicates top of second and top piston rings. Top of second and top piston rings must be installed facing piston dome to prevent damage to equipment.

15. INSTALL SECOND AND TOP PISTON RINGS (16) IN TOP TWO RING GROOVES OF PISTON (13).



**CAUTION**

Dot appearing on one side of third piston ring, 30 degrees from ring gap, indicates top of third piston ring. Top of third piston ring must be installed facing piston dome to prevent damage to equipment.

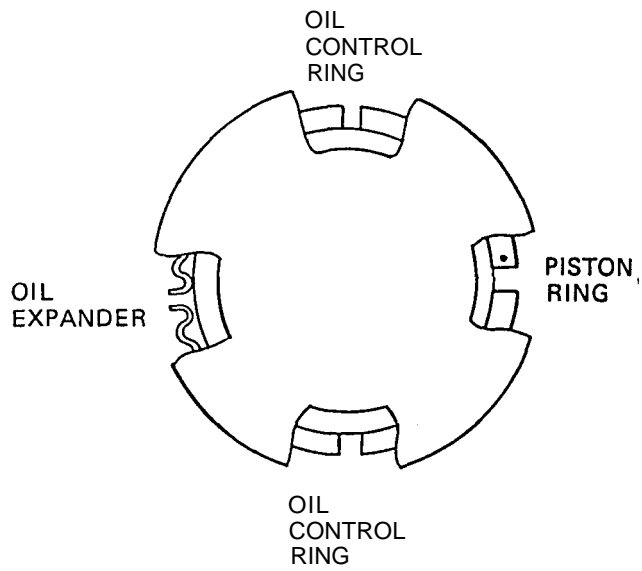
16. INSTALL THIRD PISTON RING (17) IN TOP GROOVE OF LOWER RING GROOVES ON PISTON (13).
17. INSTALL TWO OIL RINGS (18) IN BOTTOM OIL RING GROOVE ON PISTON (13).
18. INSTALL OIL RING EXPANDER (19) IN GROOVE BETWEEN OIL RINGS (18).
19. POSITION CONNECTING ROD (20) AND INSERT WRIST PIN (21) THRU PISTON (13) TO CONNECT ROD BORE IN OPPOSITE SIDE OF PISTON (13).
20. CENTER WRIST PIN (21) AND PUSH PLASTIC WRIST PIN BUTTON (22) IN EACH END OF WRIST PIN (21).

**CAUTION**

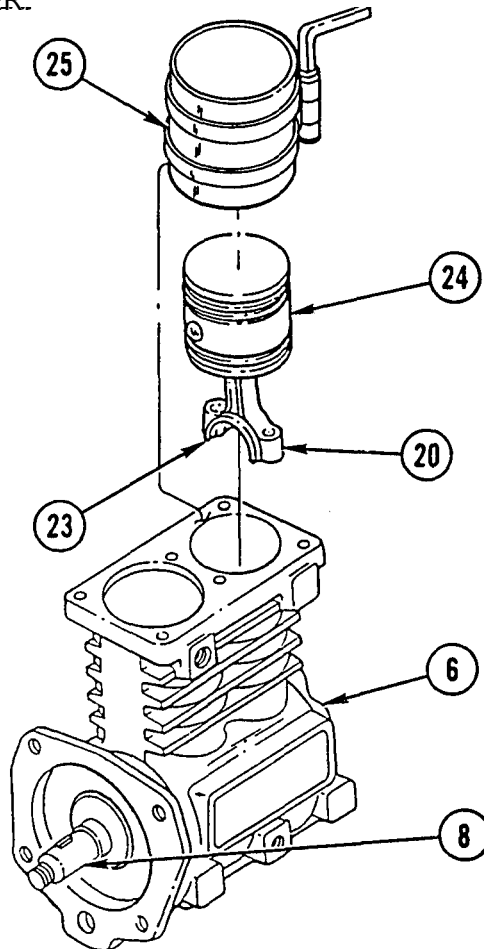
Tangs on one end of connecting rod bearing insert must be installed in corresponding notches on one side of connecting rod bearing saddle to prevent damage to equipment.

21. INSTALL NEW CONNECTING ROD BEARING INSERT (23) IN CONNECTING ROD (20) BEARING SADDLE.

## AIR COMPRESSOR REPAIR (CONT)



22. STAGGER PISTON RING GAP, TWO OIL CONTROL RING GAPS, AND OIL EXPANDER RING GAP 90 DEGREES FROM EACH OTHER.



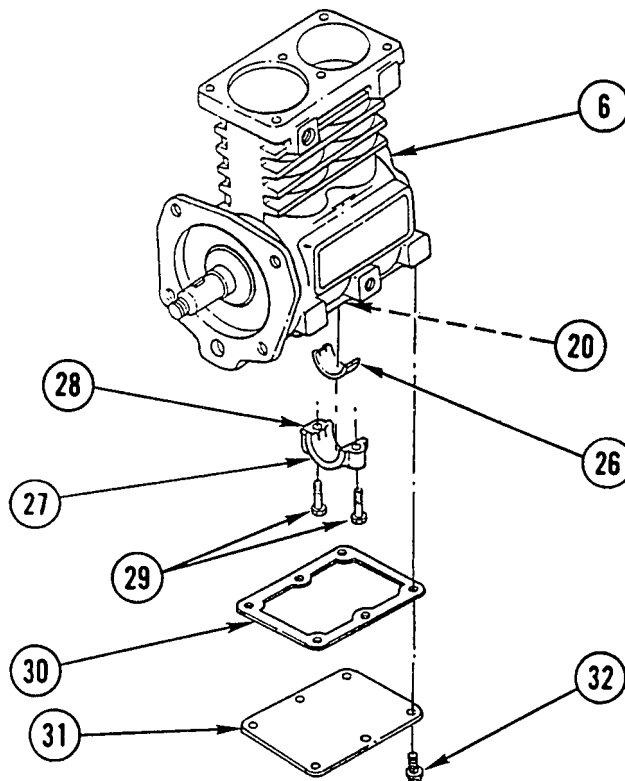
23. COAT PISTON ASSEMBLY (24) LIBERALLY WITH CLEAN ENGINE LUBRICATING OIL AND INSERT PISTON ASSEMBLY (24) IN SUITABLE RING COMPRESSOR (25).
24. APPLY FILM OF CLEAN ENGINE LUBRICATING OIL TO SURFACE OF CONNECTING ROD BEARING INSERT (23) AND INSERT CONNECTING ROD (20) AND PISTON ASSEMBLY (24) IN CYLINDER BORE.
25. POSITION CRANKSHAFT JOURNAL (8) AT BOTTOM OF ITS TRAVEL.

**CAUTION**

- To prevent damage to crankshaft, use care to guide connecting rod on crankshaft journal when pushing piston assembly in cylinder bore.
- Pistons must be installed in same location. Failure to do so could result in premature air compressor failure.

26. WITH RING COMPRESSOR (25) SQUARE AGAINST TOP OF AIR COMPRESSOR BODY (6), PUSH PISTON ASSEMBLY (24) INTO CYLINDER BORE.

## AIR COMPRESSOR REPAIR (CONT)



### **CAUTION**

Tangs on one end of connecting rod bearing insert must be installed in corresponding notches on one side of connecting rod cap to prevent damage to equipment.

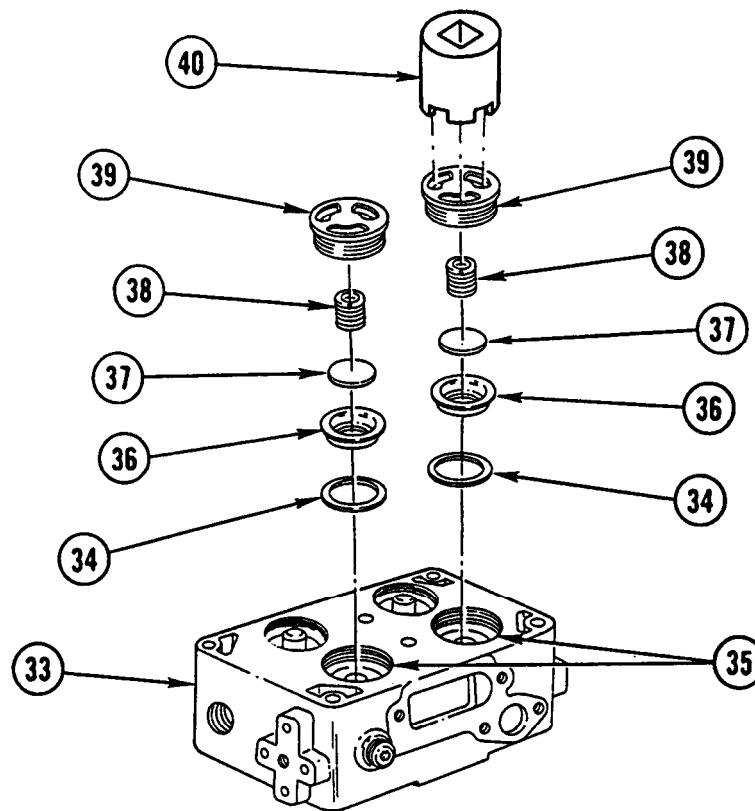
27. INSTALL NEW CONNECTING ROD BEARING INSERT (26) IN CONNECTING ROD CAP (27).
28. APPLY FILM OF CLEAN ENGINE LUBRICATING OIL TO CONNECTING ROD BEARING INSERT (26).

### **CAUTION**

- Connecting rod bearing insert tangs should be on same side of connecting rod and connecting rod cap to prevent damage to equipment.
- Make sure connecting rod is fully seated on crankshaft journal to prevent damage to equipment.

29. POSITION CONNECTING ROD CAP (27) ON CONNECTING ROD (20) SO WIDE EAR (28) ON CONNECTING ROD CAP (27) MATCHES CORRESPONDING EAR ON CONNECTING ROD (20).
30. INSTALL TWO CONNECTING ROD BOLTS (29) AND TIGHTEN TO 80-100 LB-IN (9-11 N.m).
31. POSITION NEW GASKET (30) AND CRANKCASE COVER (31) ON BOTTOM OF AIR COMPRESSOR BODY (6).

32. INSTALL SIX CAPSCREW BOLTS (32). TIGHTEN BOLTS TO 175-225 LB-IN. (20-25 N.m).



33. SUPPORT CYLINDER HEAD (33) ON BENCH, DECK SIDE UP, AND INSTALL NEW COPPER GASKET (34) IN BORE (35).
34. INSTALL INLET VALVE SEAT (36) IN BORE (35) WITH RAISED SIDE OF VALVE SEAT (36) TOWARD DECK OF CYLINDER HEAD (33).

**NOTE**

Make sure inlet valve is centered on inlet valve seat.

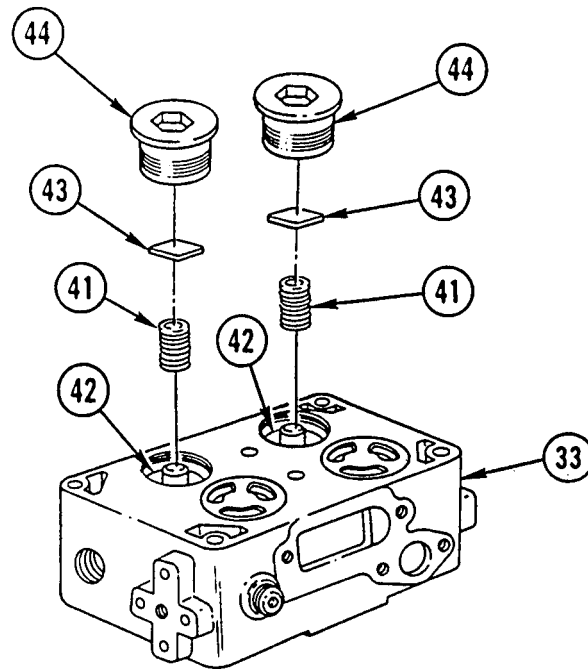
35. INSTALL INLET VALVE (37) ON TOP OF INLET VALVE SEAT (36).

**NOTE**

Make sure inlet valve spring is centered on inlet valve.

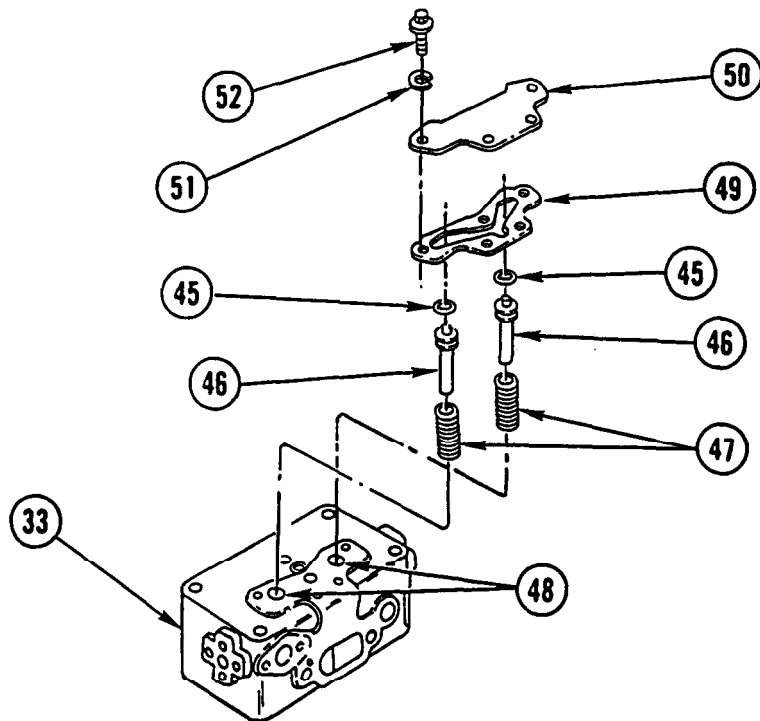
36. INSTALL INLET VALVE SPRING (38) ON TOP OF INLET VALVE (37).
37. THREAD INLET VALVE STOP (39) CAREFULLY INTO CYLINDER HEAD (33) UNTIL INLET VALVE SPRING (38) IS SEATED ON INLET VALVE STOP (39).
38. USING INSERT REMOVER/INSTALLER TOOL (40), TIGHTEN INLET VALVE STOP (39) TO 70-90 LB-FT (95-122 N.m).
39. REPEAT STEPS 33 THRU 38 FOR OTHER INLET VALVE STOP (39).

## AIR COMPRESSOR REPAIR (CONT)



40. INSERT DISCHARGE VALVE SPRING (41) IN DISCHARGE VALVE BORE (42).
41. PLACE DISCHARGE VALVE (43) ON TOP OF DISCHARGE VALVE SPRING (41) AND CENTER IN DISCHARGE VALVE BORE (42).
42. THREAD DISCHARGE VALVE SEAT (44) CAREFULLY INTO CYLINDER HEAD (33) UNTIL DISCHARGE VALVE (43) IS SEATED.
43. USING 9/16 IN. HEX WRENCH, TIGHTEN DISCHARGE VALVE SEAT (44) TO 70-90 LB-FT (95-122 N.m).
44. REPEAT STEPS 40 THRU 43 FOR OTHER DISCHARGE VALVE BORE (42).





45. INSTALL SEAL RING (45) BETWEEN RAISED LANDS ON UNLOADER PISTON (46).
46. INSTALL UNLOADER SPRING (47) ON OPPOSITE END OF UNLOADER PISTON (46).
47. SUPPORT CYLINDER HEAD (33) ON BENCH, DECK SIDE DOWN, AND INSTALL LONG END OF UNLOADER PISTON ASSEMBLY (46) IN UNLOADER BORE (46).
48. REPEAT STEPS 45 THRU 47 FOR OTHER UNLOADER PISTON (46).

**NOTE**

Make sure old gasket material is removed from mating surfaces of unloader cover plate and cylinder head.

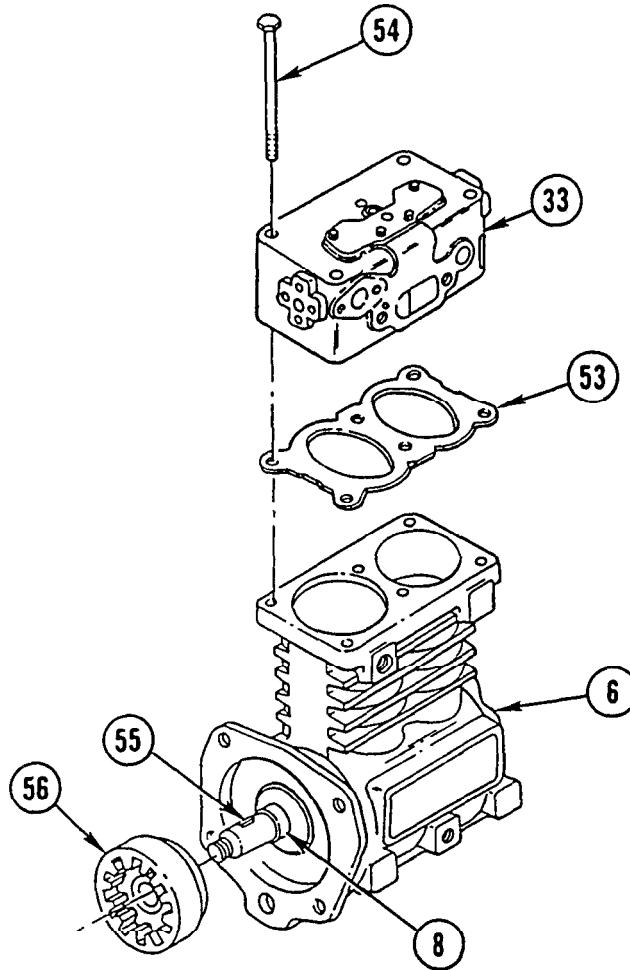
49. POSITION NEW UNLOADER GASKET (49) ON CYLINDER HEAD (33) AND ALINE BOLT HOLES IN UNLOADER GASKET (49) WITH BOLT HOLES IN CYLINDER HEAD (33).

**CAUTION**

- Make sure seal rings are not cut when pressing unloader pistons in bores to prevent damage to equipment.
- Be careful not to allow old gasket material to drop in bores to prevent damage to equipment.

50. POSITION UNLOADER COVER PLATE (50) ON TOP OF EXPOSED UNLOADER PISTONS (46) AND PRESS UNLOADER COVER PLATE (50) CAREFULLY TO PRESS UNLOADER PISTONS (46) IN BORES.
51. HOLD DOWN UNLOADER COVER PLATE (50) AND INSTALL FOUR NEW LOCK WASHERS (51) AND FOUR CAPSCREW BOLTS (52). TIGHTEN BOLTS TO 175-225 LB-IN. (20-25 N.m).

## AIR COMPRESSOR REPAIR (CONT)



### NOTE

- If beaded cylinder head gasket is used, install gasket with bead side toward cylinder head. Unbeaded cylinder head gasket can be installed with either side up.
- Make sure old gasket material is removed from mating surfaces of cylinder head and air compressor body.

52. POSITION NEW CYLINDER HEAD GASKET (53) ON DECK OF AIR COMPRESSOR BODY (6).

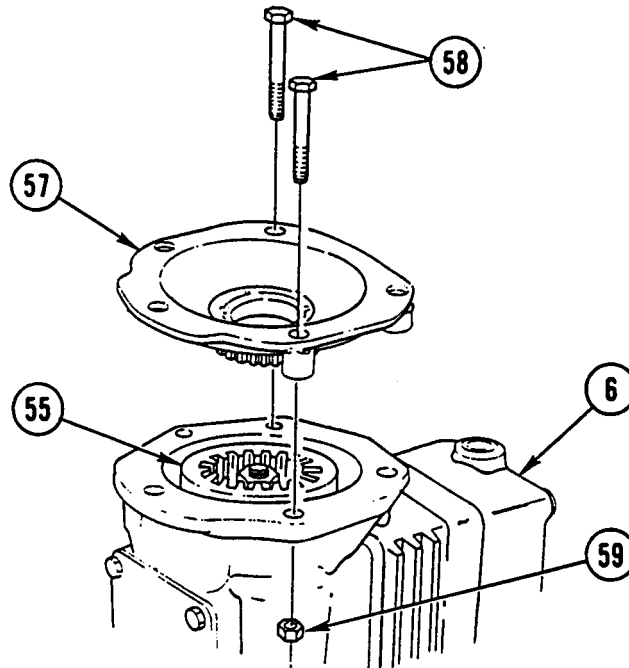
### NOTE

Cylinder head should be positioned with air inlet and discharge flange on left side of air compressor body when viewed from rear.

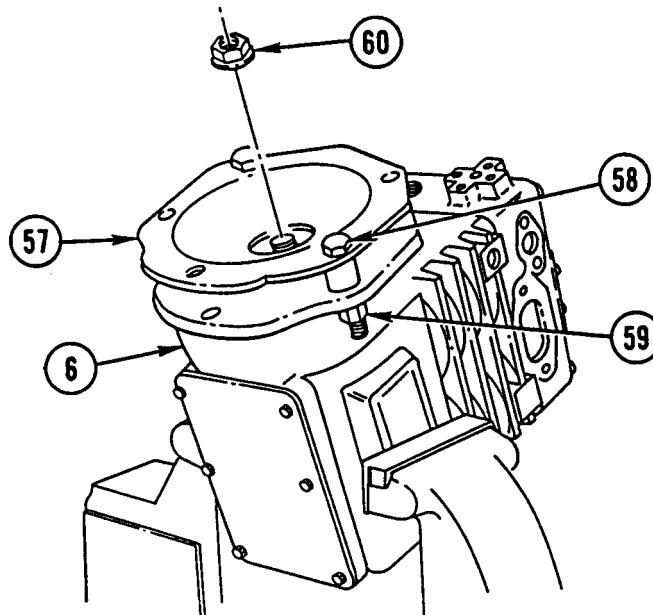
53. POSITION CYLINDER HEAD (33) ON AIR COMPRESSOR BODY (6).

54. INSTALL SIX CAPSCREW HEAD BOLTS (54). TIGHTEN BOLTS TO 300-360 LB-IN. (34-41 N.m).

55. INSTALL KEY (55) ON AIR COMPRESSOR CRANKSHAFT (8), AND POSITION AIR COMPRESSOR DRIVE HUB (56) ON AIR COMPRESSOR CRANKSHAFT (8).

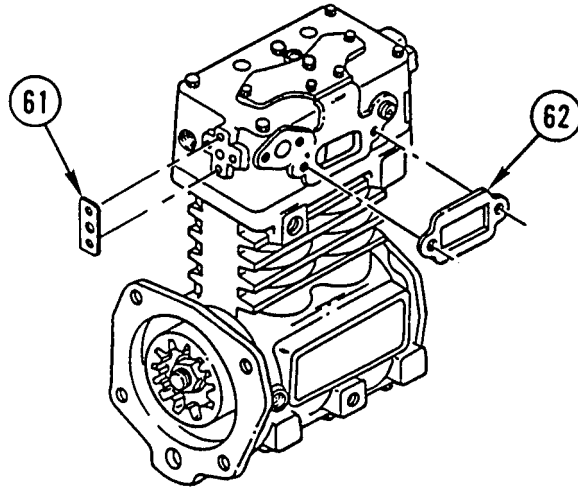


56. ENGAGE TEETH OF HOLDING FIXTURE (57) WITH TEETH IN AIR COMPRESSOR DRIVE HUB (55). ALINE SPACER LEGS OF HOLDING FIXTURE (57) WITH MOUNTING BOLT HOLES IN FLANGE FACE OF AIR COMPRESSOR BODY (6). SECURE HOLDING FIXTURE (57) TO AIR COMPRESSOR BODY (6) WITH TWO BOLTS (58) AND TWO NUTS (59).



57. SECURE AIR COMPRESSOR BODY (6) IN SUITABLE SOFT-JAWED VISE AND INSTALL AIR COMPRESSOR DRIVE HUB RETAINING NUT (60). TIGHTEN NUT TO 220-255 LB-FT (300-345 N.m).
58. REMOVE TWO NUTS (59), TWO SCREWS (58), AND HOLDING FIXTURE (57).

**AIR COMPRESSOR REPAIR (CONT)**



59. TAG TWO GASKETS (61 AND 62) FOR REINSTALLATION OF AIR COMPRESSOR.

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Cylinder Liner Remover, J35791  
 Cylinder Liner Installer, J35597  
 Ring Compressor, J35598  
 Connecting Rod Guides, J35945  
 Holding Fixture, J36211  
 Piston Ring Pliers, J22405-02  
 Top Ring Groove Gage, J38609  
 Second Ring Groove Gage, J38689

#### Materials/Parts:

Set, Cylinder Liner	P/N 23505278
Kit, Piston Ring	P/N 23505727
Oil, Lubricating	Appendix B, Item 37
Plastigauge	Appendix B, Item 46
Cloth, Abrasive	Appendix B, Item 10
International Compound No. 2	Appendix B, Item 29
Solvent, Drycleaning	Appendix B, Item 54
Toweling, Paper	Appendix B, Item 63

#### Equipment Condition:

Reference	Condition Description
Page 12-3	Engine Installed on Repair Stand
Page 3-80	Cylinder Head Removed
Page 3-199	Oil Pump Removed

#### General Safety Instructions:

### W A R N I N G

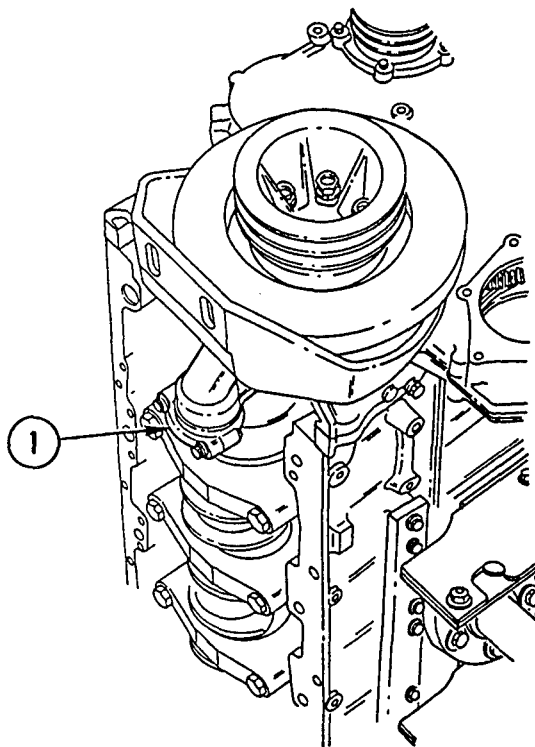
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

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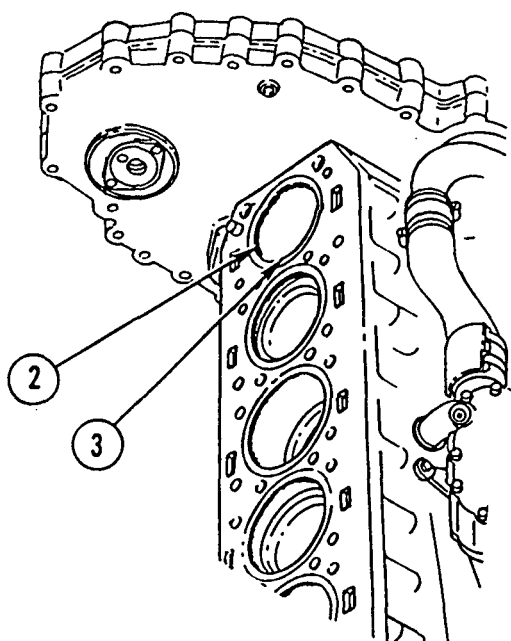
## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)

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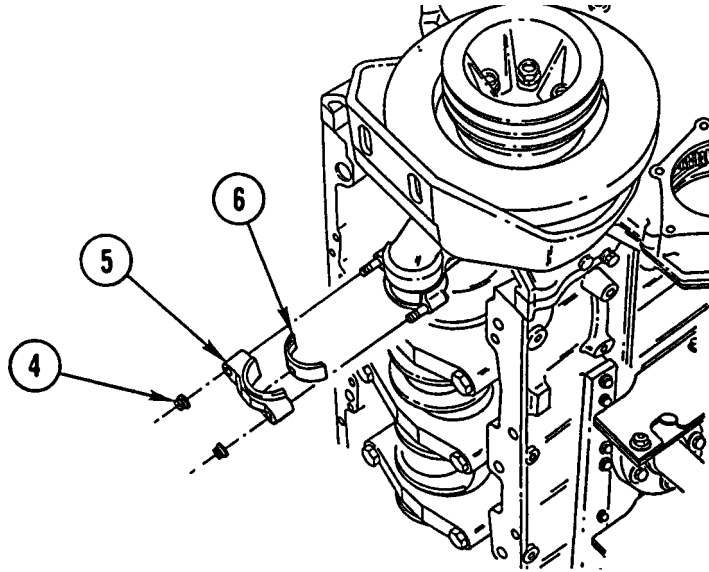
### REMOVAL



1. ROTATE ENGINE ON STAND SO ENGINE GEAR CASE IS UP.
2. BAR ENGINE OVER UNTIL CONNECTING ROD (1) OF CYLINDER BEING SERVICED IS AT BOTTOM OF TRAVEL.



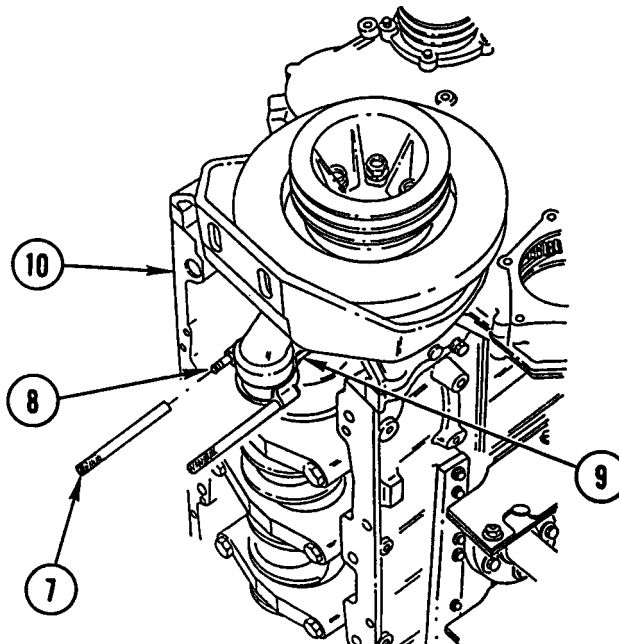
3. WITH RIDGE REAMER, REMOVE CARBON RIDGE (2) AT TOP OF CYLINDER LINER (3) ABOVE UPPER TRAVEL LIMIT OF TOP PISTON RING.



**NOTE**

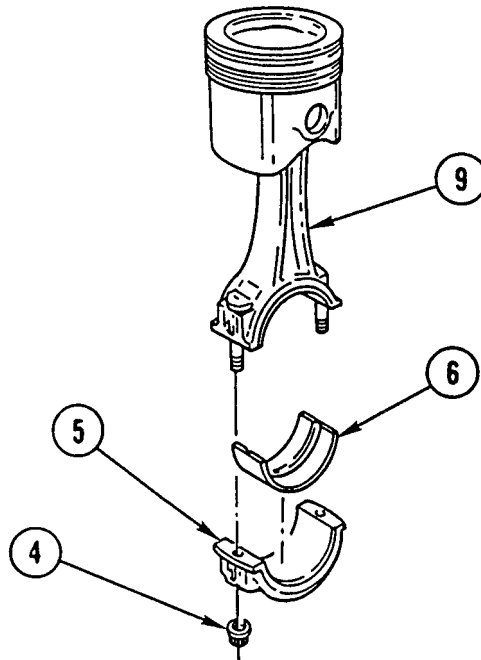
Make sure connecting rods and caps are stamped with correct location number. If not stamped, stamp correct location (1 thru 6) on tang side (cooler side) of rod cap and rod.

4. REMOVE TWO CONNECTING ROD CAP NUTS (4), CONNECTING ROD CAP (5), AND LOWER CONNECTING ROD BEARING SHELL (6).



5. INSTALL TWO CONNECTING ROD GUIDES (7) ON TWO CONNECTING ROD BOLTS (8) TO PROTECT CRANKSHAFT JOURNAL. PUSH CONNECTING ROD AND PISTON ASSEMBLY (9) THRU TOP OF CYLINDER BLOCK (10).

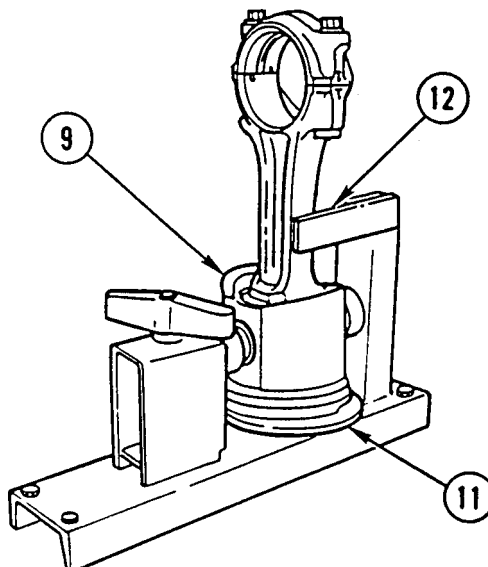
## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



### NOTE

- Always assemble rods and caps in original positions as marked.
- Connecting rod caps are numbered according to cylinder position with matching numbers stamped on tang side of connecting rod.

6. ASSEMBLE CONNECTING ROD AND PISTON ASSEMBLY (9), CONNECTING ROD CAP (5), AND LOWER CONNECTING ROD BEARING SHELL (6).
7. INSTALL TWO CONNECTING ROD CAP NUTS (4) HAND-TIGHT.
8. REPEAT STEPS 1 THRU 7 FOR EACH CYLINDER BEING SERVICED.

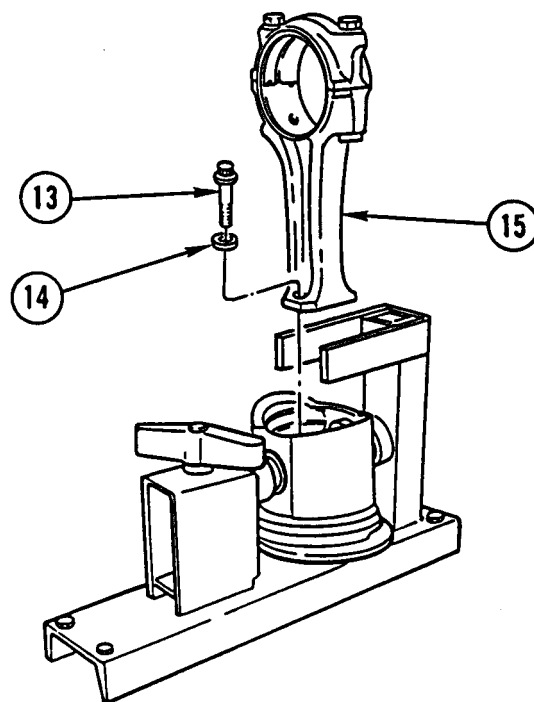




**NOTE**

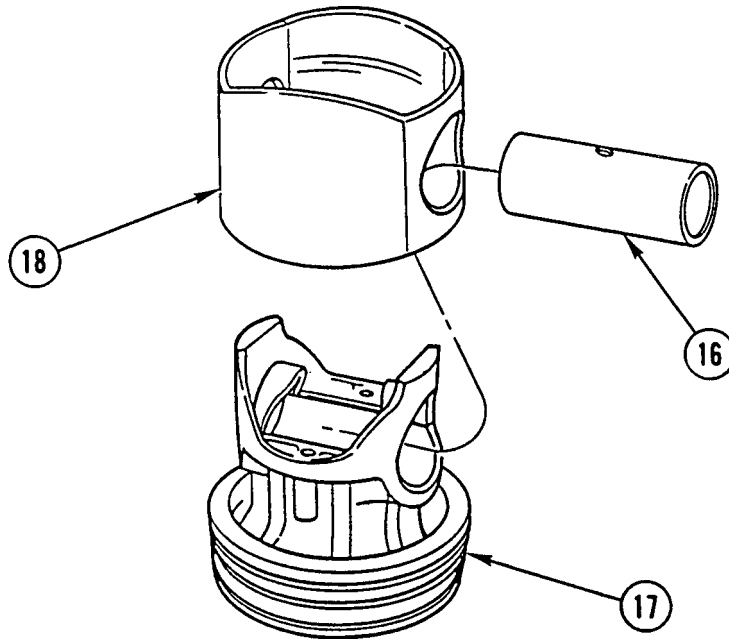
- Piston assembly components should be segregated by cylinder and matchmarked during disassembly to ensure installation in same positions.
- Holding fixture plate can be raised or lowered by turning. Adjust height of plate so recess in piston pin ends aligns with holding points of holding fixture.

9. PLACE CONNECTING ROD AND PISTON ASSEMBLY (9) DOME SIDE DOWN ON HOLDING FIXTURE PLATE (11) WITH PISTON PIN BETWEEN STATIONARY AND MOVABLE HOLDING POINTS OF HOLDING FIXTURE (11). CONNECTING ROD SHOULD BE POSITIONED BETWEEN HOLDING FINGER (12) OF HOLDING FIXTURE (11). SECURE CONNECTING ROD AND PISTON ASSEMBLY (9) IN HOLDING FIXTURE (11) BY SLIDING MOVABLE PORTION OF HOLDING FIXTURE (11) UNTIL IT CONTACTS PISTON PIN AND TIGHTENING HANDLE.

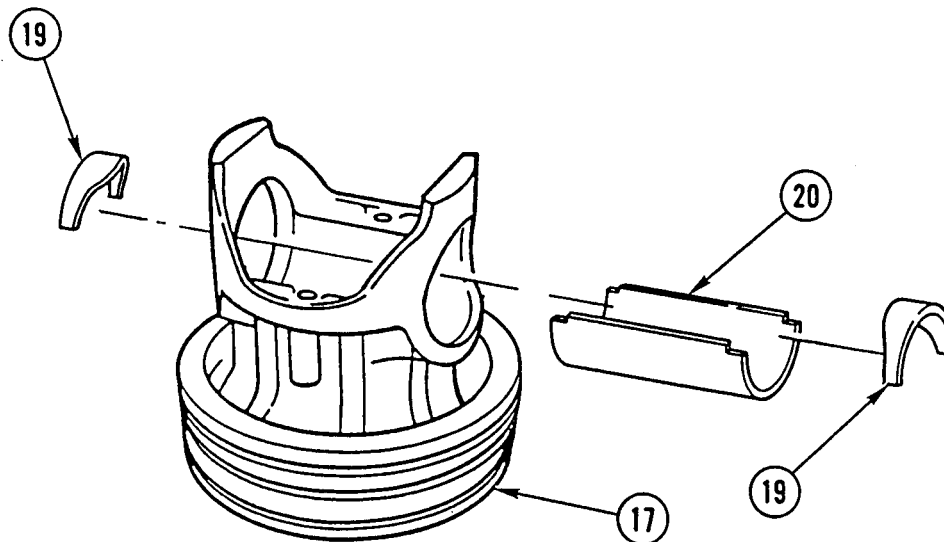


10. REMOVE TWO PISTON PIN BOLTS (13) AND TWO SPACERS (14).
11. REMOVE CONNECTING ROD ASSEMBLY (15).

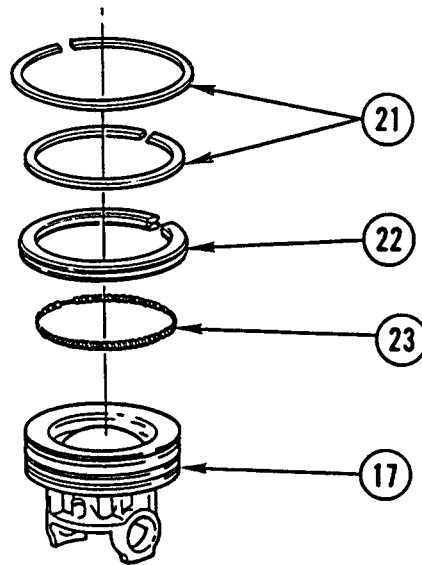
## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



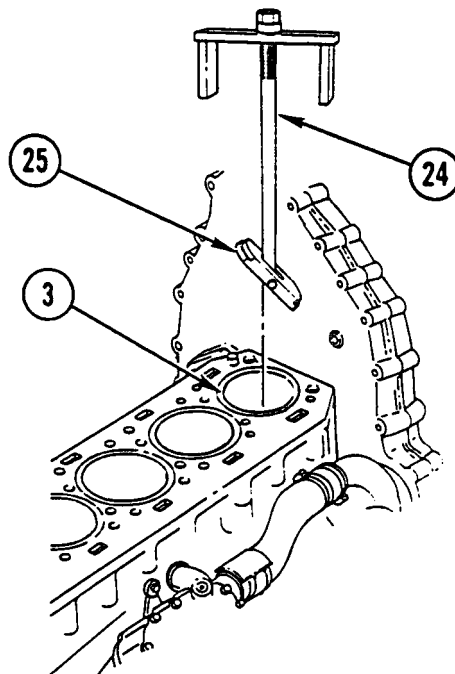
12. REMOVE PISTON ASSEMBLY FROM HOLDING FIXTURE. PLACE PISTON ASSEMBLY DOME SIDE DOWN ON BENCH.
13. PUSH PISTON PIN (16) OUT OF PISTON DOME (17) AND PISTON SKIRT (18). SEPARATE SKIRT (18) FROM DOME (17).



14. FROM INSIDE OF PISTON DOME (17), PUSH TWO PISTON PIN BUSHING ENDS (19) OUT OF PISTON PIN BORE AT EACH SIDE OF PISTON DOME (17).
15. LIFT PISTON PIN BUSHING (20) TO CLEAR RETAINING PIN IN CENTER OF PISTON DOME (17) AND SLIDE PISTON PIN BUSHING (20) OUT OF PISTON DOME (17).

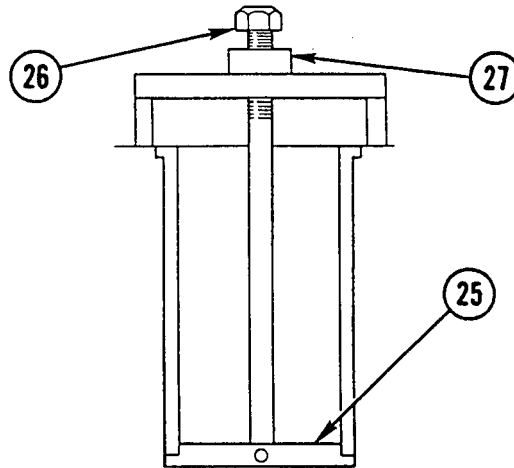


16. USING PISTON RING PLIERS, REMOVE AND DISCARD FIRE (TOP) AND MIDDLE COMPRESSION RINGS (21), LOWER OIL CONTROL RING (22), AND OIL CONTROL RING EXPANDER (23) FROM PISTON DOME (17).
17. REPEAT STEPS 9 THRU 16 FOR EACH PISTON ASSEMBLY BEING SERVICED.

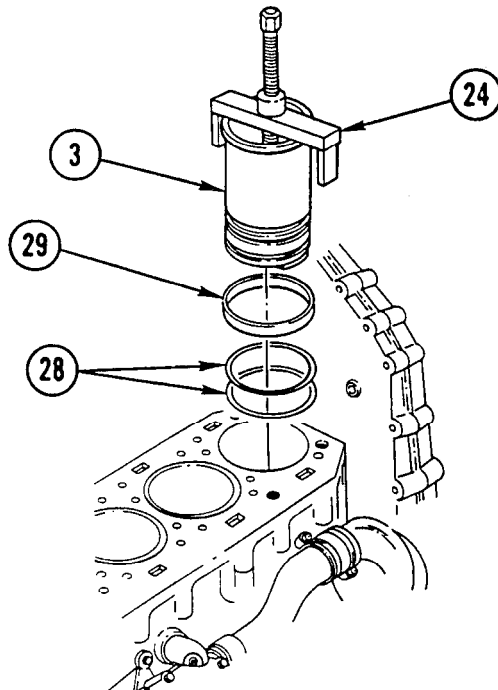


18. ROTATE ENGINE STAND SO ENGINE IS HORIZONTAL AND CYLINDER LINERS (3) ARE UP.
19. CENTER CYLINDER LINER REMOVER (24) OVER CYLINDER LINER (3). POSITION CYLINDER LINER REMOVER SHOE (25) AT BOTTOM OF CYLINDER LINER (3) WITH LIP ON EACH SIDE ENGAGING BOTTOM EDGE OF LINER (3).

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



20. KEEP CYLINDER LINER REMOVER SHOE (25) IN POSITION ON CYLINDER LINER BOTTOM AND TURN CYLINDER LINER REMOVER NUT (26) UNTIL IT CONTACTS CYLINDER LINER REMOVER THRUST BEARING (27).
21. CONTINUE TIGHTENING UNTIL CYLINDER LINER IS FREE IN CYLINDER BLOCK BORE.
22. REMOVE CYLINDER LINER AND CYLINDER LINER REMOVER FROM BLOCK.

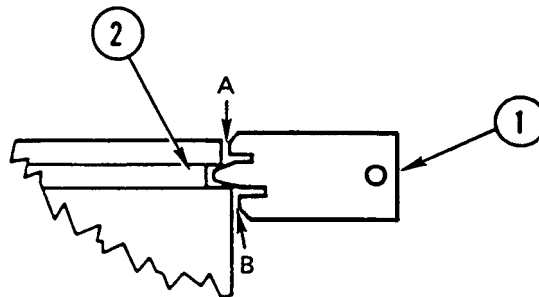


23. REMOVE CYLINDER LINER (3) FROM CYLINDER LINER REMOVER (24).
24. REMOVE AND DISCARD TWO SEAL RINGS (28) AND CREVICE SEAL (29) FROM CYLINDER LINER (3).
25. REPEAT STEPS 19 THRU 24 FOR EACH CYLINDER LINER (3) BEING SERVICED.

**CLEANING****WARNING**

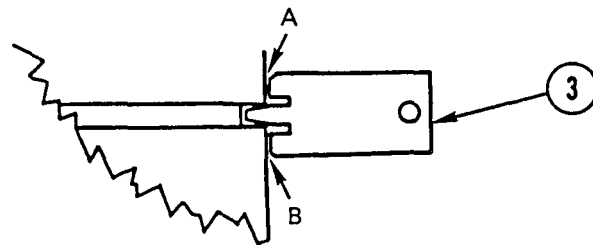
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

1. CLEAN CYLINDER COMPONENTS WITH SOLVENT AND DRY WITH COMPRESSED AIR. BLOW COMPRESSED AIR THRU OIL PASSAGE IN CONNECTING ROD TO MAKE SURE IT IS CLEAR OF OBSTRUCTION. USE CROCUS CLOTH, WET WITH SOLVENT, TO REMOVE ANY TRACE OF FRETTING AND/OR CORROSION ON CONNECTING ROD SADDLE AT PISTON PIN CONTACT SURFACE BEFORE ASSEMBLY.
2. CLEAN CYLINDER LINERS WITH SOLVENT AND DRY WITH COMPRESSED AIR.

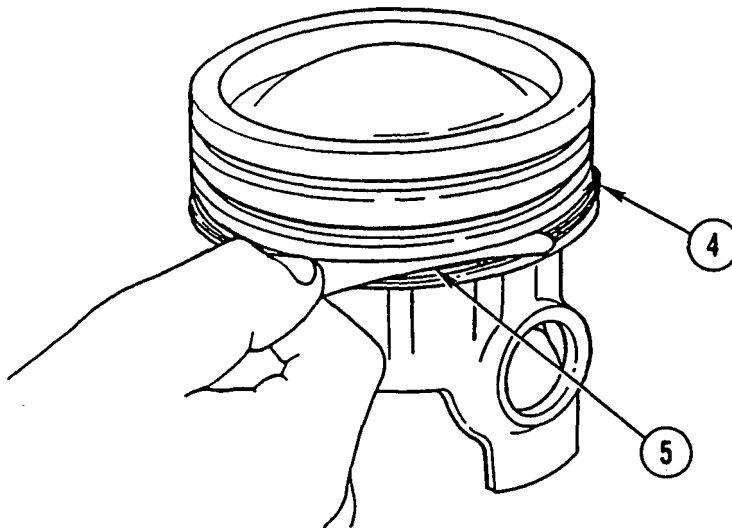
**INSPECTION**

1. EXAMINE PISTON SKIRT AND DOME FOR SCORE MARKS, CRACKS, DAMAGED RING GROOVE LANDS, OR INDICATIONS OF OVERHEATING. REPLACE ANY PISTON IF ANY OF THESE CONDITIONS ARE PRESENT.
2. USING PISTON TOP RING GROOVE GAGE (1), CHECK TAPERED FIRE (TOP) COMPRESSION RING GROOVE (2) IN PISTON DOME. IF SHOULDER A OR B OF GAGE (1) CONTACTS PISTON DOME, DISCARD DOME.
3. INSERT CENTER TANG OF PISTON TOP RING GROOVE GAGE INTO FIRE COMPRESSION RING GROOVE (2). HOLD GAGE (1) AT 90-DEGREE ANGLE TO FIRE COMPRESSION RING GROOVE (2) WITH CENTER TANG OF GAGE (1) IN RING GROOVE (2) AS FAR AS IT WILL GO TO PREVENT FALSE READINGS. THERE SHOULD BE NO CONTACT OF PISTON BY SHOULDERS OF GAGE (1). IF GAGE (1) MAKES CONTACT AT POINT A OR POINT B, FIRE COMPRESSION RING GROOVE (2) IS WORN BEYOND USABLE LIMITS AND PISTON DOME MUST BE DISCARDED.
4. CHECK FIRE COMPRESSION RING GROOVE (2) CLEARANCE AT FOUR LOCATIONS AT 90-DEGREE INTERVALS. MEASURE RING LAND PARALLEL TO, AND AT 90 DEGREES TO, WRIST PIN.

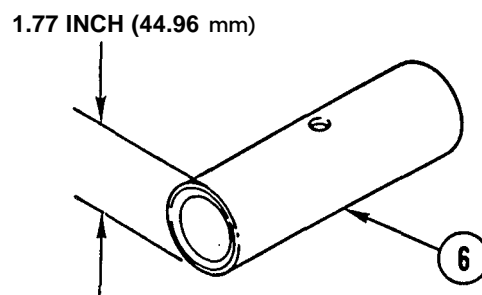
## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



5. USING PISTON SECOND RING GROOVE GAGE (3), CHECK SECOND (MIDDLE) COMPRESSION RING GROOVE IN SAME WAY. IF SHOULDER A OR B OF GAGE (3) CONTACT PISTON DOME, DISCARD DOME.



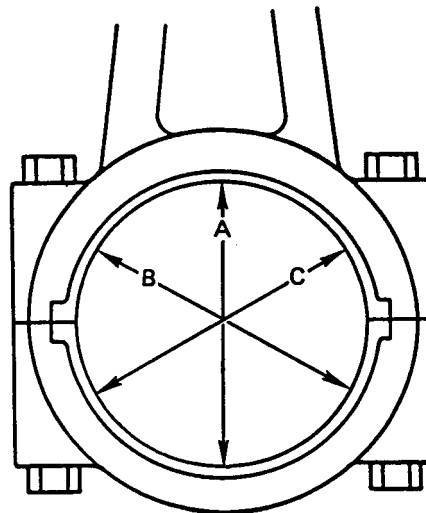
6. HOLD NEW OIL CONTROL RING (4) IN OIL CONTROL RING GROOVE SO NEW OIL CONTROL RING (4) FACE IS FLUSH WITH EDGE OF PISTON DOME, DO NOT PUSH RING (4) TO BOTTOM OF OIL CONTROL RING GROOVE. INSERT FEELER GAGE (5) BETWEEN TOP OF NEW OIL CONTROL RING (4) AND RING LAND OF OIL CONTROL RING GROOVE IN PISTON DOME. IF CLEARANCE IS GREATER THAN 0.004 IN. (0.11 mm), DISCARD DOME.



**CAUTION**

Do not use crocus cloth to polish or refinish piston pin to prevent damage to equipment.

7. IF PISTON PIN (6) SHOWS SIGNS OF FRETTING, OVERHEATING, OR IS WORN TO DIAMETER OF 1.77 IN. (44.96 mm), REPLACE PISTON PIN.
8. REPLACE CONNECTING ROD IF SUBJECTED TO ANY OF THE FOLLOWING:
  - VISUAL DAMAGE (BENT).
  - PREVIOUS BEARING OR RELATED FAILURE.
  - CONNECTING ROD BLUING AT TOP OR BOTTOM END.
  - FRETTING AT SPLIT LINE BETWEEN CONNECTING ROD AND CONNECTING ROD CAP.
  - EXCESSIVE POUND-IN OF ROD BOLT HEADS, NUTS, OR PISTON PIN BOLT AND SPACER.
  - CHECK CONNECTING ROD BOLTS AND CONNECTING ROD CAP NUTS FOR THREAD DAMAGE OR FRETTING ON UNDERSIDE OF HEADS. REPLACE ROD BOLTS AND CONNECTING ROD CAP NUTS IF EITHER CONDITION IS PRESENT.
  - UNUSUAL CYLINDER WEAR PATTERNS.
  - GOUGES, NICKS, OR BURRS ON MACHINED SURFACE OF CONNECTING RODS AT PISTON PIN END.



- MEASURE CONNECTING ROD BORE AT POINTS A, B, AND C. AVERAGE OF BORE READINGS MUST BE WITHIN 3.594-3.595 IN. (91.288-91.313 mm).

## **PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)**

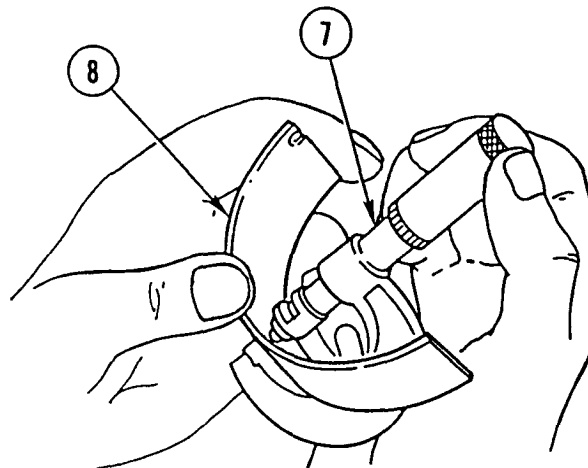
### **NOTE**

- Replace rod and main bearings whenever crankshaft is replaced or engine is rebuilt.
  - Overlay plated bearings may develop very small cracks or small isolated cavities (checking) on bearing surface during engine operation. These are characteristics of, and are not detrimental to, this type of bearing. Bearing should not be replaced for these minor surface imperfections.
9. INSPECT BEARINGS FOR SCORING, PITTING, FLAKING, CHIPPING, CRACKING, LOSS OF OVERLAY OR SIGNS OF OVERHEATING. IF ANY OF THESE CONDITIONS ARE PRESENT, DISCARD BEARINGS.

### **NOTE**

Upper connecting rod bearing shells will normally show signs of distress before lower connecting rod bearing shells. If overlay is worn to copper across connecting rod bearing shell, replace all connecting rod bearing shells.

10. INSPECT BACKS OF BEARING SHELLS FOR BRIGHT SPOTS. IF SUCH SPOTS ARE PRESENT, REPLACE BEARING SHELLS. INSPECT CONNECTING ROD BEARING BORES FOR BURRS OR FOREIGN PARTICLES.



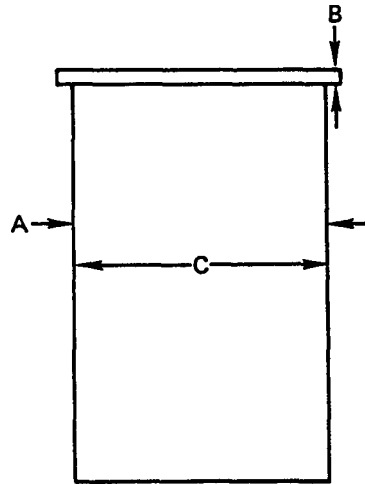
### **NOTE**

Install new upper and lower connecting rod bearing shells if new crankshaft is used.

11. USING MICROMETER (7) AND BALL ATTACHMENT, MEASURE THICKNESS OF CONNECTING ROD BEARING SHELLS (8). MINIMUM THICKNESS OF WORN STANDARD CONNECTING ROD BEARING SHELL SHOULD NOT BE LESS THAN 0.1215 IN. (3.086 mm). IF EITHER UPPER OR LOWER CONNECTING ROD BEARING SHELL (8) OF CONNECTING ROD SET IS LESS THAN MINIMUM THICKNESS, REPLACE BOTH BEARING SHELLS (8).
12. EXAMINE CYLINDER LINER FOR CRACKS, SCORING, GLAZING, RING RIDGE FORMATION, AND CAVITATION EROSION. IF ANY OF THESE CONDITIONS ARE PRESENT, LINER MUST BE DISCARDED.



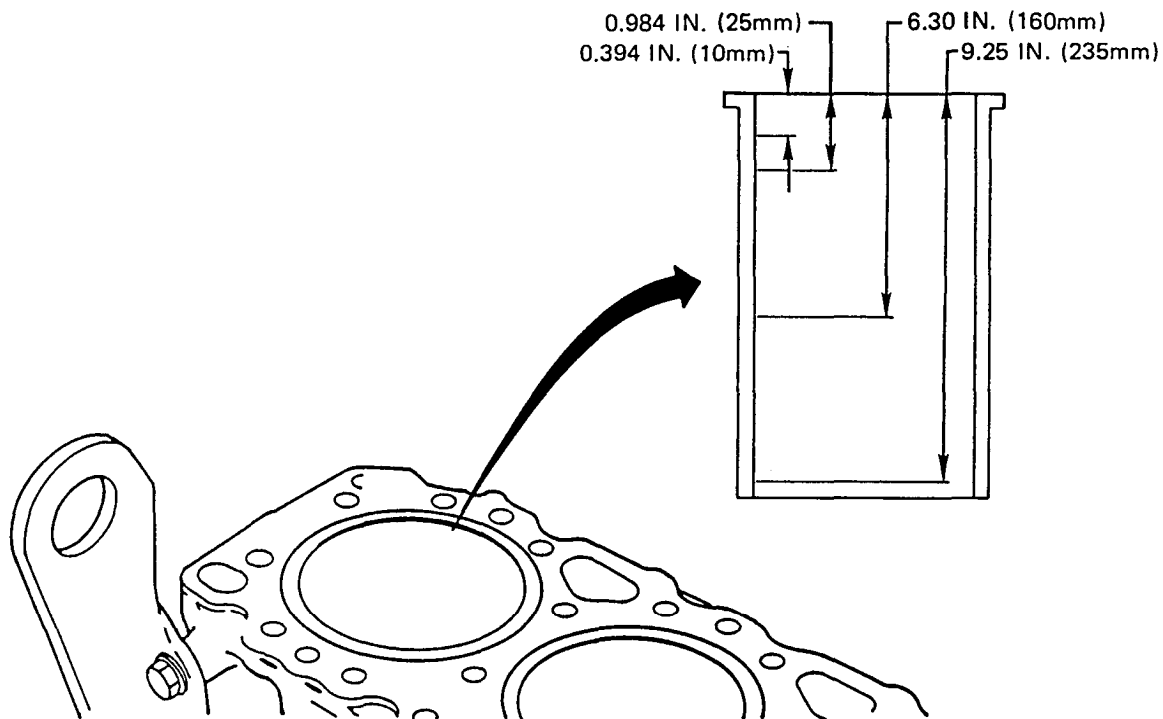
13. EXAMINE OUTSIDE DIAMETER OF LINER FOR FRETTING AT FLANGE AND CYLINDER BLOCK BORE AREA. IF LIGHT FRETTING IS PRESENT, SURFACE CAN BE RESTORED WITH CROCUS CLOTH OR FLAT STONE.



14. MEASURE CYLINDER LINER AS FOLLOWS:

CYLINDER LINER	MINIMUM in. (mm)	MAXIMUM in. (mm)	LIMITS in. (mm)
OUTSIDE DIAMETER (BELOW FLANGE) (A) . . . . .	5.864 (148.95)	5.866 (149.00)	
FLANGE THICKNESS (B) . . . . .	0.3533 (8.975)	0.3543 (9.000)	
INSIDE DIAMETER (NEW) (C) . . . . .	5.118 (130.00)	5.120 (130.05)	
INSIDE DIAMETER (USED) (C) . . . . .			5.122 (130.100)
OUT-OF-ROUND (INSIDE DIAMETER) . . . . .			0.001 (0.025)
TAPER (INSIDE DIAMETER) . . . . .			0.001 (0.025)

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



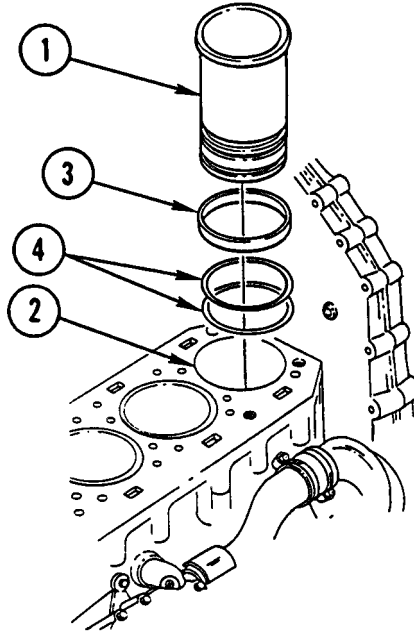
### CAUTION

- If liners are not to be installed at this time, oil them lightly with clean engine lubricating oil and store them upright in clean, dry area to prevent damage to equipment.
- Do not allow liners to rest on sides. Do not store anything on top of liners. To do so could result in damage to equipment.

### NOTE

- Do not hone used liners. Series 60 cylinder liners are honed at the factory with process that cannot be duplicated in the field.
- When installing used liners in proper bores of cylinder block, measure inside diameter at points shown in liner diagram. Maximum diameter of used liner is 5.122 in. (130.100 mm) at any measurement location. Check liner taper and out-of-round. Inside diameter of new service liner is 5.118-5.120 in. (130.00-130.05 mm).
- If any measured cylinder liner specifications are out of limits, liner must be discarded.

15. COAT BORE OF LINER WITH CLEAN ENGINE LUBRICATING OIL AND ALLOW LINER TO SIT FOR 10 MINUTES TO ALLOW OIL TO WORK INTO SURFACE FINISH. WIPE INSIDE OF LINER WITH CLEAN, WHITE PAPER TOWELS. IF DARK RESIDUE APPEARS ON TOWELS, REPEAT OILING AND WIPING UNTIL RESIDUE NO LONGER APPEARS.

**INSTALLATION****CAUTION**

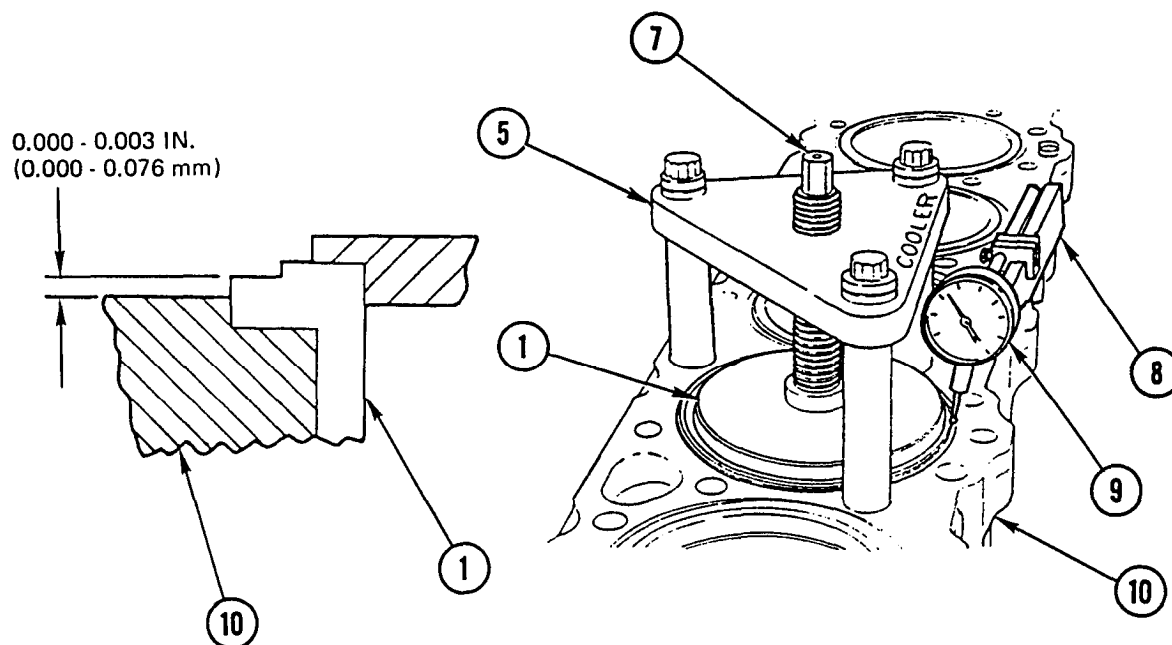
Make sure cylinder block is rotated so that cylinder block deck is up and level. Failure to do so could result in damage to seal rings and crevice seal.

**NOTE**

Make sure block counterbores and cylinder liner flange are free of foreign material or damage.

1. CLEAN INSIDE AND OUTSIDE OF NEW CYLINDER LINER (1) AND CYLINDER BLOCK BORE (2).
2. INSTALL NEW CREVICE SEAL (3) AND TWO NEW SEAL RINGS (4) ON CYLINDER LINER (1).
3. COAT TWO SEAL RINGS (4) AND CREVICE SEAL (3) WITH THIN FILM OF LUBRICATING OIL.
4. COAT CYLINDER BLOCK LINER BORE (2) WITH LUBRICATING OIL WHERE SEAL RINGS (4) AND CREVICE SEAL (3) SEAT.
5. INSTALL CYLINDER LINER (1) IN CYLINDER BLOCK BORE (2) BY HAND UNTIL LOWER SEAL MEETS UPPER CREVICE SEAL BORE.

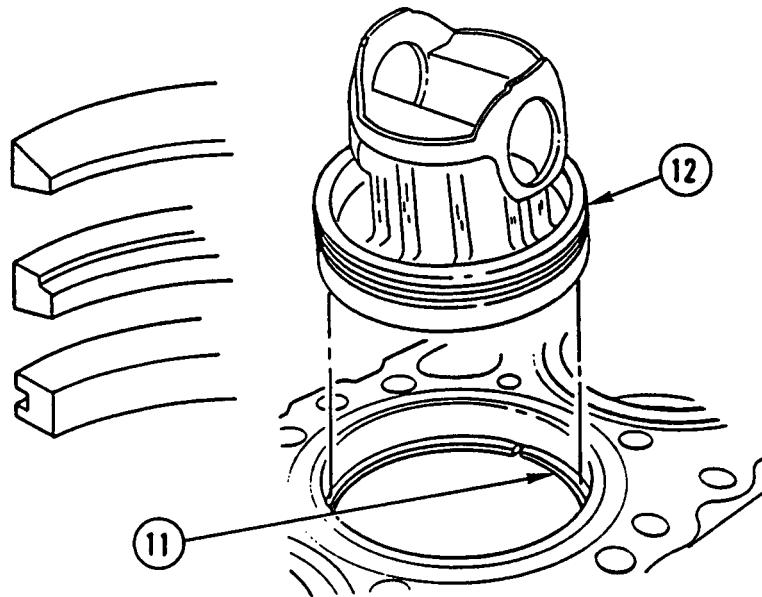
## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



### NOTE

When correctly positioned, side of cylinder liner installer stamped COOLER is on oil cooler side of cylinder block and cylinder liner installer holding bolts will align with cylinder head bolt holes.

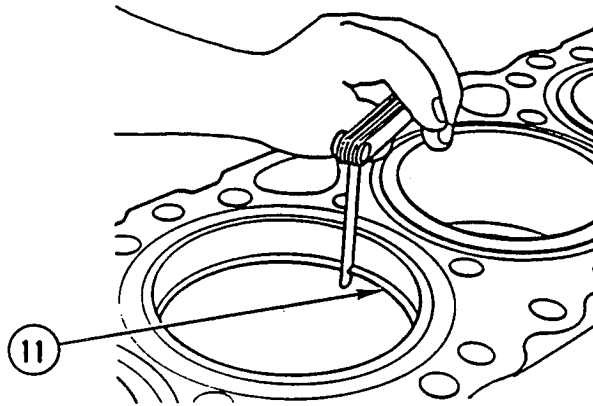
6. CENTER AND INSTALL CYLINDER LINER INSTALLER (5) OVER CYLINDER LINER (1) AND TIGHTEN THREE BOLTS (6).
7. TURN CENTER BOLT (7) OF CYLINDER LINER INSTALLER (5) UNTIL CYLINDER LINER (1) BOTTOMS IN COUNTERBORE.
8. USING DIAL INDICATOR (9), MEASURE CYLINDER LINER (1) PROTRUSION IN THREE EQUAL POSITIONS. MEASURE DISTANCE FROM TOP OF CYLINDER LINER (1) FLANGE TO TOP OF CYLINDER BLOCK (10). ALLOWABLE CYLINDER LINER (1) PROTRUSION IS 0.000-0.003 IN. (0.000-0.076 mm) WITH NO MORE THAN 0.002 IN. (0.05 mm) VARIATION BETWEEN ANY TWO ADJACENT CYLINDERS.
9. REPEAT STEPS 1 THRU 8 FOR REMAINING CYLINDER LINERS (1) BEING INSTALLED,
10. PERFORM CYLINDER BLOCK PRESSURE TESTING (PAGE 12-88).



#### NOTE

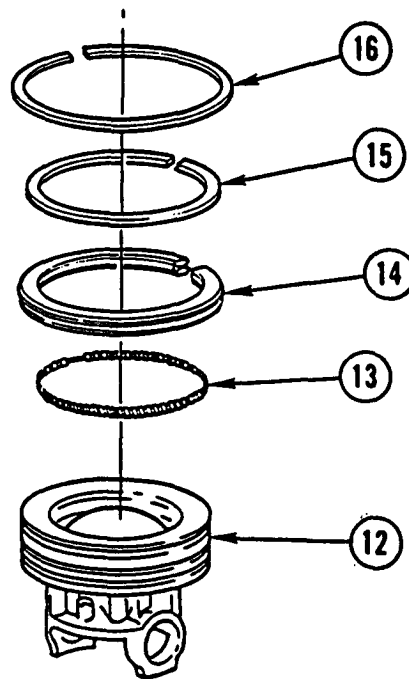
- Fire (top) compression ring has plasma (dull finish) face. Top of fire compression ring is identified by vendor's mark: dimple or color dot located 30 degrees from ring gap.
  - Middle compression ring has chrome (shiny) face. Top of middle compression ring is identified by dimple or color dot located 30 degrees from ring gap. Inner ring edge has groove.
  - Oil control ring has chrome flashed face and can be installed with either side up.
11. INSERT THREE PISTON RINGS (11) INSIDE CYLINDER LINER ONE AT A TIME, USING PISTON DOME (12) (INSERTED UPSIDE DOWN INTO LINER) TO PUSH RING DOWN. INSERT PISTON DOME INTO LINER, TO SAME DEPTH AS RING BEING POSITIONED. THIS WILL ENSURE RINGS ARE PARALLEL WITH TOP OF LINER AND POSITIONED IN LINER WITHIN NORMAL AREA OF RING TRAVEL.

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



### NOTE

- Increase insufficient compression ring gap by filing or stoning ends of piston ring. File or stone both ends of piston ring with cutting action from outer surface to inner surface to prevent chipping or peeling of plasma or chrome plate.
  - Piston ring ends must remain square and outer edge chamfer must be approximately 0.015 in. (0.381 mm).
12. MEASURE COMPRESSION RING GAP OF TOP RING AS SHOWN. REMOVE RING (11) FROM CYLINDER LINER AFTER MEASUREMENT IS COMPLETE. REPEAT THIS PROCEDURE FOR EACH RING (11) AND RECORD MEASUREMENTS. ALLOWABLE RING END GAP IS AS FOLLOWS:
- |                  |                                |
|------------------|--------------------------------|
| FIRE RING        | 0.016-0.35 IN. (0.40-0.91 mm)  |
| COMPRESSION RING | 0.031-0.052 IN (0.80-1.31 mm)  |
| OIL CONTROL RING | 0.016-0.032 IN. (0.40-0.81 mm) |



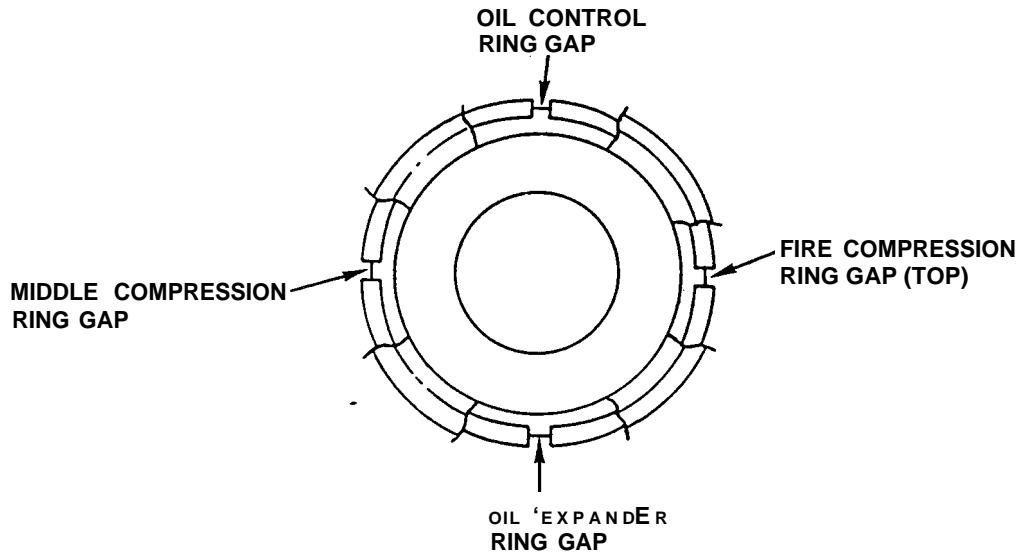
#### CAUTION

Do not spread rings more than necessary to slip them over piston dome to prevent damage to equipment.

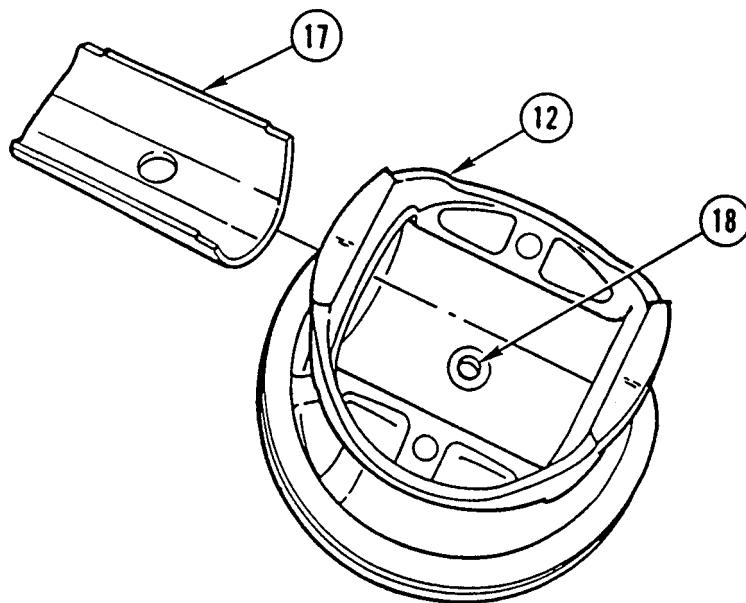
#### NOTE

- Do not overlap oil control ring expander ends.
  - Make sure oil control ring expander is fully seated inside oil control ring groove.
13. INSTALL NEW OIL CONTROL RING EXPANDER (13) IN OIL CONTROL RING GROOVE OF PISTON DOME (12).
  14. INSTALL NEW OIL CONTROL RING (14) BY HAND. OIL CONTROL RING (14) CAP MUST BE POSITIONED 180 DEGREES FROM OIL CONTROL RING EXPANDER (13) SPRING GAP.
  15. WITH PISTON RING PLIERS, INSTALL NEW SECOND (MIDDLE) COMPRESSION RING (15) WITH VENDOR'S MARK: DIMPLE OR COLOR DOT LOCATED 30 DEGREES FROM RING GAP, TOWARD PISTON DOME (12) TOP.
  16. WITH PISTON RING PLIERS, INSTALL NEW FIRE (TOP) COMPRESSION RING (16) WITH VENDOR'S MARK: DIMPLE OR COLOR DOT LOCATED 30 DEGREES FROM RING GAP, TOWARD PISTON DOME (12) TOP.

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)

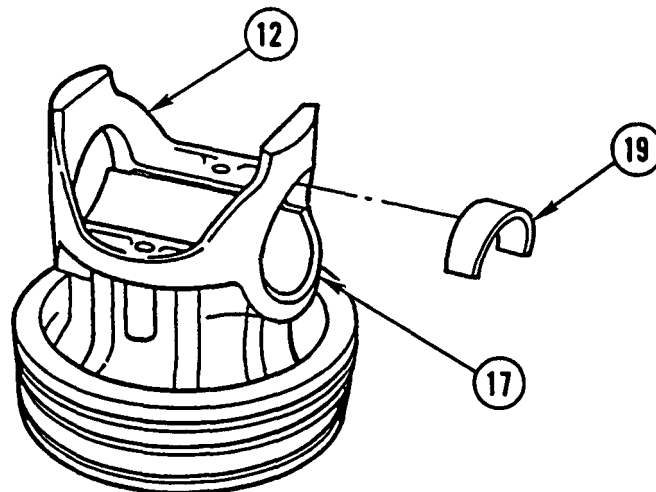


17. POSITION FIRE (TOP) AND MIDDLE COMPRESSION RING GAPS 180 DEGREES FROM EACH OTHER AND 90 DEGREES FROM OIL CONTROL RING AND OIL EXPANDER RING GAPS.

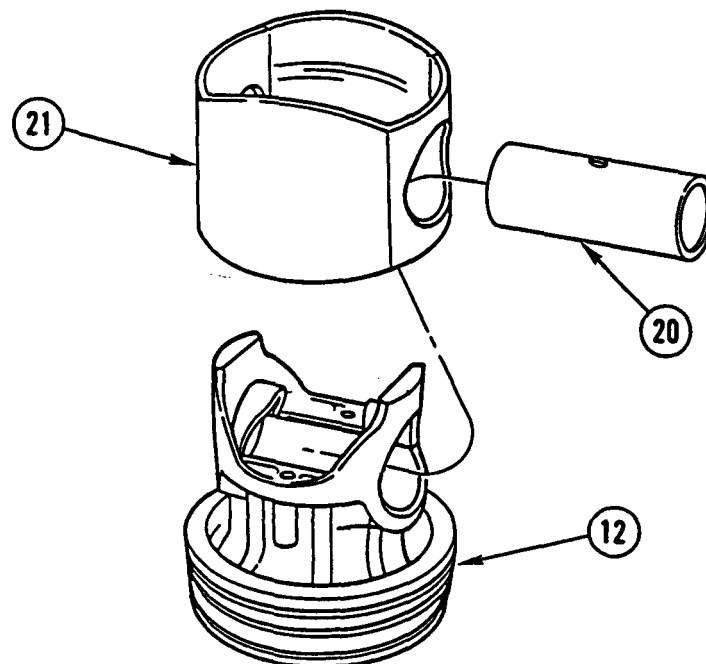


18. PLACE PISTON PIN BUSHING (17) IN PISTON DOME (12). POSITION PISTON PIN BUSHING (17) OVER PISTON DOME RETAINING PIN (18).





19. WITH FLAT SIDE OF PISTON PIN BUSHING END (19) FACING PISTON DOME (12) CROWN LEG, PLACE PISTON PIN BUSHING END (19) IN SLOT OF PISTON PIN BUSHING (17). USING BOTH THUMBS, PRESS PISTON PIN BUSHING END (19) INTO PISTON DOME (12) LEG BORE.
20. REPEAT STEP 19 TO INSTALL OTHER PISTON PIN BUSHING END (19) ON OPPOSITE PISTON DOME (12) LEG.

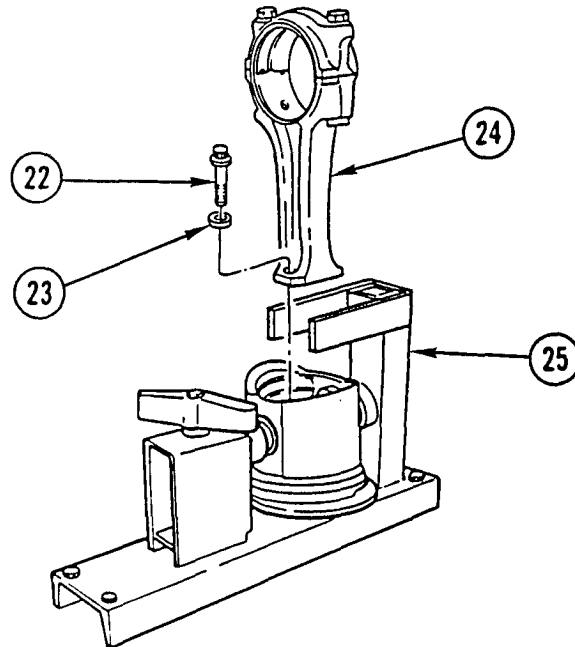


**NOTE**

Make sure both piston pin bushing ends are in place.

21. APPLY LIGHT COATING OF CLEAN ENGINE LUBRICATING OIL TO PISTON PIN BUSHING, PISTON PIN BUSHING ENDS, AND PISTON PIN (20). PLACE PISTON SKIRT (21) OVER PISTON DOME (12) AND ALINE PISTON PIN (20) BORES IN DOME (12) AND SKIRT (21).
22. INSTALL PISTON PIN (20) THRU PISTON SKIRT (21) BORE AND CROWN WITH PISTON PIN (20) ROD BOLT HOLES FACING AWAY FROM PISTON DOME (12).

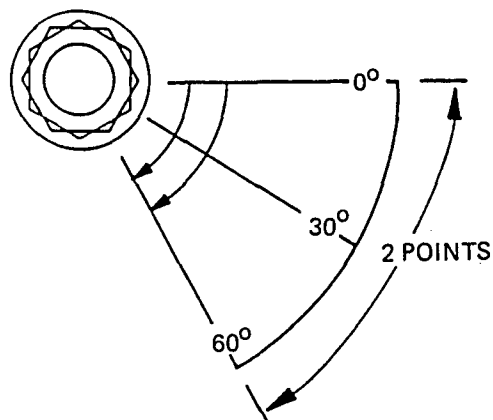
## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



### CAUTION

Connecting rod-to-piston attaching bolts and spacers are specially designed components. No other bolts or spacers may be used. To do so will cause engine damage.

23. APPLY SMALL AMOUNT OF INTERNATIONAL COMPOUND NO. 2 TO THREADS AND BOLT HEAD CONTACT AREA ON TWO PISTON PIN BOLTS (22) AND TO BOTH ENDS OF TWO SPACERS (23). INSTALL TWO SPACERS (23) ON TWO PISTON PIN BOLTS (22).
24. POSITION CONNECTING ROD ASSEMBLY (24) ON PISTON PIN AND INSTALL PISTON PIN BOLTS (22) AND SPACERS (23) HAND-TIGHT.
25. PLACE CONNECTING ROD AND PISTON ASSEMBLY, DOME SIDE DOWN, ON PLATE OF HOLDING FIXTURE (25) WITH PISTON PIN BETWEEN STATIONARY AND MOVABLE HOLDING POINTS OF HOLDING FIXTURE (25). SECURE CONNECTING ROD AND PISTON ASSEMBLY IN HOLDING FIXTURE (25).

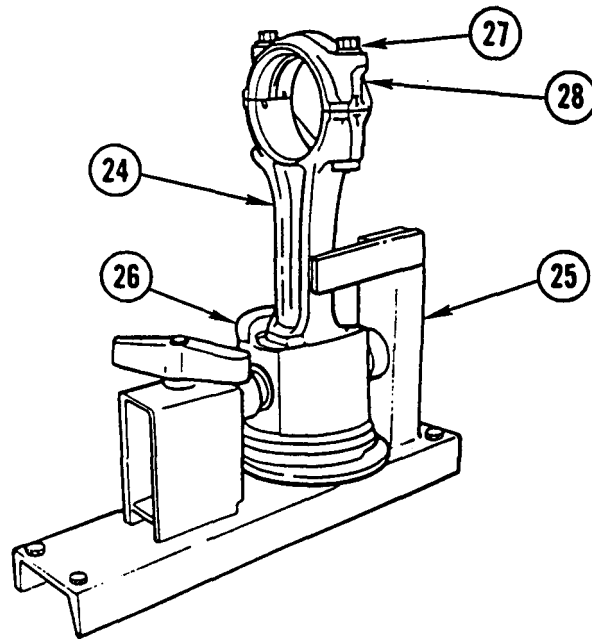


26. TIGHTEN PISTON PIN BOLTS TO 33 LB-FT (45 N.m).
27. TURN PISTON PIN BOLTS AN ADDITIONAL 60 DEGREES (TWO POINTS ON 12-POINT BOLT).

**NOTE**

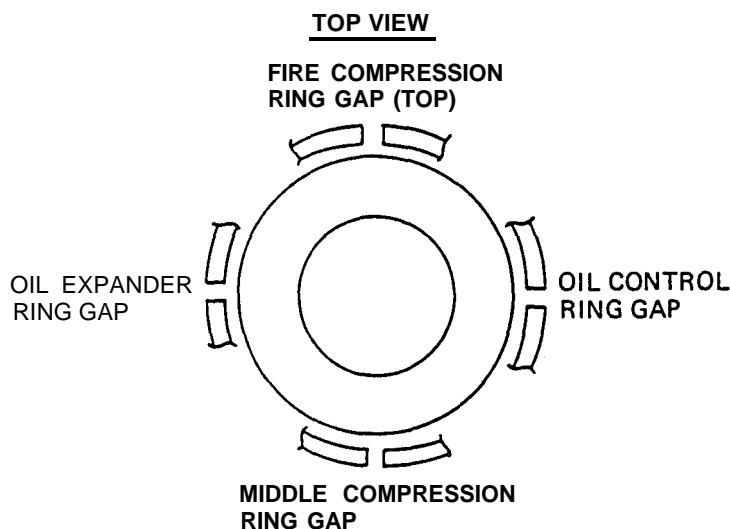
Steps 28 and 29 are required to reduce joint friction for more consistent bolt-clamp load.

28. LOOSEN PISTON PIN BOLTS AND TIGHTEN TO 33 LB-FT (45 N.m).
29. TURN PISTON PIN BOLTS AN ADDITIONAL 60 DEGREES (TWO POINTS ON 12-POINT BOLTS).

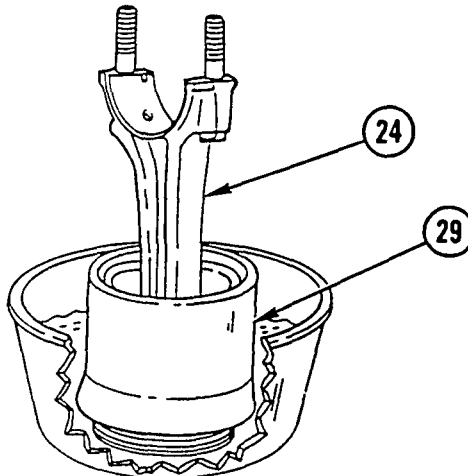


30. REMOVE CONNECTING ROD AND PISTON ASSEMBLY (24) FROM HOLDING FIXTURE (25).
31. PLACE PISTON ASSEMBLY (26), DOME DOWN, IN CLEAN PAN. COAT PISTON ASSEMBLY (26) LIBERALLY WITH CLEAN ENGINE LUBRICATING OIL.
32. REPEAT STEPS 8 THRU 31 FOR REMAINING CONNECTING ROD AND PISTON ASSEMBLIES.
33. REMOVE TWO CONNECTING ROD CAP NUTS (27) AND CONNECTING ROD CAP (28).

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



34. MAKE SURE PISTON RING GAPS ARE STAGGERED.

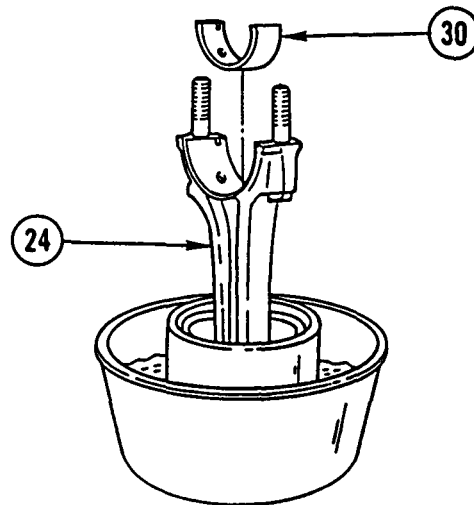


### **CAUTION**

Nicks or burrs on non-tapered inside diameter end of piston ring compressor may result in damage to piston rings. Inspect piston ring compressor for nicks or burrs.

35. COAT INSIDE OF PISTON RING COMPRESSOR (29) WITH CLEAN ENGINE LUBRICATING OIL.

36. INSTALL TAPERED END OF PISTON RING COMPRESSOR (29) OVER END OF CONNECTING ROD (24) AND DOWN ON PISTON. SLIDE PISTON RING COMPRESSOR (29) DOWN UNTIL IT CONTACTS BOTTOM OF PAN.

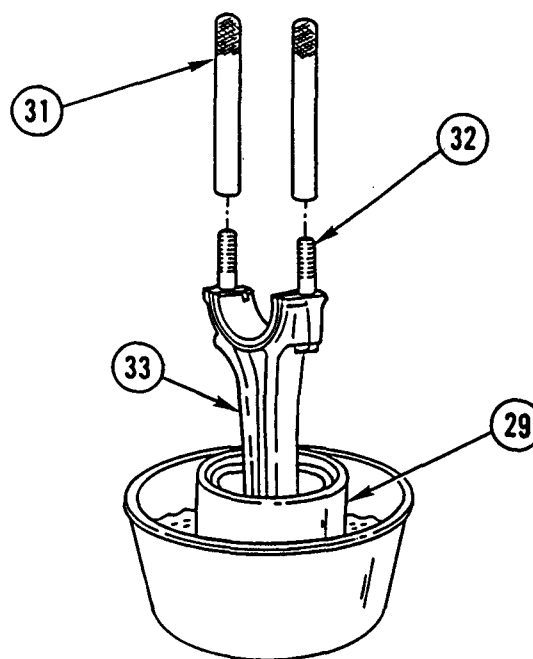


37. POSITION CRANKSHAFT CONNECTING ROD JOURNAL OF CYLINDER BEING SERVICED AT BOTTOM-DEAD-CENTER.
38. INSTALL UPPER CONNECTING ROD BEARING SHELL (30) IN CONNECTING ROD (24). INDEX TANG ON BEARING SHELL (30) WITH NOTCH IN CONNECTING ROD (24) BEARING SADDLE.

**NOTE**

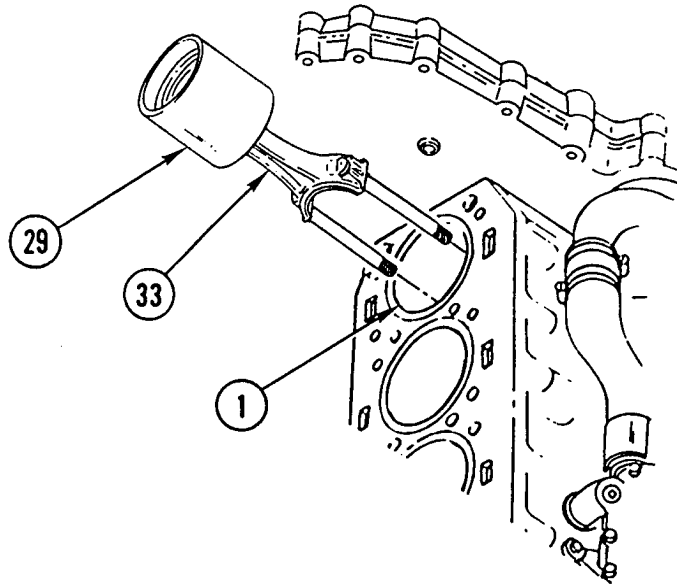
Perform step 39 only if not performing plastigauge check.

39. LUBRICATE UPPER CONNECTING ROD BEARING SHELL (30) AND CRANKSHAFT CONNECTING ROD JOURNAL WITH CLEAN ENGINE LUBRICATING OIL.



40. INSTALL TWO CONNECTING ROD GUIDES (31) ON TWO CONNECTING ROD BOLTS (32).
41. LIFT CONNECTING ROD ASSEMBLY (33) AND PISTON RING COMPRESSOR (29) OUT OF PAN.

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)



### **CAUTION**

Number stamped on connecting rods indicates cylinder they should be installed in. Number must be on oil cooler side of cylinder block when installing connecting rods to prevent damage to equipment.

### **NOTE**

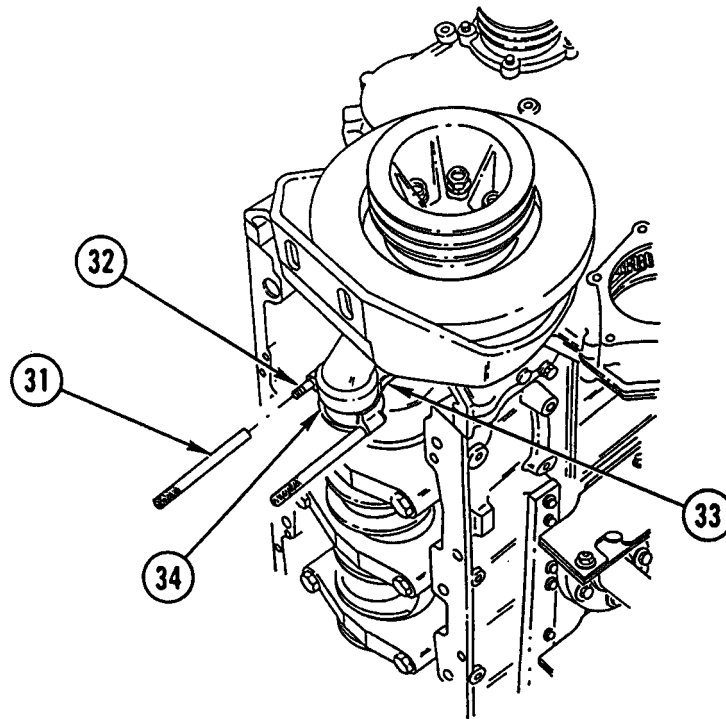
Do not allow piston to slide out of bottom of piston ring compressor.

42. PLACE PISTON RING COMPRESSOR (29) AND CONNECTING ROD AND PISTON ASSEMBLY (33) OVER CYLINDER TO BE SERVICED. POSITION PISTON RING COMPRESSOR (29) SQUARELY ON CYLINDER LINER (1) FLANGE.

### **CAUTION**

Do not force connecting rod and piston assembly into cylinder liner as oil control ring expander applies considerable force on oil control ring. Be careful to prevent ring breakage.

43. PUSH CONNECTING ROD AND PISTON ASSEMBLY (33) INTO CYLINDER LINER BY HAND UNTIL PISTON IS FREE OF PISTON RING COMPRESSOR (29).



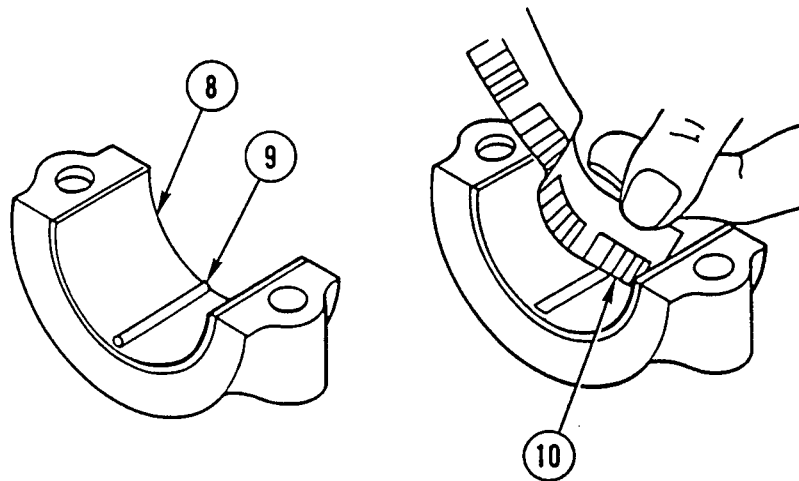
44. REMOVE PISTON RING COMPRESSOR.

**NOTE**

Make sure two connecting rod bolts have not been unseated or turned.

45. PUSH OR TAP CONNECTING ROD AND PISTON ASSEMBLY (33) UNTIL UPPER CONNECTING ROD BEARING SHELL IS FIRMLY SEATED ON CRANKSHAFT JOURNAL (34). REMOVE TWO CONNECTING ROD GUIDES (31).

## PISTON AND CYLINDER ASSEMBLY REPLACEMENT (CONT)

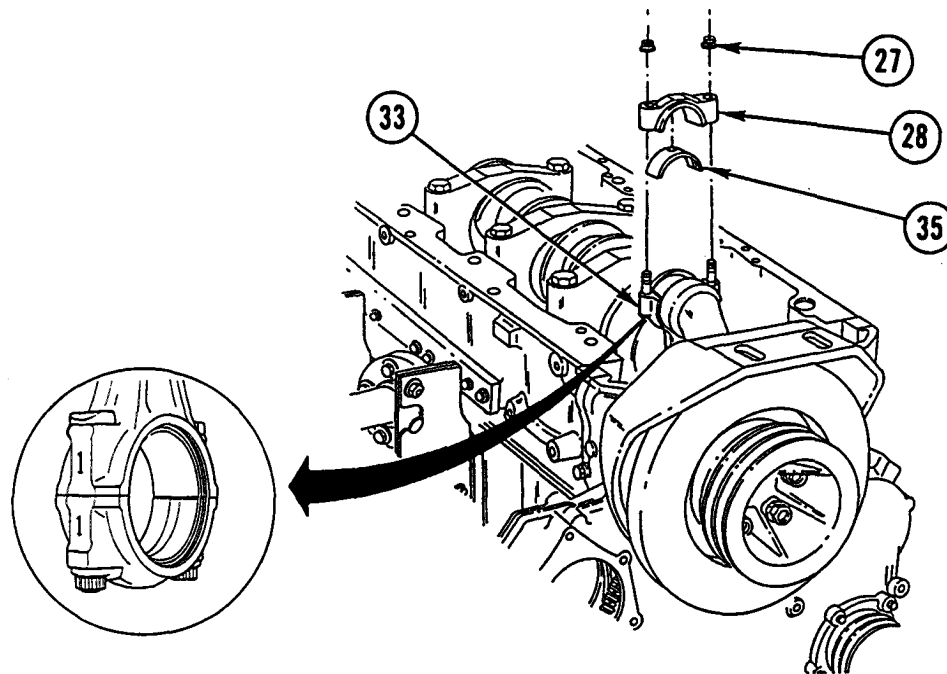


### NOTE

- Perform step 46 only if performing plastigauge check.
- Go to step 47 if not performing plastigauge check.

46. CHECK CLEARANCE BETWEEN CONNECTING ROD BEARING SHELLS AND CRANKSHAFT JOURNAL AT TIME OF CONNECTING ROD AND PISTON ASSEMBLY INSTALLATION AS FOLLOWS:
- A. WITH UPPER AND LOWER BEARING SHELLS (8) INSTALLED IN CONNECTING ROD AND CONNECTING ROD CAP, WIPE ANY OIL FROM BEARING SHELLS (8) AND CONNECTING ROD JOURNAL.
  - B. PLACE PIECE OF PLASTIGAUGE (9) ALONG FULL WIDTH OF LOWER CONNECTING ROD BEARING SHELL (8) ABOUT 1/4 IN. (6.35 mm) OFF CENTER.
  - C. INSTALL CONNECTING ROD AND ROD BOLTS ON CRANKSHAFT BEARING JOURNAL IN ITS CORRESPONDING CYLINDER.
  - D. INSTALL CONNECTING ROD CAP AND CAP NUTS ON CONNECTING ROD AND TIGHTEN CONNECTING ROD CAP NUTS TO 118-137 LB-FT (160-185 N.m.).
  - E. REMOVE CONNECTING ROD CAP AND BEARING SHELL (8).
  - F. FLATTENED PLASTIGAUGE (9) WILL ADHERE TO EITHER BEARING SHELL OR CONNECTING ROD JOURNAL. COMPARE WIDTH OF PLASTIGAUGE (9) AT WIDEST POINT WITH GRADUATIONS SCALE (10) ON PLASTIGAUGE (9) ENVELOPE TO DETERMINE CONNECTING ROD BEARING CLEARANCE. MAXIMUM CONNECTING ROD BEARING TO CONNECTING ROD JOURNAL CLEARANCE WITH USED PARTS IS 0.006 IN. (0.152 mm).
  - G. INSPECT CRANKSHAFT JOURNALS BEFORE INSTALLING BEARINGS (PAGE 12-41).
  - H. COAT CONNECTING ROD BEARING SHELLS AND JOURNAL WITH CLEAN ENGINE LUBRICATING OIL BEFORE ASSEMBLY.





47. PLACE LOWER CONNECTING ROD BEARING SHELL (35) IN CONNECTING ROD CAP (28). INDEX BEARING TANG WITH NOTCH IN CONNECTING ROD CAP (28). LUBRICATE BEARING SHELL (35) WITH CLEAN ENGINE LUBRICATING OIL.

**CAUTION**

Number stamped on connecting rod caps indicates cylinder they should be installed in. Number must be on oil cooler side of cylinder block when installing connecting rod caps to prevent damage to equipment.

48. INSTALL CONNECTING ROD CAP (28) AND LOWER CONNECTING ROD BEARING SHELL (35) ON CONNECTING ROD ASSEMBLY (33).

**CAUTION**

Make sure connecting rod bolt has not turned in connecting rod before connecting rod cap nut is tightened to prevent damage to equipment.

49. INSTALL TWO CONNECTING ROD CAP NUTS (27). TIGHTEN CAP NUTS ALTERNATELY TO 118-137 LB-FT (160-185 N.m). CHECK CONNECTING ROD SIDE CLEARANCE BY MOVING CONNECTING ROD FROM CRANK NECK. IF THERE IS NO CLEARANCE, CHECK BEARING INSTALLATION.

50. INSTALL REMAINING PISTON AND ROD ASSEMBLIES IN SAME MANNER.

**NOTE**

Follow-on Maintenance:

Install oil pump (page 3-199).

Install cylinder head (page 3-80).

## Section II. FUEL SYSTEM REPAIR

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### OVERVIEW

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This section illustrates and describes procedures for maintenance of the fuel system and related parts.

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### FUEL TANK REPAIR

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This task covers: Repair

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#### INITIAL SETUP

##### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

##### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Fuel Tank Removed

##### References:

FM 43-2  
TM 9-237  
TM 9-2320-363-20

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### REPAIR

REPAIR FUEL TANK IN ACCORDANCE WITH FM 43-2 AND TM 9-237.

#### NOTE

Follow-on Maintenance:  
Install fuel tank (TM 9-2320-363-20).

## Section III. AIR INTAKE REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the air intake and related parts.

### **TURBOCHARGER REPAIR**

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

#### **INITIAL SETUP**

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Turbocharger Fixture Set, J39508

**Materials/Parts:**

Bolt (4)	P/N 400674-620
Ring, Seal	P/N 400474-9
Ring, Piston	P/N 403818
Screw (3)	P/N 400872-0410
Bearing, Thrust	P/N 443686-1
Bearing, Journal	P/N 410394-1
Ring, Retaining (3)	P/N 400446-81
Bolt (4)	P/N 400448-3
Ring, Piston	P/N 408049-4
Compound, Antiseize	Appendix B, Item 11
Compound, Pipe Sealing	Appendix B, Item 15

**Materials/Parts (Cont):**

Oil, Lubricating	Appendix B, Item 37
Grease, General Purpose	Appendix B, Item 27

**Equipment Condition:**

Reference	Condition Description
Page 3-101	Turbocharger Removed

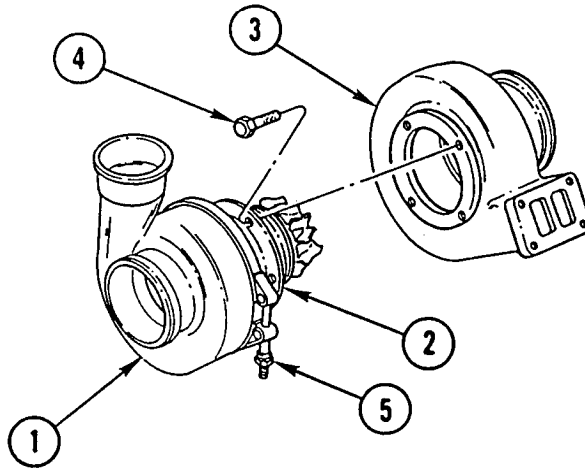
**General Safety Instructions:**

**WARNING**

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

## TURBOCHARGER REPAIR (CONT)

### DISASSEMBLY

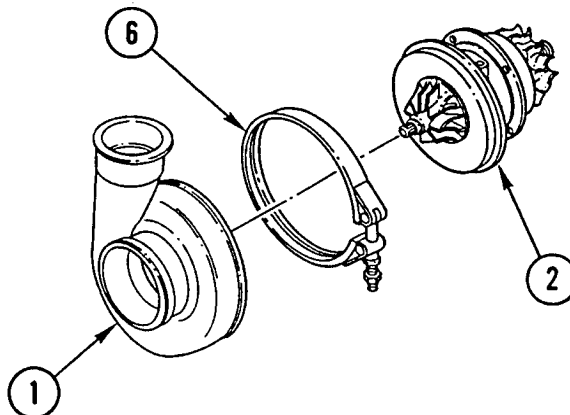


1. SCRIBE MATCH MARKS ON COMPRESSOR HOUSING (1), CENTER HOUSING (2), AND TURBINE HOUSING (3) TO AID IN ASSEMBLY.

#### CAUTION

Tilting or cocking turbine housing during removal could damage turbine wheel blades.

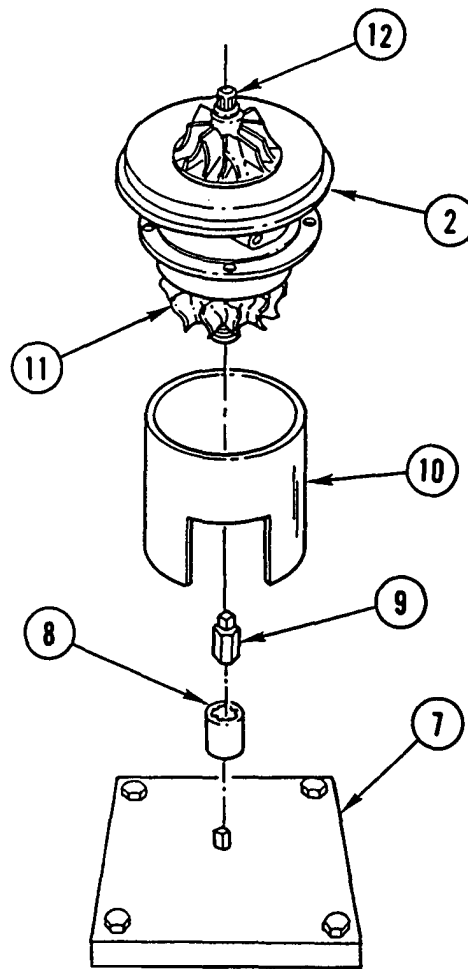
2. REMOVE FOUR BOLTS (4) AND TURBINE HOUSING (3) FROM CENTER HOUSING (2). DISCARD BOLTS.
3. LOOSEN COUPLING NUT (5).



#### CAUTION

Tilting or cocking compressor housing during removal could damage compressor blades.

4. REMOVE COMPRESSOR HOUSING (1) AND CLAMP (6) FROM CENTER HOUSING (2). IF NECESSARY, LOOSEN HOUSING (1) BY TAPPING WITH SOFT MALLET.



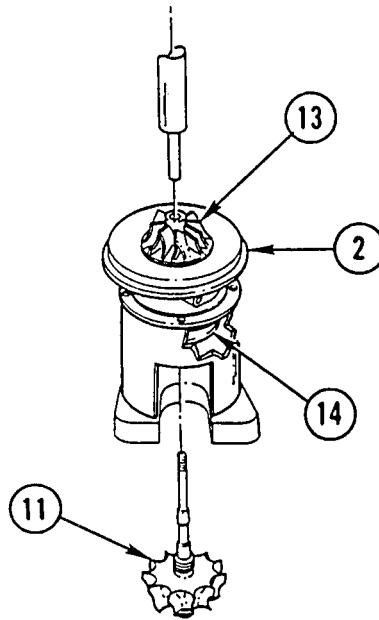
5. BOLT SUPPORT FIXTURE BASE PLATE (7) TO BENCH. INSTALL SUPPORT FIXTURE SOCKET (8) ON BASE PLATE. INSTALL SUPPORT FIXTURE HEX BIT (9) ON SOCKET (8).
6. PLACE SMALL SUPPORT FIXTURE SUPPORT (10) ON BASE PLATE (7). INSTALL CENTER HOUSING (2) AND TURBINE WHEEL ASSEMBLY (11) ON SUPPORT (10) WITH TURBINE WHEEL SHAFT ON HEX BIT (9).

**CAUTION**

- Be prepared to catch turbine wheel assembly and turbine shroud if they fall free when compressor wheel is removed. Damage to components could result if dropped to floor.
- Note that compressor wheel nut has left-hand threads to prevent damage to equipment.

7. REMOVE COMPRESSOR WHEEL NUT (12) WITH NUT WRENCH.

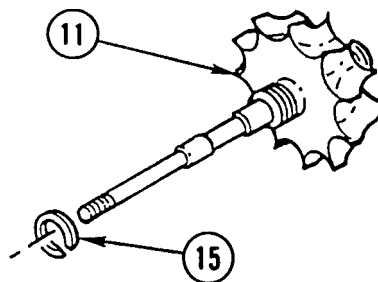
## TURBOCHARGER REPAIR (CONT)



### **CAUTION**

If hydraulic press is required to remove compressor wheel, make sure press ram does not contact compressor wheel to prevent blade damage.

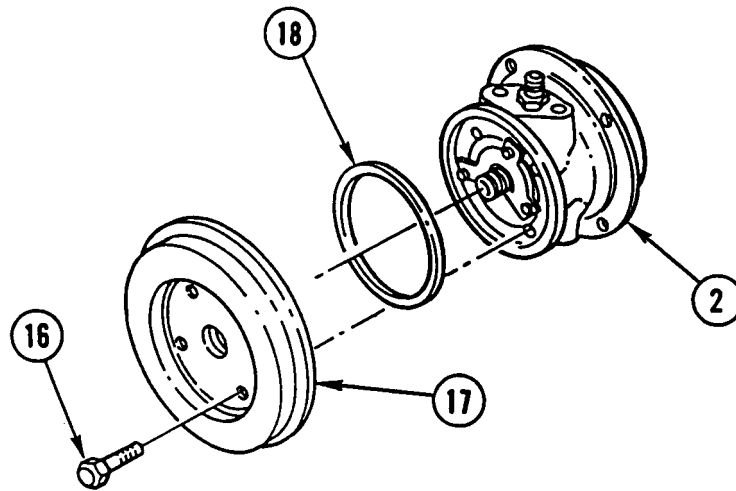
8. IF COMPRESSOR WHEEL (13) CANNOT BE REMOVED BY HAND, ALINE CENTER HOUSING (2) AND TURBINE WHEEL ASSEMBLY (11) CAREFULLY IN SUPPORT FIXTURE ATTACHED TO ARBOR PRESS. PRESS TURBINE WHEEL ASSEMBLY (11) FROM COMPRESSOR WHEEL (13). CATCH TURBINE WHEEL ASSEMBLY (11) AND SHROUD (14) AS THEY DROP FROM CENTER HOUSING (2).



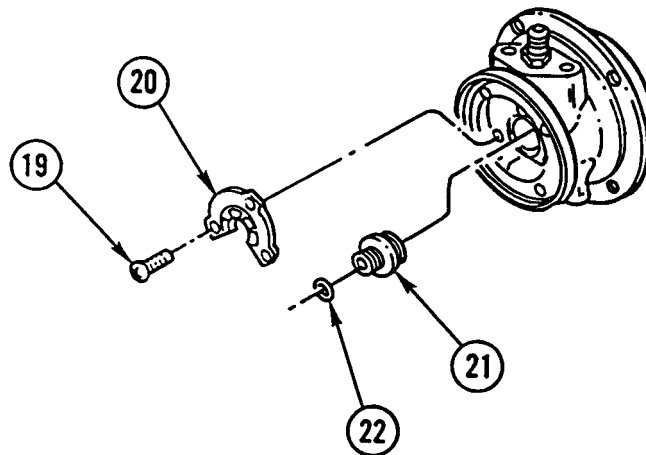
### **CAUTION**

If turbine wheel assembly piston ring catches in turbine wheel shroud bore, do not force piston ring. Guide piston ring thru gently to avoid damaging shroud.

9. REMOVE AND DISCARD PISTON RING (15) FROM TURBINE WHEEL ASSEMBLY (11).

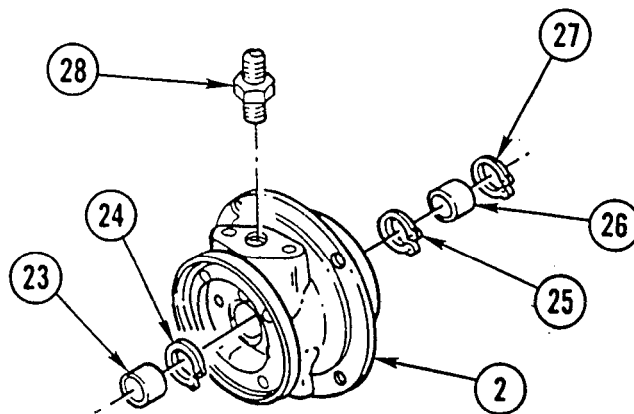


10. REMOVE FOUR BOLTS (16) AND BACKPLATE (17) FROM CENTER HOUSING (2). DISCARD BOLTS. IF NECESSARY, TAP BACKPLATE WITH 1/2-IN. DIAMETER WOODEN DOWEL AND SOFT MALLET TO SEPARATE BACKPLATE (17) FROM CENTER HOUSING (2).
11. REMOVE AND DISCARD SEAL RING (18) FROM CENTER HOUSING (2) GROOVE.



12. REMOVE THREE SCREWS (19), THRUST BEARING (20), AND THRUST COLLAR (21). DISCARD SCREWS AND THRUST BEARING.
13. REMOVE AND DISCARD PISTON RING (22) FROM THRUST COLLAR (21).

## TURBOCHARGER REPAIR (CONT)



### **CAUTION**

Be careful not to damage center housing bore with retaining ring pliers when removing retaining ring.

14. REMOVE AND DISCARD COMPRESSOR END JOURNAL BEARING (23) AND RETAINING RING (24) FROM COMPRESSOR END OF CENTER HOUSING (2).
15. REMOVE TURBINE END RETAINING RING (25), JOURNAL BEARING (26), AND RETAINING RING (27) FROM TURBINE END OF CENTER HOUSING (2). DISCARD RETAINING RINGS.
16. REMOVE OIL INLET CONNECTOR (28) FROM CENTER HOUSING (2).

### **CLEANING**

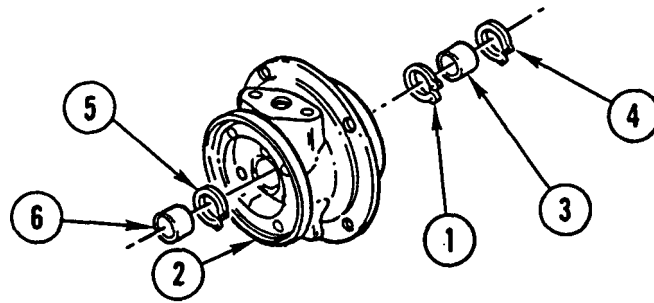
Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

1. INSPECT ALL PARTS FOR SIGNS OF DAMAGE, CORROSION, OR DETERIORATION. CHECK FOR NICKED, CROSSED, OR STRIPPED THREADS.
2. VISUALLY CHECK TURBINE WHEEL SHROUD AND TURBINE WHEEL FOR SIGNS OF RUBBING.
3. CHECK COMPRESSOR WHEEL FOR SIGNS OF RUBBING OR DAMAGE FROM FOREIGN MATERIAL. WHEEL MUST BE FREE OF DIRT AND OTHER FOREIGN MATERIAL.



**ASSEMBLY**



**CAUTION**

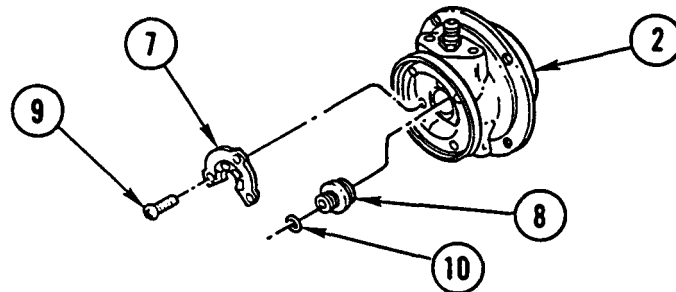
Be careful not to damage center housing bore with retaining ring pliers when installing retaining rings.

1. INSTALL NEW RETAINING RING (1) IN TURBINE END OF CENTER HOUSING (2).
2. COAT JOURNAL BEARING (3) WITH ENGINE OIL. INSTALL JOURNAL BEARING (3) AND NEW RETAINING RING (4) IN TURBINE END OF CENTER HOUSING (2).

**CAUTION**

Be careful not to damage center housing bore with retaining ring pliers when installing retaining ring.

3. INSTALL NEW RETAINING RING (5) IN COMPRESSOR END OF CENTER HOUSING (2).
4. COAT NEW JOURNAL BEARING (6) WITH ENGINE OIL. INSTALL JOURNAL BEARING (6) IN COMPRESSOR END OF CENTER HOUSING (2).



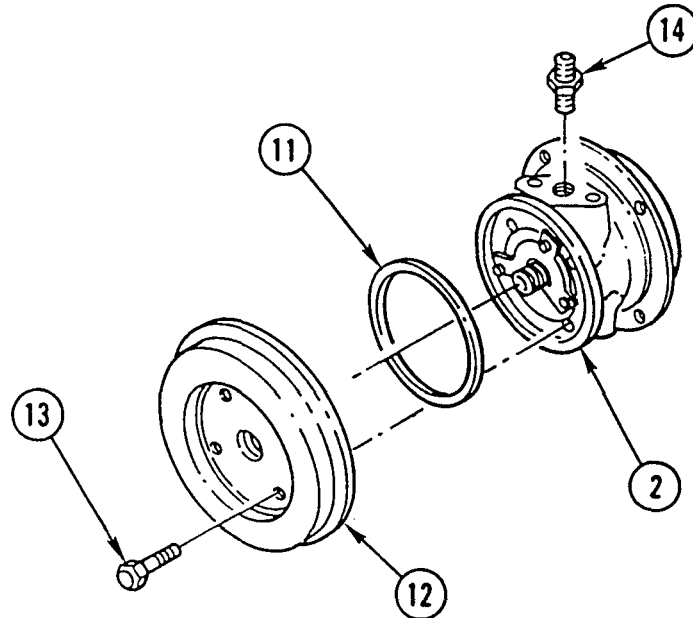
5. FIT NEW THRUST BEARING (7) INTO GROOVE OF THRUST COLLAR (8). INSTALL THRUST COLLAR (8) ON CENTER HOUSING (2). SECURE THRUST COLLAR AND BEARING WITH THREE NEW SCREWS (9). TIGHTEN SCREWS TO 30-35 LB-IN. (3.4-3.9 N.m).

**CAUTION**

Do not force piston ring into place as it is easily broken.

6. INSTALL NEW PISTON RING (10) ON THRUST COLLAR (8) BY HAND.

## TURBOCHARGER REPAIR (CONT)

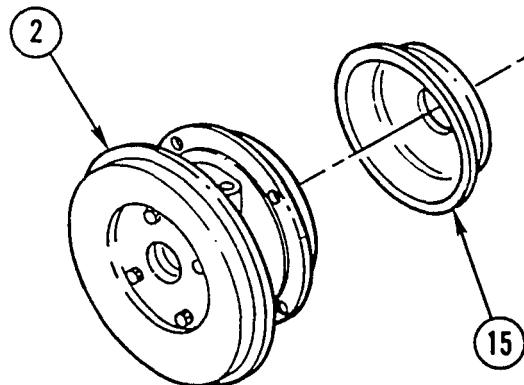


7. INSTALL NEW SEAL RING (11) IN GROOVE IN CENTER HOUSING (2).
8. INSTALL BACKPLATE (12) AND SECURE WITH FOUR NEW BOLTS (13). TIGHTEN BOLTS TO 90-105 LB-IN. (10.1 -11.4 N.m).

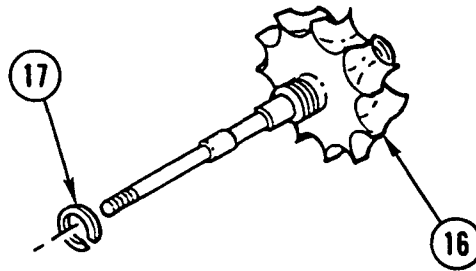
### **WARNING**

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

9. COAT THREADS OF OIL INLET CONNECTOR (14) WITH PIPE SEALANT AND INSTALL CONNECTOR (14) IN CENTER HOUSING (2).



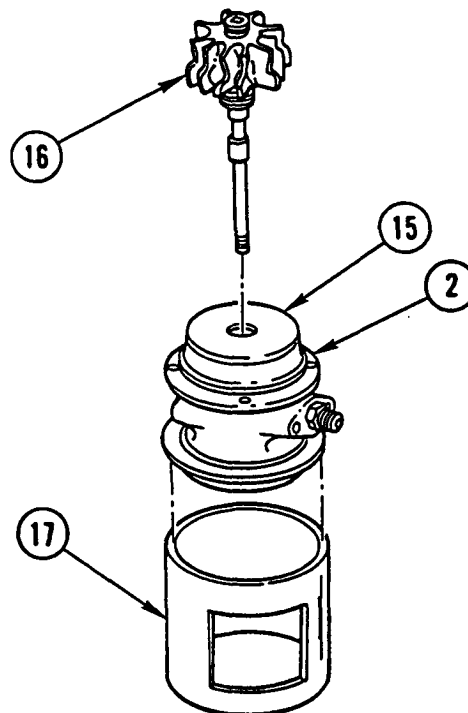
10. INSTALL TURBINE WHEEL SHROUD (15) ON CENTER HOUSING (2).



**CAUTION**

Make sure piston ring is installed in square-bottomed groove of turbine shaft and not in round-bottomed groove. Piston ring installed in wrong groove will not allow turbine shaft to seat properly.

11. APPLY GREASE TO SQUARE-BOTTOMED GROOVE IN TURBINE WHEEL ASSEMBLY (16) AND INSTALL NEW PISTON RING (17).

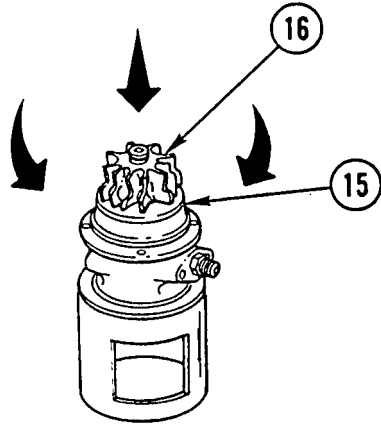


**CAUTION**

Keep turbine wheel assembly shaft straight during installation into center housing to avoid scuffing journal bearings.

12. PLACE CENTER HOUSING (2), TURBINE END UP, ON LARGE SUPPORT FIXTURE SUPPORT (17). GUIDE SHAFT OF TURBINE WHEEL ASSEMBLY (16) CAREFULLY THRU WHEEL SHROUD (15) AND INTO CENTER HOUSING (2).

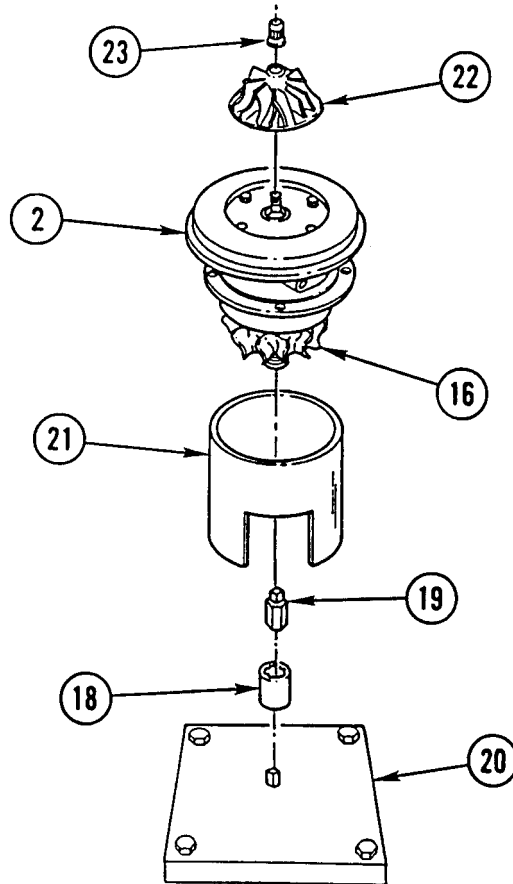
## TURBOCHARGER REPAIR (CONT)



### CAUTION

Do not force turbine wheel assembly shaft piston ring into center housing as piston ring is very brittle.

13. APPLY GENTLE, DOWNWARD PRESSURE TO TURBINE WHEEL ASSEMBLY (16) AND ROTATE WHEEL SHROUD (15) TO SEAT PISTON RING IN BORE.

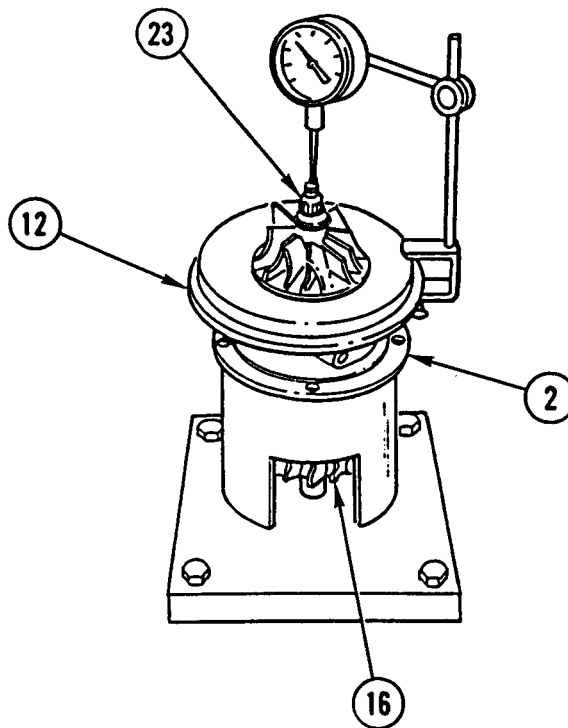


14. INSTALL SUPPORT FIXTURE SOCKET (18) AND HEX BIT (19) ON SUPPORT FIXTURE BASE PLATE (20). PLACE SMALL SUPPORT FIXTURE SUPPORT (21) ON BASE PLATE (20). INSTALL CENTER HOUSING (2) AND TURBINE WHEEL ASSEMBLY (16) ON SUPPORT (21) WITH TURBINE WHEEL SHAFT ON HEX BIT (19).
15. INSTALL COMPRESSOR WHEEL (22) ON SHAFT OF TURBINE WHEEL ASSEMBLY (16).

**CAUTION**

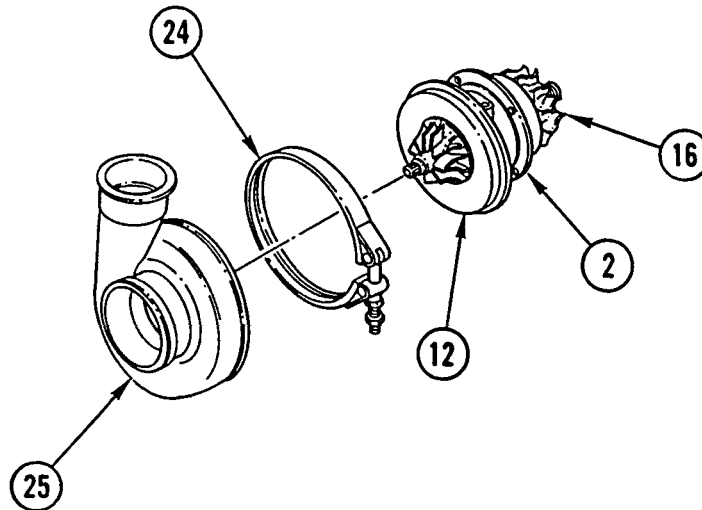
- Use double universal joint (two universal joints connected in tandem or single universal joint and universal socket connected in tandem) to avoid imposing bending loads on turbine shaft when tightening compressor wheel nut.
- Note that compressor wheel nut has left-hand threads to prevent damage to equipment.

16. LUBRICATE SHAFT THREADS OF TURBINE WHEEL ASSEMBLY (16) AND FRONT FACE OF COMPRESSOR WHEEL (22) WITH ENGINE OIL. INSTALL COMPRESSOR WHEEL NUT (23) AND TIGHTEN TO 32-42 LB-IN. (3.6-4.7 N.m).

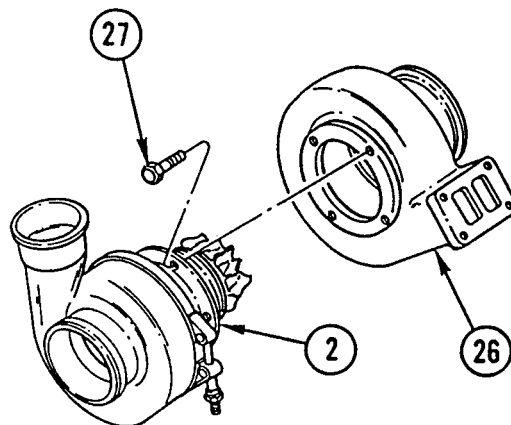


17. CLAMP DIAL INDICATOR TO BACKPLATE (12) AND CENTER HOUSING (2). POSITION DIAL INDICATOR PLUNGER ON TIP OF TURBINE WHEEL ASSEMBLY (16) AND SET DIAL AT ZERO. TIGHTEN NUT (23) WITH NUT WRENCH UNTIL DIAL INDICATOR READS 0.008-0.009 IN. (0.28-0.33 mm) OF SHAFT STRETCH.

## TURBOCHARGER REPAIR (CONT)



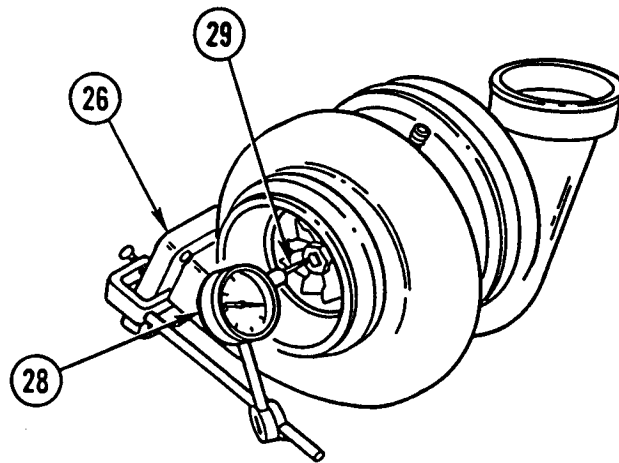
18. REMOVE CENTER HOUSING (2) AND TURBINE WHEEL ASSEMBLY (16) FROM HOLDING FIXTURE SUPPORT.
19. SLIDE CLAMP (24) OVER BACKPLATE (12). INSTALL COMPRESSOR HOUSING (25) AGAINST BACKPLATE (12) AND SECURE TO CENTER HOUSING (2) WITH CLAMP (24).
20. POSITION COMPRESSOR HOUSING (25), AS MATCHMARKED IN DISASSEMBLY, AGAINST BACKPLATE (12). SECURE WITH CLAMP (24). LUBRICATE THREADS OF CLAMP (24) BOLT LIGHTLY WITH ENGINE OIL AND TIGHTEN BOLT TO 110-130 LB-IN. (12-15 N.m).



**CAUTION**

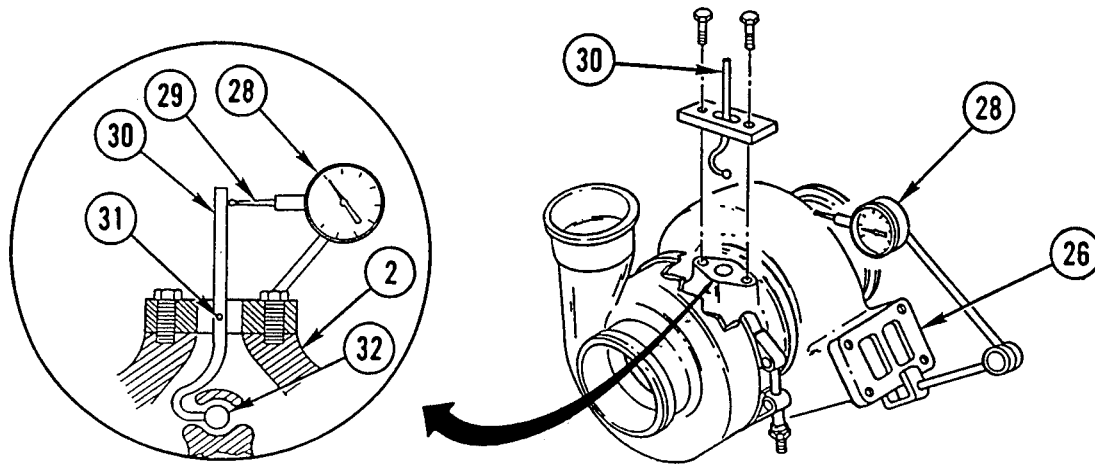
Make sure bolts are tightened enough to prevent turbine housing from contacting turbine wheel.

21. POSITION TURBINE HOUSING (26), AS MARKED IN DISASSEMBLY, AGAINST CENTER HOUSING (2). COAT THREADS OF FOUR NEW BOLTS (27) WITH ANTISEIZE COMPOUND. INSTALL BOLTS (27) AND TIGHTEN TO 160-190 LB-IN. (18.1 -21.5 N.m).



22. ATTACH DIAL INDICATOR (28) TO TURBINE HOUSING (26) SO DIAL INDICATOR PLUNGER (29) RESTS ON HUB END OF TURBINE WHEEL ASSEMBLY.
23. APPLY MANUAL PRESSURE TO COMPRESSOR WHEEL AND TURBINE WHEEL ASSEMBLY TO MOVE ASSEMBLY AS FAR AS IT WILL GO AWAY FROM TURBINE END OF TURBOCHARGER (AWAY FROM DIAL INDICATOR PLUNGER (29)).
24. SET DIAL INDICATOR (28) AT ZERO.
25. APPLY MANUAL PRESSURE TO COMPRESSOR WHEEL AND TURBINE WHEEL ASSEMBLY TO MOVE ASSEMBLY AS FAR AS IT WILL GO TOWARD TURBINE END OF TURBOCHARGER (TOWARD DIAL INDICATOR PLUNGER (29)). NOTE MAXIMUM SHAFT MOVEMENT SHOWN ON DIAL INDICATOR (28).
26. REPEAT STEPS 23, 24, AND 25 SEVERAL TIMES TO MAKE SURE MAXIMUM BEARING AXIAL CLEARANCE, AS INDICATED BY MAXIMUM TURBINE WHEEL ASSEMBLY MOVEMENT, HAS BEEN MEASURED.
27. BEARING AXIAL CLEARANCE MUST BE 0.0020-0.0032 IN. (0.051-0.081 mm). DISASSEMBLE AND REPAIR TURBOCHARGER IF BEARING AXIAL CLEARANCE DOES NOT MEET SPECIFICATION.

## TURBOCHARGER REPAIR (CONT)



28. MAKE RADIAL PLAY MEASUREMENT WITH DIAL INDICATOR (28) CLAMPED TO TURBINE HOUSING (26). PLACE CURVED END OF INDICATOR ADAPTER (30) IN CONTACT WITH WHEEL SHAFT THRU OIL OUTLET PORT AND INTERNAL OPENING IN CENTER HOUSING (2).
29. PLACE DIAL INDICATOR PLUNGER (29) IN CONTACT WITH EXPOSED PORTION OF INDICATOR ADAPTER (30) AT POINT EQUIDISTANT FROM ADAPTER PIVOT (31) AND POINT OF CONTACT WITH WHEEL SHAFT (32) ADAPTER TO CENTER HOUSING (2). SPRING ACTION OF DIAL INDICATOR PLUNGER (29) WILL KEEP ADAPTER IN CONTACT WITH SHAFT (32).
30. APPLY EVEN PRESSURE SIMULTANEOUSLY TO COMPRESSOR AND TURBINE WHEELS TO MOVE SHAFT (32) AS FAR AS IT WILL GO AWAY FROM DIAL INDICATOR PLUNGER.
31. SET DIAL INDICATOR (28) AT ZERO.
32. APPLY EVEN PRESSURE SIMULTANEOUSLY TO COMPRESSOR AND TURBINE WHEELS TO MOVE SHAFT (32) AS FAR AS IT WILL GO TOWARD DIAL INDICATOR PLUNGER (29). NOTE MAXIMUM SHAFT (32) MOVEMENT SHOWN ON DIAL INDICATOR.
33. ROTATE WHEELS SLIGHTLY IN ONE DIRECTION, THEN IN OTHER, WHILE APPLYING PRESSURE TO COMPRESSOR AND TURBINE WHEELS, TO MAKE SURE DIAL INDICATOR (28) READING IS MAXIMUM POSSIBLE.
34. APPLY EVEN PRESSURE SIMULTANEOUSLY TO COMPRESSOR AND TURBINE WHEELS TO MOVE SHAFT (32) AS FAR AS IT WILL GO AWAY FROM DIAL INDICATOR PLUNGER (29). MAKE SURE DIAL INDICATOR (28) POINTER RETURNS TO ZERO.
35. REPEAT STEPS 30 THRU 34 SEVERAL TIMES TO MAKE SURE MAXIMUM BEARING RADIAL CLEARANCE, AS INDICATED BY MAXIMUM SHAFT (32) MOVEMENT, HAS BEEN MEASURED.
36. BEARING RADIAL CLEARANCE MUST BE 0.0048-0.0068 IN. (0.122-0.173 mm). DISASSEMBLE AND REPAIR TURBOCHARGER IF BEARING RADIAL CLEARANCE DOES NOT MEET SPECIFICATION.



## Section IV. COOLING SYSTEM REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the radiator. A list of tasks contained in this section is shown below.

	<b>Page</b>
Radiator Repair .....	12-186
Water Pump Repair .....	12-190
Fan Clutch Repair (M915A2 and M916A1) .....	12-206
Fan Clutch Repair (All Except M915A2 and M916A1) .....	12-207.0
Spindle and Housing Repair .....	12-208

---

## RADIATOR REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Equipment Condition:

Reference	Condition Description
TM9-2320-363-20	Radiator Removed

#### References:

TM9-2320-363-20  
TM 750-254

---

### DISASSEMBLY

1. REMOVE TWO NUTS (1), TWO CLAMPS (2), HOSE (3), AND RADIATOR CAP (4).
2. REMOVE NUT (5), CLAMP (6), TWO CLAMPS (7), AND HOSE (8).
3. REMOVE TWO NUTS (9) AND EXPANSION TANK (10) FROM RADIATOR (11).
4. REMOVE 17 NUTS (12), BOLTING BAR (13), 20 SCREWS (14), AND TOP CHANNEL (15).
5. REMOVE 17 NUTS (16), BOLTING BAR (17), 20 SCREWS (18), AND BOTTOM CHANNEL (19).
6. REMOVE 40 NUTS (20), 40 SCREWS (21), 4 BOLTING PLATES (22), 4 HEADER BARS (23), OUTLET TANK (24), INLET TANK (25), AND 2 RADIATOR GASKETS (26).
7. REMOVE DRAIN PLUG (27) FROM INLET TANK (25).

### CLEANING

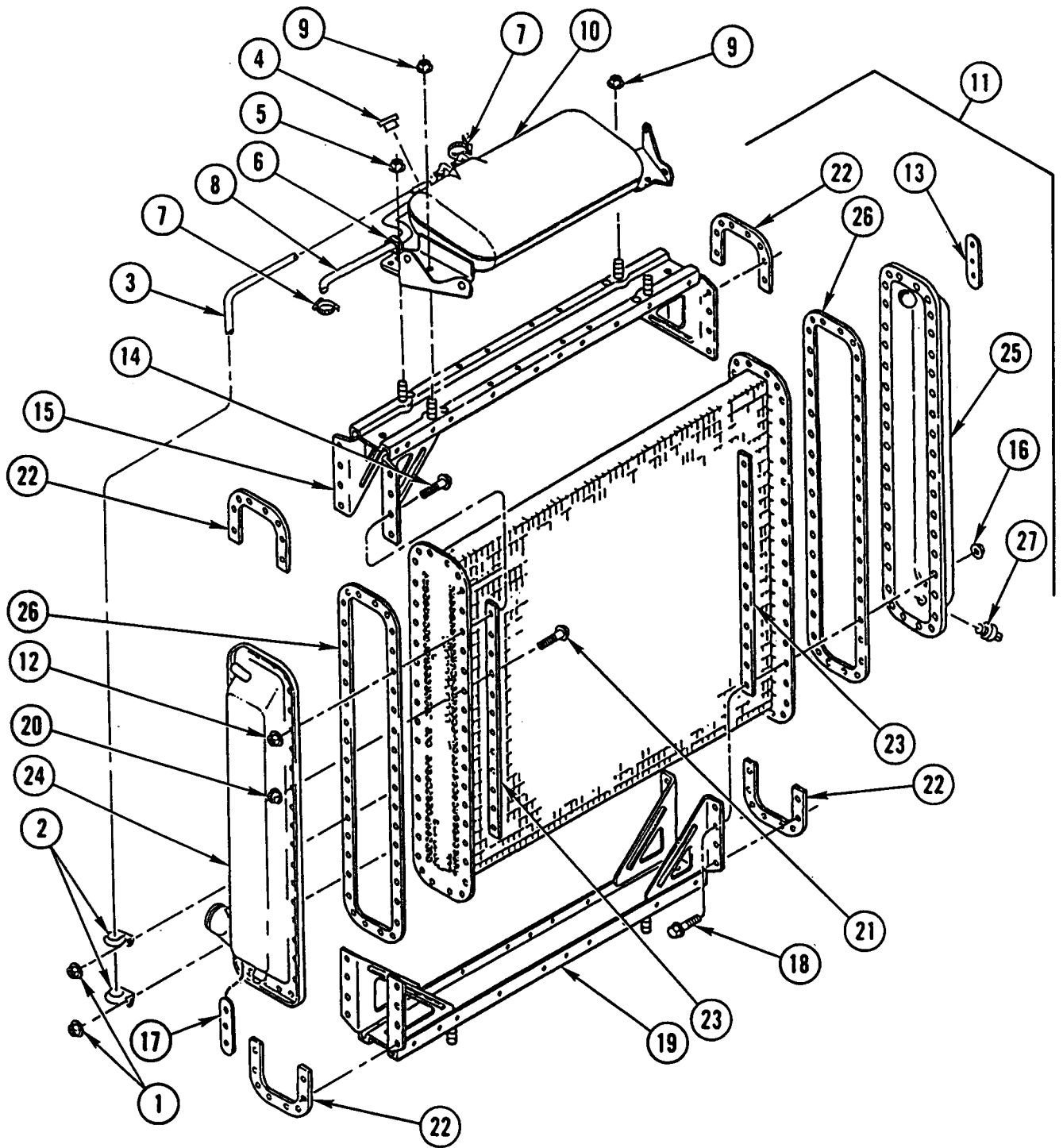
Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. PRESSURE TEST RADIATOR AT 15.0 PSI (103.4 kPa) FOR LEAKS.

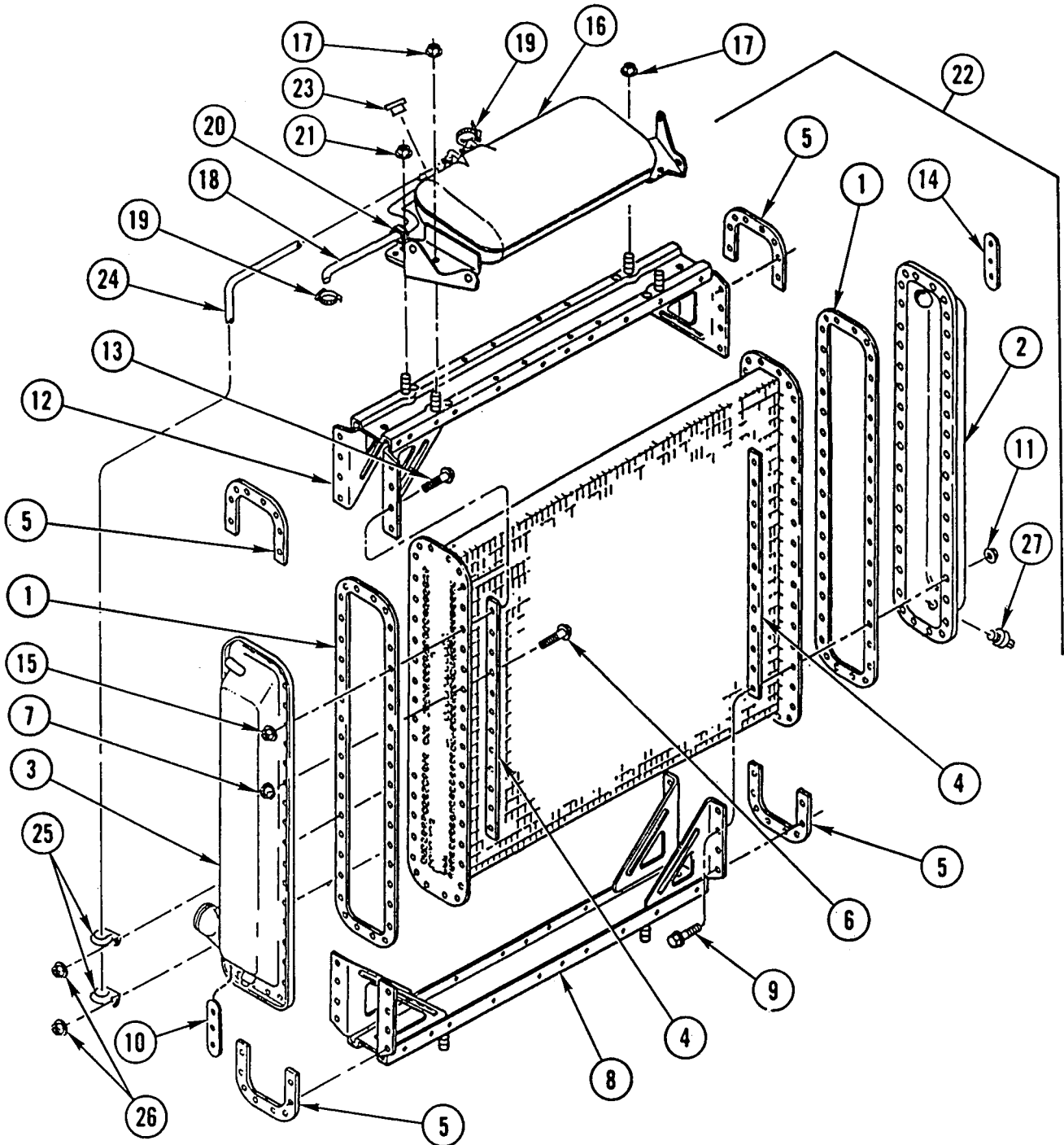
### REPAIR

1. IF REPAIR IS REQUIRED, NO MORE THAN 12 TUBES CAN BE BLOCKED OFF.
2. REFER TO TM 750-254 FOR ADDITIONAL INFORMATION ON COOLING SYSTEM REPAIR.



# RADIATOR REPAIR (CONT)

## ASSEMBLY



1. INSTALL 2 RADIATOR GASKETS (1), INLET TANK (2), OUTLET TANK (3), 4 HEADER BARS (4), 4 BOLTING PLATES (5), 40 SCREWS (6), AND 40 NUTS (7).
2. INSTALL BOTTOM CHANNEL (8), 20 SCREWS (9), BOLTING BAR (10), AND 17 NUTS (11).
3. INSTALL TOP CHANNEL (12), 20 SCREWS (13), BOLTING BAR (14), AND 17 NUTS (15).
4. INSTALL EXPANSION TANK (16) AND TWO NUTS (17).
5. INSTALL HOSE (18), TWO CLAMPS (19), CLAMP (20), AND NUT (21) ON RADIATOR (22).
6. INSTALL RADIATOR CAP (23), HOSE (24), TWO CLAMPS (25), AND TWO NUTS (26).
7. INSTALL DRAIN PLUG (27) IN INLET TANK (2).

---

## WATER PUMP REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-A26  
Service Set, J35988-B  
Slip/Lash Tester, J35687

#### Materials/Parts:

Kit, Water Pump O/H	P/N 23509128
Loctite	Appendix B, Item 34
Preventive, Rust	Appendix B, Item 47
Form-A-Gasket	Appendix B, Item 23
Oil, Lubricating	Appendix B, Item 37
Rags	Appendix B, Item 48
Toweling, Paper	Appendix B, item 63

#### References:

TM 9-2320-363-20

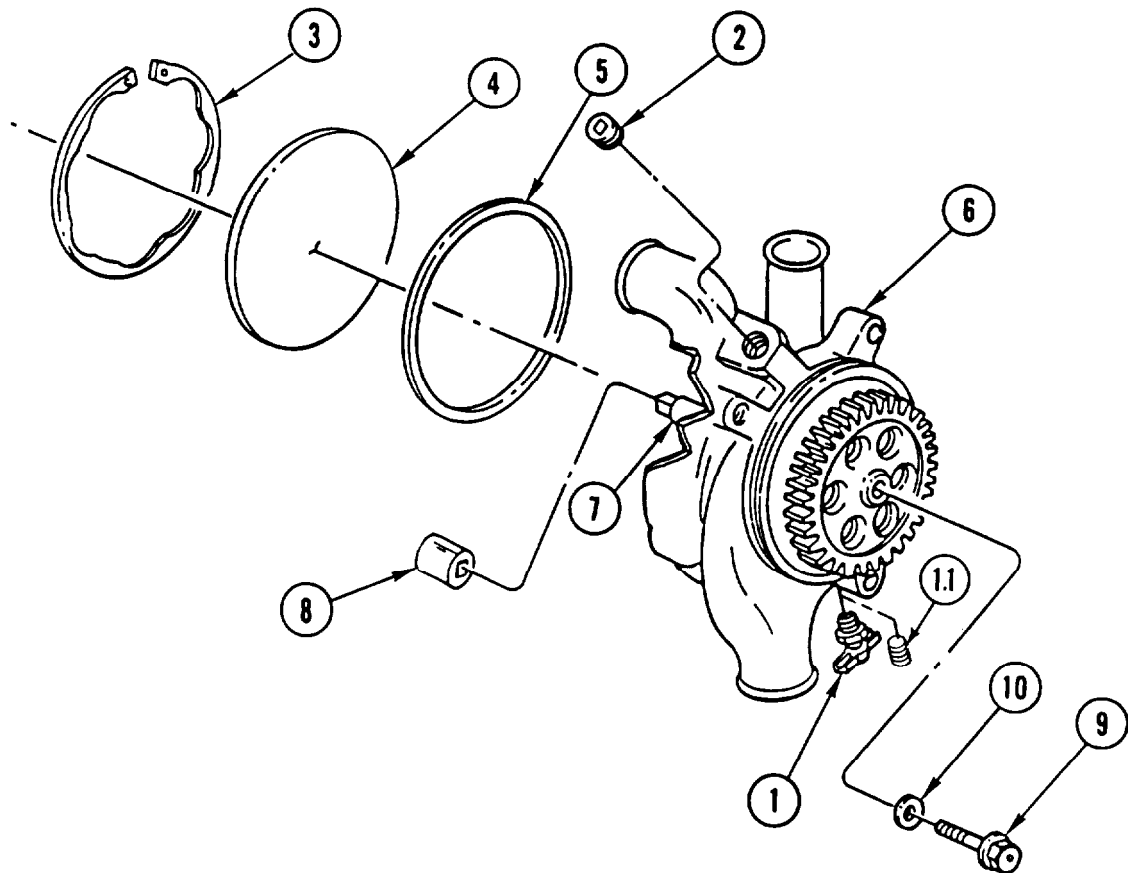
#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Water Pump Removed

#### General Safety Instructions:

#### WARNING

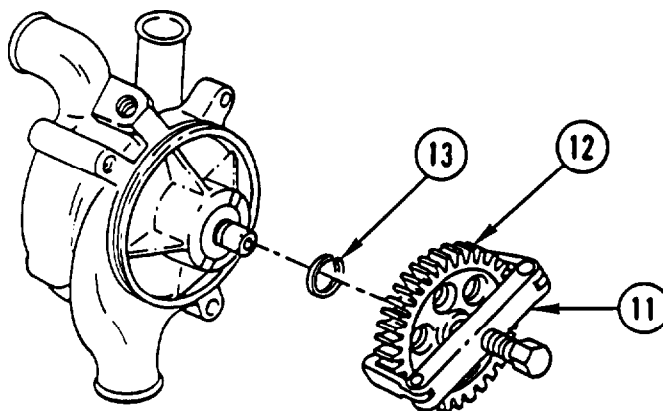
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Water pump cover snap ring is strong. Wear adequate face and eye protection during removal or installation to prevent personal injury.
- Water pump shaft bearing retaining ring is strong. Wear adequate face and eye protection during removal or installation to prevent injury to personnel.

**DISASSEMBLY**

**WARNING**

Water pump cover snap ring is strong. Wear adequate face and eye protection during removal to prevent personal injury.

1. REMOVE DRAINCOCK (1) (M915A2 AND M916A1) OR PLUG (1.1) (ALL EXCEPT M915A2 AND M916A1), PIPE PLUGS (2) IF INSTALLED, SNAP RING (3), COVER (4), AND SEAL RING (5) FROM WATER PUMP HOUSING (6). DISCARD SEAL RING.
2. HOLD SQUARE END OF WATER PUMP SHAFT (7) WITH SERVICE SET SOCKET (8) AND REMOVE RETAINING BOLT (9) AND WASHER (10).

## WATER PUMP REPAIR (CONT)

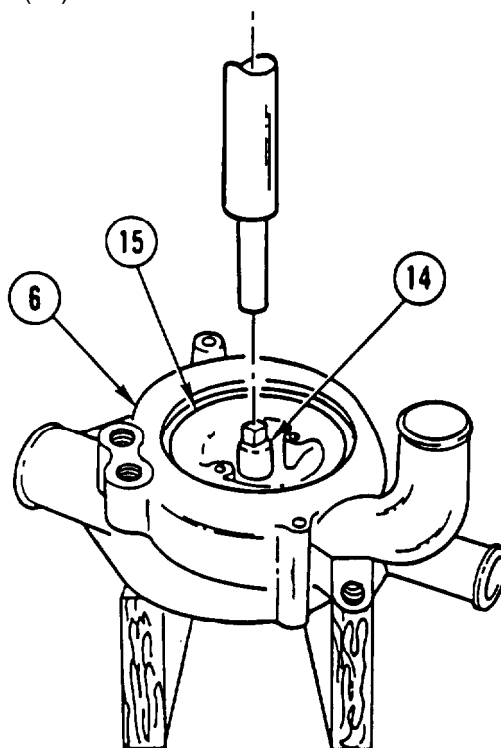


3. USING TWO-JAW PULLER (11), REMOVE DRIVE GEAR (12).

### **WARNING**

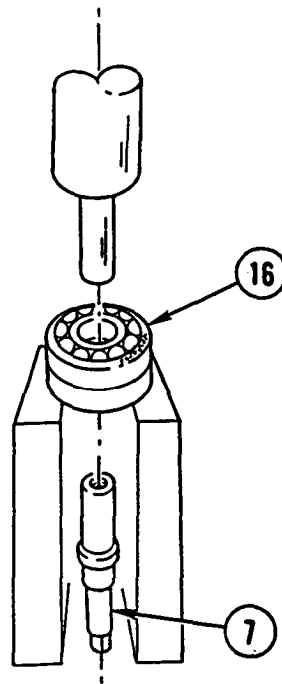
Water pump shaft bearing retaining ring is strong. Wear adequate face and eye protection during removal to prevent injury to personnel.

4. REMOVE RETAINING RING (13).



5. SUPPORT WATER PUMP HOUSING (6) IMPELLER SIDE UP, ON PRESS BED ON MACHINED BOLT BOSSES. PRESS ROLLER BEARING AND SHAFT ASSEMBLY (14) FROM WATER PUMP HOUSING (6).
6. REMOVE IMPELLER (15) FROM WATER PUMP HOUSING (6).

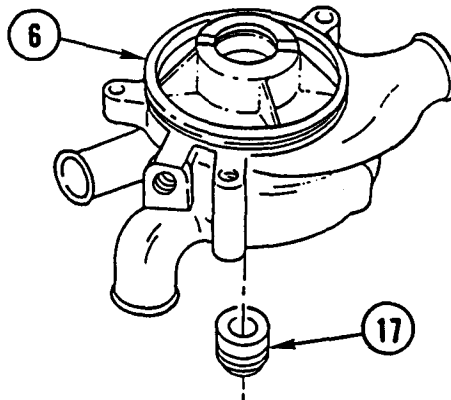




**NOTE**

Whenever water pump shaft is removed, discard roller bearing.

7. WITH SQUARE END OF WATER PUMP SHAFT (7) DOWN, SUPPORT WATER PUMP SHAFT ROLLER BEARING (16) ON INNER RACE OF ROLLER BEARING. PRESS WATER PUMP SHAFT (7) FROM ROLLER BEARING (16). DISCARD ROLLER BEARING.



**CAUTION**

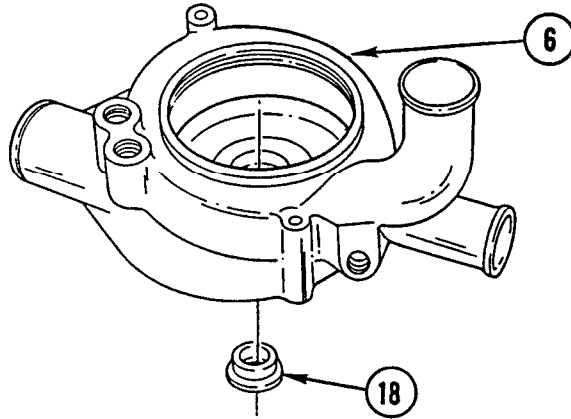
Be careful when removing oil seal to prevent damage to water pump housing seal bores.

**NOTE**

Whenever water pump shaft is removed, discard oil seal.

8. PLACE WATER PUMP HOUSING (6) ON BENCH, IMPELLER SIDE DOWN. USING BRASS DRIFT AND HAMMER, REMOVE WATER SEAL (17) FROM WATER PUMP HOUSING (6) BORE. DISCARD WATER SEAL.

## WATER PUMP REPAIR (CONT)



### **CAUTION**

Be careful when removing water seal to prevent damage to water pump housing seal bores.

### **NOTE**

Whenever water pump shaft is removed, discard water seal.

9. PLACE WATER PUMP HOUSING (6) ON BENCH, IMPELLER SIDE UP. REMOVE OIL SEAL (18) FROM WATER PUMP BODY BORE. DISCARD OIL SEAL.

### **CLEANING**

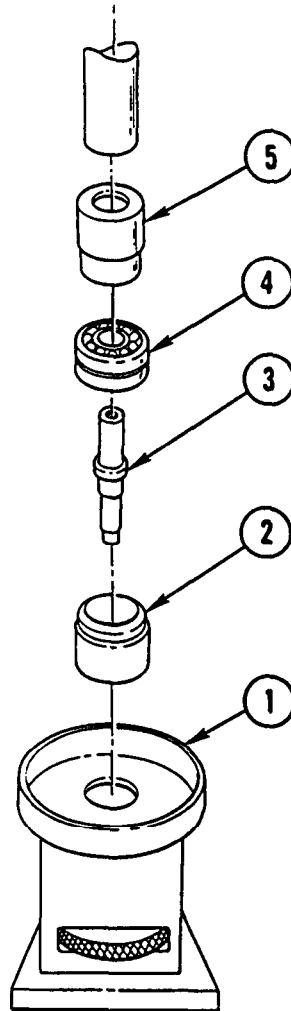
Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

Inspect all parts for wear, damage, or cracks. Replace damaged parts.

### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).



## ASSEMBLY

### CAUTION

Do not separate bearing components. Bearing assembly is a matched set of parts and should be installed as received. Failure to do so could result in bearing misalignment and/or foreign material in bearings.

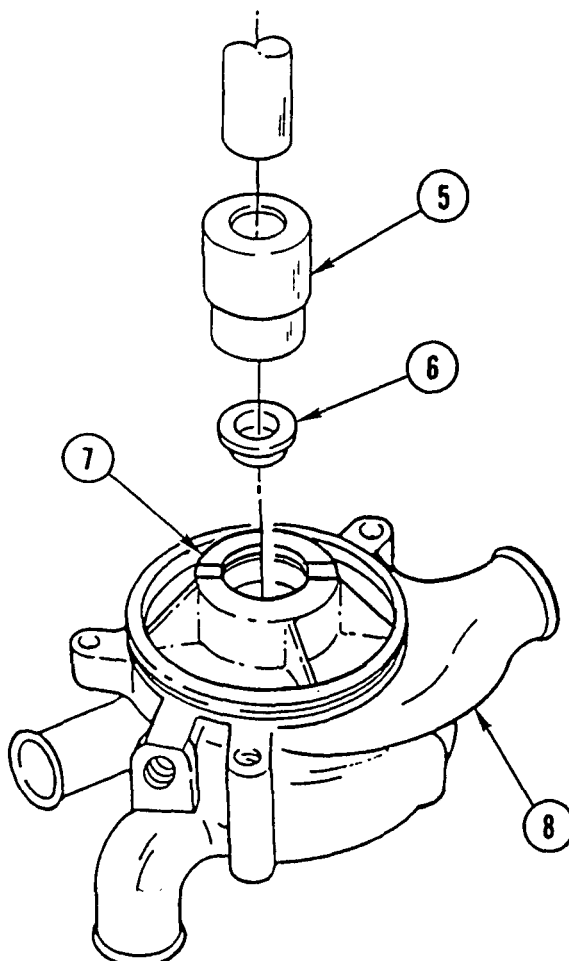
1. PLACE SERVICE SET HOLDING FIXTURE (1) ON PRESS BED. INSTALL DRIVE SHAFT SUPPORT TOOL (2) IN HOLDING FIXTURE (1). INSTALL SQUARE END OF WATER PUMP SHAFT (3) IN SUPPORT TOOL (2).

### NOTE

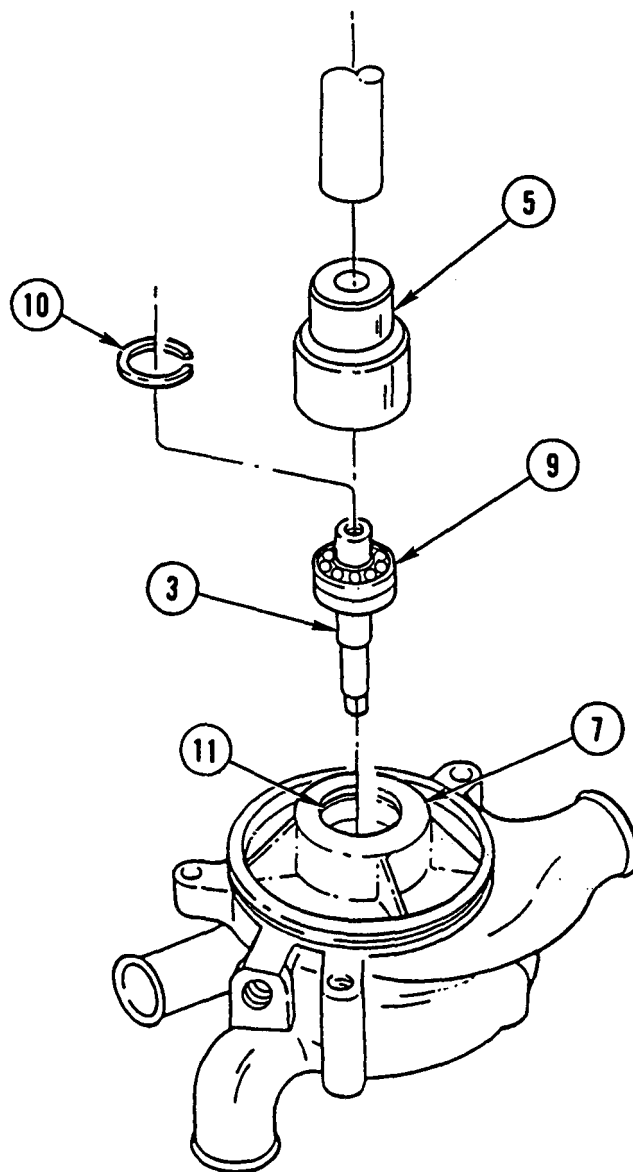
Make sure roller bearing identification numbers are against bearing and seal installer.

2. POSITION NEW ROLLER BEARING (4) ON WATER PUMP SHAFT (3) WITH ROLLER BEARING IDENTIFICATION NUMBERS UP. USING SMALL END OF SERVICE SET BEARING AND SEAL INSTALLER (5), PRESS ROLLER BEARING (4) ON WATER PUMP SHAFT (3) UNTIL ROLLER BEARING IS SEATED AGAINST SHOULDER OF WATER PUMP SHAFT. REMOVE ASSEMBLED SHAFT AND BEARING FROM HOLDING FIXTURE.

## WATER PUMP REPAIR (CONT)



3. APPLY THIN FILM OF CLEAN ENGINE LUBRICATING OIL TO OUTSIDE DIAMETER OF NEW OIL SEAL (6) AND WATER PUMP HOUSING BORE (7).
4. SUPPORT WATER PUMP HOUSING (8) ON PRESS BED, IMPELLER SIDE DOWN. USING SMALL END OF SERVICE SET BEARING AND SEAL INSTALLER (5), PRESS OIL SEAL IN WATER PUMP HOUSING BORE (7). REMOVE BEARING AND SEAL INSTALLER (5).



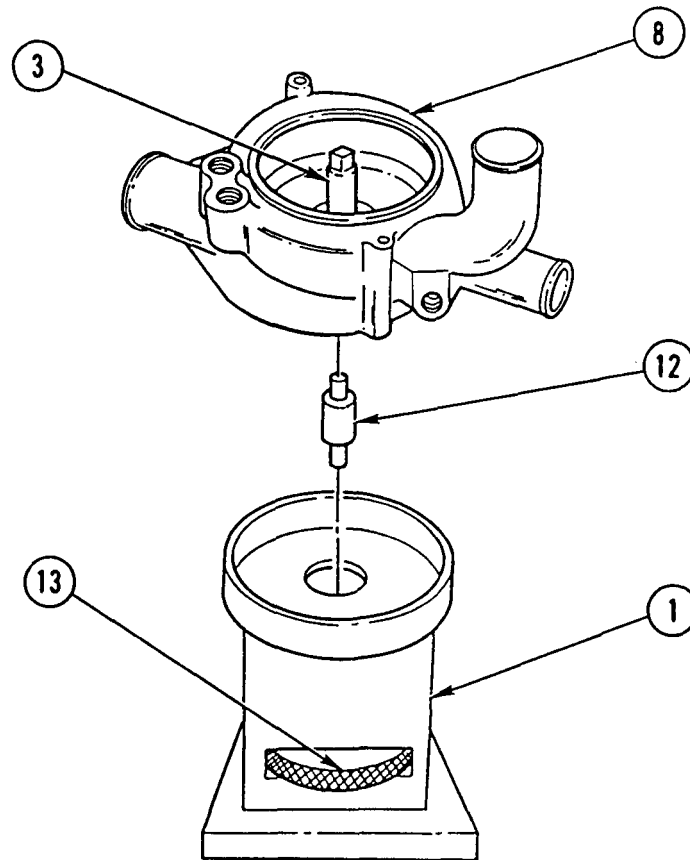
5. APPLY THIN FILM OF CLEAN ENGINE LUBRICATING OIL TO SEALING LIP OF OIL SEAL. LUBRICATE ROLLER BEARING ASSEMBLY (9). INSTALL SQUARE END OF WATER PUMP SHAFT (3) CAREFULLY THRU OIL SEAL AND POSITION ROLLER BEARING ASSEMBLY (9) IN WATER PUMP HOUSING BORE (7).
6. USING LARGE END OF SERVICE SET BEARING AND SEAL INSTALLER (5), PRESS ROLLER BEARING AND SHAFT ASSEMBLY IN WATER PUMP HOUSING BORE (7) UNTIL ROLLER BEARING (9) IS SEATED AGAINST SHOULDER OF WATER PUMP HOUSING BORE. REMOVE BEARING INSTALLER.

**NOTE**

Make sure retaining ring is fully seated in ring groove.

7. INSTALL RETAINING RING (10) IN RING GROOVE (11) OF WATER PUMP HOUSING BORE (7).

## WATER PUMP REPAIR (CONT)

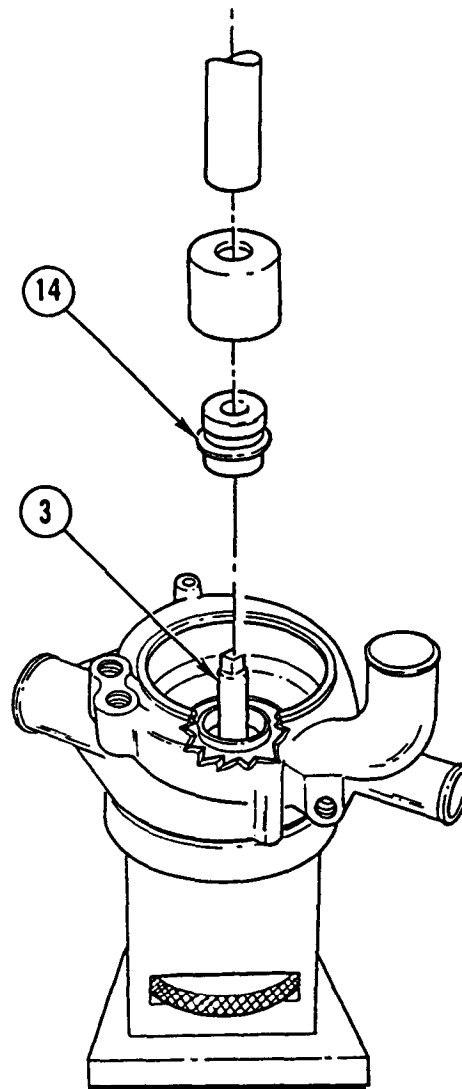


8. PLACE SERVICE SET HOLDING FIXTURE (1) ON PRESS BED. INSTALL EXTENSION TOOL (12) IN HOLDING FIXTURE IN CONTACT WITH ADJUSTING WHEEL (13).

### **NOTE**

Make sure water pump shaft is supported when water pump components are being assembled.

9. TURN WATER PUMP HOUSING (8), GEAR SIDE DOWN.
10. POSITION WATER PUMP SHAFT (3) OVER EXTENSION TOOL (12) IN HOLDING FIXTURE (1).
11. TURN ADJUSTING WHEEL (13) UNTIL EXTENSION TOOL (12) CONTACTS WATER PUMP SHAFT (3) FOR SUPPORT.

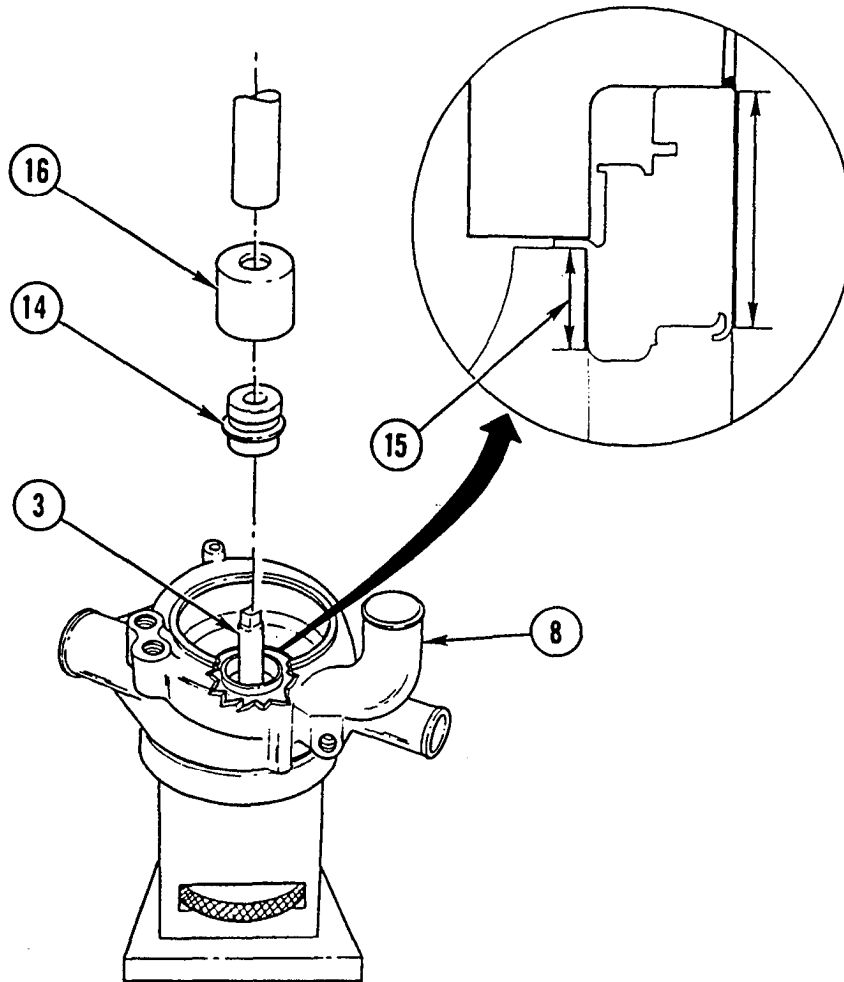


**WARNING**

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

12. APPLY THIN FILM OF RUST PREVENTIVE TO INSIDE DIAMETER OF NEW WATER SEAL (14) WHERE CONTACT WILL BE MADE WITH WATER PUMP SHAFT (3).

## WATER PUMP REPAIR (CONT)



### NOTE

Make sure all old Form-A-Gasket material has been removed from water seal bore.

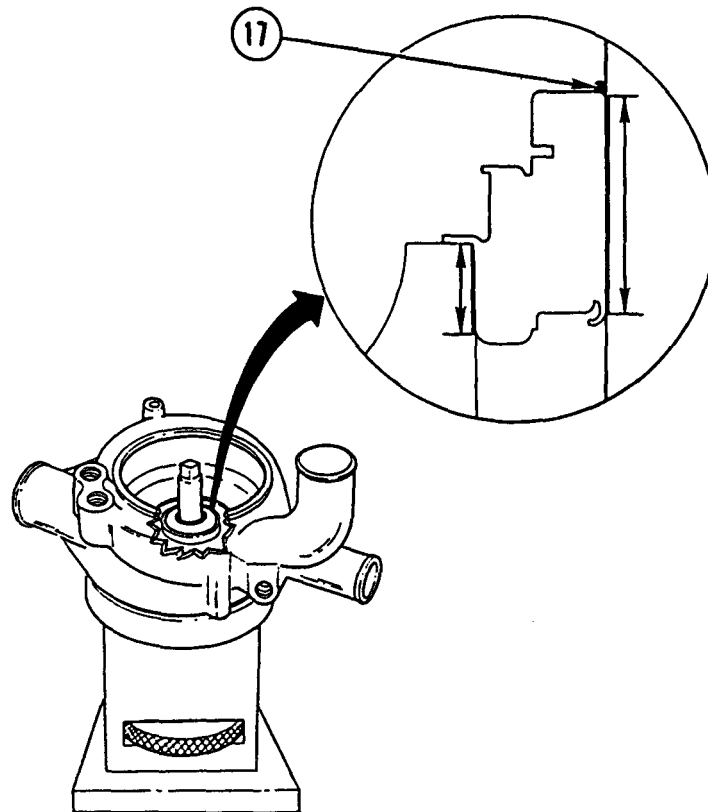
13. APPLY THIN FILM OF FORM-A-GASKET TO WATER SEAL BORE (15) IN WATER PUMP HOUSING (8).

### CAUTION

Make sure water pump shaft is supported by holding fixture extension to prevent damage to equipment.

14. POSITION WATER SEAL (14) OVER SQUARE END OF WATER PUMP SHAFT (3) WITH CLOSED END OF WATER SEAL DOWN.
15. USING WATER SEAL INSTALLER (16), PRESS WATER SEAL (14) IN WATER PUMP SEAL BORE UNTIL WATER SEAL INSTALLER (16) BOTTOMS AGAINST WATER PUMP HOUSING (8) SEAL BORE. REMOVE WATER SEAL INSTALLER (16).





**CAUTION**

Be careful when applying sealer. Too much can cause damage to sealing surface.

16. APPLY ONE DROP OF SEALER TO WATER SEAL AND WATER PUMP SHAFT CONTACT AREA (17). WIPE OFF EXCESS SEALER WITH CLEAN, LINT-FREE SHOP RAG OR PAPER TOWEL.

**CAUTION**

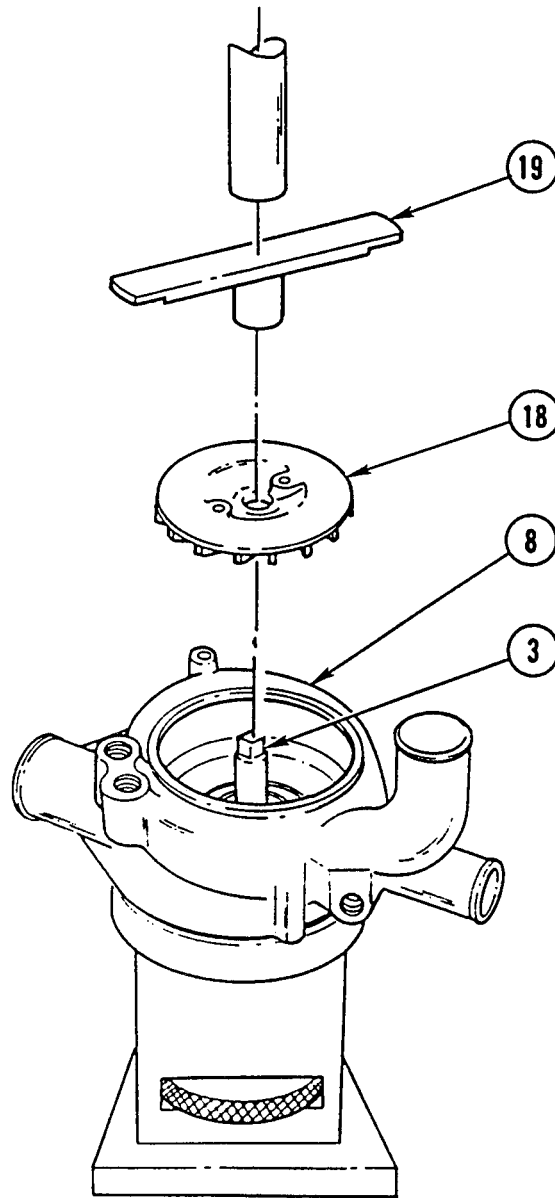
Wait 2 hours after applying primer. Water pump shaft must remain vertical and must not be rotated or moved to prevent damage to equipment.

**NOTE**

- Shaft should not be turned, moved from vertical, or seal-pressure tested for at least 2 hours to allow time for curing. Do not exceed 25 psi (172 kPa) when pressure testing.
- Due to time required for curing, maintenance units should keep spare pumps for immediate use when needed. Pump removed from an engine could be rebuilt and placed in storage for later use.

17. APPLY SMALL AMOUNT OF PRIMER TO WATER SEAL AND WATER PUMP SHAFT CONTACT AREA (17) WHERE SEALER WAS APPLIED.

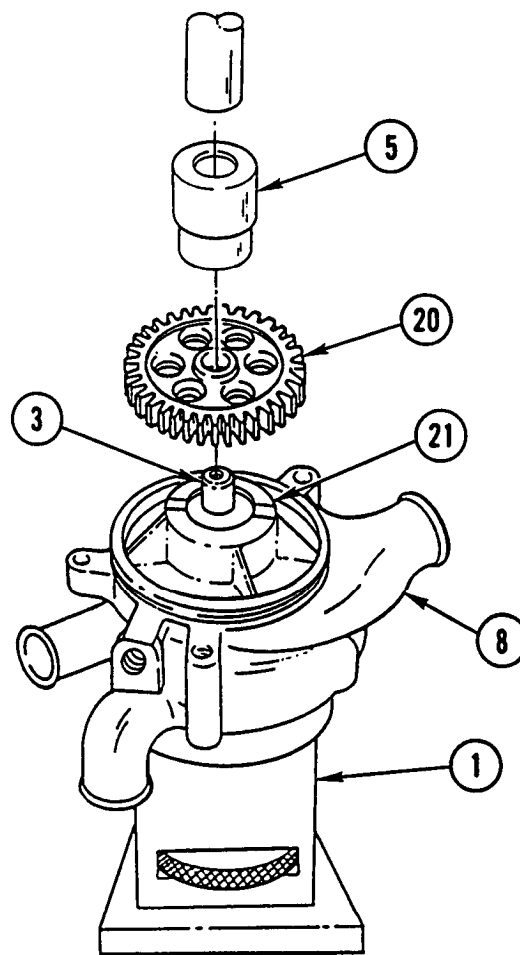
## WATER PUMP REPAIR (CONT)



### **CAUTION**

Support water pump shaft when pressing water pump impeller on water pump shaft to prevent damage to bearing.

18. INSTALL WATER PUMP IMPELLER (18), WIDE END UP, OVER SQUARE END OF WATER PUMP SHAFT (3). USING SERVICE KIT IMPELLER INSTALLATION TOOL (19), PRESS WATER PUMP IMPELLER (18) ON WATER PUMP SHAFT (3) UNTIL INSTALLATION TOOL (19) IS FLUSH AGAINST WATER PUMP ASSEMBLY (8). REMOVE INSTALLATION TOOL (19).



**NOTE**

Make sure water pump shaft is supported when water pump components are being assembled.

19. TURN WATER PUMP HOUSING (8) OVER, IMPELLER SIDE DOWN, ON HOLDING FIXTURE (1).

**CAUTION**

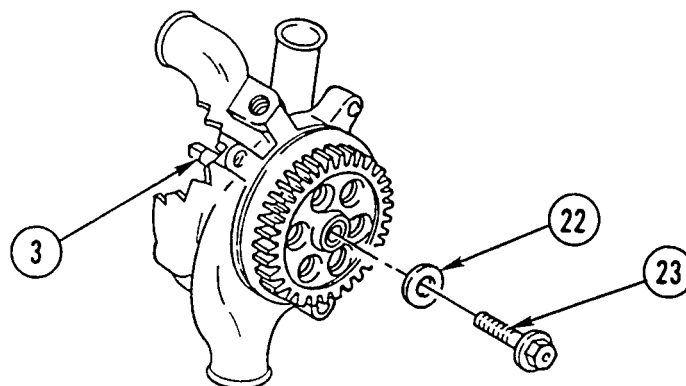
Water pump drive gear may be press fit to water pump shaft. Support water pump shaft when pressing water pump drive gear onto shaft to prevent damage to bearing.

**NOTE**

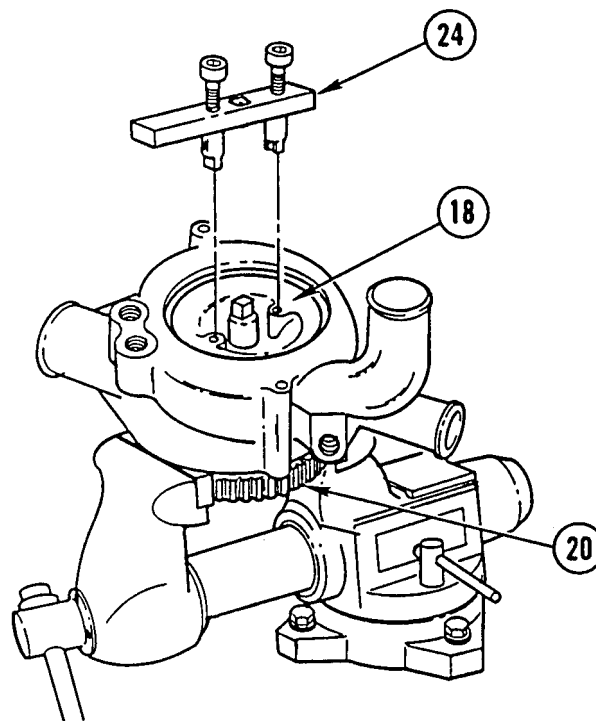
Water pump drive gear may be a slip fit. This is due to manufacturing tolerances and is acceptable.

20. POSITION WATER PUMP DRIVE GEAR (20) OVER WATER PUMP SHAFT (3).
21. USING SMALL END OF SERVICE SET BEARING AND SEAL INSTALLER (5), PRESS DRIVE GEAR (20) ON WATER PUMP SHAFT (3) UNTIL DRIVE GEAR IS SEATED AGAINST BEARING INNER RACE (21). REMOVE BEARING AND SEAL INSTALLER (5).

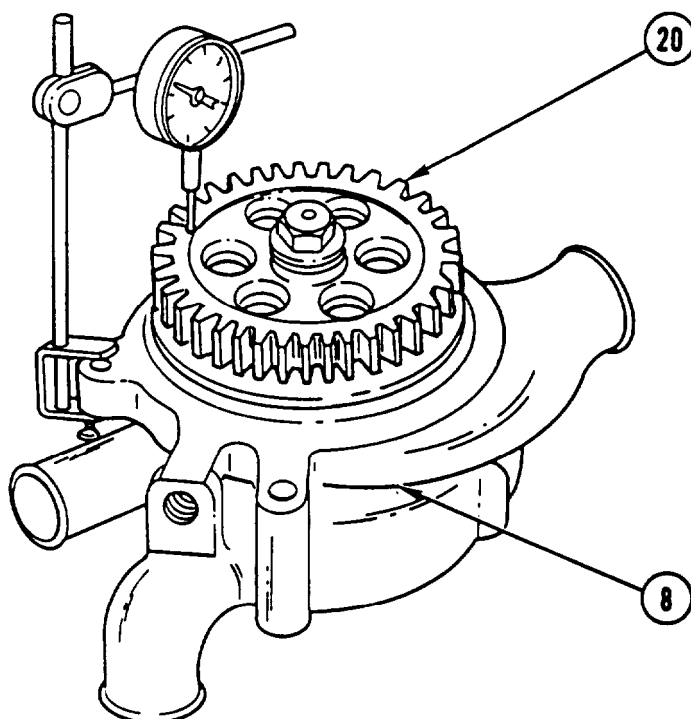
## WATER PUMP REPAIR (CONT)



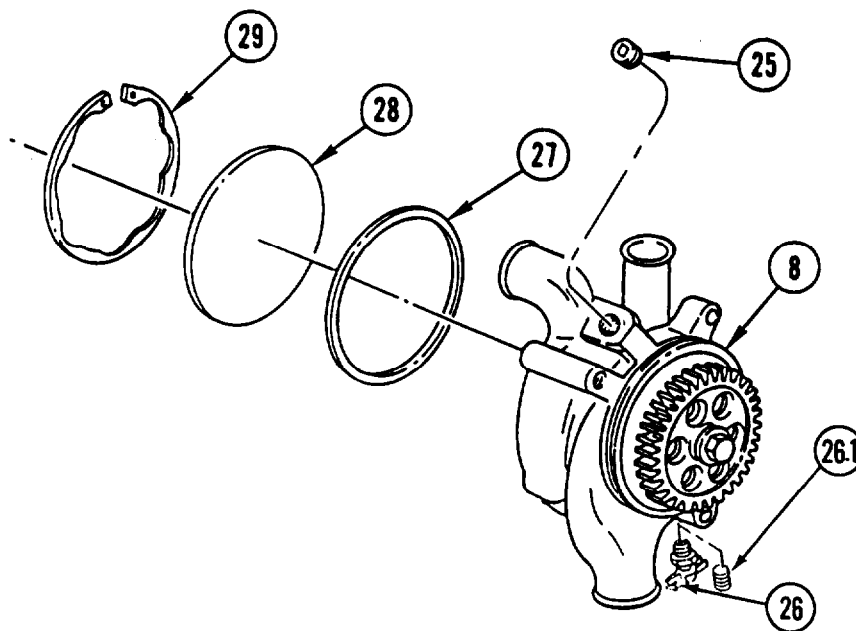
22. INSTALL WASHER (22) AND GEAR RETAINING BOLT (23). HOLD SQUARE END OF WATER PUMP SHAFT (3). TIGHTEN BOLT (23) TO 75-93 LB-FT (101-126 N.m).



23. TURN WATER PUMP OVER, GEAR SIDE DOWN. CLAMP WATER PUMP DRIVE GEAR (20) IN SOFT-JAWED VISE WITH WATER PUMP IMPELLER (18) FACING UP.
24. INSTALL WATER PUMP IMPELLER SLIP TESTER (24) IN TAPPED HOLES PROVIDED IN IMPELLER (18). TIGHTEN BOLTS TO 13-17 LB-FT (18-23 N.m).
25. USING 1/2-IN. DRIVE TORQUE WRENCH, INSERT 1/2-IN. DRIVE IN HOLE PROVIDED IN CENTER OF SLIP/LASH TESTER. APPLY 50 LB-FT (68 N.m) TORQUE IN EITHER DIRECTION. IMPELLER (18) MUST WITHSTAND TORQUE WITHOUT SLIPPING. IF IMPELLER SLIPPAGE IS DETECTED, REMOVE AND DISCARD IMPELLER (18). INSTALL NEW IMPELLER AND RETEST. REMOVE SLIP/LASH TESTER (24) AFTER TESTING.



26. TURN WATER PUMP OVER, IMPELLER SIDE DOWN.
27. ATTACH DIAL INDICATOR TO WATER PUMP HOUSING (8). MEASURE GEAR FACE RUNOUT JUST INSIDE OF DRIVE GEAR (20) TEETH. ROTATE DRIVE GEAR (20) AND MEASURE RUNOUT IN FOUR PLACES AT 90-DEGREE INTERVALS. MAXIMUM ALLOWABLE RUNOUT IS 0.0025 IN. (0.0635 mm). IF LIMIT IS EXCEEDED, REMOVE WATER PUMP DRIVE GEAR (20) AND CHECK FOR BURRS OR FOREIGN PARTICLES. INSTALL DRIVE GEAR AND RECHECK RUNOUT. IF RUNOUT STILL EXCEEDS LIMITS, REPLACE WATER PUMP DRIVE GEAR (20) AND/OR WATER PUMP SHAFT. AS NECESSARY.



28. INSTALL PIPE PLUG (25), DRAINCOCK (26) (M915A2 AND M916A1) OR PLUG (26.1) (ALL EXCEPT M915A2 OR M916A1), NEW SEAL RING (27), COVER (28), AND SNAP RING (29) IN WATER PUMP HOUSING (8).

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## FAN CLUTCH REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

#### Applicable Configuration:

M915A2 and M916A1

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Kit Repair P/N 1033-05435-02  
Seal, Dust P/N 3018-01519-01

#### References:

TM9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
TM9-2320-363-20	Fan Clutch Removed

#### General Safety Instructions:

### WARNING

Housing is under spring tension. Use suitable clamps to hold housing and shaft assembly in place while removing cylinder. Failure to do so could result in injury to personnel.

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### DISASSEMBLY

1. REMOVE LOCK NUT (1), TAB WASHER (2) CYLINDER (3), TWO PACKINGS (4 AND 5) AND DUST SEAL (6) FROM CLUTCH ASSEMBLY (7). DISCARD LOCK NUT, TAB WASHER, PACKINGS, AND DUST SEAL.

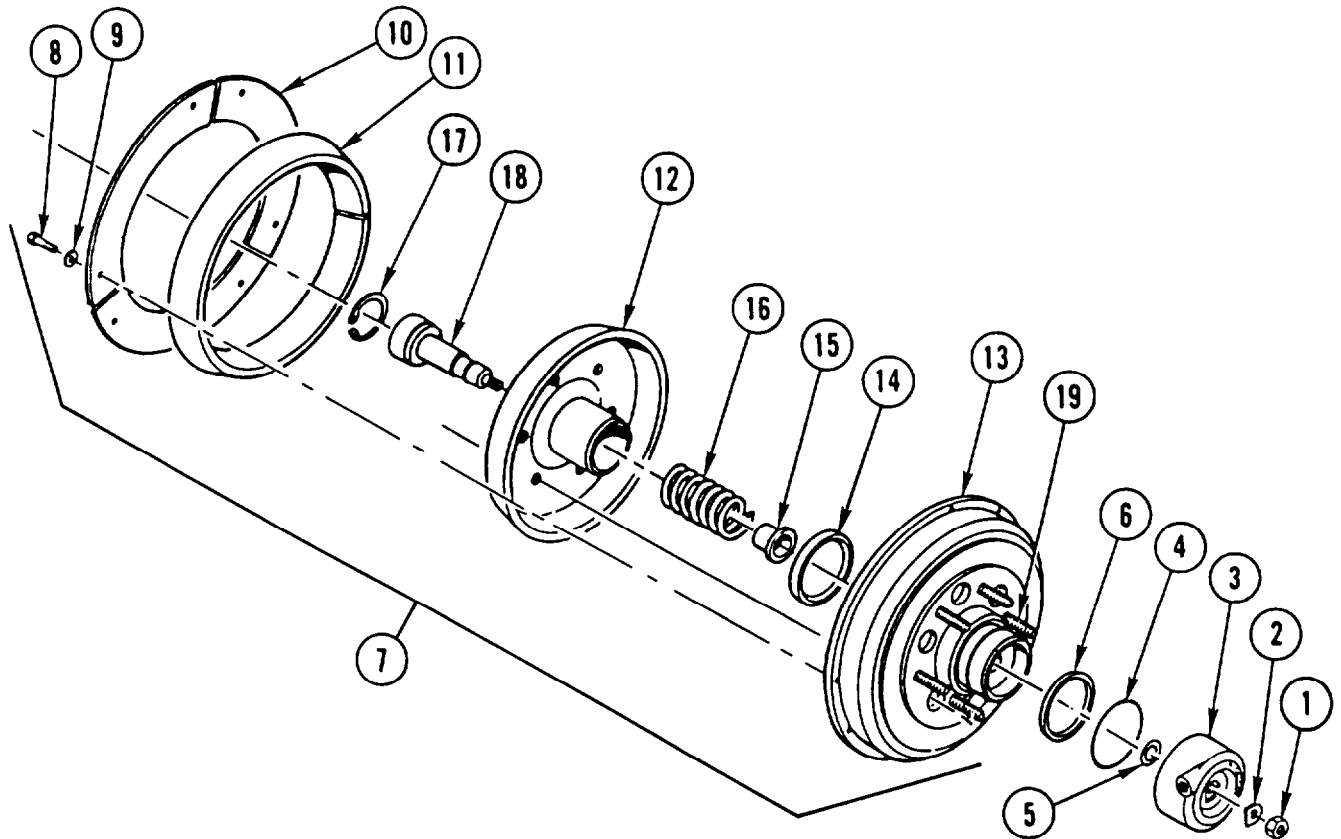
### WARNING

Housing is under spring tension. Use suitable "C" clamps to hold housing and shaft assembly in place while removing cylinder. Failure to do so could result in injury to personnel.

2. INSTALL TWO "C" CLAMPS ON OPPOSITE SIDES OF CLUTCH ASSEMBLY (7).
3. REMOVE SIX SCREWS (8) SIX LOCK WASHERS (9), THREE RETAINING PLATES (10), AND LINING (11) FROM SHAFT ASSEMBLY (12). DISCARD SCREWS, LOCK WASHERS, AND LINING.
4. RELEASE "C" CLAMPS SLOWLY TO RELIEVE SPRING TENSION AND REMOVE HOUSING (13) SEAL (14), END CAP (15), AND SPRING (16) FROM SHAFT ASSEMBLY (12). DISCARD SEAL AND SPRING.
5. REMOVE RETAINING RING (17) AND PISTON ASSEMBLY (18).
6. IF DAMAGED, REMOVE AND DISCARD SIX STUDS (19) FROM HOUSING (13).

### CLEANING

Use general cleaning methods to clean all parts (page 2-30)



### INSPECTION

Inspect fan drive shaft and clutch for galling, pitting, scoring, or cracks. Replace as necessary.

### ASSEMBLY

1. IF REMOVED, INSTALL SIX NEW STUDS (19) IN HOUSING (13).
2. INSTALL PISTON ASSEMBLY (16) AND RETAINING RING (17).
3. INSTALL NEW SPRING (16) END CAP (15), NEW SEAL (14), AND HOUSING (13) ON SHAFT ASSEMBLY (12).
4. COMPRESS HOUSING (13) AND SHAFT ASSEMBLY (12) TOGETHER USING TWO "C" CLAMPS AND INSTALL NEW LINING (11), THREE RETAINING PLATES (10), SIX NEW LOCK WASHERS (9) AND SIX NEW SCREWS (8) IN SHAFT ASSEMBLY (12).
5. REMOVE TWO "C" CLAMPS FROM OPPOSITE SIDES OF CLUTCH ASSEMBLY (7).
6. INSTALL NEW DUST SEAL (6), TWO NEW PACKINGS (5 AND 4), CYLINDER (3), NEW TAB WASHER (2) AND NEW LOCK NUT (1) ON CLUTCH ASSEMBLY (7).

---

## FAN CLUTCH REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

#### Applicable Configuration:

All except M915A2 and M916A1

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Kit, Repair P/N 1033-05435-03  
Kit, Seal P/N 1033-07781-01  
Seal, Dust P/N 3018-01519-01

#### References:

TM9-2320-363-20

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#### Equipment Condition:

Reference	Condition Description
TM9-2320-363-20	Fan Clutch Removed

#### General Safety Instructions:

##### WARNING

Housing is under spring tension. Use suitable clamps to hold housing and shaft assembly in place while removing cylinder. Failure to do so could result in injury to personnel.

### DISASSEMBLY

#### NOTE

Note position of seal for assembly.

1. REMOVE LOCK NUT (1) TAB WASHER (2) CYLINDER (3) SEAL (4) PACKING (5) AND DUST SEAL (6) FROM CLUTCH ASSEMBLY (7). DISCARD LOCK NUT, TAB WASHER, SEAL, PACKING, AND DUST SEAL

##### WARNING

Housing is under spring tension. Use suitable "C" clamps to hold housing and shaft assembly in place while removing cylinder. Failure to do so could result in injury to personnel.

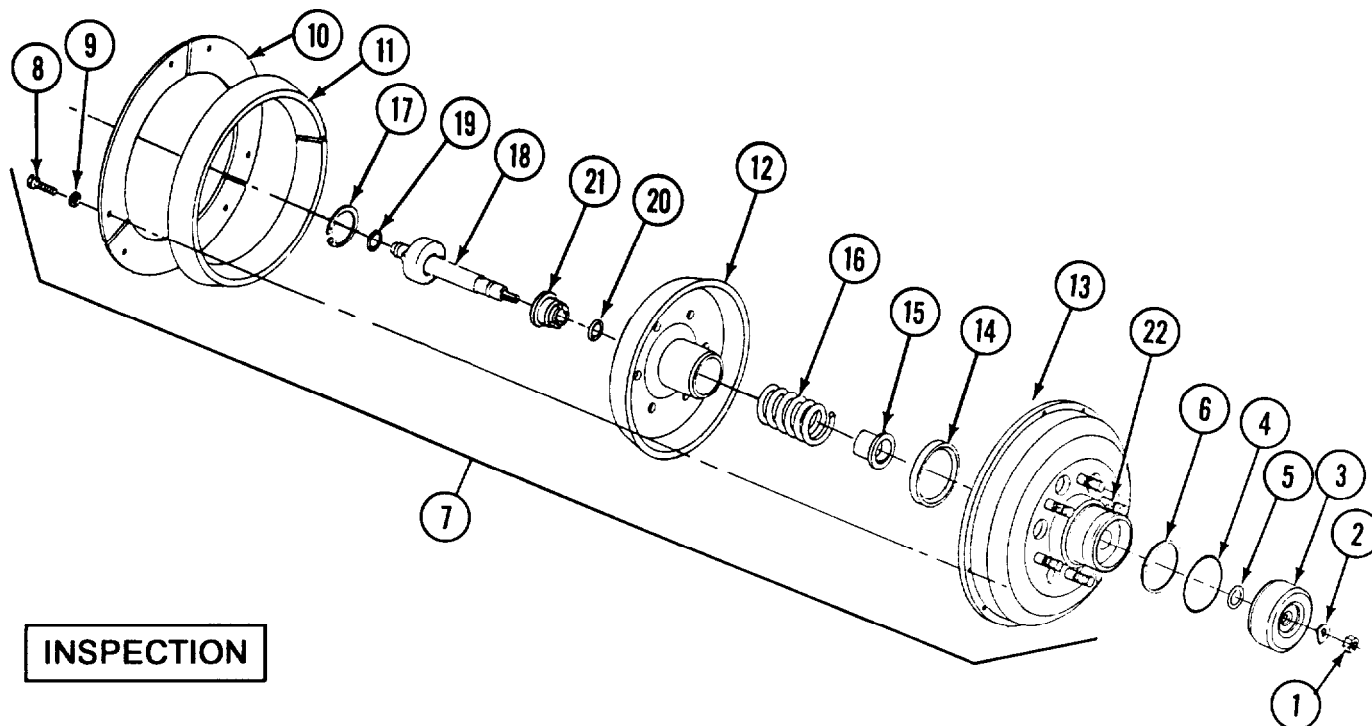
2. INSTALL TWO "C" CLAMPS ON OPPOSITE SIDES OF CLUTCH ASSEMBLY (7).
3. REMOVE SIX SCREWS (8) SIX LOCK WASHERS (9) THREE RETAINING PLATES (10), AND LINING (11) FROM SHAFT ASSEMBLY (12). DISCARD SCREWS, LOCK WASHERS, AND LINING.
4. RELEASE "C" CLAMPS SLOWLY TO RELIEVE SPRING TENSION AND REMOVE HOUSING (13) SEAL (14) END CAP (15) AND SPRING (16) FROM SHAFT ASSEMBLY (12). DISCARD SEAL AND SPRING.



5. REMOVE RETAINING RING (17) AND PISTON ASSEMBLY (18). REMOVE TWO PACKINGS (19 AND 20) AND SPRING CARRIER (21) FROM PISTON. DISCARD PACKINGS.
6. IF DAMAGED, REMOVE AND DISCARD SIX STUDS (22) FROM HOUSING (13)

### CLEANING

Use general cleaning methods to clean all parts (page 2-30)



### INSPECTION

Inspect fan drive shaft and clutch for galling, pitting, scoring, or cracks. Replace as necessary

### ASSEMBLY

1. IF REMOVED, INSTALL SIX NEW STUDS (22) IN HOUSING (13).
2. INSTALL TWO NEW PACKINGS (19 AND 20) AND SPRING CARRIER (21) TO PISTON (18) AND INSTALL PISTON ASSEMBLY AND RETAINING RING (17).
3. INSTALL NEW SPRING (16) END CAP (15) NEW SEAL (14). AND HOUSING (13) ON SHAFT ASSEMBLY (12).
4. COMPRESS HOUSING (13) AND SHAFT ASSEMBLY (12) TOGETHER USING TWO "C" CLAMPS AND INSTALL NEW LINING (11), THREE RETAINING PLATES (10), SIX NEW LOCK WASHERS (9) AND SIX NEW SCREWS (8) IN SHAFT ASSEMBLY (12).
5. REMOVE TWO "C" CLAMPS FROM OPPOSITE SIDES OF CLUTCH ASSEMBLY (7).
6. INSTALL NEW DUST SEAL (6) NEW PACKING (5) NEW SEAL (4) CYLINDER (3). NEW TAB WASHER (2). AND NEW LOCK NUT (1) ON CLUTCH ASSEMBLY (7)

### NOTE

Follow-on Maintenance:  
Install fan clutch (TM 9-2320-363-20).

---

## SPINDLE AND HOUSING REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Air Compressor Service Set, J36310-A

#### Materials Parts:

Roller Bearing Assembly	P/N 8929820
Ball Bearing Assembly	P/N 8929530
Seal, Oil	P/N V454136RR
Plug, cup	P/N 8929215
Grease, Au Automotive and Artillery	Appendix B, Item 26
Sealant, Non-Hardening	Appendix B, Item 51
Oil, Lubricating	Appendix B, Item 37

#### References:

TM9-2320-363-20

Equipment Condition:

Reference	Condition	Description
TM-9-2320-363-20	Spindle and Housing Removed	

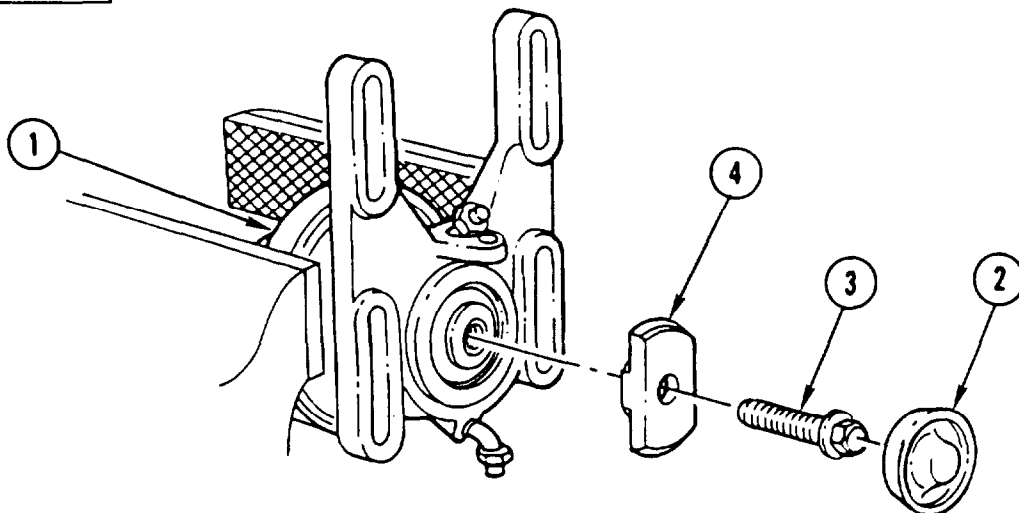
#### General Safety Instructions:

**WARNING**

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

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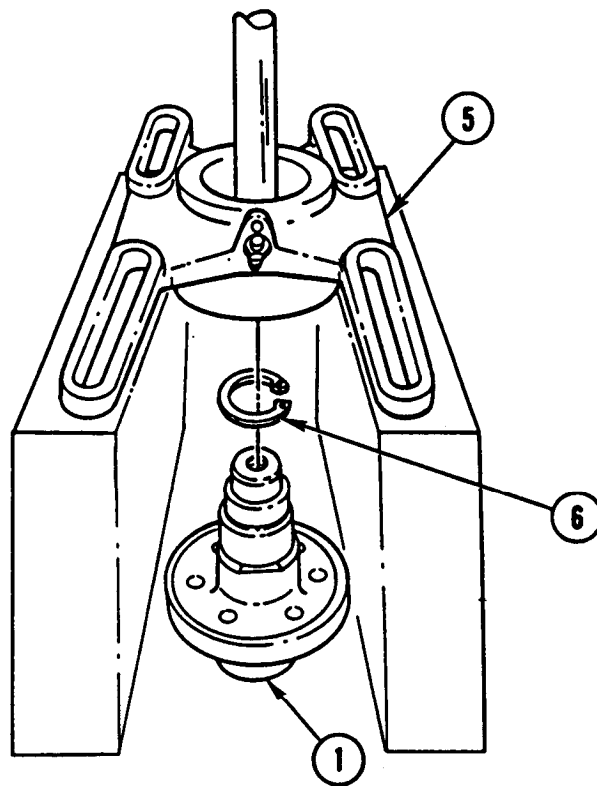
### DISASSEMBLY



**CAUTION**

Use pieces of wood or similar soft material to protect fan spindle from vise damage.

1. SECURE FAN SPINDLE (1) IN VISE AND REMOVE CUP PLUG (2) BY PIERCING WITH PUNCH AND PRYING OUT. DISCARD CUP PLUG.
2. REMOVE SPACER RETAINING BOLT (3) AND SPACER (4). REMOVE FAN SPINDLE (1) FROM VISE.

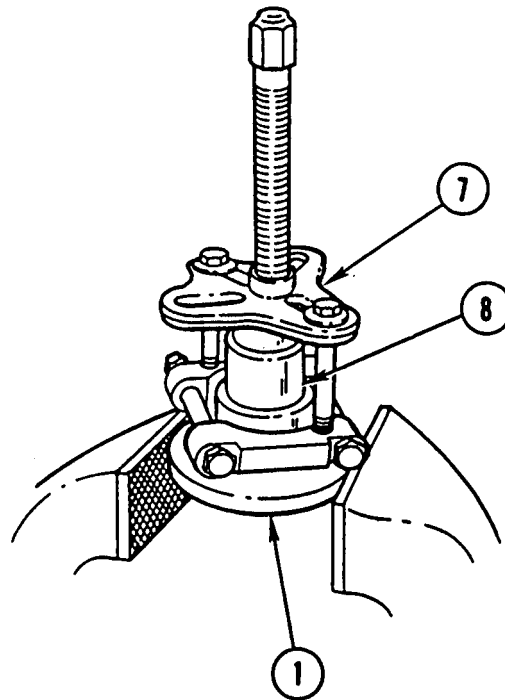


**CAUTION**

Make sure fan spindle does not drop free from spindle housing to prevent damage to equipment.

3. SUPPORT SPINDLE HOUSING (5) ON BLOCKS. USING HYDRAULIC PRESS, REMOVE FAN SPINDLE (1) FROM SPINDLE HOUSING (5).
4. REMOVE INNER ROLLER BEARING SNAP RING (6) FROM FAN SPINDLE (1).

## SPINDLE AND HOUSING REPAIR (CONT)



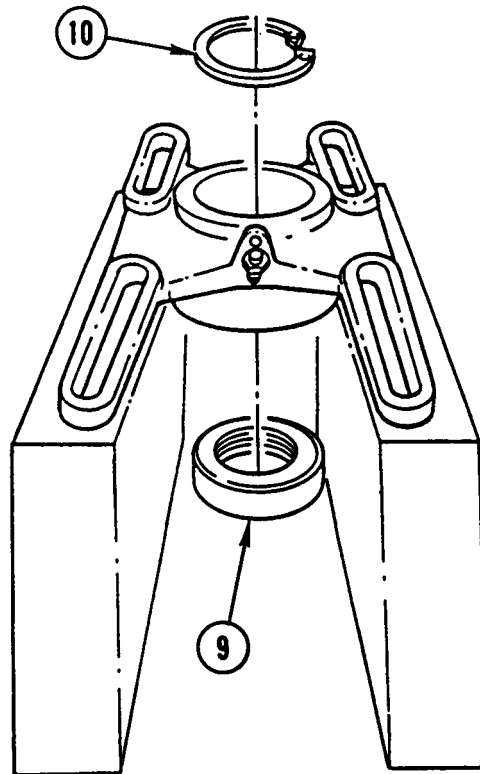
### CAUTION

Use pieces of wood or similar soft material to protect fan spindle from vise damage.

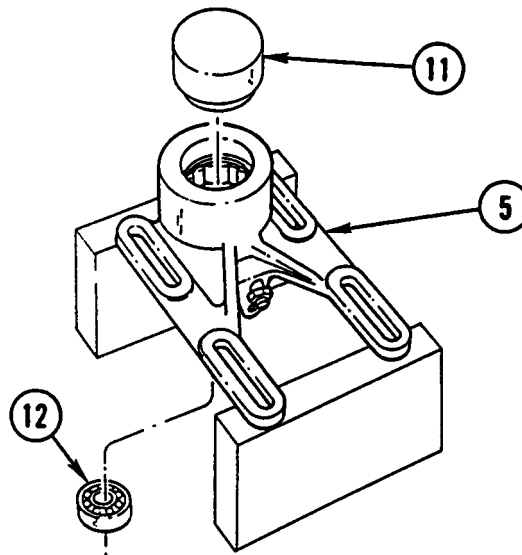
### NOTE

Roller bearing assembly must be replaced whenever inner race is removed from fan spindle or roller bearing is removed from spindle housing.

5. SECURE FAN SPINDLE (1) IN VISE. USING UNIVERSAL PULLER (7), REMOVE ROLLER BEARING INNER RACE (8) FROM FAN SPINDLE (1). DISCARD ROLLER BEARING INNER RACE.



6. USING BRASS DRIFT AND HAMMER, REMOVE AND DISCARD OIL SEAL (9).
7. REMOVE BALL BEARING RETAINING SNAP RING (10).

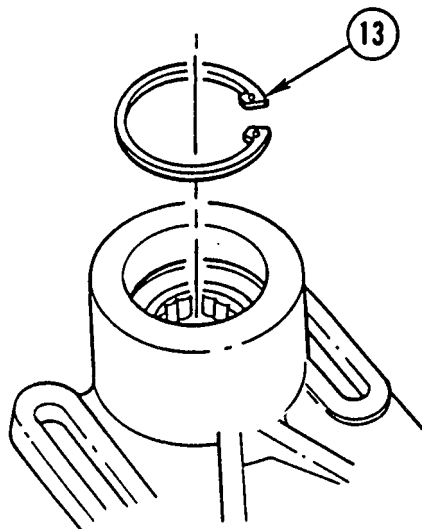


**NOTE**

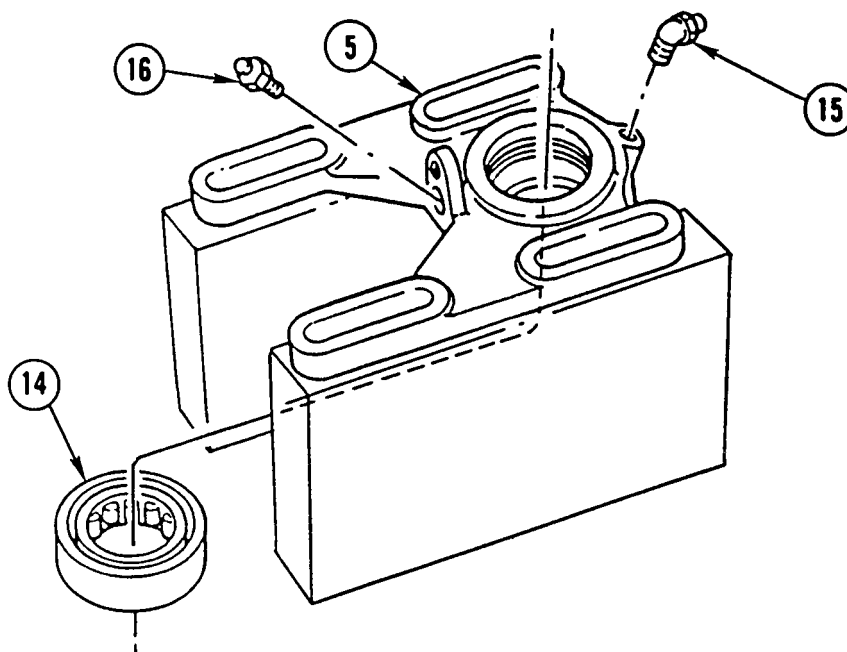
Ball bearing assembly must be replaced whenever fan spindle is removed from spindle housing.

8. SUPPORT SPINDLE HOUSING (5) AS SHOWN.
9. USING BEARING REMOVING/INSTALLING TOOL (11), REMOVE AND DISCARD BALL BEARING ASSEMBLY (12).

## SPINDLE AND HOUSING REPAIR (CONT)



10. REMOVE ROLLER BEARING RETAINING SNAP RING (13).



11. SUPPORT SPINDLE HOUSING (5) AND REMOVE ROLLER BEARING (14) BY TAPPING ALTERNATELY AROUND ROLLER BEARING (14) OUTER RACE WITH BRASS DRIFT AND HAMMER. DISCARD ROLLER BEARING.

12. REMOVE GREASE FITTING (15).

13. REMOVE LUBE PRESSURE RELIEF FITTING (16).

**CLEANING**

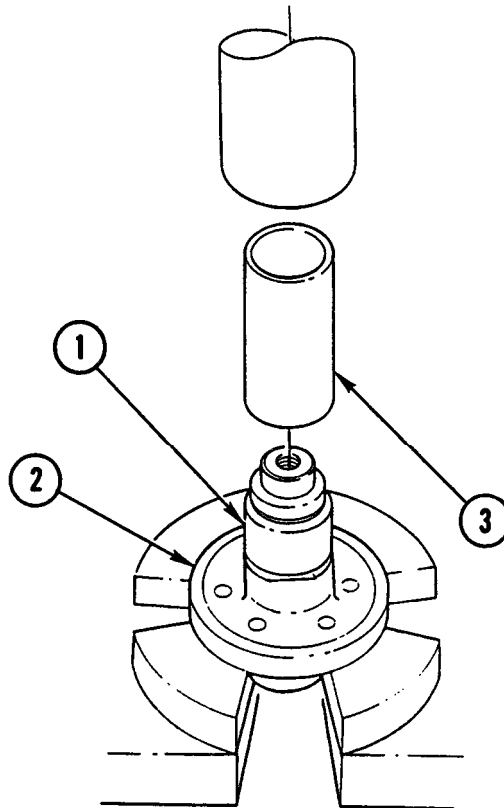
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

1. INSPECT ALL PARTS FOR RUST, CORROSION, NICKS, BURRS, CRACKS, AND DETERIORATION.
2. INSPECT SPINDLE AND HOUSING MACHINED SURFACES FOR PITS, GOUGES, AND SCRATCHES.
3. INSPECT FOR STRIPPED OR DAMAGED THREADS.

**REPAIR**

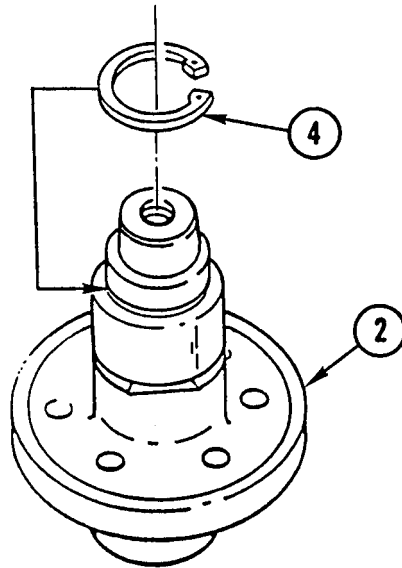
Use general repair methods to repair damaged parts (page 2-33).

**ASSEMBLY****NOTE**

Make sure roller bearing inner race part number is facing up against installing tool.

1. INSTALL NEW ROLLER BEARING INNER RACE (1) ON FAN SPINDLE (2).
2. SUPPORT FAN SPINDLE (2) ON PRESS BED. USING INSTALLING TOOL (3), PRESS ROLLER BEARING INNER RACE (1) AGAINST SHOULDER OF FAN SPINDLE (2).

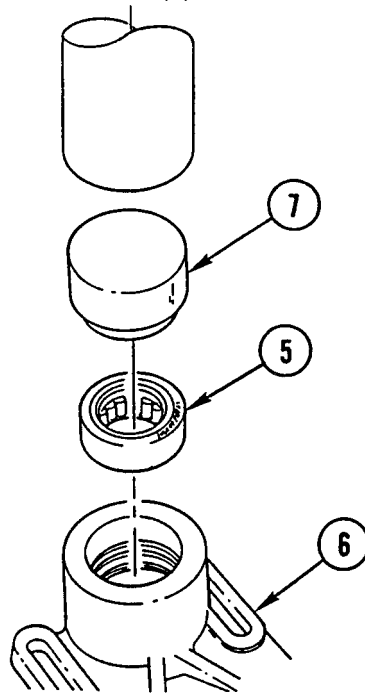
## SPINDLE AND HOUSING REPAIR (CONT)



### NOTE

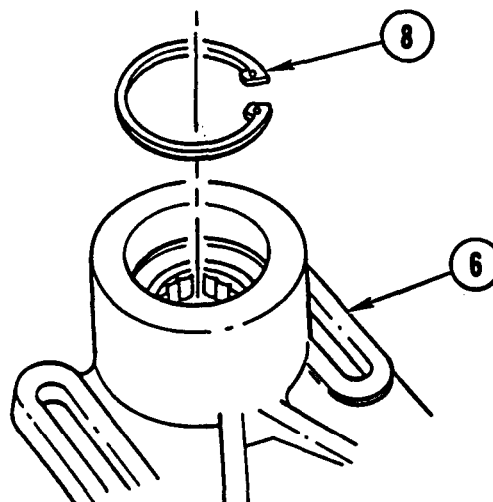
Make sure snap ring is fully seated in groove of fan spindle.

3. INSTALL INNER ROLLER BEARING SNAP RING (4) IN GROOVE OF FAN SPINDLE (2).



4. PACK NEW ROLLER BEARING (5) WITH LITHIUM BASE MULTIPURPOSE GREASE.
5. SUPPORT SPINDLE HOUSING (6) ON PRESS BED AND INSTALL ROLLER BEARING (5) IN SPINDLE HOUSING (6). USING STEPPED SIDE OF INSTALLING TOOL (7), PRESS ROLLER BEARING (5) AGAINST SHOULDER OF SPINDLE HOUSING (6).

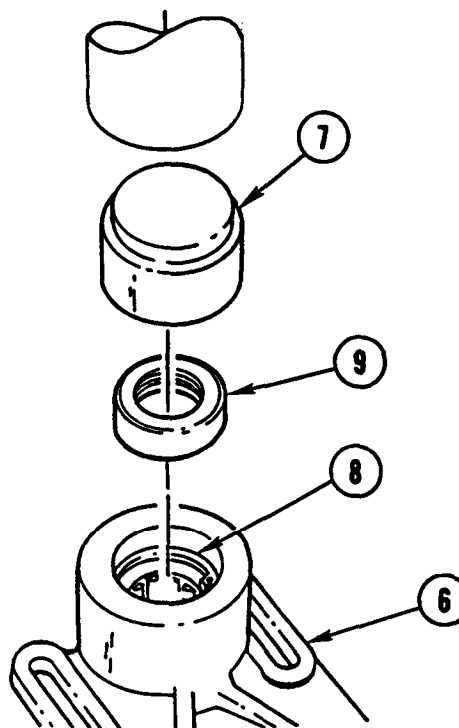




**NOTE**

Make sure snap ring is fully seated in groove of spindle housing.

6. INSTALL ROLLER BEARING RETAINING SNAP RING (8) IN GROOVE OF SPINDLE HOUSING (6).

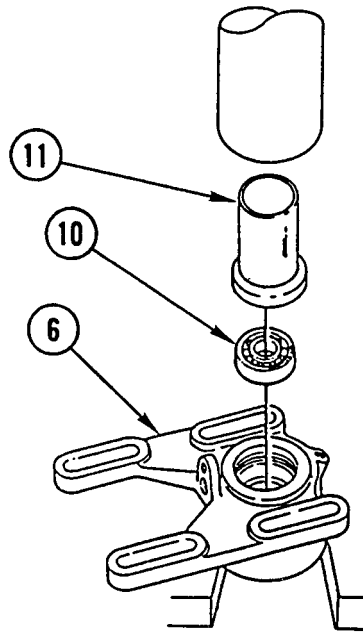


**CAUTION**

Be careful when installing oil seal. Excessive pressure in seating oil seal may deform oil seal case.

7. USING SMOOTH SIDE OF INSTALLING TOOL (7), PRESS NEW OIL SEAL (9) IN SPINDLE HOUSING (6) AGAINST ROLLER BEARING RETAINING SNAP RING (8).
8. LUBRICATE LIP OF OIL SEAL (9) WITH CLEAN ENGINE LUBRICATING OIL.

## SPINDLE AND HOUSING REPAIR (CONT)

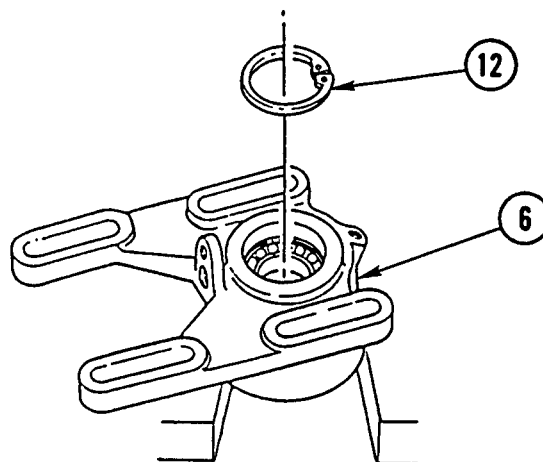


9. PACK NEW BALL BEARING ASSEMBLY (10) WITH LITHIUM BASE MULTIPURPOSE GREASE.
10. TURN SPINDLE HOUSING (6) OVER ON PRESS BED AND INSTALL BALL BEARING ASSEMBLY (10) IN SPINDLE HOUSING (6).

### **NOTE**

Make sure ball bearing outer race part number is facing up against installing tool.

11. USING WIDE END OF INSTALLING TOOL (11), PRESS ON BALL BEARING ASSEMBLY (10) OUTER RACE. PRESS BALL BEARING ASSEMBLY (10) FIRMLY AGAINST SHOULDER IN SPINDLE HOUSING (6).



**NOTE**

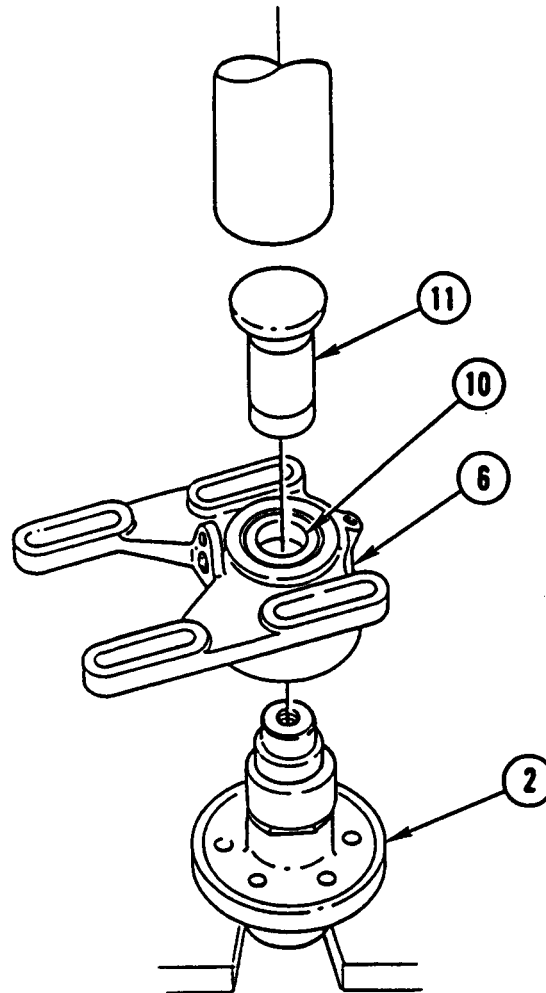
Make sure snap ring is fully seated in groove of spindle housing.

12. INSTALL BALL BEARING RETAINING SNAP RING (12) IN SPINDLE HOUSING (6).

**NOTE**

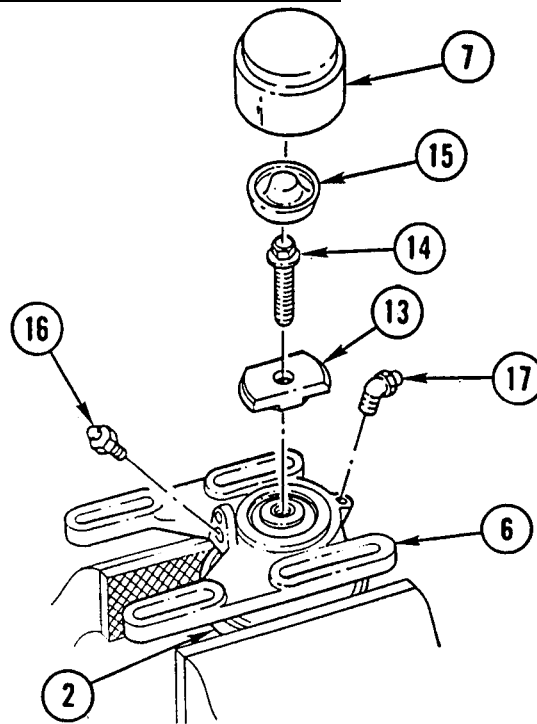
Do not pack spindle housing more than 1/2-2/3 full.

13. PACK SPINDLE HOUSING (6) WITH LITHIUM BASE MULTIPURPOSE GREASE.



14. SUPPORT FAN SPINDLE (2) ON PRESS BED AND CAREFULLY INSTALL SPINDLE HOUSING (6) ON FAN SPINDLE (2). USING NARROW END OF INSTALLING TOOL (11), PRESS BALL BEARING ASSEMBLY (10) INNER RACE ON FAN SPINDLE (2) UNTIL BALL BEARING ASSEMBLY (10) INNER RACE IS FIRMLY SEATED AGAINST SHOULDER OF FAN SPINDLE (2).

## SPINDLE AND HOUSING REPAIR (CONT)



### CAUTION

Use pieces of wood or similar soft material to protect fan spindle from vise damage.

15. SECURE FAN SPINDLE (2) IN VISE. INSTALL SPACER (13) AND SPACER RETAINING BOLT (14) IN SPINDLE HOUSING (6). TIGHTEN BOLT TO 43-54 LB-FT (58-73 N.m).

### WARNINGS

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

16. COAT EDGE OF NEW CUP PLUG (15) WITH NON-HARDENING SEALANT. USING FLAT SIDE OF INSTALLING TOOL (7), PRESS NEW CUP PLUG (15) IN SPINDLE HOUSING (6) UNTIL RAISED CENTER OF CUP PLUG (15) IS FLUSH WITH EDGE OF SPINDLE HOUSING (6).
17. INSTALL LUBE PRESSURE RELIEF FITTING (16).
18. INSTALL GREASE FITTING (17) AND TIGHTEN TO 6 LB-FT (8.0 N.m) MINIMUM.

## CHAPTER 13 ELECTRICAL SYSTEM REPAIR INSTRUCTIONS

This chapter illustrates and describes procedures for maintenance of the electrical system and related parts.

	<b>Page</b>
Section I. Alternator Repair . . . . .	13-2
Section II. Starter Repair . . . . .	13-26

## Section I. ALTERNATOR REPAIR

OVERVIEW

This section illustrates and describes procedures for maintenance of the alternator.

	Page
Alternator Repair (M915A2) . . . . .	13-3
Alternator Repair (All Except M915A2) . . . . .	13-16

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## ALTERNATOR REPAIR

---

This task covers: a. Disassembly b. Testing c. Cleaning d. Inspection e. Repair f. Assembly

---

### INITIAL SETUP

#### Applicable Configuration:

M915A2

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Gasket	P/N 73814
Seal	P/N 57611
Seal	P/N 79404
Seal	P/N 79403
Seal	P/N 79405
Bearing	P/N 79406
Washer, Lock (8)	P/N 2434
Nut, Lock (3)	P/N 26175
Nut, Tenz (5)	P/N 59982
Nut, Tenz (3)	P/N 79024
Compound, Sealing	Appendix B, Item 16
Cloth, Abrasive	Appendix B, Item 10

#### References:

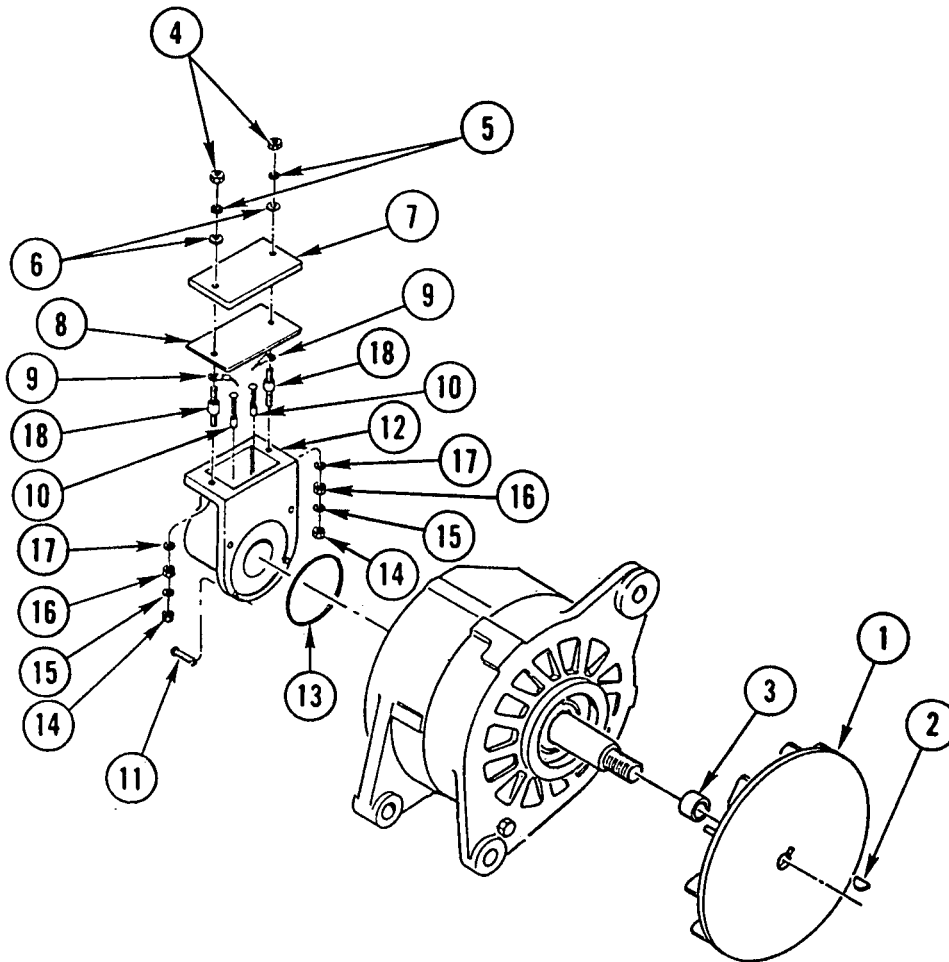
TM 9-2320-363-20  
 TM 9-214

#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Alternator Removed

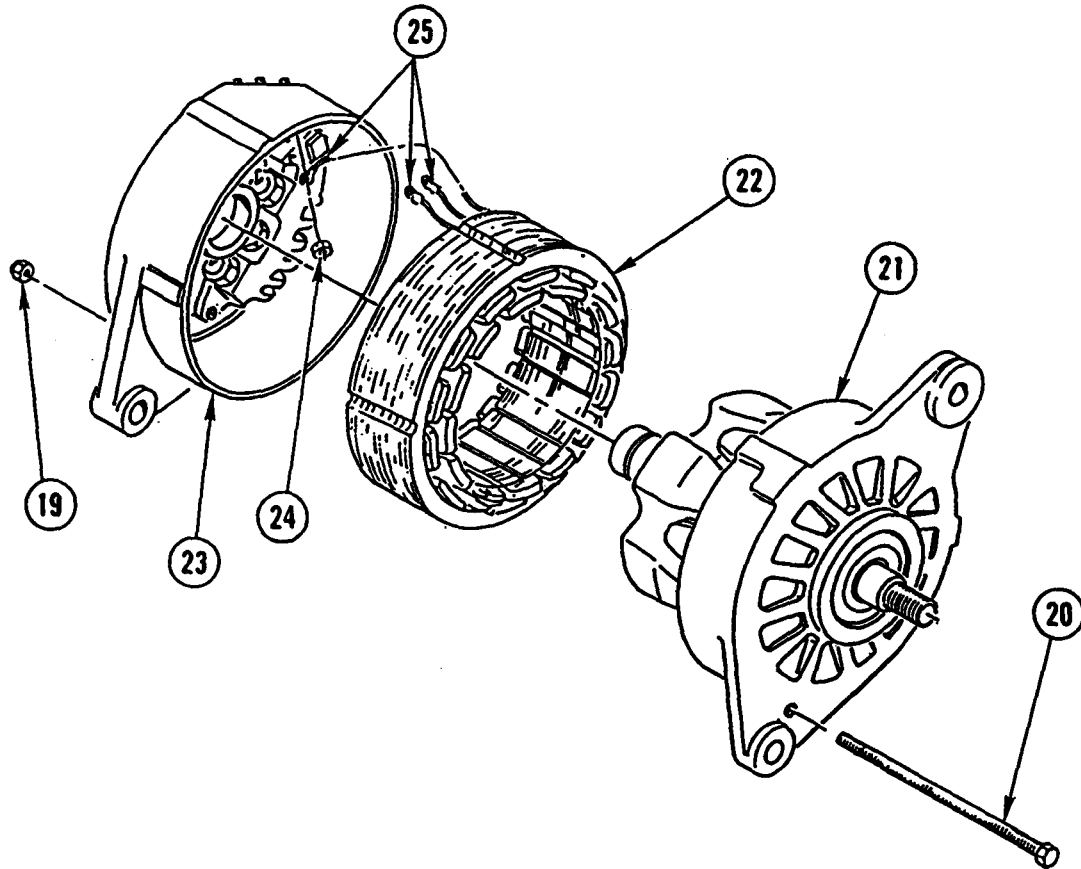
## ALTERNATOR REPAIR (CONT)

### DISASSEMBLY



1. REMOVE FAN (1), WOODRUFF KEY (2), AND SPACER (3).
2. REMOVE TWO NUTS (4), TWO LOCK WASHERS (5), TWO GUARD WASHERS (6), COVER (7), GASKET (8), AND TWO JUMPERS (9). DISCARD GASKET AND LOCK WASHERS.
3. REMOVE TWO BRUSHES (10).
4. REMOVE FOUR SCREWS (11), BRUSH HOLDER (12), AND SEAL (13). DISCARD SEAL.
5. REMOVE TWO NUTS (14), TWO LOCK WASHERS (15), TWO NUTS (16), TWO LOCK WASHERS (17), AND TWO TERMINAL STUDS (18). DISCARD LOCK WASHERS.





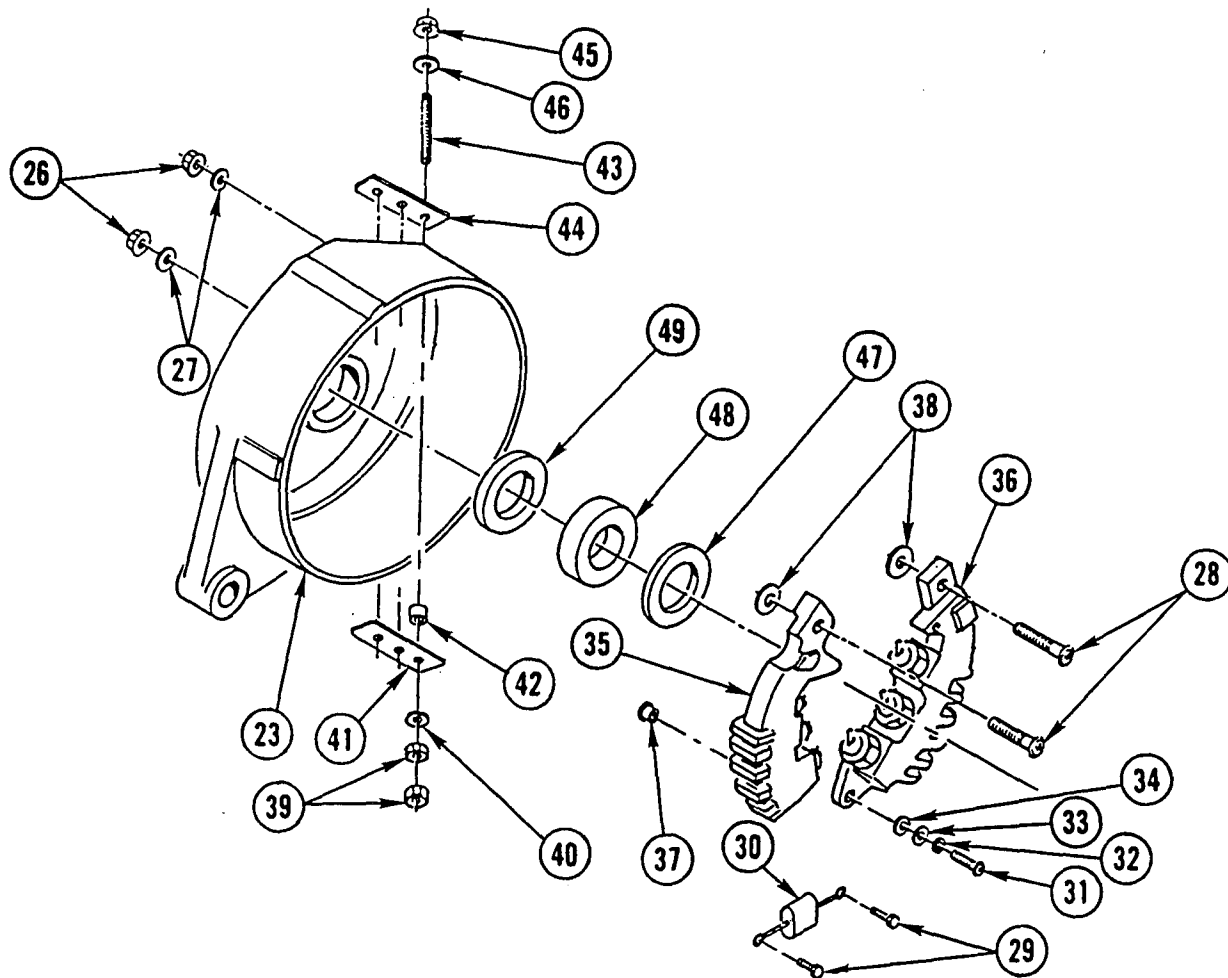
6. REMOVE THREE LOCK NUTS (19) AND THREE SCREWS (20). DISCARD LOCK NUTS.

**CAUTION**

If drive end housing binds, tap gently on mounting ears. Make sure drive end housing separates from stator and stator remains attached to slip ring end housing to avoid damage to stator leads.

7. REMOVE ROTOR AND DRIVE END HOUSING (21) FROM STATOR (22) AND SLIP RING END HOUSING (23).
8. REMOVE AND DISCARD THREE TENZ NUTS (24). DISCONNECT THREE LEADS (25) AND REMOVE STATOR (22). PROCEED TO STATOR TEST (PAGE 13-11).

## ALTERNATOR REPAIR (CONT)

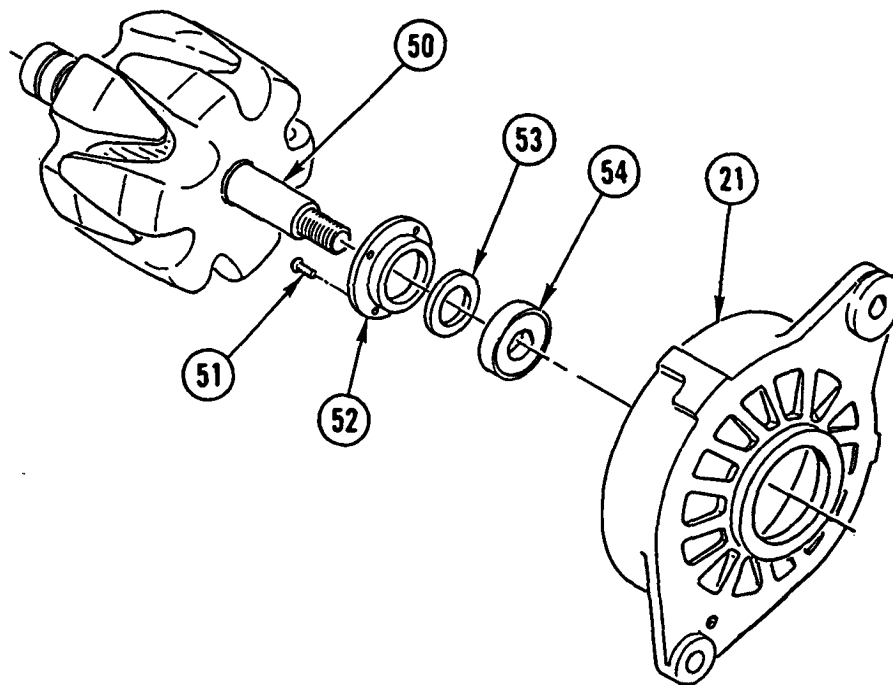


9. REMOVE TWO TENZ NUTS (26), TWO INSULATOR BUSHINGS (27), AND TWO TERMINAL SCREWS (28). DISCARD TENZ NUTS.
10. REMOVE TWO SCREWS (29) AND CAPACITOR (30).
11. REMOVE TWO SCREWS (31), TWO LOCK WASHERS (32), TWO WASHERS (33), TWO INSULATING WASHERS (34), POSITIVE RECTIFIER (35), AND NEGATIVE RECTIFIER (36). DISCARD LOCK WASHERS. PROCEED TO RECTIFIER TEST (PAGE 13-9).
12. REMOVE TWO INSULATING BUSHINGS (37) FROM POSITIVE RECTIFIER (35) AND NEGATIVE RECTIFIER (36).

**NOTE**

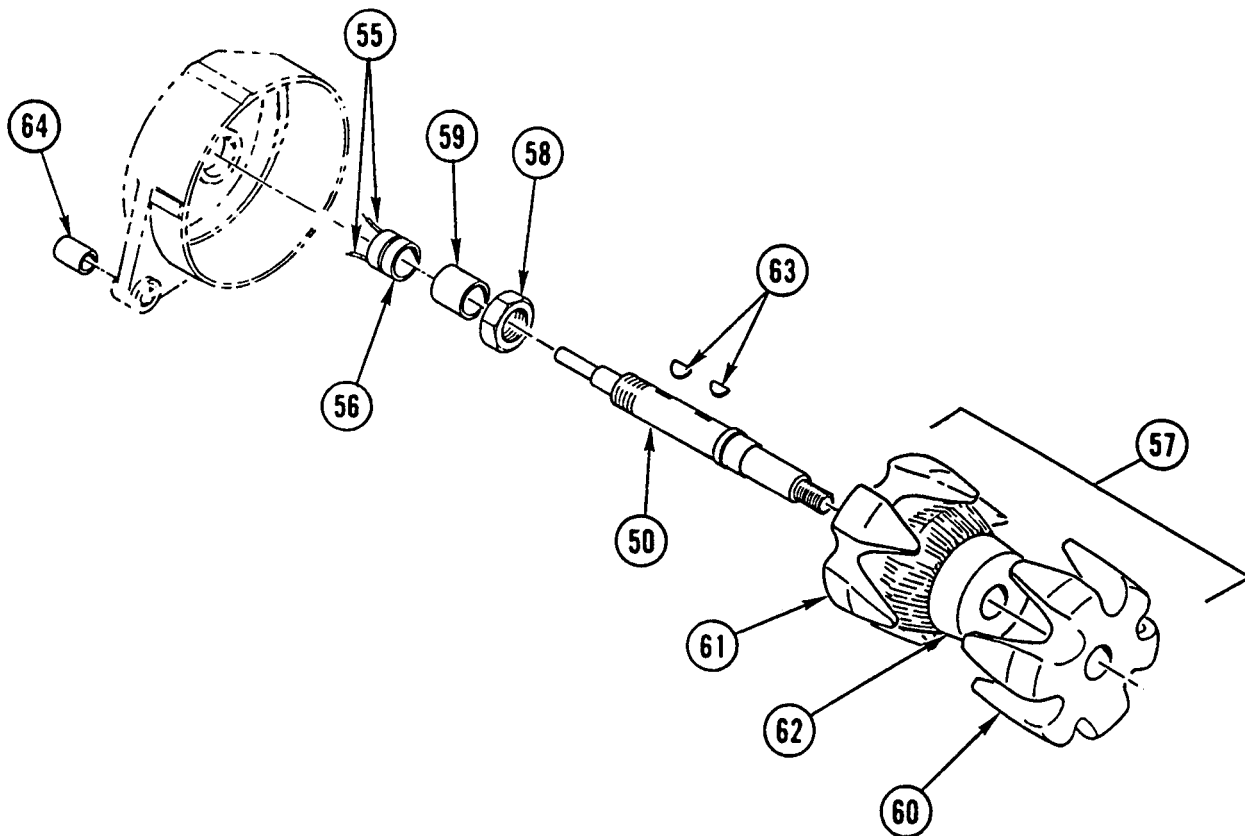
Note position of insulating bushings in slip ring end housing prior to removal to aid in installation.

13. REMOVE TWO INSULATING BUSHINGS (38) FROM SLIP RING END HOUSING (23).
14. REMOVE SIX NUTS (39), THREE WASHERS (40), INSULATOR (41), THREE INSULATORS (42), THREE TERMINAL STUDS (43), AND INSULATOR (44).
15. REMOVE TENZ NUT (45) AND WASHER (46) FROM EACH OF THREE TERMINAL STUDS (43). DISCARD TENZ NUTS.
16. REMOVE INNER SEAL (47) AND BEARING (48). DISCARD SEAL AND BEARING.
17. REMOVE SEAL (49) FROM REAR OF SLIP RING END HOUSING (23) BY TAPPING EQUALLY IN ALL FIVE HOLES ON OUTSIDE OF SLIP RING END HOUSING (23). DISCARD SEAL.

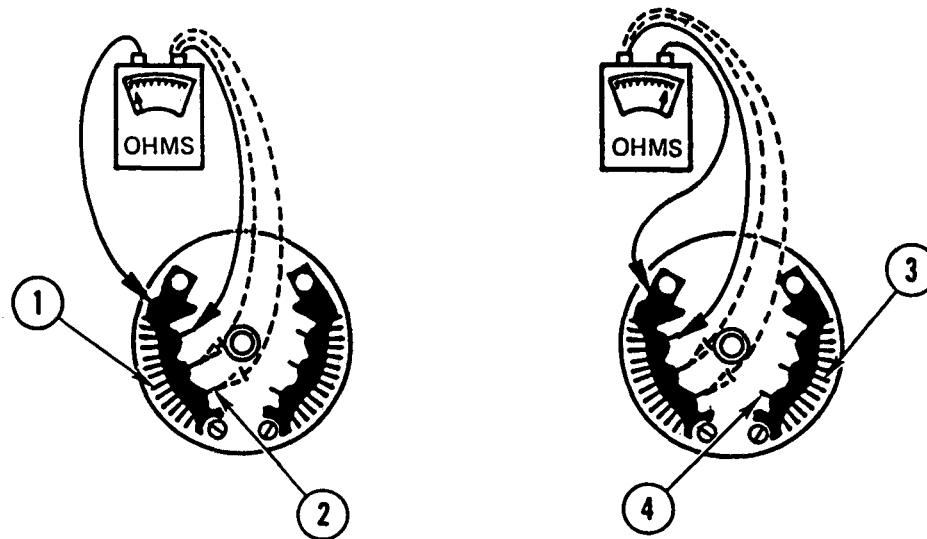


18. REMOVE ROTOR AND DRIVE END HOUSING (21) FROM SHAFT (50).
19. REMOVE FOUR SCREWS (51), BEARING RETAINER (52), SEAL (53) AND BEARING (54). DISCARD SEAL.
20. TEST ROTOR IN ACCORDANCE WITH ROTOR TEST PROCEDURES (PAGE 13-10).

## ALTERNATOR REPAIR (CONT)

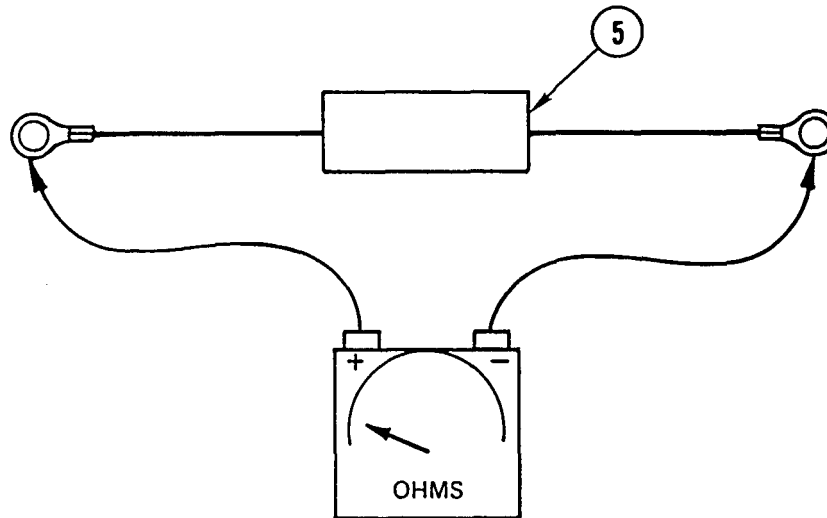


21. UNSOLDER TWO LEADS (55) FROM SLIP RING ASSEMBLY (56).
22. REMOVE SLIP RING ASSEMBLY (56).
23. PLACE ROTOR ASSEMBLY (57) IN SOFT-JAWED VISE AND REMOVE NUT (58).
24. REMOVE INNER BEARING RACE (59).
25. REMOVE TWO ROTOR HALVES (60 AND 61), HUB (62), AND TWO WOODRUFF KEYS (63) FROM SHAFT (50).
26. IF DAMAGED, REMOVE SLIDABLE BUSHING (64).

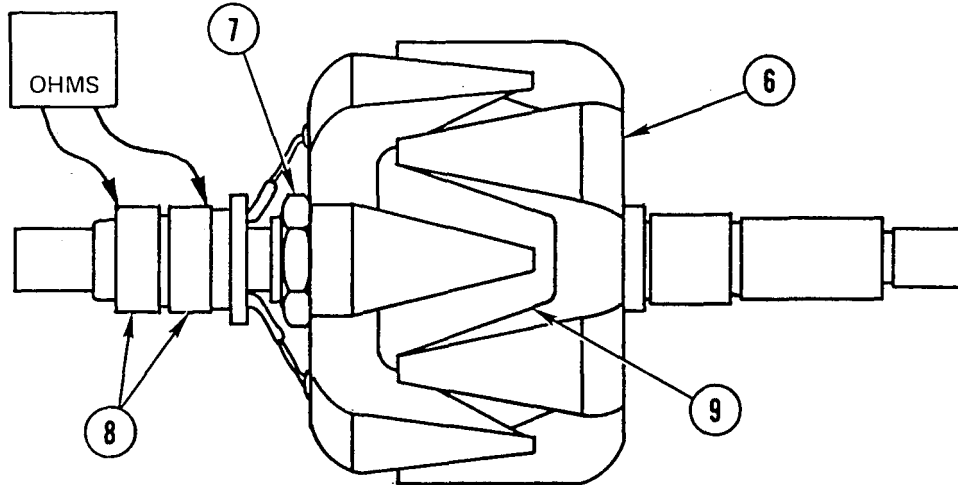
**TESTING**

1. TEST POSITIVE RECTIFIER (1) AS FOLLOWS:
  - A. CONNECT POSITIVE LEAD OF DIODE TESTER TO POSITIVE RECTIFIER (1). TOUCH NEGATIVE LEAD TO EACH OF THREE DIODES (2). HIGH RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (2) SHOWS LOW RESISTANCE, REPLACE POSITIVE RECTIFIER (1).
  - B. REVERSE TEST LEADS SO NEGATIVE LEAD IS CONNECTED TO POSITIVE RECTIFIER (1). TOUCH POSITIVE LEAD TO EACH OF THREE DIODES (2). LOW RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (2) SHOWS HIGH RESISTANCE, REPLACE POSITIVE RECTIFIER (1).
2. TEST NEGATIVE RECTIFIER (3) AS FOLLOWS:
  - A. CONNECT NEGATIVE LEAD OF DIODE TESTER TO NEGATIVE RECTIFIER (3). TOUCH NEGATIVE LEAD TO EACH OF THREE DIODES (4). HIGH RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (4) SHOWS LOW RESISTANCE, REPLACE NEGATIVE RECTIFIER (3).
  - B. REVERSE TEST LEADS SO POSITIVE LEAD IS CONNECTED TO NEGATIVE RECTIFIER (3). TOUCH POSITIVE LEAD TO EACH OF THREE DIODES (4). LOW RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (4) SHOWS HIGH RESISTANCE, REPLACE NEGATIVE RECTIFIER (1).

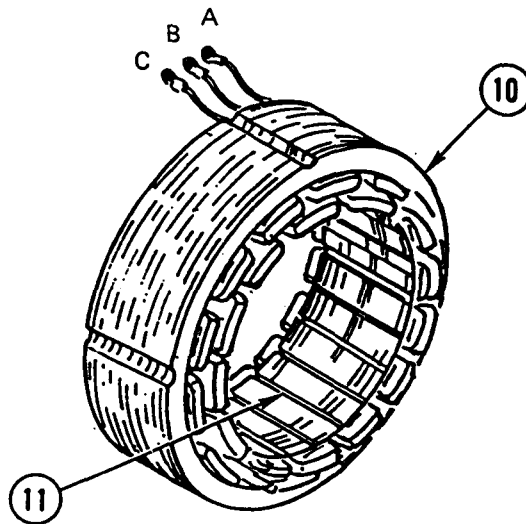
## ALTERNATOR REPAIR (CONT)



3. CHECK CAPACITOR (5) USING OHMMETER WITH POSITIVE AND NEGATIVE LEADS CONNECTED TO TERMINALS. IF RESISTANCE READING IS LOW, REPLACE CAPACITOR (5).



4. TEST ROTOR ASSEMBLY (6) AS FOLLOWS:
  - A. WITH OHMMETER CONNECTED BETWEEN NUT (7) AND EITHER OF TWO SLIP RINGS (8), NO READING SHOULD BE OBTAINED. IF ANY READING IS OBTAINED, ROTOR COIL (9) IS GROUNDING, AND ROTOR ASSEMBLY (6) MUST BE DISASSEMBLED TO REPAIR SHORT.
  - B. CHECK ROTOR COIL (9) RESISTANCE BY CONNECTING OHMMETER ACROSS BOTH SLIP RINGS (8). RESISTANCE SHOULD BE 9.6-10.4 OHMS. IF RESISTANCE IS OUTSIDE LIMITS, REPLACE ROTOR COIL (9).



5. TEST STATOR (10) AS FOLLOWS:

A. CONNECT ONE OHMMETER LEAD TO BARE METAL SURFACE ON STATOR LAMINATION (11). CONNECT OTHER LEAD TO EACH OF THREE STATOR (10) TERMINALS. HIGH RESISTANCE READING SHOULD BE OBTAINED EACH TIME. IF THERE IS NO READING OR OHMMETER READS ZERO, REPLACE STATOR (10).

B. CONNECT OHMMETER LEADS AS FOLLOWS (NOTE EACH READING):

- A AND B
- A AND C
- B AND C

EACH MEASUREMENT SHOULD BE APPROXIMATELY EQUAL. IF DIFFERENCE IS GREAT BETWEEN ANY TWO READINGS, REPLACE STATOR (10).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

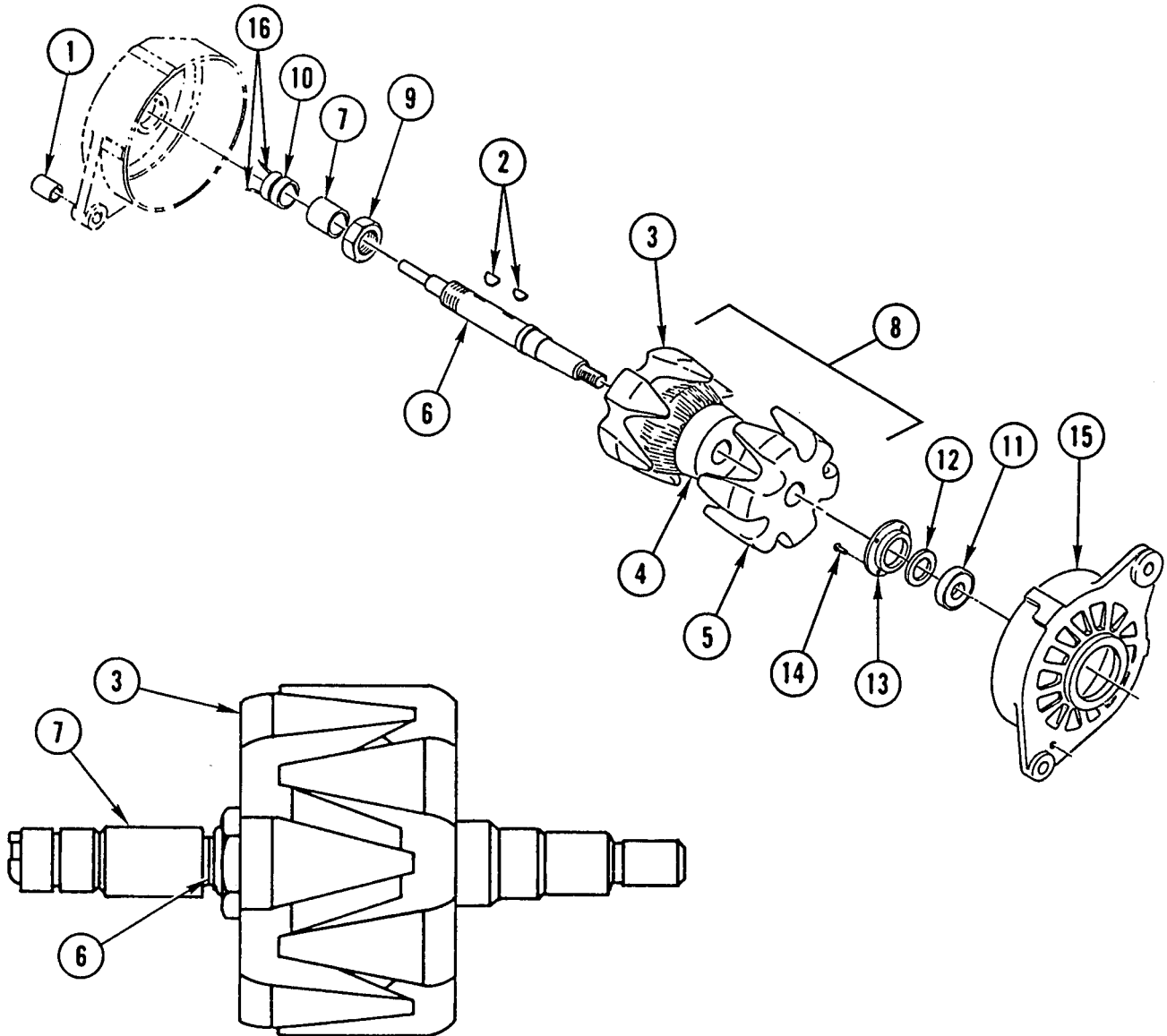
1. INSPECT FOR BURNED OR CHARRED COMPONENTS (I.E., STATOR, ROTOR, ETC.).
2. INSPECT BEARINGS IN ACCORDANCE WITH TM 9-214.
3. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

**REPAIR**

Repair of the alternator is the replacement of all worn or defective parts.

## ALTERNATOR REPAIR (CONT)

### ASSEMBLY



1. IF REMOVED, INSTALL NEW SLIDABLE BUSHING (1).



**CAUTION**

If either rotor half has been damaged, both rotor halves must be replaced. Failure to replace both will cause rotor to be out of balance and alternator will not operate properly.

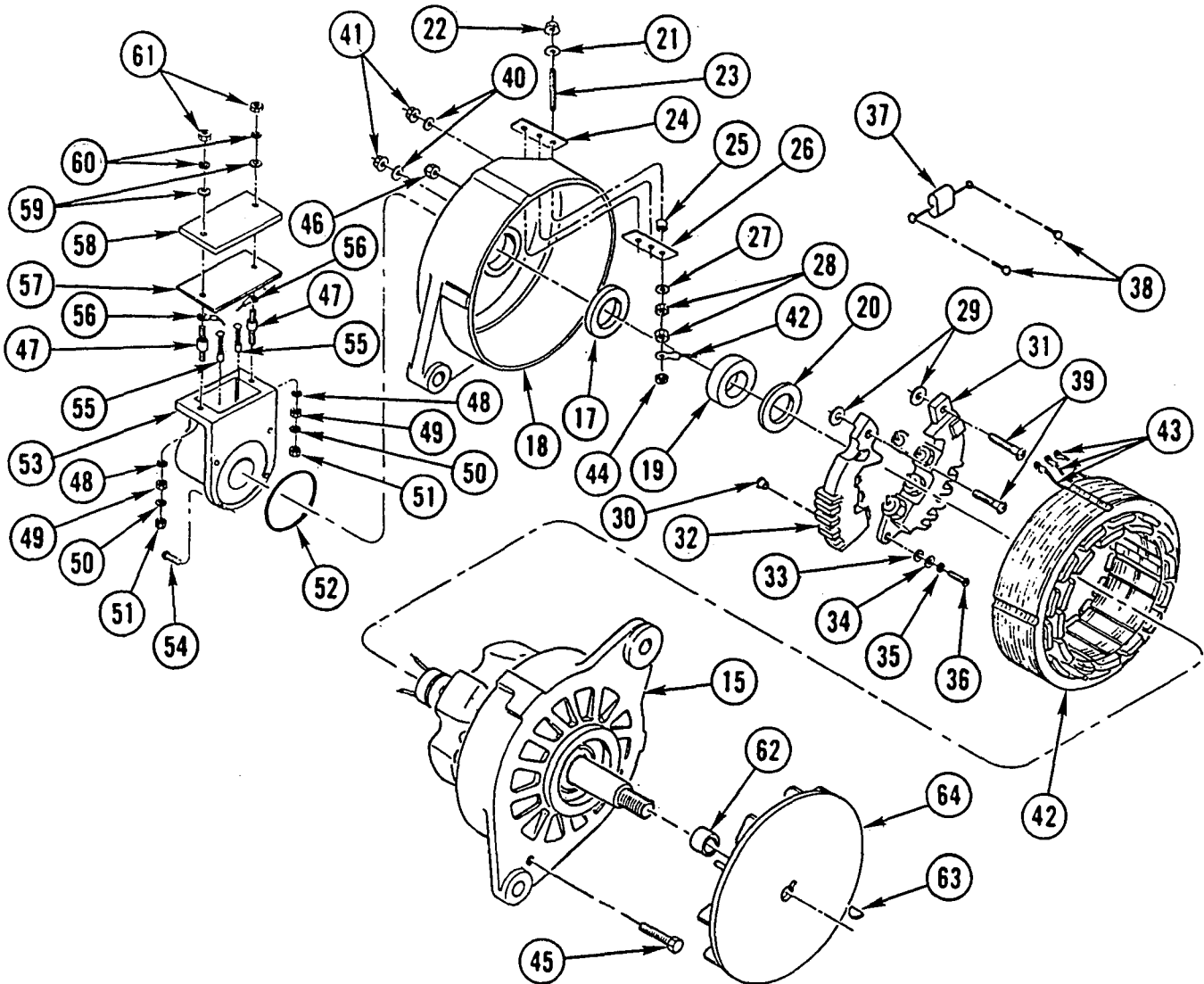
2. INSTALL TWO WOODRUFF KEYS (2), ROTOR HALF (3), HUB (4), AND ROTOR HALF (5) ON SHAFT (6).
3. INSTALL INNER BEARING RACE (7) WITH CHAMFERED EDGE FACING AWAY FROM ROTOR HALF (3) UNTIL GAP OF 0.141 IN. (3.6 mm) IS BETWEEN INNER BEARING RACE (7) AND SHAFT (6) THREADS.
4. PLACE ROTOR ASSEMBLY (8) IN SOFT-JAWED VISE AND INSTALL NUT (9). TIGHTEN NUT TO 110 LB-FT (149 N.m).
5. APPLY LIGHT COATING OF SEALING COMPOUND TO SHAFT (6) WHERE SLIP RING ASSEMBLY (10) WILL BE INSTALLED.

**CAUTION**

Use extreme care not to damage two terminals located on end of slip ring assembly.

6. INSTALL SLIP RING ASSEMBLY (10) ON SHAFT (6) UNTIL END OF SLIP RING ASSEMBLY (10) IS AGAINST INNER BEARING RACE (7).
7. INSTALL BEARING (11), NEW SEAL (12), BEARING RETAINER (13), AND FOUR SCREWS (14).
8. INSTALL SHAFT (6) IN ROTOR AND DRIVE END HOUSING (15).
9. MOUNT ROTOR AND DRIVE END HOUSING (15) IN SOFT-JAWED VISE AND, USING DIAL INDICATOR GAGE WITH MAGNETIC BASE, CHECK RUNOUT OF SLIP RING ASSEMBLY (10). MAXIMUM ALLOWABLE RUNOUT IS 0.002 IN. (0.05 mm).
10. IF RUNOUT IS EXCESSIVE, MOUNT ASSEMBLY ON LATHE USING ABRASIVE CLOTH. DRESS SLIP RING ASSEMBLY (10).
11. REPEAT STEPS 9 AND 10 UNTIL PROPER RUNOUT IS ACHIEVED.
12. SOLDER TWO LEADS (16) TO TERMINALS LOCATED ON END OF SLIP RING ASSEMBLY (10).

## ALTERNATOR REPAIR (CONT)



13. INSTALL NEW SEAL (17) IN REAR OF SLIP RING END HOUSING (18).

14. INSTALL NEW BEARING (19) AND NEW INNER SEAL (20).

15. INSTALL WASHER (21) AND NEW TENZ NUT (22) ON EACH OF THREE TERMINAL STUDS (23).

16. INSTALL INSULATOR (24), THREE TERMINAL STUDS (23), THREE INSULATORS (25), INSULATOR (26), THREE WASHERS (27), AND SIX NUTS (28).

17. INSTALL TWO INSULATING BUSHINGS (29) IN SLIP RING END HOUSING (18).

18. INSTALL TWO INSULATING BUSHINGS (30) IN NEGATIVE RECTIFIER (31) AND POSITIVE RECTIFIER (32).
19. INSTALL NEGATIVE RECTIFIER (31), POSITIVE RECTIFIER (32), TWO INSULATING WASHERS (33), TWO WASHERS (34), TWO NEW LOCK WASHERS (35), AND TWO SCREWS (36).
20. INSTALL CAPACITOR (37) AND TWO SCREWS (38).
21. INSTALL TWO TERMINAL SCREWS (39), TWO INSULATOR BUSHINGS (40), AND TWO NEW TENZ NUTS (41).

**CAUTION**

Use caution to make sure stator leads are not damaged.

22. INSTALL STATOR (42) IN SLIP RING END HOUSING (18).
23. CONNECT THREE LEADS (43) AND INSTALL THREE NEW TENZ NUTS (44).
24. INSTALL ROTOR AND DRIVE END HOUSING (15) IN STATOR (42) AND SLIP RING END HOUSING (18)
25. INSTALL THREE SCREWS (45) AND THREE NEW LOCK NUTS (46).
28. INSTALL TWO TERMINAL STUDS (47), TWO NEW LOCK WASHERS (48), TWO NUTS (49), TWO NEW LOCK WASHERS (50), AND TWO NUTS (51).
27. INSTALL NEW SEAL (52), BRUSH HOLDER (53), AND FOUR SCREWS (54).
28. INSTALL TWO BRUSHES (55).
29. INSTALL TWO JUMPERS (56), NEW GASKET (57), COVER (58), TWO GUARD WASHERS (59), TWO NEW LOCK WASHERS (60), AND TWO NUTS (61).
30. INSTALL SPACER (62), WOODRUFF KEY (63), AND FAN (64).

---

## ALTERNATOR REPAIR

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This task covers: a. Disassembly b. Testing c. Cleaning d. Inspection e. Repair f. Assembly

---

### INITIAL SETUP

#### Applicable Configuration:

All except M915A2

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

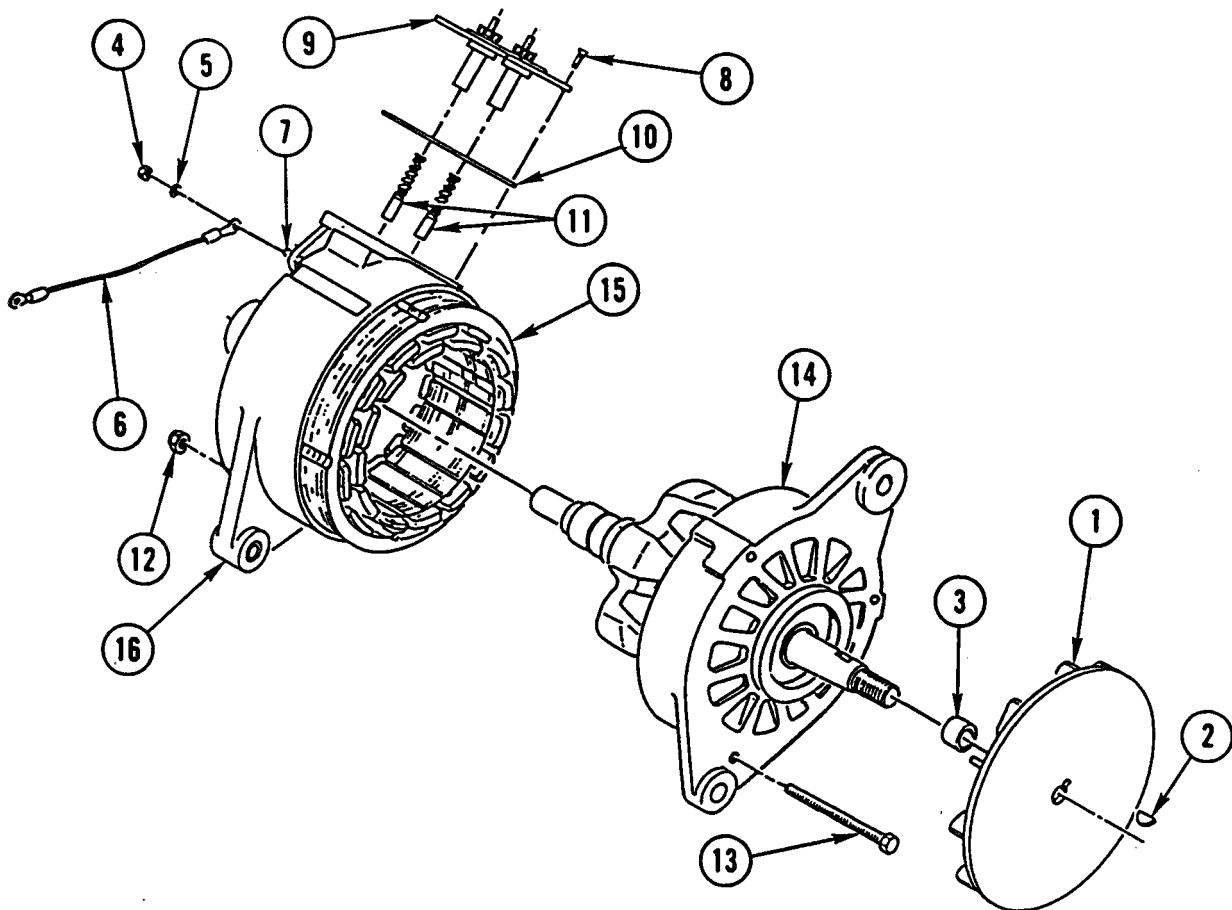
Gasket	P/N 97706
Bearing	P/N 78625
Washer, Lock	PIN 3231
Nut, Lock (3)	P/N 26175
Nut, Tenz (2)	P/N 73009
Nut, Tenz (3)	P/N 59982
Compound, Sealing	Appendix B, Item 16
Paper, Abrasive	Appendix B, Item 45

#### References:

TM9-2326-363-20  
TM 9-214

#### Equipment Condition:

Reference	Condition Description
TM9-2320-363-20	Alternator Removed

**DISASSEMBLY**

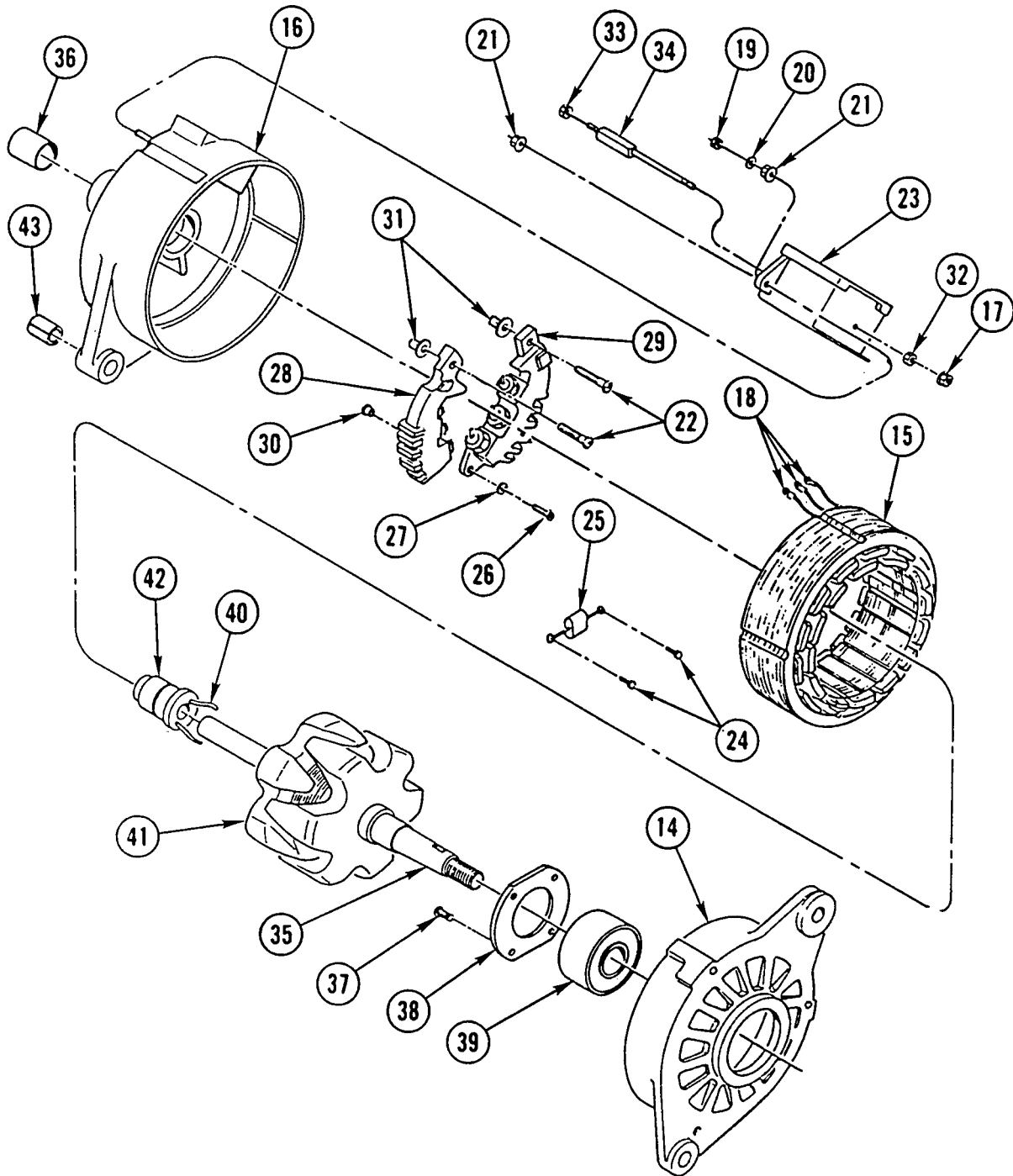
1. REMOVE FAN (1), WOODRUFF KEY (2), AND SPACER (3).
2. REMOVE NUT (4), LOCK WASHER (5), AND LEAD (6) FROM F+ TERMINAL (7). DISCARD LOCK WASHER.
3. REMOVE FOUR SCREWS (8), COVER (9), AND GASKET (10). DISCARD GASKET.
4. REMOVE TWO BRUSHES (11).
5. REMOVE THREE LOCK NUTS (12) AND THREE SCREWS (13). DISCARD LOCK NUTS.

**CAUTION**

If drive end housing binds, tap gently on mounting ears. Make sure drive end housing separates from stator and stator remains attached to slip ring end housing to avoid damage to stator leads.

6. REMOVE ROTOR AND DRIVE END HOUSING (14) FROM STATOR (15) AND SLIP RING END HOUSING (16).

## ALTERNATOR REPAIR (CONT)



7. REMOVE THREE NUTS (17). DISCONNECT THREE LEADS (18) AND REMOVE STATOR (15). PROCEED TO STATOR TEST (PAGE 13-22).

8. REMOVE NUT (19), WASHER (20), TWO TENZ NUTS (21), TWO TERMINAL STUDS (22), AND BRUSH HOUSING (23). DISCARD TENZ NUTS.
9. REMOVE TWO SCREWS (24) AND CAPACITOR (25).
10. REMOVE TWO SCREWS (26), TWO INSULATING WASHERS (27), POSITIVE RECTIFIER (28), AND NEGATIVE RECTIFIER (29). PROCEED TO RECTIFIER TEST (PAGE 13-20).

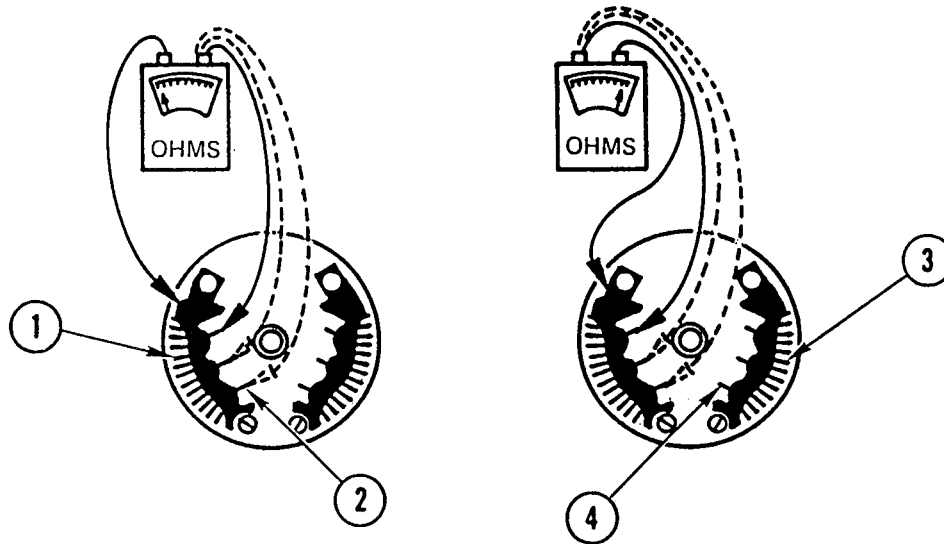
**NOTE**

Note position of insulating bushings prior to removal to aid in installation.

11. REMOVE TWO INSULATING BUSHINGS (30) FROM POSITIVE RECTIFIER (28) AND NEGATIVE RECTIFIER (29).
12. REMOVE TWO INSULATING BUSHINGS (31) FROM SLIP RING END HOUSING (16).
13. REMOVE THREE NUTS (32), THREE TENZ NUTS (33), AND THREE TERMINAL STUDS (34). DISCARD TENZ NUTS.
14. REMOVE AND DISCARD BEARING (36).
15. REMOVE ROTOR AND DRIVE END HOUSING (14) FROM ROTOR SHAFT (35). PROCEED TO ROTOR TEST (PAGE 13-21 ).
16. REMOVE FOUR SCREWS (37) AND BEARING RETAINER (38).
17. **REMOVE BEARING (39).**
18. **UNSOLDER TWO LEADS (40) FROM ROTOR (41).**
19. CAREFULLY REMOVE SLIP RING ASSEMBLY (42).
20. IF DAMAGED, REMOVE SLIDABLE BUSHING (43).

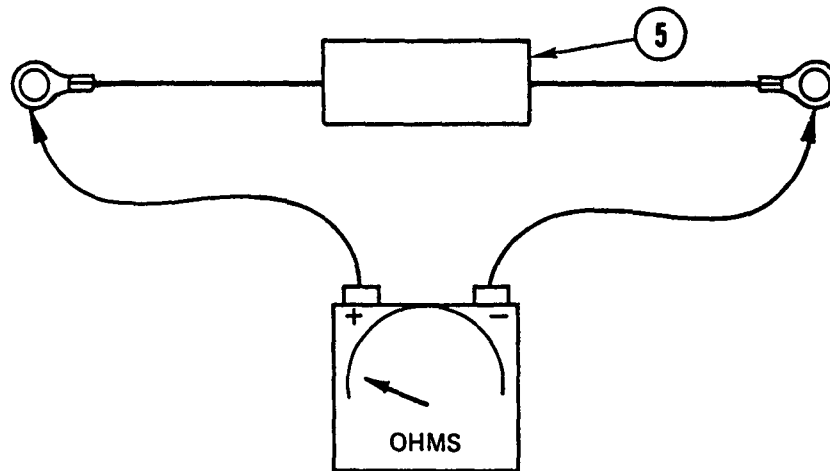
## ALTERNATOR REPAIR (CONT)

### TESTING

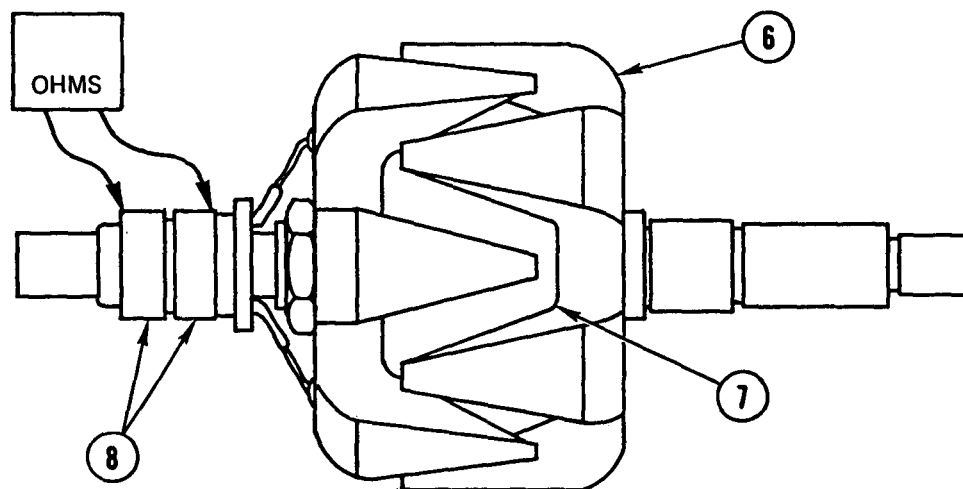


1. TEST POSITIVE RECTIFIER (1) AS FOLLOWS:
  - A. CONNECT POSITIVE LEAD OF DIODE TESTER TO POSITIVE RECTIFIER (1). TOUCH NEGATIVE LEAD TO EACH OF THREE DIODES (2). HIGH RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (2) SHOWS LOW RESISTANCE, REPLACE POSITIVE RECTIFIER (1).
  - B. REVERSE TEST LEADS SO NEGATIVE LEAD IS CONNECTED TO POSITIVE RECTIFIER (1). TOUCH POSITIVE LEAD TO EACH OF THREE DIODES (2). LOW RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (2) SHOWS HIGH RESISTANCE, REPLACE POSITIVE RECTIFIER (1).
2. TEST NEGATIVE RECTIFIER (3) AS FOLLOWS:
  - A. CONNECT NEGATIVE LEAD OF DIODE TESTER TO NEGATIVE RECTIFIER (3). TOUCH NEGATIVE LEAD TO EACH OF THREE DIODES (4). HIGH RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (4) SHOWS LOW RESISTANCE, REPLACE NEGATIVE RECTIFIER (3).
  - B. REVERSE TEST LEADS SO POSITIVE LEAD IS CONNECTED TO NEGATIVE RECTIFIER (3). TOUCH POSITIVE LEAD TO EACH OF THREE DIODES (4). LOW RESISTANCE SHOULD BE INDICATED. IF ANY OF THREE DIODES (4) SHOWS HIGH RESISTANCE, REPLACE NEGATIVE RECTIFIER (1).





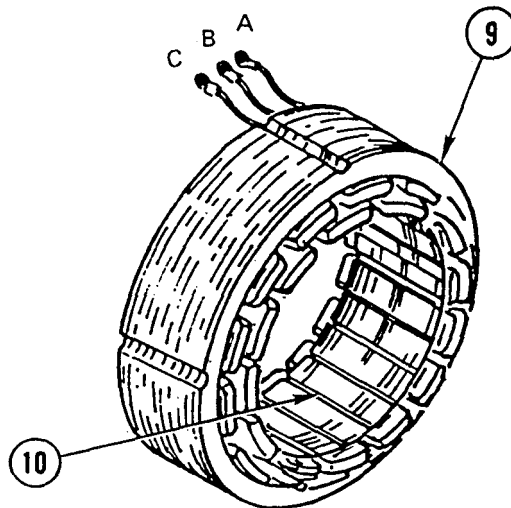
3. CHECK CAPACITOR (5) USING OHMMETER WITH POSITIVE AND NEGATIVE LEADS CONNECTED TO TERMINALS. IF RESISTANCE READING IS LOW, REPLACE CAPACITOR (5).



4. TEST ROTOR ASSEMBLY (6) AS FOLLOWS:

CHECK ROTOR COIL (7) RESISTANCE BY CONNECTING OHMMETER ACROSS BOTH SLIP RINGS (8). RESISTANCE SHOULD BE 9.6-10.4 OHMS. IF RESISTANCE IS OUTSIDE LIMITS, REPLACE ROTOR COIL (7).

## ALTERNATOR REPAIR (CONT)



5. TEST STATOR (9) AS FOLLOWS:

- A. CONNECT ONE OHMMETER LEAD TO BARE METAL SURFACE ON STATOR LAMINATION (10). CONNECT OTHER LEAD TO EACH OF THREE STATOR (10) TERMINALS. HIGH RESISTANCE READING SHOULD BE OBTAINED EACH TIME. IF THERE IS NO READING OR OHMMETER READS ZERO, REPLACE STATOR (10).
- B. CONNECT OHMMETER LEADS AS FOLLOWS (NOTE EACH READING):
- A AND B
  - A AND C
  - B AND C

EACH MEASUREMENT SHOULD BE APPROXIMATELY EQUAL. IF DIFFERENCE IS GREAT BETWEEN ANY TWO READINGS, REPLACE STATOR (10).

### **CLEANING**

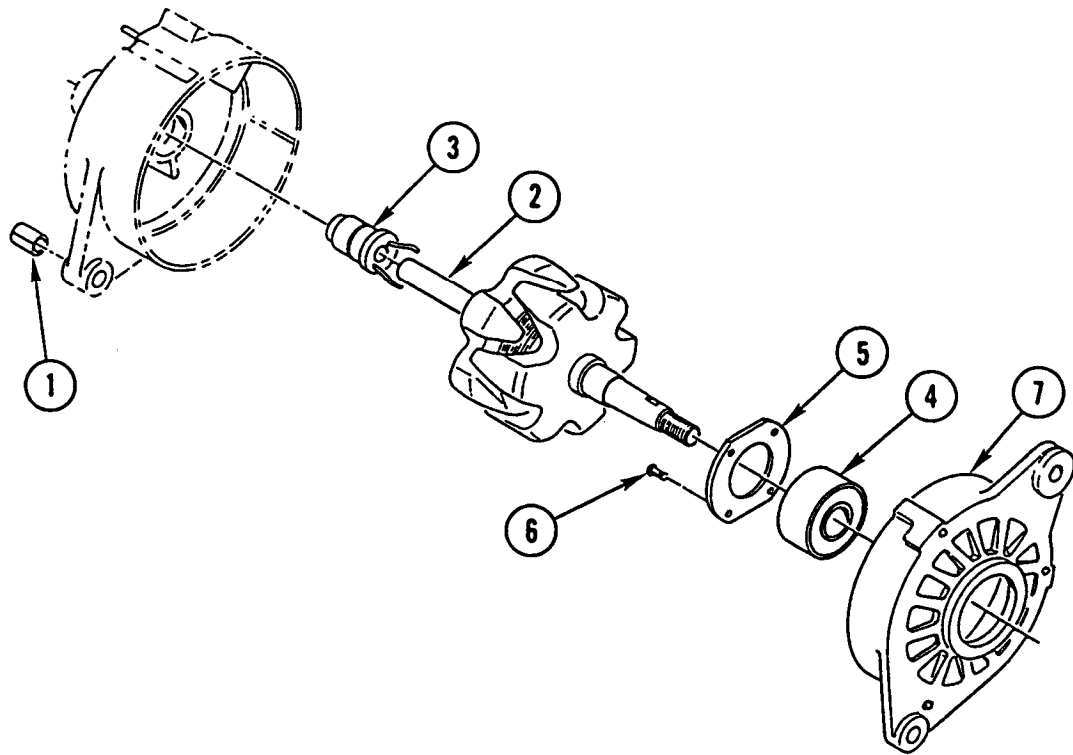
Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

1. INSPECT FOR BURNED OR CHARRED COMPONENTS (I.E., STATOR, ROTOR, ETC.).
2. INSPECT BEARINGS IN ACCORDANCE WITH TM 9-214.
3. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

### **REPAIR**

Repair of the alternator is the replacement of all worn or defective parts.

**ASSEMBLY**

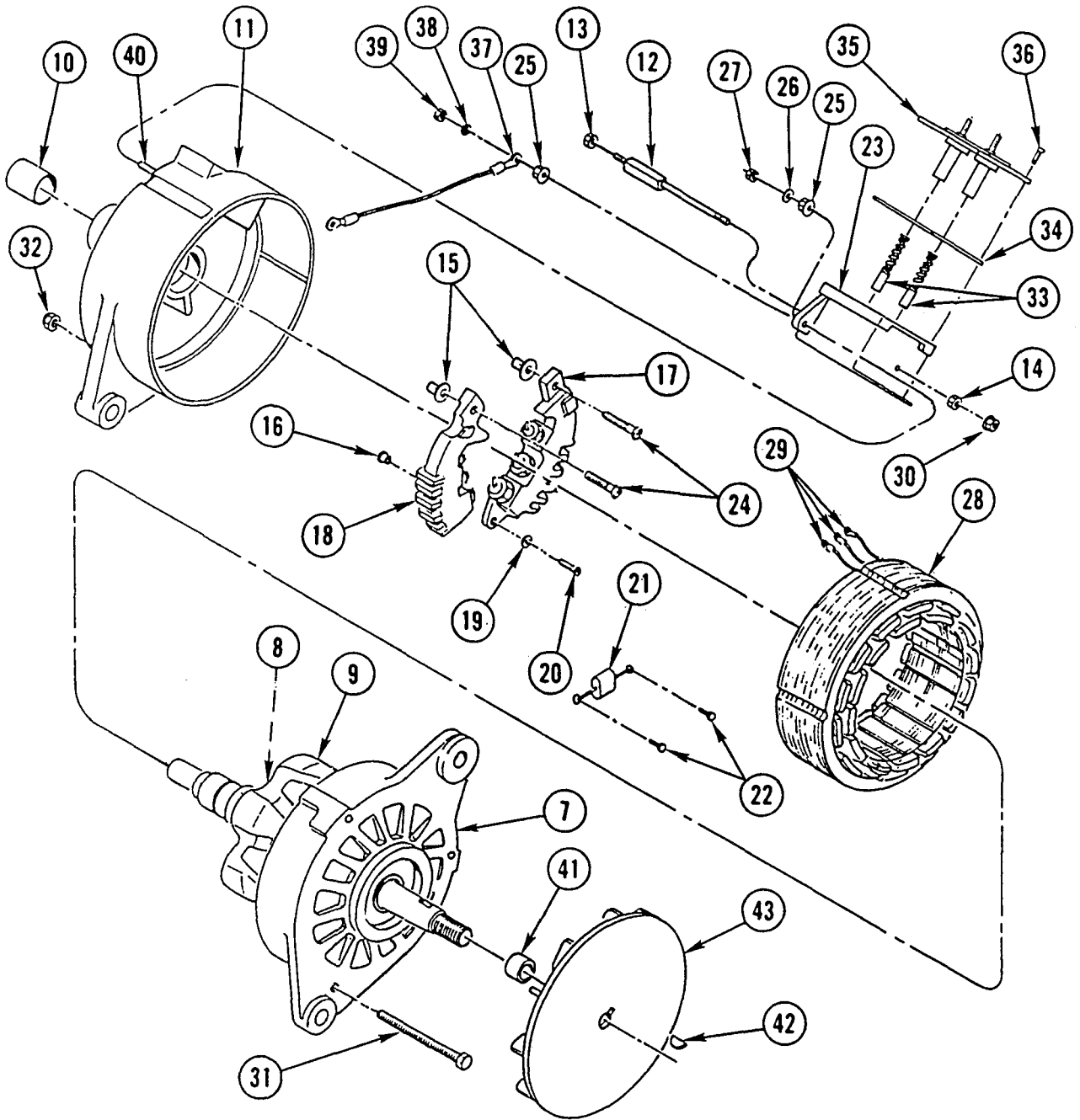
1. IF REMOVED, INSTALL NEW SLIDABLE BUSHING (1)
2. APPLY LIGHT COATING OF SEALING COMPOUND TO ROTOR SHAFT (2) WHERE SLIP RING ASSEMBLY (3) WILL BE INSTALLED.

**NOTE**

Make sure leads on slip ring assembly are in line with solder terminals on rotor.

3. CAREFULLY INSTALL SLIP RING ASSEMBLY (3) ON ROTOR SHAFT (2) UNTIL END OF SLIP RING ASSEMBLY (3) IS 0.375 IN. (9.5 mm) FROM RAISED PORTION OF ROTOR SHAFT (2).
4. INSTALL NEW BEARING (4).
5. INSTALL BEARING RETAINER (5) AND FOUR SCREWS (6).
6. CAREFULLY INSTALL ROTOR SHAFT (2) IN ROTOR AND DRIVE END HOUSING (7).
7. MOUNT ROTOR AND DRIVE END HOUSING (7) IN SOFT-JAWED VISE AND, USING DIAL INDICATOR GAGE WITH MAGNETIC BASE, CHECK RUNOUT OF SLIP RING ASSEMBLY (3). MAXIMUM ALLOWABLE RUNOUT IS 0.002 IN. (0.05 mm).
8. IF RUNOUT IS EXCESSIVE, MOUNT ASSEMBLY ON LATHE. USING ABRASIVE PAPER, DRESS SLIP RING ASSEMBLY (3).
9. REPEAT STEPS 7 AND 8 UNTIL PROPER RUNOUT IS ACHIEVED.

## ALTERNATOR REPAIR (CONT)



10. SOLDER TWO LEADS (8) TO TERMINALS LOCATED ON ROTOR (9).

11. INSTALL BEARING (10) IN SLIP RING END HOUSING (11).
12. INSTALL THREE TERMINAL STUDS (12), THREE NEW TENZ NUTS (13), AND THREE NUTS (14).
13. INSTALL TWO INSULATING BUSHINGS (15) IN SLIP RING END HOUSING (11).
14. INSTALL TWO INSULATING BUSHINGS (16) IN NEGATIVE RECTIFIER (17) AND POSITIVE RECTIFIER (18).
15. INSTALL NEGATIVE RECTIFIER (17), POSITIVE RECTIFIER (18), TWO INSULATING WASHERS (19), AND TWO SCREWS (20).
16. INSTALL CAPACITOR (21) AND TWO SCREWS (22).
17. INSTALL BRUSH HOUSING (23), TWO TERMINAL STUDS (24), TWO NEW TENZ NUTS (25), WASHER (26), AND NUT (27).
18. INSTALL STATOR (28) IN SLIP RING END HOUSING (11).
19. CONNECT THREE LEADS (29) AND INSTALL THREE NUTS (30).
20. INSTALL ROTOR AND DRIVE END HOUSING (7) IN STATOR (28) AND SLIP RING END HOUSING (11).
21. INSTALL THREE SCREWS (31) AND THREE NEW LOCK NUTS (32).
22. INSTALL TWO BRUSHES (33).
23. INSTALL NEW GASKET (34), COVER (35), AND FOUR SCREWS (36).
24. INSTALL LEAD (37), NEW LOCK WASHER (38), AND NUT (39) TO F+ TERMINAL (40)
25. INSTALL SPACER (41), WOODRUFF KEY (42), AND FAN (43).

## Section II. STARTER REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the starter.

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## STARTER REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Washer, Lock (10)	P/N 2523
Washer, Lock (4)	P/N 2434
Seal	P/N 97799
Packing (2)	P/N 71040
Packing	P/N 71038
Packing	P/N 71041
Packing (3)	P/N 95777
Adhesive-Sealant	Appendix B, Item 3

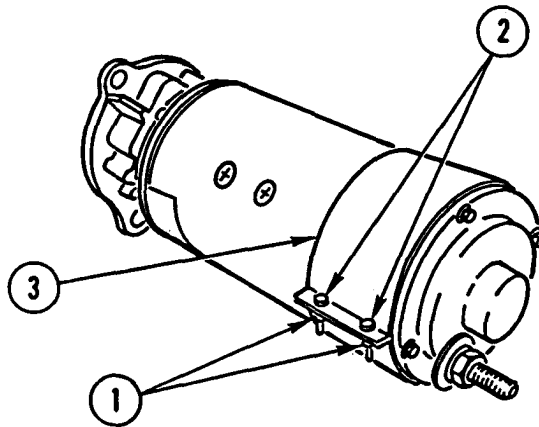
#### References:

TM 9-2320-363-20

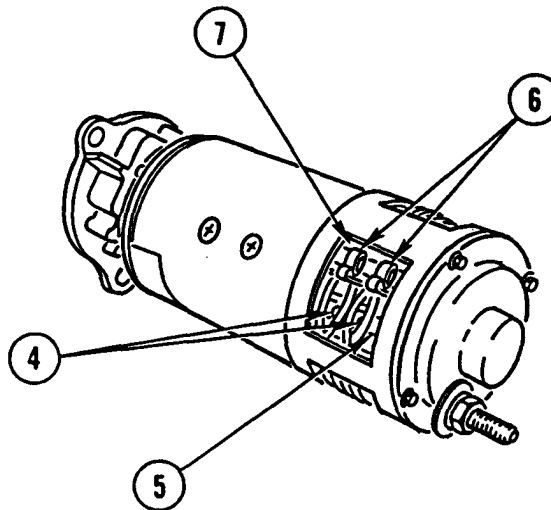
#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Starter Removed
Page 4-48	Starter Solenoid Removed

**DISASSEMBLY**



1. REMOVE TWO NUTS (1), TWO SCREWS (2), AND BRUSH OPENING BAND (3).

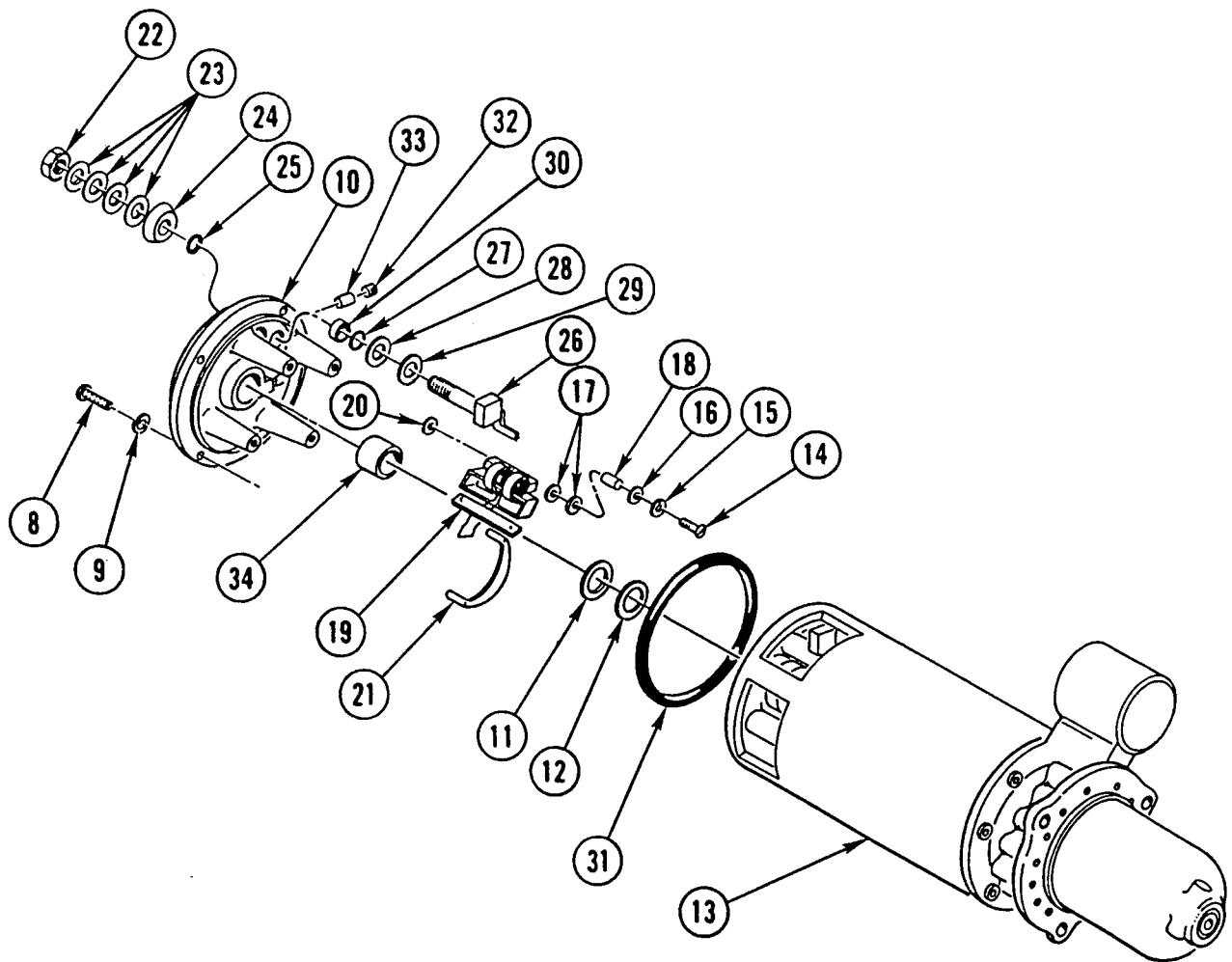


**CAUTION**

Do not pull brush leads until spring tension is relieved to prevent damage to equipment.

2. REMOVE EIGHT SCREWS (4) AND FOUR LOCK PLATES (5). PULL TWO SPRINGS (6) UPWARD AND REMOVE EIGHT BRUSHES (7).

## STARTER REPAIR (CONT)



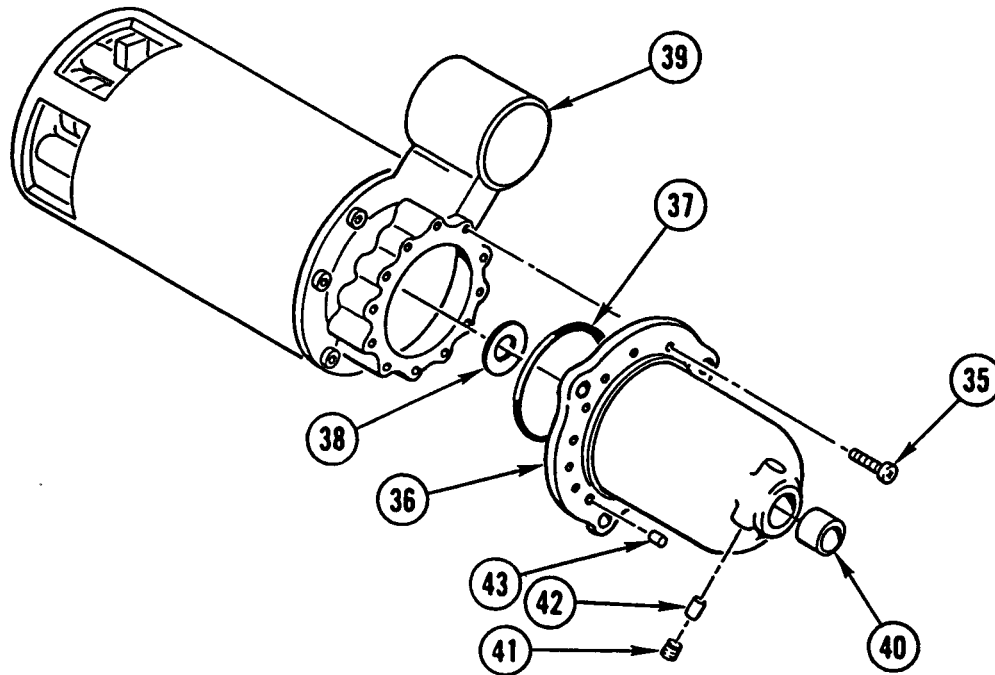
### NOTE

Mark commutator housing and field ring prior to removing commutator housing to aid in installation.

3. REMOVE FOUR SCREWS (8), FOUR LOCK WASHERS (9), COMMUTATOR HOUSING (10), INSULATION WASHER (11), AND WASHER (12) FROM FIELD RING (13). DISCARD LOCK WASHERS.
4. REMOVE FOUR SCREWS (14), FOUR LOCK WASHERS (15), FOUR WASHERS (16), EIGHT INSULATION WASHERS (17), AND FOUR INSULATION BUSHINGS (18). DISCARD LOCK WASHERS.
5. REMOVE FOUR BRUSH HOLDERS (19), FOUR INSULATION WASHERS (20), AND GROUND JUMPER (21) FROM COMMUTATOR HOUSING (10).



6. REMOVE NUT (22), FOUR WASHERS (23), INSULATOR (24) AND PACKING (25) FROM GROUND STUD (26). DISCARD PACKING.
7. REMOVE GROUND STUD (26) FROM COMMUTATOR HOUSING (10).
8. REMOVE PACKING (27), INSULATION WASHER (28), AND WASHER (29) FROM GROUND STUD (26). DISCARD PACKING.
9. IF DAMAGED, REMOVE BUSHING (30) FROM COMMUTATOR HOUSING (10).
10. REMOVE PACKING (31), PIPE PLUG (32), AND FELT WICK (33) FROM COMMUTATOR HOUSING (10). DISCARD PACKING.
11. IF DAMAGED, REMOVE BUSHING (34) FROM COMMUTATOR HOUSING (10),



**NOTE**

Mark nose housing and shift housing prior to removing nose housing to aid in installation.

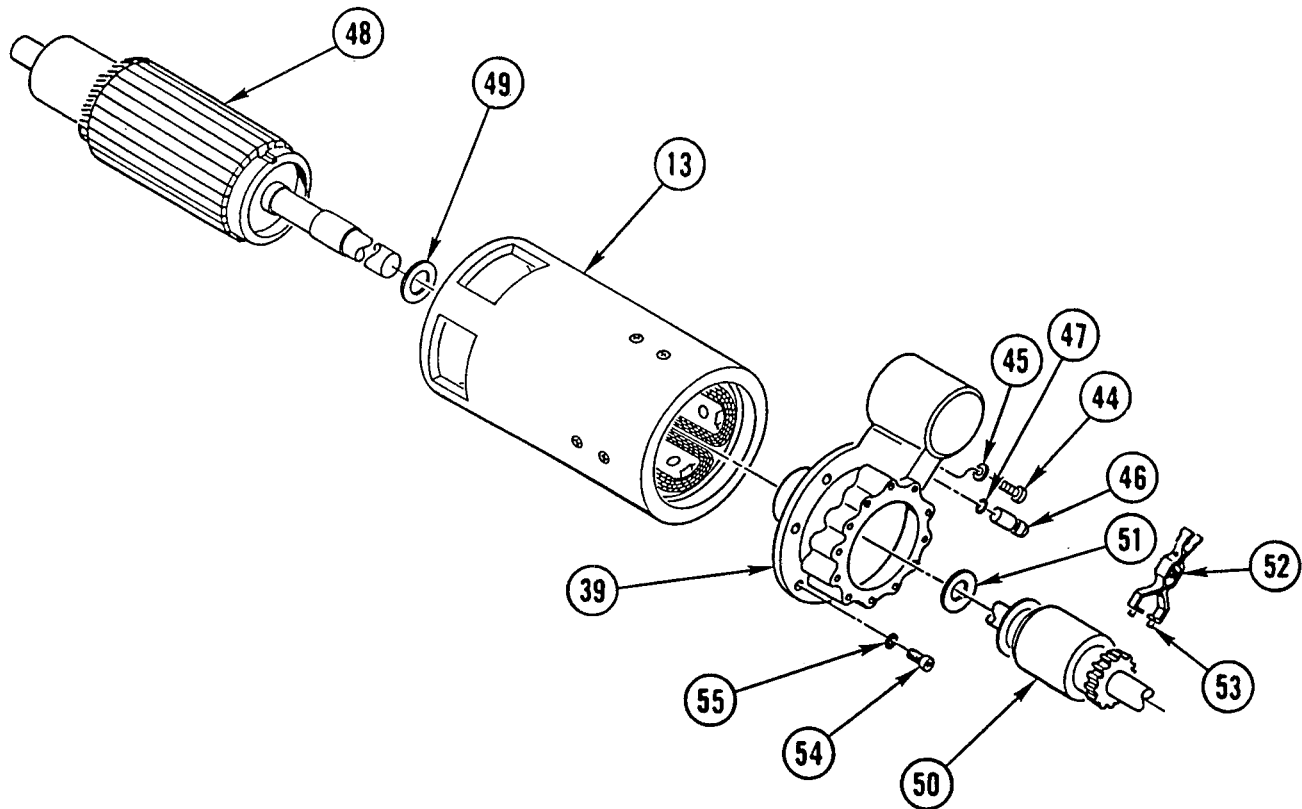
12. REMOVE SIX SCREWS (35), NOSE HOUSING (36), PACKING (37), AND WASHER (38) FROM SHIFT HOUSING (39).

**NOTE**

Perform step 13 only if components are damaged.

13. REMOVE BUSHING (40), PLUG (41), FELT WICK (42), AND SIX PLUGS (43) FROM NOSE HOUSING (36).

## STARTER REPAIR (CONT)

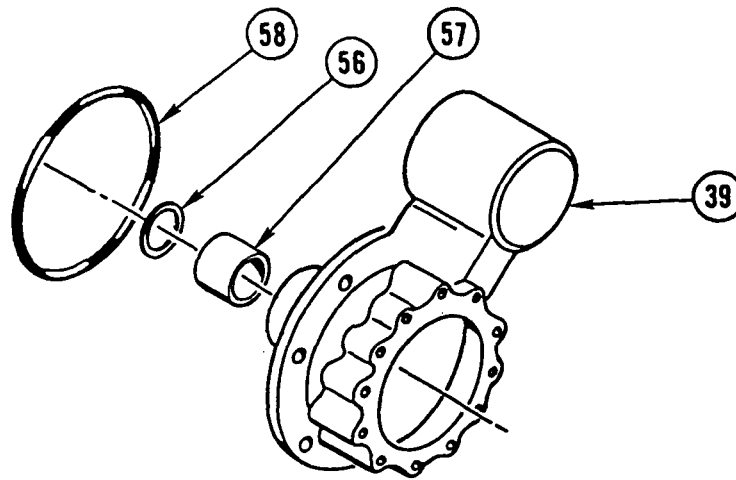


14. REMOVE SCREW (44), WASHER (45), SHAFT (46), AND PACKING (47) FROM SHIFT HOUSING (39). DISCARD PACKING.
15. REMOVE ARMATURE (48), WASHER (49), DRIVE ASSEMBLY (50), INSULATOR (51), SHIFT LEVER (52), AND TWO CAMS (53).

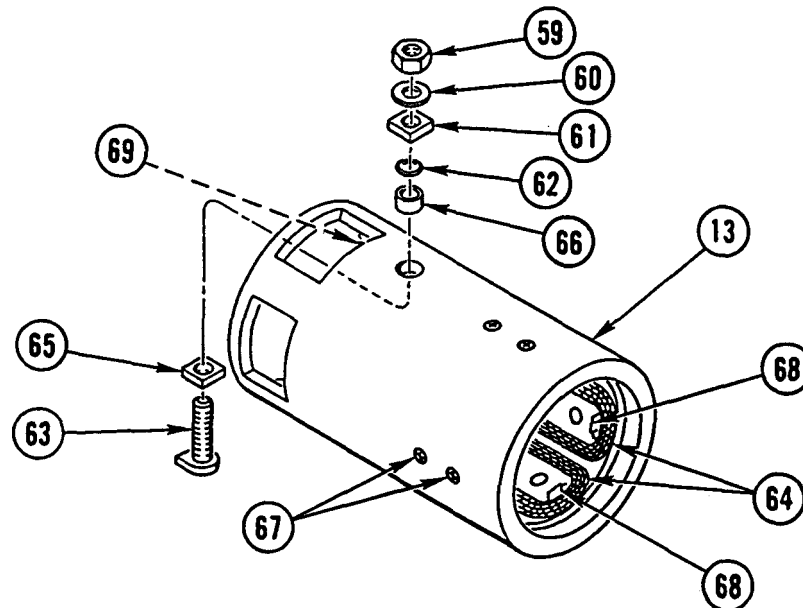
### NOTE

Mark shift housing and field ring prior to removing shift housing to aid in installation.

16. REMOVE FIVE SCREWS (54), FIVE LOCK WASHERS (55), AND SHIFT HOUSING (39) FROM FIELD RING (13). DISCARD LOCK WASHERS.



17. REMOVE SEAL (56), BUSHING (57), AND PACKING (58) FROM SHIFT HOUSING (39). DISCARD SEAL AND PACKING.



18. REMOVE NUT (59), WASHER (60), INSULATOR (61), AND PACKING (62) FROM FIELD RING (13). DISCARD PACKING.

**CAUTION**

When removing stud terminal, do not use hammer to tap stud out. To do so could cause damage to components.

19. TO REMOVE STUD TERMINAL (63), TEMPORARILY REPLACE NUT (59) FLUSH WITH END OF STUD. USING SUITABLE PLIERS, WORK STUD OUT WHILE SUPPORTING FIELD COIL (64).
20. REMOVE INSULATOR (65) AND BUSHING (66) FROM FIELD RING (13).
21. REMOVE EIGHT SCREWS (67), FOUR POLE PIECES (68), FIELD COIL (64), AND INSULATOR (69) FROM FIELD RING (13).

## STARTER REPAIR (CONT)

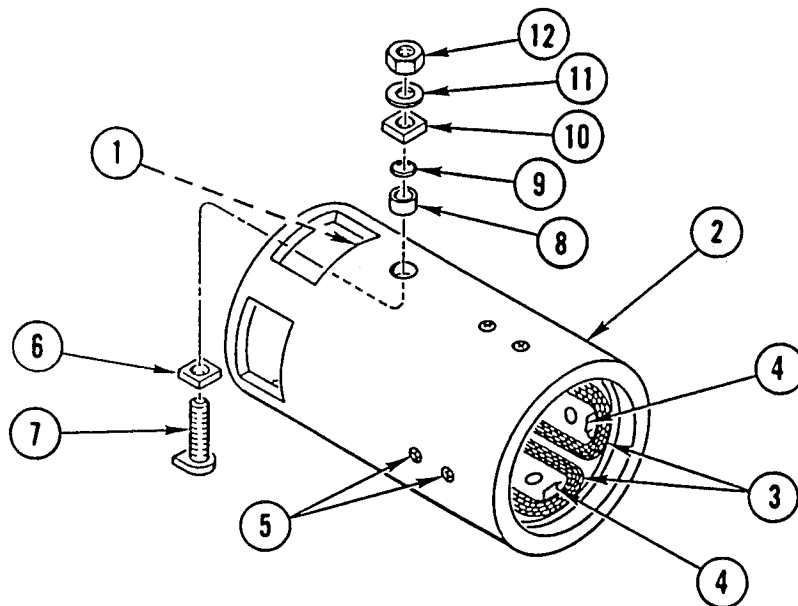
### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.

### ASSEMBLY



1. INSTALL INSULATOR (1) IN FIELD RING (2).
2. INSTALL FIELD COIL (3) IN FIELD RING (2) SO THAT TERMINAL STUD HOLES IN FIELD COIL (3) AND FIELD RING (2) LINE UP.

#### CAUTION

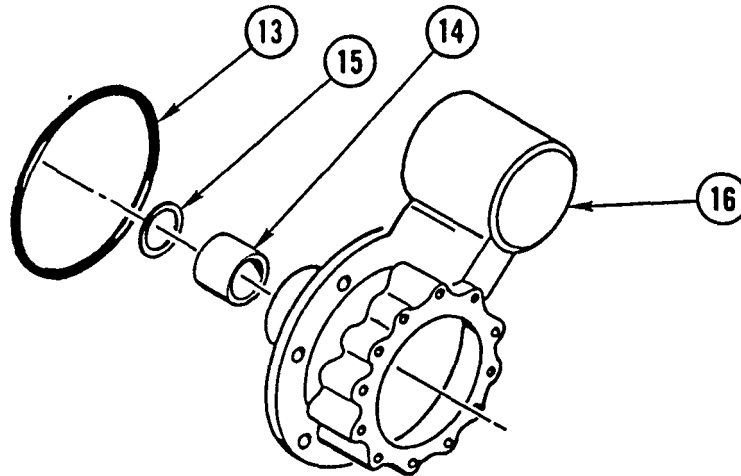
Pole pieces must be installed so that slot clears field coil contact tab. Failure to do so will cause damage to starter motor.

3. INSTALL FOUR POLE PIECES (4) AND EIGHT SCREWS (5).

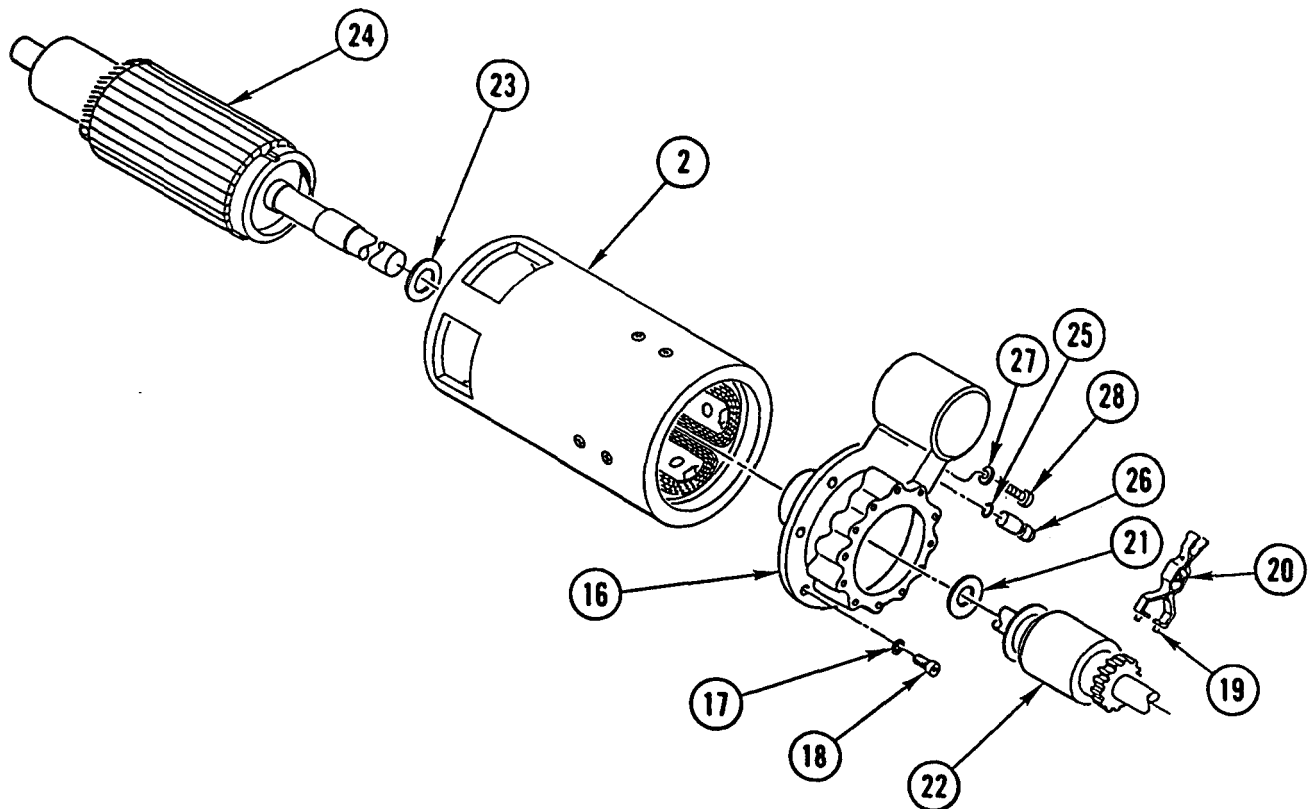
#### CAUTION

Insulator must be installed between field coil and field ring. Failure to do so will cause a short, damaging starter motor.

4. INSTALL INSULATOR (6) AND STUD TERMINAL (7) THRU FIELD COIL (3) AND FIELD RING (2).
5. INSTALL BUSHING (8), NEW PACKING (9), INSULATOR (10), WASHER (11), AND NUT (12) ON STUD TERMINAL (7).

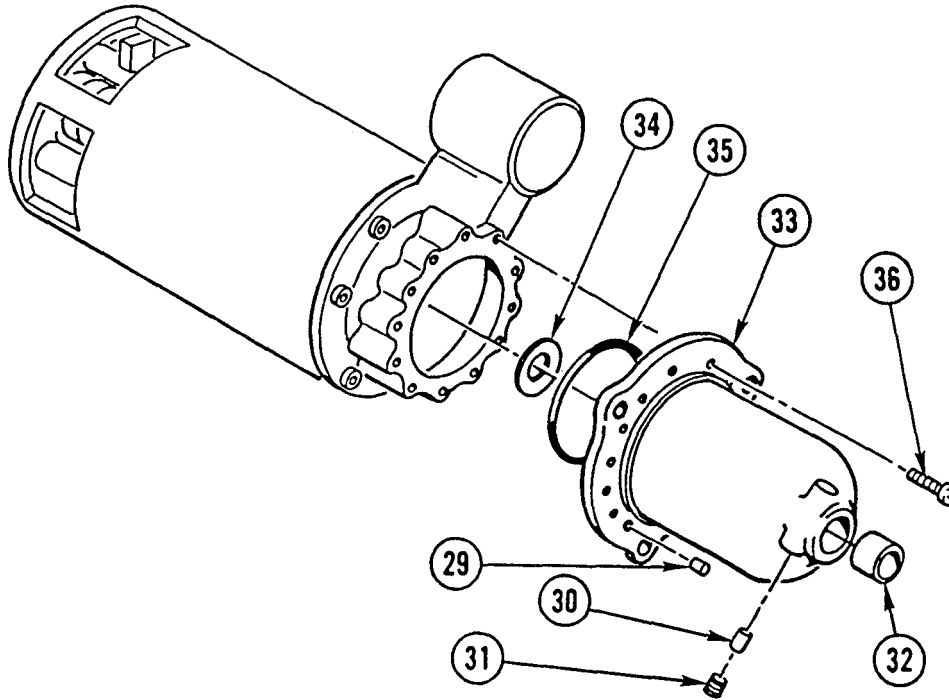


6. INSTALL NEW PACKING (13), BUSHING (14), AND NEW SEAL (15) IN SHIFT HOUSING (16).



7. INSTALL SHIFT HOUSING (16), FIVE NEW LOCK WASHERS (17), AND FIVE SCREWS (18) ON FIELD RING (2).
8. INSTALL TWO CAMS (19), SHIFT LEVER (20), INSULATOR (21), DRIVE ASSEMBLY (22), WASHER (23), AND ARMATURE (24).
9. INSTALL NEW PACKING (25), SHAFT (26), WASHER (27), AND SCREW (28) IN SHIFT HOUSING (16).

## STARTER REPAIR (CONT)

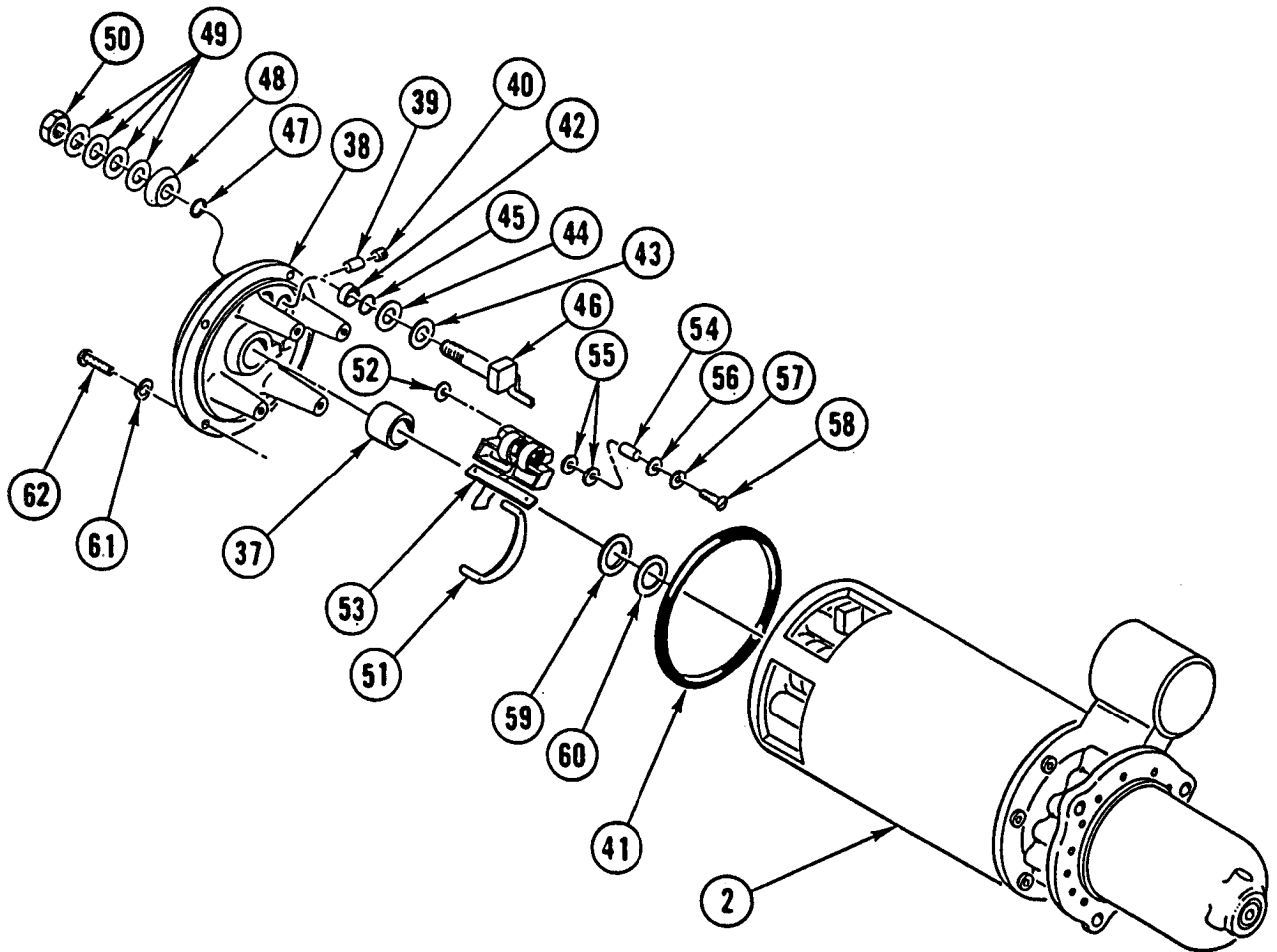


10. IF REMOVED, INSTALL SIX NEW PLUGS (29), NEW FELT WICK (30), NEW PLUG (31), AND NEW BUSHING (32) IN NOSE HOUSING (33).

### NOTE

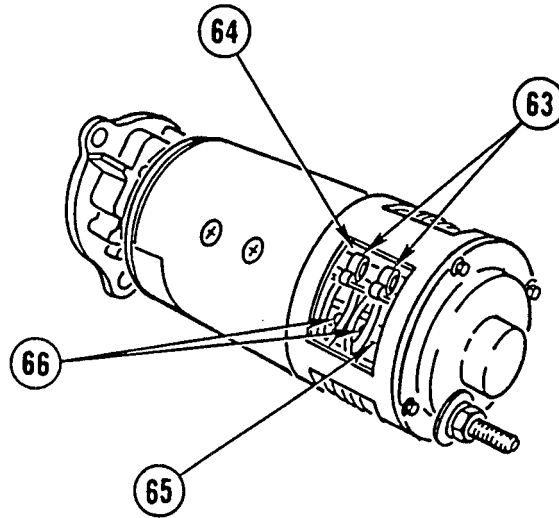
Install nose housing as noted in Disassembly step 12.

11. INSTALL WASHER (34), PACKING (35), NOSE HOUSING (33), AND SIX SCREWS (36).

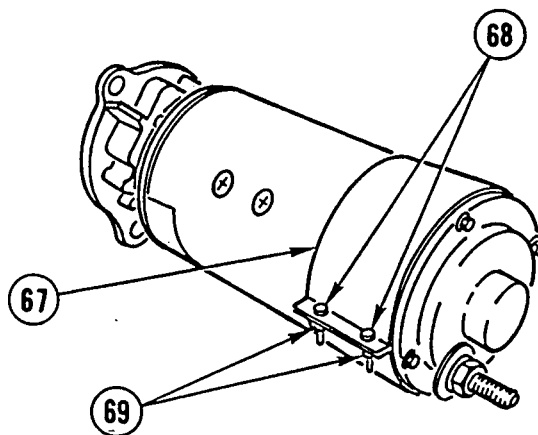


12. IF REMOVED, INSTALL NEW BUSHING (37) IN COMMUTATOR HOUSING (38).
13. INSTALL FELT WICK (39), PIPE PLUG (40), AND NEW PACKING (41) IN COMMUTATOR HOUSING (38).
14. IF REMOVED, INSTALL NEW BUSHING (42) IN COMMUTATOR HOUSING (38).
15. INSTALL WASHER (43), INSULATION WASHER (44), AND NEW PACKING (45) ON GROUND STUD (46).
16. INSTALL GROUND STUD (46) IN COMMUTATOR HOUSING (38).
17. INSTALL NEW PACKING (47), INSULATOR (48), FOUR WASHERS (49), AND NUT (50) ON GROUND STUD (46).
18. INSTALL GROUND JUMPER (51), FOUR INSULATION WASHERS (52), AND FOUR BRUSH HOLDERS (53) IN COMMUTATOR HOUSING (38).
19. INSTALL FOUR INSULATION BUSHINGS (54), EIGHT INSULATION WASHERS (55), FOUR WASHERS (56), FOUR NEW LOCK WASHERS (57), AND FOUR SCREWS (58).
20. INSTALL INSULATION WASHER (59), WASHER (60), AND COMMUTATOR HOUSING (38) IN FIELD RING (2).
21. APPLY ADHESIVE-SEALANT TO THREADS AND INSTALL FOUR NEW LOCK WASHERS (61) AND FOUR SCREWS (62).

## STARTER REPAIR (CONT)



22. PULL TWO SPRINGS (63) UPWARD AND INSTALL BRUSH (64), LOCK PLATE (65), AND TWO SCREWS (66).
23. REPEAT STEP 22 FOR REMAINING BRUSHES.



24. INSTALL BRUSH OPENING BAND (67), TWO SCREWS (66), AND TWO NUTS (69).

### NOTE

Follow-on Maintenance:  
Install starter solenoid (page 4-48).



## CHAPTER 14 TRANSMISSION REPAIR INSTRUCTIONS

This chapter illustrates and describes procedures for maintenance of the transmission and related parts.

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## Section I. TRANSMISSION INSTALLATION/REMOVAL FROM TRANSMISSION STAND

### OVERVIEW

This section illustrates and describes procedures for installation and removal of the transmission on/from the transmission stand.

---

## TRANSMISSION INSTALLATION/REMOVAL FROM TRANSMISSION STAND

---

This task covers: a. Installation b. Removal

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05  
Transmission Holding Fixture, J24310  
Eye Hook (3), 3062

#### Personnel Required: (2)

#### Equipment Condition:

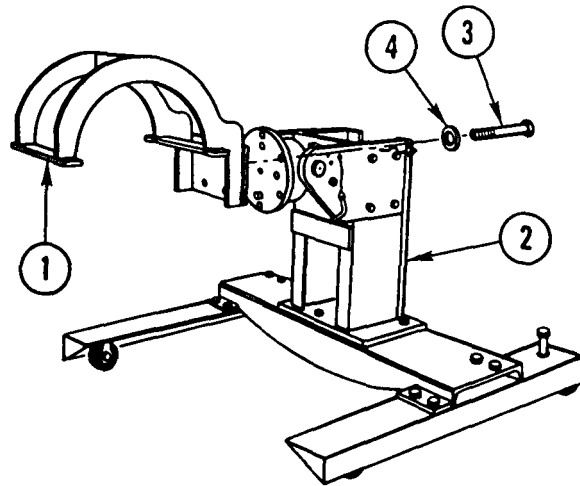
Reference	Condition Description
	Transmission Removed from Container

#### General Safety Instructions:

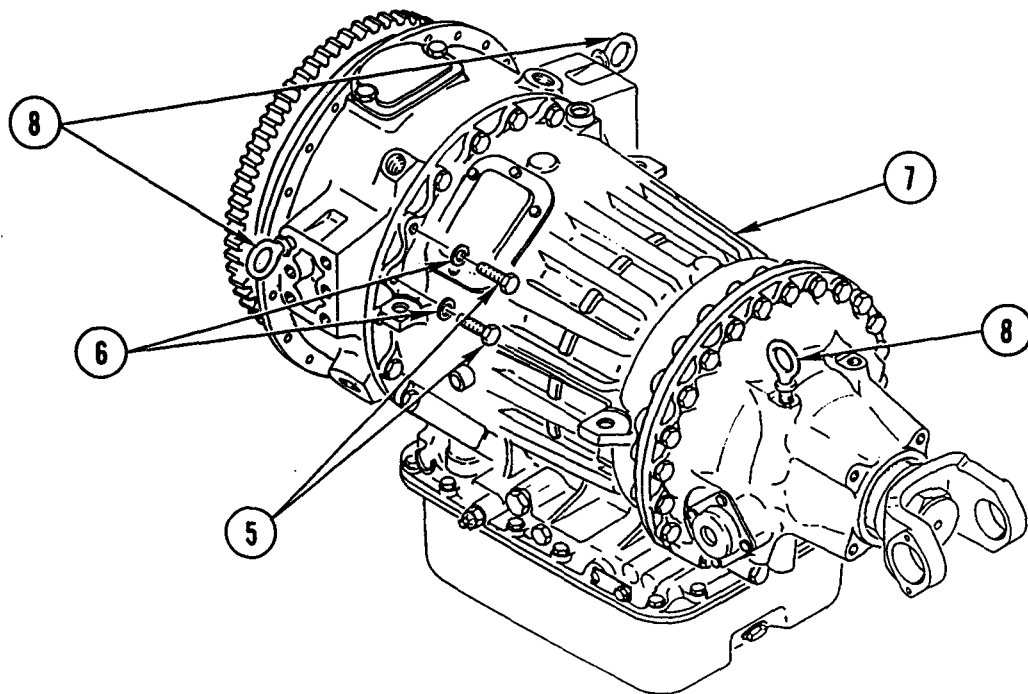
### WARNING

Transmission weighs 900 lb (409 kg). Support transmission with transmission jack during removal or installation to prevent possible injury to personnel.

**INSTALLATION**



1. INSTALL TRANSMISSION HOLDING FIXTURE (1) ON TRANSMISSION STAND (2) WITH FOUR SCREWS (3) AND FOUR WASHERS (4).

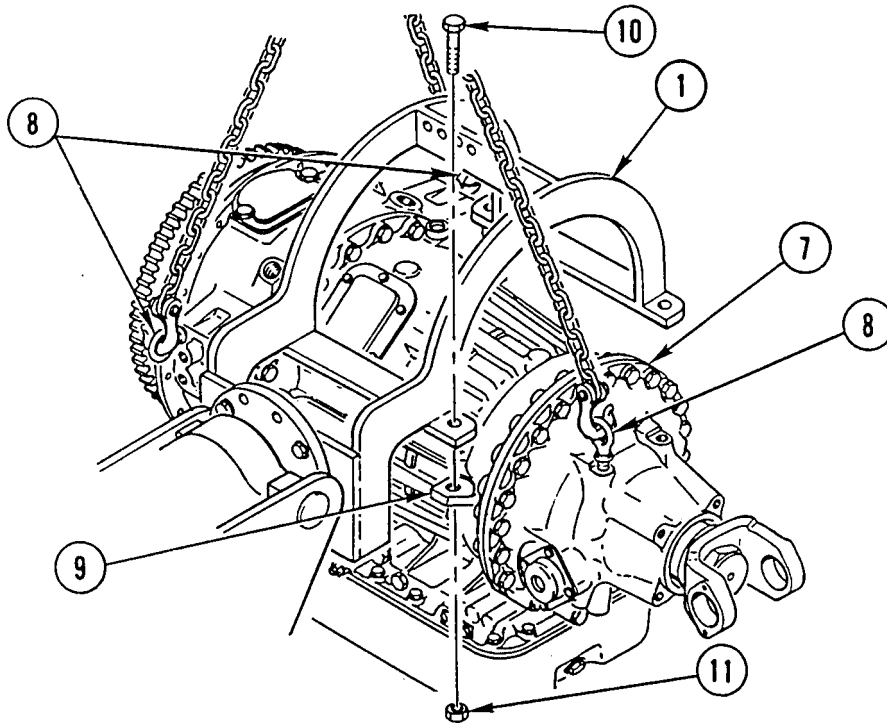


2. REMOVE FOUR SCREWS (5) AND FOUR LOCK WASHERS (6) FROM TRANSMISSION (7),
3. INSTALL THREE EYE HOOKS (8) ON TRANSMISSION (7).

---

## TRANSMISSION INSTALLATION/REMOVAL FROM TRANSMISSION STAND (CONT)

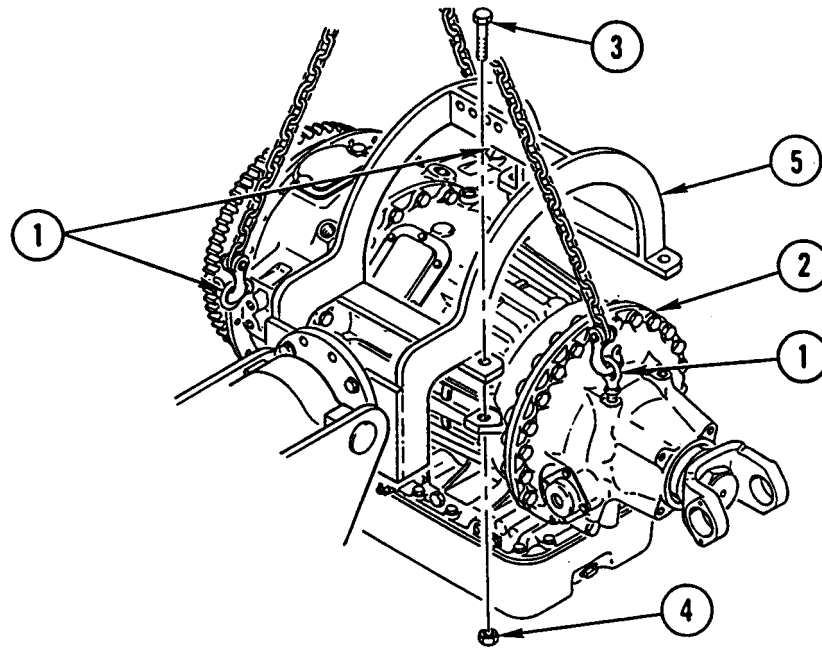
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**WARNING**

Transmission weighs 900 lb (409 kg). Support transmission with transmission jack during installation to prevent possible injury to personnel.

4. INSTALL LIFTNG DEVICE TO THREE EYE HOOKS (8) AND LIFT TRANSMISSION (7).
5. PLACE TRANSMISSION HOLDING FIXTURE (1) OVER TRANSMISSION (7) AND INSTALL TRANSMISSION HOLDING FIXTURE (1) ON FOUR TRANSMISSION MOUNTING SURFACES (9) WITH FOUR SCREWS (10) AND FOUR LOCK NUTS (11).
6. REMOVE LIFTING DEVICE FROM TRANSMISSION (7).
7. REMOVE THREE EYE HOOKS (8).

**REMOVAL**

1. INSTALL THREE EYE HOOKS (1) ON TRANSMISSION (2).
2. INSTALL LIFTING DEVICE TO THREE EYE HOOKS (1) ON TRANSMISSION (2).

**WARNING**

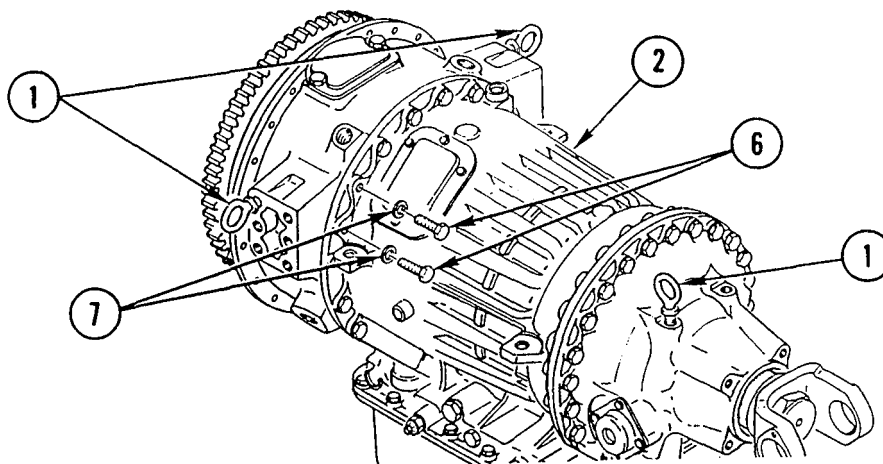
Transmission weighs 900 lb (409 kg). Support transmission with transmission jack during removal to prevent possible injury to personnel.

3. REMOVE FOUR SCREWS (3) AND FOUR LOCK NUTS (4) FROM TRANSMISSION (2).
4. REMOVE TRANSMISSION (2) FROM TRANSMISSION HOLDING FIXTURE (5).
5. REMOVE LIFTING DEVICE FROM THREE EYE HOOKS (1).

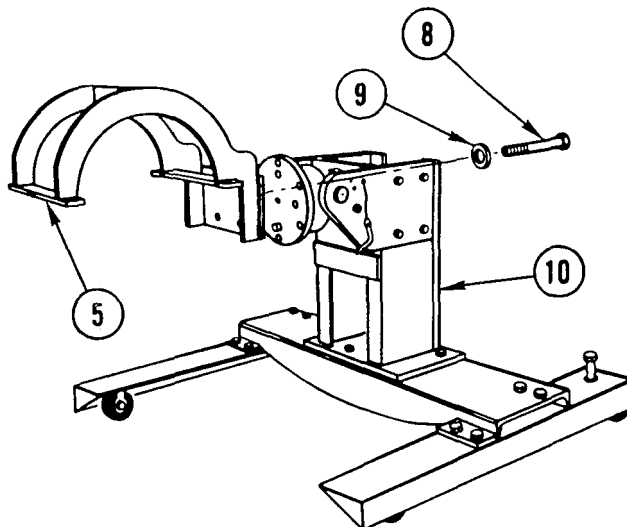
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## TRANSMISSION INSTALLATION/REMOVAL FROM TRANSMISSION STAND (CONT)

---



6. REMOVE THREE EYE HOOKS (1) FROM TRANSMISSION (2).
7. INSTALL FOUR SCREWS (6) AND FOUR LOCK WASHERS (7) ON TRANSMISSION (2). TIGHTEN SCREWS TO 67-80 LB-FT (91-108 N.m).



8. REMOVE FOUR SCREWS (8) AND FOUR WASHERS (9) AND REMOVE TRANSMISSION HOLDING FIXTURE (5) FROM TRANSMISSION STAND (10).

## Section II. FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the flywheel and turbine.

Replacement of the flywheel and turbine is direct support maintenance; repair is general support maintenance.

---

### FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly g. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Flywheel Lifting Bracket, J24365

#### Personnel Required: (2)

#### Equipment Condition:

#### Reference

Page 14-2

#### Condition Description

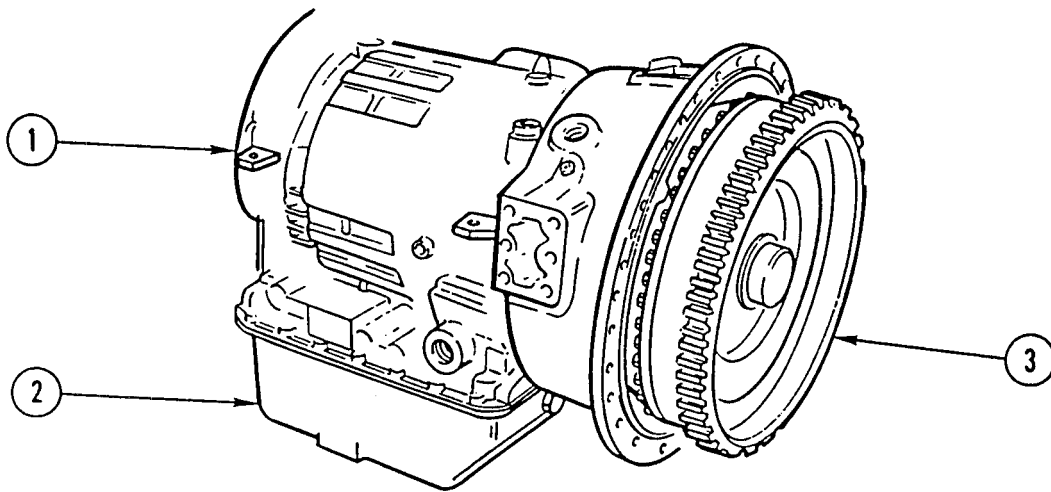
Transmission Installed on  
 Transmission Stand

#### Materials/Parts:

Gasket	P/N 6750186
Ring, Seal	P/N 6770492
Ring, Seal	P/N 6758740
Ring, Seal	P/N 6880389
Ring, Seal	P/N 23019653
Oil, Lubricating	Appendix B, Item 37
Towel, Shop	Appendix B, Item 62

## FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR (CONT)

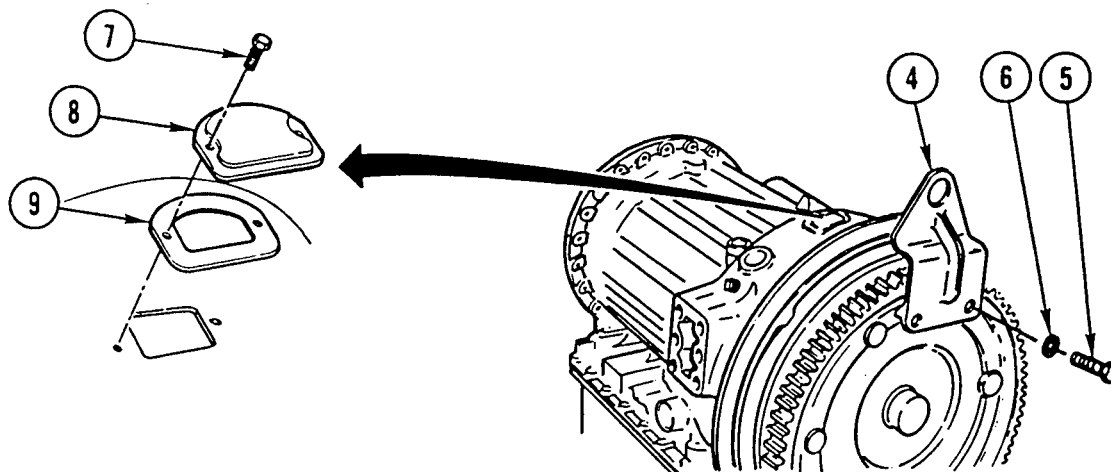
### REMOVAL



#### NOTE

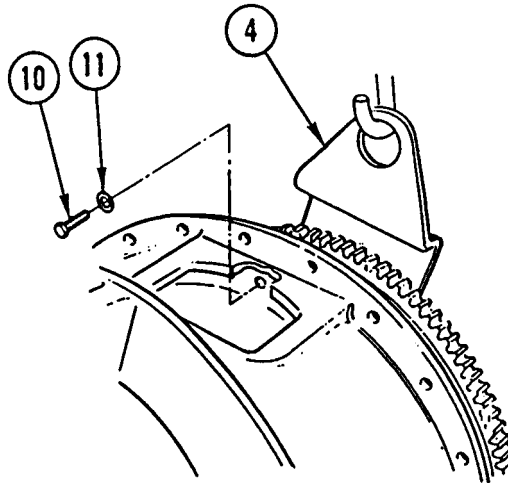
Transmission may require further draining.

1. POSITION TRANSMISSION (1) SO OIL PAN (2) IS AT BOTTOM.
2. SET DRAIN PAN UNDER FLYWHEEL (3) TO CATCH DRAINING OIL.



3. ALINE AND INSTALL LIFTING BRACKET (4) WITH TWO SCREWS (5) AND TWO WASHERS (6).
4. REMOVE TWO SCREWS (7) FROM ACCESS COVER (8).
5. REMOVE ACCESS COVER (8) AND GASKET (9). DISCARD GASKET.

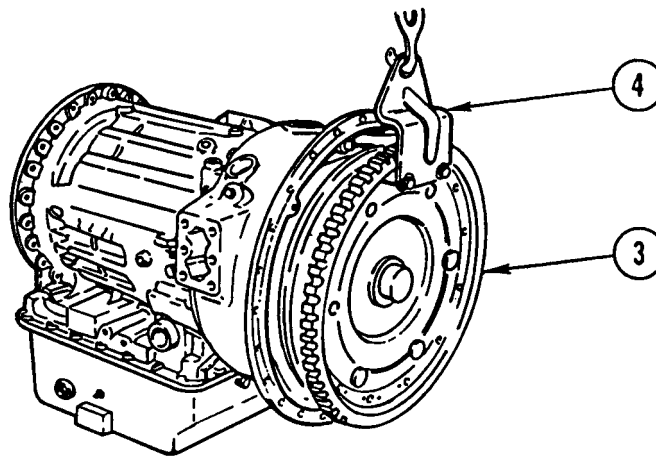




**NOTE**

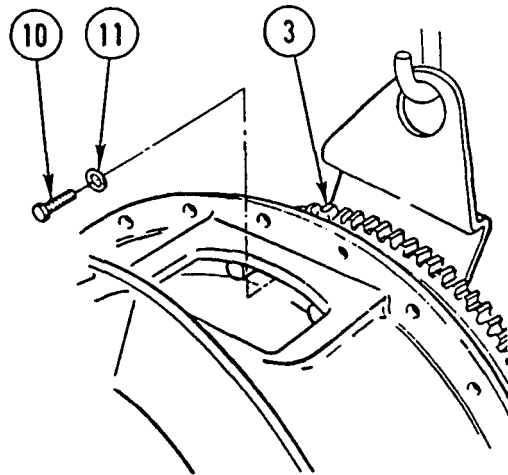
Use flywheel lifting bracket to turn flywheel for access to screws inside converter housing.

6. REMOVE 29 OF 30 SCREWS (10) AND 29 WASHERS (11) LEAVING 1 SCREW (10) AND 1 WASHER (11) IN PLACE BEHIND LIFTING BRACKET (4).

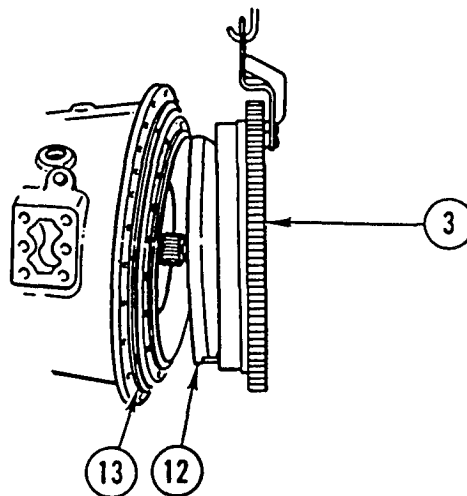


7. INSTALL LIFTING DEVICE TO LIFTING BRACKET (4).
8. RAISE LIFTING DEVICE UNTIL IT SUPPORTS WEIGHT OF FLYWHEEL (3).

## FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR (CONT)



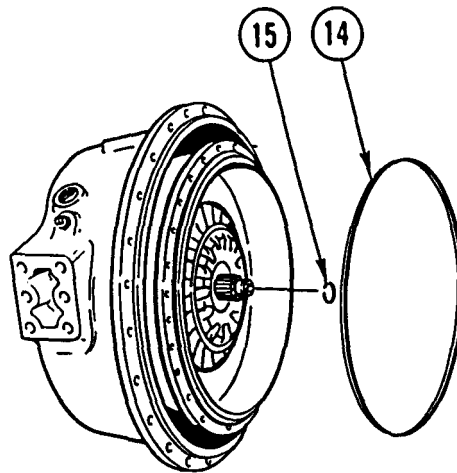
9. REMOVE ONE SCREW (10) AND ONE WASHER FROM FLYWHEEL(3).



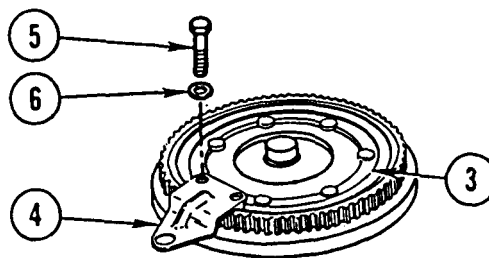
### **CAUTION**

When flywheel is removed from converter housing, torque converter turbine may come off with flywheel, stay with converter housing, or be in position to fall. Take care to prevent torque converter turbine from falling and being damaged.

10. REMOVE FLYWHEEL (3) WITH TORQUE CONVERTER TURBINE (12) FROM CONVERTER PUMP (13).
11. MOVE FLYWHEEL (3) WITH TORQUE CONVERTER TURBINE (12) TO WORK SURFACE AND REMOVE LIFTING DEVICE.

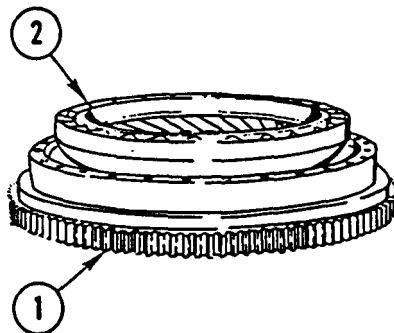


12. REMOVE AND DISCARD CONVERTER SEAL RING (14) AND TURBINE SHAFT SEAL RING (15).



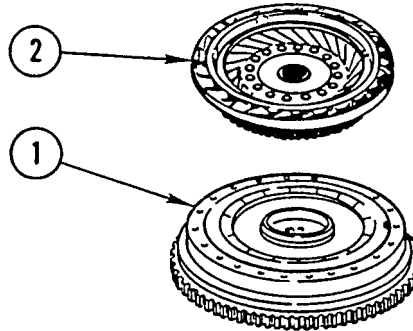
13. REMOVE TWO SCREWS (5) AND TWO WASHERS (6) AND REMOVE LIFTING BRACKET (4) FROM FLYWHEEL (3).

**DISASSEMBLY**



1. SET FLYWHEEL (1) ON WORK SURFACE WITH TORQUE CONVERTER TURBINE (2) UP.

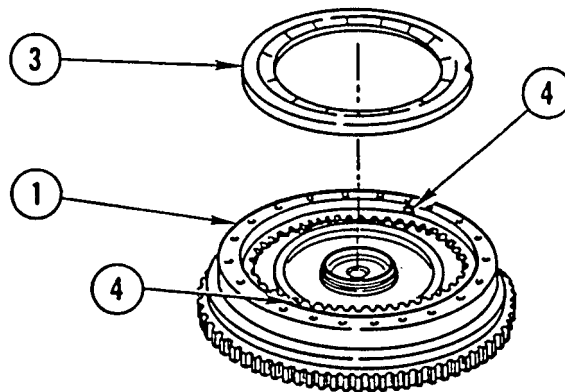
## FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR (CONT)



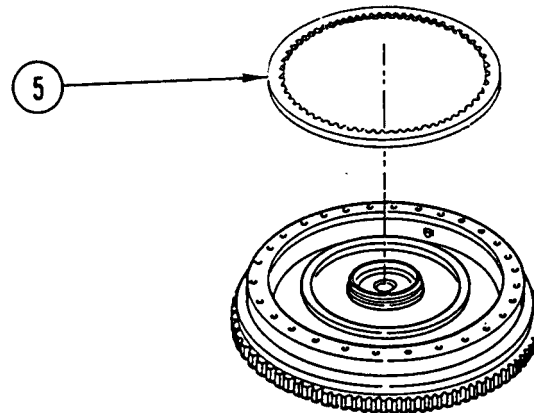
### **CAUTION**

Torque converter turbine must be evenly pried up and off flywheel. Use shop towels at two pry points to prevent scoring or other damage to torque converter turbine or flywheel.

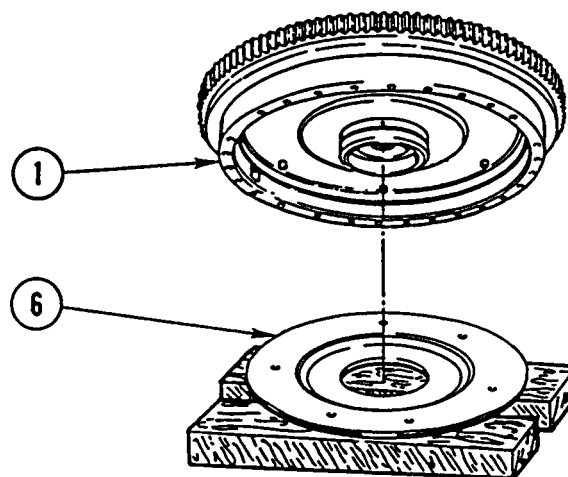
2. REMOVE TORQUE CONVERTER TURBINE (2) FROM FLYWHEEL (1).



3. REMOVE BACKPLATE (3) FROM FLYWHEEL (1).
4. REMOVE TWO KEYS (4).

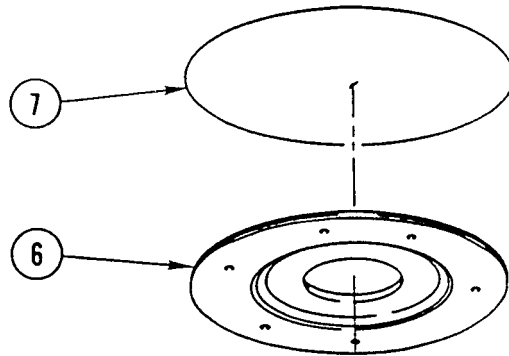


5. REMOVE LOCKUP CLUTCH PLATE (5).

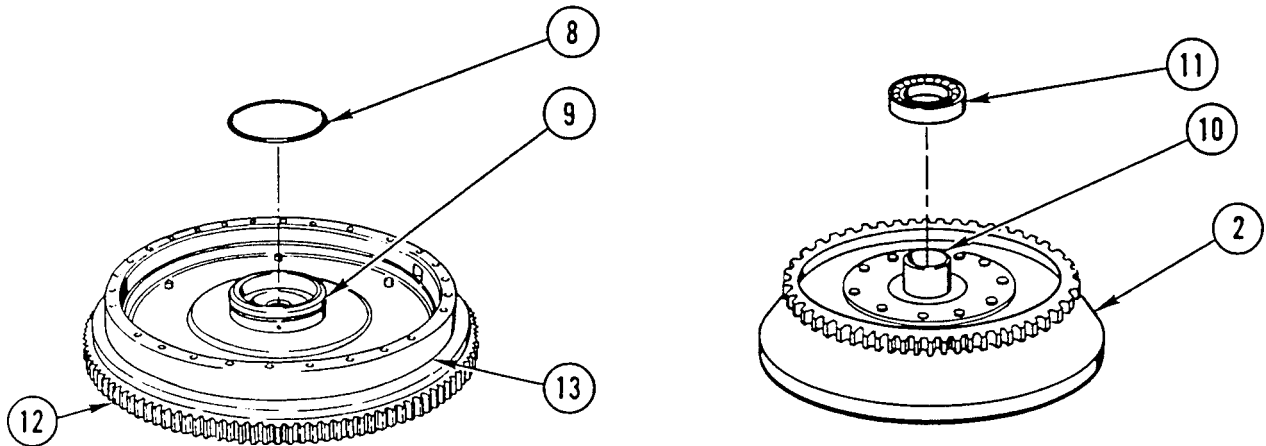


6. TURN FLYWHEEL (1) OVER AND SUPPORT ON WOODEN BLOCKS.
7. LIFT FLYWHEEL (1) 1 FT (30.5 cm) AND DROP FLYWHEEL TO FREE PISTON (6).
8. REMOVE PISTON (6).

## FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR (CONT)



9. REMOVE AND DISCARD SEAL RING (7) FROM OUTER GROOVE IN PISTON (6).

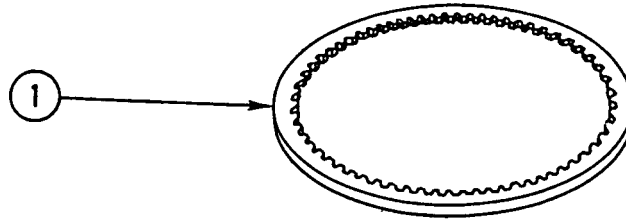


10. REMOVE AND DISCARD SEAL RING (8) FROM OUTER GROOVE IN HUB (9).
11. SET TORQUE CONVERTER TURBINE (2) ON WORK SURFACE WITH BEARING SHAFT (10) UP.
12. REMOVE BEARING (1) FROM BEARING SHAFT (10).
13. IF TEETH ON RING GEAR (12) ARE WORN OR CHIPPED, REMOVE RING GEAR (12) FROM FLYWHEEL (13).

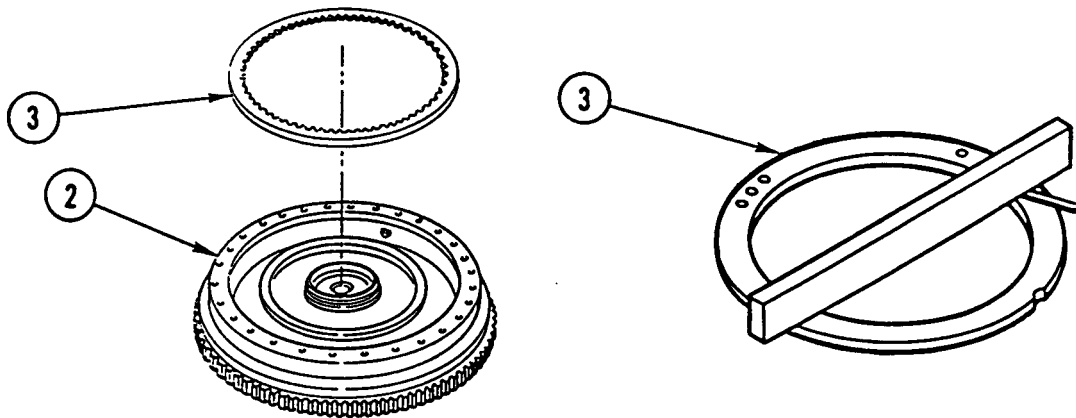
### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

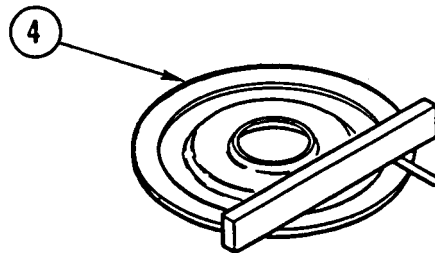
**INSPECTION**



1. MEASURE THICKNESS OF LOCKUP CLUTCH PLATE (1). REPLACE IF LESS THAN 0.19-IN. (4.8-mm) THICK.



2. IF INSIDE OF FLYWHEEL (2) IS GROOVED, REPLACE FLYWHEEL (2) AND BACKPLATE (3).
3. PLACE STRAIGHTEDGE ON BACKPLATE (3).
4. IF FEELER GAGE LARGER THAN 0.010 IN. (0.25 mm) WILL FIT UNDER STRAIGHTEDGE, REPLACE BACKPLATE (3).

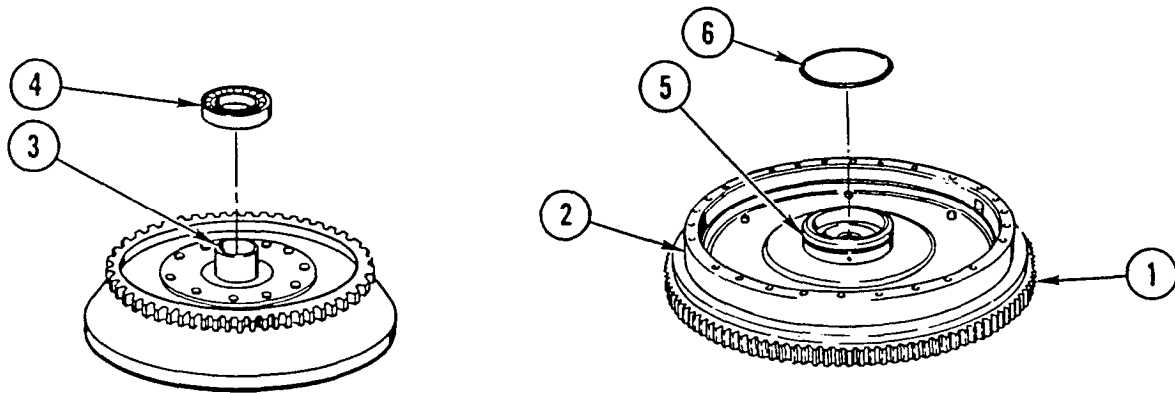


5. PLACE STRAIGHTEDGE ON PISTON (4).
- & IF FEELER GAGE LARGER THAN 0.010 IN. (0.25 mm) WILL FIT UNDER STRAIGHTEDGE, REPLACE PISTON (4).

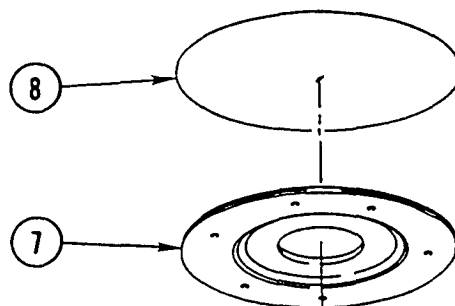
**REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

## FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR (CONT)

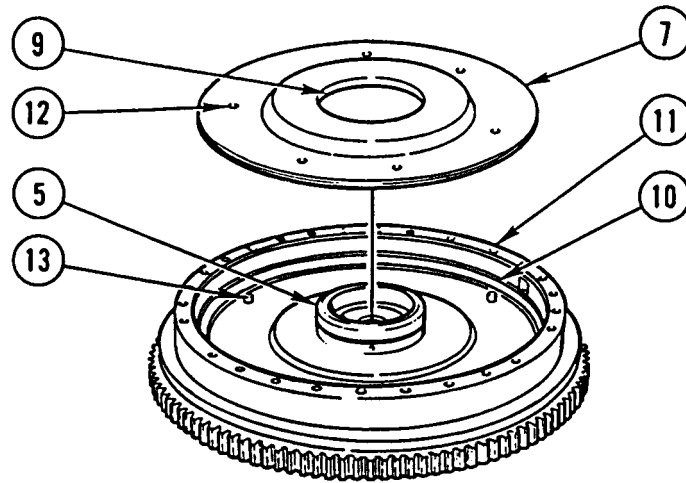


1. IF REMOVED, INSTALL NEW RING GEAR (1) ON FLYWHEEL (2).
2. COAT BEARING SHAFT (3) AND BEARING (4) WITH LUBRICATING OIL.
3. SEAT BEARING (4) ON BEARING SHAFT (3) WITH IDENTIFICATION NUMBER UP.
4. PRESS BEARING (4) ON BEARING SHAFT (3).
5. COAT OUTSIDE OF HUB (5) WITH LUBRICATING OIL.
6. APPLY LUBRICATING OIL TO NEW SEAL RING (6) AND INSTALL SEAL RING (6) IN OUTER GROOVE ON HUB (5).

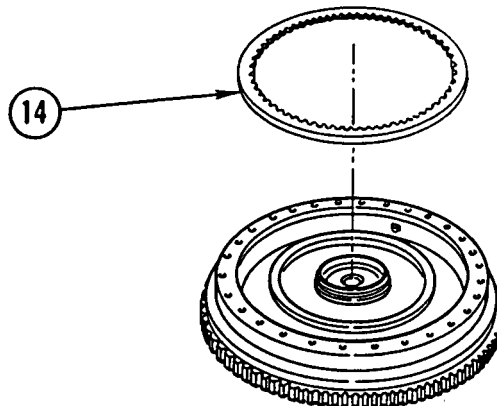


7. APPLY LUBRICATING OIL TO OUTER GROOVE OF PISTON (7).
8. APPLY LUBRICATING OIL TO NEW SEAL RING (8) AND INSTALL SEAL RING (8).



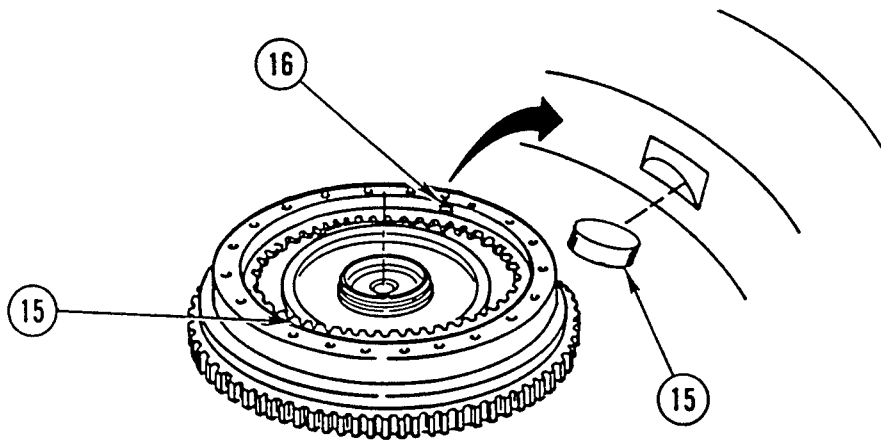


9. APPLY LUBRICATING OIL TO INNER HUB (9) OF PISTON (7) AND TO PISTON SEAL SURFACE (10) OF FLYWHEEL (11).
10. ALINE SIX HOLES (12) WITH SIX PINS (13).
11. INSTALL PISTON (7) ON HUB (5). MAKE SURE PISTON (7) IS FIRMLY SEATED ON SIX PINS (13).

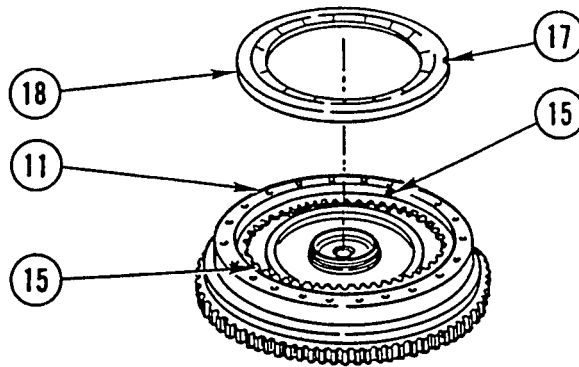


12. SOAK LOCKUP CLUTCH PLATE (14) IN LUBRICATING OIL FOR 3 MINUTES AND INSTALL LOCKUP CLUTCH PLATE (14).

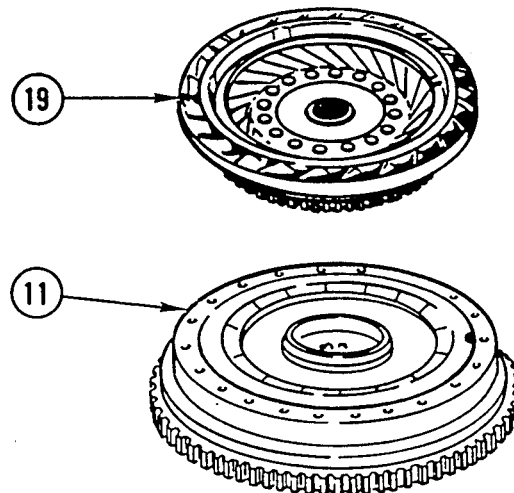
## FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR (CONT)



13. INSTALL TWO KEYS (15) IN TWO SLOTS (16).



14. ALINE TWO NOTCHES (17) WITH TWO KEYS (15) AND INSTALL BACKPLATE (18) IN FLYWHEEL (11).

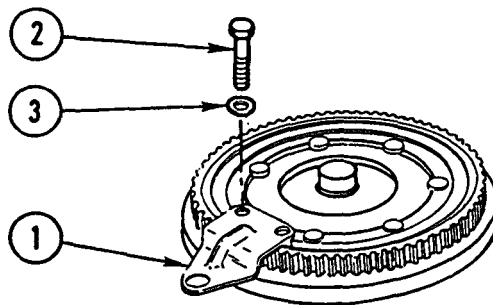


**NOTE**

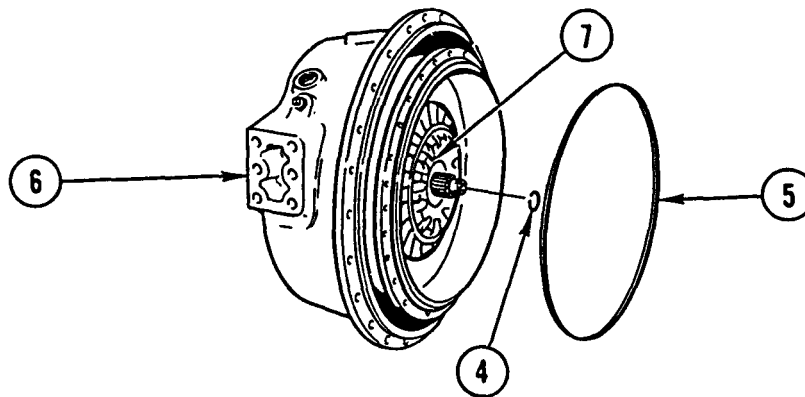
Gear on torque converter turbine must be lined up with teeth of lockup clutch plate before installing.

15. INSTALL TORQUE CONVERTER TURBINE (19) ON FLYWHEEL (11).

**INSTALLATION**

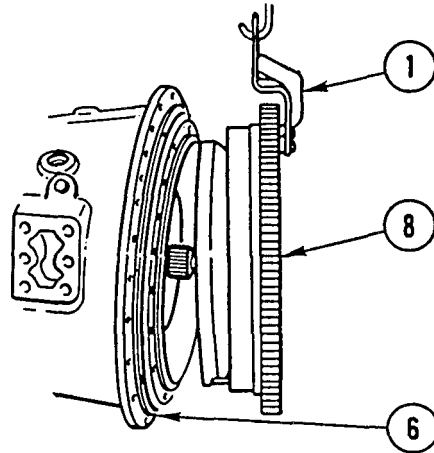


1. INSTALL LIFTING BRACKET (1) WITH TWO SCREWS (2) AND TWO WASHERS (3).

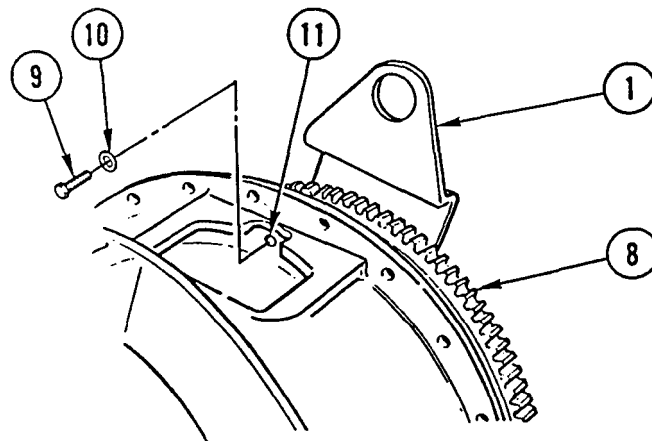


2. COAT NEW TURBINE SHAFT SEAL RING (4) AND NEW CONVERTER SEAL RING (5) WITH LUBRICATING OIL.
3. INSTALL TURBINE SHAFT SEAL RING (4) IN GROOVE AND SNAP ENDS TOGETHER.
4. INSTALL CONVERTER SEAL RING (5) ON TORQUE CONVERTER PUMP (6).
5. COAT TORQUE CONVERTER THRUST PADS (7) WITH LUBRICATING OIL.

## FLYWHEEL AND TURBINE REPLACEMENT AND REPAIR (CONT)



6. INSTALL LIFTING DEVICE ON LIFTING BRACKET(1).
7. ALINE AND INSTALL FLYWHEEL (8) SO FLYWHEEL FITS FLUSH AGAINST TORQUE CONVERTER PUMP (6).

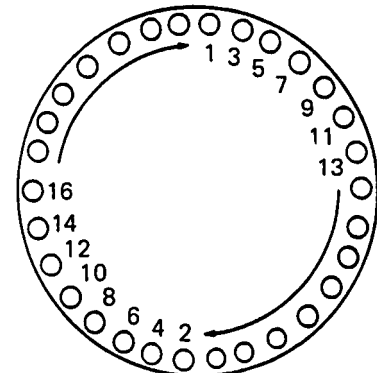
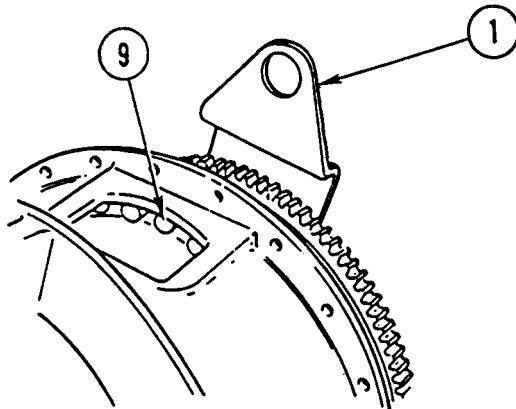


8. INSTALL ONE SCREW (9) AND ONE WASHER (10) THRU HOLE (11) IN FLYWHEEL (8) AND TIGHTEN SCREW UNTIL SNUG.
9. REMOVE LIFTING DEVICE FROM LIFTING BRACKET (1).

### **NOTE**

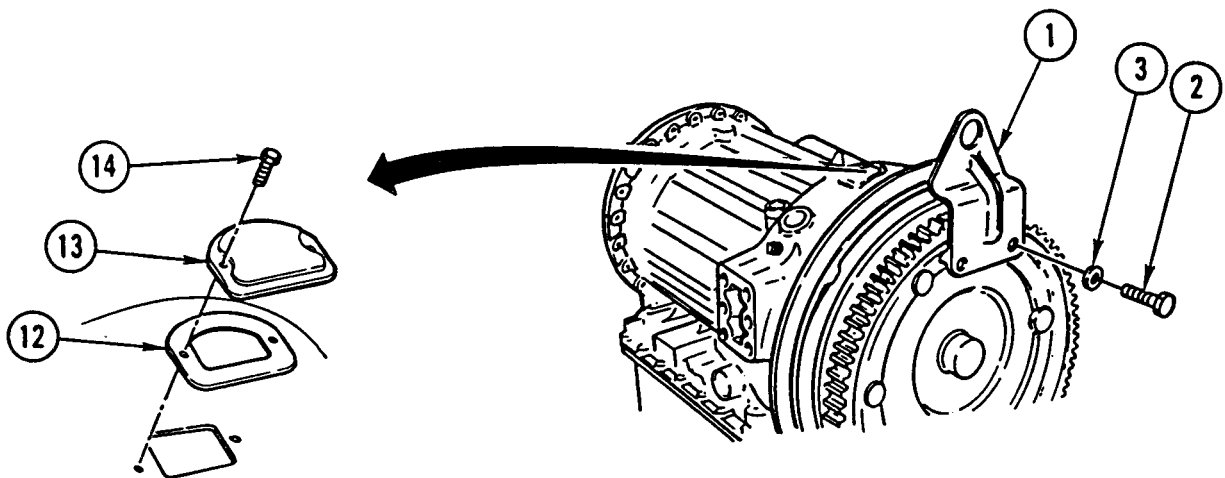
Use flywheel lifting bracket to turn flywheel for access to screw holes inside converter housing.

10. INSTALL 29 SCREWS (9) AND 29 WASHERS (10) THRU HOLES (11) IN FLYWHEEL (8) AND TIGHTEN SCREWS UNTIL SNUG.



TIGHTENING SEQUENCE

11. TIGHTEN 30 SCREWS (9) TO 45-50 LB-FT (61-66 N.m) IN ORDER SHOWN.



12. REMOVE TWO SCREWS (2) AND TWO WASHERS (3) AND REMOVE LIFTING BRACKET (1).

13. INSTALL NEW GASKET (12) AND ACCESS COVER (13).

14. INSTALL TWO SCREWS (14) AND TIGHTEN TO 25-30 LB-FT (34-41 N.m).

**NOTE**

Follow-on Maintenance:  
Remove transmission from transmission stand (page 14-2).

### Section III. TORQUE CONVERTER STATOR REPLACEMENT AND REPAIR

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the torque converter stator.

Replacement and repair of the torque converter stator is general support maintenance.

---

#### TORQUE CONVERTER STATOR REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly g. Installation

---

#### INITIAL SETUP

##### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05  
Roller Spring Installer, J24218-2

##### Equipment Condition:

##### Reference

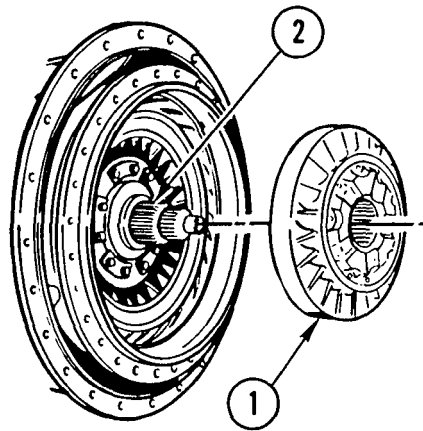
Page 14-7

##### Condition Description

Flywheel and Turbine  
Removed

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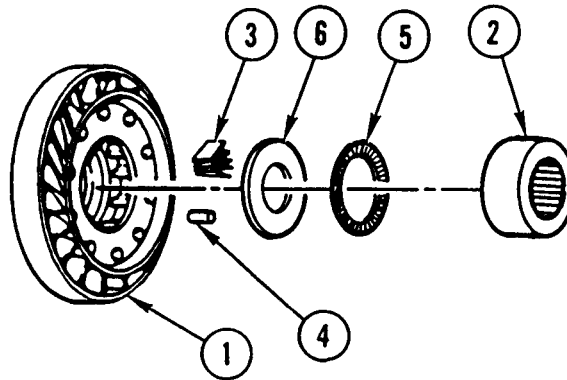
#### REMOVAL



#### NOTE

- Twist stator counterclockwise and away from torque converter pump when removing stator from shaft.
- Rollers and sp rings may fall out when stator is removed.

REMOVE STATOR 1) FROM SHAFT (2).

**DISASSEMBLY**

1. HOLD RIM OF STATOR (1) ON WORK SURFACE.
2. TURNING ROLLER RACE (2) CLOCKWISE, SLOWLY REMOVE ROLLER RACE (2) FROM STATOR (1).
3. REMOVE 10 ROLLER SPRINGS (3) AND 10 ROLLERS (4) FROM STATOR (1).
4. REMOVE ROLLER BEARING (5) AND THRUST BEARING RACE (6) FROM STATOR (1).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

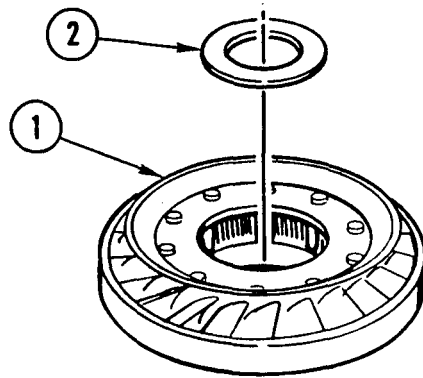
Inspect stator and cam for cracks and rivet holes for burrs or swelling. If stator or cam is cracked or distorted, replace stator.

**REPAIR**

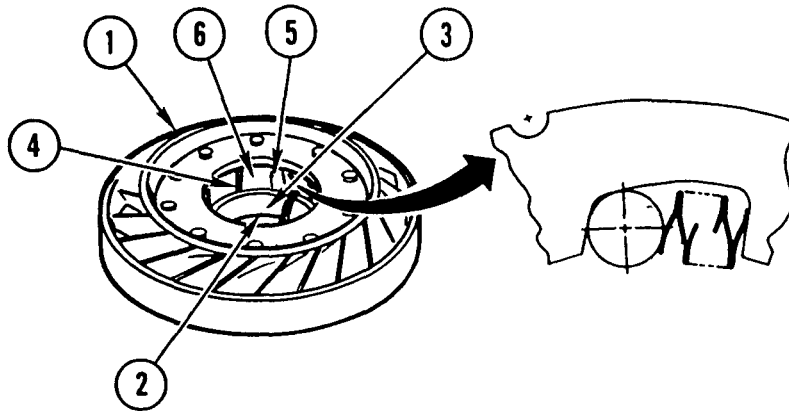
Use general repair methods to repair damaged parts (page 2-33).

## TORQUE CONVERTER STATOR REPLACEMENT AND REPAIR (CONT)

### ASSEMBLY



1. POSITION STATOR (1) ON WORK SURFACE, REAR SIDE UP.
2. INSTALL THRUST BEARING FACE (2) IN STATOR (1).



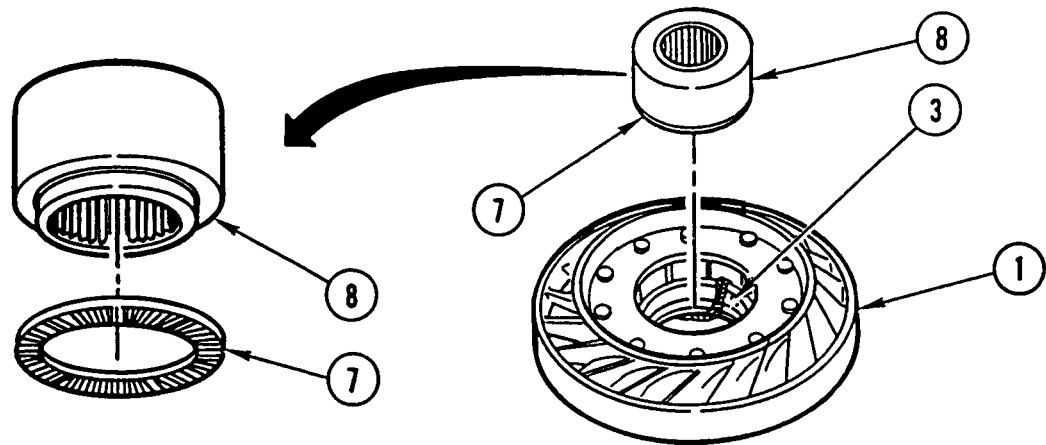
3. INSTALL ROLLER SPRING INSTALLER (3) AGAINST THRUST BEARING RACE (2) SO STRING OF ROLLER SPRING INSTALLER (3) HANGS OUT BOTTOM OF STATOR (1).

### CAUTION

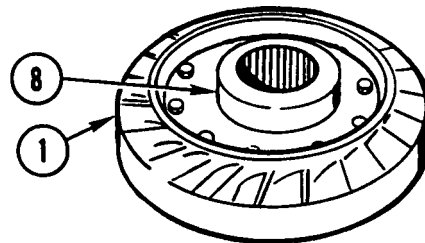
Install roller springs as shown to prevent damage to equipment.

4. INSTALL 10 ROLLER SPRINGS (4) AND 10 ROLLERS (5) IN STATOR CAM POCKETS (6).





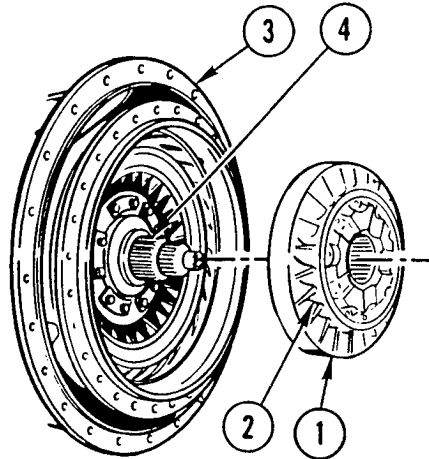
5. INSTALL ROLLER BEARING (7) ON ROLLER RACE (8).
6. INSTALL ROLLER RACE (8) IN STATOR (1) UNTIL ROLLER BEARING (7) IS NEAR ROLLER SPRING INSTALLER (3).
7. REMOVE ROLLER SPRING INSTALLER (3) BY PULLING ON ATTACHED STRING.
8. PUSH ROLLER RACE (8) INWARD WHILE TURNING ROLLER RACE (8) CLOCKWISE UNTIL ROLLER BEARING (7) SEATS.



9. POSITION STATOR (1) WITH ROLLER RACE (8) UP.
10. TURN ROLLER RACE (8) COUNTERCLOCKWISE TO LOCK IN PLACE.

## TORQUE CONVERTER STATOR REPLACEMENT AND REPAIR (CONT)

### INSTALLATION



#### CAUTION

Keep outer face of stator down so rollers and springs will not fall out.

1. HOLD STATOR (1) WITH THRUST PADS (2) AWAY FROM TRANSMISSION (3).

#### CAUTION

Stator must turn freely in clockwise direction and lock up in counter clockwise direction to operate properly and prevent damage to equipment.

2. INSTALL STATOR (1) ON SHAFT (4).

#### NOTE

Follow-on Maintenance:  
Install flywheel and turbine (page 14-7).

## Section IV. TORQUE CONVERTER PUMP REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the torque converter pump.

Repair of the torque converter pump is general support maintenance.

---

### **TORQUE CONVERTER PUMP REPLACEMENT AND REPAIR**

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly

---

### INITIAL SETUP

#### **Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Bearing Installer, J24447  
 Driver Handle, J24202-4  
 Snap Ring Remover/Installer, J26598A

#### **Equipment Condition:**

##### **Reference**

Page 14-22

##### **Condition Description**

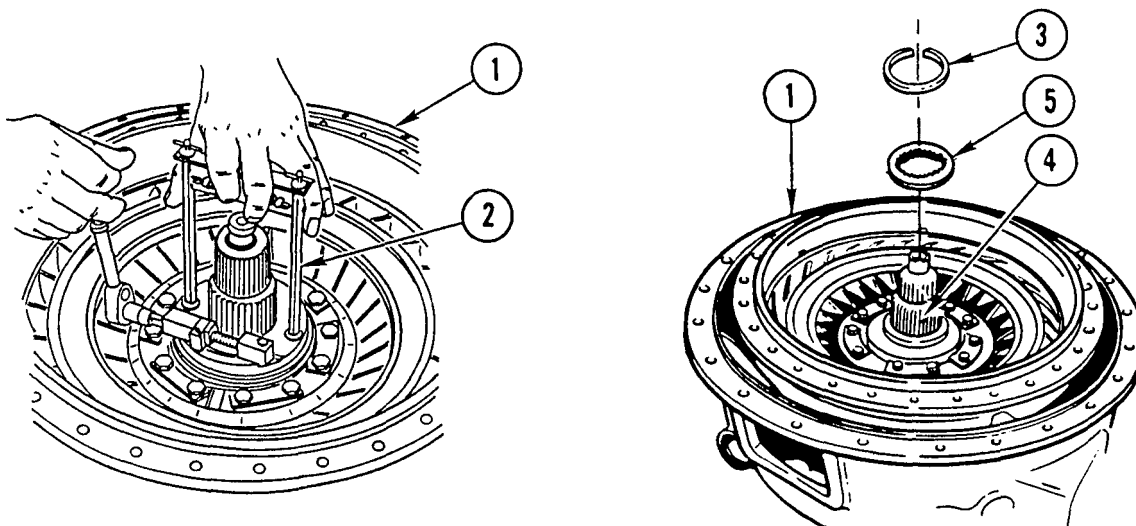
Torque Converter Stator  
 Removed

#### **Materials/Parts:**

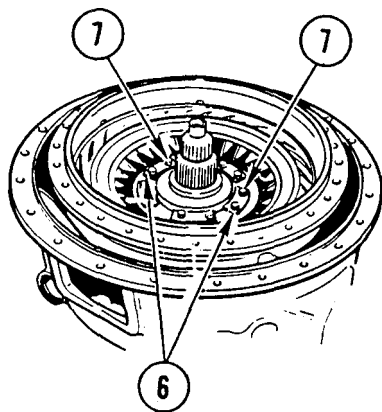
Gasket	P/N 6880901
Ring, Seal	P/N 23014631
Ring, Seal	P/N 23045519
Strip, Locking (6)	P/N 6880899
Oil, Lubricating	Appendix B, Item 37

## TORQUE CONVERTER PUMP REPLACEMENT AND REPAIR (CONT)

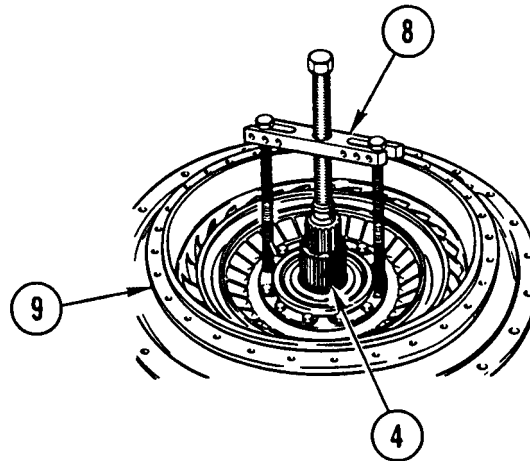
### REMOVAL



1. TURN TRANSMISSION SO TORQUE CONVERTER HOUSING (1) FACES UP.
2. USING SNAP RING REMOVER (2), REMOVE SNAP RING (3) FROM GROUND SLEEVE (4).
3. REMOVE SPACER (5).

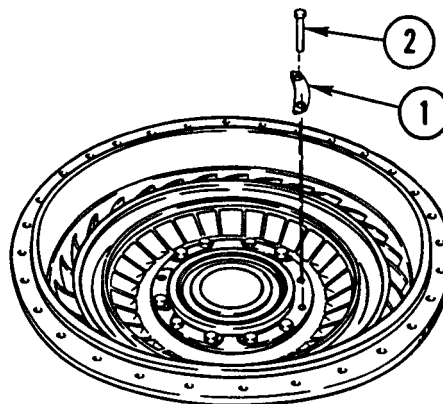


4. BEND CORNERS OF TWO LOCKING STRIPS (6) AWAY FROM HEADS OF TWO OPPOSING SCREWS (7).
5. REMOVE TWO SCREWS (7) FROM TWO LOCKING STRIPS (6).



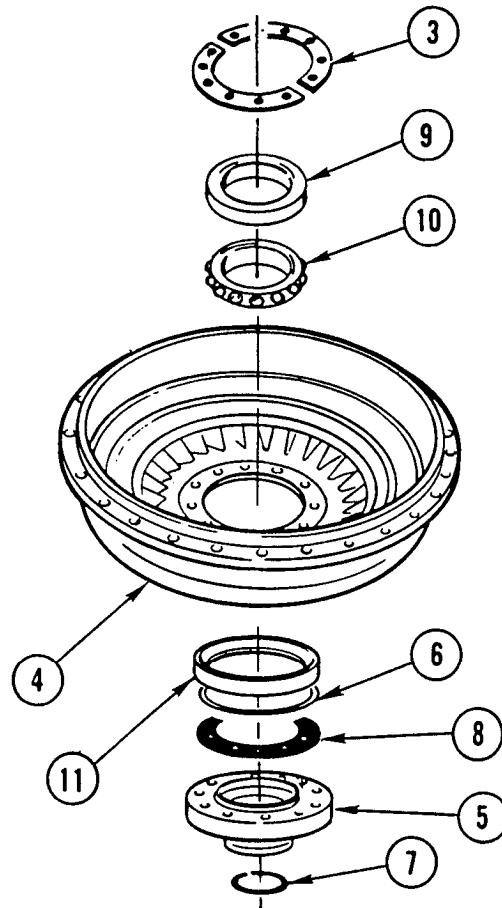
6. INSTALL PULLER (8).
7. TIGHTEN PULLER (8) TO SEPARATE PUMP (9) FROM GROUND SLEEVE (4).
8. REMOVE PULLER (8).
9. REMOVE PUMP (9) AND PLACE ON WORK SURFACE.

**DISASSEMBLY**



1. BEND CORNERS OF 4 LOCKING STRIPS (1) AWAY FROM HEADS OF 10 SCREWS (2).
2. REMOVE 10 SCREWS (2) AND 6 LOCKING STRIPS (1). DISCARD LOCKING STRIPS.

## TORQUE CONVERTER PUMP REPLACEMENT AND REPAIR (CONT)



3. REMOVE TWO BEARING RETAINERS (3) FROM PUMP (4).
4. REMOVE HUB (5), TWO SEAL RINGS (6 AND 7), AND GASKET (8) AS AN ASSEMBLY FROM PUMP (4).
5. REMOVE AND DISCARD TWO SEAL RINGS (6 AND 7) AND GASKET (8) FROM HUB (5).
6. REMOVE OUTER RACE (9) AND BEARING (10).
7. REMOVE INNER RACE (11).

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

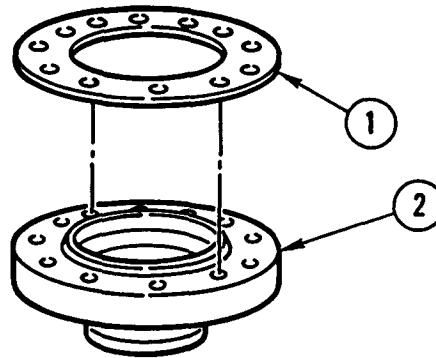
### INSPECTION

Inspect all parts for wear or damage.

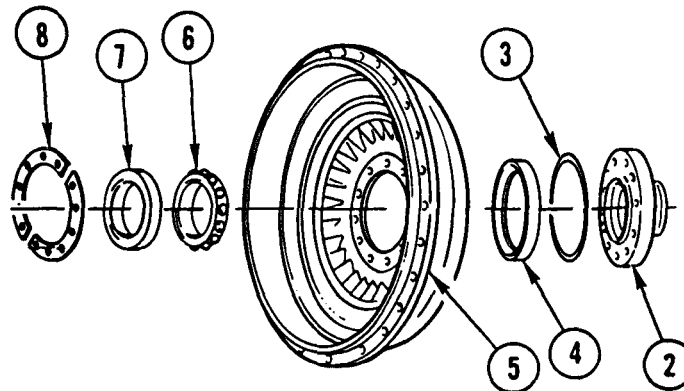
### REPAIR

Use general repair method to repair damaged parts (page 2-33).

**ASSEMBLY**



1. APPLY LUBRICATING OIL TO NEW GASKET (1) AND INSTALL GASKET (1) ON HUB (2).



**NOTE**

- Check that three parts of bearing have same serial number.
- Outer race is grooved.

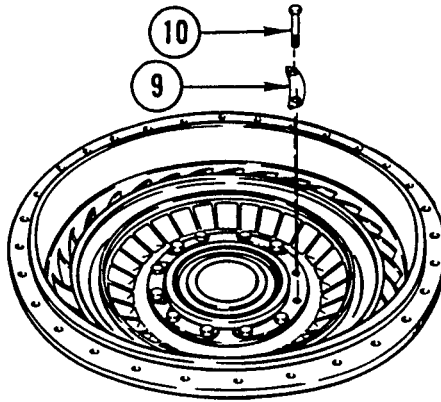
2. APPLY LUBRICATING OIL TO NEW SEAL RING (3) AND INSTALL SEAL RING (3) ON HUB (2).
3. INSTALL INNER RACE (4) ON HUB (2).
4. INSTALL PUMP (5) ON HUB (2).

**CAUTION**

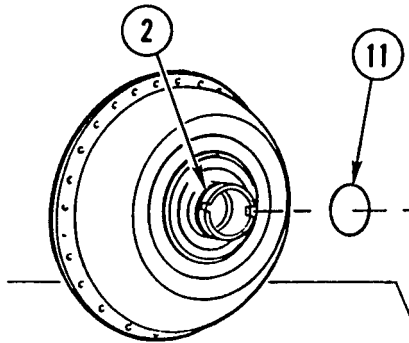
Bearing must be kept clean during installation. Keep bearing wrapped until installed. Set bearing on clean, lint-free paper. Failure to do so could result in equipment damage.

5. INSTALL BEARING (6) IN INNER RACE (4).
6. INSTALL OUTER RACE (7) OVER BEARING (6).
7. POSITION TWO BEARING RETAINERS (8) ON HUB (2) IN OUTER RACE (7) GROOVE.

## TORQUE CONVERTER PUMP REPLACEMENT AND REPAIR (CONT)



8. INSTALL 6 NEW LOCKING STRIPS (9) AND 12 SCREWS (10) AND TIGHTEN SCREWS TO 35-40 LB-FT (47-54 N.m).
9. BEND CORNERS OF 6 LOCKING STRIPS (9) AGAINST HEADS OF 12 SCREWS (10).



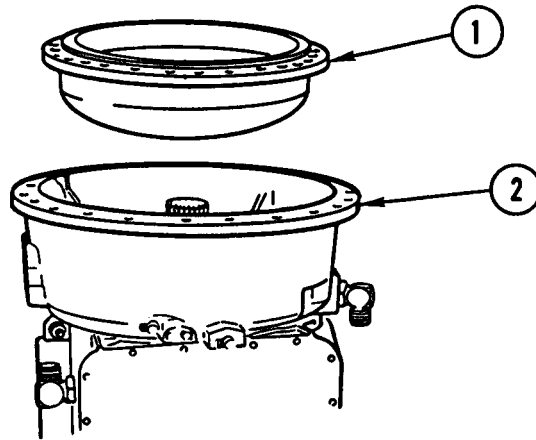
### NOTE

Keep seal ring sealed in package until ready to use so seal ring does not change shape.

10. ROLL NEW SEAL RING (11) TO ONE-HALF LENGTH AND HOLD FOR AT LEAST 10 SECONDS.
11. INSTALL SEAL RING (11) IN GROOVE ON HUB (2).



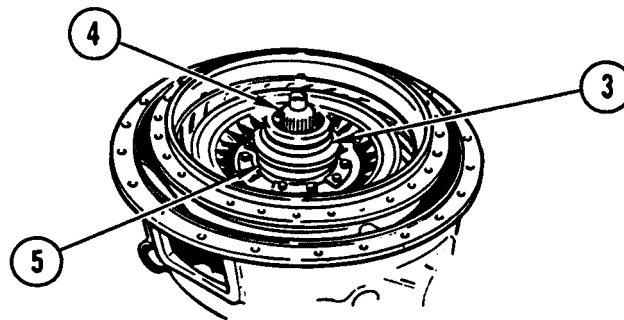
**INSTALLATION**



**NOTE**

When installing pump, slots in pump hub must be aligned with tangs on oil pump in torque converter housing.

1. INSTALL PUMP (1) IN TORQUE CONVERTER HOUSING (2).

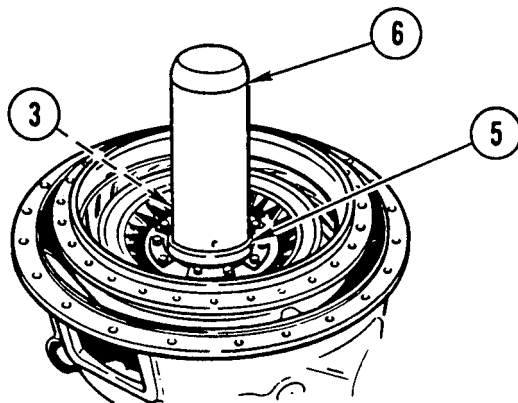


2. INSTALL BEARING INSTALLER (3) AROUND GROUND SLEEVE (4) AND ON BEARING (5).

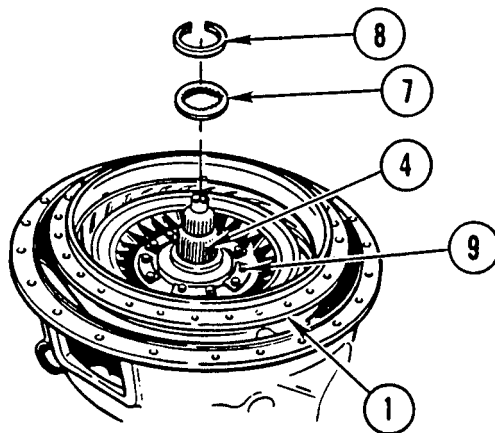
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## TORQUE CONVERTER PUMP REPLACEMENT AND REPAIR (CONT)

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3. PLACE DRIVER HANDLE (6) OVER BEARING INSTALLER (3).
4. DRIVE BEARING (5) DOWN UNTIL SEATED.
5. REMOVE DRIVER HANDLE (6) AND BEARING INSTALLER (3).



6. INSTALL SPACER (7) OVER GROUND SLEEVE (4) ON PUMP (1).
7. INSTALL RETAINING RING (8) ON GROUND SLEEVE (4).
8. COAT PUMP (1) HUB AND HUB AREA (9) WITH LUBRICATING OIL.

**NOTE**

Follow-on Maintenance:  
Install torque converter stator (page 14-22).

## Section V. TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the torque converter housing and front support.

Replacement and repair of the torque converter housing and front support is general support maintenance.

---

### TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly g. Installation

---

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Bearing Installer, J24197  
 Bearing Installer, J24219  
 Eye Hook (2), 3062  
 Drive Handle, J8092  
 Guide Stud (2), Appendix C, Item 3

**Personnel Required:** (2)

**Equipment Condition:**

Reference	Condition Description
Page 14-27	Torque Converter Pump Removed

**Materials/Parts:**

Ring, Seal	P/N 23014441
Ring, Seal	P/N 6837255
Seal, Oil	P/N 23016947
Gasket	P/N 23046658
Oil, Lubricating	Appendix B, Item 37

**General Safety Instructions:**

**WARNING**

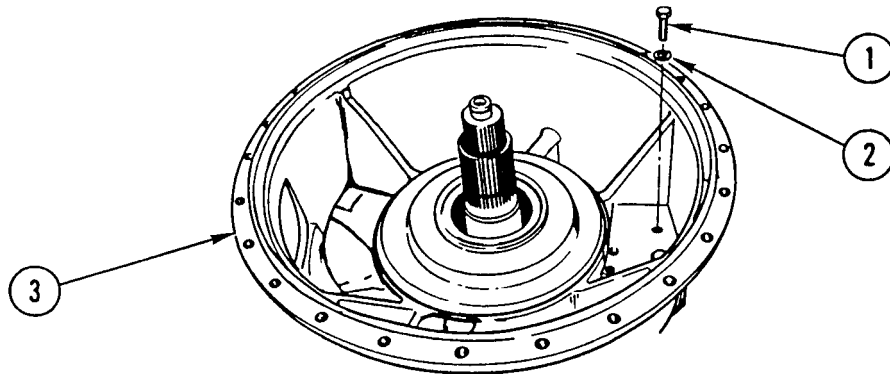
Parts are under spring tension. Release tension slowly to prevent personal injury.

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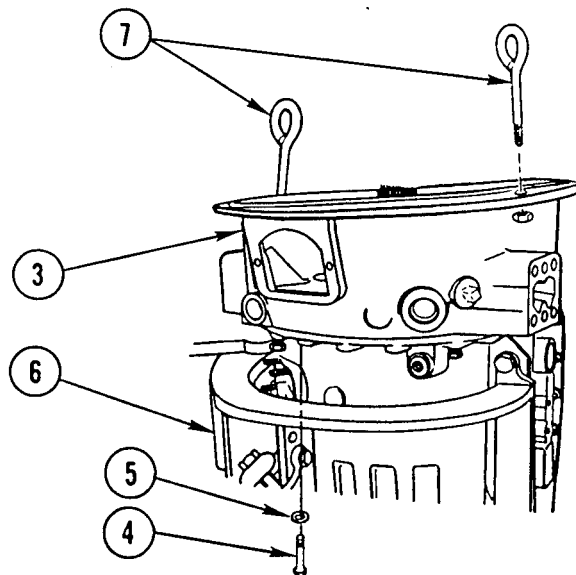
## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

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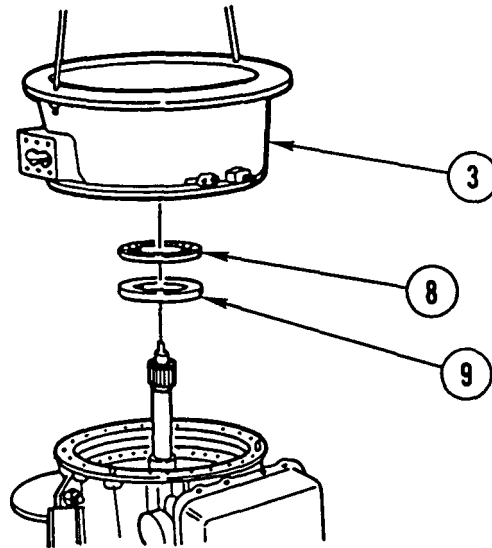
### REMOVAL



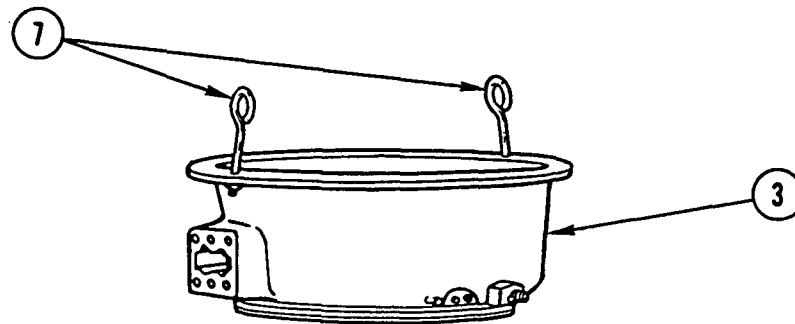
1. REMOVE SEVEN SCREWS (1) AND SEVEN LOCK WASHERS (2) FROM INSIDE TORQUE CONVERTER HOUSING (3).



2. REMOVE SEVEN SCREWS (4) AND SEVEN LOCK WASHERS (5) HOLDING TORQUE CONVERTER HOUSING (3) TO TRANSMISSION HOUSING (6).
3. INSTALL TWO EYE HOOKS (7) ON TORQUE CONVERTER HOUSING (3).
4. INSTALL LIFTING DEVICE TO TWO EYE HOOKS (7).



5. REMOVE TORQUE CONVERTER HOUSING (3).
6. REMOVE ROLLER BEARING (8) AND BEARING RACE (9).

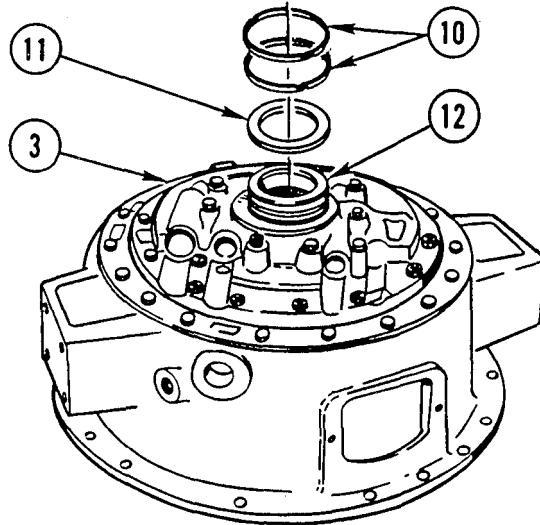


7. PLACE TORQUE CONVERTER HOUSING (3) ON WORK SURFACE.
8. REMOVE LIFTING DEVICE AND TWO EYE HOOKS (7).

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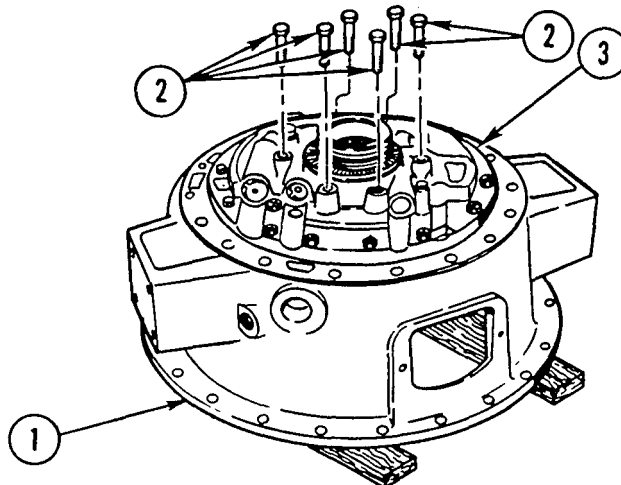
## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

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9. TURN TORQUE CONVERTER HOUSING (3) OVER.
10. REMOVE TWO SEAL RINGS (10) AND BEARING RACE (11) FROM SUPPORT HUB (12). DISCARD SEAL RINGS.

### DISASSEMBLY

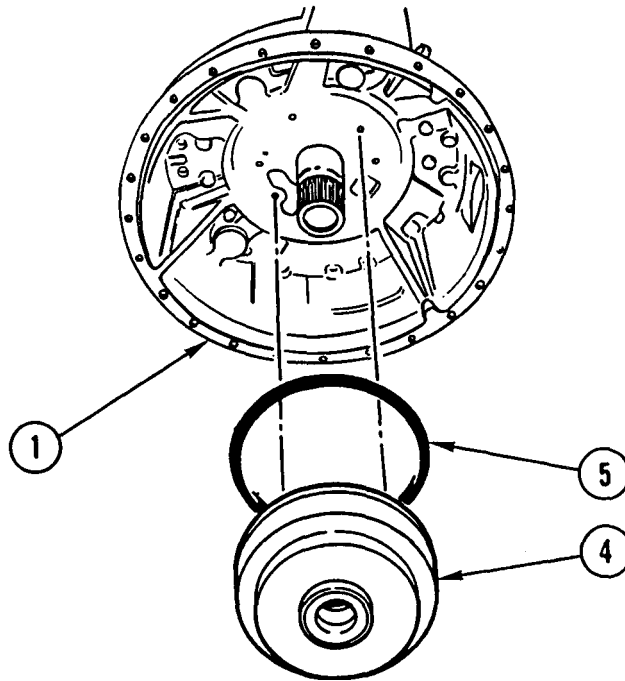


1. SET TORQUE CONVERTER HOUSING (1) ON TWO WOODEN BLOCKS.

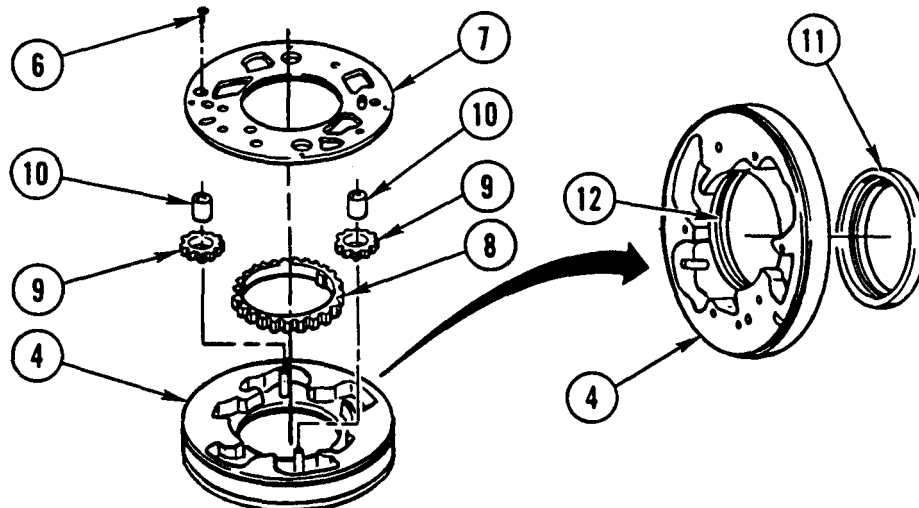
### CAUTION

When screws are removed, oil pump will fall. Support oil pump to prevent damage.

2. REMOVE SIX SCREWS (2) FROM FRONT SUPPORT ASSEMBLY (3).

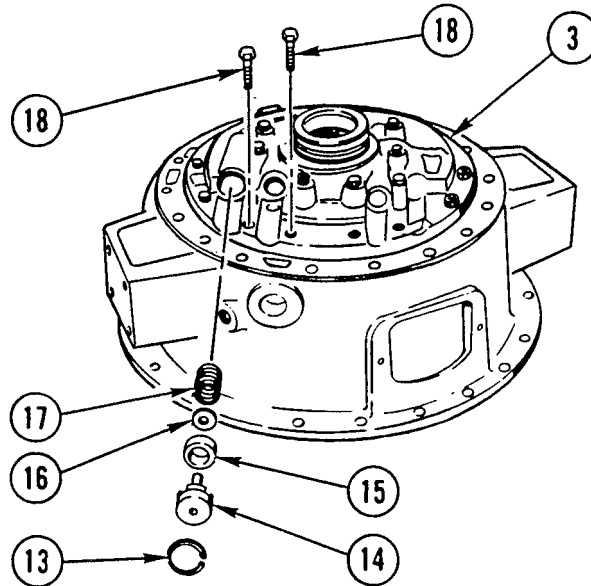


3. REMOVE OIL PUMP (4) FROM UNDER TORQUE CONVERTER HOUSING (1).
4. REMOVE AND DISCARD OUTER SEAL RING (5) FROM OIL PUMP (4).



5. REMOVE SCREW (6) FROM OIL PUMP (4).
6. REMOVE BACKPLATE (7) FROM OIL PUMP (4).
7. REMOVE DRIVE GEAR (8).
8. REMOVE TWO DRIVEN GEARS (9).
9. REMOVE TWO BEARINGS (10) FROM TWO DRIVEN GEARS (9).
10. SET OIL PUMP (4) ON RIM AND REMOVE OIL SEAL (11) FROM GROOVE (12). DISCARD OIL

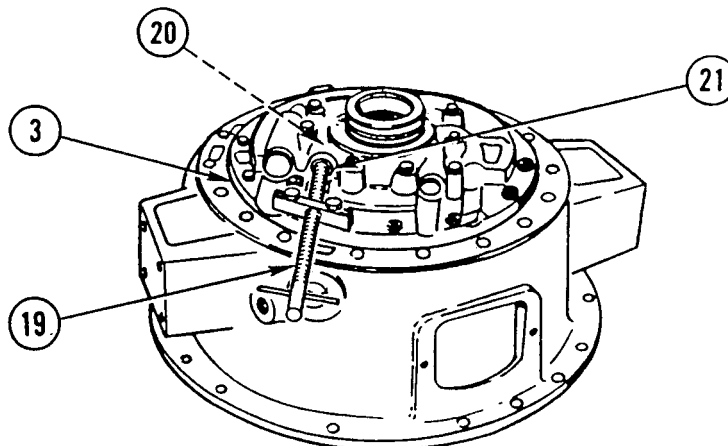
## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)



### WARNING

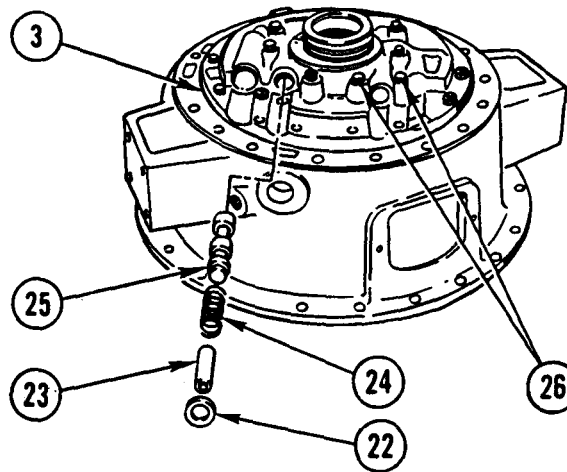
Parts are under spring tension. Release tension slowly to prevent personal injury.

11. REMOVE RETAINING RING (13) WHILE PUSHING SUPPORT ASSEMBLY (14).
12. REMOVE SUPPORT ASSEMBLY (14), VALVE SEAT (15), CONVERTER BYPASS VALVE (16), AND SPRING (17).
13. REMOVE TWO SCREWS (18) FROM FRONT SUPPORT ASSEMBLY (3).

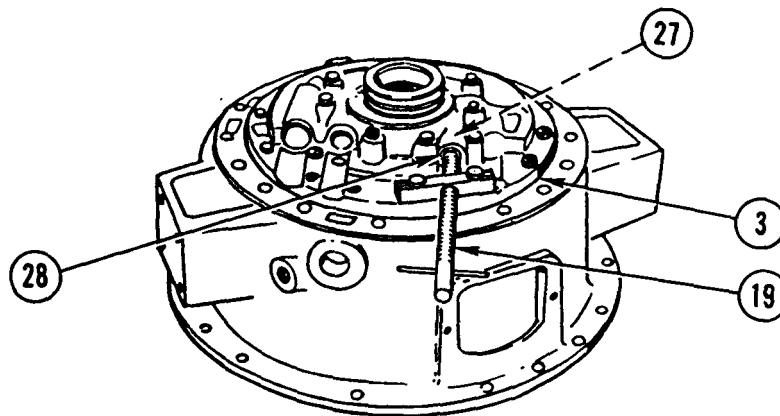




14. INSTALL BEARING INSTALLER (19) TO FRONT SUPPORT ASSEMBLY (3).
15. USING BEARING INSTALLER (19), COMPRESS VALVE ASSEMBLY (20) AND REMOVE RETAINING RING (21).
16. USING BEARING INSTALLER (19), RELEASE VALVE ASSEMBLY (20).
17. REMOVE BEARING INSTALLER (19).



18. REMOVE RETAINER WASHER (22), VALVE STOP (23), VALVE SPRING (24), AND LOCKUP SHIFT VALVE (25).
19. REMOVE TWO SCREWS (26) FROM FRONT SUPPORT ASSEMBLY (3).

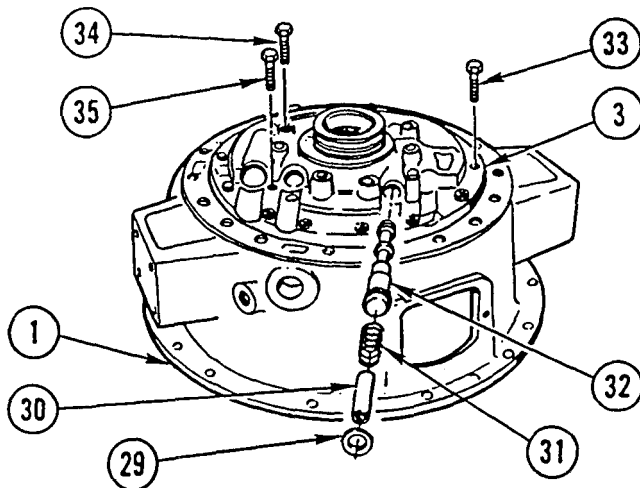


20. INSTALL BEARING INSTALLER (19) TO FRONT SUPPORT ASSEMBLY (3).
21. USING BEARING INSTALLER (19), COMPRESS VALVE ASSEMBLY (27) AND REMOVE RETAINING RING (28).
22. USING BEARING INSTALLER (19), RELEASE VALVE ASSEMBLY (27).
23. REMOVE BEARING INSTALLER (19).

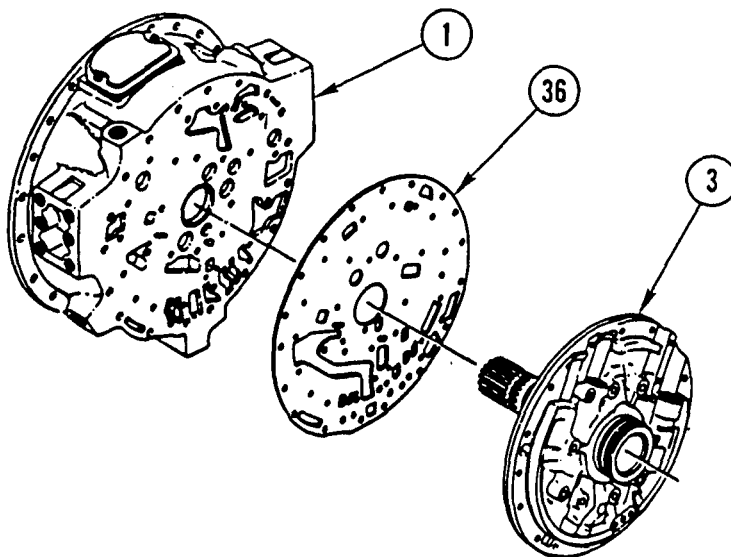
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## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

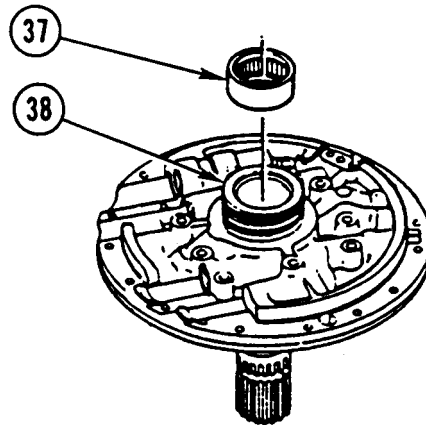
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24. REMOVE RETAINER WASHER (29), VALVE STOP (30), MAIN PRESSURE REGULATOR VALVE SPRING (31), AND MAIN PRESSURE REGULATOR VALVE (32).
25. REMOVE 15 SCREWS (33) HOLDING FRONT SUPPORT ASSEMBLY (3) TO TORQUE CONVERTER HOUSING (1).
26. REMOVE THREE SCREWS (34).
27. REMOVE SCREW (35).



28. POSITION AND HOLD TORQUE CONVERTER HOUSING (1) ON RIM.
29. REMOVE FRONT SUPPORT ASSEMBLY (3).
30. REMOVE AND DISCARD GASKET (36) FROM TORQUE CONVERTER HOUSING (1).



31. REMOVE BEARING (37) FROM GROUND SLEEVE BORE (38).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. REPLACE CONVERTER BYPASS VALVE SPRING, LOCKUP SHIFT VALVE SPRING, AND MAIN PRESSURE REGULATOR VALVE SPRING IF LOAD-HEIGHT SPECIFICATIONS LISTED IN FOLLOWING TABLE ARE NOT MET.

**Spring Load-Height Specifications**

Spring	Length Without Load	Length Under Load	Load
Converter Bypass Valve	2.65 in. (67.3 mm)	1.62 in. (41.2 mm)	21.0 -23.0 lb (9.6-10.4 kg)
Lockup Shift Valve	3.22 in. (81.8 mm)	1.8 in. (45.7 mm)	22.0 -24.0 lb (10.0-10.9 kg)
Main Pressure Regulator Valve	3.94 in. (100.1 mm)	2.64 in. (67.1 mm)	82.0 -87.0 lb (37.2 -39.4 kg)

**REPAIR**

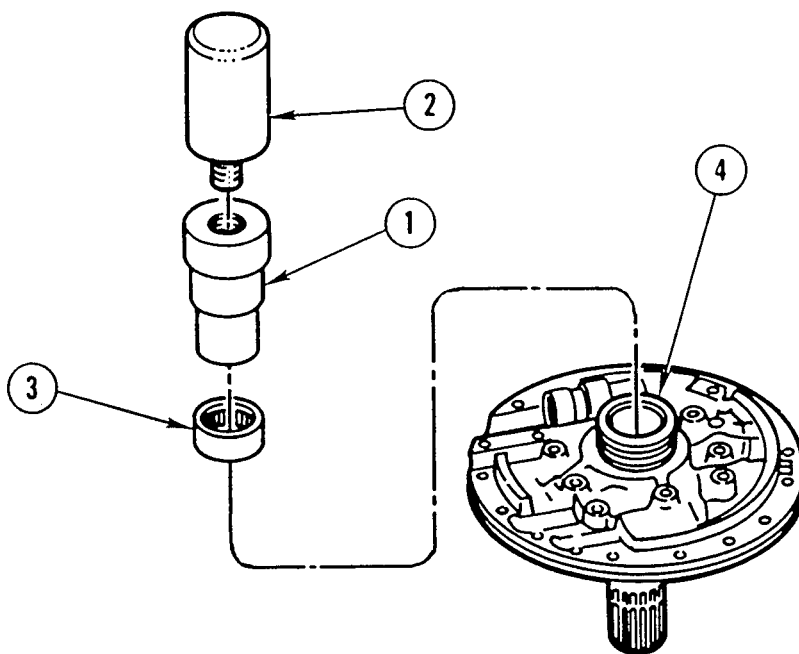
Use general repair methods to repair damaged parts (page 2-33).

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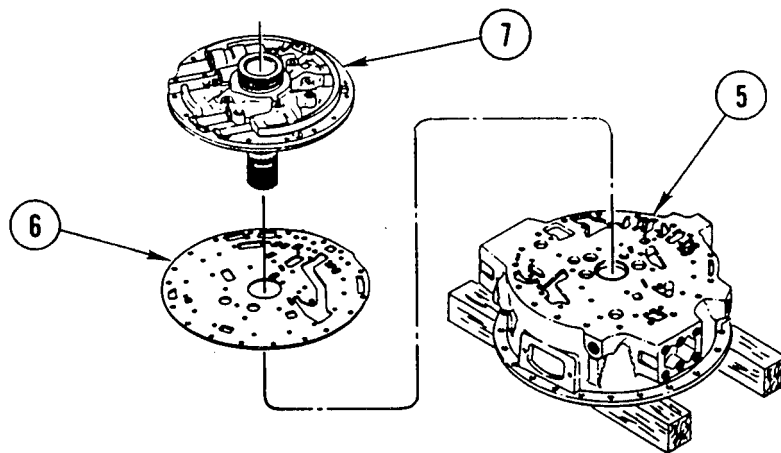
## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

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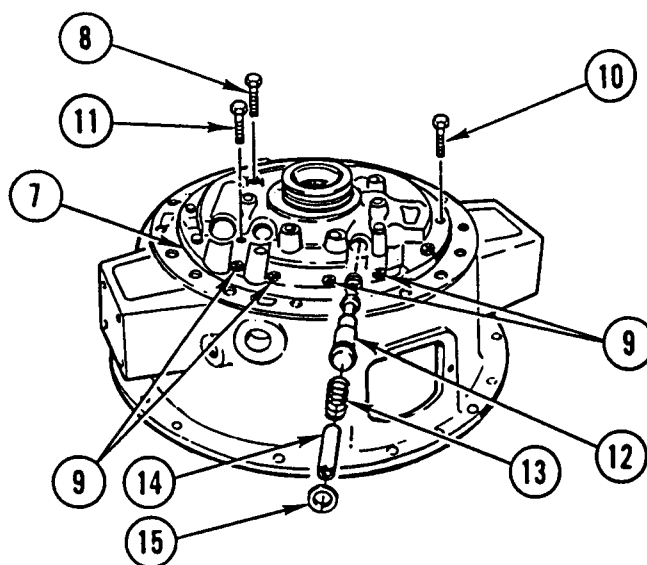
### ASSEMBLY



1. USING BEARING INSTALLER (1) AND DRIVE HANDLE (2), INSTALL BEARING (3) IN GROUND SLEEVE BORE (4).



2. SET TORQUE CONVERTER HOUSING (5) ON WOODEN BLOCKS.
3. ALINE HOLES AND INSTALL NEW GASKET (6) ON TORQUE CONVERTER HOUSING (5).
4. ALINE HOLES AND INSTALL FRONT SUPPORT ASSEMBLY (7).



5. INSTALL THREE SCREWS (8) ACROSS FRONT SUPPORT ASSEMBLY (7).

**NOTE**

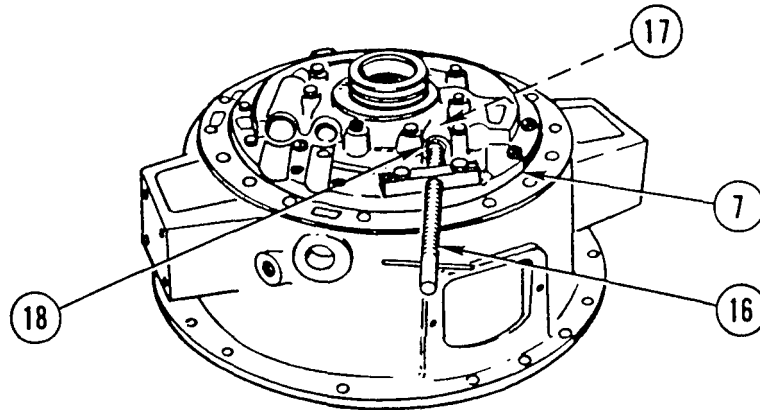
Do not install four screws (9) around outer edge of front support assembly.

6. INSTALL 11 SCREWS (10) AROUND OUTER EDGE OF FRONT SUPPORT ASSEMBLY (7).
7. INSTALL SCREW (11).
8. TIGHTEN 3 SCREWS (8), 11 SCREWS (10), AND SCREW (11) TO 35-45 LB-FT (47-61 N.m).
9. INSTALL MAIN PRESSURE REGULATOR VALVE (12) SMALL END FIRST.
10. INSTALL MAIN PRESSURE REGULATOR VALVE SPRING (13) AND VALVE STOP (14).
11. INSTALL RETAINER WASHER (15) ON MAIN PRESSURE REGULATOR VALVE SPRING (13).

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## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

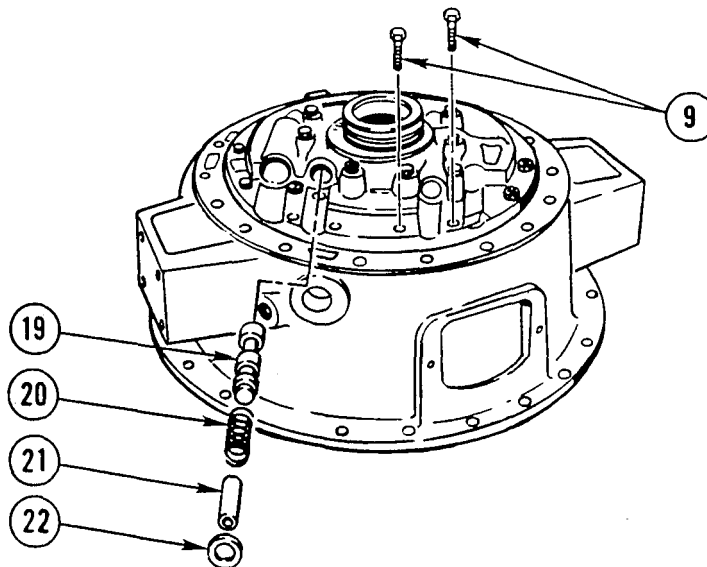
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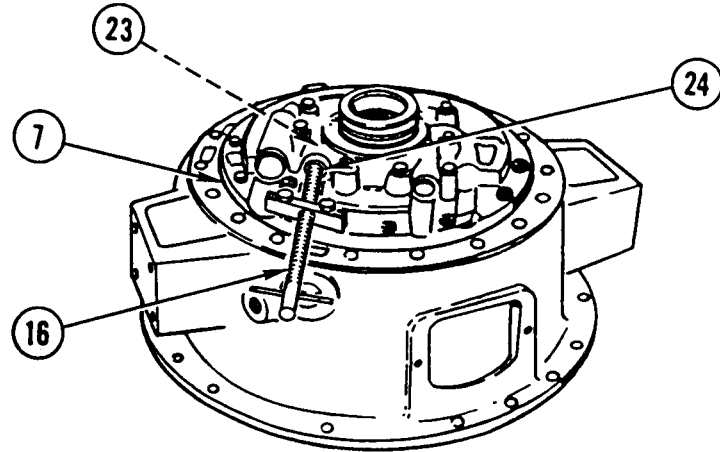
**NOTE**

Make sure retaining ring is positioned over retainer washer before installing bearing installer.

12. INSTALL BEARING INSTALLER (16) TO FRONT SUPPORT ASSEMBLY (7).
13. USING BEARING INSTALLER (16), COMPRESS VALVE ASSEMBLY (17) AND INSTALL RETAINING RING (18).
14. USING BEARING INSTALLER (16), RELEASE VALVE ASSEMBLY (17).
15. REMOVE BEARING INSTALLER (16).



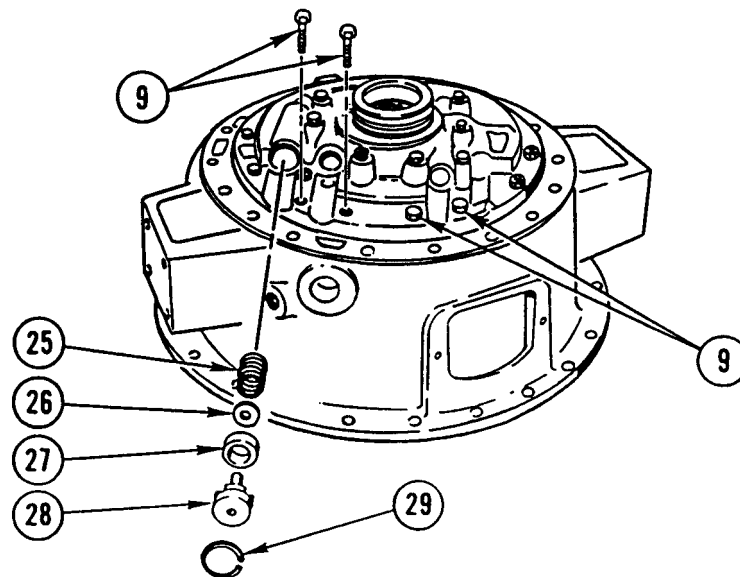
16. INSTALL TWO SCREWS (9). DO NOT TIGHTEN SCREWS.
17. INSTALL LOCKUP SHIFT VALVE (19) SMALL END FIRST.
18. INSTALL VALVE SPRING (20) AND VALVE STOP (21).
19. INSTALL RETAINER WASHER (22) ON VALVE SPRING (20).



**NOTE**

Make sure retaining ring is positioned over retainer washer before installing bearing installer.

20. INSTALL BEARING INSTALLER (16) TO FRONT SUPPORT ASSEMBLY (7).
21. USING BEARING INSTALLER (16), COMPRESS VALVE ASSEMBLY (23) AND INSTALL RETAINING RING (24).
22. USING BEARING INSTALLER (16), RELEASE VALVE ASSEMBLY (23).
23. REMOVE BEARING INSTALLER (16).

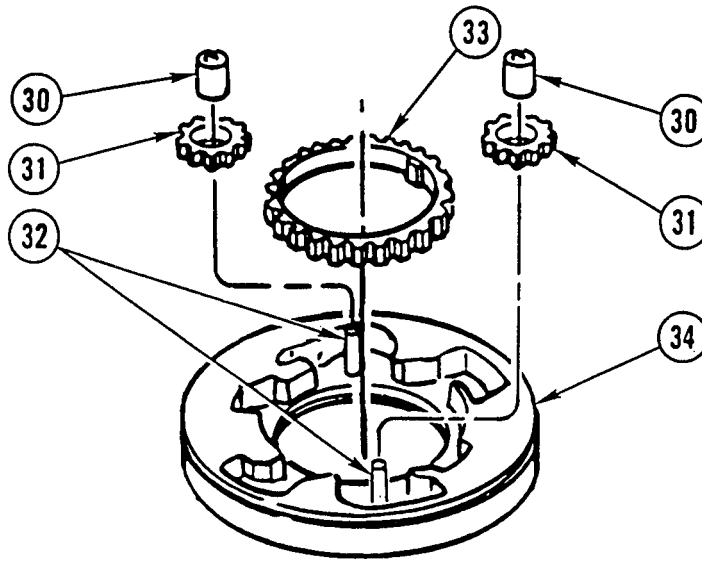


24. INSTALL TWO SCREWS (9). TIGHTEN FOUR SCREWS (9) TO 35-45 LB-FT (47-61 N.m).
25. INSTALL SPRING (25), CONVERTER BYPASS VALVE (26), VALVE SEAT (27), AND SUPPORT ASSEMBLY (28).
26. INSTALL RETAINING RING (29) WHILE PUSHING SUPPORT ASSEMBLY (28).

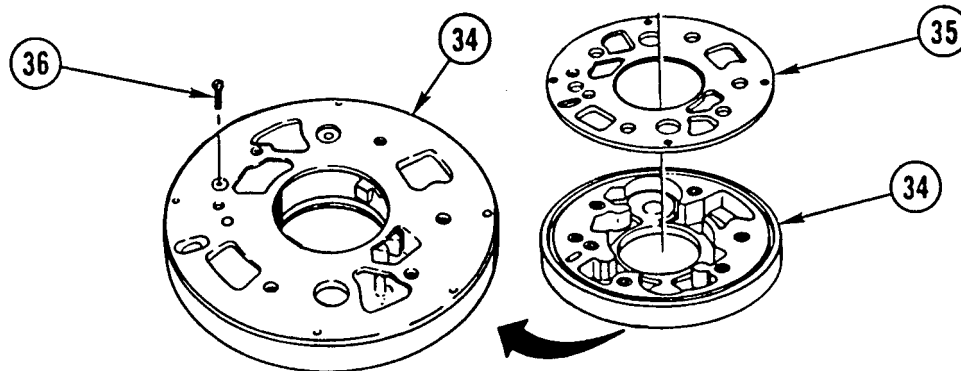
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## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

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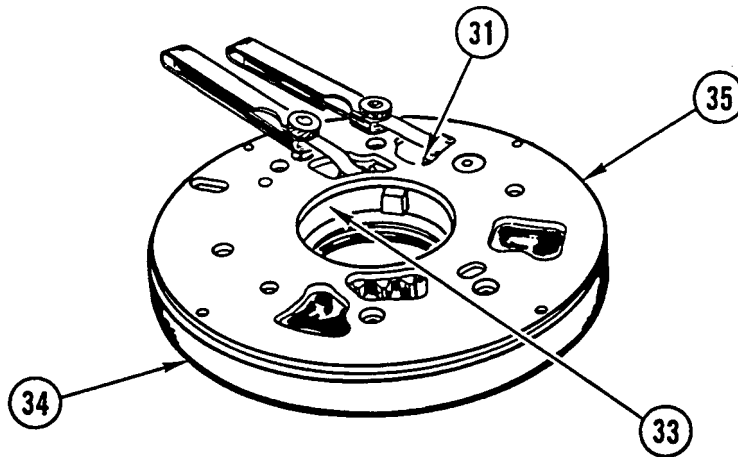


27. INSTALL TWO BEARINGS (30) IN TWO DRIVEN GEARS (31).
28. INSTALL TWO DRIVEN GEARS (31) ON TWO SHAFTS (32).
29. INSTALL DRIVE GEAR (33) IN OIL PUMP (34).

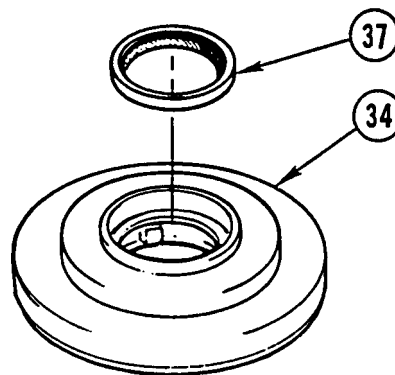


30. INSTALL BACKPLATE (35) ON OIL PUMP (34).
31. INSTALL SCREW (36) AND TIGHTEN TO 9-11 LB-FT (12-15 N.m).

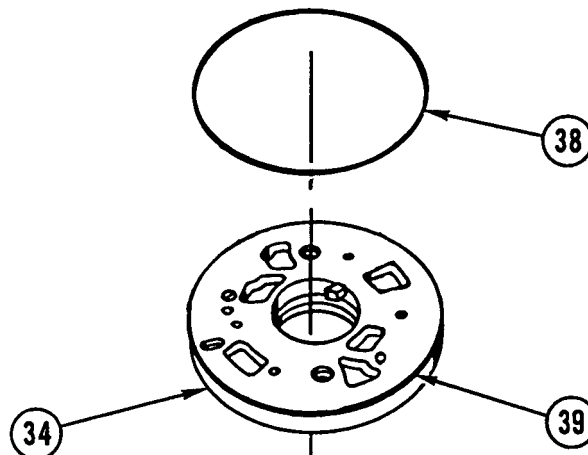




32. CHECK CLEARANCE BETWEEN BACKPLATE (35), DRIVE GEAR (33), AND TWO DRIVEN GEARS (31). MAXIMUM CLEARANCE IS 0.006 IN. (0.15 mm).
33. TURN OIL PUMP (34) OVER.



34. APPLY LUBRICATING OIL TO RUBBER LIP OF NEW OIL SEAL (37) AND INSTALL OIL SEAL (37) IN OIL PUMP (34).

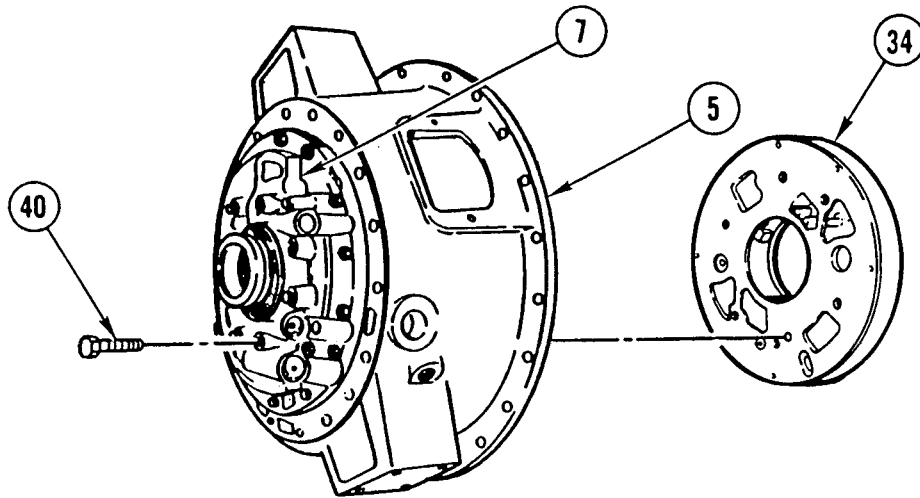


35. COAT NEW OUTER SEAL RING (38) WITH LUBRICATING OIL AND INSTALL ON OUTER CIRCUMFERENCE (39) OF OIL PUMP (34).

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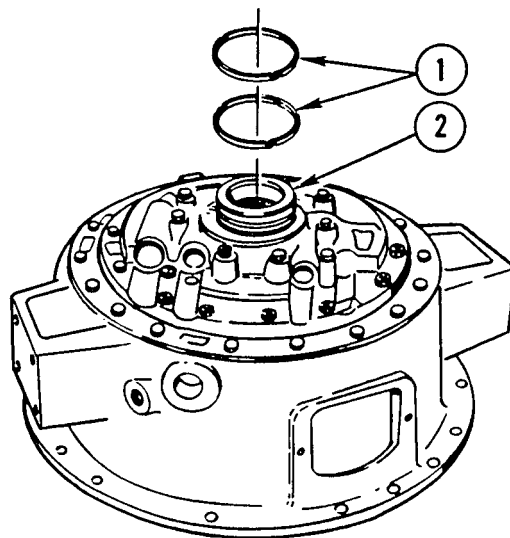
## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

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36. TURN TORQUE CONVERTER HOUSING (5) ON SIDE.
37. ALINE SCREW HOLES IN OIL PUMP (34) WITH HOLES IN TORQUE CONVERTER HOUSING (5).
38. INSTALL OIL PUMP (34) WHILE HOLDING TORQUE CONVERTER HOUSING (5).
39. INSTALL SIX SCREWS (40) THRU FRONT SUPPORT ASSEMBLY (7) WHILE HOLDING OIL PUMP (34).
40. TIGHTEN SIX SCREWS (40) TO 26-32 LB-FT (35-43 N.m).

### INSTALLATION



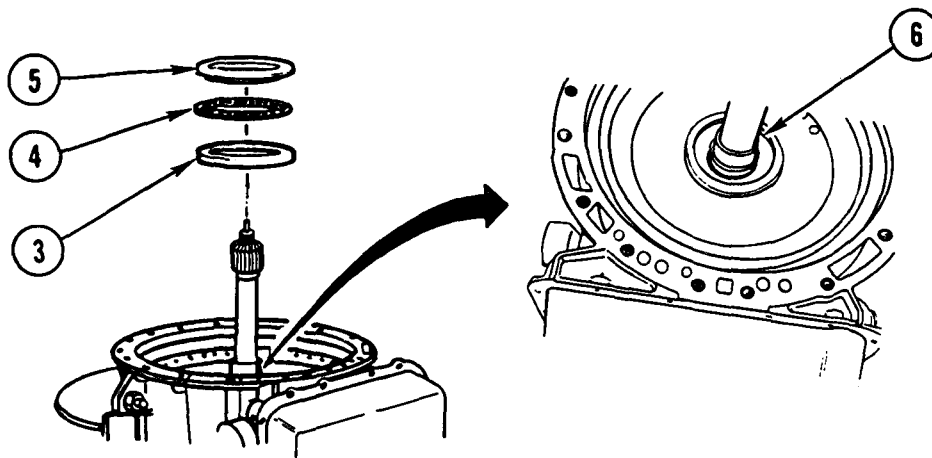
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**CAUTION**

To prevent damage to seal rings, keep sealed in package until ready to use.

---

1. ROLL NEW SEAL RING (1) TO ONE-HALF LENGTH AND HOLD FOR AT LEAST 10 SECONDS.
2. INSTALL SEAL RING (1) IN LOWER GROOVE OF SUPPORT HUB (2).
3. ROLL NEW SEAL RING (1) TO ONE-HALF LENGTH AND HOLD FOR 10 SECONDS.
4. INSTALL SEAL RING (1) IN UPPER GROOVE OF SUPPORT HUB (2).

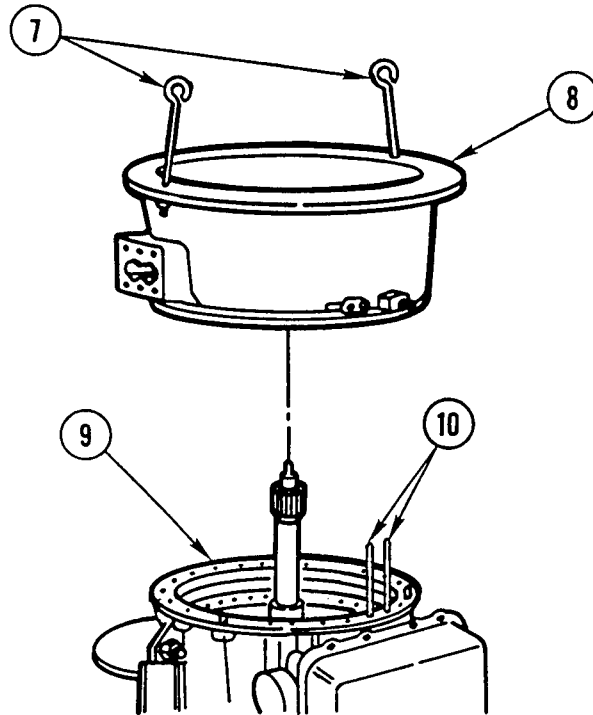


5. INSTALL BEARING RACE (3), ROLLER BEARING (4), AND BEARING RACE (5) ON INNER BORE (6).

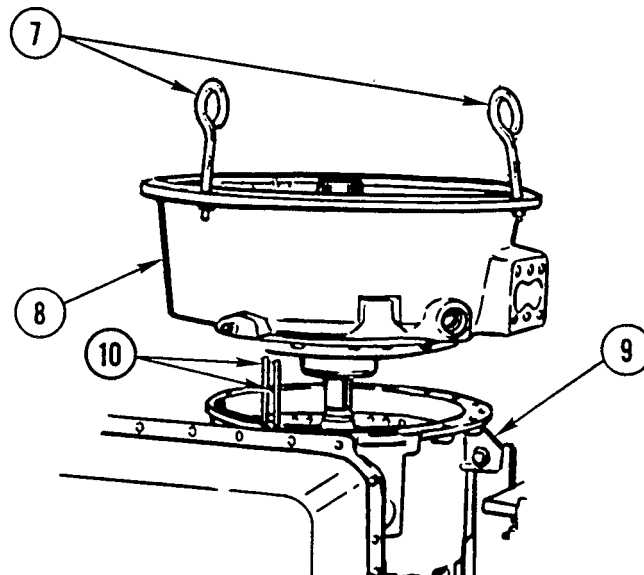
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## TORQUE CONVERTER HOUSING AND FRONT SUPPORT REPLACEMENT AND REPAIR (CONT)

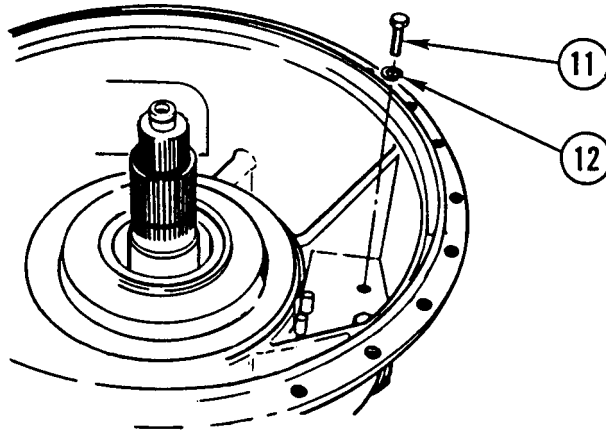
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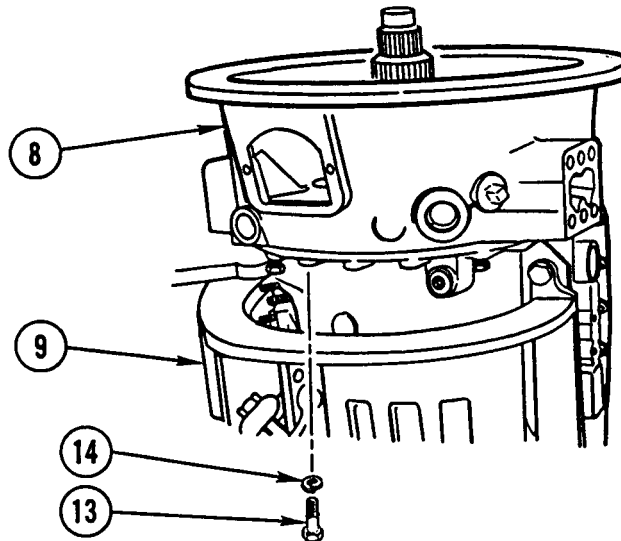
6. INSTALL TWO EYE HOOKS (7) AND LIFTING DEVICE ON TORQUE CONVERTER HOUSING (8).
7. POSITION TORQUE CONVERTER HOUSING (8) OVER TRANSMISSION HOUSING (9).
8. INSTALL TWO GUIDE STUDS (10) IN TRANSMISSION HOUSING (9).



9. INSTALL TORQUE CONVERTER HOUSING (8) ON TRANSMISSION HOUSING (9).
10. REMOVE LIFTING DEVICE AND TWO EYE HOOKS (7).
11. REMOVE TWO GUIDE STUDS (10).



INSTALL SEVEN SCREWS (11) AND SEVEN LOCK WASHERS (12). TIGHTEN SEVEN SCREWS TO 70-80 LB-FT (95-108 N.m).



13. INSTALL SEVEN SCREWS (13) AND SEVEN LOCK WASHERS (14) TO HOLD TORQUE CONVERTER HOUSING (8) TO TRANSMISSION HOUSING (9). TIGHTEN SEVEN SCREWS (13) TO 80 LB-FT (108 N.m).

**NOTE**

Follow-on Maintenance:  
Install torque converter pump (page 14-27).

## Section VI. FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the forward clutch and housing.

Replacement and repair of the forward clutch and housing is general support maintenance.

### FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly g. Installation

#### INITIAL SETUP

**Tools and Special Equipment:**

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N05
- Clutch Spring Compressor, J24204
- Collector Ring Installer and Staker, J24200
- Inner Seal Protector, J24216-01
- PTO Gear Removal Fixture, J26899
- Fourth Clutch Alining Tool, J24221

**Materials/Parts:**

- |                      |                     |
|----------------------|---------------------|
| Ring, Seal (2)       | P/N 23019652        |
| Ring, Seal           | P/N 6833980         |
| Ring, Seal           | P/N 6836799         |
| Shim Stock           | Appendix B, Item 53 |
| Oil, Lubricating     | Appendix B, Item 37 |
| Solvent, Drycleaning | Appendix B, Item 54 |
| Compound, Retaining  | Appendix B, Item 14 |

**Personnel Required:** (2)

**Equipment Condition:**

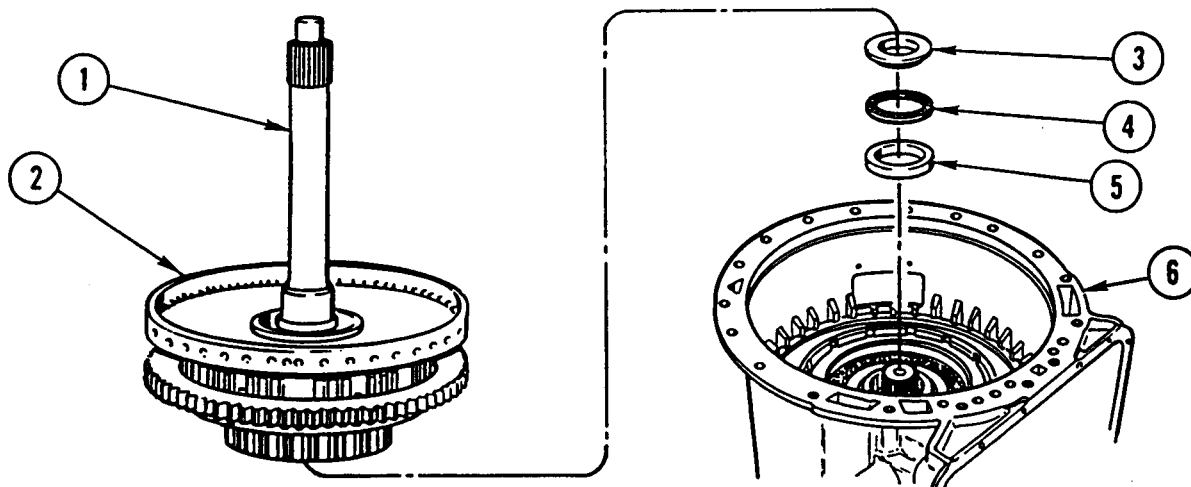
Reference	Condition Description
Page 14-35	Torque Converter Housing and Front Support Removed

**General Safety Instructions:**

**W A R N I N G**

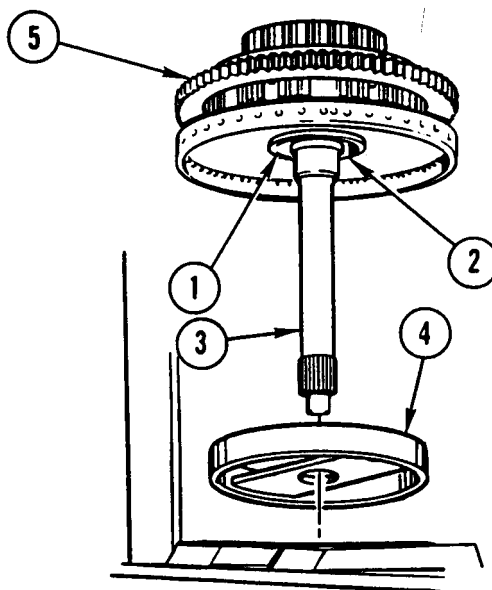
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa), Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.
- Hot PTO gear can cause burns. Wear heat-resistant gloves.

**REMOVAL**



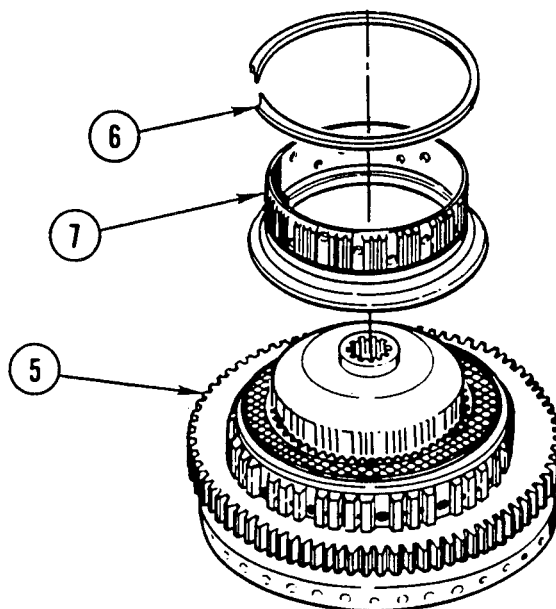
1. HOLD TURBINE SHAFT (1) AND REMOVE FORWARD CLUTCH ASSEMBLY (2), OUTER RACE (3), ROLLER BEARING (4), AND INNER RACE (5) FROM TRANSMISSION HOUSING (6).
2. PLACE FORWARD CLUTCH ASSEMBLY (2) IN CLEAN AREA.

**DISASSEMBLY**

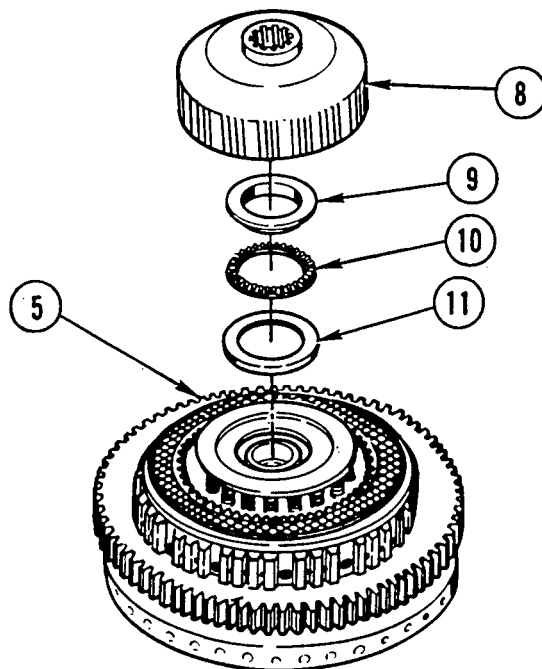


1. REMOVE AND DISCARD TWO SEAL RINGS (1 AND 2) FROM TURBINE SHAFT (3).
2. PLACE PILOT RING (4) ON BED OF PRESS.
3. TURN FORWARD CLUTCH ASSEMBLY (5) OVER AND INSTALL TURBINE SHAFT (3) THRU PILOT RING (4) AND IN BED OF PRESS.

## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)

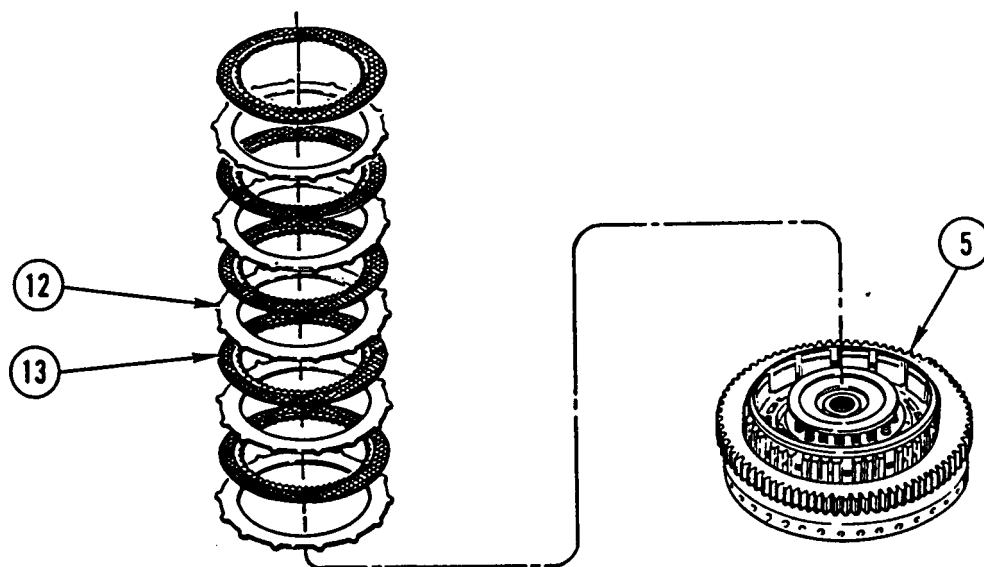


4. REMOVE LARGE INNER RETAINING RING (6) HOLDING FOURTH CLUTCH DRIVING HUB (7).
5. REMOVE FOURTH CLUTCH DRIVING HUB (7) FROM FORWARD CLUTCH ASSEMBLY (5).

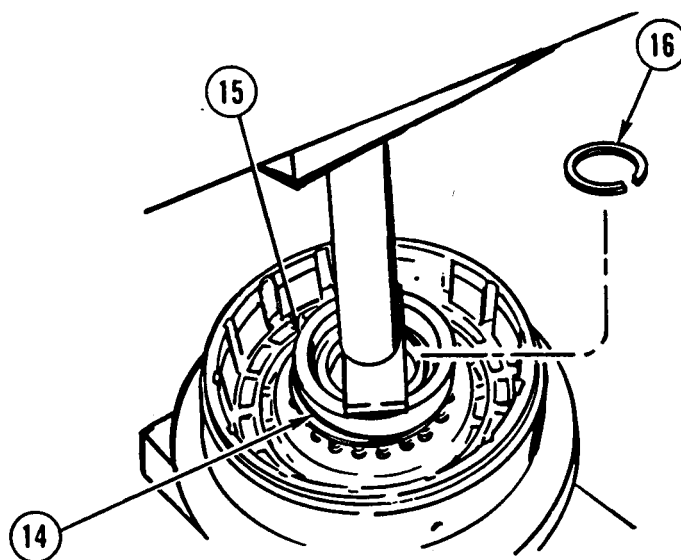


6. REMOVE FORWARD CLUTCH DRIVING HUB (8), INNER RACE (9), BEARING (10), AND OUTER RACE (11) FROM FORWARD CLUTCH ASSEMBLY (5).





7. REMOVE FIVE STEEL PLATES (12) AND FIVE FRICTION PLATES (13) FROM FORWARD CLUTCH ASSEMBLY (5).

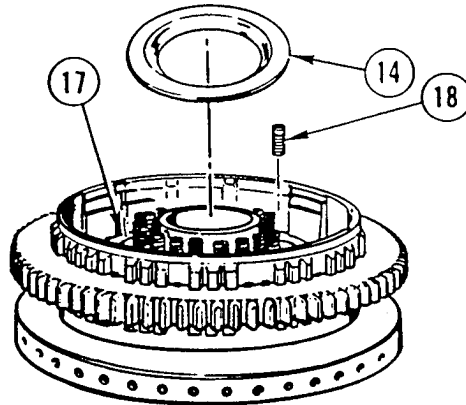


8. COMPRESS SPRING RETAINER (14) WITH CLUTCH SPRING COMPRESSOR (15). REMOVE RETAINING RING (16).
9. RELEASE PRESSURE FROM SPRING RETAINER (14) AND REMOVE CLUTCH SPRING COMPRESSOR (15).

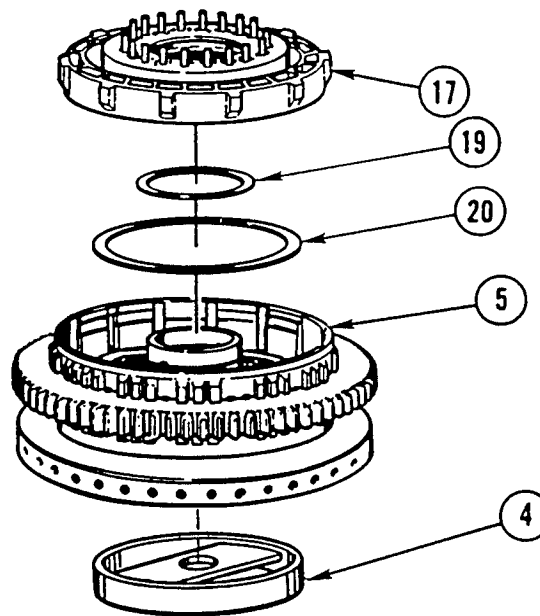
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## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)

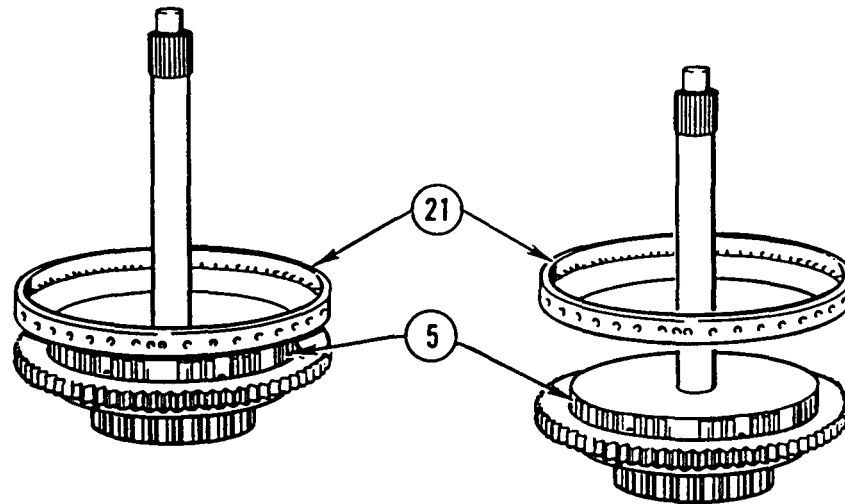
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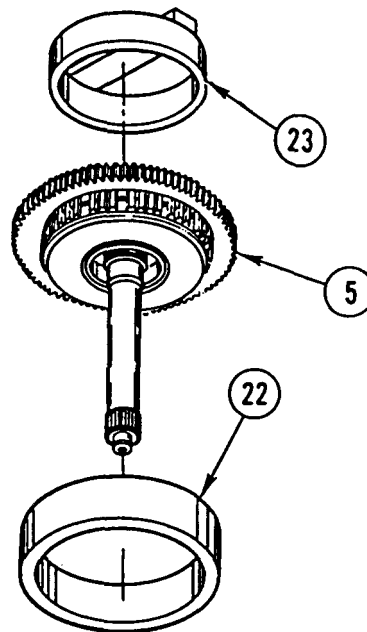
10. REMOVE SPRING RETAINER (14) FROM FORWARD CLUTCH PISTON (17).
11. REMOVE 20 PISTON RELEASE SPRINGS (18) FROM FORWARD CLUTCH PISTON (17).



12. REMOVE FORWARD CLUTCH PISTON (17) FROM FORWARD CLUTCH ASSEMBLY (5).
13. REMOVE AND DISCARD INNER SEAL RING (19) AND OUTER SEAL RING (20) FROM FORWARD CLUTCH PISTON (17).
14. REMOVE FORWARD CLUTCH ASSEMBLY (5) AND PILOT RING (4) FROM PRESS.



15. USING BRASS DRIFT, REMOVE OIL COLLECTOR RING (21) FROM FORWARD CLUTCH ASSEMBLY (5).

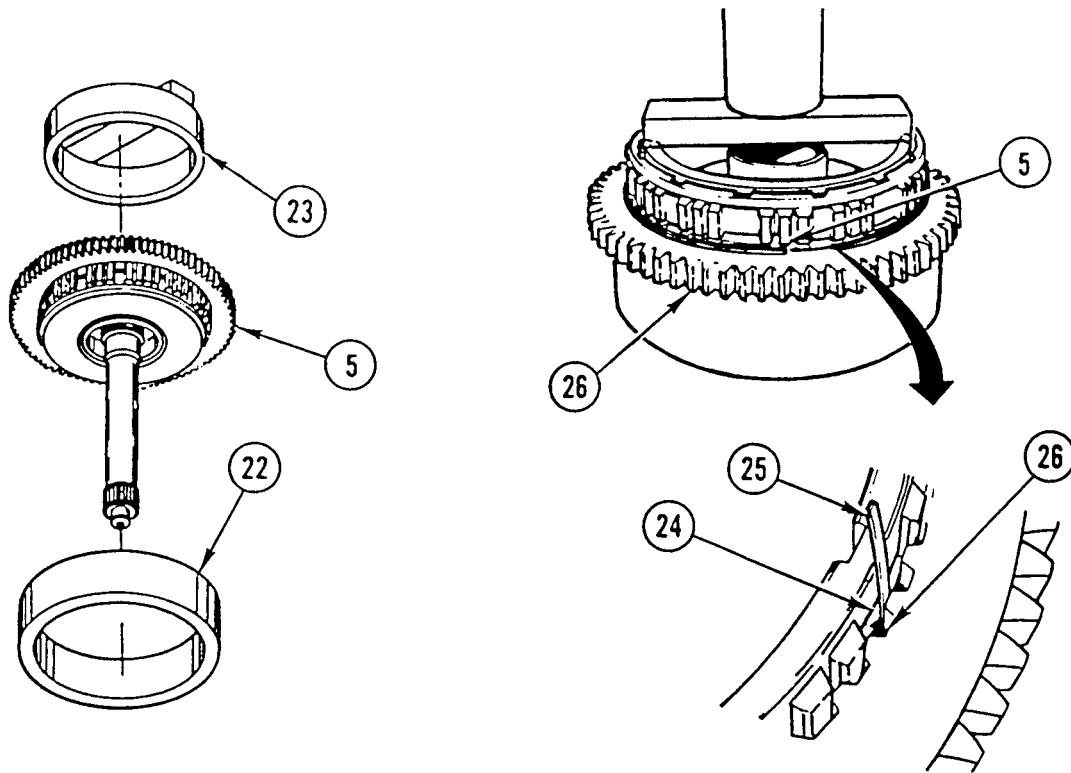


**NOTE**

Perform steps 16 thru 22 only if PTO gear is worn or damaged.

16. PLACE OUTER RING SUPPORT (22) FROM PTO GEAR REMOVAL FIXTURE IN PRESS.
17. INSTALL FORWARD CLUTCH ASSEMBLY (5) ON OUTER RING SUPPORT (22).
18. INSTALL INNER RING DRIVER (23) FROM PTO GEAR REMOVAL FIXTURE IN FORWARD CLUTCH ASSEMBLY (5).

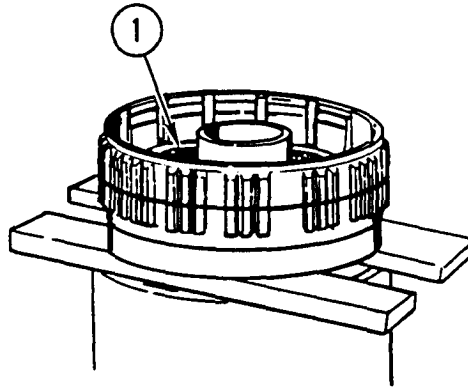
## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



19. FIND GAP IN RETAINING RING (24).
20. INSTALL SHIM STOCK (25) BETWEEN RETAINING RING (24) AND TEETH OF PTO GEAR (26). PUSH RETAINING RING (24) INTO FORWARD CLUTCH ASSEMBLY (5). PUT SHIM STOCK (25) EVERY 3 IN. (76 mm) AROUND FORWARD CLUTCH ASSEMBLY (5).
21. PRESS FORWARD CLUTCH ASSEMBLY (5) OUT OF PTO GEAR (26).
22. REMOVE PTO GEAR (26), FORWARD CLUTCH ASSEMBLY (5), INNER RING DRIVER (23), AND OUTER RING SUPPORT (22) FROM PRESS.

### CLEANING

1. USE GENERAL CLEANING METHODS TO CLEAN ALL PARTS (PAGE 2-30).



### WARNING

- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

2. IF THERE IS LEAKAGE AT BOTTOM SIDE OF HOUSING OR IF BALLS DO NOT MOVE FREELY, CLEAN BALL POCKETS (1) WITH DRYCLEANING SOLVENT AND DRY WITH COMPRESSED AIR.
3. APPLY LUBRICATING OIL AROUND AREA OF BALL POCKETS (1).

### INSPECTION

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. TURBINE SHAFT IS PRESSED IN FORWARD CLUTCH HOUSING AND SHOULD BE TIGHT. REPLACE FORWARD CLUTCH HOUSING IF THERE IS ANY UP AND DOWN MOVEMENT.
3. REPLACE ALL 20 PISTON RELEASE SPRINGS IF ANY 3 SPRINGS DO NOT MEET FOLLOWING LOAD-HEIGHT REQUIREMENTS:

LENGTH WITHOUT LOAD: 1.2 IN. (31.8 mm).

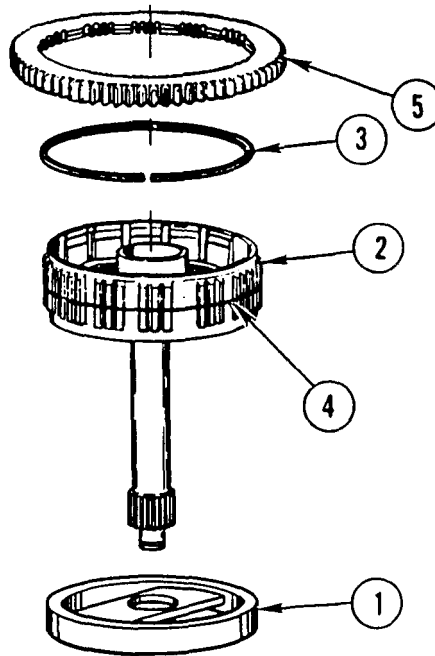
LENGTH UNDER LOAD: 0.88 IN. (22.4 mm) WITH LOAD OF 17.9 -18.9 LB (8.13-8.58 kg).

### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)

### ASSEMBLY



#### NOTE

- Perform steps 1 thru 8 if PTO gear was removed.
- Coat all parts with lubricating oil before installing.

1. PLACE PILOT RING (1) IN PRESS.
2. INSTALL FORWARD CLUTCH ASSEMBLY (2) ON PILOT RING (1).
3. INSTALL RETAINING RING (3) IN GROOVE (4) ON OUTSIDE OF FORWARD CLUTCH ASSEMBLY (2).

#### WARNING

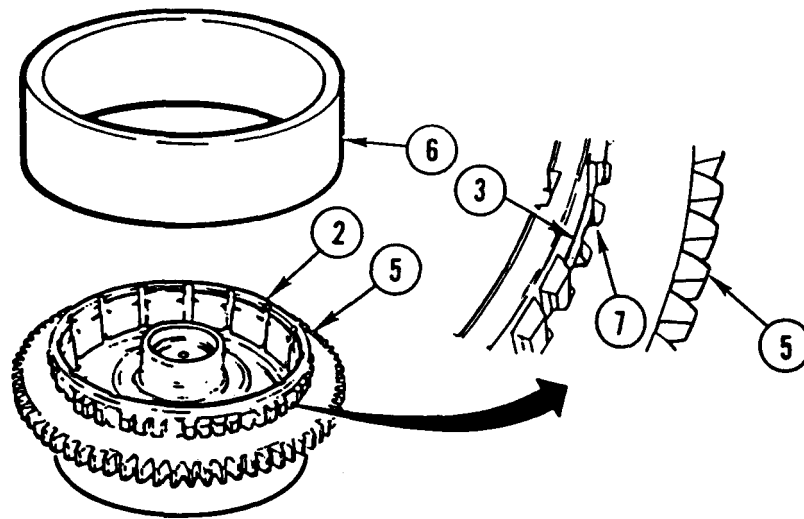
Hot PTO gear can cause burns. Wear heat-resistant gloves.

4. HEAT NEW PTO GEAR (5) IN OVEN OR OIL BATH TO 350°-375° F (177°-191° C).

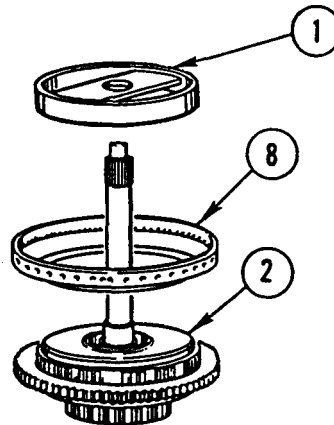
#### NOTE

Install PTO gear with beveled side of inner teeth down.

5. CAREFULLY PLACE PTO GEAR (5) ON FORWARD CLUTCH ASSEMBLY (2).

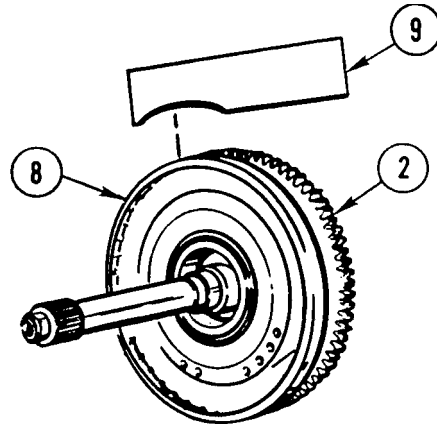


6. INSTALL OUTER RING SUPPORT (6) ON FORWARD CLUTCH ASSEMBLY (2).
7. PRESS PTO GEAR (5) ON FORWARD CLUTCH ASSEMBLY (2) UNTIL RETAINING RING (3) EXPANDS IN GROOVE (7) INSIDE PTO GEAR (5).

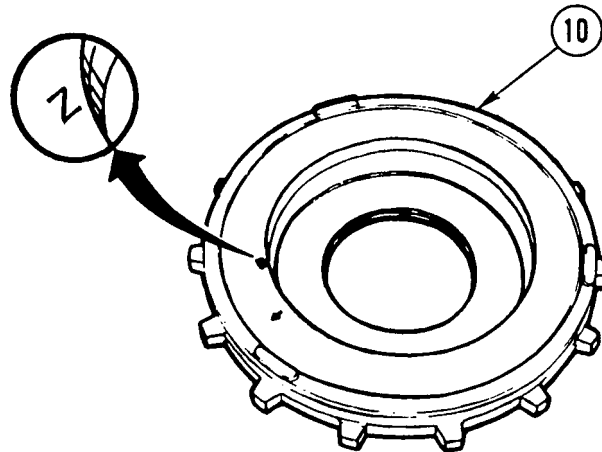


8. REMOVE FORWARD CLUTCH ASSEMBLY (2) AND PILOT RING (1) FROM PRESS.
9. COAT COLLAR OF OIL COLLECTOR RING (8) WITH RETAINING COMPOUND AND PLACE ON FORWARD CLUTCH ASSEMBLY (2).
10. INSTALL PILOT RING (1) ON OIL COLLECTOR RING (8) AND INSTALL OIL COLLECTOR RING (8).
11. REMOVE PILOT RING (1).

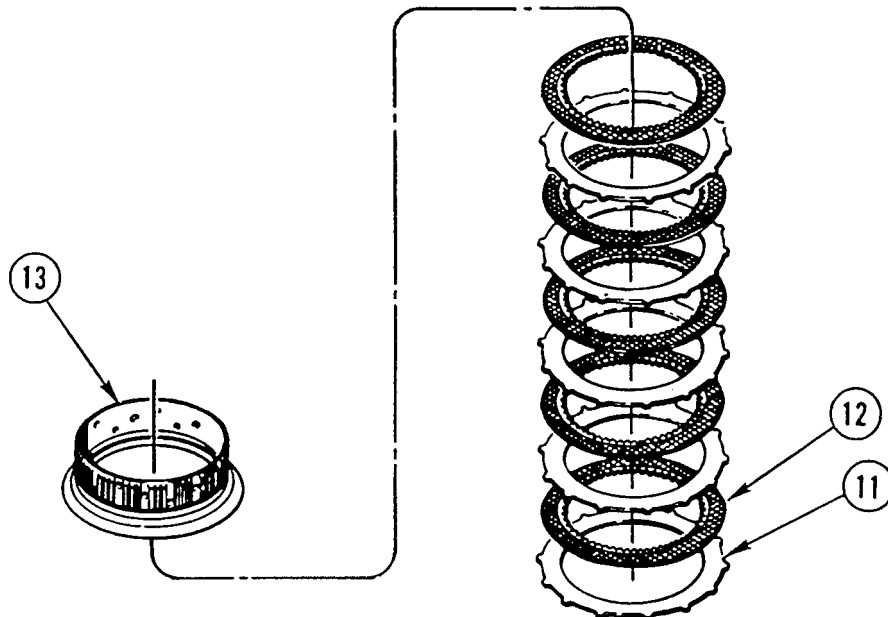
## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



12. USING STAKER (9), BEND EDGE OF OIL COLLECTOR RING (8) IN GROOVE IN FORWARD CLUTCH ASSEMBLY (2) WHILE SUPPORTING FORWARD CLUTCH ASSEMBLY (2) ON EDGE. MAKE SURE OIL COLLECTOR RING (8) DOES NOT TOUCH WORK SURFACE.

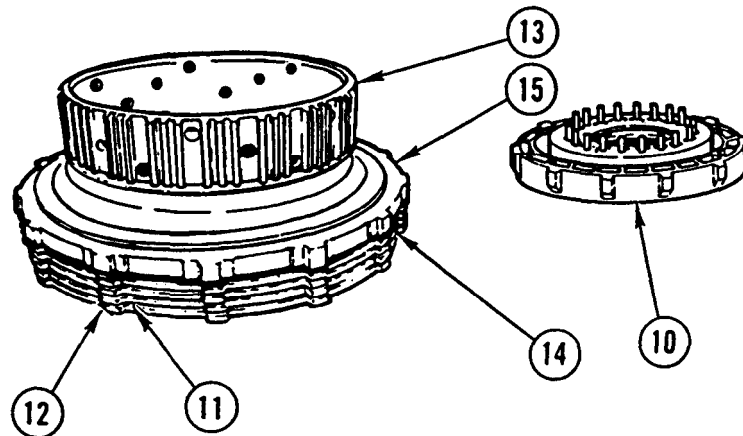


13. LOOK AT BOTTOM OF FORWARD CLUTCH PISTON (10) AND NOTE WHETHER LABELED Z, Y, OR X.





14. STACK 10 CLUTCH PLATES (11 AND 12) ON FLAT SURFACE OF PRESS STARTING WITH STEEL PLATE (11) AND ALTERNATING WITH FRICTION PLATE (12).
15. PLACE FOURTH CLUTCH DRIVING HUB (13) ON CLUTCH PLATES (11 AND 12).

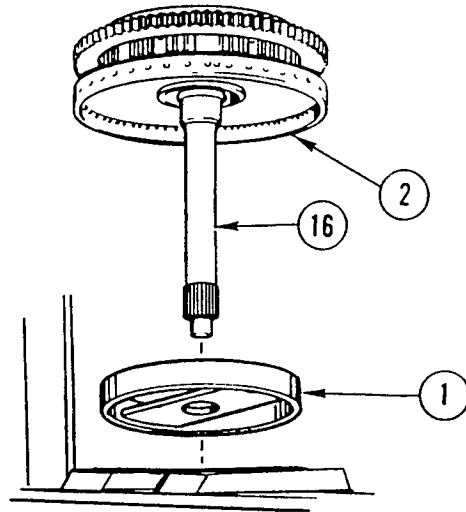


**NOTE**

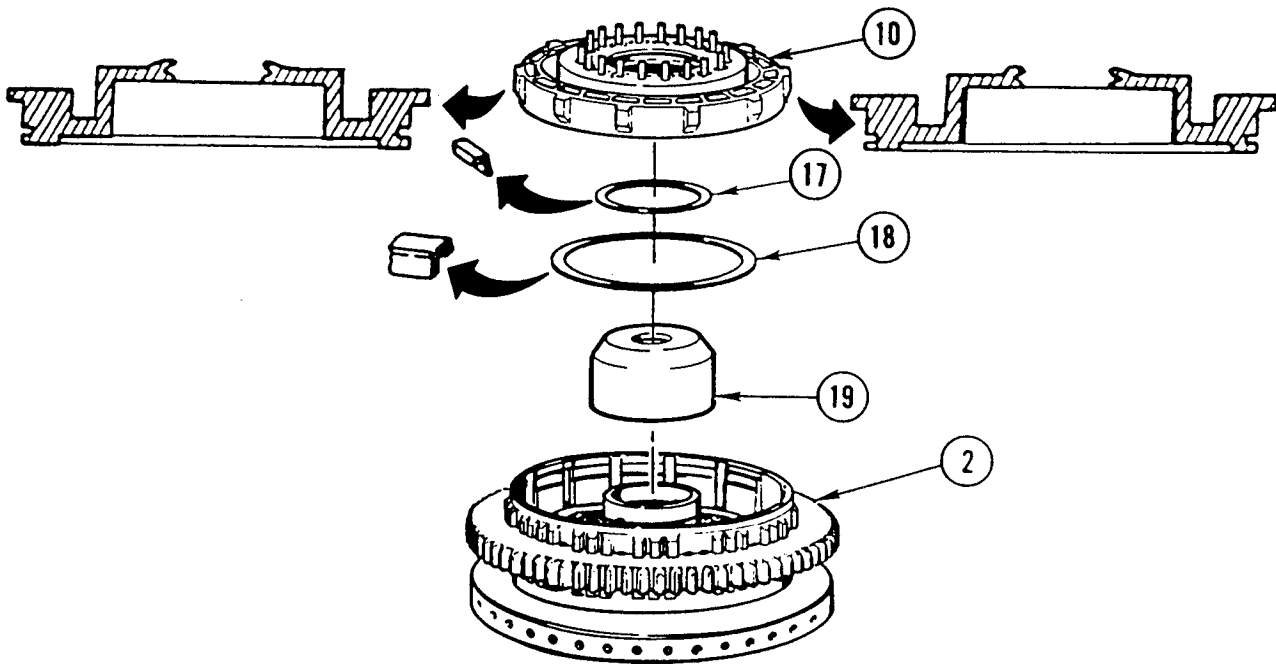
Apply pressure to clutch pack to steady clutch pack.

16. PRESS EVENLY ON FOURTH CLUTCH DRIVING HUB (13) WITH 100 PSI (689.5 kPa).
17. MEASURE DISTANCE FROM BASE OF CLUTCH PACK (14) TO MACHINED SURFACE (15) OF FOURTH CLUTCH DRIVING HUB (13) TO DETERMINE CLUTCH PACK THICKNESS.
18. IF FORWARD CLUTCH PISTON (10) IS Z PISTON, CLUTCH PACK THICKNESS MUST BE 1.415-1.442 IN. (35.94-36.63 mm). IF FORWARD CLUTCH PISTON (10) IS Y PISTON, CLUTCH PACK THICKNESS MUST BE 1.388-1.414 IN. (35.26-35.92 mm). IF FORWARD CLUTCH PISTON (10) IS X PISTON, CLUTCH PACK THICKNESS MUST BE 1.361-1.387 IN. (34.57-35.23 mm). REPLACE CLUTCH PLATE(S) (11 AND 12) AS NEEDED TO ENSURE PROPER CLUTCH PACK THICKNESS.
19. REMOVE CLUTCH PACK (14) AND FOURTH CLUTCH DRIVING HUB (13) FROM PRESS.

## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



20. INSTALL FORWARD CLUTCH ASSEMBLY (2) WITH TURBINE SHAFT (16) DOWN THRU PILOT RING (1) AND IN HYDRAULIC PRESS.



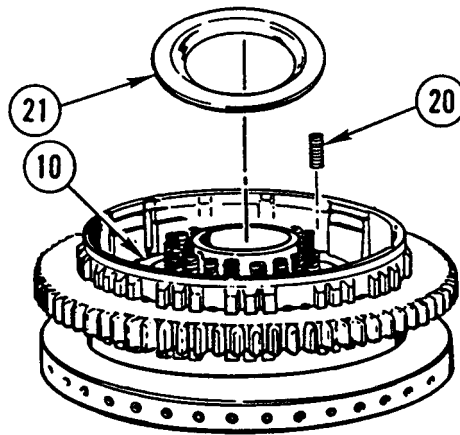
21. APPLY LUBRICATING OIL TO TWO NEW SEAL RINGS (17 AND 18).

### CAUTION

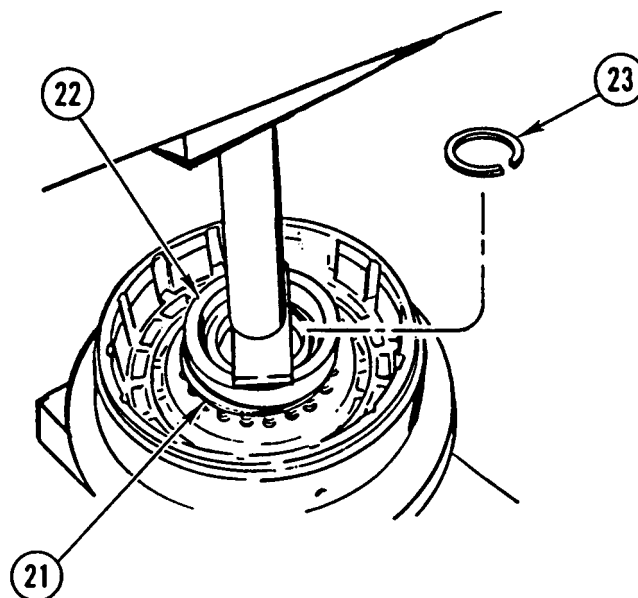
Make sure seal rings are positioned with lips down before installing to prevent damage to equipment.

22. INSTALL SMALL SEAL RING (17) AND LARGE SEAL RING (18) ON FORWARD CLUTCH PISTON (10).

23. INSTALL INNER SEAL PROTECTOR (19) OVER INNER HUB OF FORWARD CLUTCH ASSEMBLY (2).
24. INSTALL FORWARD CLUTCH PISTON (10) OVER INNER SEAL PROTECTOR (19). CAREFULLY WORK PISTON COMPLETELY DOWN UNTIL SEATED.
25. REMOVE INNER SEAL PROTECTOR (19).

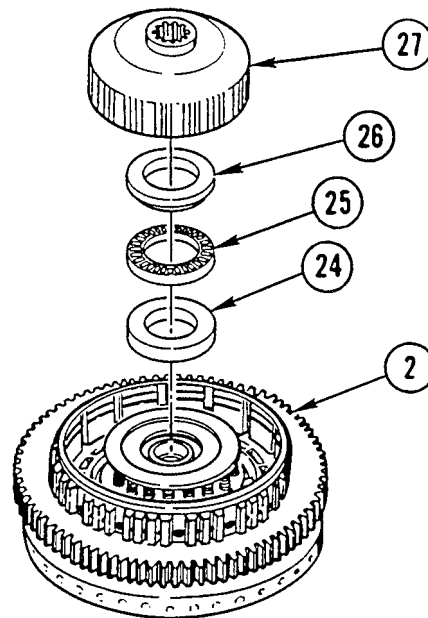


26. INSTALL 20 PISTON RELEASE SPRINGS (20) ON FORWARD CLUTCH PISTON (10).
27. INSTALL SPRING RETAINER (21) ON PISTON RELEASE SPRINGS (20).



28. COMPRESS SPRING RETAINER (21) WITH CLUTCH SPRING COMPRESSOR (22) AND PRESS. INSTALL RETAINING RING (23).
29. RELEASE PRESSURE FROM SPRING RETAINER (21) AND REMOVE CLUTCH SPRING COMPRESSOR (22).

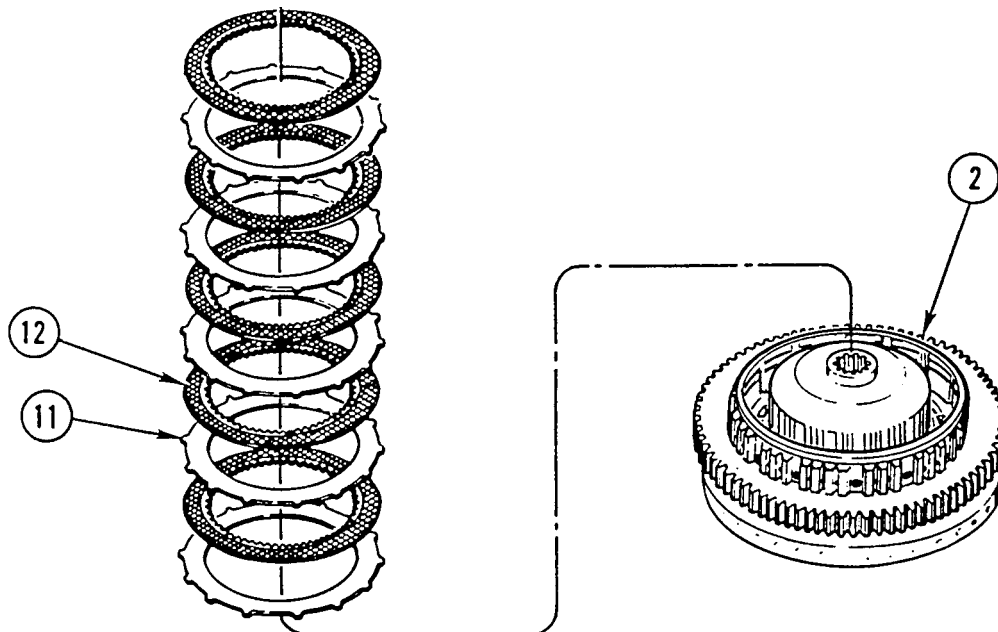
## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



### NOTE

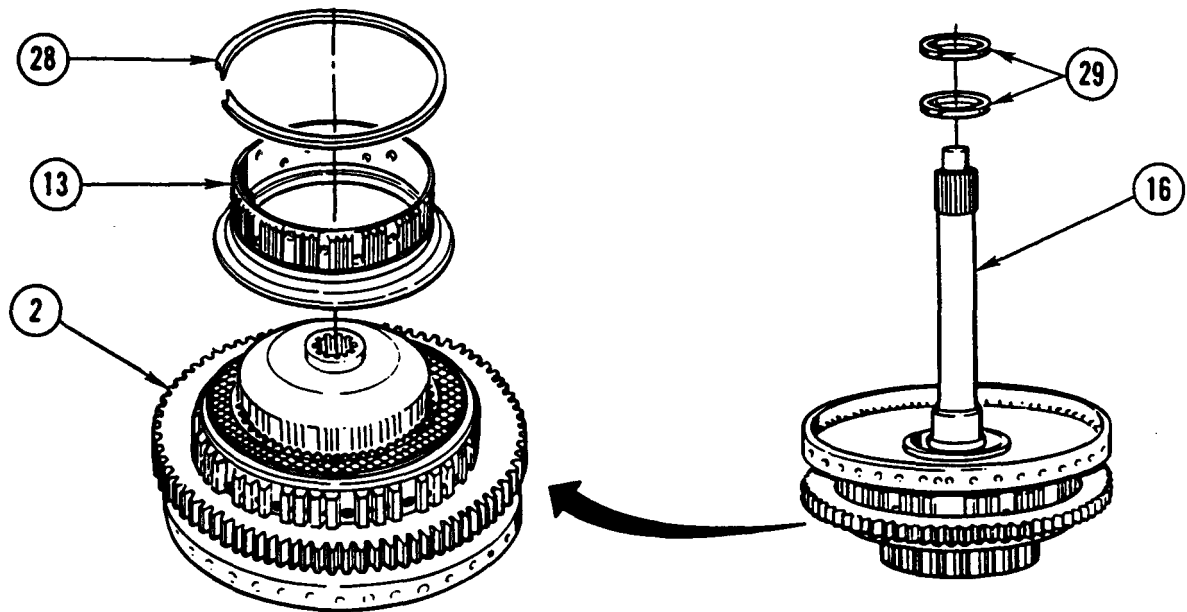
Install bearing race with cupped side down.

30. INSTALL THRUST BEARING RACE (24) ON SMALL HUB OF FORWARD CLUTCH ASSEMBLY (2).
31. INSTALL THRUST BEARING (25) ON THRUST BEARING RACE (24).
32. COAT BEARING RACE (26) WITH LUBRICATING OIL AND INSTALL.
33. INSTALL FORWARD CLUTCH DRIVING HUB (27) ON FORWARD CLUTCH ASSEMBLY (2).



34. SOAK FIVE FRICTION PLATES (12) IN CLEAN LUBRICATING OIL FOR 2 MINUTES.

35. INSTALL 10 CLUTCH PLATES (11 AND 12) ON FORWARD CLUTCH ASSEMBLY (2) STARTING WITH STEEL PLATE (11) AND ALTERNATING WITH FRICTION PLATE (12).

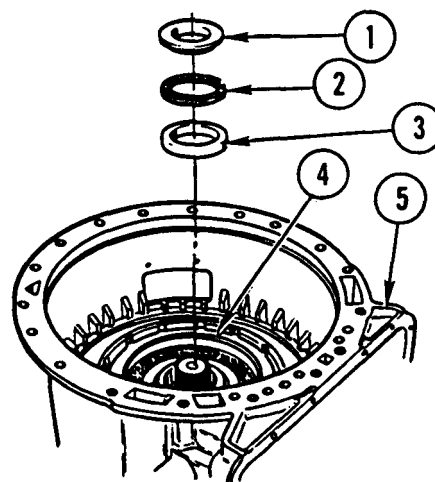


36. INSTALL FOURTH CLUTCH DRIVING HUB (13) ON FORWARD CLUTCH ASSEMBLY (2).

37. INSTALL LARGE INNER RETAINING RING (28) ON FOURTH CLUTCH DRIVING HUB (13).

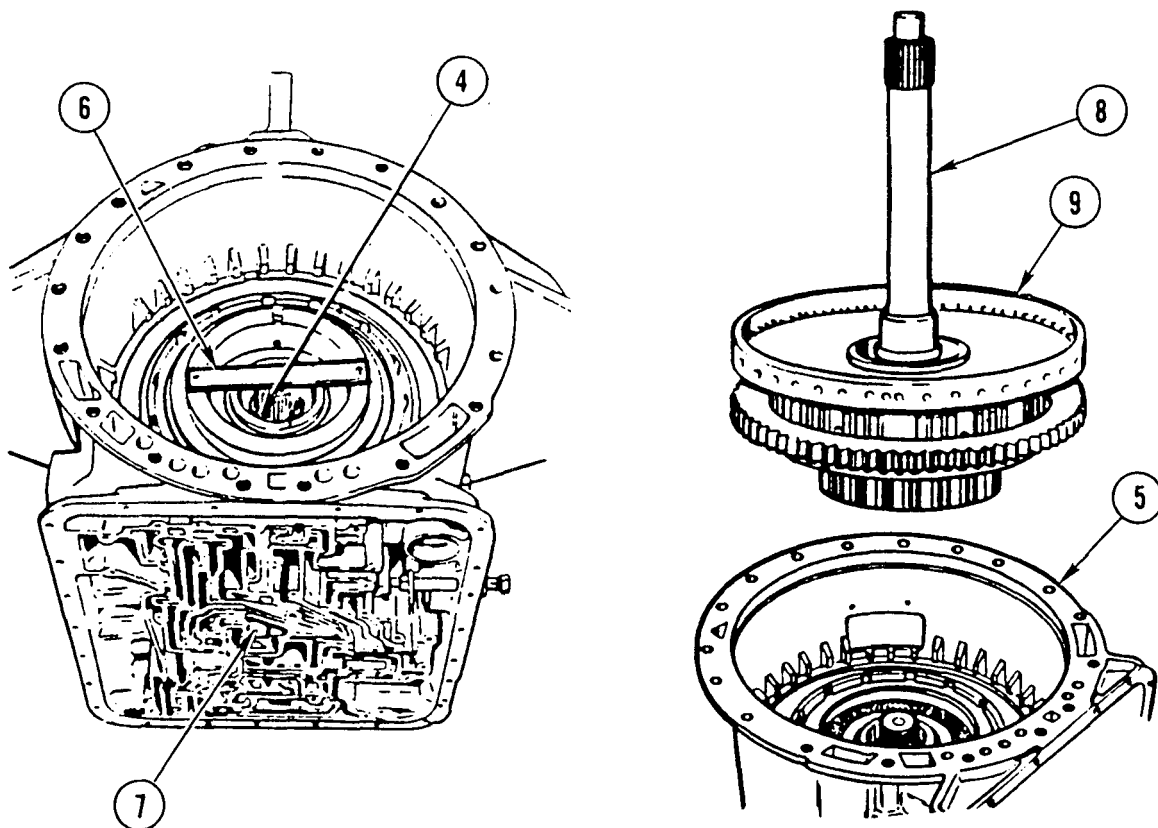
38. INSTALL TWO NEW SEAL RINGS (29) ON TURBINE SHAFT (16).

### INSTALLATION



1. INSTALL OUTER RACE (1), ROLLER BEARING (2), AND INNER RACE (3) ON FOURTH CLUTCH ASSEMBLY (4) IN TRANSMISSION HOUSING (5).

## FORWARD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



2. INSTALL FOURTH CLUTCH ALINING TOOL (6) ON FOURTH CLUTCH ASSEMBLY (4).

### WARNING

To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

3. APPLY AIR PRESSURE TO PORT (7) TO LOCK UP FOURTH CLUTCH PLATES.
4. HOLD AIR PRESSURE IN FOURTH CLUTCH ASSEMBLY (4) AND REMOVE FOURTH CLUTCH ALINING TOOL (6).
5. CONTINUE TO APPLY AIR PRESSURE IN FOURTH CLUTCH ASSEMBLY (4) WHILE HOLDING TURBINE SHAFT (8) AND INSTALL FORWARD CLUTCH ASSEMBLY (9) IN TRANSMISSION HOUSING (5).
6. STOP APPLYING AIR PRESSURE WHEN FORWARD CLUTCH ASSEMBLY (9) IS FULLY SEATED IN TRANSMISSION HOUSING (5).

### NOTE

Follow-on Maintenance:  
Install torque converter housing and front support (page 14-35).

## Section VII. LOCKUP CUTOFF CONTROL VALVE REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the lockup cutoff control valve.

Repair of the lockup cutoff control valve is general support maintenance.

---

### LOCKUP CUTOFF CONTROL VALVE REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Oil, Lubricating	Appendix B, Item 37
Tag, Identification	Appendix B, Item 55
Cloth, Abrasive	Appendix B, Item 10

**Equipment Condition:**

**Reference**

Page 3-262

**Condition Description**

Lockup Cutoff Control Valve Removed

## **LOCKUP CUTOFF CONTROL VALVE REPAIR (CONT)**

### **DISASSEMBLY**

#### **NOTE**

Tag all parts prior to removal to aid in installation.

1. REMOVE RETAINER PIN (1) FROM VALVE BODY (2).
2. REMOVE VALVE PLUG (3) AND SECOND AND THIRD CLUTCH LOCKUP CUTOFF VALVE (4) FROM BORE (5).
3. REMOVE RETAINER PIN (6) FROM VALVE BODY (2).
4. REMOVE VALVE PLUG (7) AND FIRST AND SECOND CLUTCH LOCKUP CUTOFF VALVE (8) FROM BORE (9).
5. REMOVE RETAINER PIN (10) FROM VALVE BODY (2).
6. REMOVE VALVE PLUG (11) AND THIRD AND FOURTH CLUTCH LOCKUP CUTOFF VALVE (12) FROM BORE (13).

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

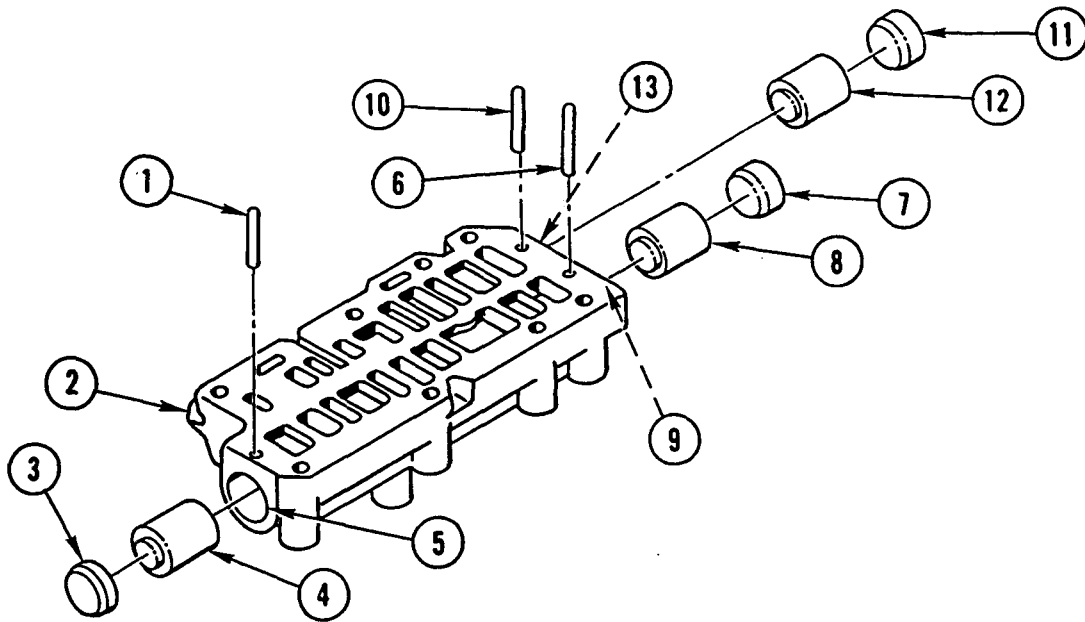
### **INSPECTION**

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. INSPECT VALVE BODY AND VALVES FOR NICKS, BURRS, AND SCRATCHES. REMOVE DEFECTS WITH CROCUS CLOTH. IF SCRATCHES ARE DEEP OR PART IS CRACKED, REPLACE PART.

### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).





## ASSEMBLY

### NOTE

Install each valve in same bore from which valve was removed.

APPLY LUBRICATING OIL TO ALL PARTS AND TO VALVE BODY (2).

INSTALL THIRD AND FOURTH CLUTCH LOCKUP CUTOFF VALVE (12) AND VALVE PLUG (11) IN BORE (13).

### CAUTION

Retainer pins must not be driven in beyond machined surface of valve body to prevent damage to equipment.

3. INSTALL RETAINER PIN (10) IN VALVE BODY (2).
4. INSTALL FIRST AND SECOND CLUTCH LOCKUP CUTOFF VALVE (8) AND VALVE PLUG (7) IN BORE (9).
5. INSTALL RETAINER PIN (6) IN VALVE BODY (2).
6. INSTALL SECOND AND THIRD CLUTCH LOCKUP CUTOFF VALVE (4) AND VALVE PLUG (3) IN BORE (5).
7. INSTALL RETAINER PIN (1) IN VALVE BODY (2).

### NOTE

Follow-on Maintenance:  
Install lockup cutoff control valve (page 3-262).

## Section VIII. CONTROL VALVE REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the control valve.

Replacement and repair of the control valve is general support maintenance.

---

### CONTROL VALVE REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly  
g. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Oil, Lubricating                      Appendix B, Item 37

**Personnel Required:** (2)

#### Equipment Condition:

##### Reference

Page 3-261

Page 3-262

Page 14-2

##### Condition Description

Modulator Valve  
Removed

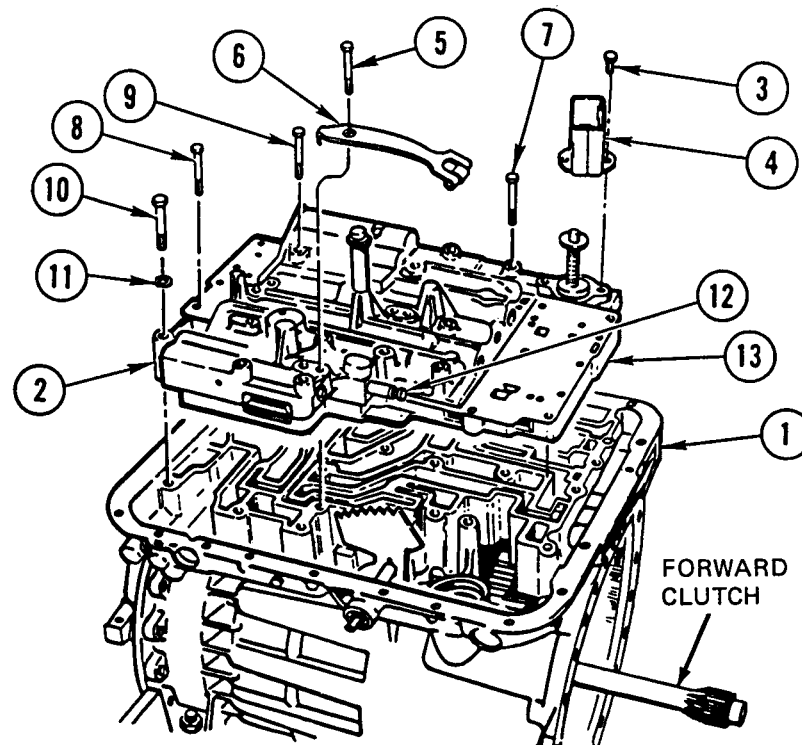
Lockup Cutoff Control  
Valve Removed

Transmission Installed  
on Transmission Stand

#### General Safety Instructions:

##### **WARNING**

Parts are under spring tension.  
Release tension slowly to  
prevent personal injury.

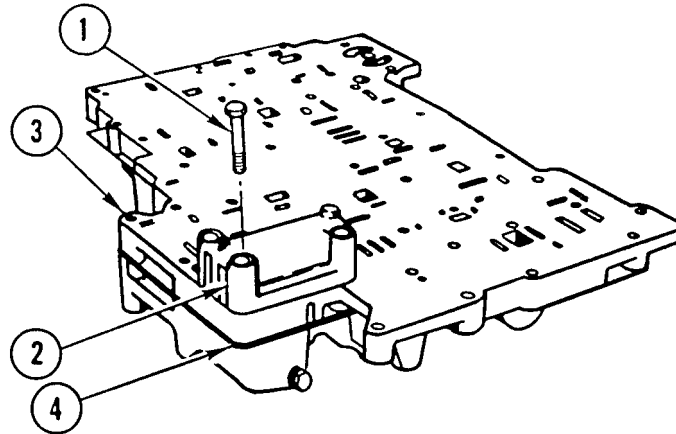
**REMOVAL****CAUTION**

Make sure forward clutch is secured before turning transmission. Clutch could fall and be damaged.

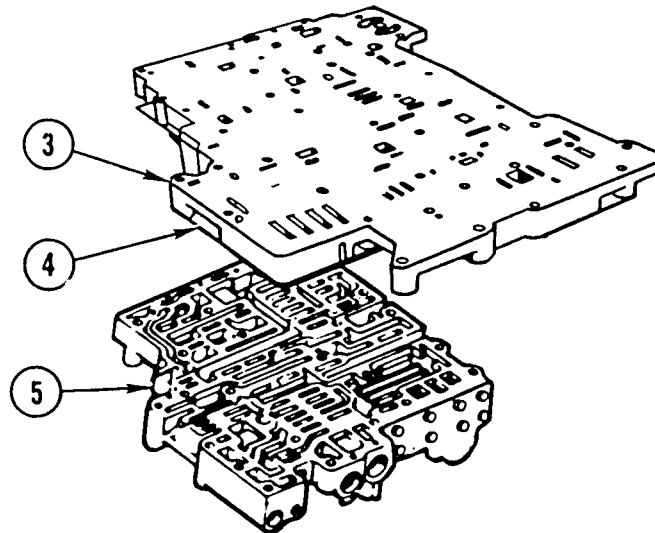
1. TURN TRANSMISSION (1) SO CONTROL VALVE BODY (2) IS UP.
2. REMOVE TWO SCREWS (3) AND OIL BAFFLE (4).
3. REMOVE SCREW (5) AND MANUAL DETENT LEVER (6).
4. REMOVE 15 SCREWS (7), 7 SCREWS (8), 3 SCREWS (9), 2 SCREWS (10), AND 2 WASHERS (11).
5. WHILE HOLDING SELECTOR VALVE (12), REMOVE CONTROL VALVE BODY (2) AND OIL TRANSFER PLATE (13) FROM TRANSMISSION HOUSING (1).
6. REMOVE SELECTOR VALVE (12) FROM CONTROL VALVE BODY (2).

## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)

### DISASSEMBLY



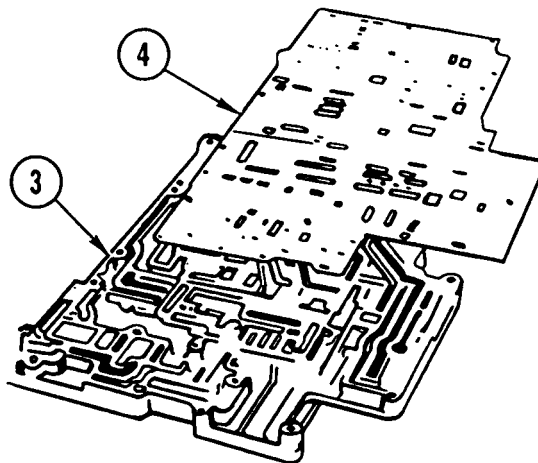
1. REMOVE THREE SCREWS (1) FROM MODULATOR VALVE BODY (2).
2. REMOVE MODULATOR VALVE BODY (2) WHILE HOLDING OIL TRANSFER PLATE (3) AND SEPARATOR PLATE (4) TOGETHER.



#### NOTE

Turn oil transfer plate and separator plate over before placing on work surface.

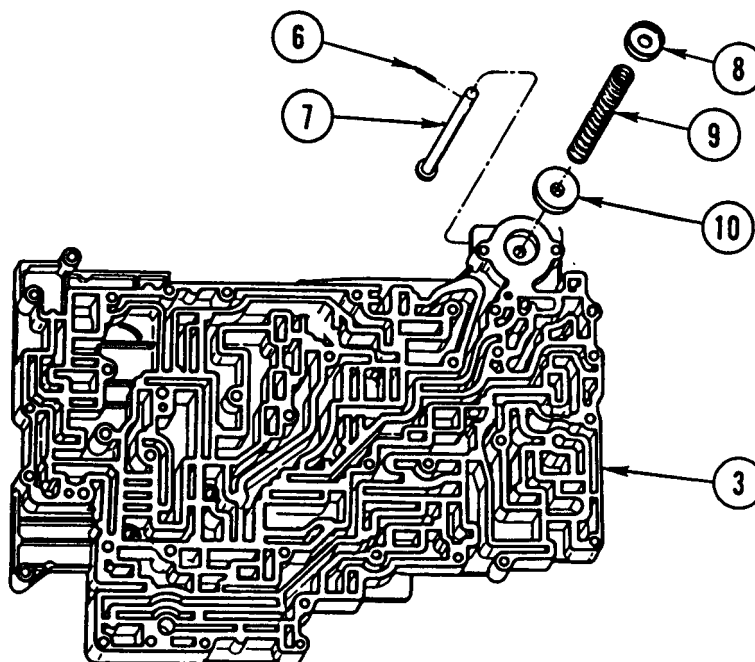
3. HOLD OIL TRANSFER PLATE (3) AND SEPARATOR PLATE (4) TOGETHER AND REMOVE FROM CONTROL VALVE BODY (5). PLACE ON WORK SURFACE.



**NOTE**

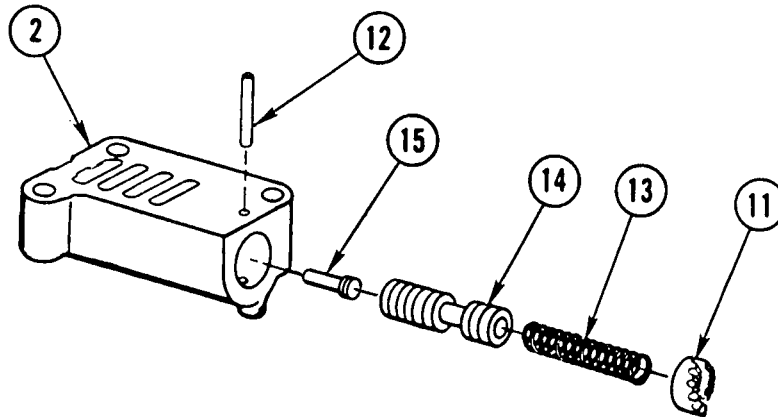
If ball bearings are installed, remove and discard. They are not required for assembly.

4. LIFT SEPARATOR PLATE (4) FROM OIL TRANSFER PLATE (3).



5. REMOVE RETAINER PIN (6) FROM CHECK VALVE PIN (7) WHILE PRESSING DOWN ON CUP WASHER (8).
6. REMOVE CUP WASHER (8), SPRING (9), LUBRICATION CHECK VALVE (10), AND CHECK VALVE PIN (7) FROM OIL TRANSFER PLATE (3).

## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



### WARNING

Parts are under spring tension. Release tension slowly to prevent personal injury.

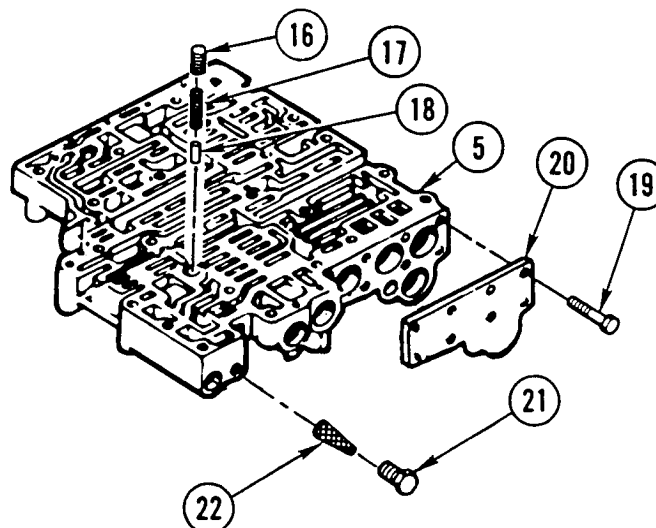
### CAUTION

Do not use magnets to remove valve bodies to prevent damage to equipment. Magnetized valve bodies may not work properly.

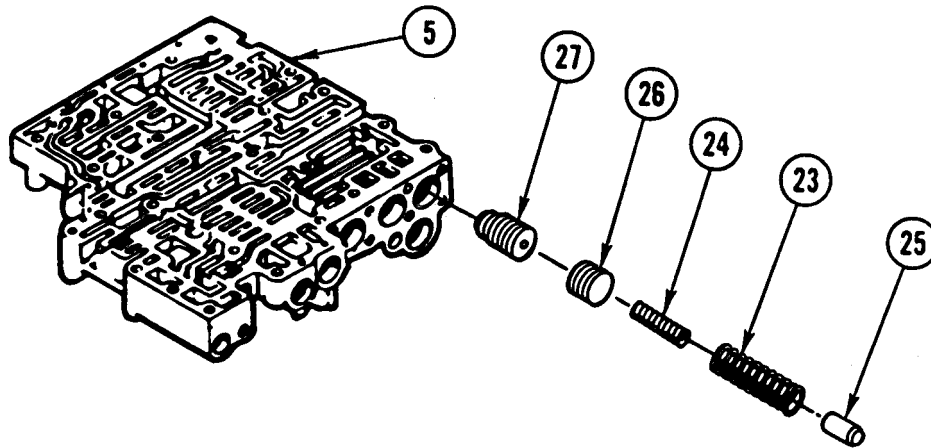
### NOTE

Record each notch on adjusting ring that touches retainer pin.

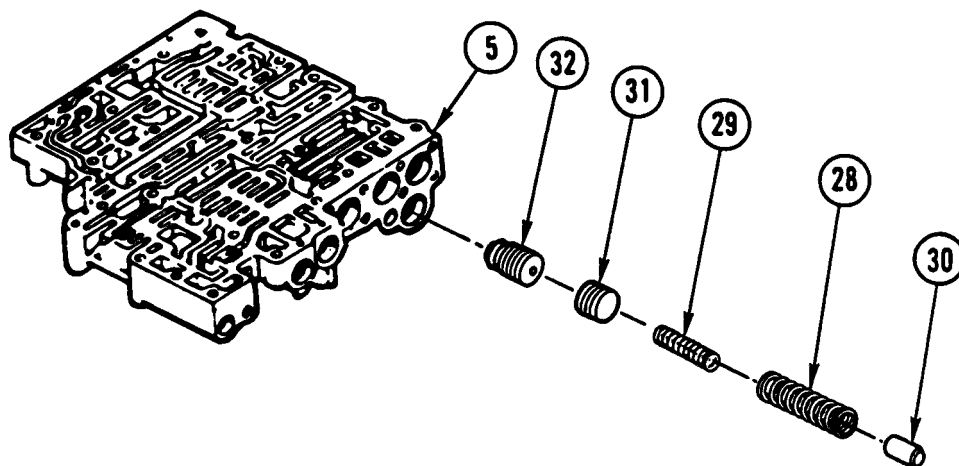
7. PRESS ADJUSTING RING (11) INWARD AND REMOVE RETAINER PIN (12) FROM MODULATOR VALVE BODY (2).
8. REMOVE ADJUSTING RING (11), SPRING (13), VALVE (14), AND PIN (15) FROM MODULATOR VALVE BODY (2).



9. REMOVE PRIORITY VALVE (16), SPRING (17), AND VALVE STOP (18) FROM CONTROL VALVE BODY (5).
10. REMOVE SIX SCREWS (19).
11. REMOVE LAST TWO SCREWS (19) EVENLY WHILE HOLDING DOWN TRIMMER VALVE COVER (20). REMOVE TRIMMER VALVE COVER (20).
12. REMOVE PLUG (21) AND GOVERNOR SCREEN ASSEMBLY (22) FROM CONTROL VALVE BODY (5).

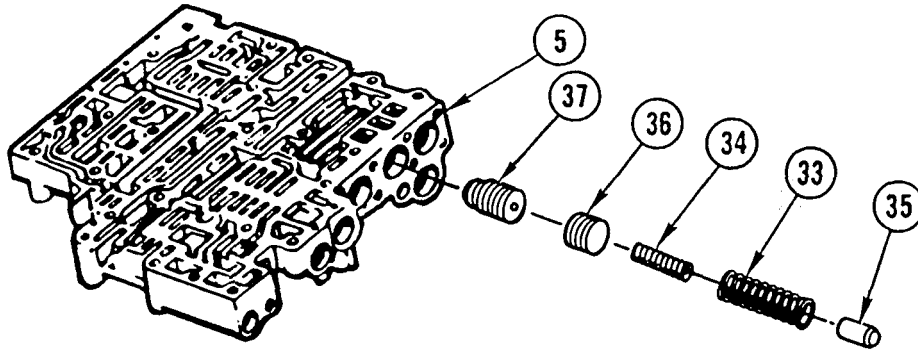


13. REMOVE TWO SPRINGS (23 AND 24), VALVE STOP (25), TRIMMER PLUG (26), AND THIRD CLUTCH TRIMMER VALVE (27) FROM CONTROL VALVE BODY (5).

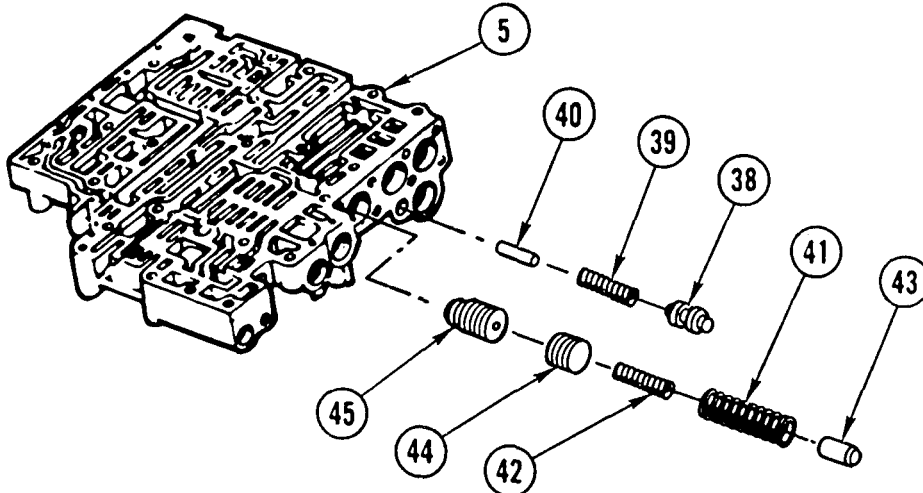


14. REMOVE TWO SPRINGS (28 AND 29), VALVE STOP (30), PLUG (31), AND FIRST CLUTCH TRIMMER VALVE (32) FROM CONTROL VALVE BODY (5).

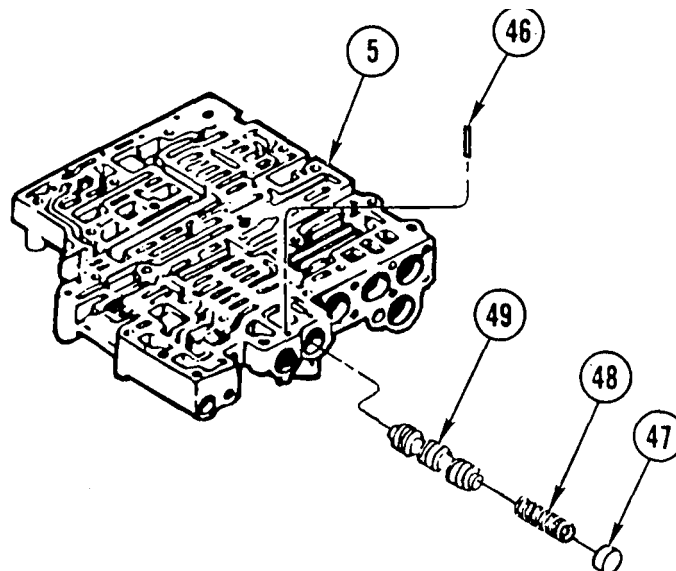
## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



15. REMOVE TWO SPRINGS (33 AND 34), VALVE STOP (35), PLUG (36), AND SECOND CLUTCH TRIMMER VALVE (37) FROM CONTROL VALVE BODY (5).

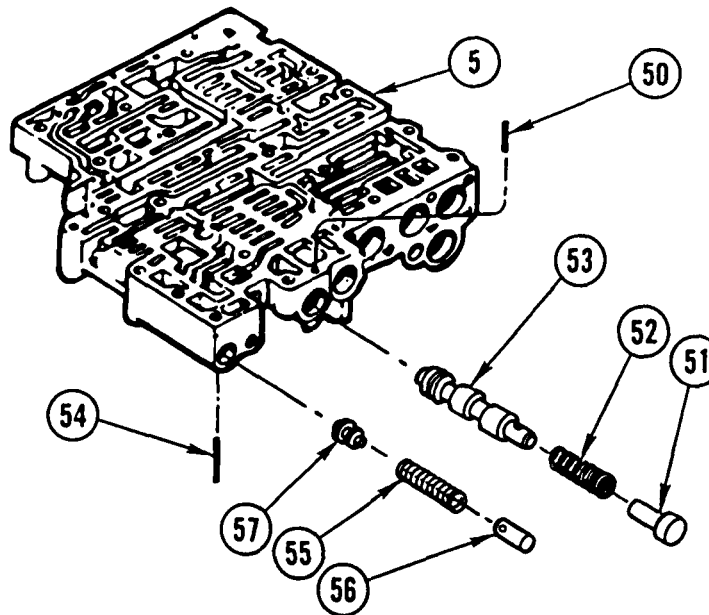


16. REMOVE ACCUMULATOR VALVE (38), SPRING (39), AND VALVE STOP (40).
17. REMOVE TWO SPRINGS (41 AND 42), VALVE STOP (43), PLUG (44), AND FOURTH CLUTCH TRIMMER VALVE (45) FROM CONTROL VALVE BODY (5).

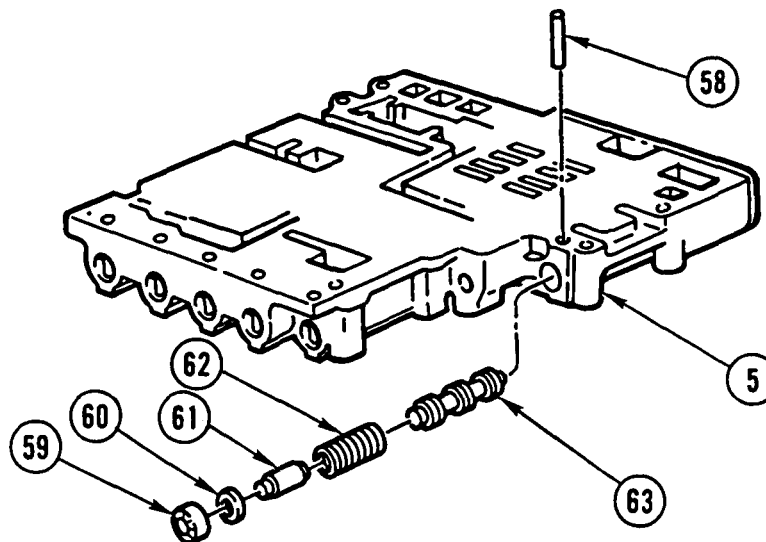




18. REMOVE RETAINER PIN (46), VALVE STOP (47), SPRING (48), AND 2-3 RELAY VALVE (49) FROM CONTROL VALVE BODY (5).

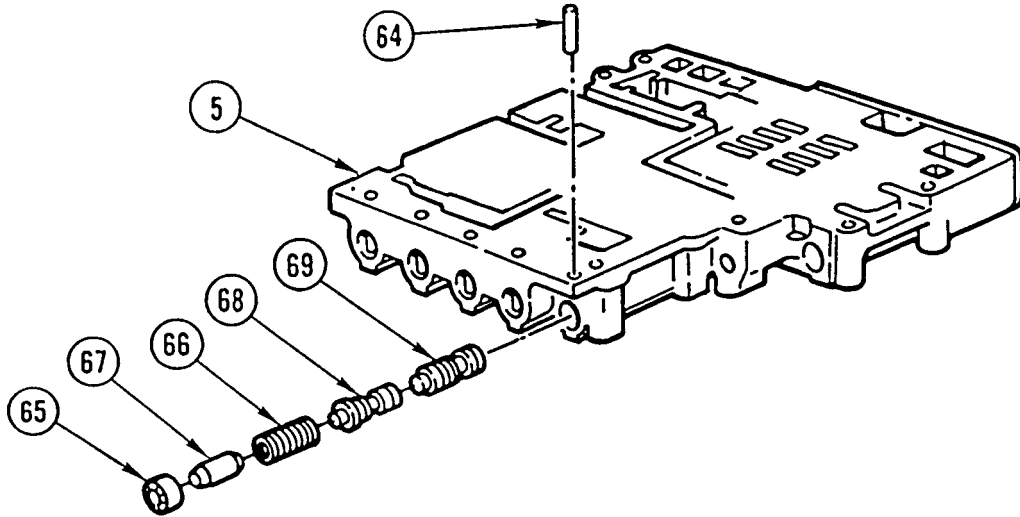


19. REMOVE RETAINER PIN (50), SPRING SPACER (51), SPRING (52), AND 1-2 RELAY VALVE (53).
20. REMOVE RETAINER PIN (54), SPRING (55), VALVE STOP (56), AND ACCUMULATOR VALVE (57) FROM CONTROL VALVE BODY (5).

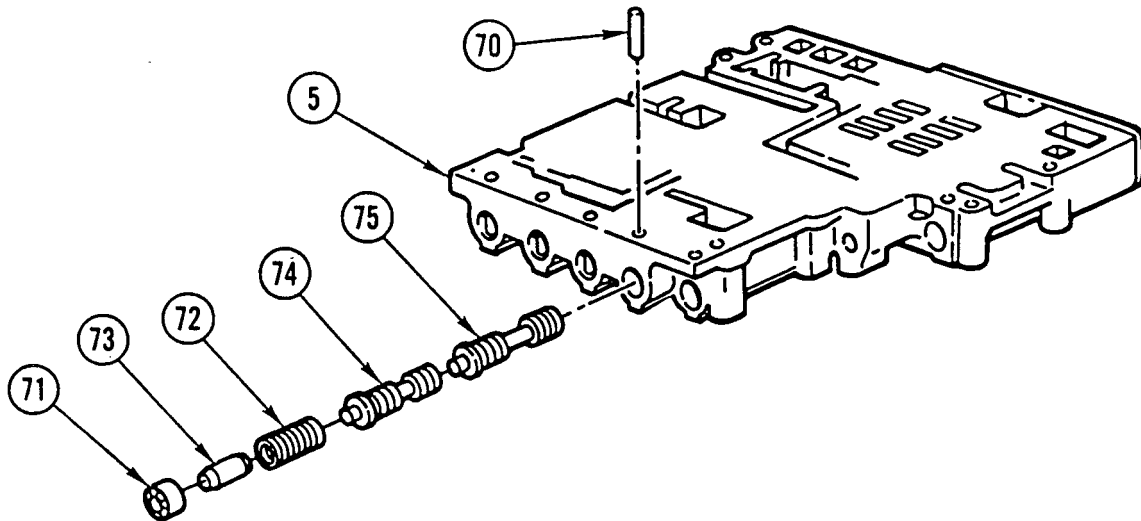


21. REMOVE RETAINER PIN (58), ADJUSTING RING (59), WASHER (60), VALVE STOP (61), VALVE SPRING (62), AND REGULATOR VALVE (63) FROM CONTROL VALVE BODY (5).

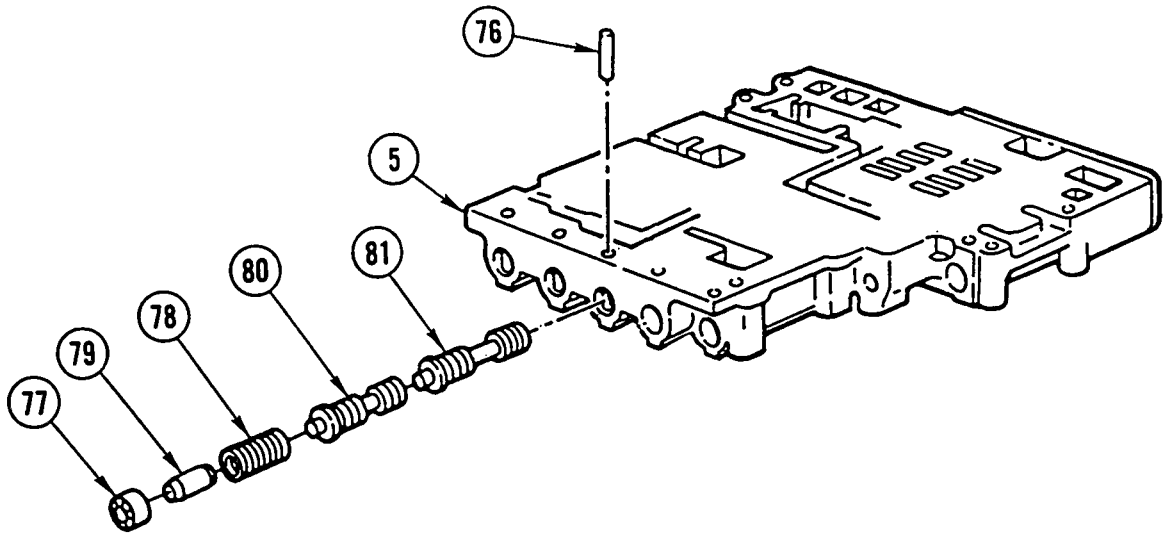
## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



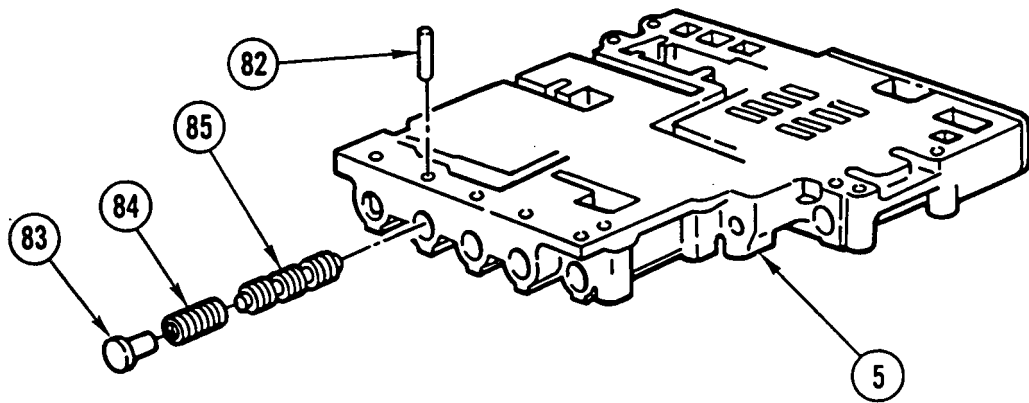
22. REMOVE RETAINER PIN (64), ADJUSTING RING (65), VALVE SPRING (66), VALVE STOP (67), 1-2 MODULATOR VALVE (68), AND 1-2 SHIFT VALVE (69) FROM CONTROL VALVE BODY (5).



23. REMOVE RETAINER PIN (70), ADJUSTING RING (71), VALVE SPRING (72), VALVE STOP (73), 2-3 MODULATOR VALVE (74), AND 2-3 SHIFT VALVE (75) FROM CONTROL VALVE BODY (5).

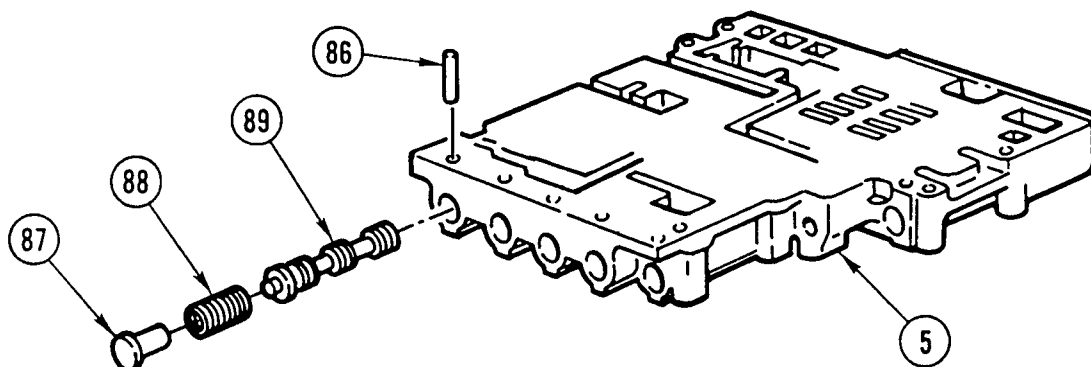


24. REMOVE RETAINER PIN (76), ADJUSTING RING (77), VALVE SPRING (78), VALVE STOP (79), 3-4 MODULATOR VALVE (80), AND 3-4 SHIFT VALVE (81) FROM CONTROL VALVE BODY (5).



25. REMOVE RETAINER PIN (82), VALVE STOP (83), VALVE SPRING (84), AND 3-4 RELAY VALVE (85) FROM CONTROL VALVE BODY (5).

## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



26. REMOVE RETAINER PIN (86), VALVE STOP (87), VALVE SPRING (88), AND TRIMMER REGULATOR VALVE (89) FROM CONTROL VALVE BODY (5).

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

1. INSPECT ALL VALVES, VALVE STOPS, AND PLUGS FOR DAMAGE. REPLACE DAMAGED PARTS.
2. INSPECT BORES AND SURFACES OF CONTROL VALVE BODY FOR DAMAGE.
3. REPLACE SPRINGS THAT DO NOT MEET LOAD-LENGTH SPECIFICATIONS LISTED IN FOLLOWING TABLE.

**Spring Load-Length Specifications**

Spring	Length Without Load in. (mm)	Length Under Load in. (mm)	Load lb (kg)	Text Reference Step No.	Reference Callout No.
Lubrication Check Valve	2.56 (65.00)	1.97 (50.00)	35.72-39.48 (16.2-17.9)	(6)	(9)
Modulator Valve	1.27 (32.30)	0.80 (20.30)	11.9 -13.1 (5.40-5.95)	(8)	(13)
Priority Valve	1.17 (29.70)	0.94 (23.90)	8.15-9.25 (3.7-4.2)	(9)	(17)
Third Clutch Trimmer Valve	1.80 (45.70)	1.10 (27.90)	20.3-24.9 (9.21-11.29)	(13)	(24)
Third Clutch Trimmer Valve	2.56 (65.00)	1.94 (49.30)	20.0-22.0 (9.07-9.98)	(13)	(24)
First Clutch Trimmer Valve	1.69 (42.90)	1.10 (27.90)	32.6-39.8 (14.80-18.07)	(14)	(28)

## Spring Load-Length Specifications (Cont)

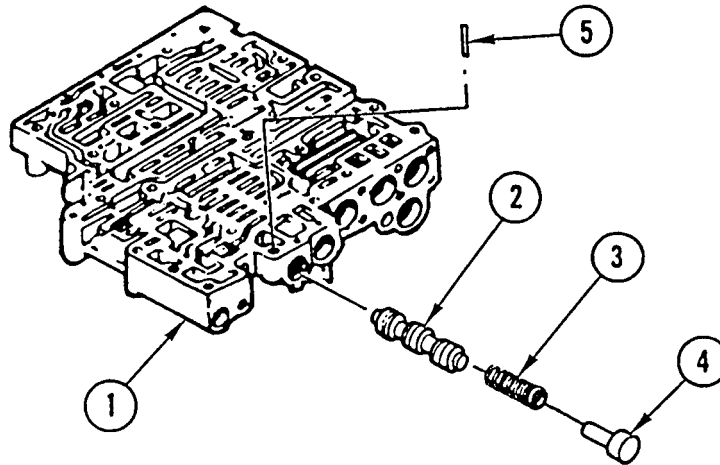
Spring	Length Without Load in. (mm)	Length Under Load in. (mm)	Load lb (kg)	Text Reference Step No.	Reference Callout No.
First Clutch Trimmer Valve	2.98 (75.70)	1.94 (49.30)	6.2-7.4 (2.81-3.36)	(14)	(29)
Second Clutch Trimmer Valve	1.95 (49.50)	1.10 (27.90)	29.0-35.4 (13.15-16.05)	(15)	(34)
Second Clutch Trimmer Valve	2.56 (65.00)	1.94 (49.30)	20.0-22.0 (9.07-9.98)	(15)	(33)
Accumulator Valve	2.77 (70.40)	1.49 (37.90)	11.6-12.8 (5.27-5.81)	(16)	(39)
Fourth Clutch Trimmer Valve	1.69 (42.90)	1.10 (27.90)	32.6-39.8 (14.78-18.05)	(17)	(42)
Fourth Clutch Trimmer Valve	1.95 (49.50)	1.10 (27.90)	22.4-26.4 (10.16-11.97)	(17)	(41)
2-3 Relay Valve	2.18 (55.40)	1.20 (30.50)	16.2-19.8 (7.35-8.99)	(18)	(48)
1-2 Relay Valve	1.52 (38.60)	1.10 (27.90)	7.2-8.8 (3.27-3.00)	(19)	(52)
Governor Accumulator Valve	1.84 (46.70)	<b>0.7</b> (17.80)	9.6-10.6 (4.35-4.81)	(20)	(55)
Regulator Valve	2.01 (51.10)	1.15 (29.20)	6.22-6.48 (2.82-2.94)	(21)	(62)
1-2 Shift Valve	2.07 (52.60)	1.15 (29.20)	5.2-5.8 (2.36-2.63)	(22)	(66)
2-3 Shift Valve	2.51 (63.80)	1.15 (29.20)	10.75-11.25 (4.88-5.11)	(23)	(72)
3-4 Shift Valve	2.51 (63.80)	1.15 (29.20)	10.75-11.25 (4.88-5.11)	(24)	(78)
3-4 Shift Valve	2.18 (55.40)	1.20 (30.50)	16.2-19.8 (7.35-8.99)	(25)	(84)
Trimmer Regulator Valve	1.33 (33.80)	0.86 (21.80)	2.30-2.54 (1.04-1.15)	(26)	(88)

## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)

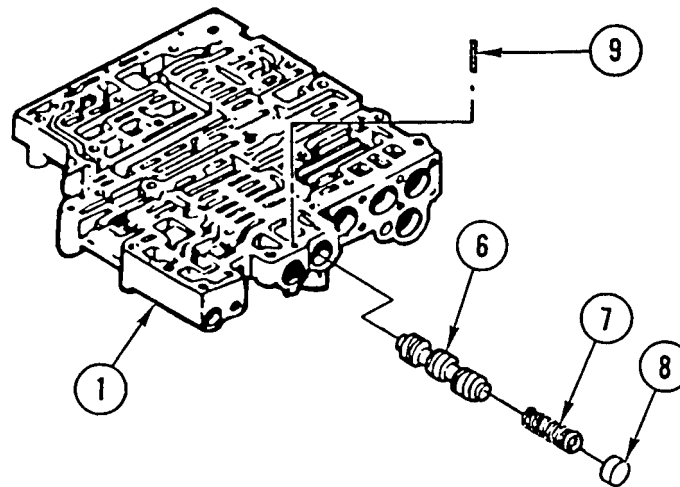
### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

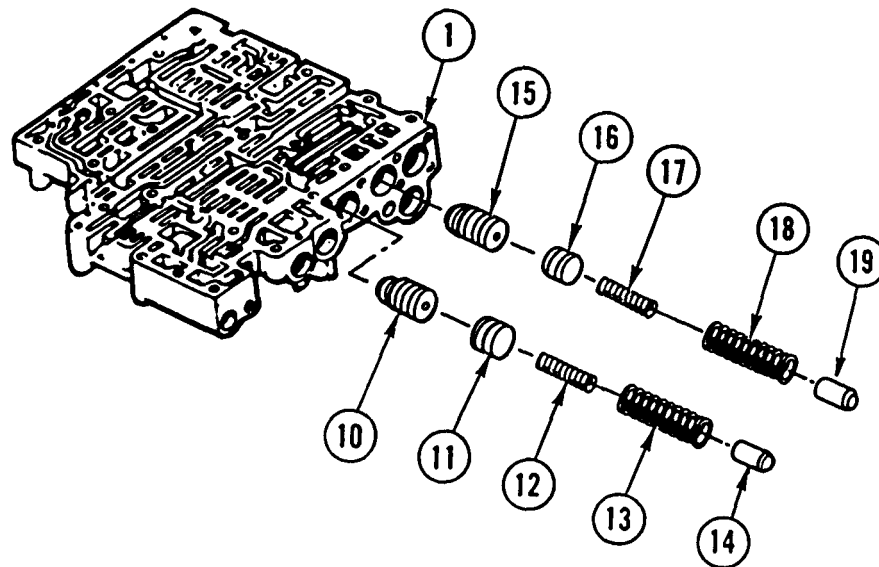
### ASSEMBLY



1. PLACE CONTROL VALVE BODY (1) WITH FLAT SIDE UP.
2. INSTALL 1-2 RELAY VALVE (2), SPRING (3), AND SPRING SPACER (4) IN BORE OF CONTROL VALVE BODY (1).
3. PRESS SPRING SPACER (4) AND INSTALL RETAINER PIN (5) IN CONTROL VALVE BODY (1).



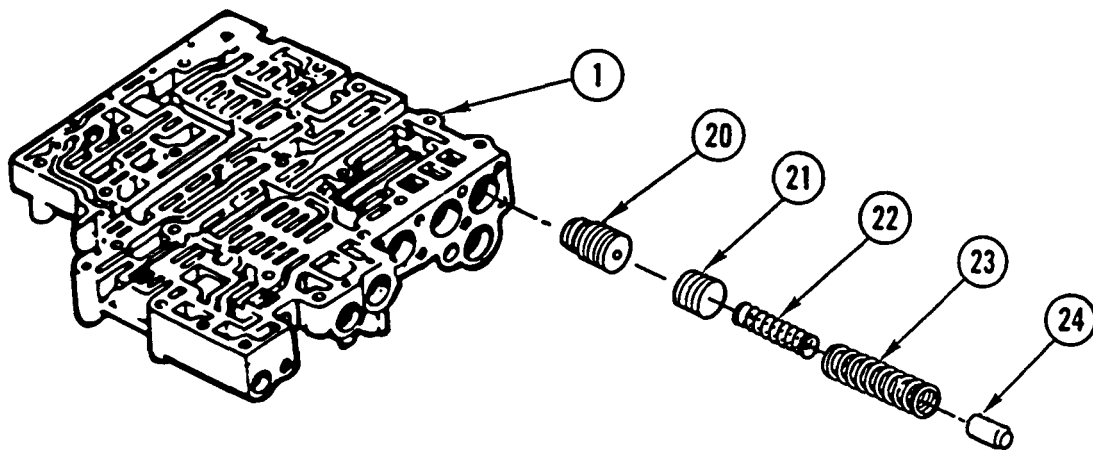
4. INSTALL 2-3 RELAY VALVE (6), SPRING (7), AND VALVE STOP (8) IN CONTROL VALVE BODY (1).
5. PRESS VALVE STOP (3) AND INSTALL RETAINER PIN (9) IN CONTROL VALVE BODY (1).



**NOTE**

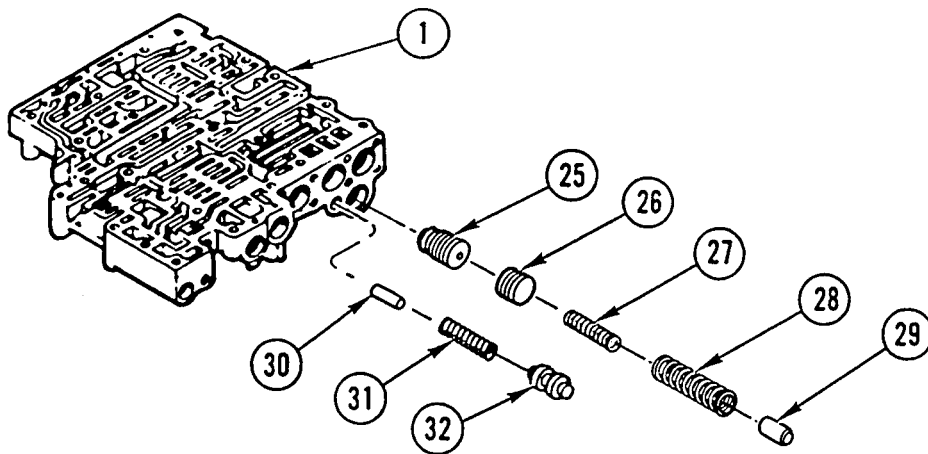
Install four clutch trimmer valves with small end first (steps 6 thru 9).

6. INSTALL FOURTH CLUTCH TRIMMER VALVE (10), PLUG (11), SPRING (12), SPRING (13), AND VALVE STOP (14).
7. INSTALL SECOND CLUTCH TRIMMER VALVE (15), PLUG (16), SPRING (17), SPRING (18), AND VALVE STOP (19) IN CONTROL VALVE BODY (1).

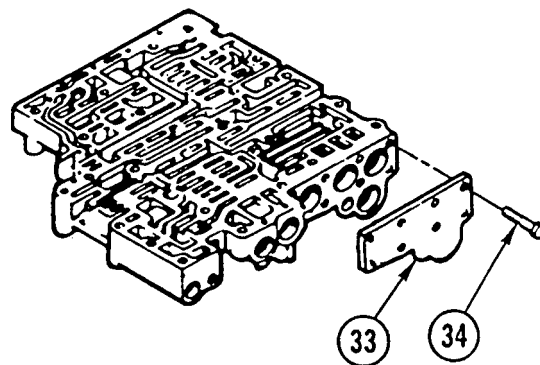


8. INSTALL THIRD CLUTCH TRIMMER VALVE (20), PLUG (21), SPRING (22), SPRING (23), AND VALVE STOP (24) IN CONTROL VALVE BODY (1).

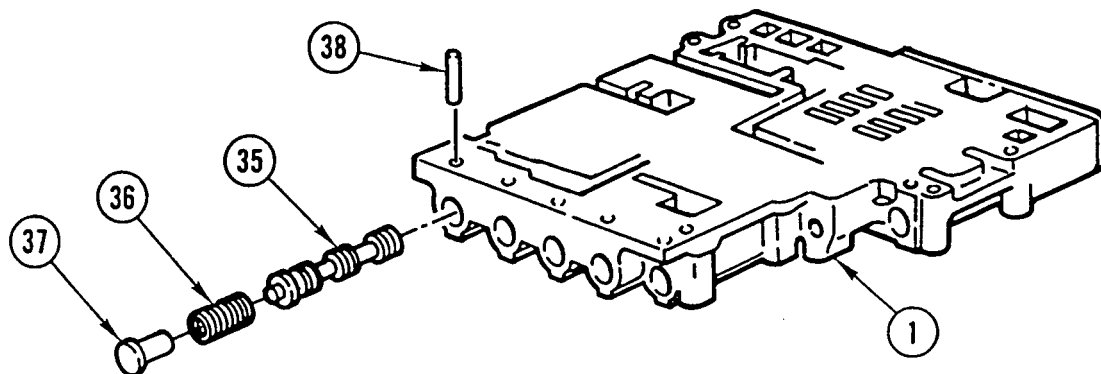
## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



9. INSTALL FIRST CLUTCH TRIMMER VALVE (25), PLUG (26), SECONDARY SPRING (27), PRIMARY SPRING (28), AND VALVE STOP (29) IN CONTROL VALVE BODY (1)
10. INSTALL VALVE STOP (30), SPRING (31), AND ACCUMULATOR VALVE (32) IN CONTROL VALVE BODY (1).

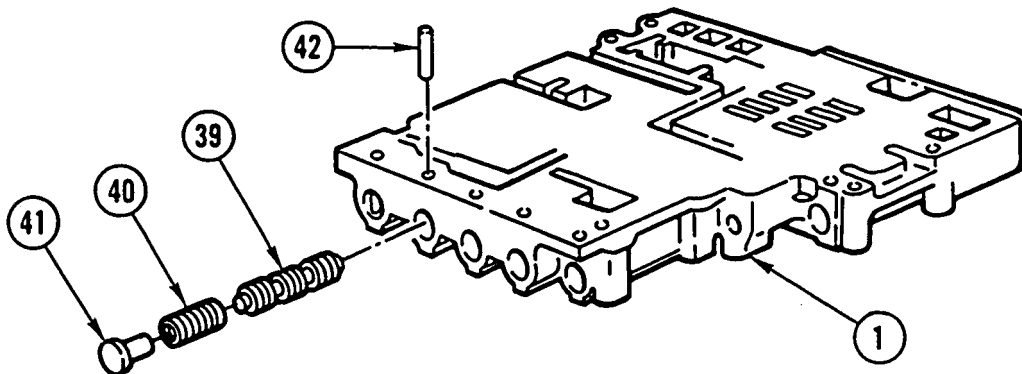


11. INSTALL TRIMMER VALVE COVER (33) AND EIGHT SCREWS (34) WHILE PRESSING ON SPRINGS. TIGHTEN SCREWS TO 48-60 LB-IN. (5.4-6.8 N.m).

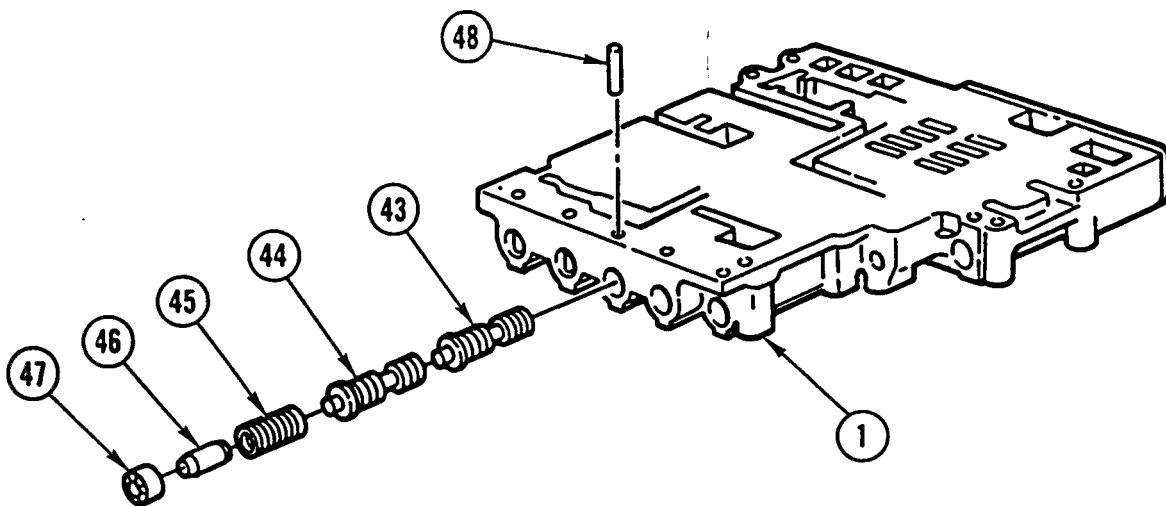




12. INSTALL TRIMMER REGULATOR VALVE (35), VALVE SPRING (36), AND VALVE STOP (37) IN CONTROL VALVE BODY (1).
13. PRESS VALVE STOP (37) AND INSTALL RETAINER PIN (38) IN CONTROL VALVE BODY (1).

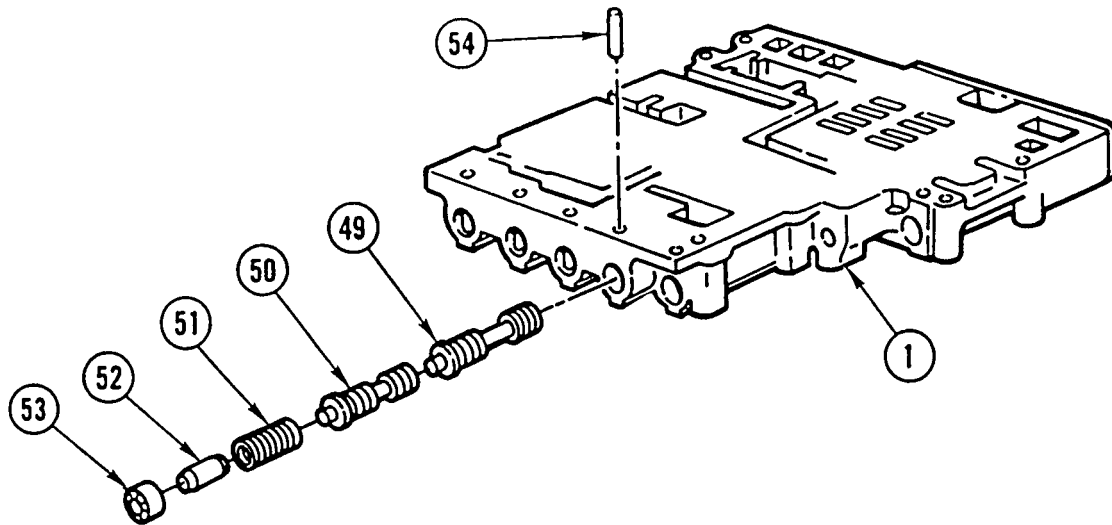


14. INSTALL 3-4 RELAY VALVE (39), VALVE SPRING (40), AND VALVE STOP (41).
15. PRESS VALVE STOP (41) AND INSTALL RETAINER PIN (42) IN CONTROL VALVE BODY (1).

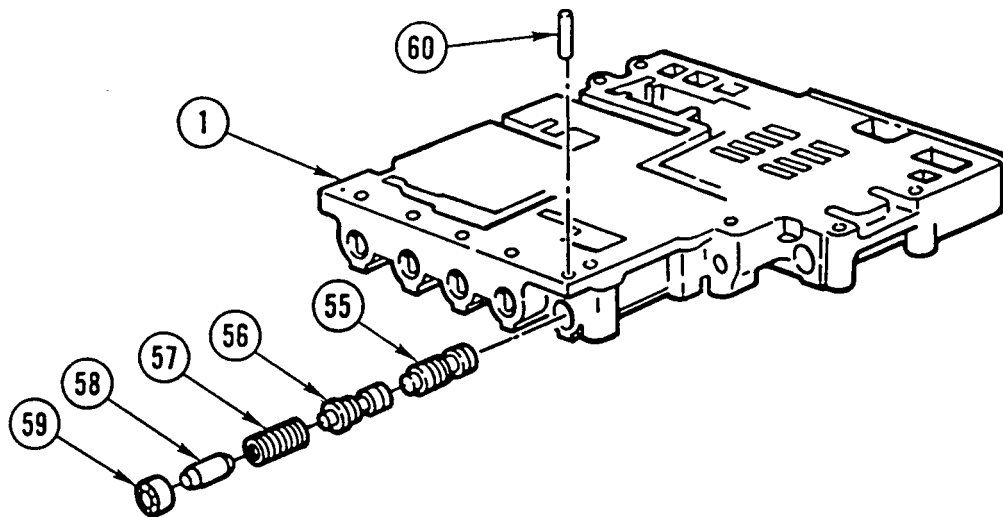


16. INSTALL 3-4 SHIFT VALVE (43), MODULATOR VALVE (44), VALVE SPRING (45), VALVE STOP (46), AND ADJUSTING RING (47).
17. ALINE PINHOLE IN VALVE STOP (46) WITH PINHOLES IN CONTROL VALVE BODY (1).
18. PRESS ADJUSTING RING (47) AND INSTALL RETAINER PIN (48) IN CONTROL VALVE BODY (1).

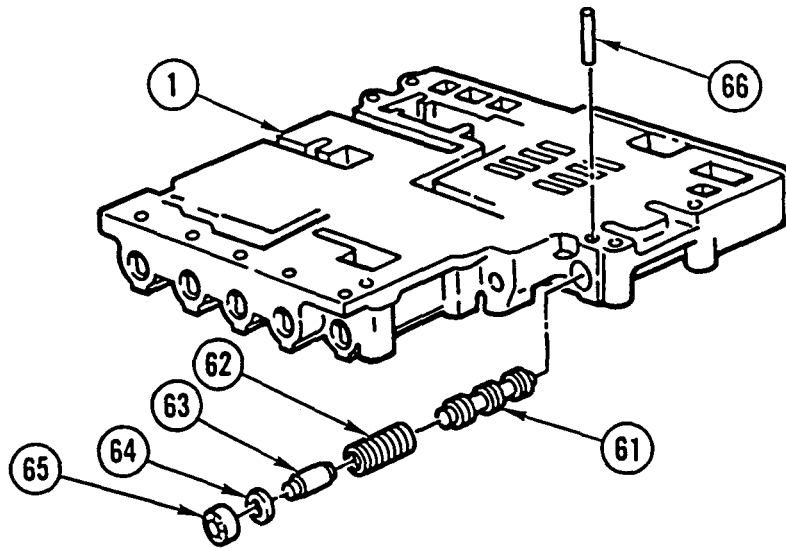
## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



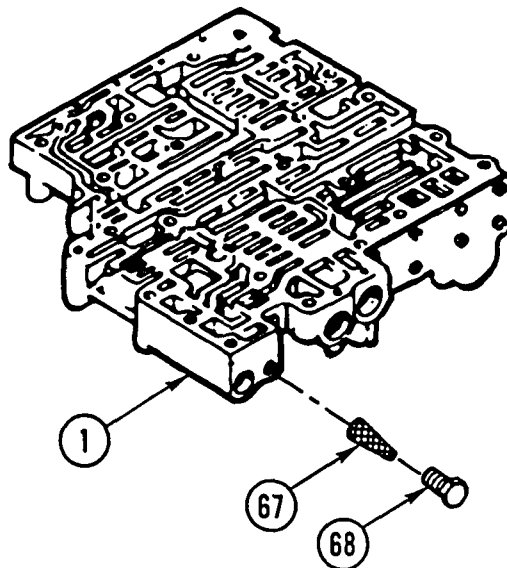
19. INSTALL 2-3 SHIFT VALVE (49), 2-3 MODULATOR VALVE (50), VALVE SPRING (51), VALVE STOP (52), AND ADJUSTING RING (53).
20. ALINE PINHOLE IN VALVE STOP (52) WITH PINHOLES IN CONTROL VALVE BODY (1).
21. PRESS ADJUSTING RING (53) AND INSTALL RETAINER PIN (54) IN CONTROL VALVE BODY (1).



22. INSTALL 1-2 SHIFT VALVE (55), 1-2 MODULATOR VALVE (56), SPRING (57), VALVE STOP (58), AND ADJUSTING RING (59).
23. ALINE PINHOLE IN VALVE STOP (58) WITH PINHOLES IN CONTROL VALVE BODY (1).
24. PRESS ADJUSTING RING (59) AND INSTALL RETAINER PIN (60) IN CONTROL VALVE BODY (1).

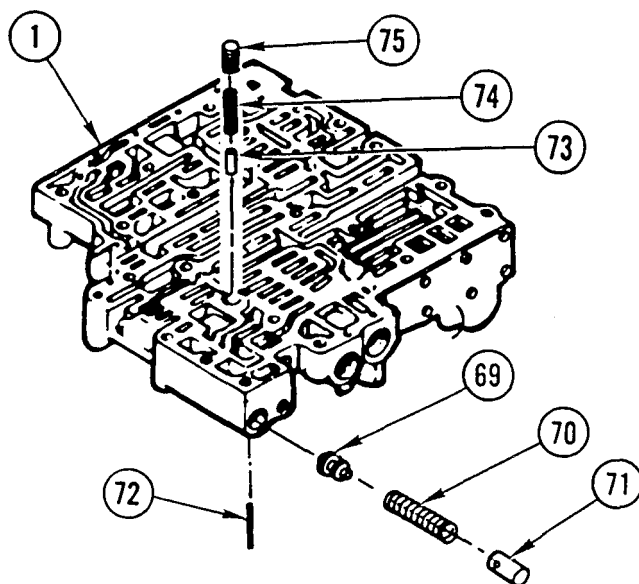


25. INSTALL REGULATOR VALVE (61), VALVE SPRING (62), VALVE STOP (63), WASHER (64), AND ADJUSTING RING (65).
26. ALINE PINHOLE IN VALVE STOP (63) WITH PINHOLES IN CONTROL VALVE BODY (1).
27. PRESS ADJUSTING RING (65) AND INSTALL RETAINER PIN (66) IN CONTROL VALVE BODY (1).

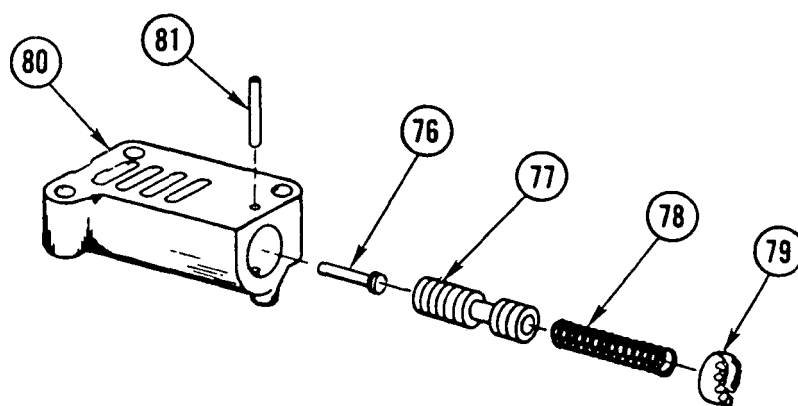


28. INSTALL GOVERNOR SCREEN ASSEMBLY (67) AND PLUG (68) IN CONTROL VALVE BODY (1). TIGHTEN PLUG TO 50-60 LB-IN. (5.6-6.8 N.m).

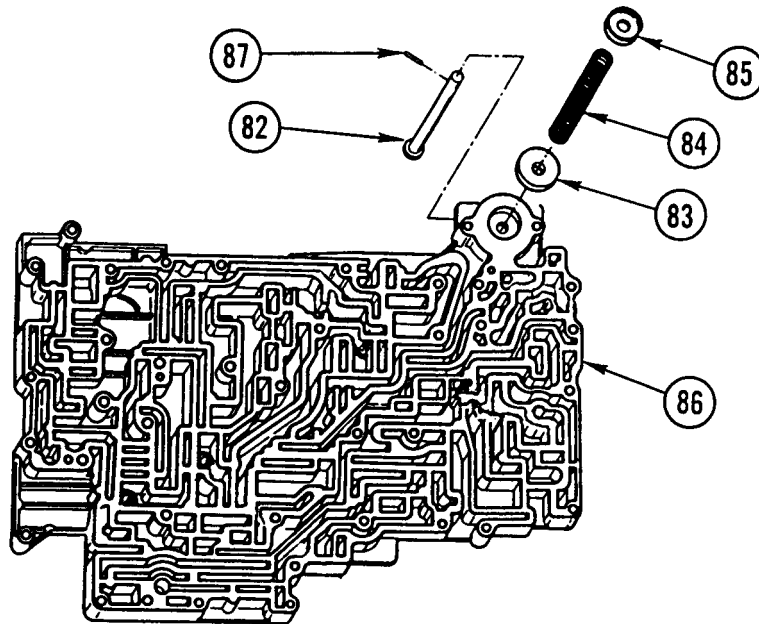
## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



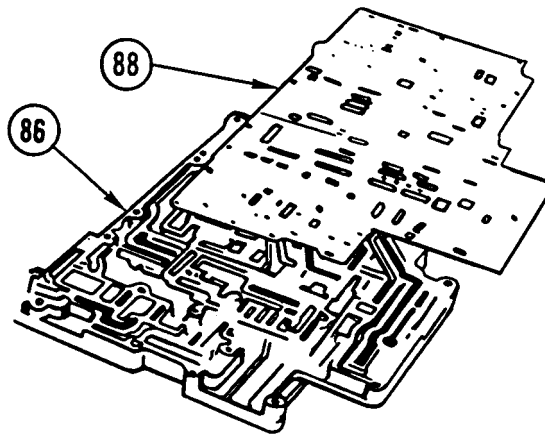
29. INSTALL ACCUMULATOR VALVE (69), SPRING (70), AND VALVE STOP (71) IN CONTROL VALVE BODY (1).
30. ALINE PINHOLE IN VALVE STOP (71) WITH PINHOLES IN CONTROL VALVE BODY (1).
31. PRESS VALVE STOP (71) AND INSTALL RETAINER PIN (72) IN CONTROL VALVE BODY (1).
32. INSTALL VALVE STOP (73), SPRING (74), AND PRIORITY VALVE (75) IN CONTROL VALVE BODY (1).



33. INSTALL PIN (76), MODULATOR VALVE (77), SPRING (78), AND ADJUSTING RING (79) IN MODULATOR VALVE BODY (80).
34. PRESS ADJUSTING RING (79) AND INSTALL RETAINER PIN (81) IN MODULATOR VALVE BODY (80).

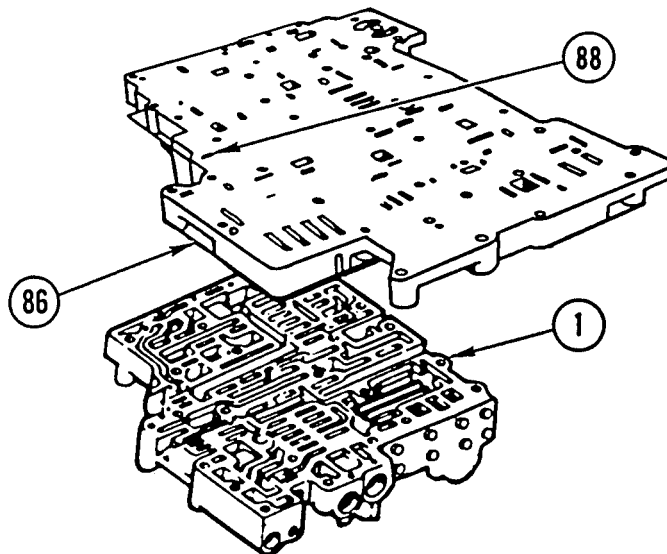


35. INSTALL CHECK VALVE PIN (82), LUBRICATION CHECK VALVE (83), SPRING (84), AND SPRING CUP WASHER (85) ON OIL TRANSFER PLATE (86).
36. INSTALL RETAINER PIN (87) WHILE PRESSING DOWN ON SPRING CUP WASHER (85).

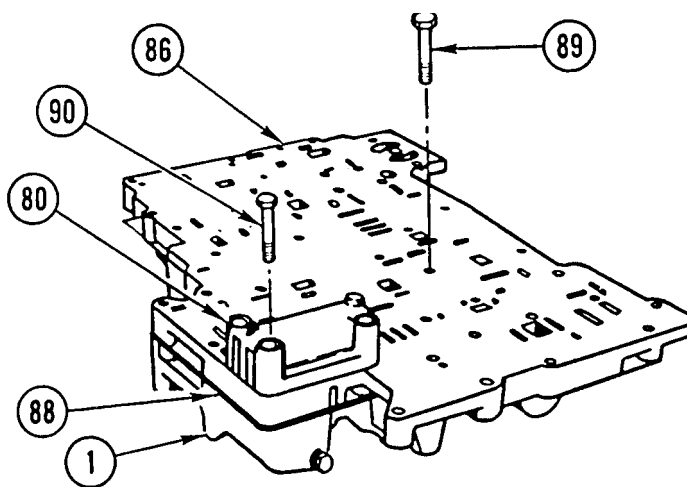


37. SLIDE SEPARATOR PLATE (88) ONTO OIL TRANSFER PLATE (86).

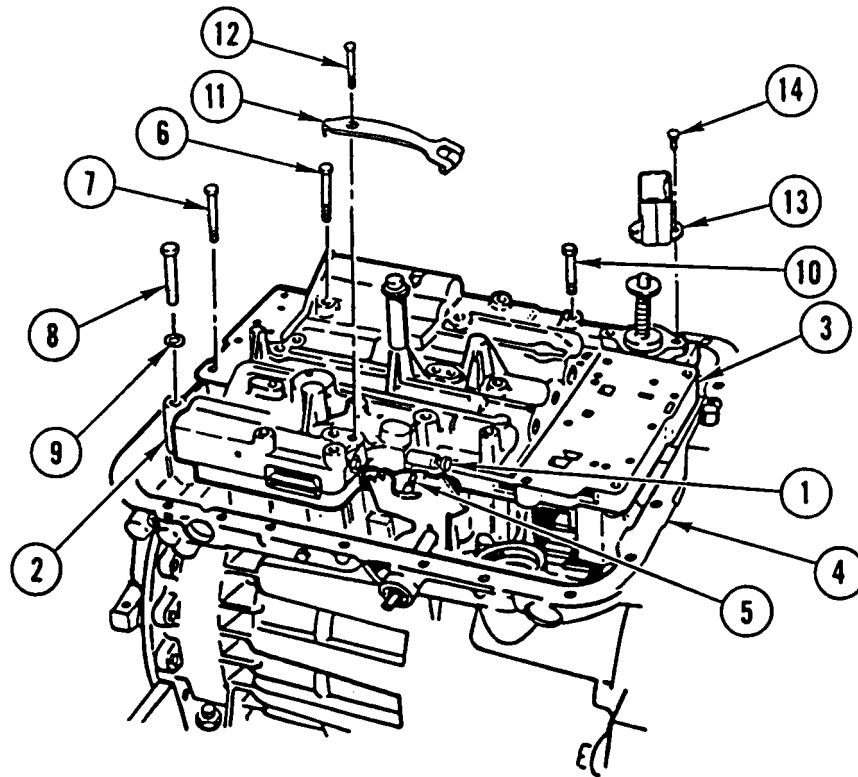
## CONTROL VALVE REPLACEMENT AND REPAIR (CONT)



38. HOLD SEPARATOR PLATE (88) AND OIL TRANSFER PLATE (86) TOGETHER, TURN OVER, AND PLACE ON CONTROL VALVE BODY (1).



39. INSERT SIX SCREWS (89) THRU OIL TRANSFER PLATE (86), SEPARATOR PLATE (88), AND CONTROL VALVE BODY (1) TO ALINE SCREW HOLES,
40. PLACE MODULATOR VALVE BODY (80) ON OIL TRANSFER PLATE (86) AND INSTALL THREE SCREWS (90). TIGHTEN SCREWS TO 108-132 LB-IN. (12-15 N.m).
41. REMOVE SIX SCREWS (89).

**INSTALLATION**

1. INSTALL SELECTOR VALVE (1) IN CONTROL VALVE BODY (2).
2. INSTALL CONTROL VALVE BODY (2) AND OIL TRANSFER PLATE (3) IN TRANSMISSION HOUSING (4), MAKING SURE SHIFT RACK PIN (5) ENGAGES SLOT ON SELECTOR VALVE (1).
3. INSTALL THREE SCREWS (6) IN CONTROL VALVE BODY (2).
4. INSTALL SEVEN SCREWS (7).
5. INSTALL TWO SCREWS (8) AND TWO WASHERS (9).
6. INSTALL 15 SCREWS (10) IN CONTROL VALVE BODY (2).
7. INSTALL MANUAL DETENT LEVER (11) AND SCREW (12) IN CONTROL VALVE BODY (2).
8. INSTALL OIL BAFFLE (13) AND TWO SCREWS (14).
9. TIGHTEN SCREWS (6, 7, 8, 10, 12, AND 14) TO 108-132 LB-IN. (12-15 N.m).

**NOTE**

Follow-on Maintenance:

- Install lockup cutoff control valve (page 3-262).
- Install modulator valve (page 3-261).

## Section IX. FOURTH CLUTCH REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the fourth clutch.

Replacement and repair of the fourth clutch is general support maintenance.

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### FOURTH CLUTCH REPLACEMENT AND REPAIR

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This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly g. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Clutch Spring Compressor, J24204

#### Materials/Parts:

Ring, Seal (2)	P/N 23019652
Ring, Seal	P/N 6836799
Ring, Seal	P/N 23014441
Oil, Lubricating	Appendix B, Item 37
Solvent, Drycleaning	Appendix B, Item 54
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26

#### Equipment Condition:

Reference	Condition Description
Page 14-54	Forward Clutch and Housing Removed

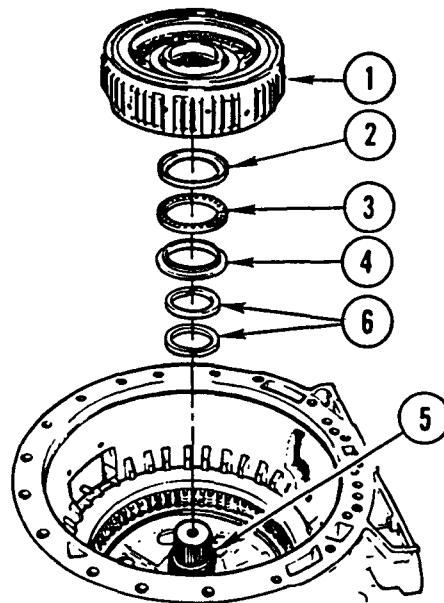
#### General Safety Instructions:

#### W A R N I N G

- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

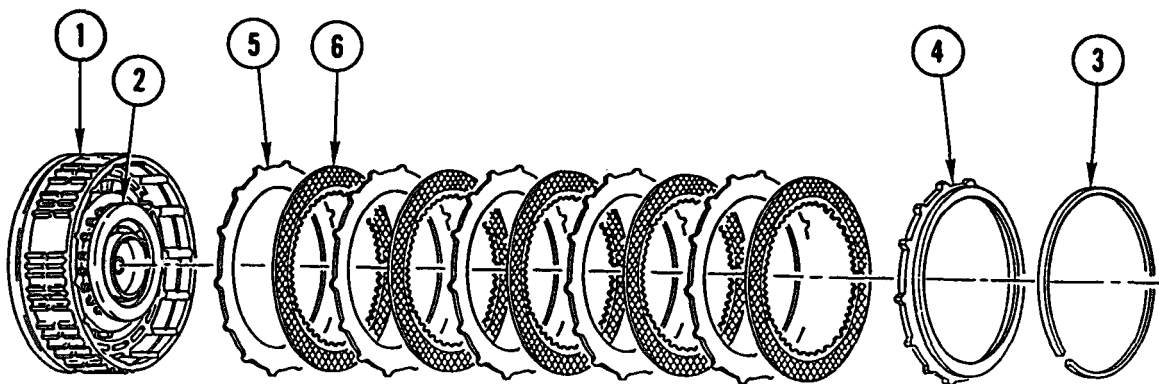


**REMOVAL**



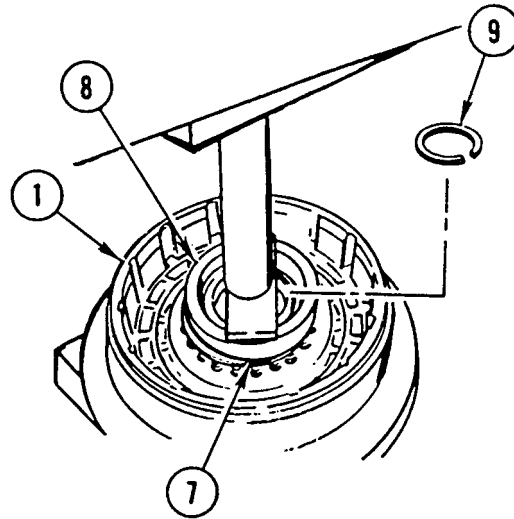
1. REMOVE FOURTH CLUTCH ASSEMBLY (1).
2. REMOVE RACE (2), BEARING (3), AND RACE (4) FROM CENTER SUPPORT (5) AND FOURTH CLUTCH ASSEMBLY (1).
3. REMOVE AND DISCARD TWO SEAL RINGS (6) FROM CENTER SUPPORT (5).

**DISASSEMBLY**

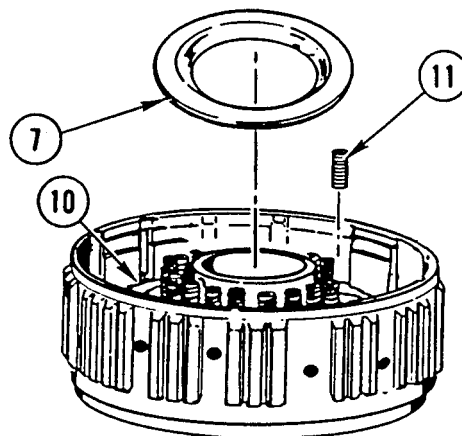


1. POSITION FOURTH CLUTCH HOUSING (1) WITH FRONT HUB (2) UP AND REMOVE LARGE RETAINING RING (3) AND BACKPLATE (4).
2. REMOVE FIVE STEEL PLATES (5) AND FIVE FRICTION PLATES (6) FROM FOURTH CLUTCH HOUSING (1).

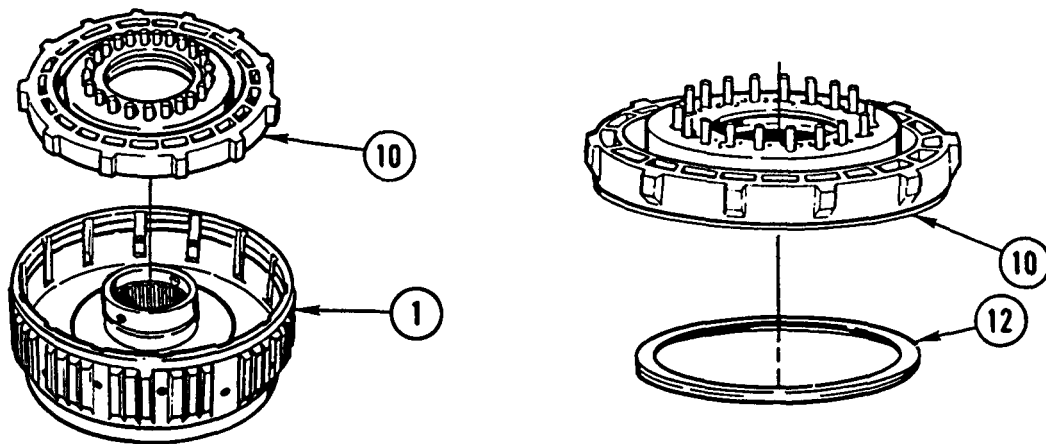
## FOURTH CLUTCH REPLACEMENT AND REPAIR (CONT)



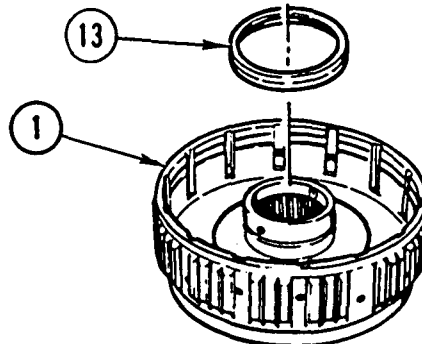
3. INSTALL FOURTH CLUTCH HOUSING (1) IN HYDRAULIC PRESS.
4. COMPRESS SPRING RETAINER (7) WITH CLUTCH SPRING COMPRESSOR (8) AND REMOVE RETAINING RING (9).
5. RELEASE PRESSURE FROM SPRING RETAINER (7) AND REMOVE CLUTCH SPRING COMPRESSOR (8).
6. REMOVE FOURTH CLUTCH HOUSING (1) FROM HYDRAULIC PRESS.



7. REMOVE SPRING RETAINER (7) FROM FOURTH CLUTCH PISTON (10).
8. REMOVE 20 PISTON RELEASE SPRINGS FROM FOURTH CLUTCH PISTON (10).



9. REMOVE FOURTH CLUTCH PISTON (10) FROM FOURTH CLUTCH HOUSING (1).
10. REMOVE AND DISCARD OUTER SEAL RING (12) FROM FOURTH CLUTCH PISTON (10).

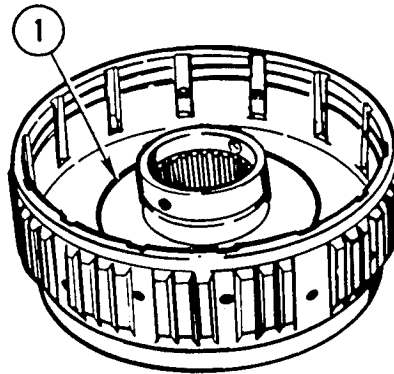


11. REMOVE AND DISCARD INNER SEAL RING (13) FROM FOURTH CLUTCH HOUSING (1).

### **CLEANING**

1. USE GENERAL CLEANING METHODS TO CLEAN ALL PARTS (PAGE 2-30).

## **FOURTH CLUTCH REPLACEMENT AND REPAIR (CONT)**



### **WARNING**

- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

2. CLEAN EIGHT BALL POCKETS (1) WITH DRYCLEANING SOLVENT AND DRY WITH COMPRESSED AIR.

APPLY LUBRICATING OIL AROUND AREA OF EIGHT BALL POCKETS (1).

### **INSPECTION**

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. REPLACE ALL PISTON RELEASE SPRINGS IF ANY THREE DO NOT MEET FOLLOWING LOAD-HEIGHT REQUIREMENTS:

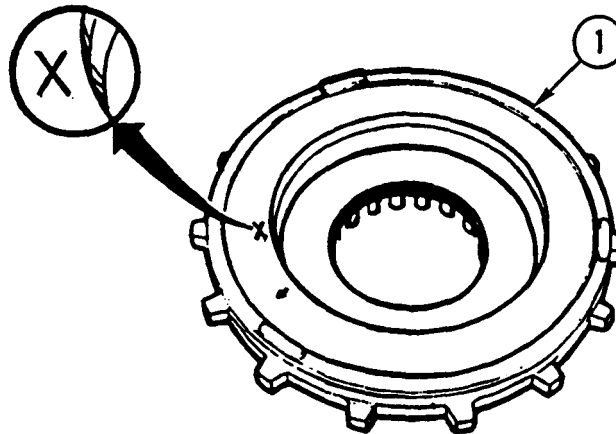
LENGTH WITHOUT LOAD: AT LEAST 1.25 IN. (31.8 mm).

LENGTH UNDER LOAD: AT LEAST 0.88 IN. (22.4 mm) WITH LOAD OF 17.9-18.9 LB (8.13-8.58 kg).

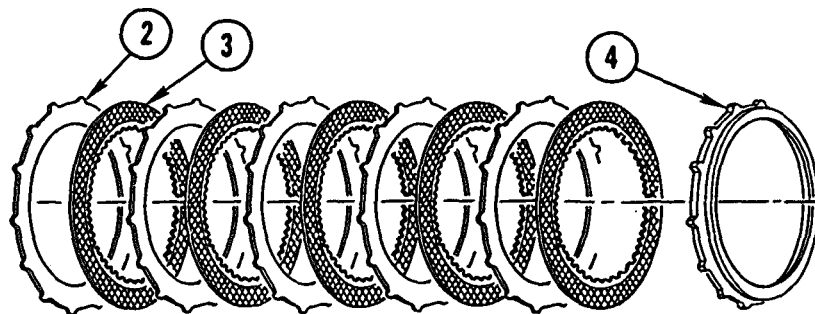
### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

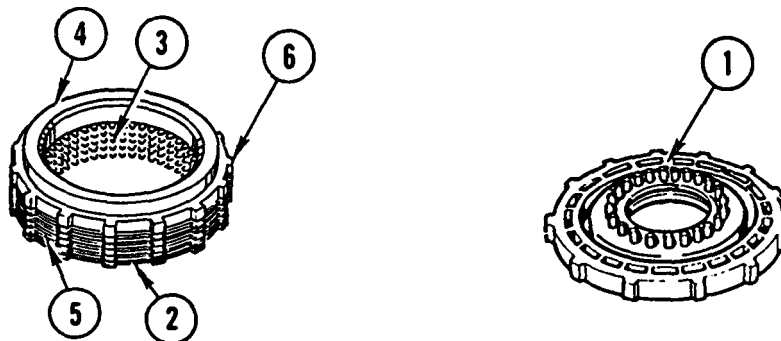
**ASSEMBLY**



1. CHECK BOTTOM OF FOURTH CLUTCH PISTON (1) AND NOTE WHETHER LABELED X, Y, OR Z.

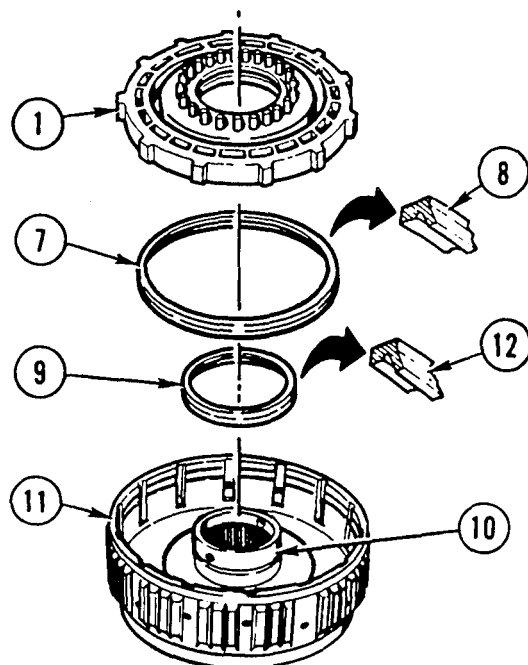


2. STACK 10 CLUTCH PLATES (2 AND 3) ON FLAT SURFACE OF PRESS STARTING WITH STEEL PLATE (2) AND ALTERNATING WITH FRICTION PLATE (3).
3. PLACE BACKPLATE (4) ON CLUTCH PLATES (2 AND 3).

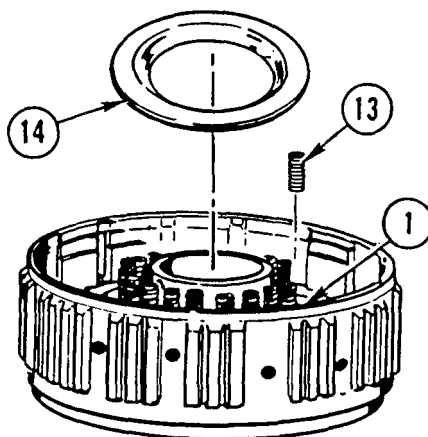


4. PRESS EVENLY ON BACKPLATE (4) WITH 100 PSI (689.5 kPa).
5. MEASURE DISTANCE FROM BASE OF CLUTCH PACK (5) TO MACHINED SURFACE (6) OF BACKPLATE (4). THIS IS CLUTCH PACK THICKNESS.
6. IF FOURTH CLUTCH PISTON (1) IS X PISTON, CLUTCH PACK THICKNESS MUST BE 1.361-1.387 IN. (34.59-35.23 mm). IF FOURTH CLUTCH PISTON IS Y PISTON, CLUTCH PACK THICKNESS MUST BE 1.386-1.414 IN. (35.26-35.92 mm). IF FOURTH CLUTCH PISTON IS Z PISTON, CLUTCH PACK THICKNESS MUST BE 1.415-1.441 IN. (35.94-36.60 mm). IF MEASUREMENT IS INCORRECT, REPLACE CLUTCH PLATE(S) (2 AND 3) AS NEEDED.
7. REMOVE CLUTCH PACK (5) AND BACKPLATE (4) FROM PRESS.

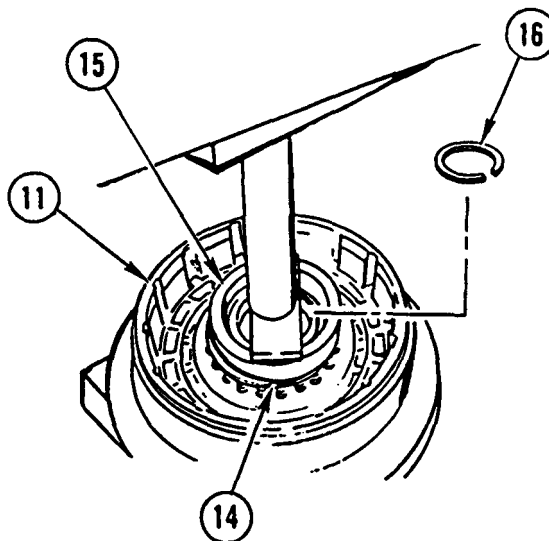
## FOURTH CLUTCH REPLACEMENT AND REPAIR (CONT)



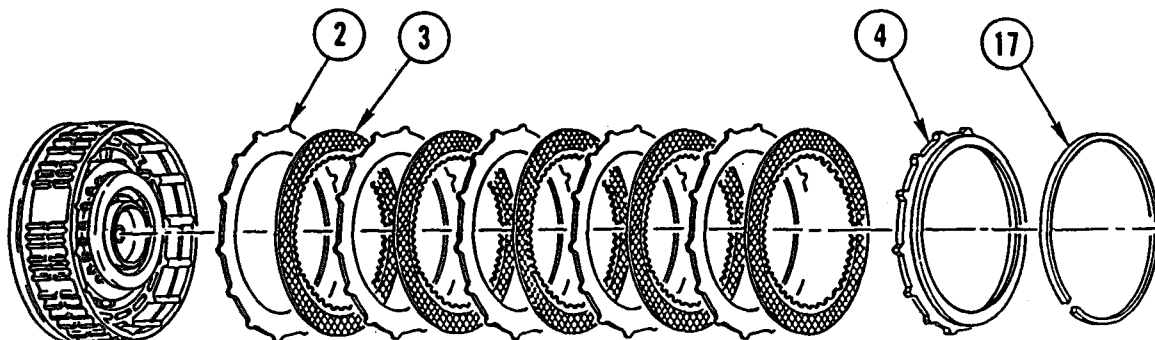
8. COAT NEW SEAL RING (7) AND OUTER RIM OF FOURTH CLUTCH PISTON (1) WITH LUBRICATING OIL.
9. INSTALL SEAL RING (7) ON OUTER RING OF FOURTH CLUTCH PISTON (1) WITH SEAL RING LIP (8) FACING DOWN.
10. COAT NEW SEAL RING (9) AND HUB (10) OF FOURTH CLUTCH HOUSING (11) WITH LUBRICATING OIL.
11. INSTALL SEAL RING (9) ON HUB (10) WITH SEAL RING LIP (12) POINTING DOWN.
12. INSTALL FOURTH CLUTCH PISTON (1) IN FOURTH CLUTCH HOUSING (11).



13. INSTALL 20 PISTON RELEASE SPRINGS (13) ON FOURTH CLUTCH PISTON (1).
14. INSTALL PISTON RELEASE SPRING RETAINER (14) ON PISTON RELEASE SPRINGS (13).



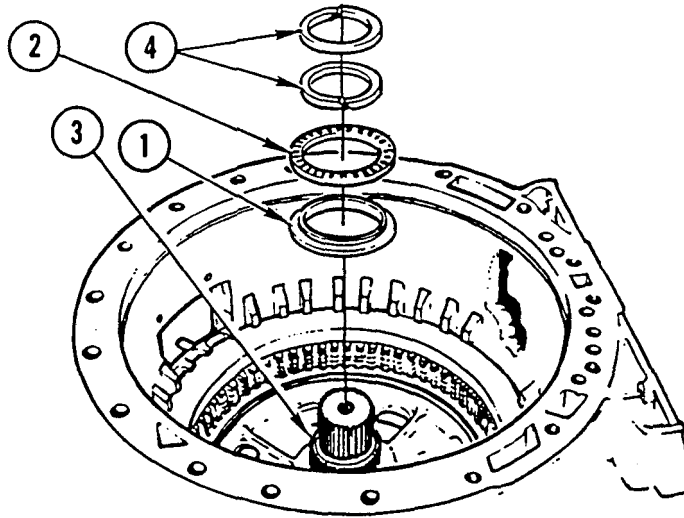
15. INSTALL FOURTH CLUTCH HOUSING (11) IN HYDRAULIC PRESS.
16. COMPRESS PISTON RELEASE SPRING RETAINER (14) WITH CLUTCH SPRING COMPRESSOR (15) AND PRESS. INSTALL RETAINING RING (16).
17. RELEASE PRESSURE FROM PISTON RELEASE SPRING RETAINER (14) AND REMOVE CLUTCH SPRING COMPRESSOR (15).
18. REMOVE FOURTH CLUTCH HOUSING (11) FROM PRESS.



19. INSTALL 10 CLUTCH PLATES (2 AND 3) STARTING WITH STEEL PLATE (2) AND ALTERNATING WITH FRICTION PLATE (3).
20. INSTALL BACKPLATE (4) AND RETAINING RING (17).

## FOURTH CLUTCH REPLACEMENT AND REPAIR (CONT)

### INSTALLATION

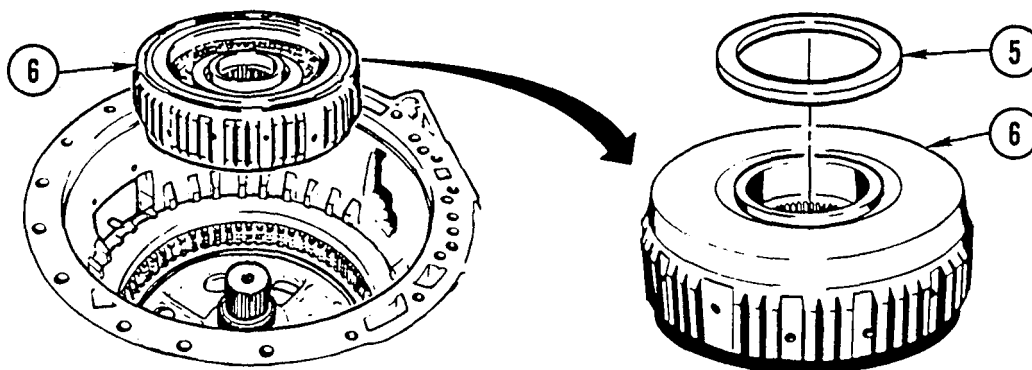


1. APPLY LUBRICATING OIL TO INNER BEARING RACE (1) AND BEARING (2) AND INSTALL ON CENTER SUPPORT HOUSING HUB (3).

#### **CAUTION**

To prevent damage to seal rings, keep seal rings sealed in packages until ready to use.

2. ROLL TWO NEW SEAL RINGS (4) ONE-HALF LENGTH AND ALLIED FOR AT LEAST 10 SECONDS.
3. INSTALL ONE SEAL RING (4) IN LOWER GROOVE ON CENTER SUPPORT HOUSING HUB (3).
4. INSTALL SECOND SEAL RING (4) IN UPPER GROOVE ON CENTER SUPPORT HOUSING HUB (3).



5. APPLY GAA TO OUTER BEARING RACE (5) AND INSTALL ON BOTTOM OF FOURTH CLUTCH ASSEMBLY (6).
6. INSTALL FOURTH CLUTCH ASSEMBLY (6).

#### **NOTE**

Follow-on Maintenance:  
Install forward clutch and housing (page 14-54).



## Section X. THIRD CLUTCH AND HOUSING REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the third clutch and housing.

Replacement and repair of the third clutch and housing is general support maintenance

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### THIRD CLUTCH AND HOUSING REPLACEMENT AND REPAIR

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly  
 a. Installation

---

#### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Center Support, J28525-1  
 Snap Ring Assembly, J24208-D

**Equipment Condition:**

Reference	Condition Description
Page 14-96	Fourth Clutch Removed
Page 14-74	Control Valve Removed

**Materials/Parts:**

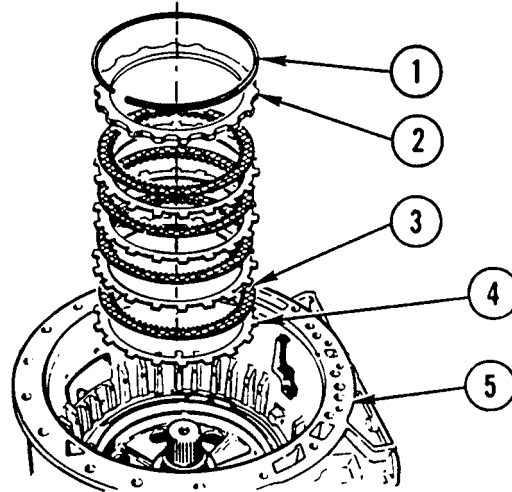
Ring, Seal	P/N 23011454
Ring, Seal	P/N 23011453
Ring, Retaining (4)	P/N 3909063
Screw, Anchor	P/N 23045343
Oil, Lubricating	Appendix B, Item 37
Cloth, Abrasive	Appendix B, Item 10

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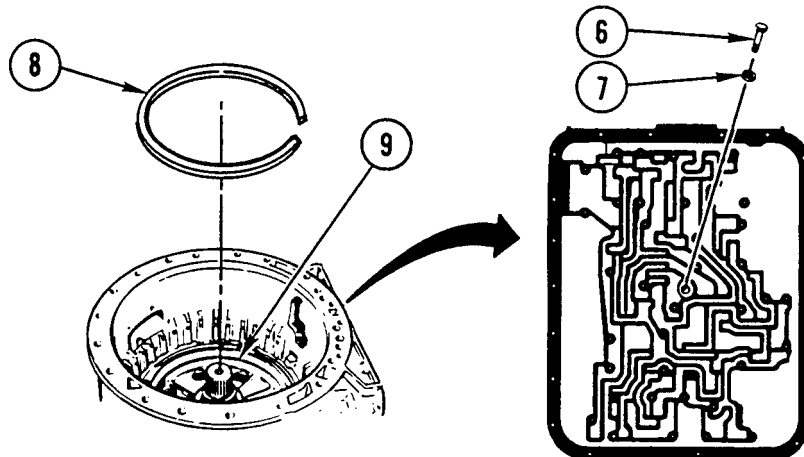
## THIRD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)

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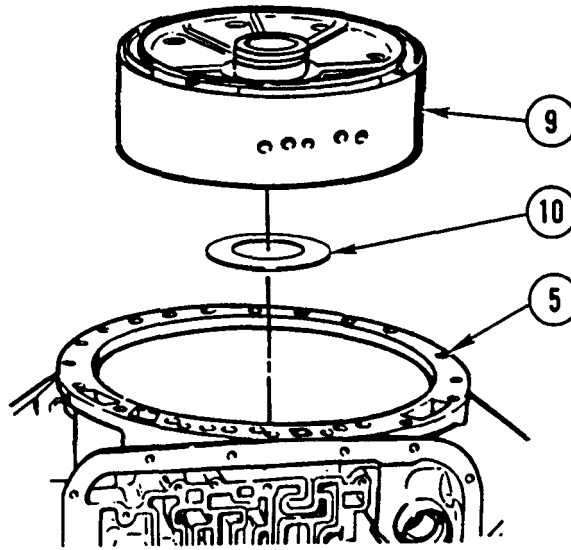
### REMOVAL



1. REMOVE RETAINING RING (1).
2. REMOVE BACKING PLATE (2).
3. REMOVE FOUR FRICTION PLATES (3) AND FOUR STEEL PLATES (4) FROM TRANSMISSION HOUSING (5).



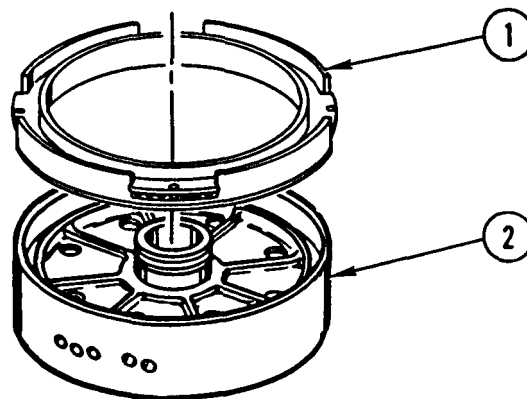
4. REMOVE SUPPORT HOUSING ANCHOR SCREW (6) AND WASHER (7). DISCARD ANCHOR SCREW.
5. REMOVE RETAINING RING (8) HOLDING CENTER SUPPORT HOUSING (9).



**NOTE**

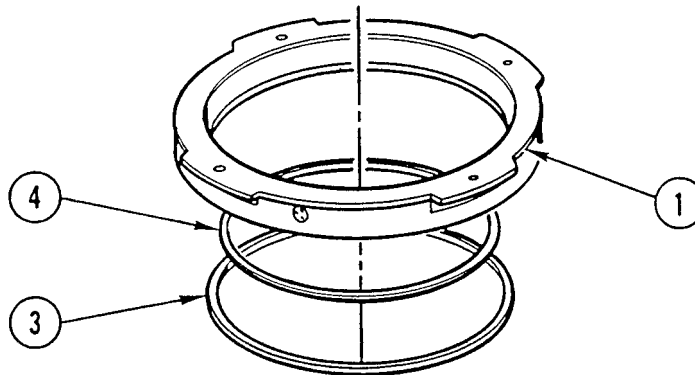
- Center support housing is fitted to transmission housing with very little clearance and may bind if transmission housing is cold. Heat transmission housing with heat lamp or warm current of air.
  - If center support housing starts up and then binds, tap center support housing down and lift again.
6. LIFTING STRAIGHT UP, REMOVE CENTER SUPPORT HOUSING (9) AND THRUST WASHER (10) FROM TRANSMISSION HOUSING (5).

**DISASSEMBLY**

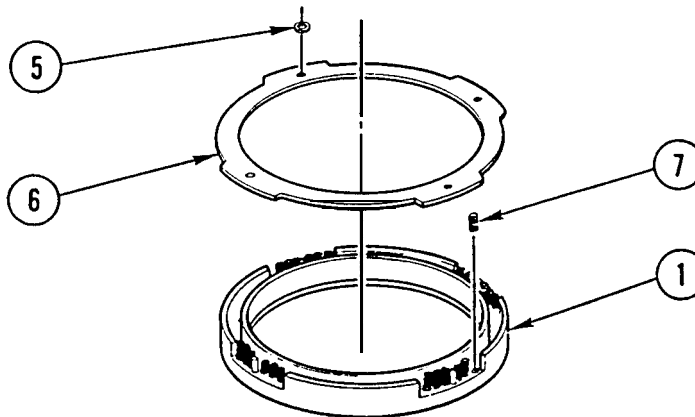


1. REMOVE THIRD CLUTCH PISTON (1) FROM CENTER SUPPORT HOUSING (2).

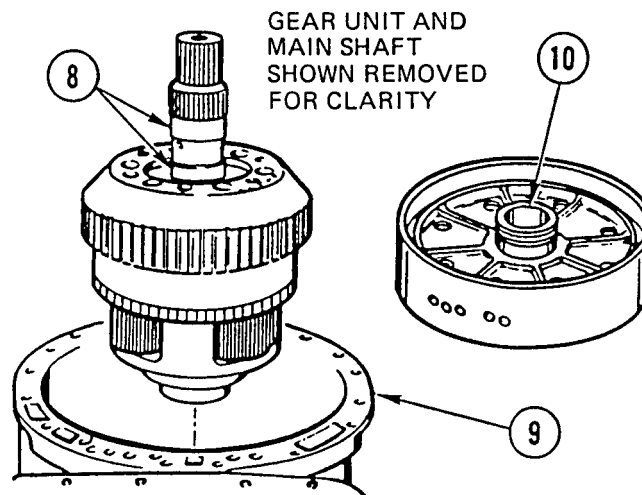
## THIRD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



2. REMOVE AND DISCARD OUTER SEAL RING (3) AND INNER SEAL RING (4) FROM THIRD CLUTCH PISTON (1).



3. CUT AND REMOVE FOUR RETAINING RINGS (5). DISCARD RETAINING RINGS.
4. REMOVE CLUTCH RING (6) FROM THIRD CLUTCH PISTON (1).
5. REMOVE 20 PISTON RELEASE SPRINGS (7) FROM THIRD CLUTCH PISTON (1).



6. MEASURE DIAMETER OF MAIN SHAFT BEARING SURFACES (8) INSIDE TRANSMISSION HOUSING (9).

7. MEASURE INSIDE DIAMETER OF BUSHING (10).
8. IF BUSHING (10) TO MAIN SHAFT BEARING SURFACE (8) CLEARANCE IS GREATER THAN 0.009 IN. (0.23 mm), REMOVE BUSHING (10).

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. INSPECT ALL PARTS FOR NICKS, BURRS, AND SCRATCHES. REMOVE DEFECTS WITH CROCUS CLOTH. IF SCRATCHES ARE DEEP OR PART IS CRACKED, REPIACE PART.
3. REPLACE PISTON RELEASE SPRINGS IF ANY 3 OF EACH SET OF 20 DO NOT MEET FOLLOWING LOAD-HEIGHT REQUIREMENTS:

LENGTH WITHOUT LOAD: AT LEAST 1.29 IN. (32.7 mm).

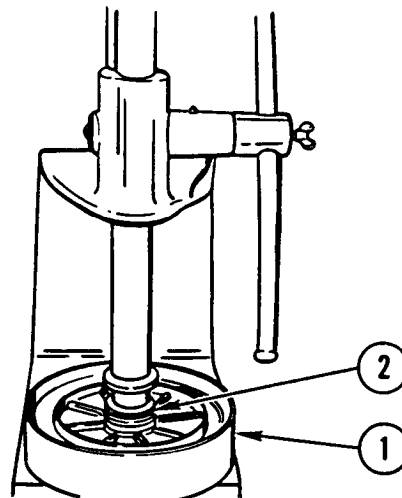
LENGTH UNDER LOAD: AT LEAST 0.82 IN. (20.8 mm) WITH LOAD OF 4.3-5.7 LB (2.0-2.6 kg).

4. MEASURE THRUST WASHER THICKNESS; THICKNESS MUST BE NO LESS THAN 0.091 IN. (2.31 mm).

### REPAIR

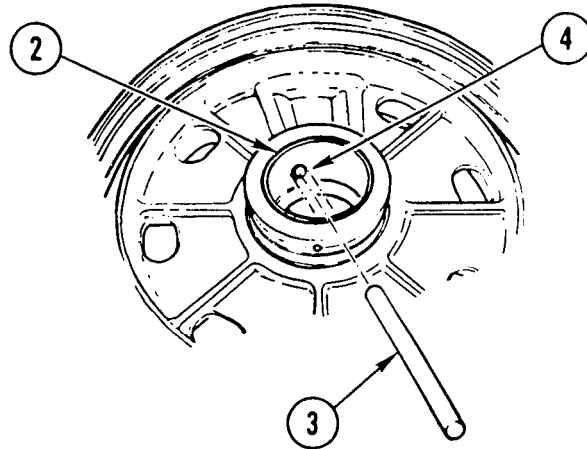
Use general repair methods to repair damaged parts (page 2-33).

### ASSEMBLY

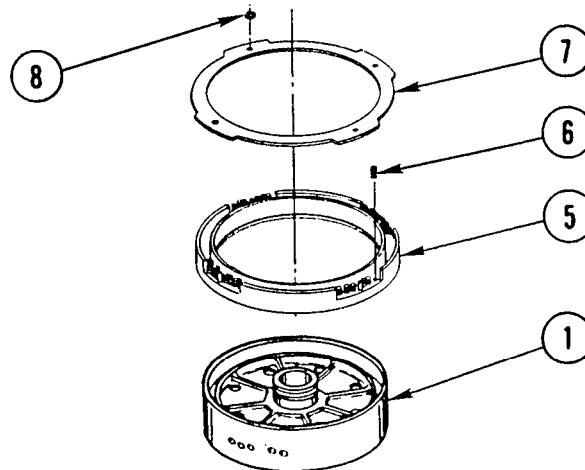


1. PLACE CENTER SUPPORT HOUSING (1) ON PRESS, HUB SIDE UP.
2. INSTALL PREBORED BUSHING (2). MAKE SURE OIL HOLE IN PREBORED BUSHING (2) IS ALINED WITH OIL HOLE IN CENTER SUPPORT HOUSING (1).

## THIRD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



3. USE CENTER SUPPORT (3) TO SWAGE BUSHING (2) BY STAKING EDGES OF OIL HOLE (4).



4. SET THIRD CLUTCH PISTON (5) IN FRONT CAVITY OF CENTER SUPPORT HOUSING (1).
5. INSTALL 20 PISTON RELEASE SPRINGS (6) IN POCKETS ON THIRD CLUTCH PISTON (5).

### NOTE

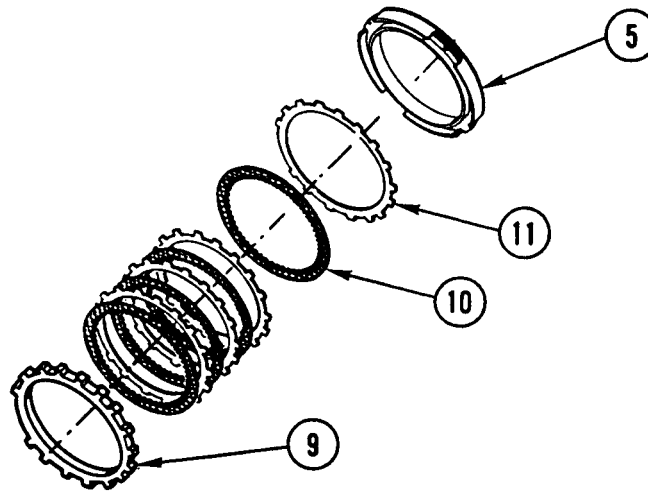
Tabs on clutch ring are different sizes and must match slots in third clutch piston for installation.

6. INSTALL CLUTCH RING (7) ON THIRD CLUTCH PISTON (5).

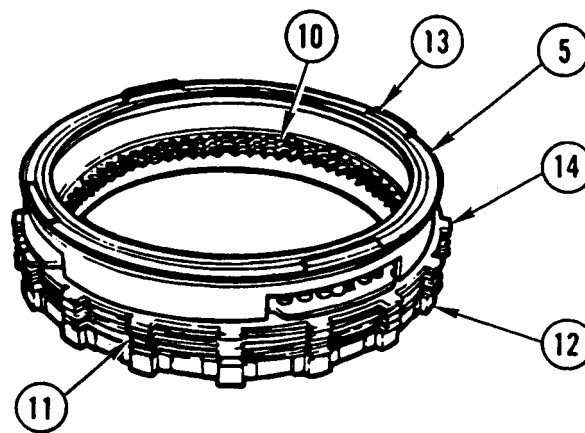
### CAUTION

Clutch ring must be pushed completely down in center support housing while installing retaining rings or clutch clearance will be wrong and transmission will not shift properly.

7. INSTALL FOUR NEW RETAINING RINGS (8) AND REMOVE THIRD CLUTCH PISTON (5) FROM CENTER SUPPORT HOUSING (1).

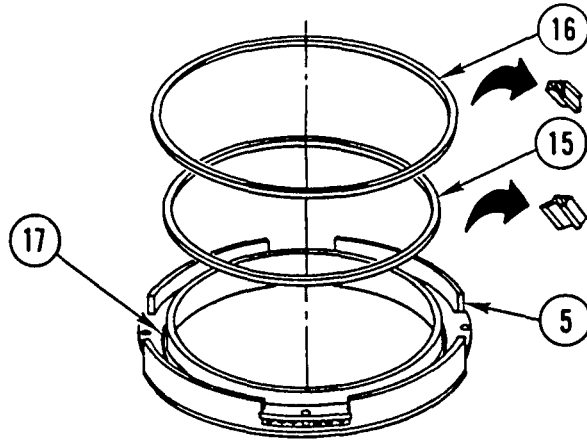


8. PLACE BACKING PLATE (9) ON FLAT SURFACE OF PRESS.
9. STACK EIGHT CLUTCH PLATES (10 AND 11) ON BACKING PLATE (9) STARTING WITH FRICTION PLATE (10) AND ALTERNATING WITH STEEL PLATE (11).
10. PLACE THIRD CLUTCH PISTON (5) ON TOP OF CLUTCH PLATES (10 AND 11).



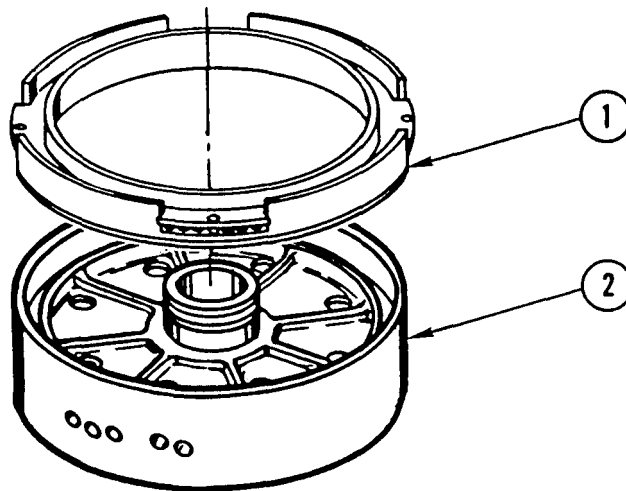
11. PRESS EVENLY ON THIRD CLUTCH PISTON (5) WITH 100 PSI (689.5 kPa).
12. MEASURE DISTANCE FROM BASE OF CLUTCH PACK (12) TO THRUST PAD (13).
13. CLUTCH PACK THICKNESS MUST BE 3.010-3.042 IN. (76.45-77.26 mm). REPLACE CLUTCH PLATE(S) (10 AND 11) AS NEEDED TO ENSURE PROPER CLUTCH PACK THICKNESS.
14. MEASURE THICKNESS OF ONE TANG (14) ON EACH OF FOUR STEEL PLATES (11). IF STEEL PLATE MEASURES 0.116-0.123 IN. (2.95-3.12 mm), STEEL PLATE IS THICK. IF STEEL PLATE MEASURES 0.099-0.106 IN. (2.51-2.69 mm), STEEL PLATE IS THIN.
15. REPEAT STEPS 8 THRU 13 TO RECHECK CLUTCH PACK THICKNESS.
16. REMOVE CLUTCH PACK (12) FROM PRESS.

## THIRD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



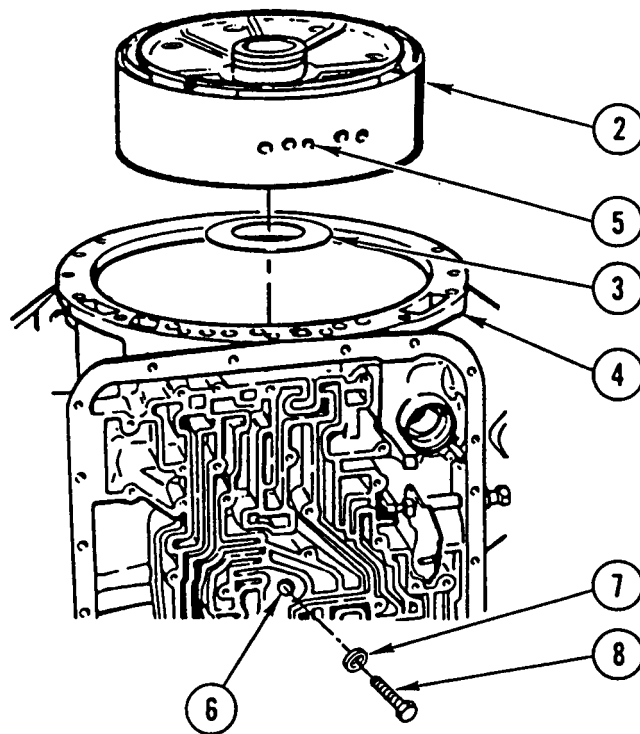
17. APPLY LUBRICATING OIL TO NEW INNER SEAL RING (15) AND NEW OUTER SEAL RING (16).
18. INSTALL INNER SEAL RING (15) IN GROOVE (17) OF THIRD CLUTCH PISTON (5) WITH LIP FACING DOWN.
19. INSTALL OUTER SEAL RING (16) ON THIRD CLUTCH PISTON (5) WITH LIP FACING DOWN.

### **INSTALLATION**



1. INSTALL THIRD CLUTCH PISTON (1) IN CENTER SUPPORT HOUSING (2).





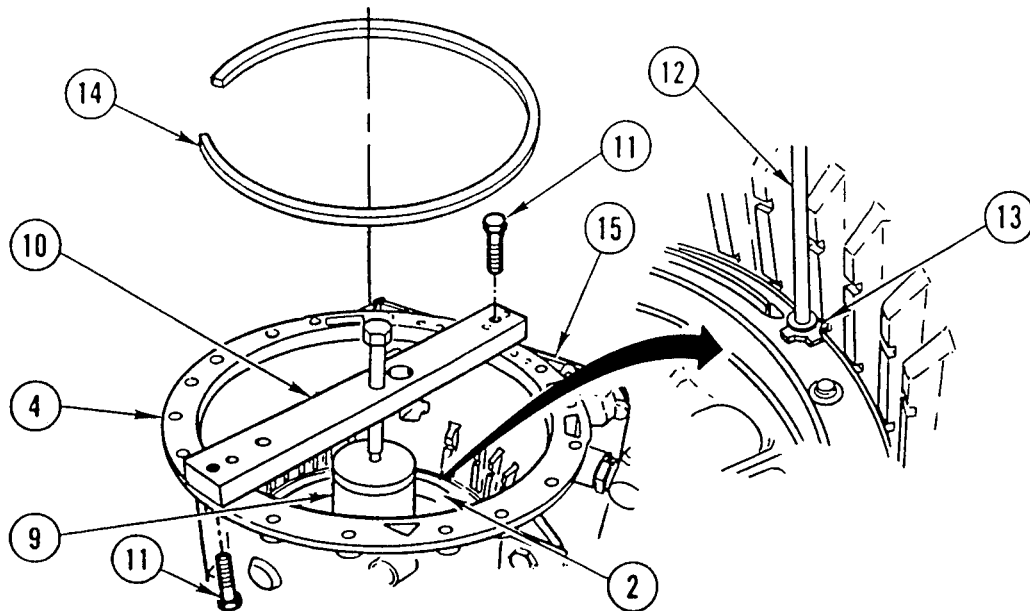
2. INSTALL THRUST WASHER (3).

#### NOTE

Center support housing is fitted to transmission housing with very little clearance and may bind if transmission housing is cold. Heat transmission housing with heat lamp or warm current of air.

3. LOWER CENTER SUPPORT HOUSING (2) INTO TRANSMISSION HOUSING (4). MAKE SURE TAPPED HOLE (5) IN SUPPORT HOUSING (2) IS ALINED WITH SCREW HOLE (6) IN TRANSMISSION HOUSING (4).
4. INSTALL WASHER (7) AND NEW SUPPORT HOUSING ANCHOR SCREW (8) AND TIGHTEN SCREW HAND-TIGHT.

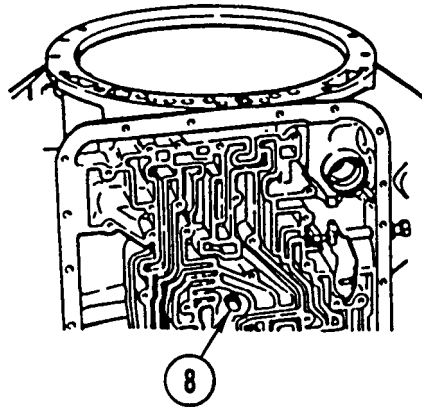
## THIRD CLUTCH AND HOUSING REPLACEMENT AND REPAIR (CONT)



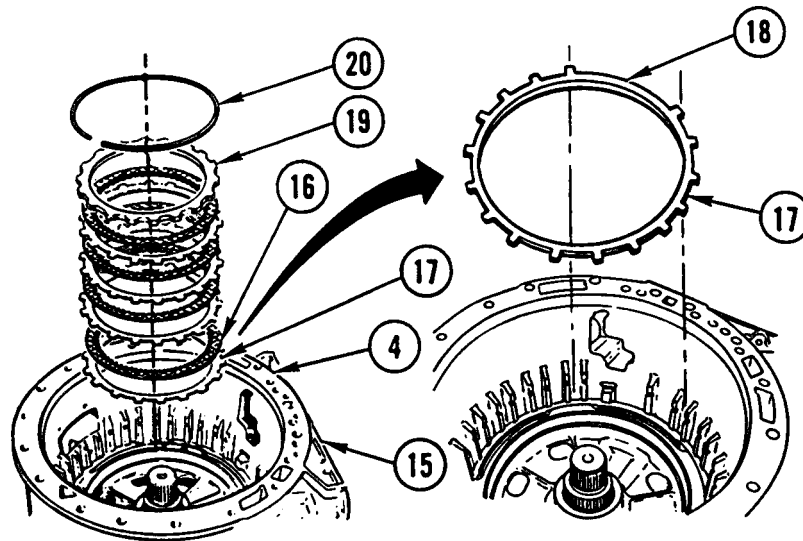
5. INSTALL SLEEVE SPACER (9) ON HUB OF CENTER SUPPORT HOUSING (2) AND PLACE CENTER SUPPORT PRESSURE PLATE (10) ACROSS TRANSMISSION HOUSING (4) WITH TWO SCREWS (11).
6. TIGHTEN CENTER SUPPORT PRESSURE PLATE (10) CENTER SCREW TO 5 LB-FT (7 N.m) TO COMPRESS CENTER SUPPORT HOUSING (2).
7. PLACE RETAINING RING GAUGE (12) IN RETAINING RING OPENING (13). MEASURE RETAINING RING OPENING (13) WITH EACH OF FOUR COLORED LUGS ON GAUGE (12) TO DETERMINE LUG WITH TIGHTEST FIT.

BLUE COLOR CODED RETAINING RING IS 0.148-0.150 IN. (3.76-3.81 mm) THICK.  
 YELLOW COLOR CODED RETAINING RING IS 0.152-0.154 IN. (3.86-3.91 mm) THICK.  
 WHITE COLOR CODED RETAINING RING IS 0.155-0.157 IN. (3.94-3.99 mm) THICK.  
 RED COLOR CODED RETAINING RING IS 0.158-0.160 IN. (4.01-4.06 mm) THICK.

8. INSTALL RETAINING RING (14) THAT HAS SAME COLOR CODE AS LUG OF GAUGE (12). RETAINING RING GAP MUST BE OPPOSITE OIL PAN SIDE (15) OF TRANSMISSION HOUSING (4).
9. REMOVE CENTER SUPPORT PRESSURE PLATE (10) AND SLEEVE SPACER (9).



10. TIGHTEN SUPPORT HOUSING ANCHOR SCREW (8) TO 45 LB-FT (61 N.m).



11. SOAK FOUR FRICTION PLATES (16) IN LUBRICATING OIL FOR 2 MINUTES.

**NOTE**

Thick steel plates must be installed on bottom of stack.

12. INSTALL STEEL PLATE (17) WITH GAP (18) FACING AS SHOWN.
13. INSTALL SEVEN CLUTCH PLATES (16 AND 17) STARTING WITH FRICTION PLATE (16) AND ALTERNATING WITH STEEL PLATE (17).
14. INSTALL BACKING PLATE (19).
15. INSTALL RETAINING RING (20) WITH GAP OPPOSITE OIL PAN SIDE (15) OF TRANSMISSION HOUSING (4).

**NOTE**

Follow-on Maintenance:

- Install fourth clutch (page 14-96).
- Install control valve (page 14-74).

## Section XI. GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the gear unit and main shaft.

Replacement and repair of the gear unit and main shaft is general support maintenance.

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### GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR

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This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly  
g. Installation

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### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05  
Sun Gear Bushing Reamer Set, J28489  
Bushing installer, J24201-A  
Main Shaft Lifting Bracket, J24196  
Bushing Swager, J26997-A

#### Materials/Parts:

Compound, Appendix B, Item 16  
Sealing  
Oil, Lubricating Appendix B, Item 37

**Personnel Required:** (2)

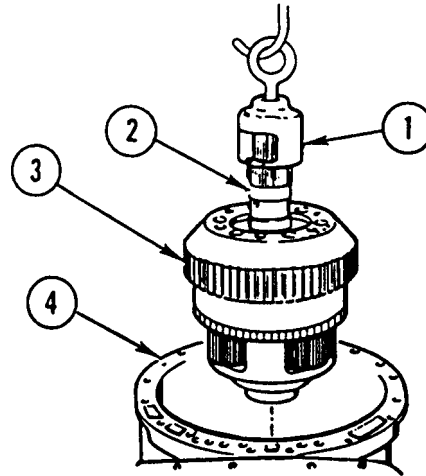
#### Equipment Condition:

Reference	Condition Description
Page 14-105	Third Clutch and Housing Removed

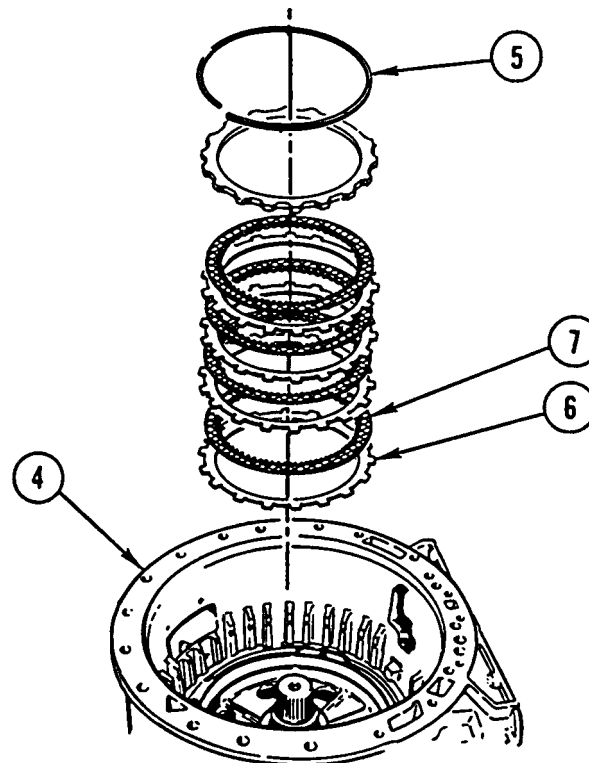
#### General Safety Instructions:

#### **WARNING**

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

**REMOVAL**

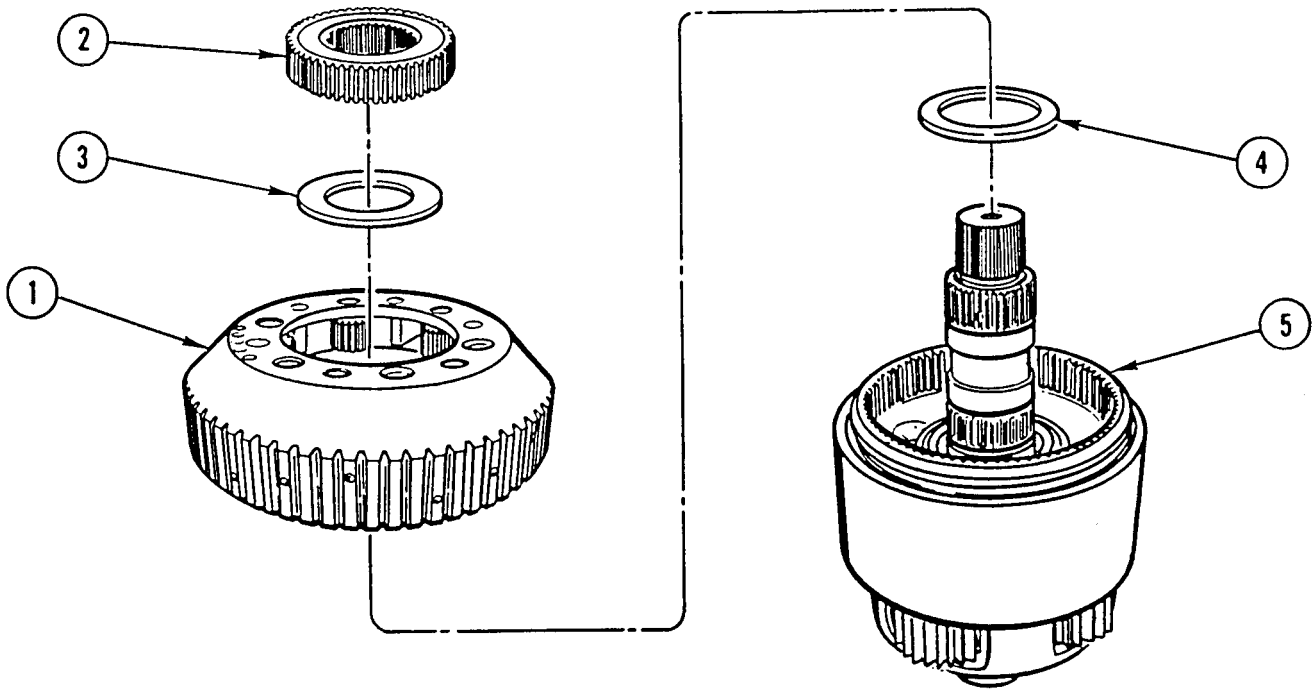
1. INSTALL LIFTING BRACKET (1) TO MAIN SHAFT (2) OF GEAR UNIT ASSEMBLY (3).
2. REMOVE GEAR UNIT ASSEMBLY (3) FROM TRANSMISSION HOUSING (4).
3. REMOVE LIFTING BRACKET (1).



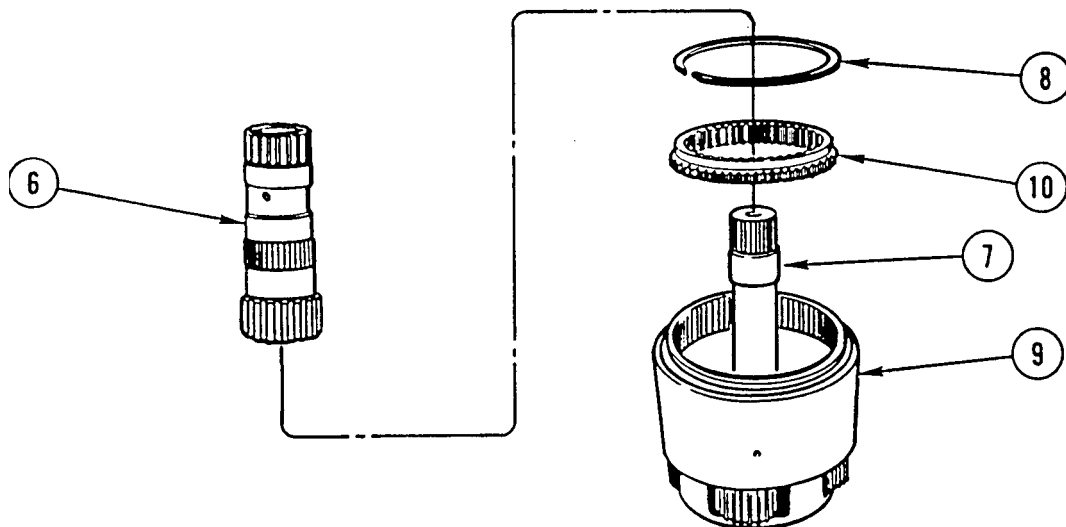
4. REMOVE RETAINING RING (5).
5. REMOVE 13 SECOND CLUTCH PLATES (6 AND 7) FROM TRANSMISSION HOUSING (4).

## GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)

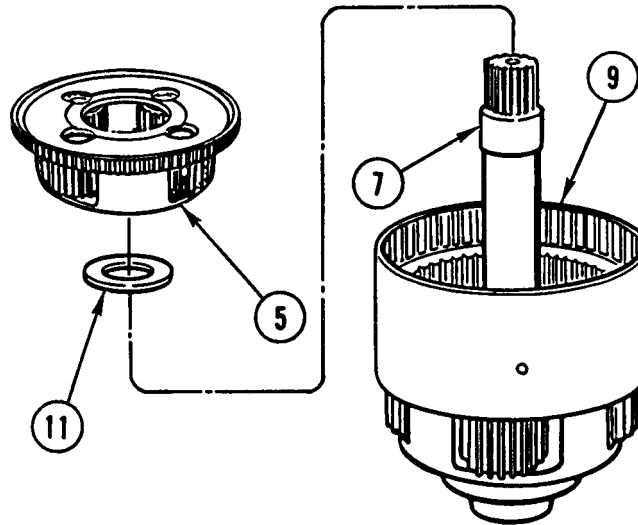
### DISASSEMBLY



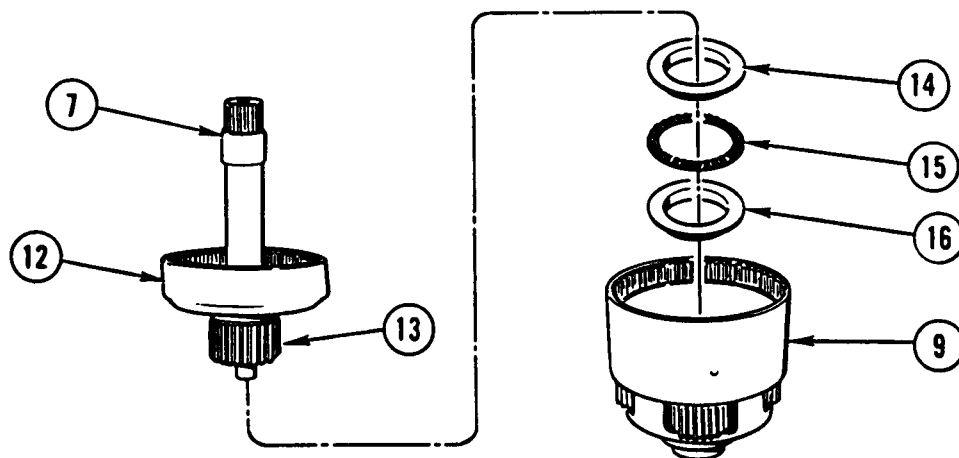
1. REMOVE FRONT CARRIER ASSEMBLY (1).
2. REMOVE DRIVEN GEAR (2) FROM FRONT CARRIER ASSEMBLY (1).
3. REMOVE THRUST WASHER (3) FROM BOTTOM OF FRONT CARRIER ASSEMBLY (1).
4. REMOVE THRUST WASHER (4) FROM TOP OF CENTER CARRIER ASSEMBLY (5).



5. REMOVE SUN GEAR SHAFT (6) FROM MAIN SHAFT (7).
6. REMOVE RETAINING RING (8) FROM TRANSMISSION DRUM (9).
7. REMOVE SPUR GEAR (10).

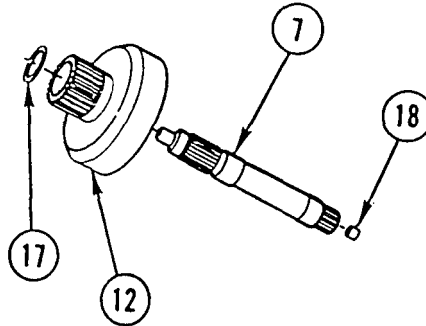


8. REMOVE CENTER CARRIER ASSEMBLY (5) FROM TRANSMISSION DRUM (9).
9. REMOVE THRUST WASHER (11) FROM BASE OF MAIN SHAFT (7).

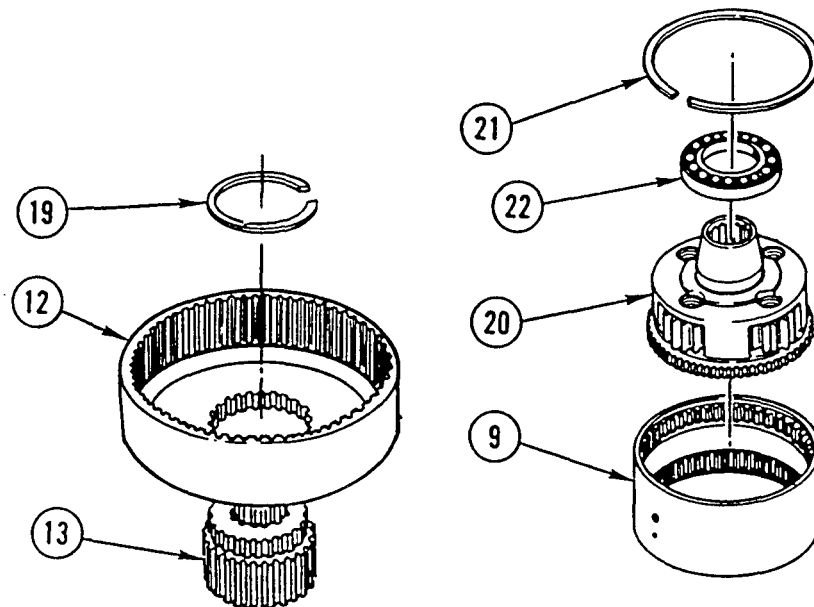


10. REMOVE MAIN SHAFT (7) FROM TRANSMISSION DRUM (9) WITH INTERNAL GEAR (12) AND SPUR GEAR SHAFT (13) ATTACHED.
11. REMOVE BEARING RACE (14), BEARING (15), AND BEARING RACE (16).

## GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)

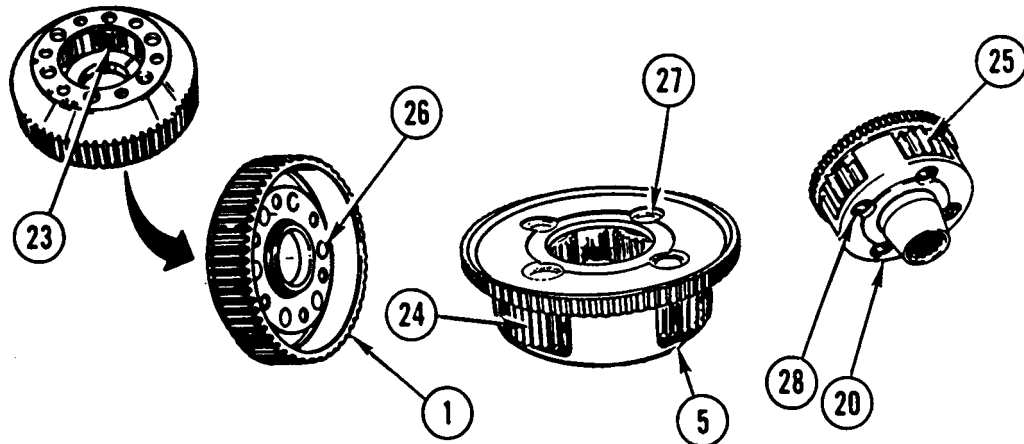


12. REMOVE SPIRAL LOCKING RING (17).
13. REMOVE INTERNAL GEAR (12) FROM MAIN SHAFT (7).
14. IF DAMAGED, REMOVE LUBE ORIFICE PLUG (18) FROM MAIN SHAFT (7).



15. REMOVE RETAINING RING (19), INTERNAL GEAR (12), AND SPUR GEAR SHAFT (13).
16. POSITION TRANSMISSION DRUM (9) SO REAR CARRIER ASSEMBLY (20) IS UP.
17. REMOVE RETAINING RING (21) AND SEPARATE REAR CARRIER ASSEMBLY (20) FROM TRANSMISSION DRUM (9).
18. REMOVE BEARING (22) FROM REAR CARRIER ASSEMBLY (20).



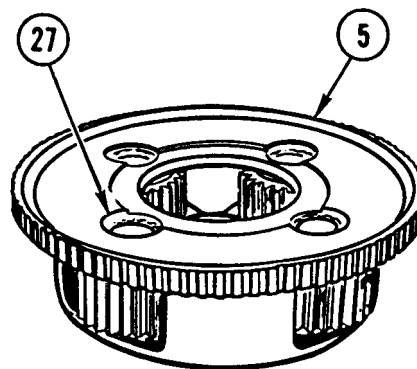


19. CHECK END PLAY BETWEEN PINION GEARS (23, 24, AND 25) AND CARRIERS (1, 5, AND 20). END PLAY MUST BE BETWEEN 0.008-0.31 IN (0.203-0.787 mm). IF END PLAY IS OUTSIDE THESE LIMITS, DO STEPS 20 THRU 25 TO REPLACE ALL PINION GEARS IN THAT ASSEMBLY.

**NOTE**

Steps 20 thru 25 are required only if end play of pinion gears is outside limits.

20. DRILL AWAY STAKED REAR ENDS OF FRONT CARRIER ASSEMBLY (1) PINION PINS (26) USING 15/16-IN. (23.8-mm) BIT.
21. DRILL AWAY STAKED FRONT ENDS OF CENTER CARRIER ASSEMBLY (5) PINION PINS (27) USING 15/16-IN. (23.8-mm) BIT.
22. DRILL AWAY STAKED ENDS OF REAR CARRIER ASSEMBLY (20) PINION PINS (28) USING 1-3/16 IN. (30.2-mm) BIT.



**NOTE**

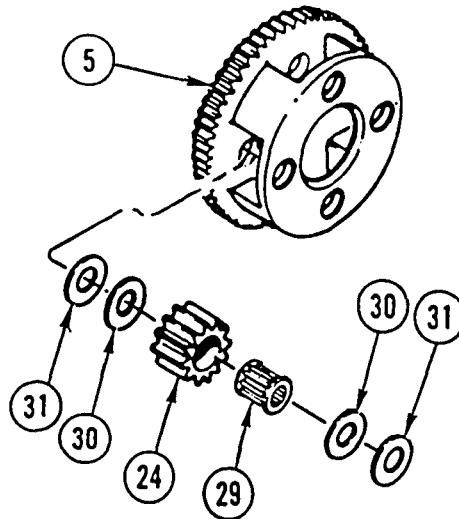
Front, center, and rear carrier assemblies are disassembled the same way. Disassembly of center carrier is shown.

23. POSITION CENTER CARRIER ASSEMBLY (5) WITH DRILLED ENDS OF PINION PINS (27) UP IN PRESS.
24. PRESS FOUR PINION PINS (27) FROM CENTER CARRIER ASSEMBLY (5).

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## **GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)**

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25. REMOVE PINION GEAR (24), ROLLER BEARING (29), TWO STEEL THRUST WASHERS (30), AND TWO BRONZE THRUST WASHERS (31) FROM CENTER CARRIER ASSEMBLY (5).
26. REPEAT STEPS 23 THRU 25 FOR EACH OF FOUR PINION GEARS (24).

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

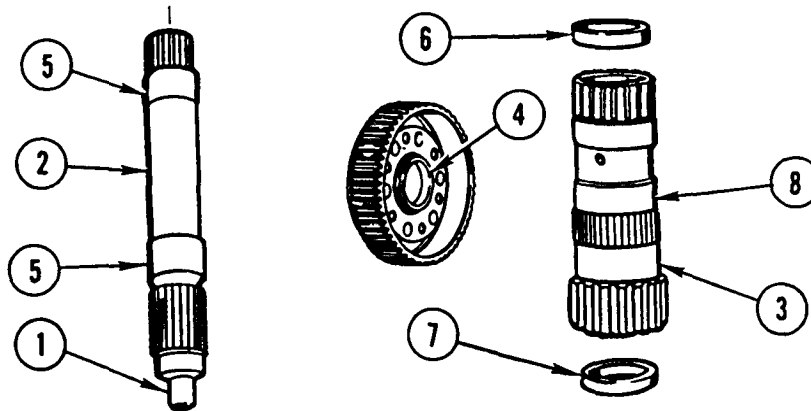
### **INSPECTION**

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

#### **NOTE**

All planetary gears in a carrier assembly are replaced as a set.

2. MEASURE THICKNESS OF THRUST WASHERS; THICKNESS MUST BE NO LESS THAN 0.091 IN. (2.31 mm).

**NOTE**

Bearing surface measurement will be used on page 14-139 to find output shaft bushing clearance.

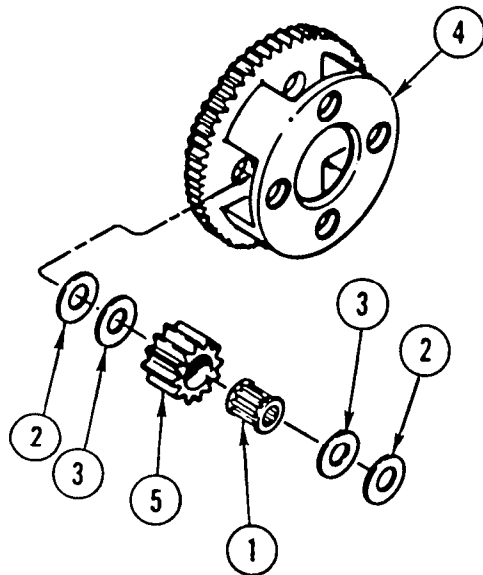
3. MEASURE AND NOTE DIAMETER OF BEARING SURFACE (1) OF MAIN SHAFT (2).
4. MEASURE DIAMETER OF FRONT CARRIER BEARING SURFACE (3).
5. MEASURE INSIDE DIAMETER OF BUSHING (4).
6. IF BUSHING (4) TO FRONT CARRIER BEARING SURFACE (3) CLEARANCE IS GREATER THAN 0.0072 IN. (0.18 mm), REPLACE BUSHING (4).
7. MEASURE DIAMETER OF BEARING SURFACE (5) ON MAIN SHAFT.
8. MEASURE INSIDE DIAMETER OF TWO BUSHINGS (6 AND 7) IN SUN GEAR SHAFT (8).
9. IF CLEARANCE BETWEEN BUSHINGS (6 AND 7) AND BEARING SURFACE (5) IS MORE THAN 0.0064 IN. (0.16 mm), REPLACE BUSHINGS (6 AND 7).

**REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

## GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)

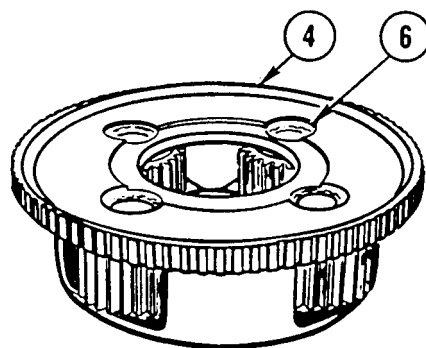
### ASSEMBLY



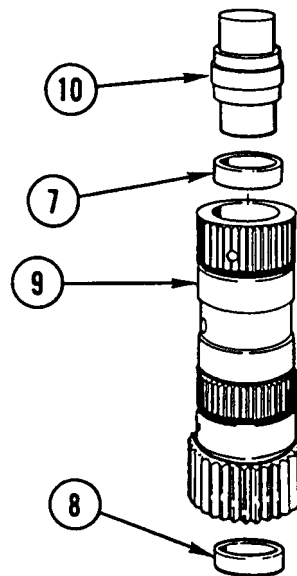
#### NOTE

Front, center, and rear carrier assemblies are assembled the same way, although front carrier has only one thrust washer on each end of pinion gears. Assembly of center carrier is shown.

1. LUBRICATE FOUR ROLLER BEARINGS (1), EIGHT BRONZE THRUST WASHERS (2), AND EIGHT STEEL THRUST WASHERS (3) WITH LUBRICATING OIL.
2. POSITION CENTER CARRIER ASSEMBLY (4) IN PRESS WITH FRONT END UP.
3. INSTALL ROLLER BEARING (1) IN PINION GEAR (5).
4. INSTALL TWO STEEL THRUST WASHERS (3) ON PINION GEAR (5).
5. INSTALL TWO BRONZE THRUST WASHERS (2) ON EACH TWO STEEL THRUST WASHERS (3).
6. INSTALL PINION GEAR (5) IN CENTER CARRIER ASSEMBLY (4). REPEAT STEPS 1 THRU 6 FOR EACH OF FOUR PINION GEARS (5).



7. PRESS FOUR PINION PINS (6) IN CENTER CARRIER ASSEMBLY (4) UNTIL ENDS OF EACH PINION PIN ARE EQUAL.
8. REMOVE CENTER CARRIER ASSEMBLY (4) FROM PRESS.
9. STAKE BOTH ENDS OF FOUR PINION PINS (6) EQUAL DISTANCE IN FOUR PLACES.

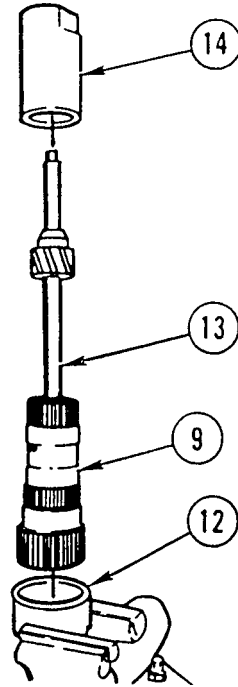
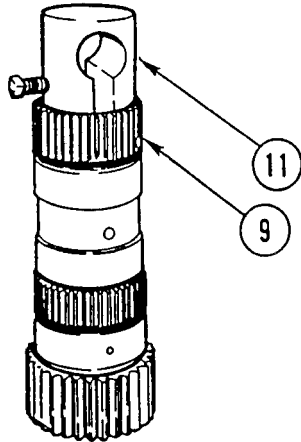


**WARNING**

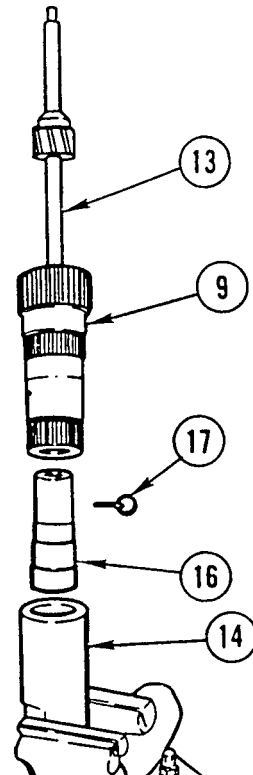
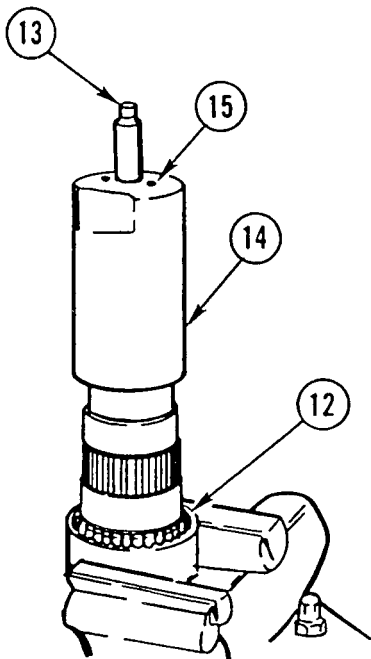
Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with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

10. APPLY SEALING COMPOUND TO TWO BUSHINGS (7) AND (8).
11. POSITION BUSHING (7) AT BORE OF SMALL END OF SUN GEAR SHAFT (9). ALINE INTERLOCK SPLIT SO BUSHING (7) IS MORE THAN 45 DEGREES FROM SWAGING HOLE IN SUN GEAR SHAFT (9).
12. USING END OF BUSHING INSTALLER (10) MARKED .360, PRESS IN BUSHING (7).
13. USING END OF BUSHING INSTALLER (10) MARKED .260, INSTALL BUSHING (8) IN LARGE END OF SUN GEAR SHAFT ASSEMBLY (9). ALINE INTERLOCK SPLIT SO BUSHING (8) IS MORE THAN 45 DEGREES FROM SWAGING HOLE IN SUN GEAR SHAFT (9).

**GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)**



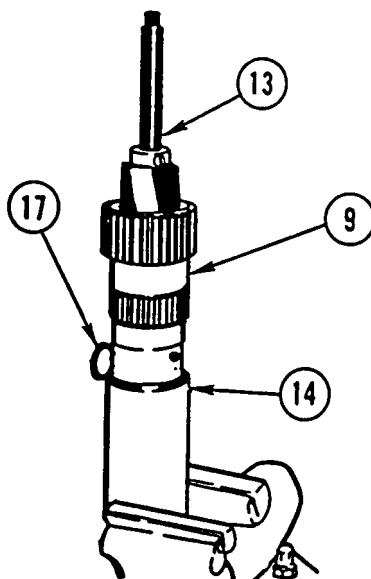
14. USING BUSHING SWAGER (11), PUSH BOTH BUSHINGS INTO SWAGING HOLES OF SUN GEAR SHAFT ASSEMBLY (9).
15. CLAMP HOLDING FIXTURE (12) IN VISE. SET SUN GEAR SHAFT (9) IN HOLDING FIXTURE (12) WITH SMALL END UP. POSITION SUN GEAR BUSHING REAMER (13) AND PILOT TOOL (14).



**CAUTION**

Keep reamer rotating at full drill speed when pulling back through bushing. If reamer is not rotating at full drill speed, bushing could be damaged.

16. USING 1/2-IN. (13-mm) ELECTRIC DRILL, MACHINE BUSHING AT APPROXIMATELY 75-150 RPM WHILE ADDING LUBRICATING OIL THRU EITHER HOLE (15) ON TOP OF PILOT TOOL (14).
17. CLAMP PILOT TOOL (14) IN VISE. INSERT BUSHING PILOT TOOL (16) IN SMALL END OF SUN GEAR SHAFT (9) AND HOLD WITH LOCKING PIN (17). POSITION BUSHING PILOT TOOL (16) IN PILOT TOOL (14) AND POSITION REAMER AND SHAFT ASSEMBLY (13) IN SUN GEAR SHAFT (9).



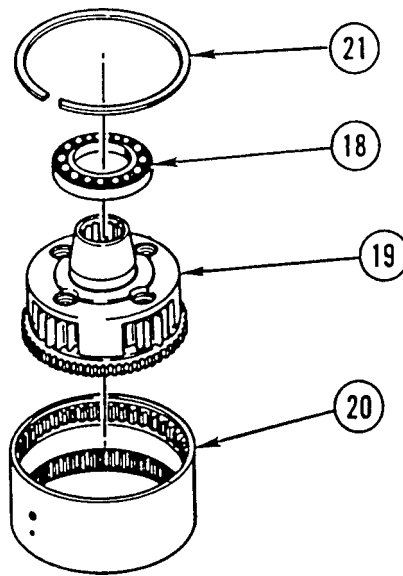
18. ENGAGE SHAFT OF REAMER AND SHAFT ASSEMBLY (13) WITH PILOT TOOL (14).

**CAUTION**

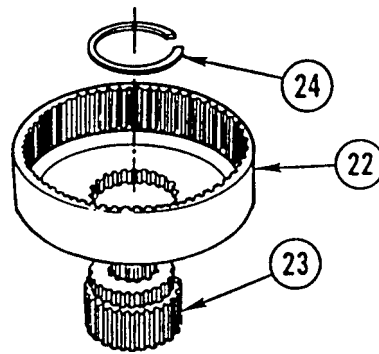
Keep reamer rotating at full drill speed when pulling back through bushing. If reamer is not rotating at full drill speed, bushing could be damaged.

19. USING 1/2-IN. (13-mm) ELECTRIC DRILL, MACHINE BUSHING AT APPROXIMATELY 75-150 RPM WHILE ADDING LUBRICATING OIL IN BORE AT SIDES OF SUNGEAR SHAFT (9).
20. CHECK INNER DIAMETER OF BUSHINGS FOR RUNOUT. RUNOUT MUST NOT EXCEED 0.002 IN. (0.05 mm) TOTAL INDICATOR READING. SURFACE FINISH SHOULD BE 30 MICROINCH (0.762 MICROMETER).
21. THOROUGHLY CLEAN SUN GEAR SHAFT (9) OF CHIPS AND DEBRIS.

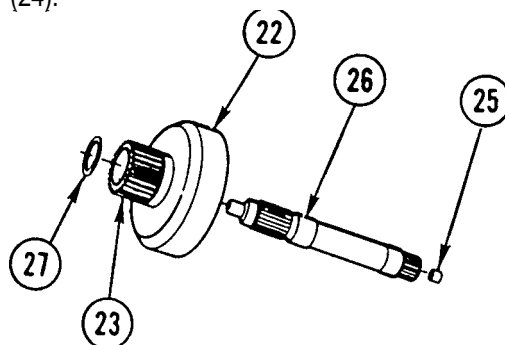
## GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)



- 22. INSTALL BEARING (18) ON REAR CARRIER ASSEMBLY (19).
- 23. POSITION REAR CARRIER ASSEMBLY (19) ON TRANSMISSION DRUM (20).
- 24. INSTALL RETAINING RING (21).

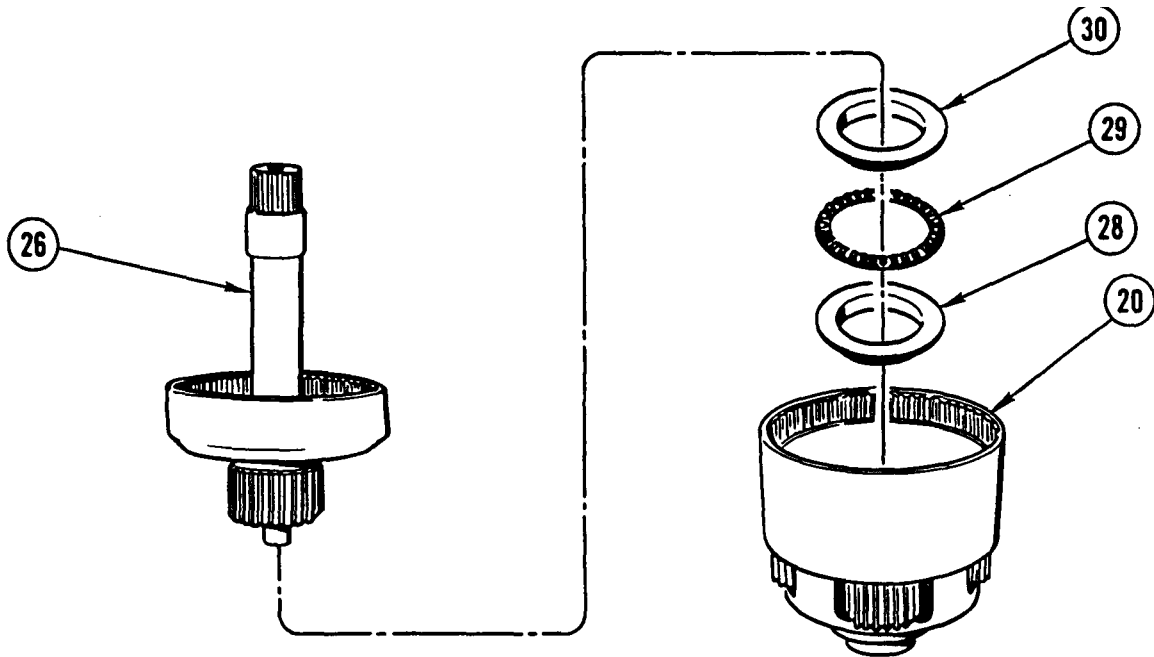


- 25. INSTALL INTERNAL GEAR (22) ON SPUR GEAR SHAFT (23).
- 26. INSTALL RETAINING RING (24).

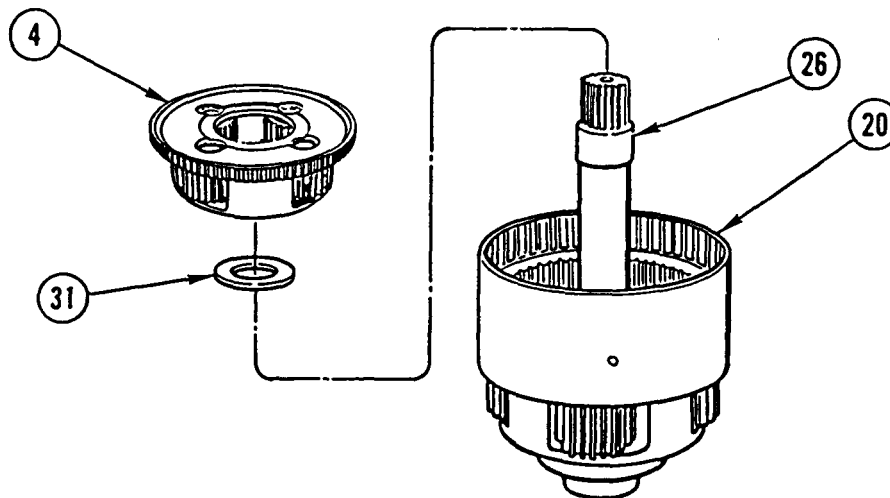




27. IF REMOVED, INSTALL NEW LUBE ORIFICE PLUG (25) ON LARGE END OF MAIN SHAFT (26).
28. POSITION MAIN SHAFT (26) THRU INTERNAL GEAR (22) AND SPUR GEAR SHAFT (23).
29. INSTALL SPIRAL LOCKING RING (27).

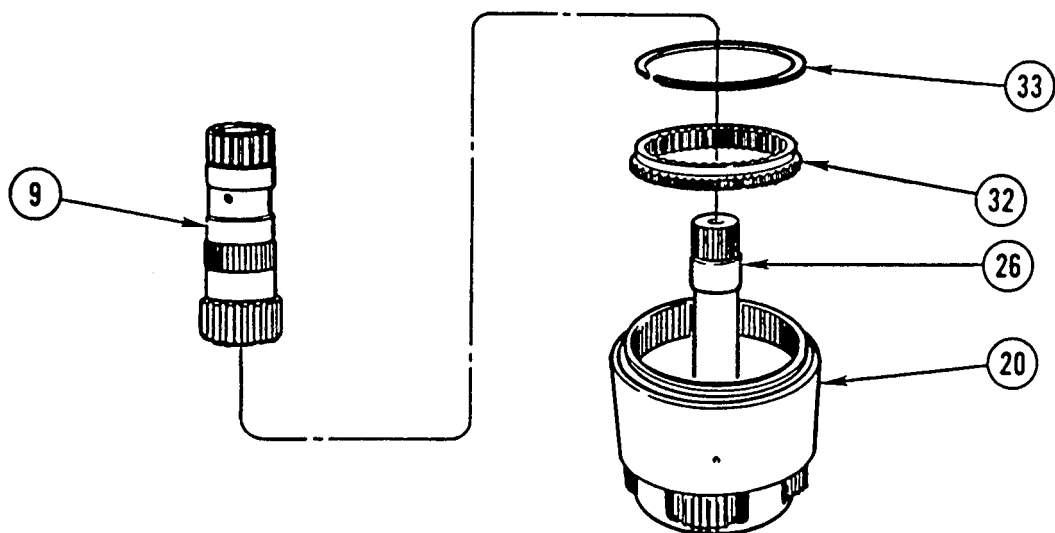


30. INSTALL BEARING RACE (28), BEARING (29), AND BEARING RACE (30) IN TRANSMISSION DRUM (20).
31. INSTALL MAIN SHAFT (26) IN TRANSMISSION DRUM (20).

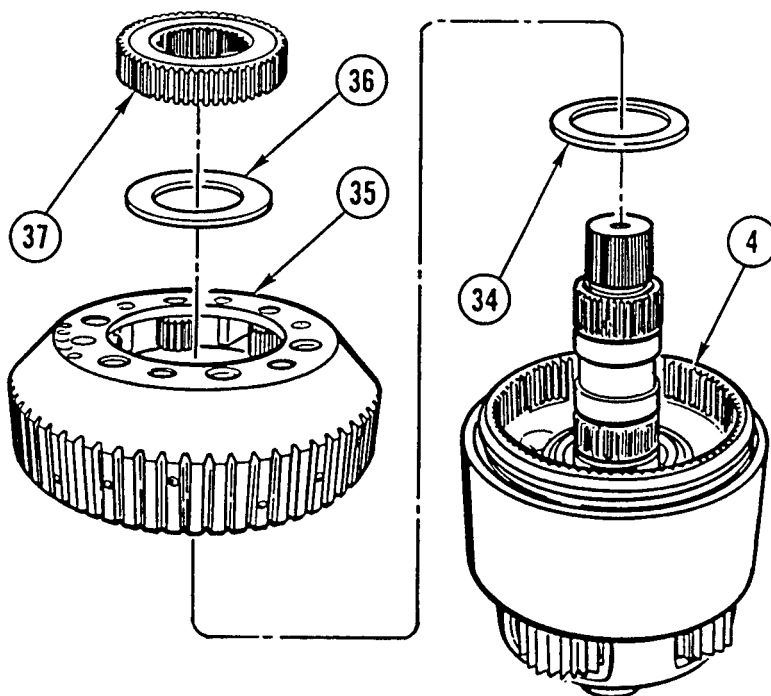


32. INSTALL THRUST WASHER (31) ON BASE OF MAIN SHAFT (26).
33. INSTALL CENTER CARRIER ASSEMBLY (4) IN TRANSMISSION DRUM (20).

## GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)

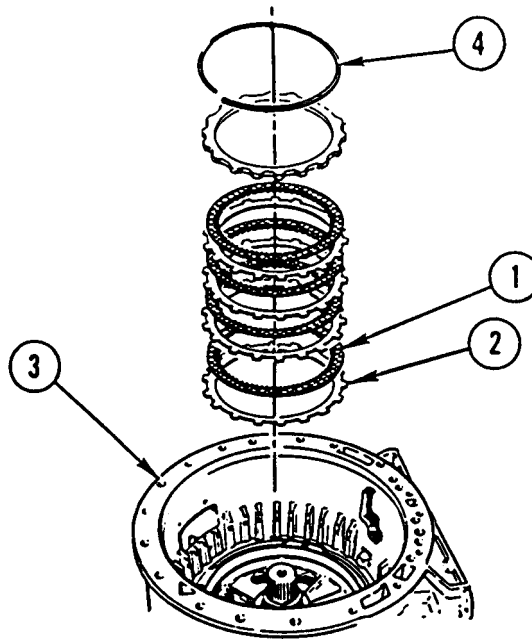


34. INSTALL SPUR GEAR (32) IN TRANSMISSION DRUM (20).
35. INSTALL RETAINING RING (33) IN TRANSMISSION DRUM (20).
36. COAT INSIDE OF SUN GEAR SHAFT (9) WITH LIGHT COATING OF LUBRICATING OIL.
37. INSTALL SUN GEAR SHAFT (9) ON MAIN SHAFT (26).



36. INSTALL THRUST WASHER (34) ON REAR OF FRONT CARRIER ASSEMBLY (35).
39. INSTALL FRONT CARRIER ASSEMBLY (35) ON CENTER CARRIER ASSEMBLY (4).
40. INSTALL THRUST WASHER (36) ON FRONT CARRIER ASSEMBLY (35).
41. INSTALL DRIVEN GEAR (37) IN FRONT CARRIER ASSEMBLY (35).

## **INSTALLATION**

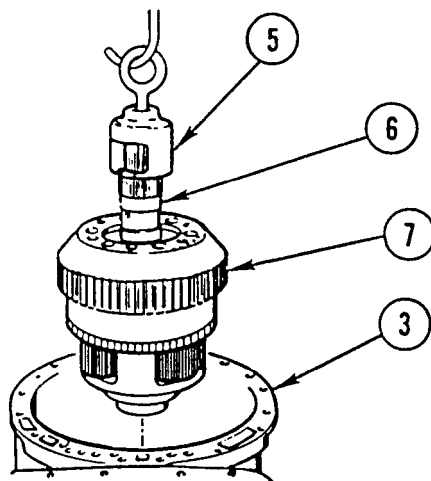


1. INSTALL 13 SECOND CLUTCH PLATES (1 AND 2) IN TRANSMISSION HOUSING (3).
2. INSTALL RETAINING RING (4).

---

## GEAR UNIT AND MAIN SHAFT REPLACEMENT AND REPAIR (CONT)

---



3. INSTALL LIFTING BRACKET (5) ON MAIN SHAFT (6).
4. LOWER GEAR UNIT ASSEMBLY (7) INTO TRANSMISSION HOUSING (3).
5. REMOVE LIFTING BRACKET (5).

### NOTE

Follow-on Maintenance:  
Install third clutch and housing (page 14-105).

## Section XII. REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the rear cover and first clutch.

Replacement and repair of the rear cover and first clutch is general support maintenance.

---

### REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly g. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Clutch Spring Compressor, J24204  
 Output Shaft Bushing Installer, J24203  
 Inner Seal Protector, J24210  
 Socket, L883  
 Yoke Holder Bar, J3453

#### Materials/Parts:

Nut, Flanged	P/N 6771144
Gasket	P/N 6839213
Ring, Seal	P/N 23011454
Ring, Seal	P/N 23011458
Oil, Lubricating	Appendix B, item 37
Compound, Retaining	Appendix B, Item 14
Compound, Pipe Sealing	Appendix B, Item 15
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26

#### Equipment Condition:

Reference	Condition Description
Page 14-2	Transmission Installed on Transmission Stand
Page 3-256	Transmission Output Yoke Removed
Page 3-260	Governor Removed

#### General Safety Instructions:

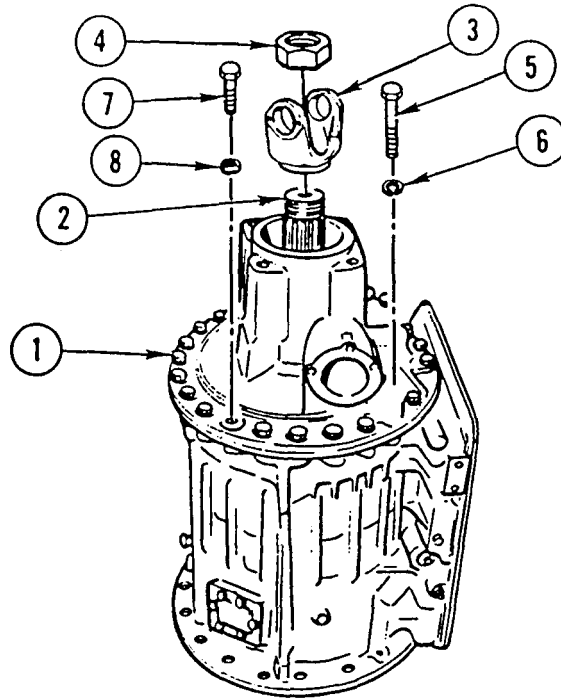
**WARNING**

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

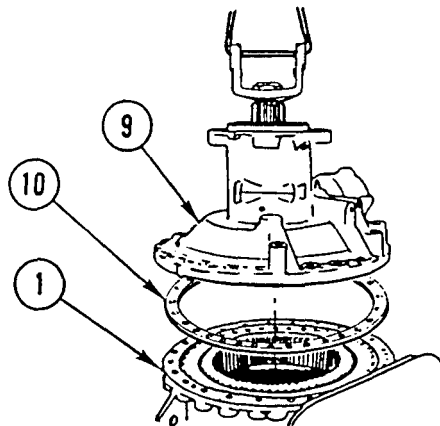
**Personnel Required:** (2)

## REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR (CONT)

### REMOVAL

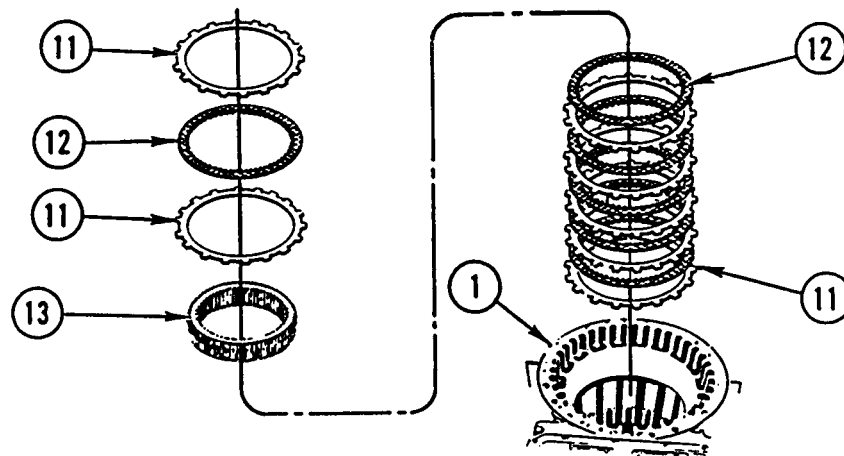


1. POSITION TRANSMISSION (1) SO OUTPUT SHAFT (2) IS POINTING UP.
2. INSTALL YOKE (3) AND NUT (4)
3. REMOVE THREE SCREWS (5) AND THREE LOCK WASHERS (6).
4. REMOVE 21 SCREWS (7) AND 21 LOCK WASHERS (8).



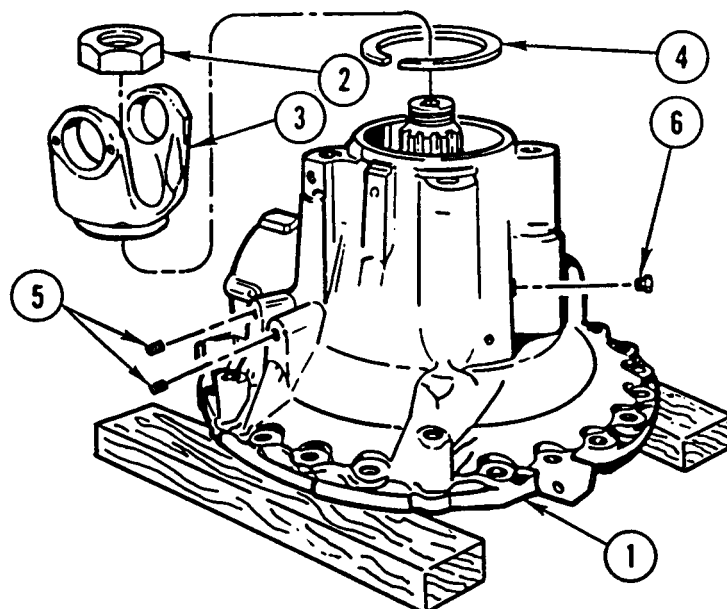
5. INSTALL SLING LIFTING DEVICE TO REAR COVER (9) AND REMOVE REAR COVER (9) FROM TRANSMISSION (1).

6. REMOVE LIFTING DEVICE.
7. REMOVE AND DISCARD GASKET (10) FROM TRANSMISSION (1).



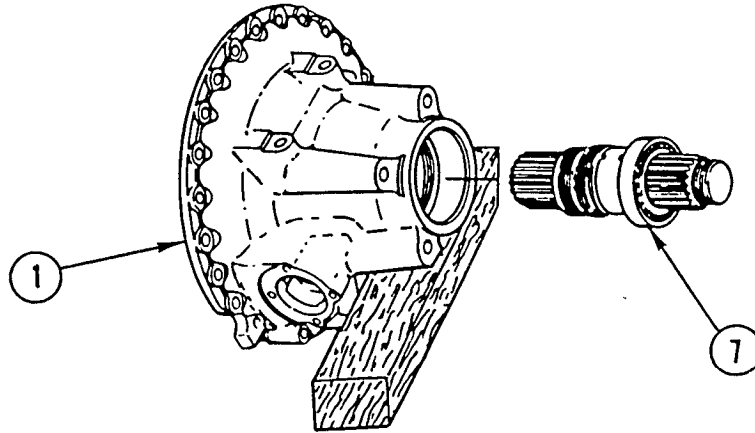
8. REMOVE TWO STEEL PLATES (11), FRICTION PLATE (1), AND REAR PLANETARY RING GEAR (13) FROM TRANSMISSION HOUSING (1).
9. REMOVE FIVE FRICTION PLATES (12) AND FIVE STEEL PLATES (11) FROM TRANSMISSION HOUSING (1).

**DISASSEMBLY**

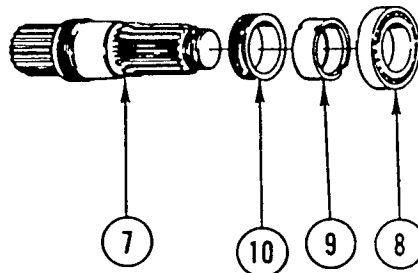


1. SET REAR COVER (1) ON WOODEN BLOCKS.
2. REMOVE NUT (2), YOKE (3), AND OUTPUT SHAFT BEARING RETAINING RING (4).
3. REMOVE TWO PLUGS (5) AND PLUG (6) FROM REAR COVER (1).

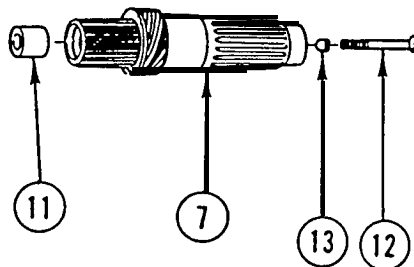
## REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR (CONT)



4. POSITION REAR COVER (1) ON SIDE, USING WOODEN BLOCK FOR SUPPORT.
5. REMOVE OUTPUT SHAFT (7) FROM REAR COVER (1).

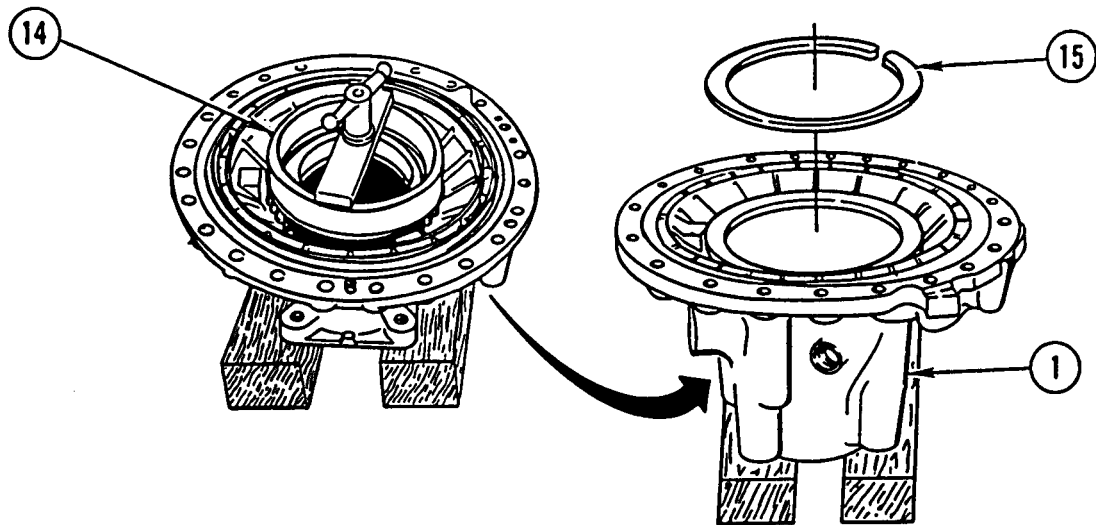


6. PRESS OUTPUT SHAFT (7) FROM BEARING (8), SPACER (9), AND SPEEDOMETER DRIVE GEAR (10).

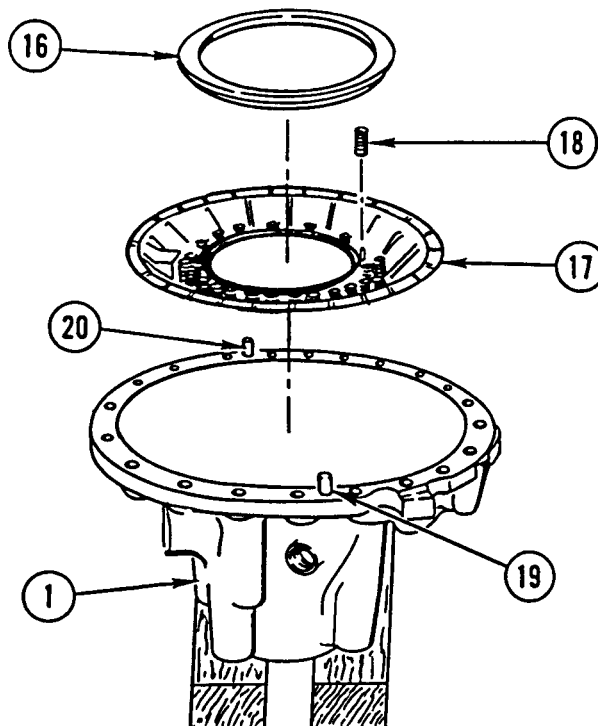


7. REMOVE BUSHING (11) FROM OUTPUT SHAFT (7).
8. SCREW LONG SCREW (12) INTO SMALL ORIFICE PLUG (13). IF DAMAGED, PRY UP ON SCREW (12) TO REMOVE PLUG (13).



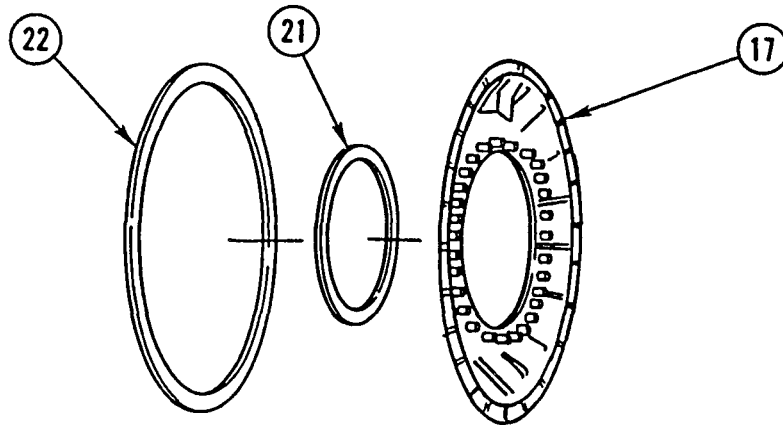


9. POSITION REAR COVER (1) FLANGE SIDE UP.
10. INSTALL CLUTCH SPRING COMPRESSOR (14) IN REAR COVER (1).
11. COMPRESS CLUTCH SPRING COMPRESSOR (14) AND REMOVE LARGE EXTERNAL RETAINING RING (11).
12. REMOVE CLUTCH SPRING COMPRESSOR (14).

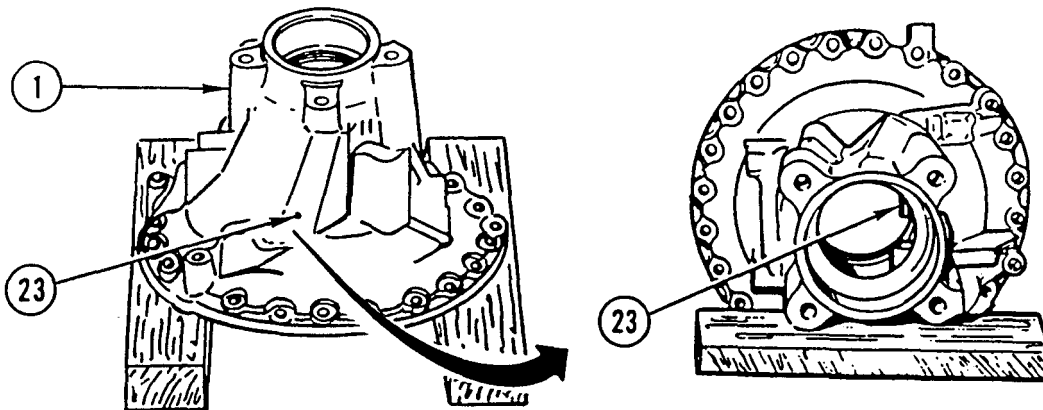


13. REMOVE PISTON SPRING RETAINER (16) FROM FIRST CLUTCH PISTON (17).
14. REMOVE 30 PISTON RELEASE SPRINGS (18) FROM FIRST CLUTCH PISTON (17).
15. REMOVE FIRST CLUTCH PISTON (17) FROM REAR COVER (1).
16. IF DAMAGED, REMOVE TWO DOWEL PINS (19 AND 20) FROM REAR COVER (1).

## REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR (CONT)



17. REMOVE AND DISCARD INNER SEAL RING (21) AND OUTER SEAL RING (22) FROM FIRST CLUTCH PISTON (17).



18. POSITION REAR COVER (1) FLANGE SIDE DOWN USING WOODEN BLOCKS FOR SUPPORT.  
19. IF DAMAGED, REMOVE GOVERNOR SUPPORT PIN (23) FROM REAR COVER (1).

### CLEANING

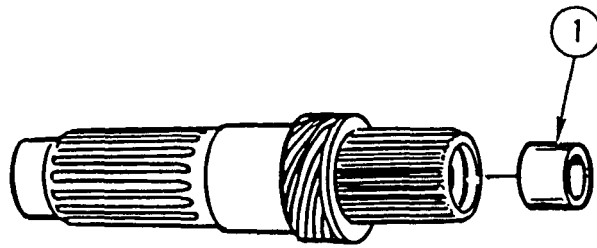
Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. INSPECT AND REPLACE PISTON RELEASE SPRINGS IF ANY FIVE DO NOT MEET FOLLOWING LOAD-HEIGHT REQUIREMENTS:

LENGTH WITHOUT LOAD: AT LEAST 1.29 IN. (32.77 mm).

LENGTH UNDER LOAD: AT LEAST 0.82 IN. (20.83 mm) WITH LOAD OF 4.3-5.7 LB (1.9-2.6 kg).

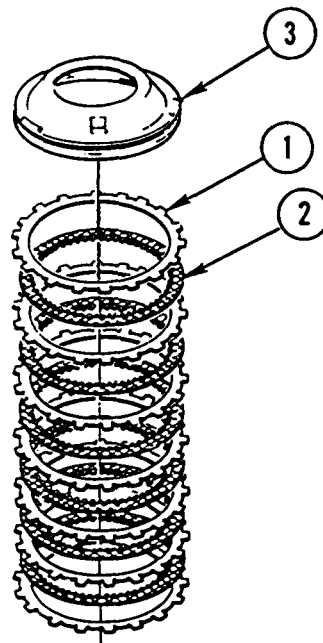


3. MEASURE INSIDE DIAMETER OF BUSHING (1),
4. CHECK CLEARANCE BETWEEN DIAMETER OF MAIN SHAFT BEARING SURFACE, MEASURED ON PAGE 14-123, AND BUSHING DIAMETER MEASURED IN STEP 3. IF CLEARANCE IS GREATER THAN 0.004 IN. (0.10 mm), REPLACE BUSHING (1).

**REPAIR**

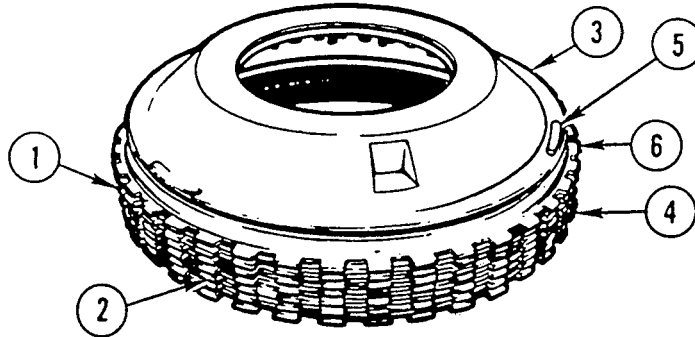
Use general repair methods to repair damaged parts (page 2-33).

**ASSEMBLY**

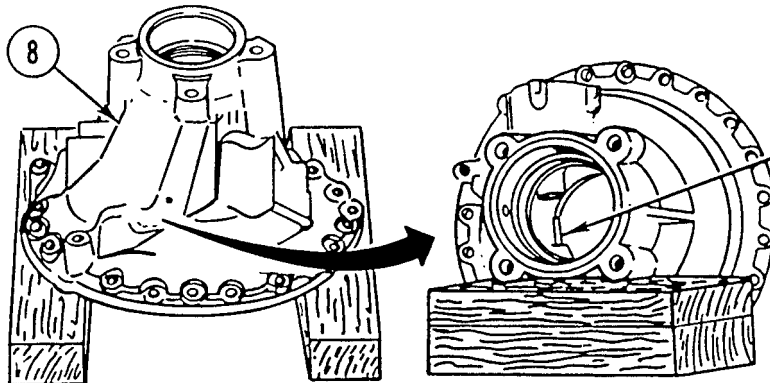


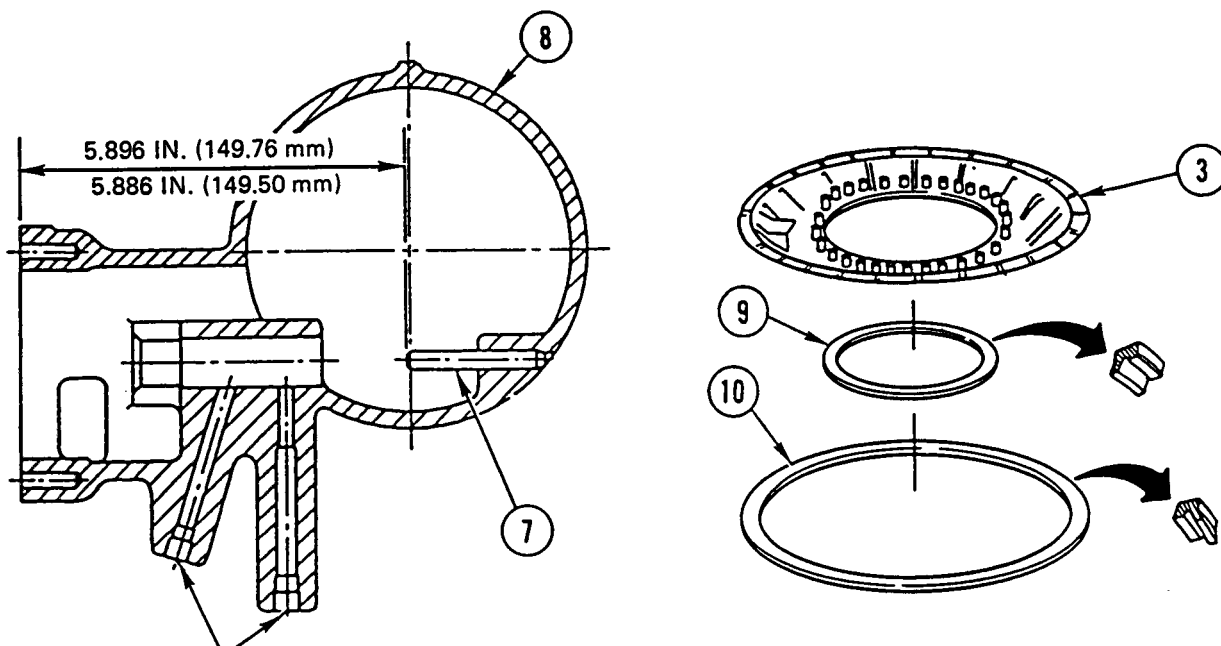
1. STACK 13 CLUTCH PLATES (1 AND 2) ON FLAT SURFACE OF PRESS STARTING WITH STEEL PLATE (1) AND ALTERNATING WITH FRICTION PLATE (2).
2. PLACE FIRST CLUTCH PISTON (3) ON TOP OF 13 CLUTCH PLATES (1 AND 2).

## REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR (CONT)

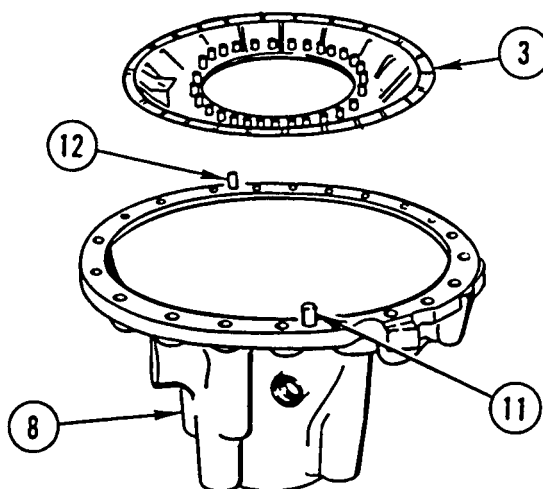


3. PRESS EVENLY ON FIRST CLUTCH PISTON (3) WITH 100 PSI (689.5 kPa).
4. MEASURE DISTANCE FROM BASE OF CLUTCH PACK (4) TO THRUST PAD (5).
5. CLUTCH PACK THICKNESS MUST BE 2.521-2.553 IN. (64.03-64.85 mm). REPLACE CLUTCH PLATE(S) (1 AND 2) AS NEEDED TO ENSURE PROPER CLUTCH PACK THICKNESS.
6. MEASURE THICKNESS OF ONE TANG (6) ON EACH OF SEVEN STEEL PLATES (1). IF STEEL PLATE MEASURES 0.116-0.123 IN. (2.95-3.12 mm), STEEL PLATE IS THICK. IF STEEL PLATE MEASURES 0.099-0.106 IN. (2.51-2.69 mm), STEEL PLATE IS THIN.
7. REPEAT STEPS 1 THRU 5 TO RECHECK CLUTCH PACK THICKNESS.
8. REMOVE FIRST CLUTCH PISTON (3) AND CLUTCH PACK (4) FROM PRESS.



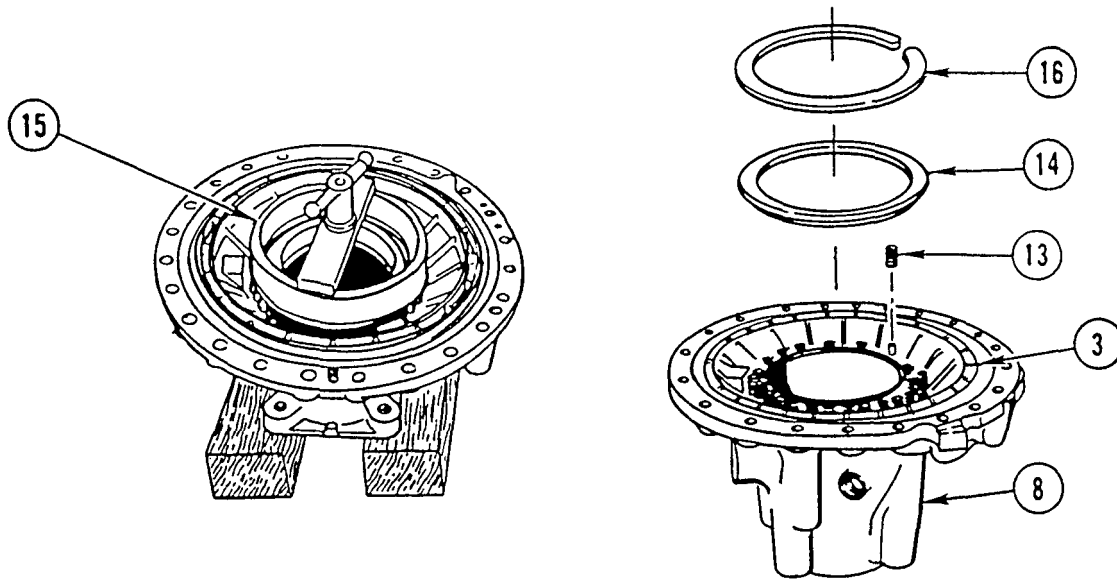


9. IF REMOVED, INSTALL NEW GOVERNOR SUPPORT PIN (7) IN REAR COVER (8) USING ILLUSTRATION AS A GUIDE.
10. COAT NEW INNER SEAL RING (9) AND NEW OUTER SEAL RING (10) WITH GAA.
11. INSTALL INNER SEAL RING (9) AND OUTER SEAL RING (10) ON FIRST CLUTCH PISTON (3) WITH LIPS FACING DOWN.

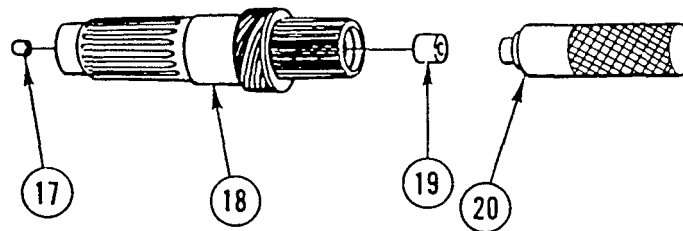


12. INSTALL FIRST CLUTCH PISTON (3) IN REAR COVER (8).
13. IF REMOVED, INSTALL TWO NEW DOWEL PINS (11 AND 12). DISTANCE BETWEEN FLANGE SURFACE AND TOP OF DOWEL PIN SHOULD BE 0.360-0.400 IN. (10.14-10.16 mm).

## REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR (CONT)



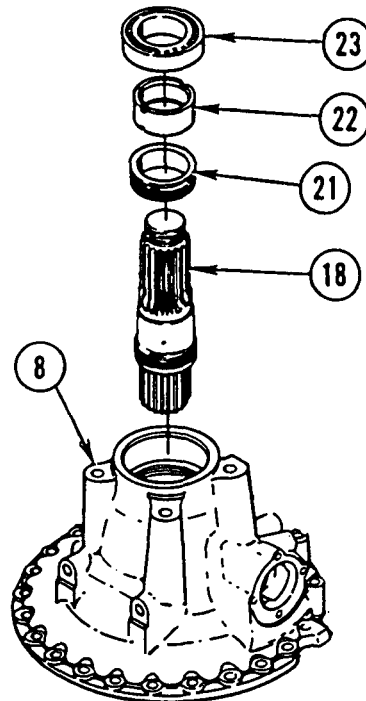
14. INSTALL 30 PISTON RELEASE SPRINGS (13) IN FIRST CLUTCH PISTON (3).
15. INSTALL PISTON SPRING RETAINER (14) ON PISTON RELEASE SPRINGS (13).
16. USING CLUTCH SPRING COMPRESSOR (15), PUSH DOWN ON PISTON SPRING RETAINER (14) AND PISTON RELEASE SPRINGS (13) UNTIL RETAINING RING GROOVE IN REAR COVER (8) IS CLEARED.
17. INSTALL RETAINING RING (16). REMOVE CLUTCH SPRING COMPRESSOR (15).



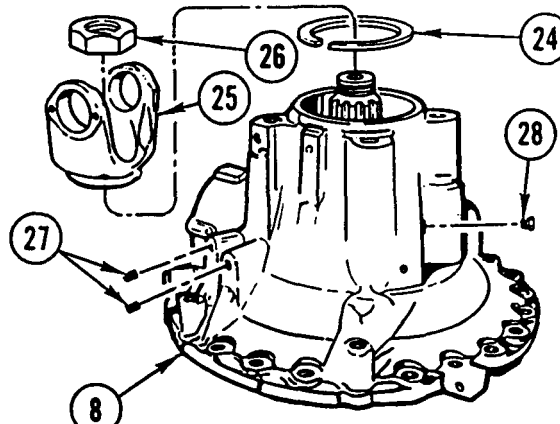
### NOTE

Orifice plug must clear chamfer at front of plug bore when installed in output shaft.

18. IF REMOVED, INSTALL NEW ORIFICE PLUG (17) IN OUTPUT SHAFT (18).
19. COAT OUTPUT SHAFT BUSHING (19) WITH RETAINING COMPOUND.
20. INSTALL OUTPUT SHAFT BUSHING (19) IN OUTPUT SHAFT (18) USING OUTPUT SHAFT BUSHING INSTALLER (20).



21. INSTALL SPEEDOMETER DRIVE GEAR (21), SPACER (22), AND BEARING (23) ON OUTPUT SHAFT (18).
22. INSTALL OUTPUT SHAFT (18) IN REAR COVER (8).



23. USING YOKE HOLDER BAR AND SOCKET, INSTALL RETAINING RING (24), YOKE (25), AND NUT (26).

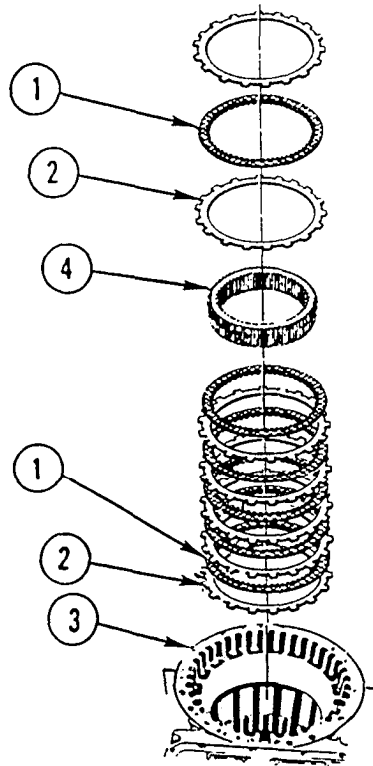
**WARNING**

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

24. LIGHTLY COAT THREADS OF TWO PLUGS (27) AND PLUG (28) WITH PIPE SEALING COMPOUND AND INSTALL IN REAR COVER (8).

## REAR COVER AND FIRST CLUTCH REPLACEMENT AND REPAIR (CONT)

### INSTALLATION

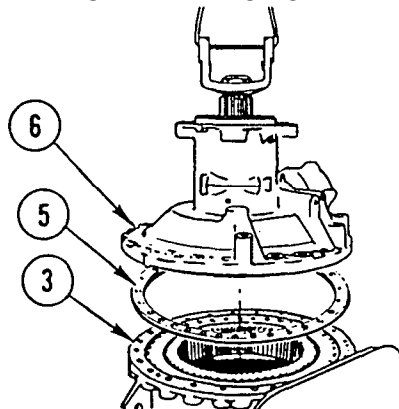


1. SOAK SIX FRICTION PLATES (1) IN CLEAN LUBRICATING OIL FOR AT LEAST 2 MINUTES.

#### NOTE

Thick steel clutch plates must be installed on top of stack for proper pressure distribution.

2. INSTALL 10 CLUTCH PLATES (1 AND 2) IN TRANSMISSION HOUSING (3) STARTING WITH STEEL PLATE (2) AND ALTERNATING WITH FRICTION PLATE (1) UNTIL FULLY SEATED.
3. INSTALL REAR PLANETARY RING GEAR (4) IN TRANSMISSION HOUSING (3).
4. INSTALL THREE CLUTCH PLATES (1 AND 2) IN TRANSMISSION HOUSING (3) STARTING WITH STEEL PLATE (2) AND ALTERNATING WITH FRICTION PLATE (1).



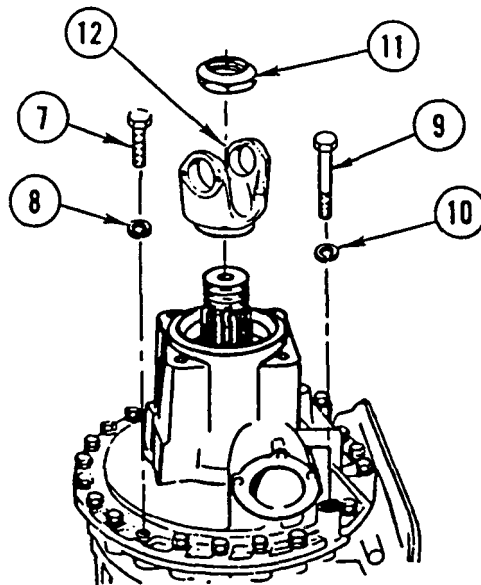


5. LIGHTLY COAT ONE SIDE OF NEW GASKET (5) WITH GAA.
6. SET GASKET (5) ON TRANSMISSION (3) WITH GREASED SIDE OF GASKET DOWN.
7. ALINE HOLES IN GASKET (5) WITH HOLES IN TRANSMISSION (3).
8. INSTALL SLING LIFTING DEVICE ON REAR COVER (6).

**NOTE**

There are two different size dowel pins on screw flange face of rear cover to help align cover with transmission.

9. ALINE DOWEL HOLES AND INSTALL REAR COVER (6) ON TRANSMISSION (3).
10. REMOVE LIFTING DEVICE.



11. INSTALL 21 SCREWS (7) AND 21 LOCK WASHERS (8).
12. INSTALL THREE SCREWS (9) AND THREE LOCK WASHERS (10).
13. TIGHTEN SCREWS (7 AND 9) ALTERNATELY TO 70-80 LB-FT (95-108 N.m).
14. REMOVE NUT (11) AND YOKE (12).

**NOTE**

Follow-on Maintenance:

- Install governor (page 3-260).
- Install transmission output yoke (page 3-256).

## Section XIII. TRANSMISSION HOUSING REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the transmission housing.

Repair of the transmission housing is general support maintenance.

---

### TRANSMISSION HOUSING REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Lever Seal Installer, J26282

**Materials/Parts:**

Pin, Cotter	P/N 6831774
Seal, Oil	P/N 23010610
Gasket	P/N 23016683
Compound, Sealing	Appendix B, Item 16
Cloth, Abrasive	Appendix B, Item 10

**References:**

TM 9-2320-363-20

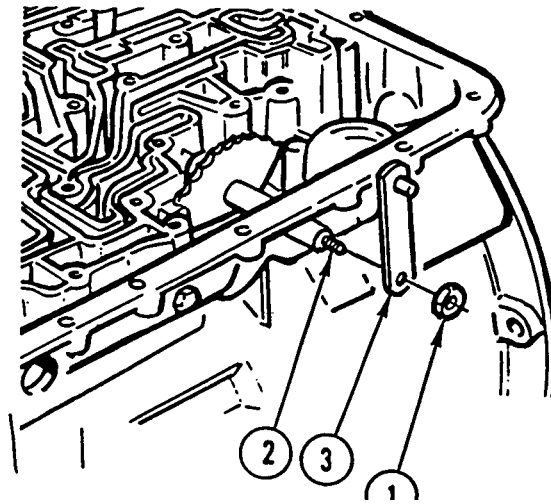
**Equipment Condition:**

Reference	Condition Description
TM 9-2320-363-20	Transmission Breather Removed
TM 9-2320-363-20	Neutral Safety Switch Removed
Page 14-133	Rear Cover and First Clutch Removed
Page 14-116	Gear Unit and Main Shaft Removed

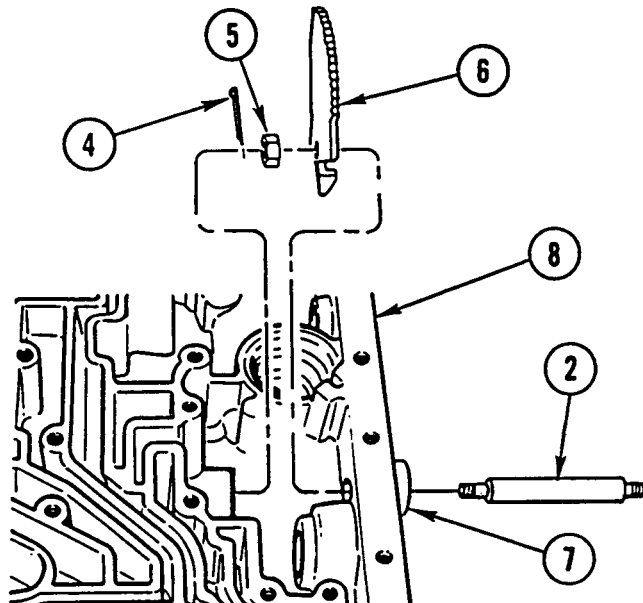
**General Safety Instructions:**

**WARNING**

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

**DISASSEMBLY**

1. REMOVE NUT (1) FROM MANUAL SHAFT (2).
2. REMOVE SELECTOR LEVER (3) FROM MANUAL SHAFT (2).



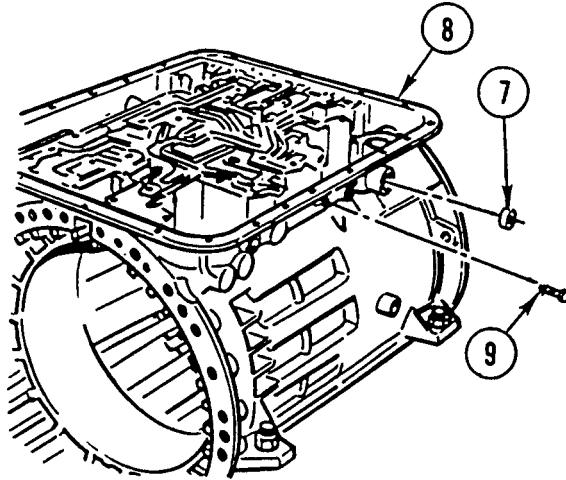
3. REMOVE AND DISCARD COTTER PIN (4).
4. REMOVE LOCK NUT (5).

**CAUTION**

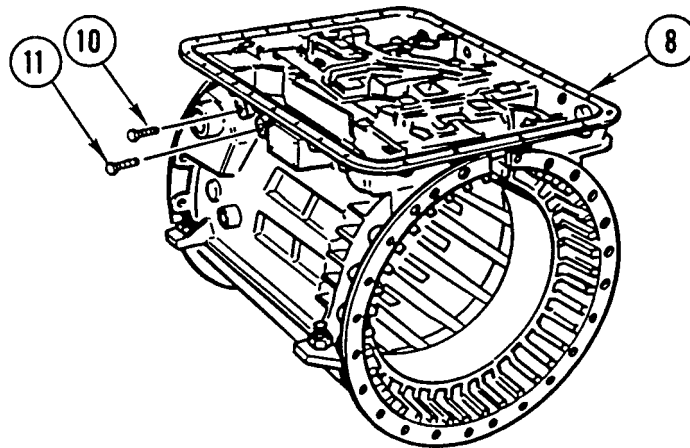
If manual shaft is burred or rough, smooth with abrasive cloth or honing stone before removal to avoid scratching transmission housing bore.

5. HOLD DETENT LEVER (6) WITH ONE HAND AND REMOVE MANUAL SHAFT (2) BY PULLING SHAFT THRU OIL SEAL (7).
6. REMOVE DETENT LEVER (6) FROM TRANSMISSION HOUSING (8).

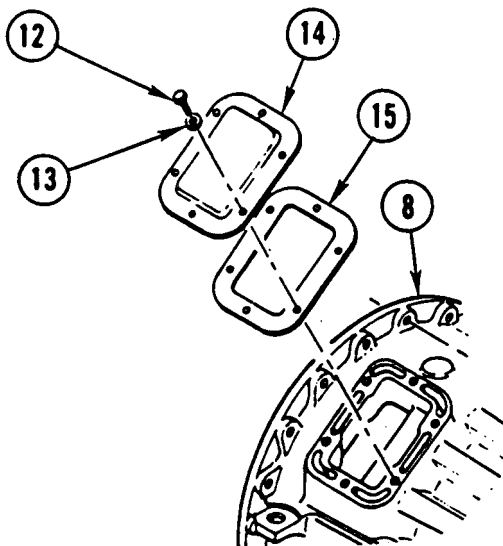
## TRANSMISSION HOUSING REPAIR (CONT)



7. REMOVE AND DISCARD OIL SEAL (7) FROM TRANSMISSION HOUSING (8).
8. REMOVE GOVERNOR PRESSURE TAP PLUG (9).



9. REMOVE FOURTH CLUTCH PRESSURE TAP PLUG (10) FROM TRANSMISSION HOUSING (8).
10. REMOVE REVERSE SIGNAL SWITCH PLUG (11).



11. REMOVE SIX SCREWS (12), SIX WASHERS (13), COVER (14), AND GASKET (15) FROM TRANSMISSION HOUSING (8). DISCARD GASKET.

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

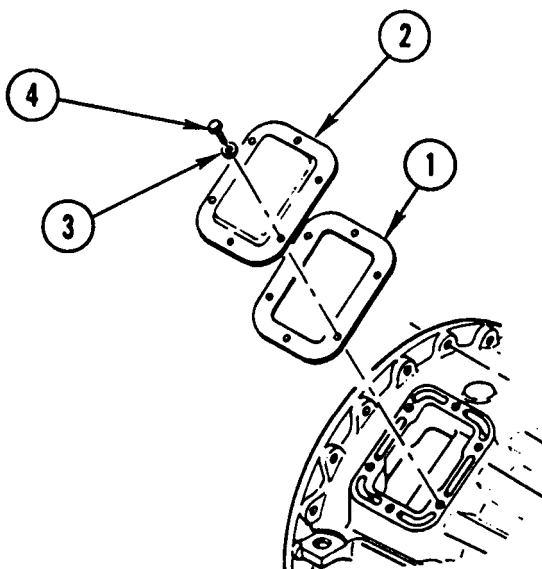
### **INSPECTION**

Inspect all parts for wear or damage.

### **REPAIR**

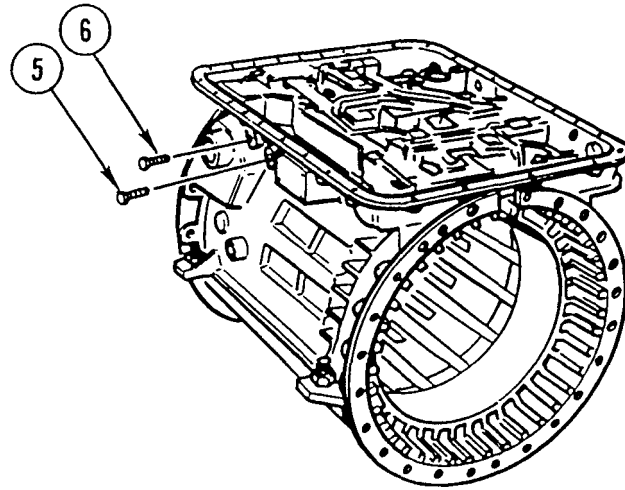
Use general repair methods to repair damaged parts (page 2-33).

### **ASSEMBLY**

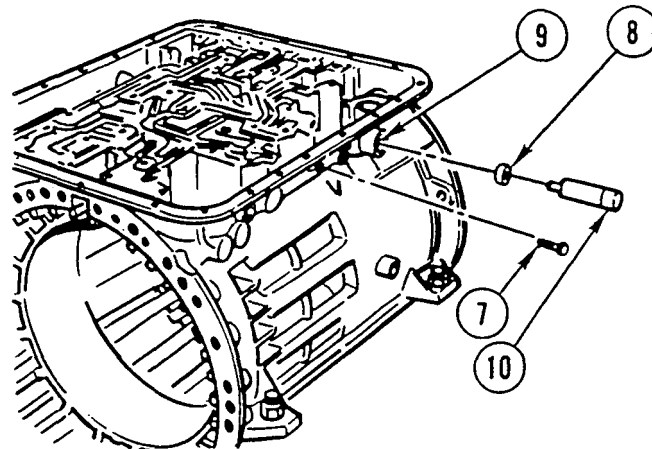


1. INSTALL NEW GASKET (1), COVER (2), SIX WASHERS (3), AND SIX SCREWS (4).

## TRANSMISSION HOUSING REPAIR (CONT)



2. INSTALL REVERSE SIGNAL SWITCH PLUG (5).
3. INSTALL FOURTH CLUTCH PRESSURE TAP PLUG (6).

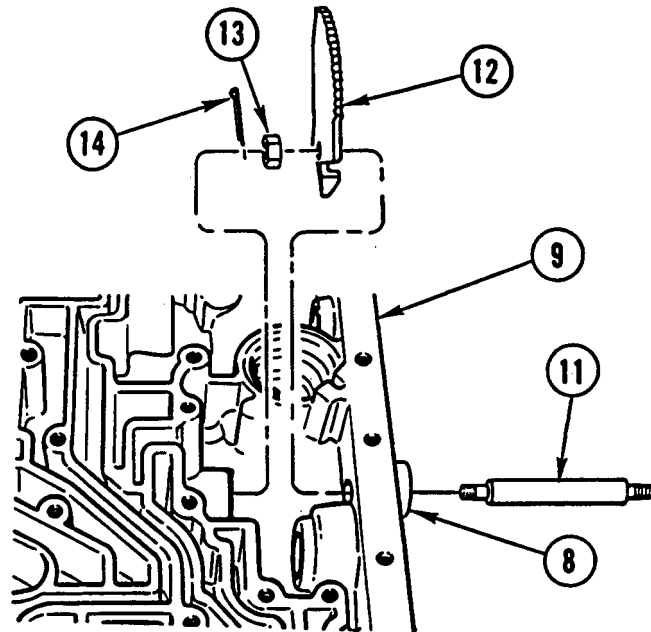


4. INSTALL GOVERNOR PRESSURE TAP PLUG (7).

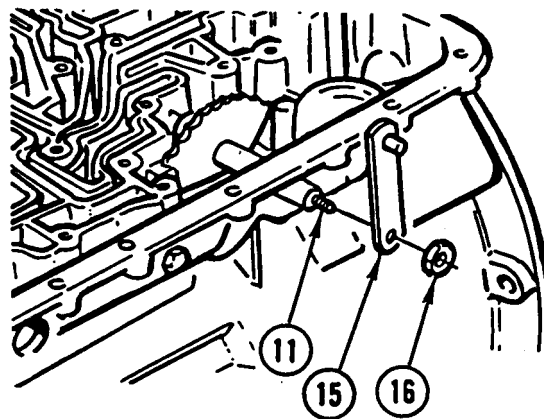
### WARNING

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

5. COAT OUTSIDE OF NEW OIL SEAL (8) WITH SEALING COMPOUND AND INSTALL OIL SEAL (8) IN TRANSMISSION HOUSING (9) USING LEVER SEAL INSTALLER (10).



6. INSTALL MANUAL SHAFT (11) BY PUSHING SHAFT THRU OIL SEAL (8) IN TRANSMISSION HOUSING (9).
7. POSITION DETENT LEVER (12) IN TRANSMISSION HOUSING (9).
8. INSTALL LOCK NUT (13) ON MANUAL SHAFT (11) AND TIGHTEN LOCK NUT (13) TO 15-20 LB-FT (20-27 N.m).
9. INSTALL NEW COTTER PIN (14).



10. INSTALL SELECTOR LEVER (15) ON MANUAL SHAFT (11).
11. INSTALL NUT (16) ON MANUAL SHAFT (11).

**NOTE**

Follow-on Maintenance:  
 Install gear unit and main shaft (page 14-116).  
 Install rear cover and first clutch (page 14-133).  
 Install transmission breather (TM 9-2320-363-20).  
 Install neutral safety switch (TM 9-2320-363-20).

## Section XIV. SECOND CLUTCH REPLACEMENT AND REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, disassembly, cleaning, inspection, repair, assembly, and installation of the second clutch.

Replacement and repair of the second clutch is general support maintenance.

---

## SECOND CLUTCH REPLACEMENT AND REPAIR

---

This task covers: a. Removal b. Disassembly c. Cleaning d. Inspection e. Repair f. Assembly g. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Ring, Seal	P/N 23011454
Ring, Seal	P/N 23011453
Ring, Retaining (4)	P/N 3909063
Oil, Lubricating	Appendix B, Item 37

#### Equipment Condition:

##### Reference

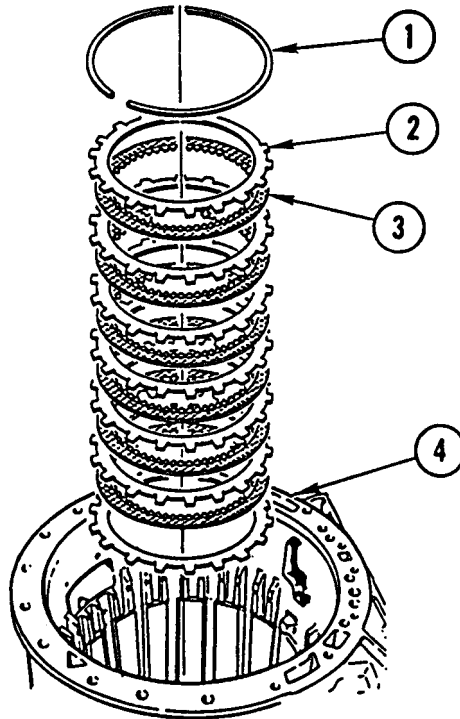
Page 14-116

##### Condition Description

Gear Unit and Main  
Shaft Removed

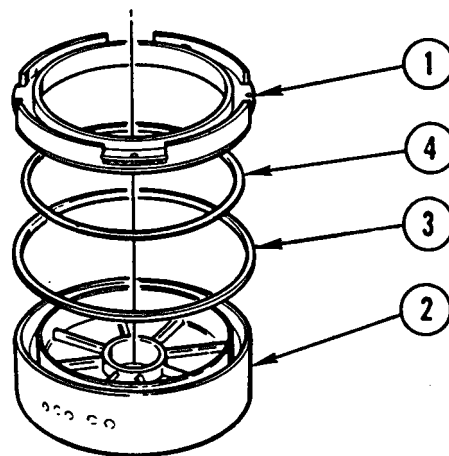


**REMOVAL**



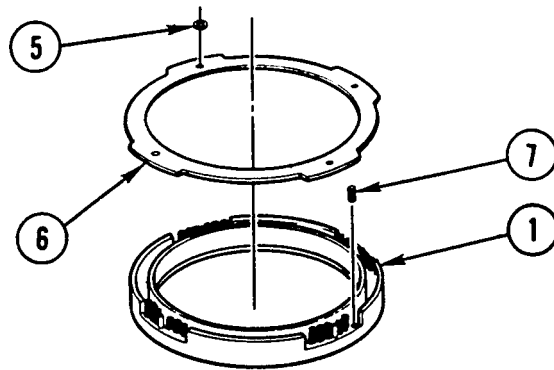
1. REMOVE RETAINING RING (1).
2. REMOVE SEVEN STEEL PLATES (2) AND SIX FRICTION PLATES (3) FROM TRANSMISSION HOUSING (4).

**DISASSEMBLY**



1. REMOVE SECOND CLUTCH PISTON (1) FROM BOTTOM OF CENTER SUPPORT HOUSING (2).
2. REMOVE AND DISCARD OUTER SEAL RING (3) AND INNER SEAL RING (4) FROM SECOND CLUTCH PISTON (1).

## **SECOND CLUTCH REPLACEMENT AND REPAIR (CONT)**



3. CUT, REMOVE, AND DISCARD FOUR RETAINING RINGS (5).
4. REMOVE CLUTCH RING (6) FROM SECOND CLUTCH PISTON (1),
5. REMOVE 20 PISTON RELEASE SPRINGS (7) FROM SECOND CLUTCH PISTON (1).

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

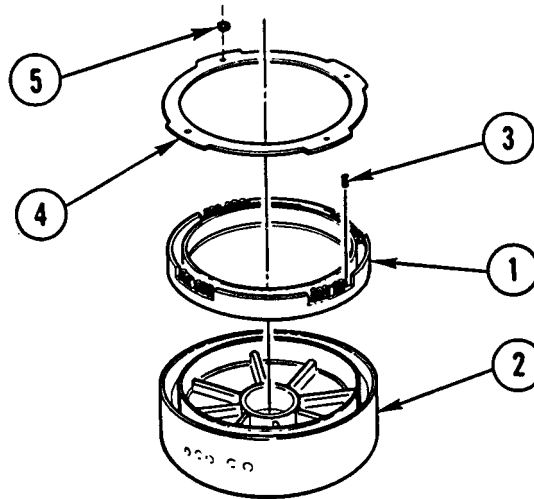
1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. REPLACE PISTON RELEASE SPRINGS IF ANY 3 IN EACH SET OF 20 DO NOT MEET FOLLOWING LOAD-HEIGHT REQUIREMENTS:

LENGTH WITHOUT LOAD: AT LEAST 1.29 IN. (32.7 mm).

LENGTH UNDER LOAD: AT LEAST 0.82 IN. (20.8 mm) WITH LOAD OF 4.3-5.7 LB (1.95-2.59 kg).

### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

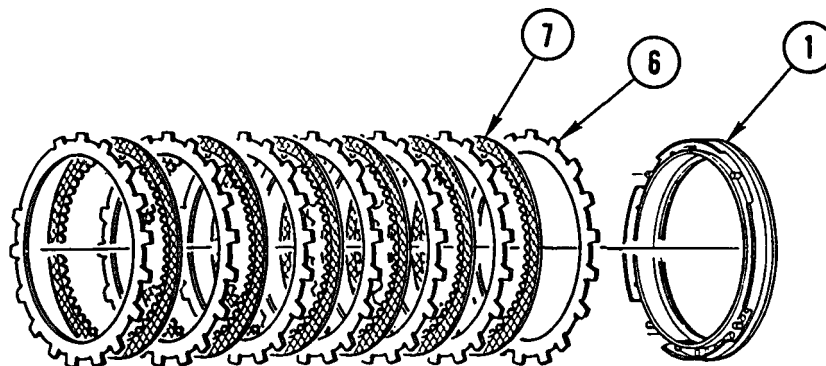
**ASSEMBLY**

1. SET SECOND CLUTCH PISTON (1) IN REAR CAVITY OF CENTER SUPPORT HOUSING (2).
2. INSTALL 20 PISTON RELEASE SPRINGS (3) IN SECOND CLUTCH PISTON (1).
3. INSTALL CLUTCH RING (4) ON SECOND CLUTCH PISTON (1).

**CAUTION**

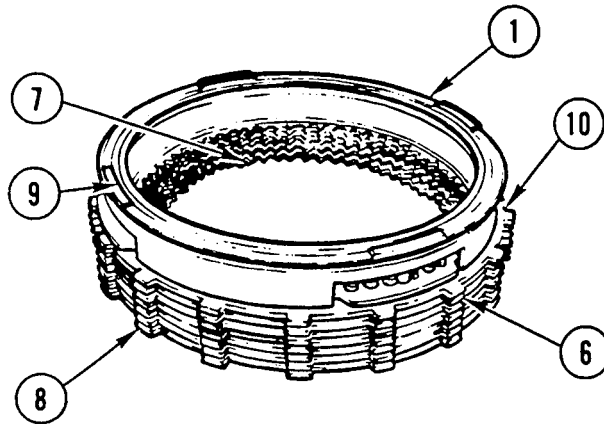
Clutch ring must be pushed completely down in center support housing while installing retaining rings, or clutch clearance will be wrong.

4. INSTALL FOUR NEW RETAINING RINGS (5).
5. REMOVE SECOND CLUTCH PISTON (1) FROM CENTER SUPPORT HOUSING (2).

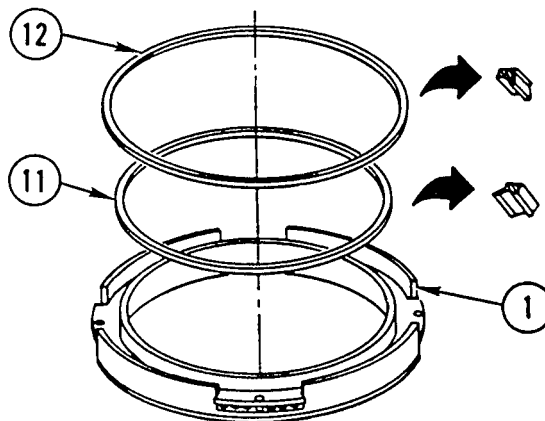


6. STACK 13 CLUTCH PLATES (6 AND 7) ON FLAT SURFACE OF PRESS STARTING WITH STEEL PLATE (6) AND ALTERNATING WITH FRICTION PLATE (7).
7. PLACE SECOND CLUTCH PISTON (1) ON TOP OF CLUTCH PLATES (6 AND 7).

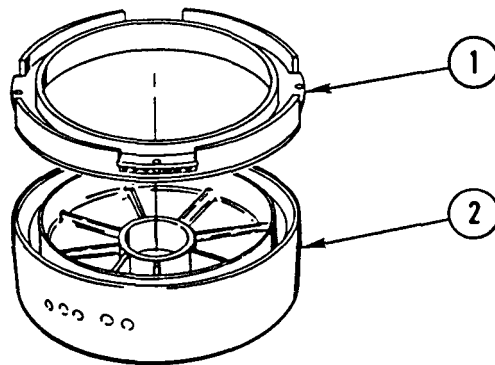
## SECOND CLUTCH REPLACEMENT AND REPAIR (CONT)



8. PRESS EVENLY ON SECOND CLUTCH PISTON (1) WITH 100 PSI (689.5 kPa).
9. MEASURE DISTANCE FROM BASE OF CLUTCH PACK (8) TO TOP OF THRUST PAD (9).
10. CLUTCH PACK THICKNESS MUST BE 3.136-3.168 IN. (79.65-80.47 mm). REPLACE CLUTCH PLATE(S) (6 AND 7) AS NEEDED TO ENSURE PROPER CLUTCH PACK THICKNESS.
11. MEASURE THICKNESS OF ONE TANG (10) ON EACH OF SEVEN STEEL PLATES (6). IF STEEL PLATE MEASURES 0.116-0.123 IN. (2.95-3.12 mm), STEEL PLATE IS THICK. IF STEEL PLATE MEASURES 0.099-0.106 IN. (2.51-2.69 mm), STEEL PLATE IS THIN.
12. REPEAT STEPS 6 THRU 10 TO RECHECK CLUTCH PACK THICKNESS.
13. REMOVE CLUTCH PACK (8) FROM PRESS.

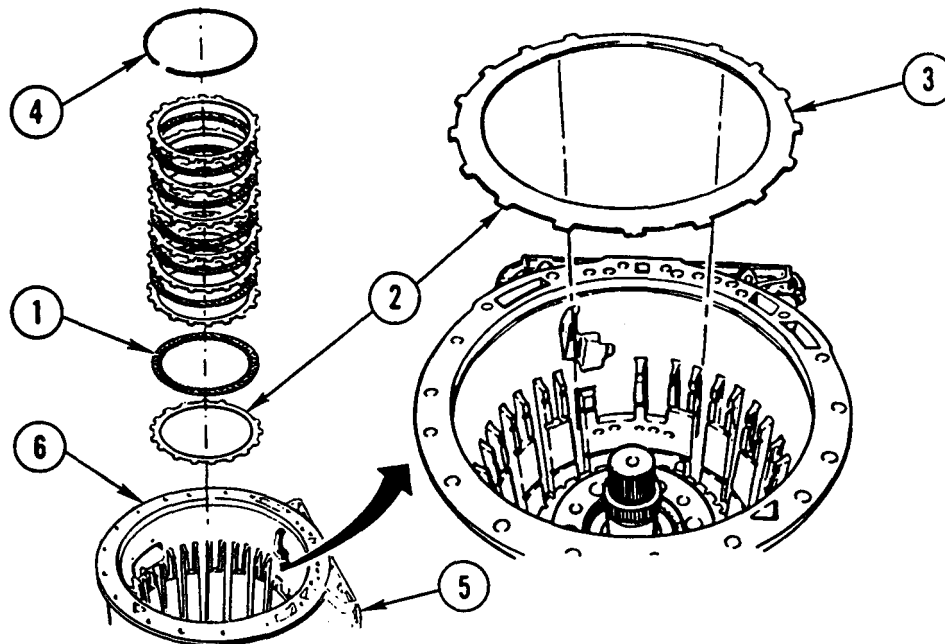


14. APPLY LUBRICATING OIL TO NEW INNER SEAL RING (11) AND NEW OUTER SEAL RING (12) AND INSTALL INNER SEAL RING (11) AND OUTER SEAL RING (12) ON SECOND CLUTCH PISTON (1) WITH LIPS FACING DOWN.



15. INSTALL SECOND CLUTCH PISTON (1) IN BOTTOM OF CENTER SUPPORT HOUSING (2).

**INSTALLATION**



1. SOAK SIX FRICTION PLATES (1) IN LUBRICATING OIL FOR 2 MINUTES.

**NOTE**

- Thick steel plates must be installed on top of stack.
- Install steel plates (2) with gap (3) facing as shown.

2. INSTALL 13 CLUTCH PLATES (1 AND 2) STARTING WITH FRICTION PLATE (1) AND ALTERNATING WITH STEEL PLATE (2).

3. INSTALL RETAINING RING (4) WITH GAP OPPOSITE OIL PAN SIDE (5) OF TRANSMISSION HOUSING (6).

**NOTE**

Follow-on Maintenance:  
Install gear unit and main shaft (page 14-116).



## CHAPTER 15

### TRANSFER CASE REPAIR INSTRUCTIONS

#### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the transfer case and related parts. A list of tasks contained in this chapter is shown below.

		Page
Section I.	Transfer Case Repair (All Except M915A2) . . . . .	15-2
Section II.	Input Shaft Repair (All Except M915A2) . . . . .	15-23
Section III.	Center Shaft Repair (All Except M915A2) . . . . .	15-29
Section IV.	Lower Rear Output Shaft Repair (All Except M915A2) .	15-33
Section V.	Lower Front Output Shaft Repair (All Except M915A2)	15-37
Section VI.	Lower Shift Rod Repair (All Except M915A2) . . . . .	<b>15-41</b>
Section VII.	Upper Shift Rod Repair (All Except M915A2) . . . . .	<b>15-44</b>
Section VIII	Lubrication Pump Repair (All Except M915A2) . . . . .	<b>15-46</b>
Section IX.	Air Shift Chamber Repair (All Except M915A2) . . . . .	15-51

## Section I. TRANSFER CASE REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the transfer case.

Repair of the transfer case is general support maintenance.

### TRANSFER CASE REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

### INITIAL SETUP

#### Applicable Configuration:

All except M915A2

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Fabricated Tool, Appendix C, Item 1

#### Materials/Parts:

Washer, Lock (2)	P/N 354AX
Washer, Lock (50)	P/N 355AX
Oil, Lubricating	Appendix B, Item 37
Adhesive-Sealant	Appendix B, Item 3
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26
Compound. Pipe	Appendix B, Item 16
Compound. Pipe Sealing	Appendix B, Item 15
Loctite 242	Appendix B, Item 33

#### Personnel Required: (2)

#### References:

TM9-2320-363-20

#### Equipment Condition:

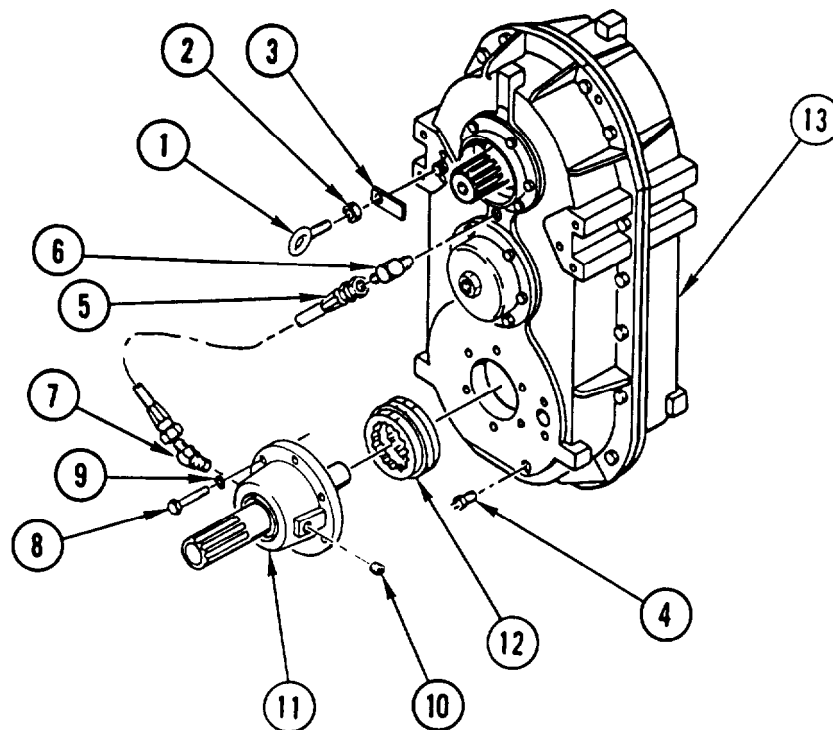
Reference	Condition Description
Page 3-263	Transfer Case Removed
TM9-2320-363-20	Breather Removed
TM9-2320-363-20	Speed Sensor Removed
Page 3-274	Transfer Case Yokes and Oil Seals Removed
Page 3-270	Air Shift Chamber Removed
Page 3-276	Lubrication Pump Removed

#### General Safety Instructions:

### WARNING

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



**DISASSEMBLY**

1. REMOVE SHIFT ROD END (1), HEX NUT (2), AND PLATE (3).
2. REMOVE SENDING UNIT (4).

**NOTE**

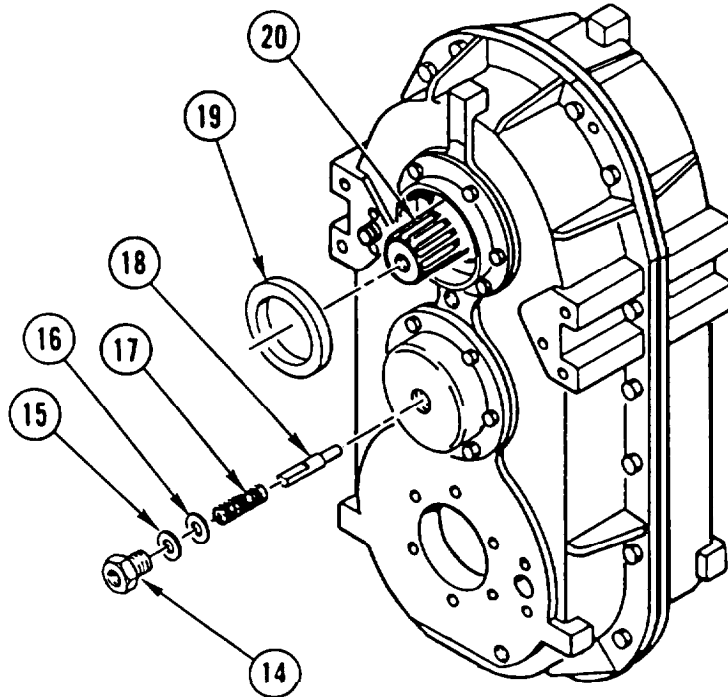
Note location of groove in clutch collar.

3. REMOVE HOSE (5), TWO ELBOW FITTINGS (6 AND 7), SIX CAPSCREWS (8), SIX LOCK WASHERS (9), PLUG (10), BEARING CAP ASSEMBLY (11), AND CLUTCH COLLAR (12) FROM TRANSFER CASE (13). DISCARD LOCK WASHERS.

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**TRANSFER CASE REPAIR (CONT)**

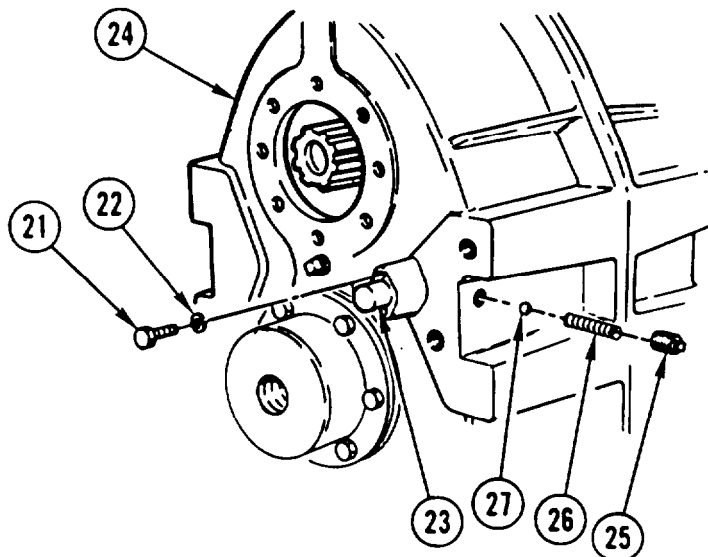
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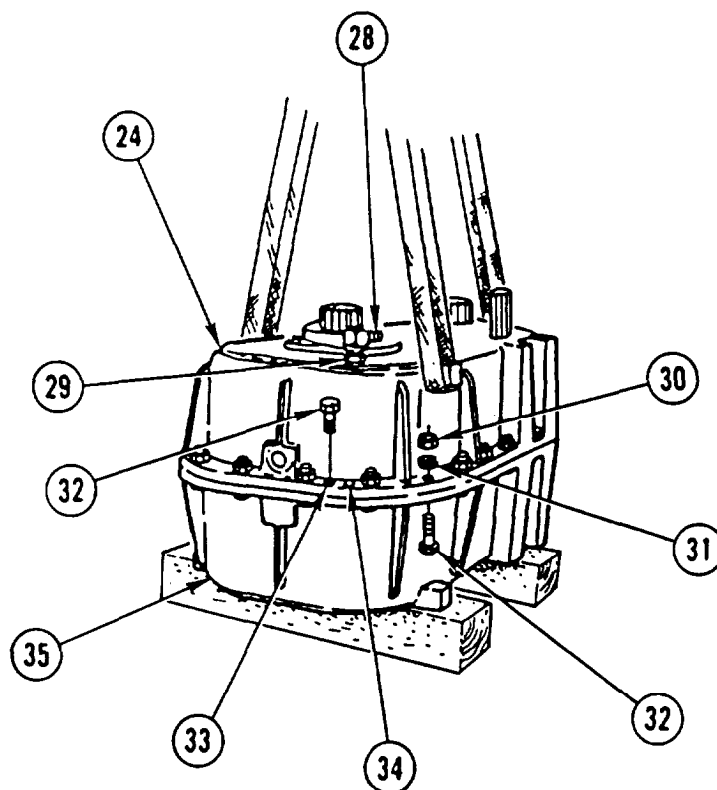
**NOTE**

Perform step 4 for M916A1 only.

4. REMOVE SLEEVE (14), THRUST BEARING (15), THRUST WASHER (16), SPRING (17), AND SPEEDOMETER DRIVE SHAFT (18).
5. REMOVE SPACER (19) FROM INPUT SHAFT (20)



6. REMOVE TWO CAPSCREWS (21), TWO LOCK WASHERS (22), AND UPPER SHIFT COVER (23) FROM TRANSFER CASE REAR HALF (24). DISCARD LOCK WASHERS.
7. REMOVE PLUG (25), SPRING (26), AND BALL (27).

**NOTE**

Make sure transfer case rear half is facing up and is placed on wood blocks.

8. REMOVE ELBOW (28) AND STRAINER (29).
9. REMOVE 20 NUTS (30), 20 LOCK WASHERS (31), AND 20 CAPSCREWS (32). DISCARD LOCK WASHERS.
10. INSTALL TWO CAPSCREWS (32) IN JACKSCREW HOLES (33) NEXT TO PINS (34). CAREFULLY TIGHTEN CAPSCREWS ALTERNATELY TO FORCE TRANSFER CASE REAR HALF (24) OFF PINS (34).

**CAUTION**

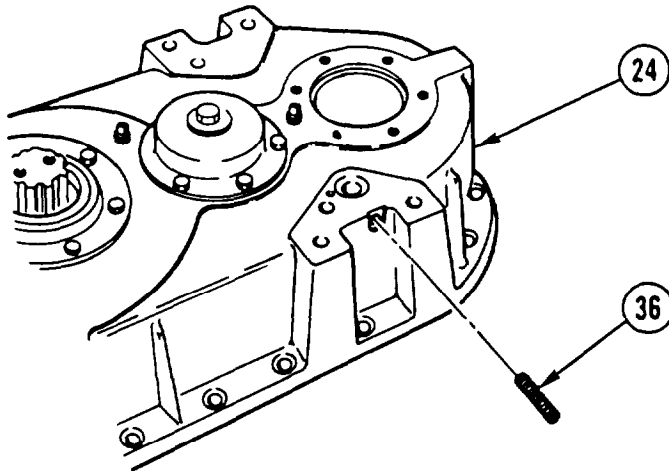
Lift transfer case rear half straight up to prevent possible damage to shift rod.

**NOTE**

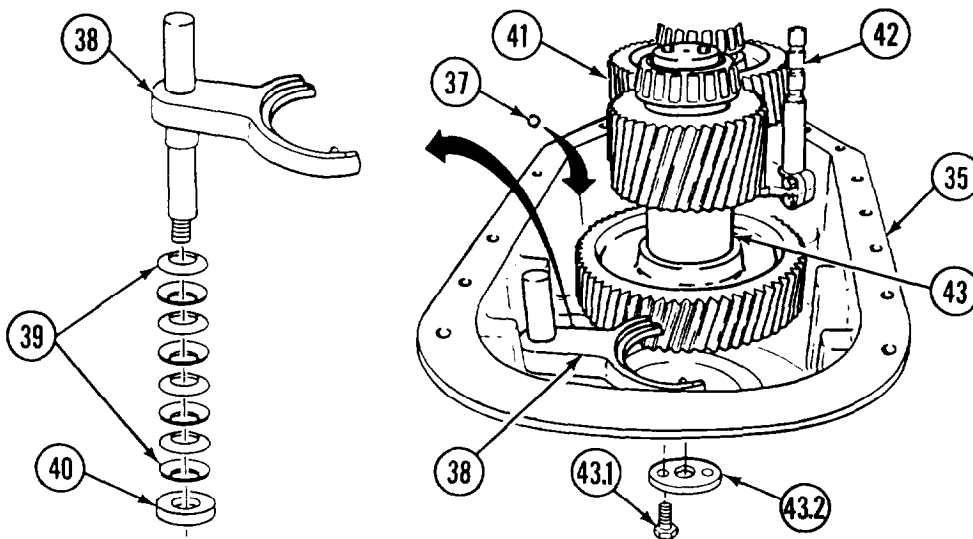
Inner detent ball on shift rod will fall into transfer case front half during separation of transfer case.

11. USING SUITABLE LIFTING DEVICE AND SLING, LIFT TRANSFER CASE REAR HALF (24) OFF TRANSFER CASE FRONT HALF (35).
12. REMOVE TWO CAPSCREWS (32).

**TRANSFER CASE REPAIR (CONT)**



13. REMOVE INNER SPRING (36) FROM TRANSFER CASE REAR HALF (24).

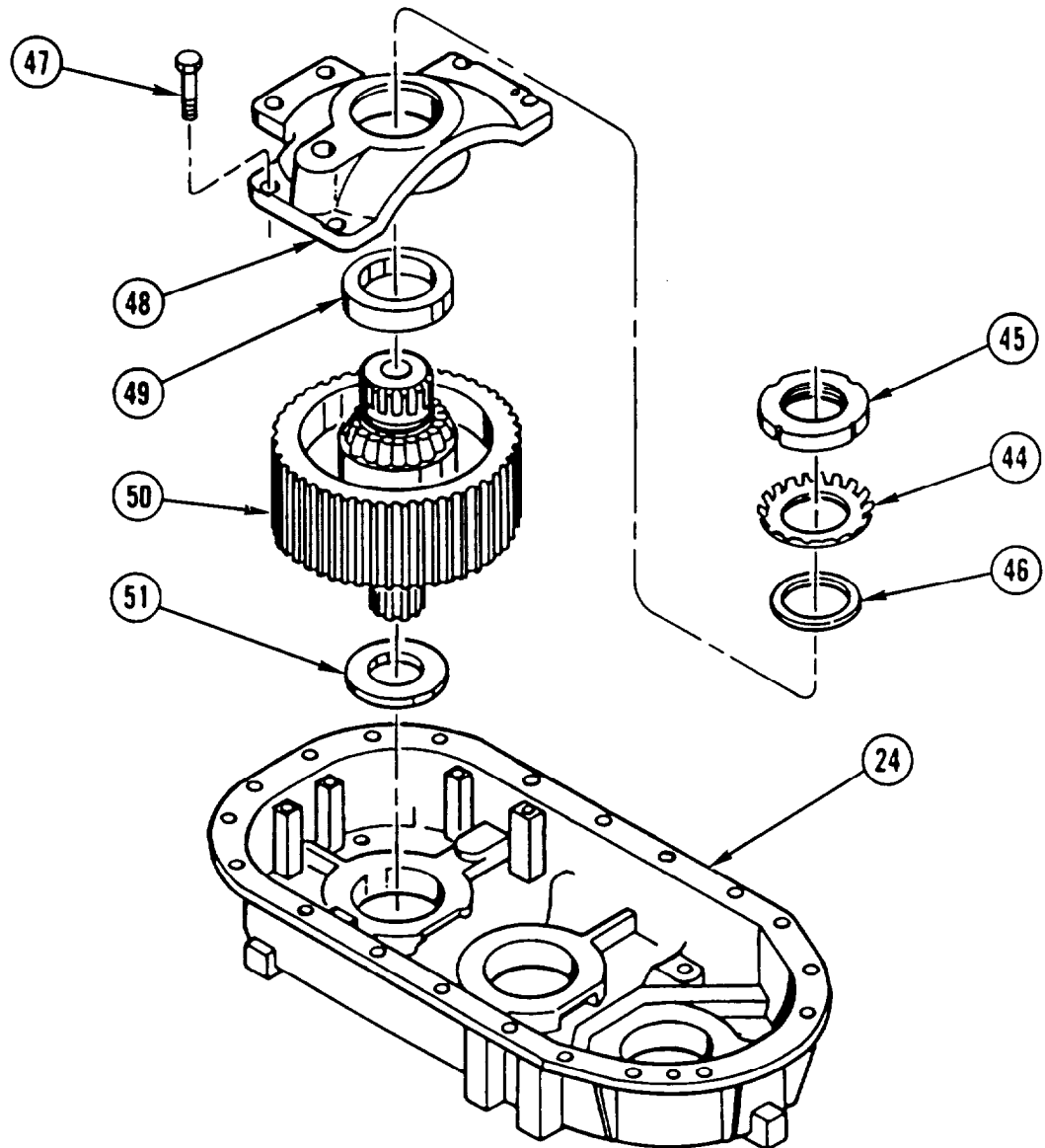


14. REMOVE DETENT BALL (37) FROM INSIDE TRANSFER CASE FRONT HALF (35).
15. REMOVE SHIFT ROD (38), EIGHT SPRING DISCS (39), AND SPACER (40).
16. USING SUITABLE LIFTING DEVICE, REMOVE INPUT SHAFT ASSEMBLY (41), SHIFT ROD ASSEMBLY (42), AND CENTER SHAFT ASSEMBLY (43) FROM TRANSFER CASE FRONT HALF (35).

**NOTE**

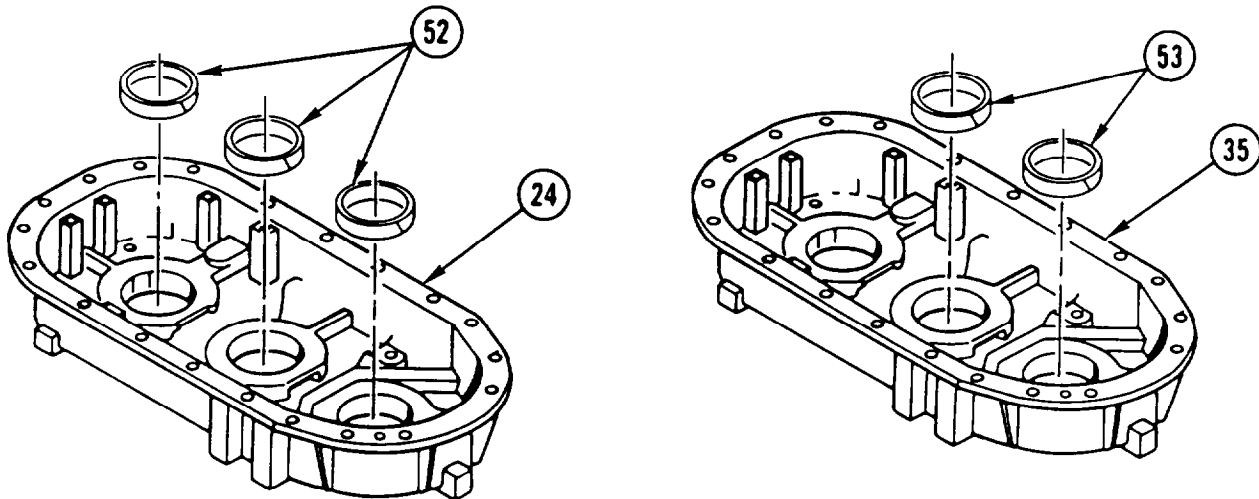
Perform step 16.1 for M916A2, M917A1, and M917A1 w/MCS.

- 16.1. REMOVE TWO CAPSCREW (43.1) AND SPEEDOMETER SENSOR RING (43.2) FROM END OF CENTER SHAFT ASSEMBLY (43).

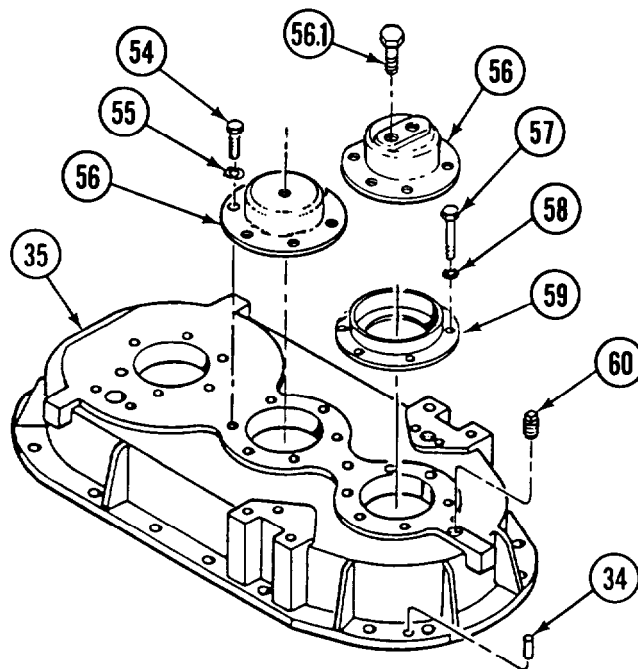


17. STRAIGHTEN TANGS OF LOCK WASHER (44), AND REMOVE LOCK NUT (45), LOCK WASHER (44), AND SPACER (46) FROM TRANSFER CASE REAR HALF (24).
18. REMOVE SIX CAPSCREWS (47) AND BEARING SUPPORT (48).
19. IF DAMAGED, REMOVE BEARING CUP (49) FROM BEARING SUPPORT (48).
20. USING SUITABLE LIFTING DEVICE, REMOVE REAR OUTPUT SHAFT ASSEMBLY (50) AND SPACER (51) FROM TRANSFER CASE REAR HALF (24).

**TRANSFER CASE REPAIR (CONT)**



21. IF DAMAGED, REMOVE THREE BEARING CUPS (52) FROM TRANSFER CASE REAR HALF (24).
22. IF DAMAGED, REMOVE TWO BEARING CUPS (53) FROM TRANSFER CASE FRONT HALF (35).

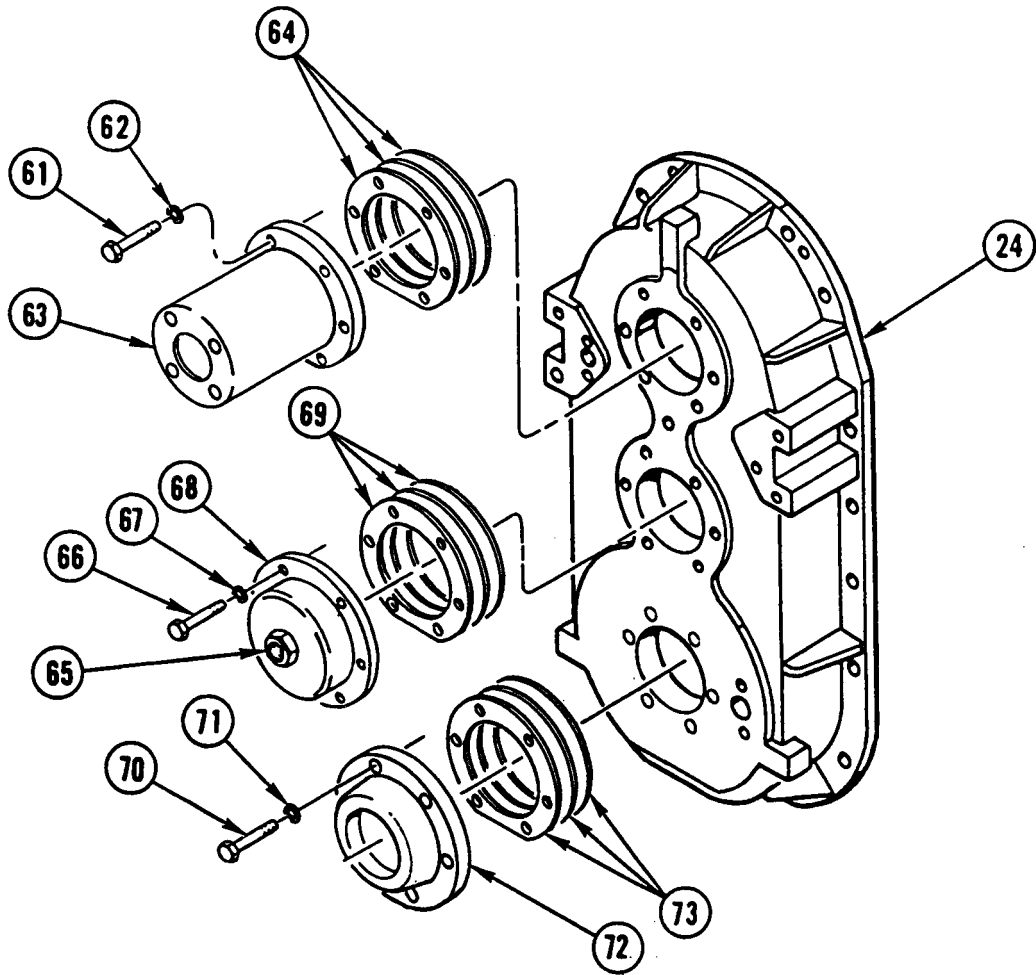


23. REMOVE SIX CAPSCREWS (54), SIX LOCK WASHERS (55), AND END CAP (56) FROM TRANSFER CASE FRONT HALF (35). DISCARD LOCK WASHERS.

**NOTE**

Perform step 23.1 for M916A2, M917A1, and M917A1 w/MCS.

- 23.1 REMOVE PLUG (56.1) FROM END CAP (56).
24. REMOVE SIX CAPSCREWS (57), SIX LOCK WASHERS (58), AND BEARING CAP (59) FROM TRANSFER CASE FRONT HALF (35). DISCARD LOCK WASHERS.
25. IF DAMAGED, REMOVE PLUG (60) AND TWO PINS (34).

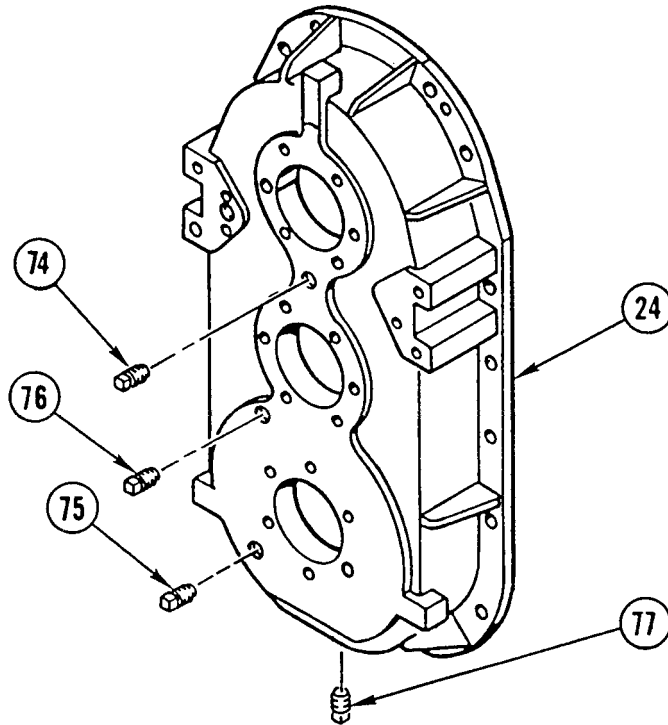


**NOTE**

Note number of shims prior to removal to aid in installation.

26. REMOVE SIX CAPSCREWS (61), SIX LOCK WASHERS (62), BEARING COVER (63), AND SHIMS (64) FROM TRANSFER CASE REAR HALF (24). DISCARD LOCK WASHERS.
27. REMOVE PLUG (65), SIX CAPSCREWS (66), SIX LOCK WASHERS (67), END CAP (66), AND SHIMS (69) FROM TRANSFER CASE REAR HALF (24). DISCARD LOCK WASHERS.
28. REMOVE SIX CAPSCREWS (70), SIX LOCK WASHERS (71), BEARING CAP (72), AND SHIMS (73) FROM TRANSFER CASE REAR HALF (24). DISCARD LOCK WASHERS.

## TRANSFER CASE REPAIR (CONT)



29. IF DAMAGED, REMOVE PLUG (74), FILL PLUG (75), PLUG (76), AND DRAIN PLUG (77) FROM TRANSFER CASE REAR HALF (24).

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

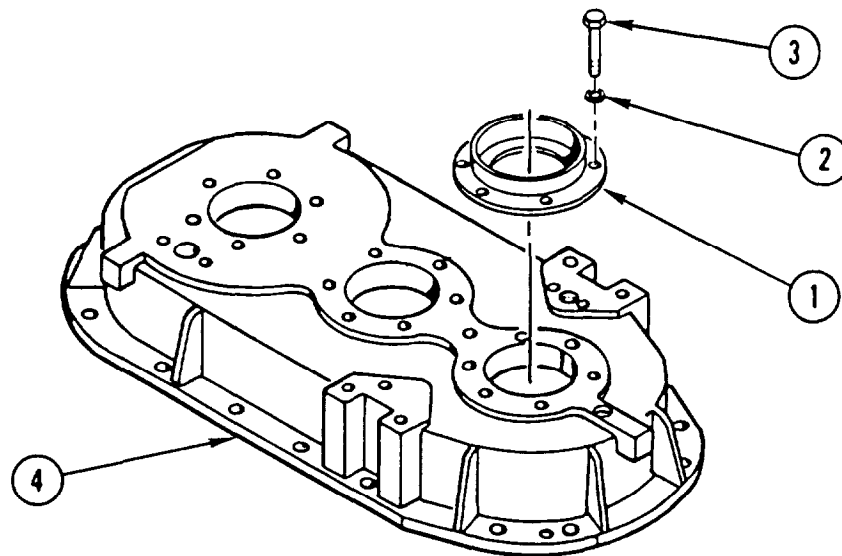
### **INSPECTION**

Inspect all parts for wear or damage.

### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

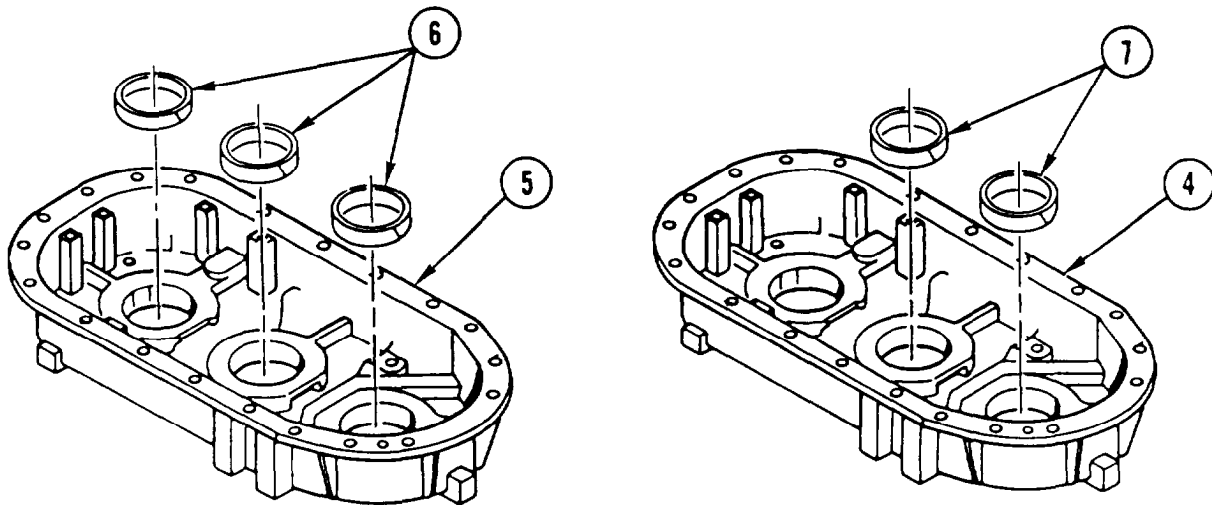


**ASSEMBLY****WARNING**

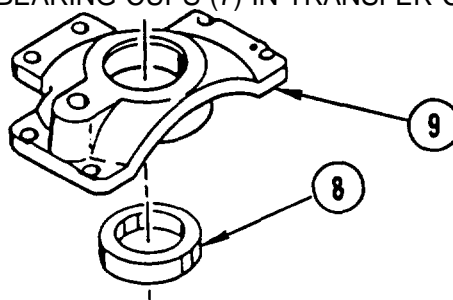
Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with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

1. APPLY LIGHT BEAD OF ADHESIVE TO INSIDE FLANGE OF BEARING CAP (1) AND INSTALL BEARING CAP (1).
2. INSTALL SIX NEW LOCK WASHERS (2) ON SIX CAPSCREWS (3).
3. APPLY LIGHT COAT OF ADHESIVE TO THREADS OF SIX CAPSCREWS (3) AND INSTALL SIX CAPSCREWS (3) THRU BEARING CAP (1) INTO TRANSFER CASE FRONT HALF (4).

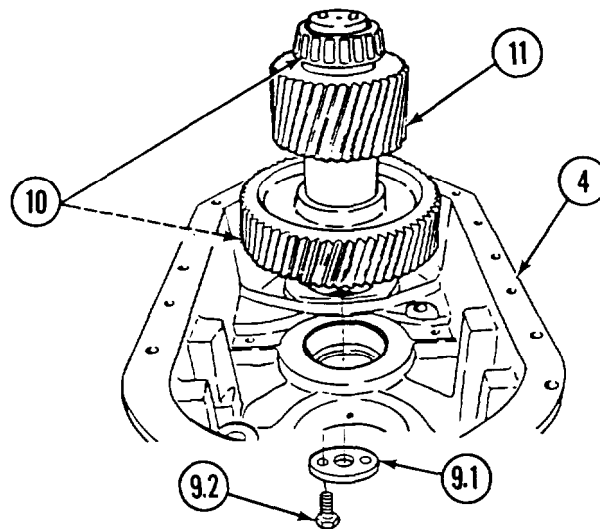
**TRANSFER CASE REPAIR (CONT)**



4. PLACE TRANSFER CASE FRONT HALF (4) AND TRANSFER CASE REAR HALF (5) WITH OPEN SIDES UP ON CLEAN WORK SURFACE.
5. IF REMOVED, INSTALL THREE NEW BEARING CUPS (6) IN TRANSFER CASE REAR HALF (5).
6. IF REMOVED, INSTALL TWO NEW BEARING CUPS (7) IN TRANSFER CASE FRONT HALF (4).



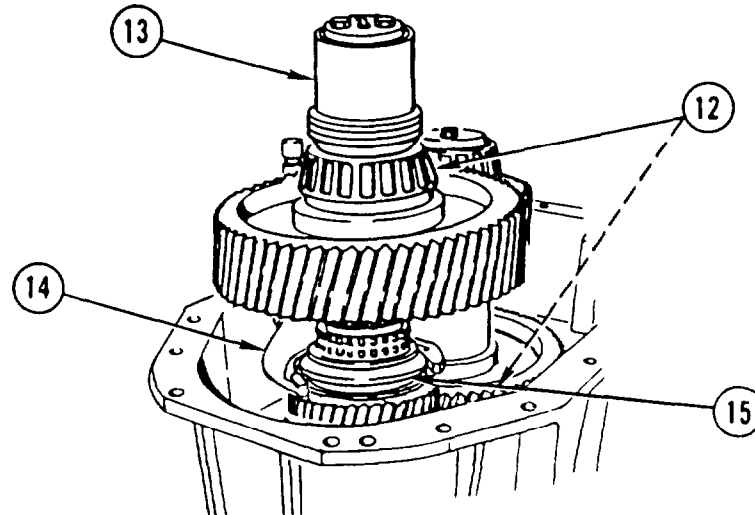
7. IF REMOVED, INSTALL NEW BEARING CUP (8) IN BEARING SUPPORT (9).



**NOTE**

Perform step 7.1 for M916A2, M917A1, and M917A1 w/MCS.

- 7.1. INSTALL SPEEDOMETER SENSOR RING (9.1) TO CENTER SHAFT ASSEMBLY (11) WITH TWO CAPSCREWS (9.2). TIGHTEN CAPSCREWS TO 40 LB-FT (54 N.m).
8. COAT TWO BEARINGS (10) WITH LUBRICATING OIL.
9. USING SUITABLE SLING AND LIFTING DEVICE, INSTALL CENTER SHAFT ASSEMBLY (11) IN TRANSFER CASE FRONT HALF (4).

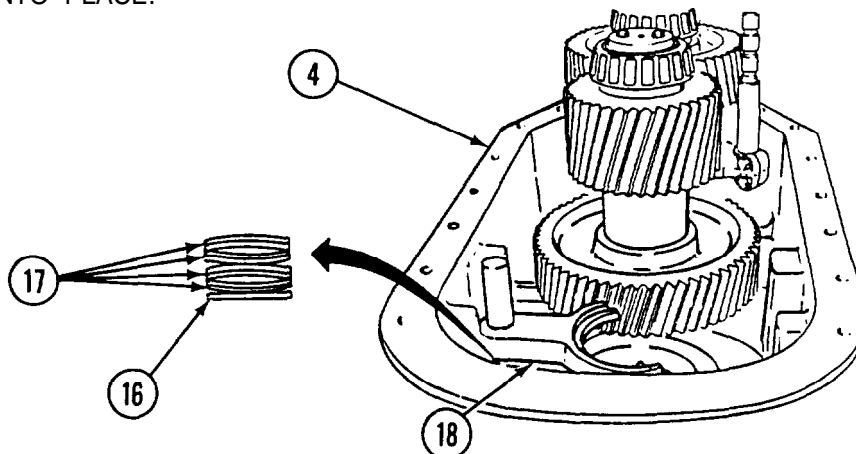


10. COAT TWO BEARINGS (12) WITH LUBRICATING OIL.

**CAUTION**

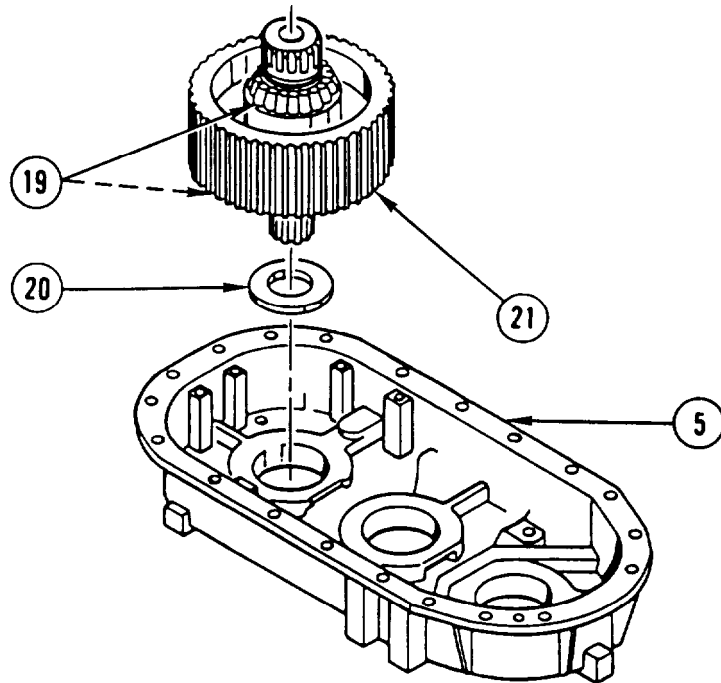
To prevent binding and possible damage, keep input shaft aligned with center shaft so that gears mesh properly.

11. USING SUITABLE SLING AND LIFTING DEVICE, INSTALL INPUT SHAFT ASSEMBLY (13) AND SHIFT ROD ASSEMBLY (14) BY ENGAGING SHIFT ROD ASSEMBLY (14) AND CLUTCH COLLAR (15). GUIDE SHIFT ROD ASSEMBLY (14) INTO PLACE WHILE LOWERING INPUT SHAFT ASSEMBLY (13) INTO PLACE.

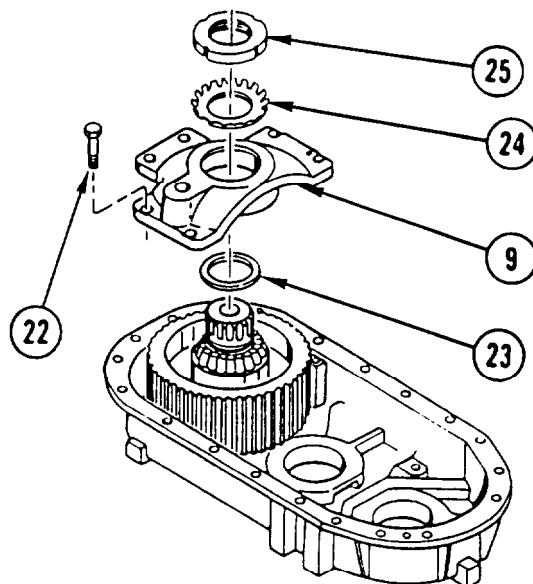


12. INSTALL SPACER (16), EIGHT SPRING DISCS (17) AS SHOWN, AND SHIFT ROD (18) IN TRANSFER CASE FRONT HALF (4).

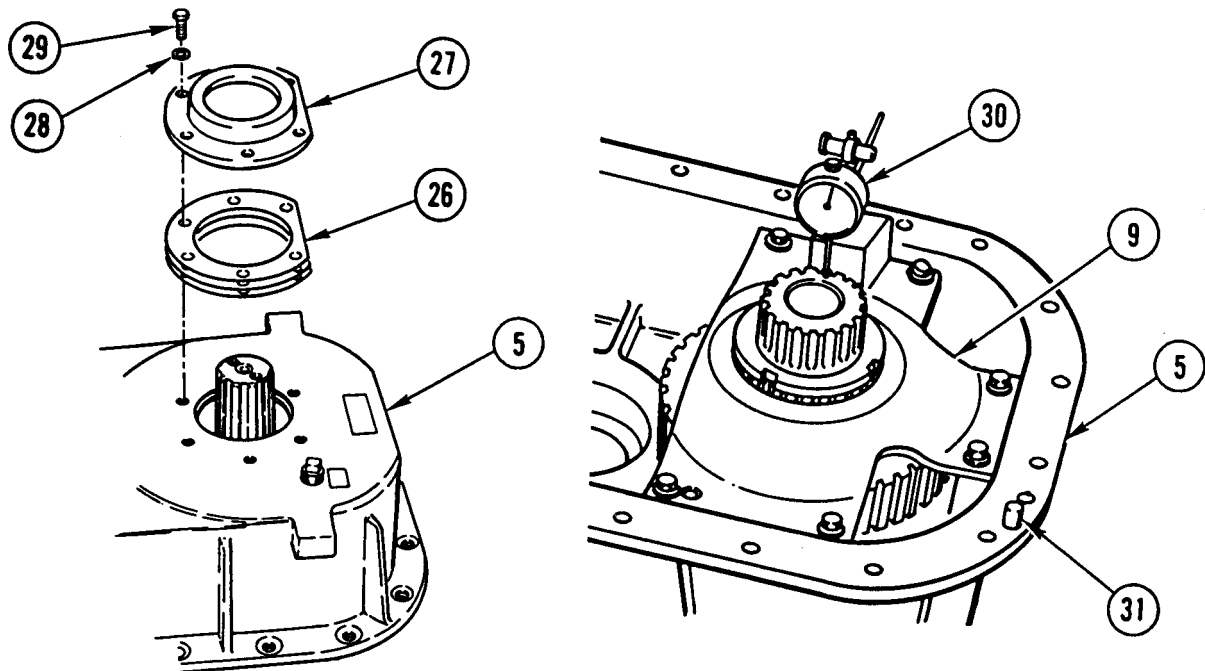
## TRANSFER CASE REPAIR (CONT)



13. COAT TWO BEARINGS (19) WITH LUBRICATING OIL.
14. INSTALL SPACER (20) ON REAR OUTPUT SHAFT ASSEMBLY (21).
15. USING SUITABLE SLING AND LIFTING DEVICE, INSTALL REAR OUTPUT SHAFT ASSEMBLY (21) IN TRANSFER CASE REAR HALF (5).



16. COAT SIX CAPSCREWS (22) WITH LOCTITE 242 AND INSTALL SPACER (23), BEARING SUPPORT (9), AND SIX CAPSCREWS (22). TIGHTEN CAPSCREWS TO 42 LB-FT (57 N.m).
17. INSTALL LOCK WASHER (24) AND LOCK NUT (25). USING HAMMER AND PUNCH, BEND UP ONE OR TWO TANGS ON LOCK WASHER (24).



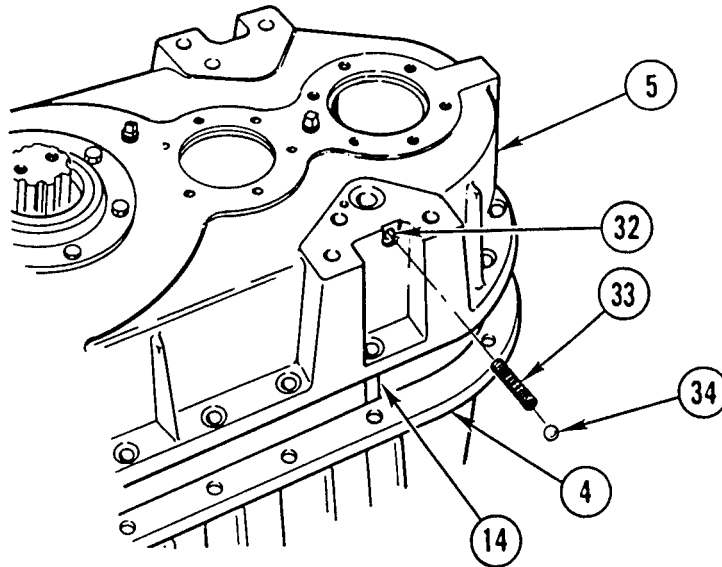
18. TURN TRANSFER CASE REAR HALF (5) OVER AND INSTALL SHIMS (26), BEARING CAP (27), SIX NEW LOCK WASHERS (28), AND SIX CAPSCREWS (29). TIGHTEN CAPSCREWS TO 60 LB-FT (81 N.m).
19. TURN TRANSFER CASE REAR HALF (5) OVER.

**NOTE**

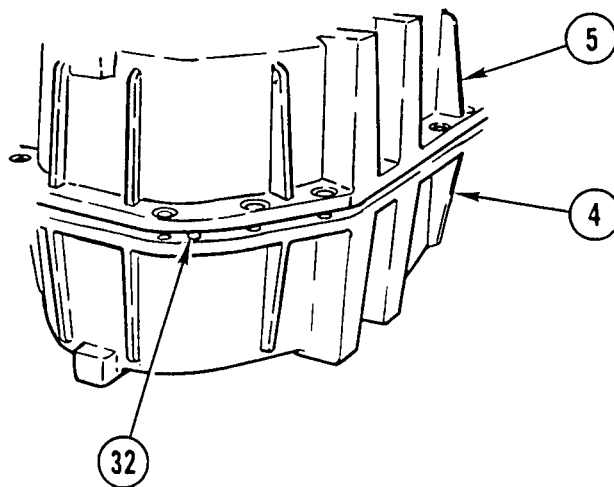
Rotate rear output shaft back and forth to seat rollers before checking end play.

20. MOUNT DIAL INDICATOR (30) ON MACHINED SURFACE OF BEARING SUPPORT (9).
21. USING PRY BAR AND FULCRUM, CHECK THAT END PLAY IS 0.003-0.006 IN. (0.08-0.15 mm). ADD OR REMOVE SHIMS (26) TO ACHIEVE CORRECT END PLAY.
22. REMOVE DIAL INDICATOR (30), SIX CAPSCREWS (29), SIX NEW LOCK WASHERS (28), AND END CAP (27).
23. APPLY LIGHT BEAD OF ADHESIVE TO INSIDE OF END CAP (27) FLANGE AND INSTALL END CAP (27) AS IN STEP 18.
24. IF REMOVED, INSTALL TWO NEW PINS (31).

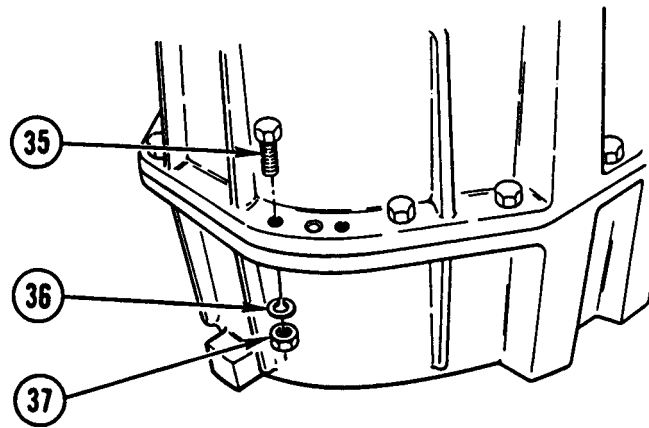
## TRANSFER CASE REPAIR (CONT)



25. APPLY LIGHT BEAD OF ADHESIVE TO TRANSFER CASE FRONT HALF (4) FLANGE.
26. USING SUITABLE SLING AND LIFTING DEVICE, LOWER TRANSFER CASE REAR HALF (5) OVER SHIFT ROD ASSEMBLY (14) IN TRANSFER CASE FRONT HALF (4) UNTIL END OF SHIFT ROD ASSEMBLY (14) IS JUST BELOW DETENT PASSAGE (32).
27. INSTALL SPRING (33) AND DETENT BALL (34).



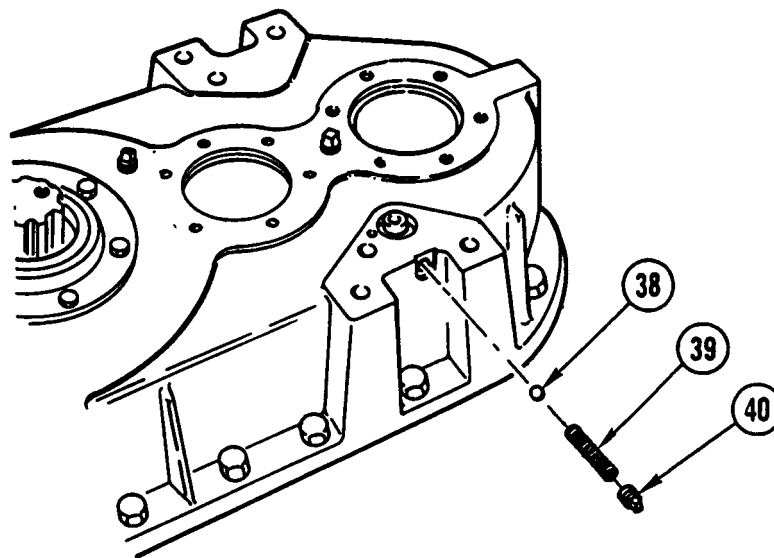
28. GUIDE TRANSFER CASE REAR HALF (5) ONTO TWO PINS (31) IN TRANSFER CASE FRONT HALF (4) AND TAP TRANSFER CASE REAR HALF (5) TO SEAT.



**NOTE**

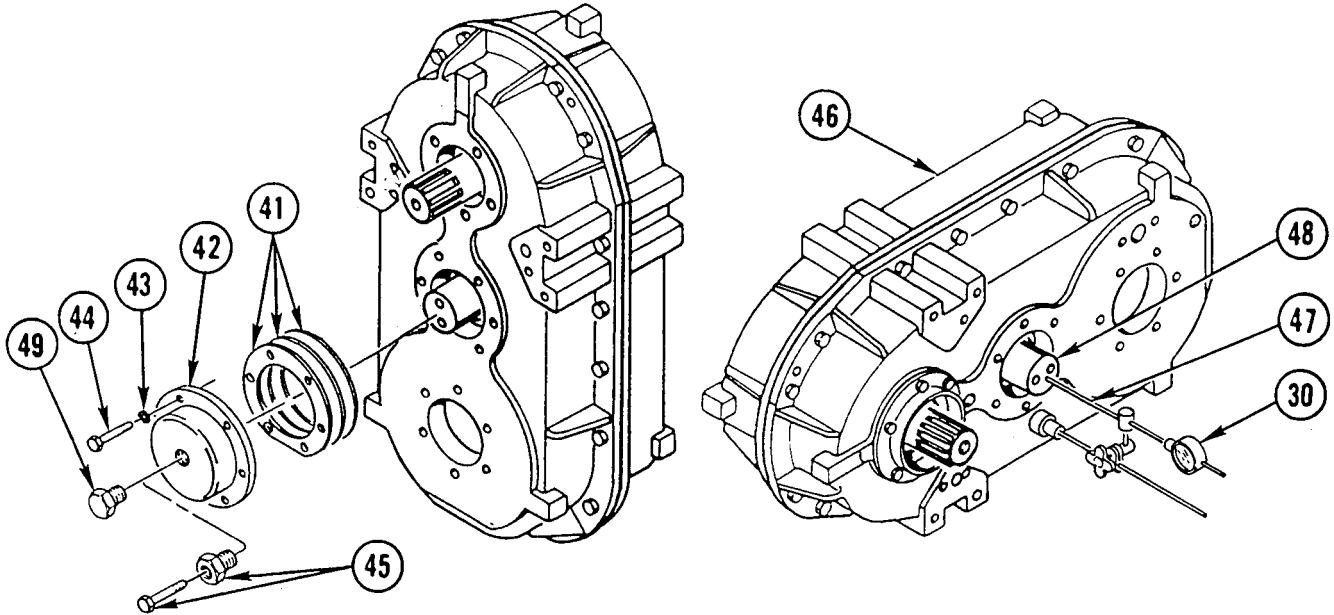
Rotate gears back and forth to make sure they are not binding.

29. COAT 20 CAPSCREWS (35) WITH LUBRICATING OIL AND INSTALL 20 CAPSCREWS (35), 20 NEW LOCK WASHERS (36), AND 20 NUTS (37). TIGHTEN NUTS TO 60 LB-FT (81 N.m).



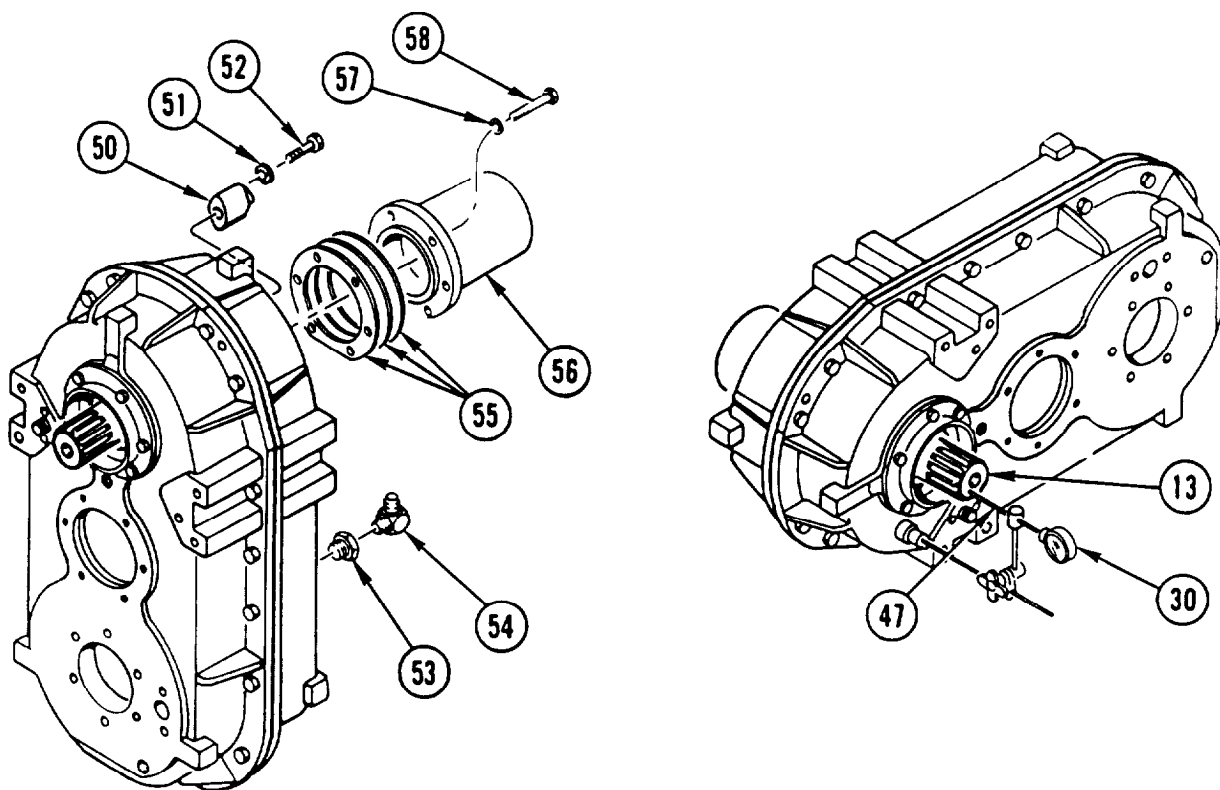
30. INSTALL BALL (38), SPRING, AND PLUG (40).

## TRANSFER CASE REPAIR (CONT)



31. INSTALL SHIMS (41), END CAP (42), SIX NEW LOCK WASHERS (43), AND SIX CAPSCREWS (44). TIGHTEN CAPSCREWS TO 60 LB-FT (81 N.m).
32. INSTALL FABRICATED TOOL (45) IN END CAP (42).
33. POSITION TRANSFER CASE (46) ON SIDE.
34. MOUNT DIAL INDICATOR (30) ON MACHINED SURFACE ON FRONT OF TRANSFER CASE (46) WITH DIAL INDICATOR SHAFT (47) RESTING ON CENTER SHAFT (48).
35. TIGHTEN FABRICATED TOOL (45) TO CHECK END PLAY. ADD OR REMOVE SHIMS (41) TO ACHIEVE 0.003-0.006 IN. (0.08-0.15 mm) END PLAY.
36. REMOVE FABRICATED TOOL (45), SIX CAPSCREWS (44), SIX NEW LOCK WASHERS (43), AND END CAP (42).
37. APPLY LIGHT BEAD OF ADHESIVE TO INSIDE OF END CAP (42) FLANGE AND INSTALL END CAP (42) AS IN STEP 31.
38. APPLY SEALING COMPOUND TO PLUG (49) AND INSTALL PLUG.



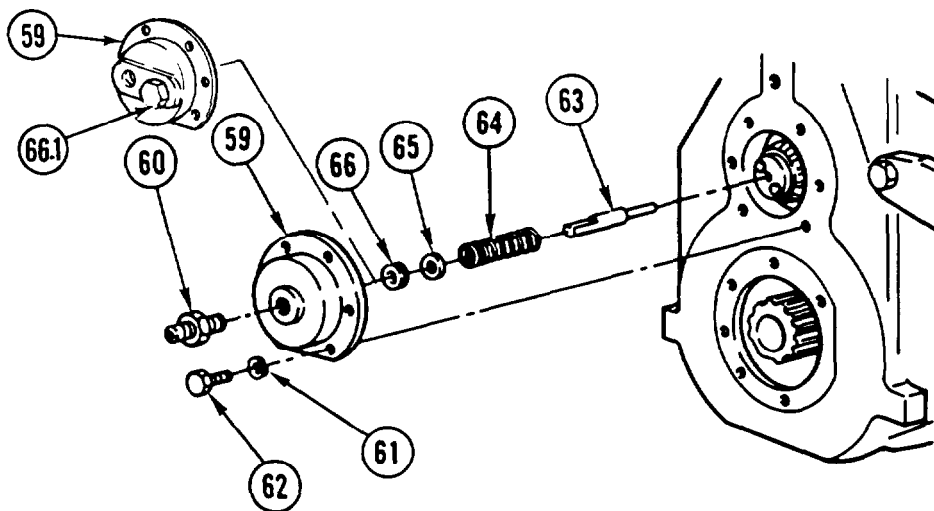


39. INSTALL COVER (50), TWO NEW LOCK WASHERS (51), AND TWO CAPSCREWS (52).
40. INSTALL STRAINER (53) AND ELBOW (54).
41. INSTALL SHIMS (55). BEARING COVER (56). SIX NEW LOCK WASHERS (57), AND SIX CAPSCREWS (58). TIGHTEN CAPSCREWS TO 60 LB-FT (81 N.m).
42. MOUNT DIAL INDICATOR (30) ON MACHINED SURFACE WITH DIAL INDICATOR SHAFT (47) RESTING ON INPUT SHAFT (13).
43. CHECK END PLAY BY APPLYING PRESSURE TO OPPOSITE END OF INPUT SHAFT (13). CORRECT END PLAY IS 0.003-0.006 IN. (0.08-0.15 mm). ADD OR REMOVE SHIMS (55) TO ACHIEVE CORRECT END PLAY.
44. REMOVE SIX CAPSCREWS (58), SIX NEW LOCK WASHERS (57), AND BEARING COVER (56).
45. APPLY LIGHT BEAD OF ADHESIVE TO INSIDE OF BEARING COVER (56) FLANGE AND INSTALL BEARING COVER (56) AS IN STEP 41.

---

**TRANSFER CASE REPAIR (CONT)**

---



**NOTE**

Sleeve is not used on M916A2, M917A1 and M917A1 w/MCS.

46. APPLY LIGHT BEAD OF ADHESIVE TO INSIDE OF END CAP (59) FLANGE AND INSIDE OF NUT ON SLEEVE (60) AND INSTALL END CAP (59)
47. INSTALL SIX NEW LOCK WASHERS (61) ON SIX CAPSCREWS (62).
48. APPLY LIGHT COAT OF ADHESIVE TO THREADS OF CAPSCREWS (62) AND INSTALL THRU END CAP (59).

**NOTE**

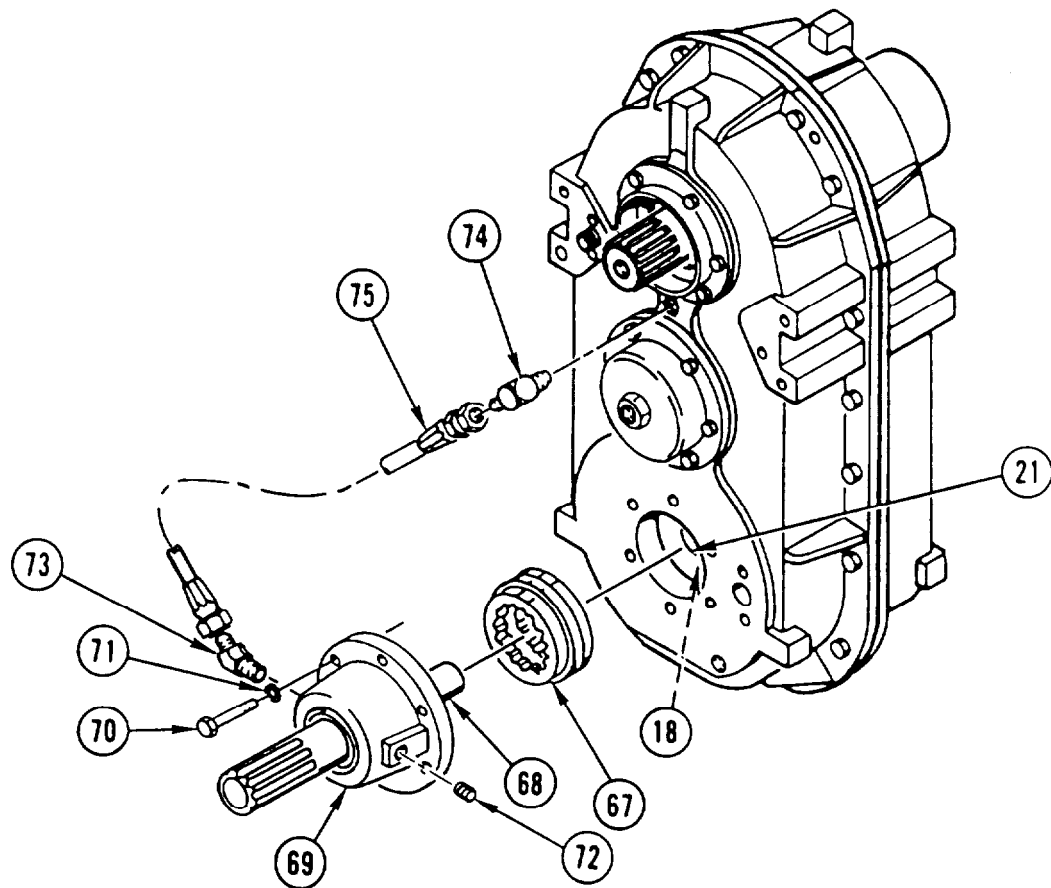
Perform step 49 for M916A1.

49. INSTALL SPEEDOMETER DRIVE SHAFT (63), SPRING (64), THRUST WASHER (65), THRUST BEARING (66). AND SLEEVE (60).

**NOTE**

Perform step 49.1 for M916A2, M917A1, and M917A1 w/MCS.

- 49.1. INSTALL PLUG (66.1) IN END CAP (59).

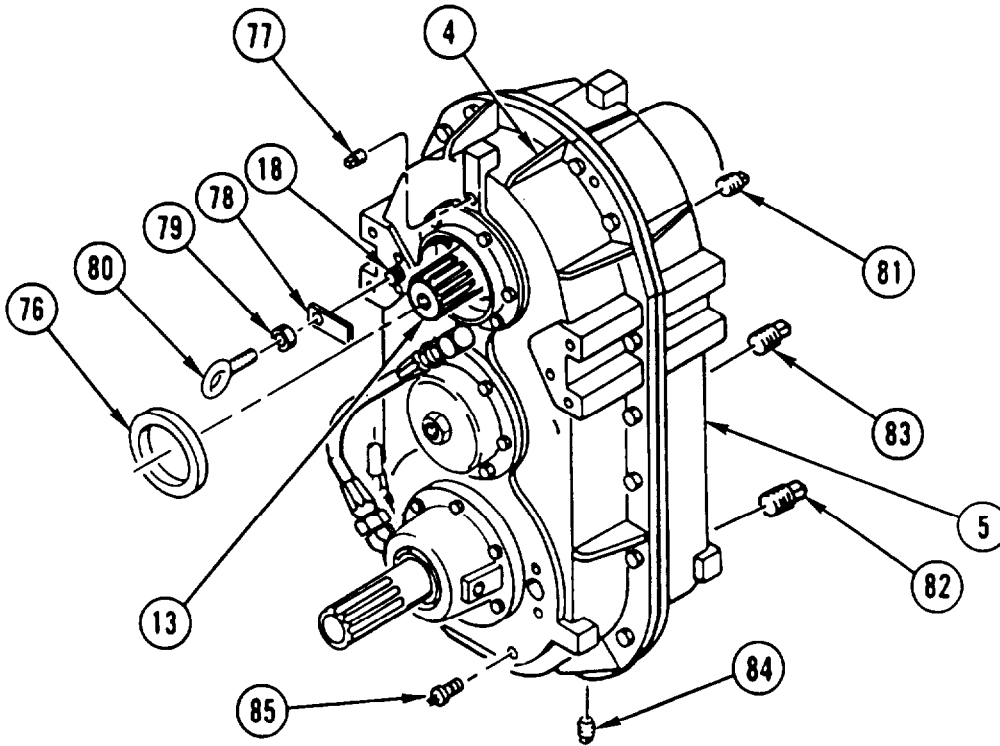


50. COAT GROOVE ON CLUTCH COLLAR (67) WITH GREASE. INSTALL CLUTCH COLLAR (67) OVER SHIFT ROD (18) AND ONTO REAR OUTPUT SHAFT ASSEMBLY (21).
51. COAT END OF FRONT OUTPUT SHAFT (68) WITH GAA.
52. COAT INSIDE FLANGE OF BEARING CAP ASSEMBLY (69) WITH SEALING COMPOUND.
53. COAT SIX CAPSCREWS (70) WITH LUBRICATING OIL AND INSTALL BEARING CAP ASSEMBLY (69), SIX NEW LOCK WASHERS (71), SIX CAPSCREWS (70), AND PLUG (72). TIGHTEN CAPSCREWS TO 60 LB-FT (81 N.m).
54. COAT THREADS OF ELBOWS (73 AND 74) WITH PIPE SEALANT COMPOUND AND INSTALL ELBOWS (73 AND 74).
55. INSTALL HOSE (75) ON ELBOWS (73 AND 74).

---

**TRANSFER CASE REPAIR (CONT)**

---



- 56. INSTALL YOKE SPACER (76) ON INPUT SHAFT ASSEMBLY (13).
- 57. IF REMOVED. INSTALL NEW PLUG (77) IN TRANSFER CASE FRONT HALF (4).
- 58. INSTALL PLATE (78) NUT (79) AND SHIFT ROD END (80) ON SHIFT ROD (18).
- 59. IF REMOVED, INSTALL PLUG (81) FILL PLUG (82) PLUG (83) AND DRAIN PLUG (84) IN TRANSFER CASE REAR HALF (5).
- 60. INSTALL SENDING UNIT (85).

**NOTE**

Follow-on Maintenance:

- Install lubrication pump (page 3-276).
- Install air shift chamber (page 3-270).
- Install transfer case yokes and oil seals (page 3-274).
- Install speed sensor (TM 9-2320-363-20).
- Install breather (TM9-2320-363-20).

## Section II. INPUT SHAFT REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the input shaft.

Repair of the input shaft is general support maintenance

---

### INPUT SHAFT REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Oil, Lubricating	Appendix B, Item 37
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26

**References:**

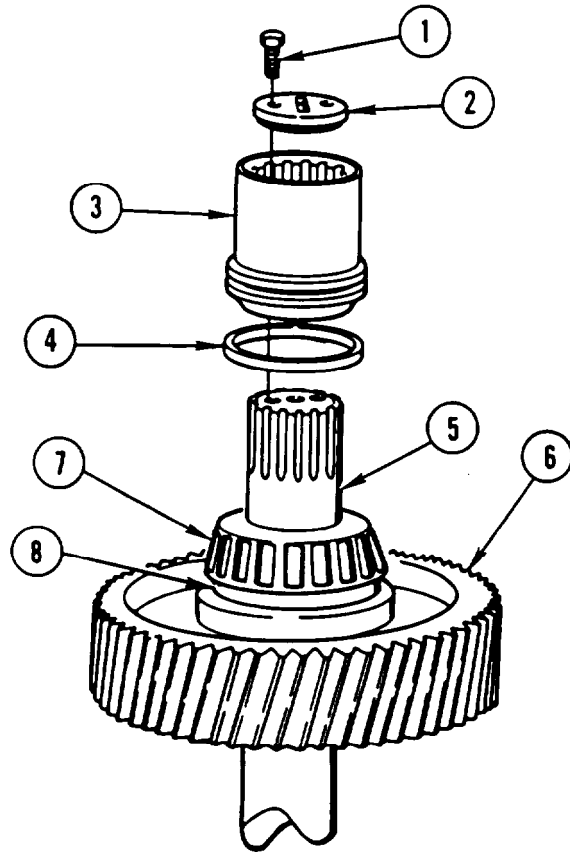
TM 9-214

**Equipment Condition:**

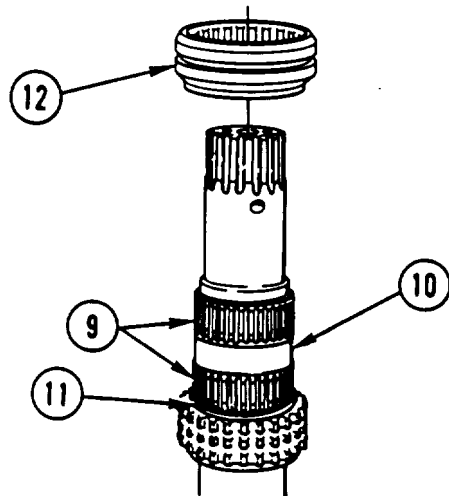
<b>Reference</b>	<b>Condition Description</b>
Page 15-2	Input Shaft Removed from Transfer Case

INPUT SHAFT REPAIR (CONT)

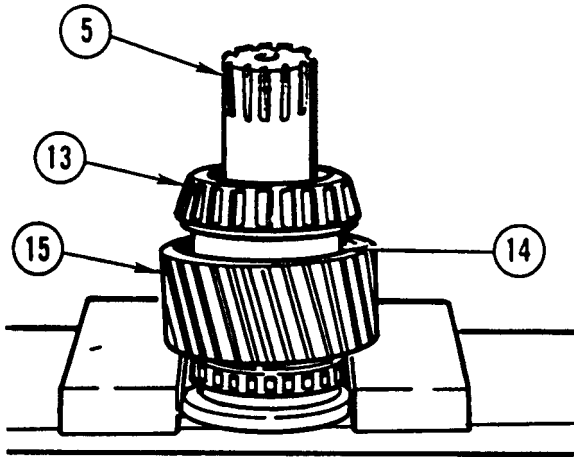
DISASSEMBLY



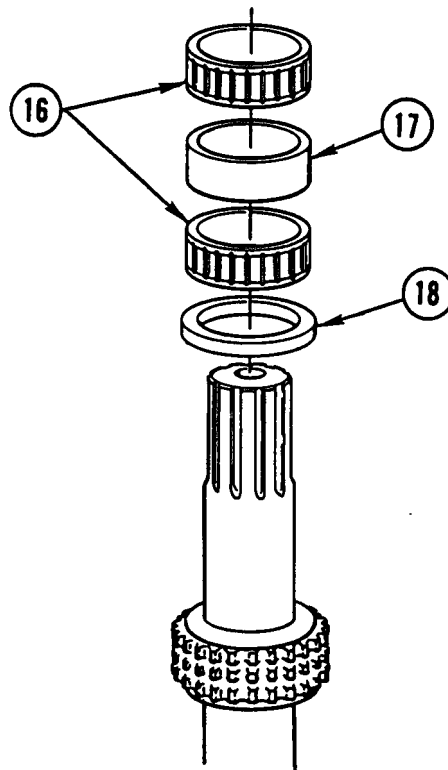
1. REMOVE TWO SCREWS (1) AND PLUG DRIVE PLATE (2).
2. REMOVE SPACER (3) AND PISTON RING (4).
3. PLACE INPUT SHAFT ASSEMBLY (5) IN PRESS WITH LARGE GEAR (6) UP.
4. PRESS INPUT SHAFT (5) OUT OF BEARING (7), SPACER (8), AND LARGE GEAR (6).



5. REMOVE TWO NEEDLE BEARINGS (9), SPACER (10), SPACER (11), AND SHIFT COLLAR (12).



6. TURN INPUT SHAFT ASSEMBLY (5) OVER AND PRESS INPUT SHAFT (5) OUT OF BEARING (13), SPACER (14), AND GEAR (15).



7. REMOVE TWO NEEDLE BEARINGS (16) AND SPACER (17).
8. REMOVE SPACER (18).

## **INPUT SHAFT REPAIR (CONT)**

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

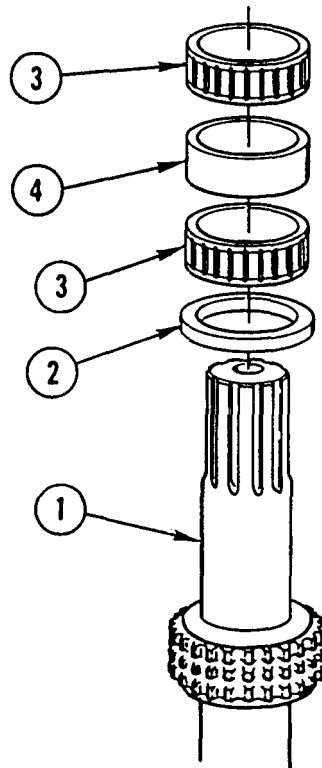
### **INSPECTION**

1. INSPECT BEARINGS IN ACCORDANCE WITH TM 9-214.
2. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

### **REPAIR**

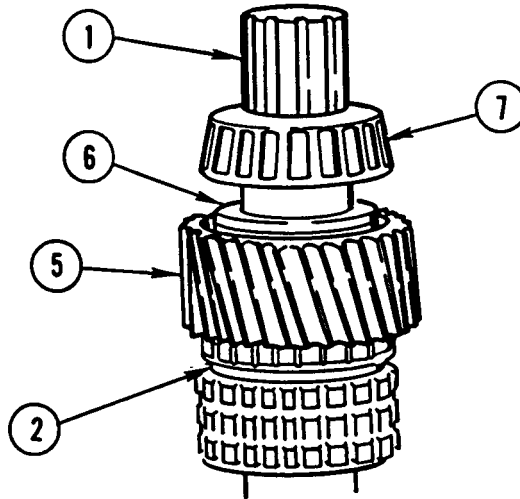
Use general repair methods to repair damaged parts (page 2-33).

### **ASSEMBLY**

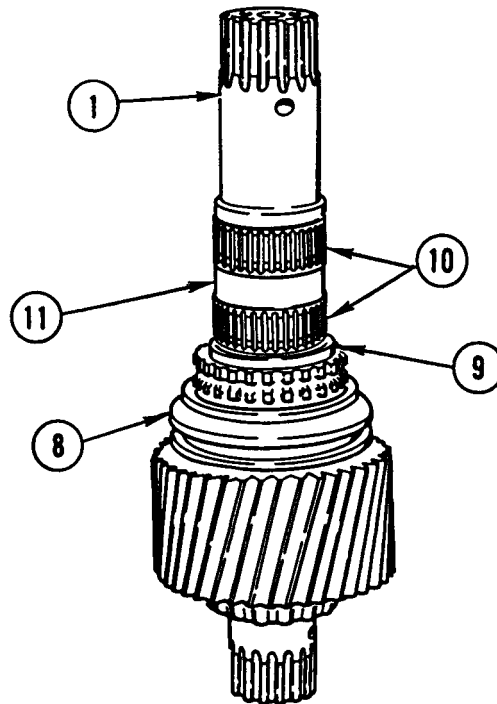


1. PLACE INPUT SHAFT (1) IN PRESS SO LONG-SPLINE END IS UP.
2. INSTALL SPACER (2), NEEDLE BEARING (3), SPACER (4), AND NEEDLE BEARING (3).
3. COAT TWO NEEDLE BEARINGS (3) WITH GREASE.



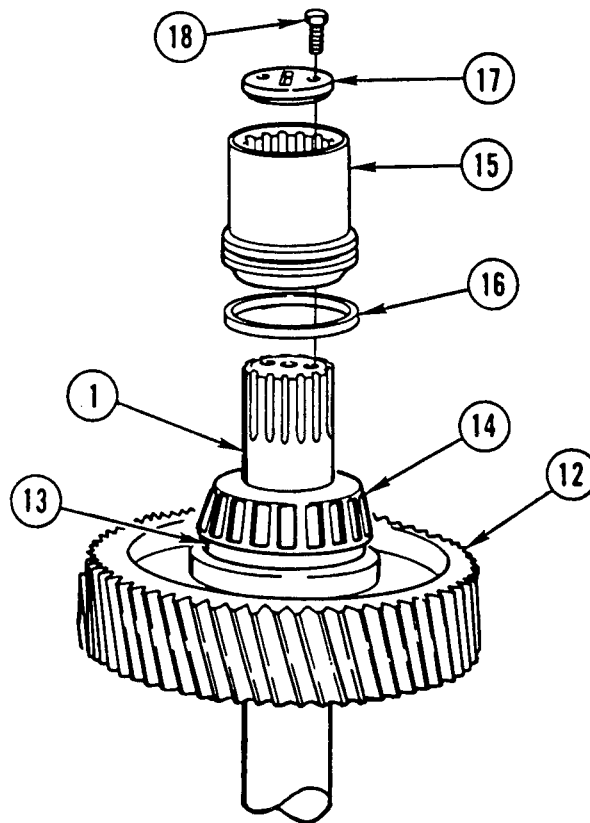


4. INSTALL GEAR (5) ON INPUT SHAFT (1) AND SEAT AGAINST SPACER (2).
5. INSTALL SPACER (6).
6. PRESS BEARING (7) TO SEAT AGAINST SPACER (6).
7. COAT BEARING (7) WITH GAA.



8. TURN INPUT SHAFT (1) OVER AND INSTALL SHIFT COLLAR (8) SO LARGER TAPER IS DOWN.
9. INSTALL SPACER (9), NEEDLE BEARING (10), SPACER (11), AND NEEDLE BEARING (10).
10. COAT TWO NEEDLE BEARINGS (10) WITH GREASE.

## INPUT SHAFT REPAIR (CONT)



11. INSTALL LARGE GEAR (12) OVER INPUT SHAFT (1).
12. INSTALL SPACER (13).
13. PRESS BEARING (14) TO SEAT AGAINST SPACER (13).
14. COAT BEARING (14) WITH GAA.
15. INSTALL SPACER (15) AND PISTON RING (16).
16. INSTALL PUMP DRIVE PLATE (17).
17. COAT THREADS OF TWO SCREWS (18) WITH LUBRICATING OIL AND INSTALL. TIGHTEN SCREWS TO 60 LB-FT (81 N.m).

### NOTE

Follow-on Maintenance:  
Install input shaft in transfer case (page 15-2).

## Section III. CENTER SHAFT REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the center shaft.

Repair of the center shaft is general support maintenance

---

### CENTER SHAFT REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Grease, Appendix B, Item 26  
 Automotive and  
 Artillery (GAA)

Compound, Appendix B, Item 16  
 Sealing

**References:**

TM 9-214

**Equipment Condition:**

**Reference**

Page 15-2

**Condition Description**

Center Shaft Removed  
 from Transfer Case

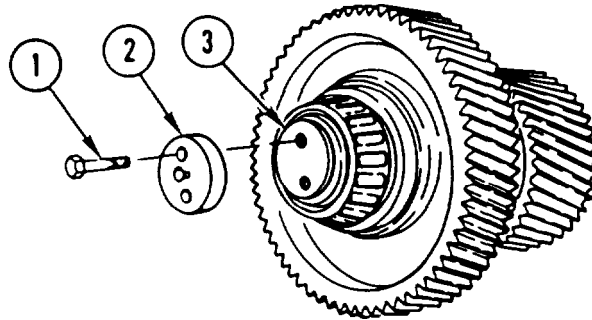
**General Safety Instructions:**

**WARNING**

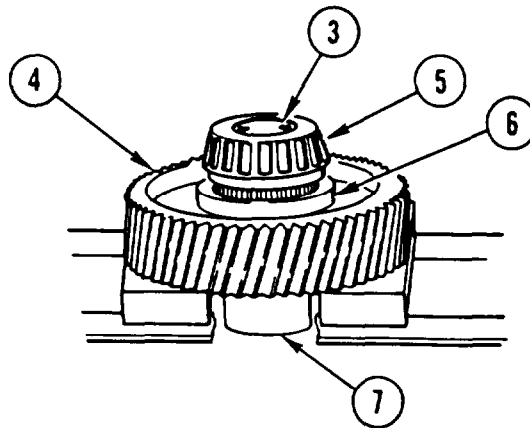
Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with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

**CENTER SHAFT REPAIR (CONT)**

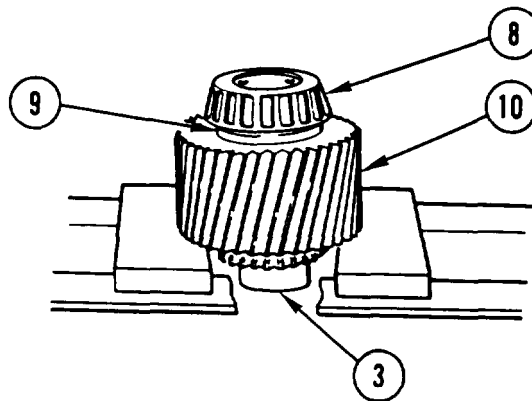
**DISASSEMBLY**



1. REMOVE TWO SCREWS (1) AND RETAINER WASHER (2) FROM END OF CENTER SHAFT (3).



2. PLACE CENTER SHAFT ASSEMBLY (3) IN PRESS WITH LARGE GEAR (4) UP.
3. PRESS CENTER SHAFT (3) OUT OF BEARING CONE (5), SPACER (6), AND LARGE GEAR (4).
4. REMOVE SPACER (7) FROM CENTER SHAFT (3).



5. TURN CENTER SHAFT (3) OVER IN PRESS.
6. PRESS CENTER SHAFT (3) OUT OF BEARING CONE (8), SPACER (9), AND SMALL GEAR (10).

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

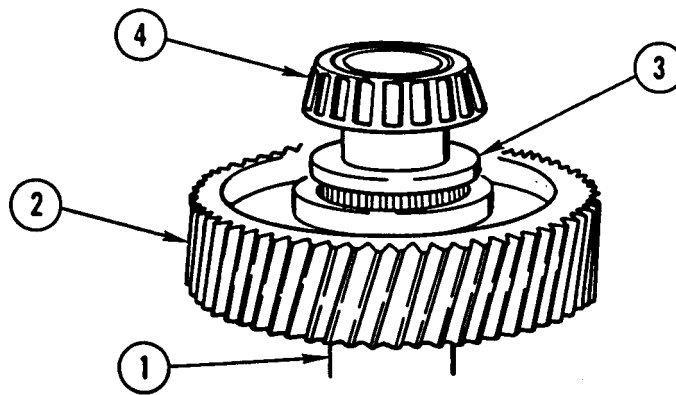
### **INSPECTION**

1. INSPECT BEARINGS IN ACCORDANCE WITH TM 9-214.
2. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

### **REPAIR**

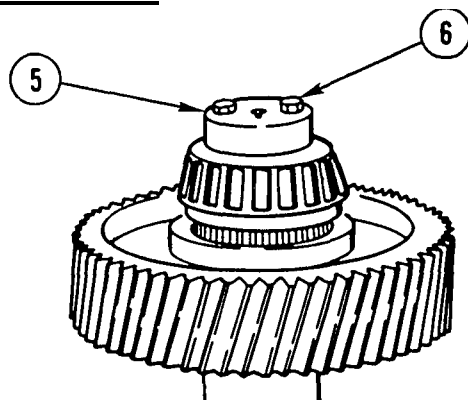
Use general repair methods to repair damaged parts (page 2-33).

### **ASSEMBLY**



1. PLACE CENTER SHAFT (1) ON CLEAN WORK SURFACE AND PRESS LARGE GEAR (2) OVER SHORT SPLINE END OF CENTER SHAFT (1).
2. INSTALL SPACER (3) AND SEAT AGAINST LARGE GEAR (2).
3. USING SLEEVE DRIVER, PRESS BEARING CONE (4) ON CENTER SHAFT (1) AND SEAT AGAINST SPACER (3).
4. COAT BEARING CONE (4) WITH GAA.

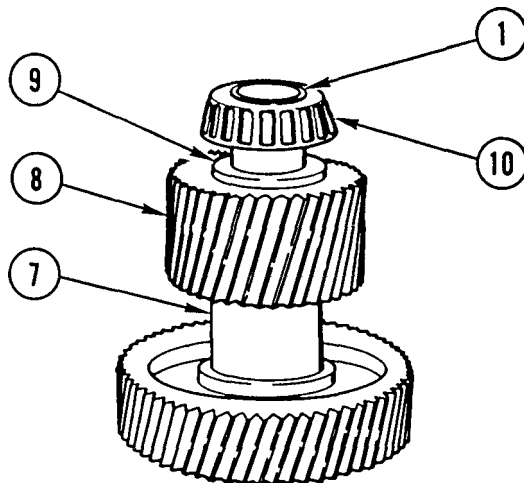
## CENTER SHAFT REPAIR (CONT)



### **WARNING**

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

5. APPLY SEALING COMPOUND TO HOLES IN RETAINER WASHER (5) AND TWO SCREWS (6).
6. INSTALL RETAINER WASHER (5) AND TWO SCREWS (6). TIGHTEN SCREWS TO 40 LB-FT (54 N.m).



7. TURN CENTER SHAFT (1) OVER AND INSTALL SPACER (7).
8. PRESS SMALL GEAR (8) ON CENTER SHAFT (1) AND INSTALL SPACER (9).
9. INSTALL BEARING CONE (10) TO SEAT AGAINST SPACER (9).
10. COAT BEARING CONE (10) WITH GAA.

### **NOTE**

Follow-on Maintenance  
Install center shaft in transfer case (page 15-2).

## Section IV. LOWER REAR OUTPUT SHAFT REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the lower rear output shaft.

Repair of the lower rear output shaft is general support maintenance.

---

### LOWER REAR OUTPUT SHAFT REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**References:**

TM 9-214

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95CL-A31  
 Tool Kit, SC 5180-90-CL-N05

**Equipment Condition:**

**Reference**

Page 15-2

**Condition Description**

Lower Rear Output Shaft  
 Removed from Transfer  
 Case

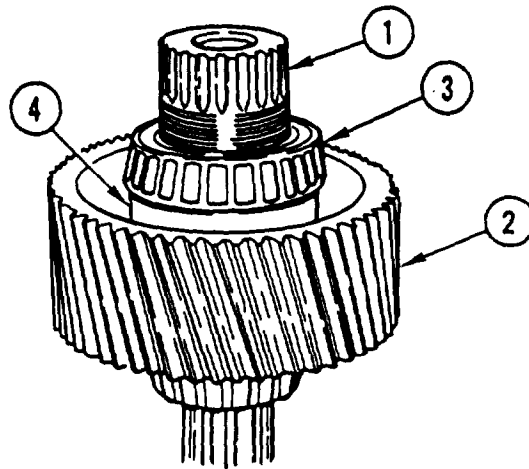
**Materials/Parts:**

Grease,  
 Automotive and  
 Artillery (GAA)

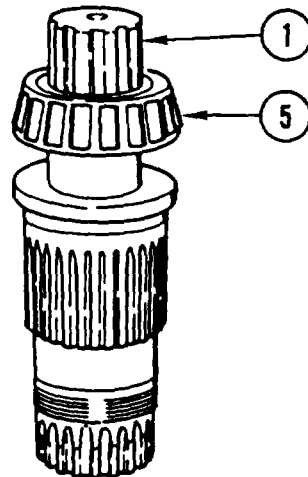
Appendix B, Item 26

## LOWER REAR OUTPUT SHAFT REPAIR (CONT)

### DISASSEMBLY



1. PLACE LOWER REAR OUTPUT SHAFT ASSEMBLY (1) IN PRESS WITH SUPPORTS UNDER GEAR (2).
2. PRESS LOWER REAR OUTPUT SHAFT (1) OUT OF BEARING CONE (3), SPACER (4), AND GEAR (2).



3. TURN LOWER REAR OUTPUT SHAFT (1) OVER AND PRESS OUT OF BEARING CONE (5).



**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

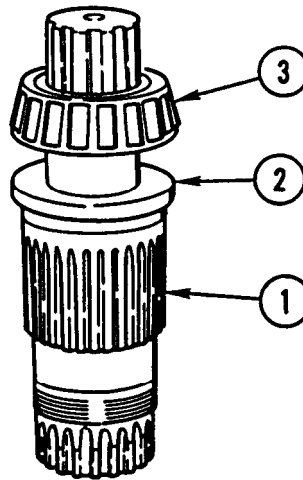
**INSPECTION**

1. INSPECT BEARINGS IN ACCORDANCE WITH TM 9-214.
2. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

**REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

**ASSEMBLY**

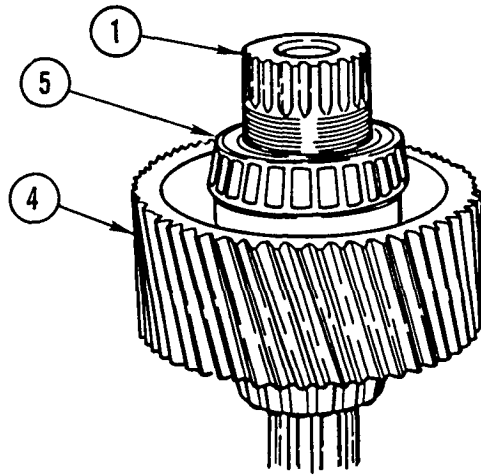


1. PLACE LOWER REAR OUTPUT SHAFT (1) ON CLEAN WORK SURFACE AND INSTALL SPACER (2).
2. PRESS BEARING CONE (3) ON LOWER REAR OUTPUT SHAFT (1) AND SEAT AGAINST SPACER (2).
3. COAT BEARING CONE (3) WITH GAA.

---

## LOWER REAR OUTPUT SHAFT REPAIR (CONT)

---



4. TURN LOWER REAR OUTPUT SHAFT (1) OVER AND PRESS GEAR (4) ON LOWER REAR OUTPUT SHAFT (1).
5. PRESS BEARING CONE (5) ON LOWER REAR OUTPUT SHAFT (1) AND SEAT ON GEAR (4).
6. COAT BEARING CONE (5) WITH GAA.

### NOTE

Follow-on Maintenance:  
Install lower rear output shaft in transfer case (page 15-2).

## Section V. LOWER FRONT OUTPUT SHAFT REPAIR

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the lower front output shaft.

Repair of the lower front output shaft is general support maintenance.

---

### LOWER FRONT OUTPUT SHAFT REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

#### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Compound, Pipe Sealing                      Appendix B, Item 15

Grease, Automotive and Artillery (GAA)                      Appendix B, Item 26

**References:**

TM 9-214

**Equipment Condition:**

**Reference**

Page 15-2

**Condition Description**

Lower Front Output Shaft  
 Removed from Transfer Case

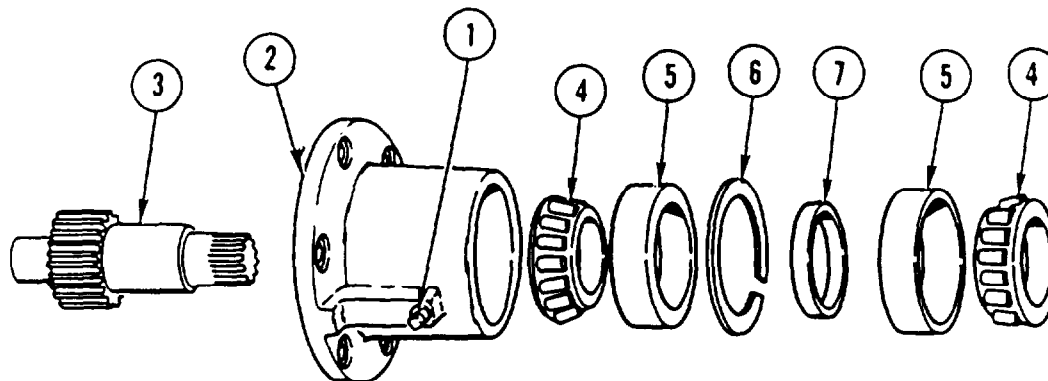
**General Safety Instructions:**

**WARNING**

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

## LOWER FRONT OUTPUT SHAFT REPAIR (CONT)

### DISASSEMBLY



1. REMOVE PLUG (1).
2. PLACE BEARING CAP (2) IN PRESS AND PRESS OUT OUTPUT SHAFT (3).
3. REMOVE TWO BEARING CONES (4).

#### NOTE

Perform steps 4 and 5 only if bearings are damaged.

4. PRESS OUT TWO BEARING CUPS (5).
5. REMOVE RETAINING RING (6) AND SPACER (7).

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

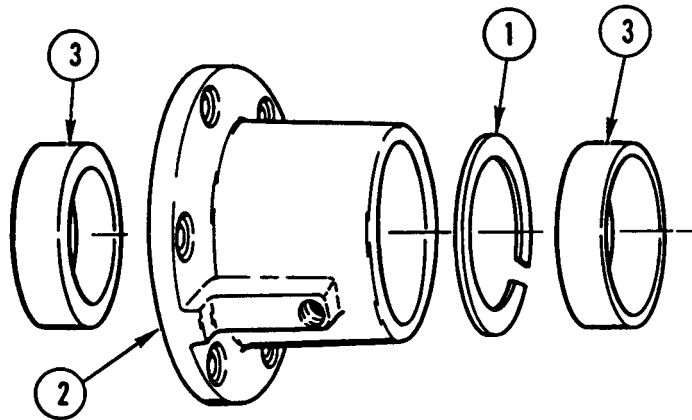
### INSPECTION

1. INSPECT BEARINGS IN ACCORDANCE WITH TM 9-214.
2. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

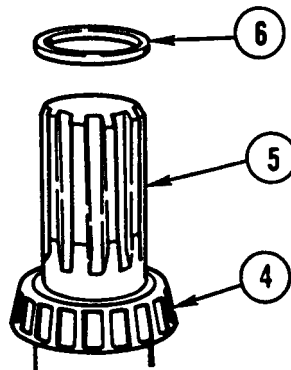
**ASSEMBLY**



**NOTE**

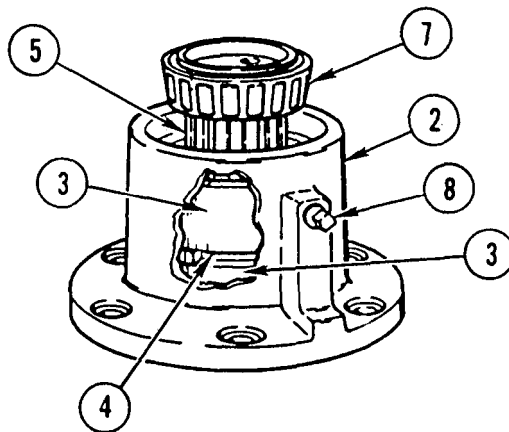
Perform steps 1 and 2 only if bearing cups have been removed.

1. INSTALL RETAINING RING (1) IN BEARING CAP (2).
2. INSTALL TWO BEARING CUPS (3) AND SEAT AGAINST RETAINING RING (1).



3. INSTALL INNER BEARING CONE (4) ON SPLINE END OF OUTPUT SHAFT (5). PRESS INNER BEARING CONE (4) UNTIL SEATED AGAINST SHOULDER OF OUTPUT SHAFT (5).
4. COAT INNER BEARING CONE (4) WITH GAA.
5. INSTALL SPACER (6).

## LOWER FRONT OUTPUT SHAFT REPAIR (CONT)



6. INSTALL BEARING CAP (2) ON SPLINE END OF OUTPUT SHAFT (5) UNTIL INNER BEARING CONE (4) IS FIRMLY SEATED IN BEARING CUP (3).
7. INSTALL OUTER BEARING CONE (7) ON SPLINE END OF OUTPUT SHAFT (5).
8. COAT OUTER BEARING CONE (7) WITH GAA.
9. PRESS OUTER BEARING CONE (7) UNTIL SEATED IN OUTER BEARING CUP (3).

### **WARNING**

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

10. COAT THREADS OF PLUG (8) WITH PIPE SEALING COMPOUND AND INSTALL PLUG (8).

### **NOTE**

Follow-on Maintenance:  
Install lower front output shaft in transfer case (page 15-2).

## Section VI. LOWER SHIFT ROD REPAIR

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the lower shift rod.

Repair of the lower shift rod is general support maintenance.

---

### LOWER SHIFT ROD REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

#### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-NO5

**Materials/Parts:**

Oil, Lubricating                      Appendix B, Item 37

Wire, Non-Electrical                  Appendix B, Item 65

**Equipment Condition:**

**Reference**

Page 15-2

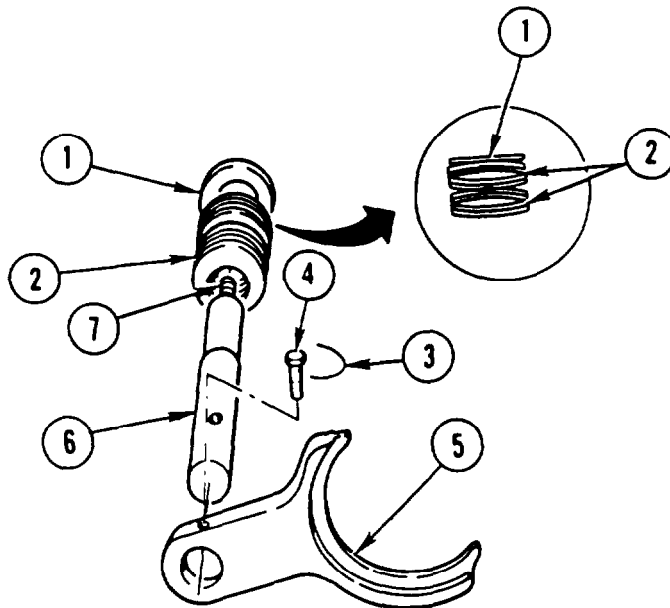
**Condition Description**

Lower Shift Rod  
Removed from Transfer  
Case

## **LOWER SHIFT ROD REPAIR (CONT)**

### **DISASSEMBLY**

1. REMOVE WASHER (1) AND EIGHT SPRING DISKS (2).
2. CUT AND REMOVE LOCKWIRE (3) FROM SCREW (4).
3. REMOVE SCREW (4) FROM FORK (5).
4. REMOVE SHIFT ROD (6) FROM FORK (5).
5. REMOVE STUD (7) FROM SHIFT ROD (6).



### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

Inspect all parts for wear or damage.

### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).



**ASSEMBLY**

1. INSTALL STUD (7) IN SHIFT ROD (6).
2. INSTALL SHIFT ROD (6) IN FORK (5).
3. COAT THREADS OF SCREW (4) WITH LUBRICATING OIL.
4. ALINE HOLES (8) AND INSTALL SCREW (4).
5. SECURE SCREW (4) WITH NEW NON-ELECTRICAL WIRE (3).
6. INSTALL EIGHT SPRING DISKS (2), ALTERNATING CONCAVE SURFACES, IN PAIRS.
7. INSTALL WASHER (1).

**NOTE**

Follow-on Maintenance:  
Install lower shift rod in transfer case (page 15-2).

## Section VII. UPPER SHIFT ROD REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the upper shift rod.

Repair of the upper shift rod is general support maintenance.

---

### UPPER SHIFT ROD REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Oil, Lubricating                      Appendix B, item 37

Wire, Non-Electrical                Appendix B, Item 65

**Equipment Condition:**

**Reference**

Page 15-2

**Condition Description**

Upper Shift Rod  
Removed from Transfer  
Case

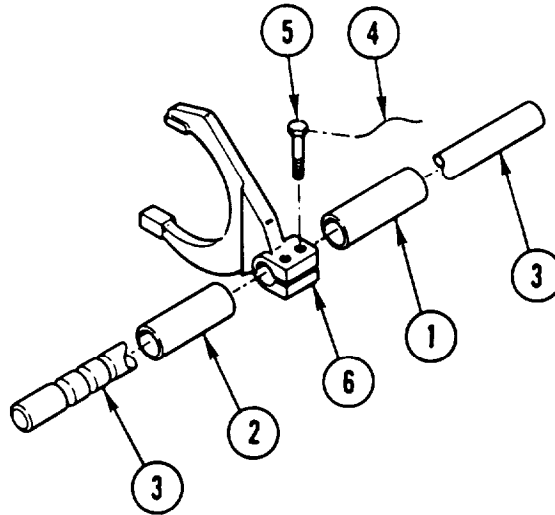
---

### DISASSEMBLY

**NOTE**

Tag spacers prior to removal to aid in installation.

1. REMOVE TWO SPACERS (1 AND 2) FROM SHIFT ROD (3).
2. CUT AND REMOVE LOCKWIRE (4) FROM TWO SCREWS (5)
3. REMOVE TWO SCREWS (5) FROM FORK (6)
4. REMOVE SHIFT ROD (3) FROM FORK (6).



### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.

### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

### ASSEMBLY

1. INSTALL SHIFT ROD (3) IN FORK (6).
2. COAT THREADS OF TWO SCREWS (5) WITH LUBRICATING OIL.
3. INSTALL TWO SCREWS (5) AND TIGHTEN TO 40 LB-FT (54 N.m).
4. SECURE TWO SCREWS (5) TOGETHER WITH NEW NON-ELECTRICAL WIRE (4).
5. INSTALL TWO SPACERS (1 AND 2) ON SHIFT ROD (3).

### NOTE

Follow-on Maintenance:  
Install upper shift rod in transfer case (page 15-2).

## Section VIII. LUBRICATION PUMP REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the lubrication pump.

Repair of the lubrication pump is general support maintenance

---

### LUBRICATION PUMP REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Equipment Condition:**

**Reference**

Page 3-276

**Condition Description**

Lubrication Pump  
Removed

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

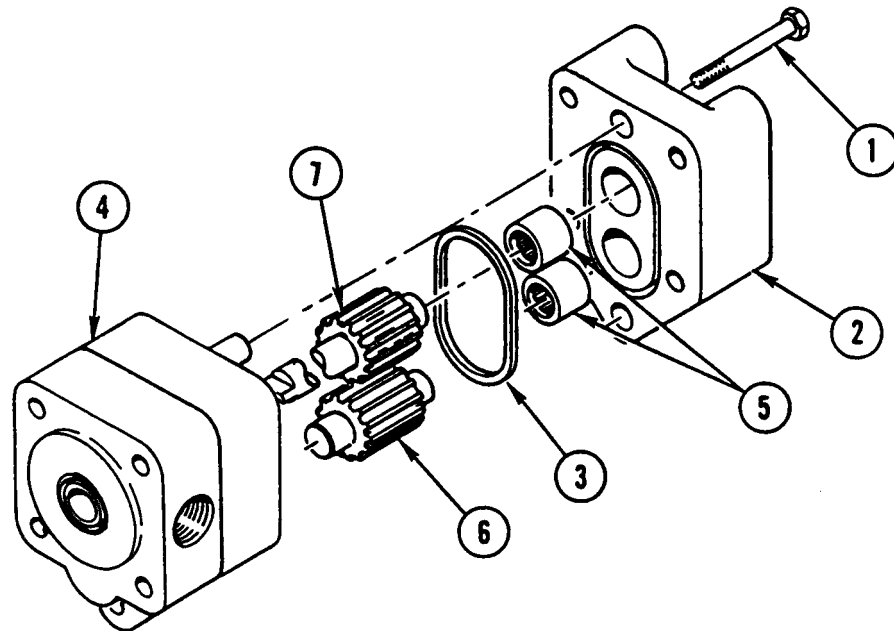
**Materials/Parts:**

Seal	P/N 2AG460
Gasket (2)	P/N 2AL656
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26

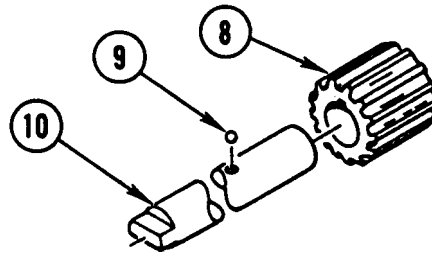
**References:**

TM 9-214

**DISASSEMBLY**

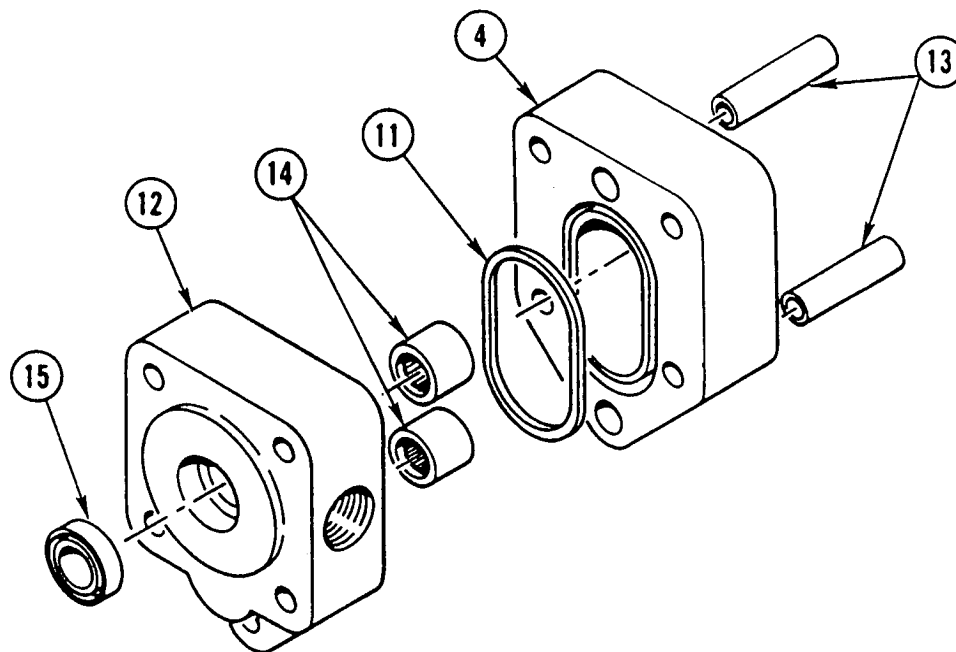


1. REMOVE TWO SCREWS (1), HEAD (2), AND GASKET (3) FROM CASING (4). DISCARD GASKET.
2. REMOVE TWO NEEDLE BEARINGS (5) FROM HEAD (2).
3. REMOVE GEAR (6) AND GEAR ASSEMBLY (7).



4. REMOVE GEAR (8) AND BALL (9) FROM SHAFT (10).

## LUBRICATION PUMP REPAIR (CONT)



5. REMOVE CASING (4) AND GASKET (11) FROM BRACKET (12). DISCARD GASKET.
6. REMOVE TWO ALINEMENT SLEEVES (13).
7. REMOVE TWO NEEDLE BEARINGS (14) AND SEAL (15) FROM BRACKET (12). DISCARD SEAL.

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

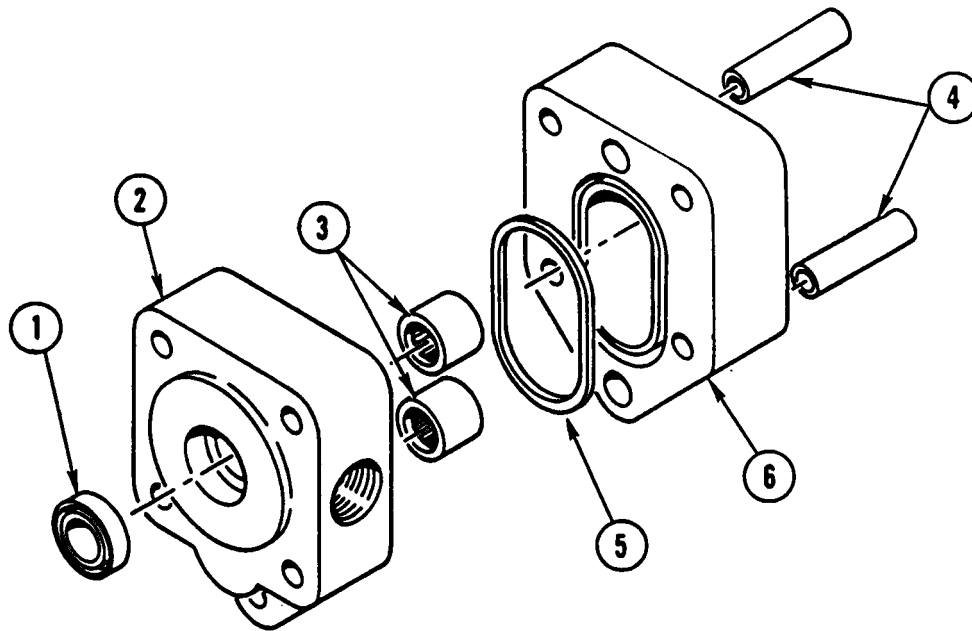
### **INSPECTION**

1. INSPECT NEEDLE BEARINGS IN ACCORDANCE WITH TM 9-214.
2. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

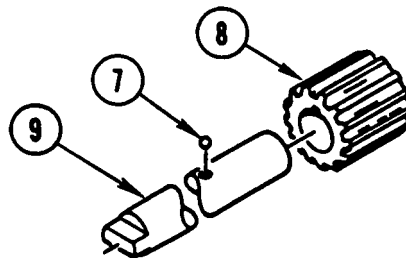
### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

**ASSEMBLY**

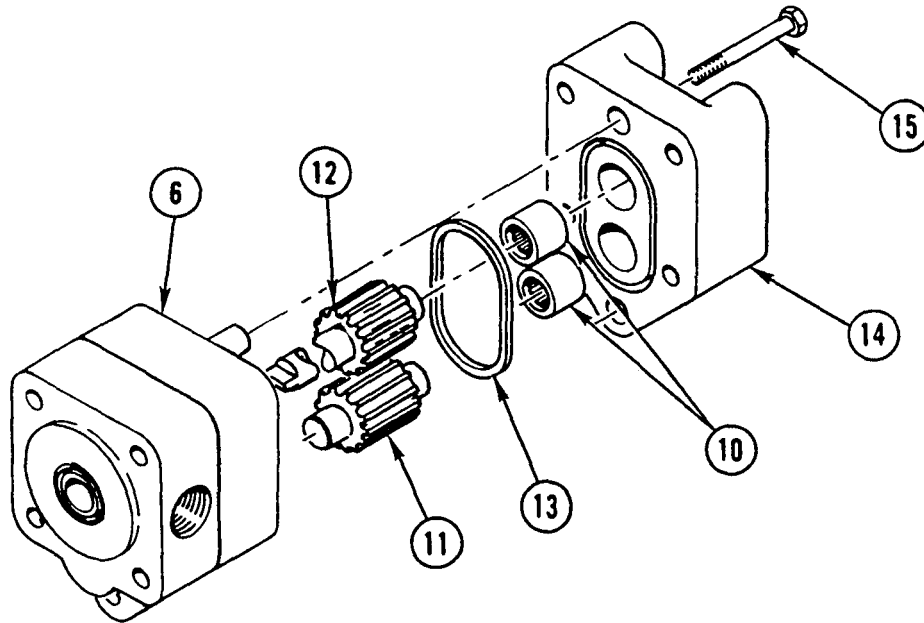


1. COAT NEW SEAL (1) WITH GAA AND INSTALL SEAL (1) IN BRACKET (2).
2. INSTALL TWO NEEDLE BEARINGS (3) AND TWO ALINEMENT SLEEVES (4) IN BRACKET (2).
3. INSTALL NEW GASKET (5) ON CASING (6) AND INSTALL CASING (6) ON BRACKET (2).



4. INSTALL BALL (7) AND GEAR (8) ON SHAFT (9).

## LUBRICATION PUMP REPAIR (CONT)



5. INSTALL TWO NEEDLE BEARINGS (10), GEAR (11), GEAR ASSEMBLY (12), AND NEW GASKET (13) IN HEAD (14).
6. INSTALL HEAD (14) AND TWO SCREWS (15) IN CASING (6).

### NOTE

Install lubrication pump (page 3-276).  
Follow-on Maintenance:



## Section IX. AIR SHIFT CHAMBER REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the air shift chamber.

Repair of the air shift chamber is general support maintenance.

---

### AIR SHIFT CHAMBER REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Seal P/N 525A517

**Equipment Condition:**

Reference	Condition Description
Page 3-270	Air Shift Chamber Removed

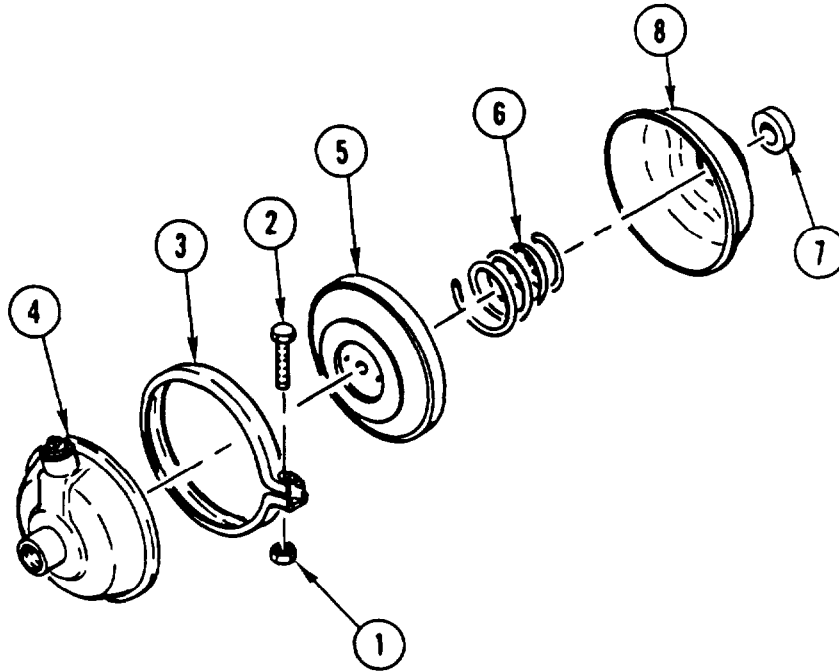
General Safety Instructions:

**WARNING**

Spring inside chamber is under load. Remove ring clamp carefully to avoid personal injury.

## AIR SHIFT CHAMBER REPAIR (CONT)

### DISASSEMBLY



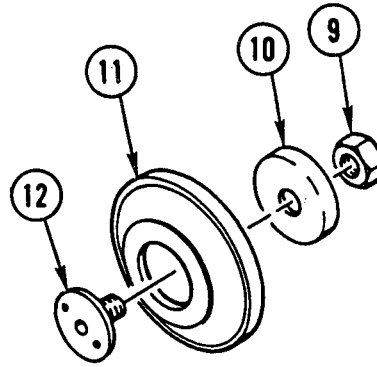
### WARNING

Spring inside chamber is under load. Remove ring clamp carefully to avoid personal injury.

### NOTE

Note position of front cover for assembly.

1. PLACE AIR SHIFT CHAMBER IN VISE AND REMOVE TWO NUTS (1), TWO SCREWS (2), AND RING CLAMP (3).
2. OPEN VISE AND REMOVE FRONT COVER (4), DIAPHRAGM ASSEMBLY (5), SPRING (6), AND SEAL (7) FROM BODY (8). DISCARD SEAL.



3. REMOVE NUT (9), GUIDE (10), AND DIAPHRAGM (11) FROM PUSH PLATE (12).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

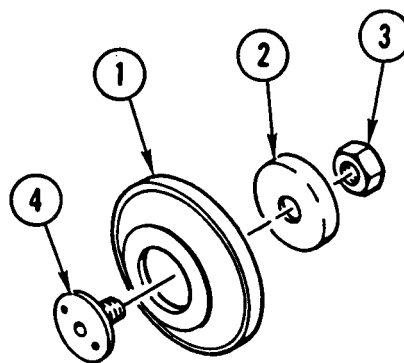
**INSPECTION**

Inspect all parts for wear or damage.

**REPAIR**

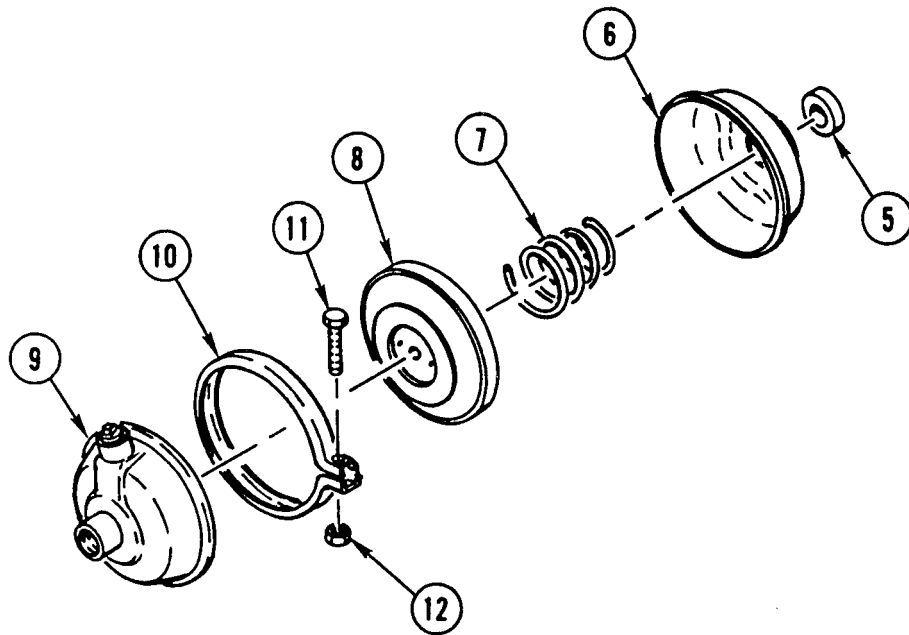
Use general repair methods to repair damaged parts (page 2-33).

**ASSEMBLY**



1. INSTALL DIAPHRAGM (1), GUIDE (2), AND NUT (3) ON PUSH PLATE (4).
2. USING HAMMER AND PUNCH, STAKE NUT (3) IN THREE PLACES.

## AIR SHIFT CHAMBER REPAIR (CONT)



3. INSTALL NEW SEAL (5) IN BODY (6).
4. INSTALL SPRING (7), DIAPHRAGM ASSEMBLY (8), AND FRONT COVER (9) IN BODY (6). PLACE IN VISE AND COMPRESS SPRING (7) BY CLOSING VISE.
5. INSTALL RING CLAMP (10), TWO SCREWS (11), AND TWO NUTS (12).

### **NOTE**

Follow-on Maintenance:  
Install air shift chamber (page 3-270).

# CHAPTER 16 FRONT AXLE REPAIR INSTRUCTIONS

## OVERVIEW

This chapter illustrates and describes procedures for maintenance of the front axle and related parts.

	Page
Front Differential Carrier Repair (All Except M915A2) . . . . .	16-2

## FRONT DIFFERENTIAL CARRIER REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Socket, 2-1/4 in., 1M723  
 Yoke Holder Bar, J3453

**Materials/Parts:**

Seal, Oil	P/N 2CS3
Nut, Lock	P/N 1227-J-946-S
Nut, Lock (12)	P/N 2788HX1
Oil Lubricating	Appendix B, Item 37
Dye, Prussian Blue	Appendix B, Item 17
Wire, Non-Electrical	Appendix B, Item 65
Compound, Sealing and Thread Locking	Appendix B, Item 13
Compound, Sealing	Appendix B, Item 16

**Personnel Required: (2)**

**References**

TM 9-214

**Equipment Condition:**

**Reference**

Page 5-34

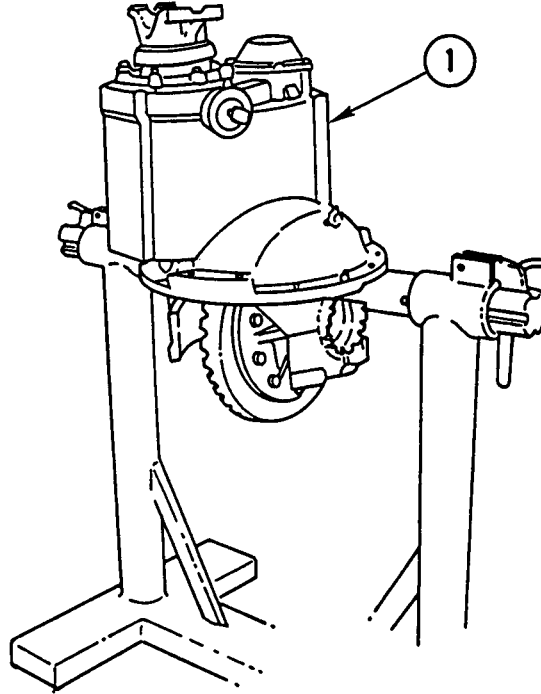
**Condition Description**

Front Differential Carrier Removed

**General Safety Instructions:**

### WARNING

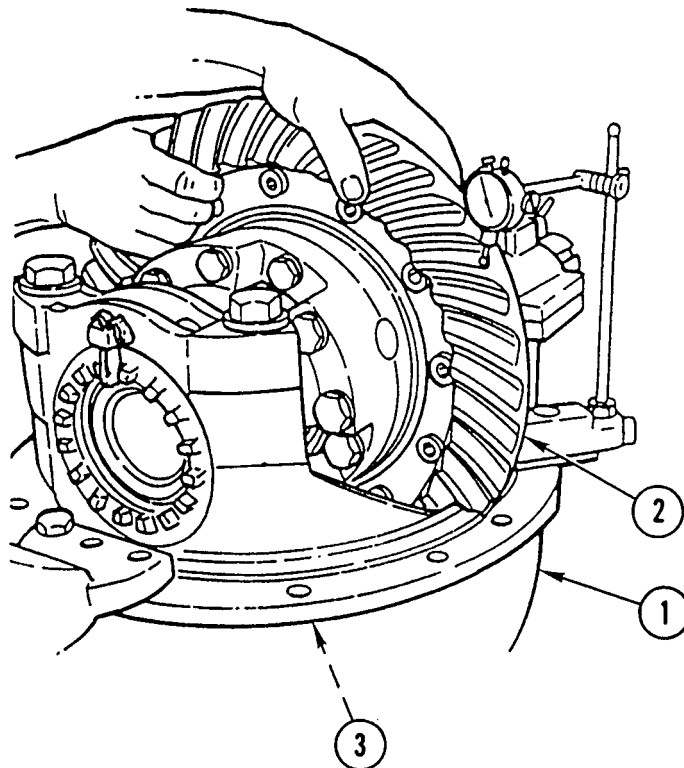
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Ring gear is heavy and can injure personnel if dropped. Do not put hands under ring gear.
- Front differential carrier weighs 820 lb (372 kg). Attach to suitable repair stand prior to disassembly or assembly to prevent possible injury to personnel.

**DISASSEMBLY****WARNING**

Differential carrier weighs 820 lb (372 kg). Attach to suitable repair stand prior to disassembly to prevent possible injury to personnel.

1. INSTALL DIFFERENTIAL CARRIER (1) ON REPAIR STAND.

## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)



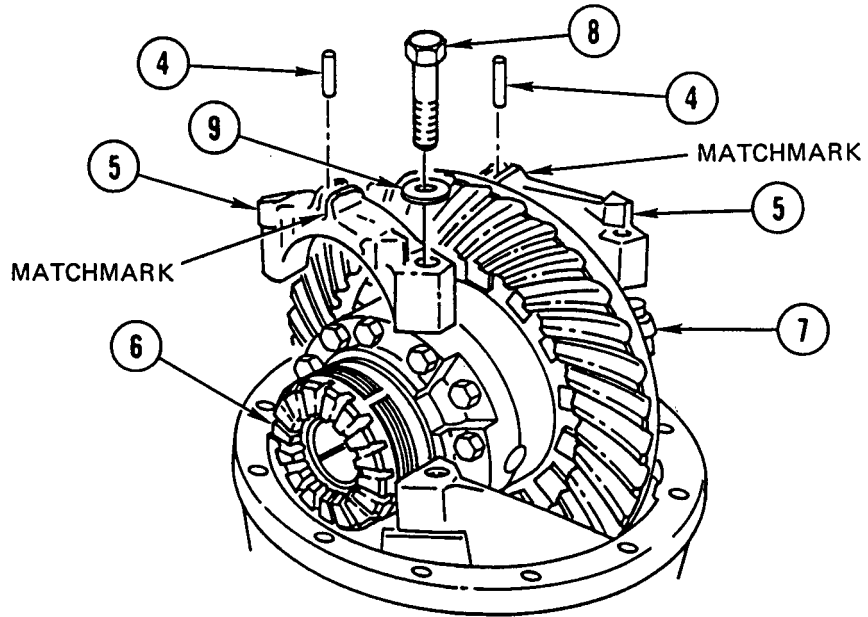
2. TURN DIFFERENTIAL CARRIER (1) SO RING GEAR (2) IS UP.

### **NOTE**

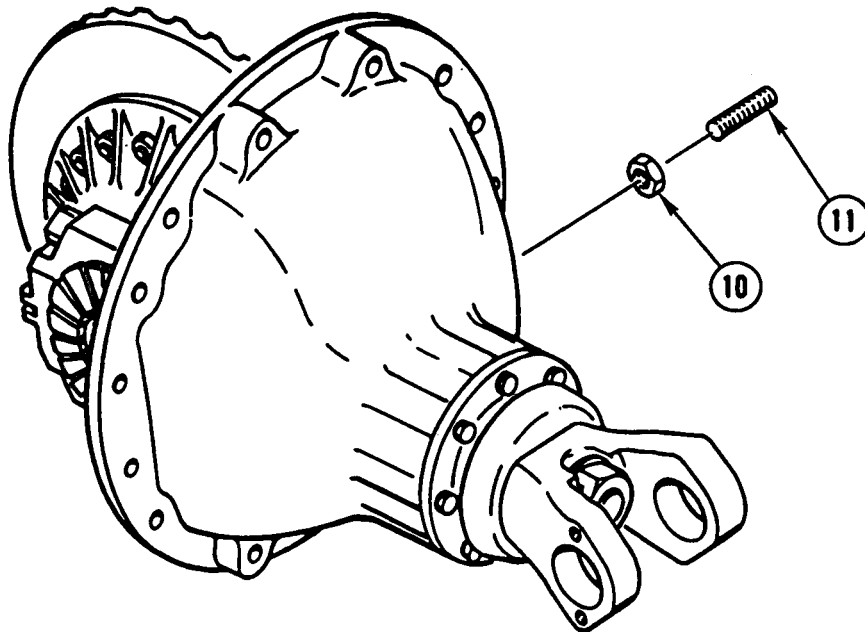
If reinstalling same ring gear and drive pinion, perform steps 3 thru 6 to measure backlash.

3. MOVE RING GEAR ASSEMBLY (2) SO RING GEAR ASSEMBLY (2) TEETH FULLY ENGAGE WITH DRIVE PINION (3) TEETH.
4. INSTALL DIAL INDICATOR ON FLANGE OF DIFFERENTIAL CARRIER (1) SO THAT TIP OF INDICATOR IS AGAINST DRIVE SIDE OF TOOTH ON RING GEAR ASSEMBLY (2). ADJUST DIAL INDICATOR TO ZERO.
5. ROTATE RING GEAR ASSEMBLY (2) IN BOTH DIRECTIONS AND RECORD READING.
6. REPEAT STEP 5 TWICE MORE IN DIFFERENT LOCATIONS.



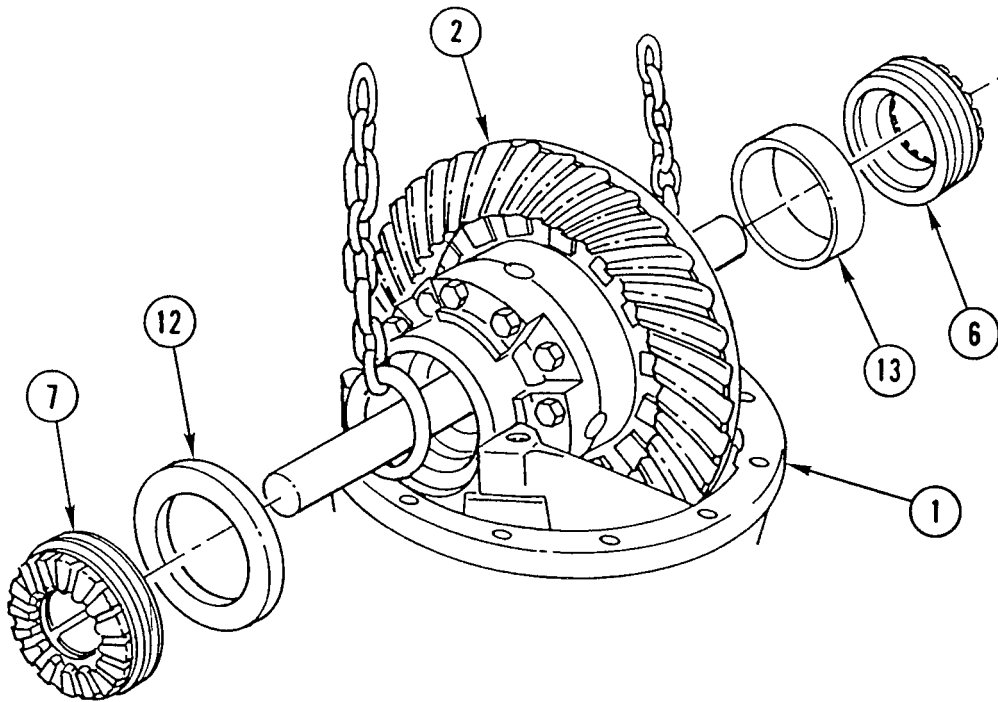


7. REMOVE TWO PINS (4) FROM TWO BEARING CAPS (5). MATCHMARK BEARING CAPS (5) AND BEARING ADJUSTERS (6 AND 7).
8. REMOVE FOUR SCREWS (8), FOUR WASHERS (9), AND TWO BEARING CAPS (5).



9. LOOSEN NUT (10) AND REMOVE THRUST SCREW (11).

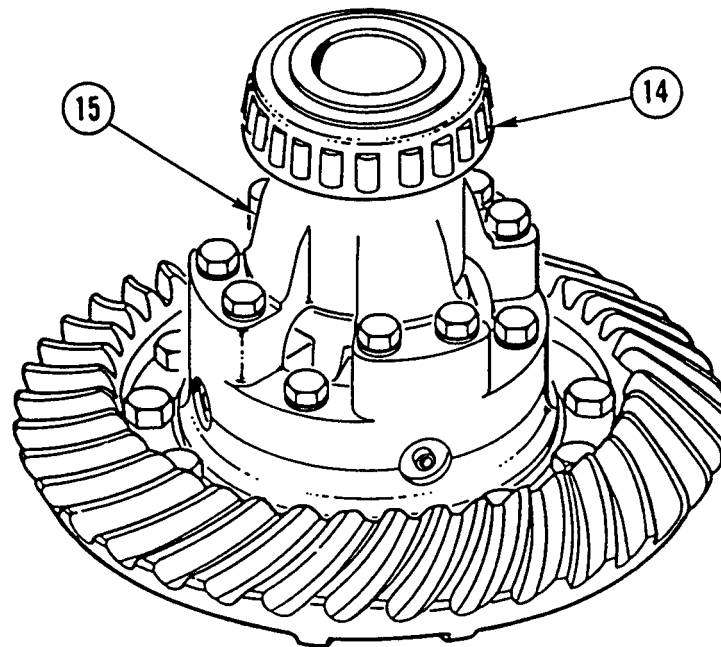
## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)



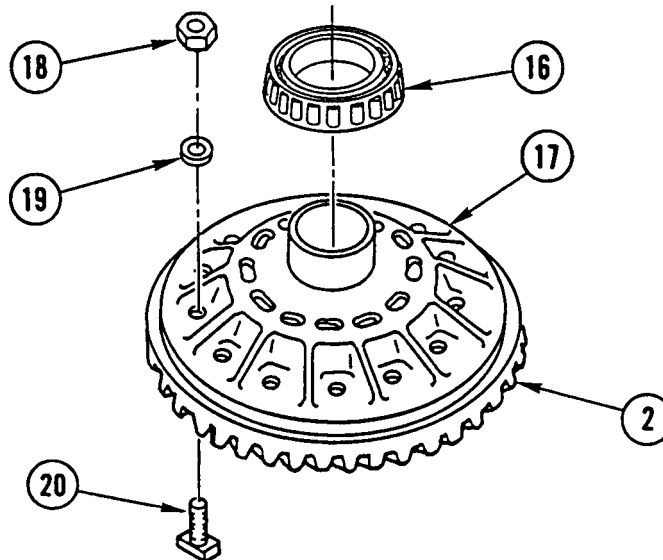
### NOTE

Ring gear and assembled parts must be tilted to clear casting inside carrier.

10. ATTACH LIFTING DEVICE TO RING GEAR ASSEMBLY (2).
11. REMOVE RING GEAR ASSEMBLY (2) FROM DIFFERENTIAL CARRIER (1).
12. PLACE RING GEAR ASSEMBLY (2) ON CLEAN WORK SURFACE AND REMOVE LIFTING DEVICE.
13. REMOVE TWO BEARING ADJUSTERS (6 AND 7) AND TWO BEARING CUPS (12 AND 13).
14. PLACE RING GEAR ASSEMBLY (2), TEETH UP, ON CLEAN WORK SURFACE.



15. REMOVE BEARING CONE (14) FROM DIFFERENTIAL CASE PLAIN HALF (15).



16. REMOVE BEARING CONE (16) FROM DIFFERENTIAL CASE FLANGED HALF (17).

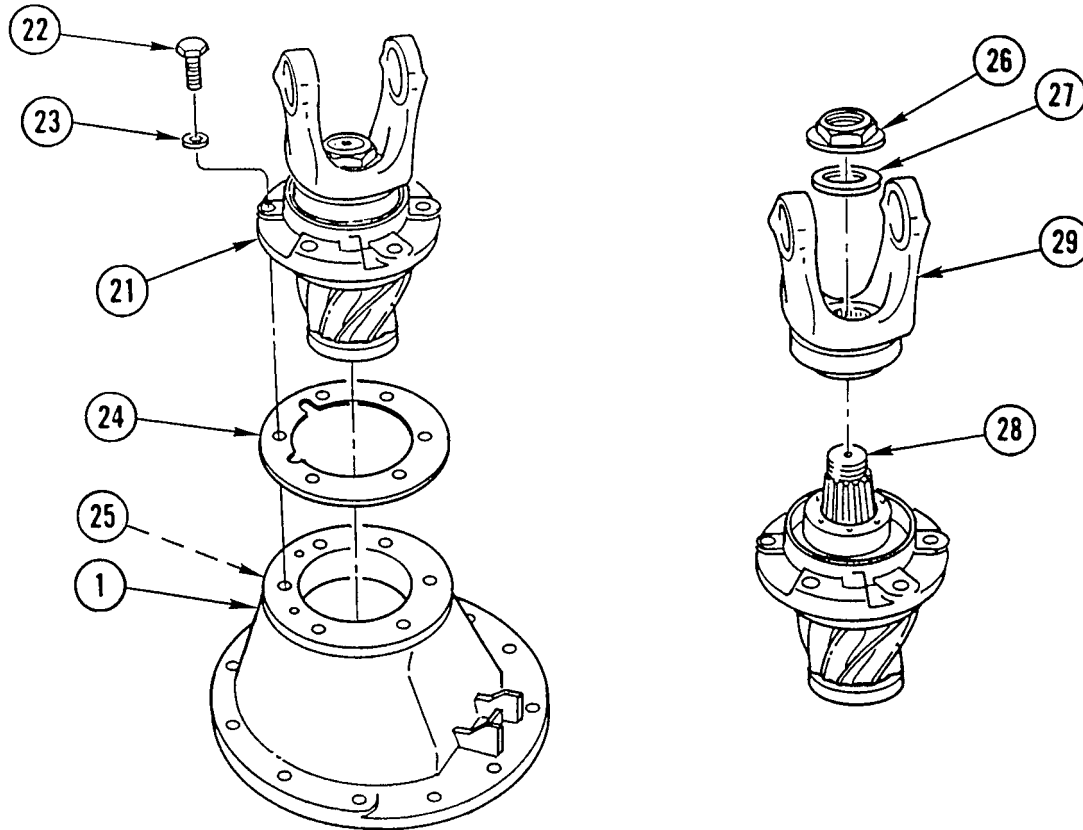
**WARNING**

Ring gear is heavy and can injure personnel if dropped. Do not put hands under ring gear.

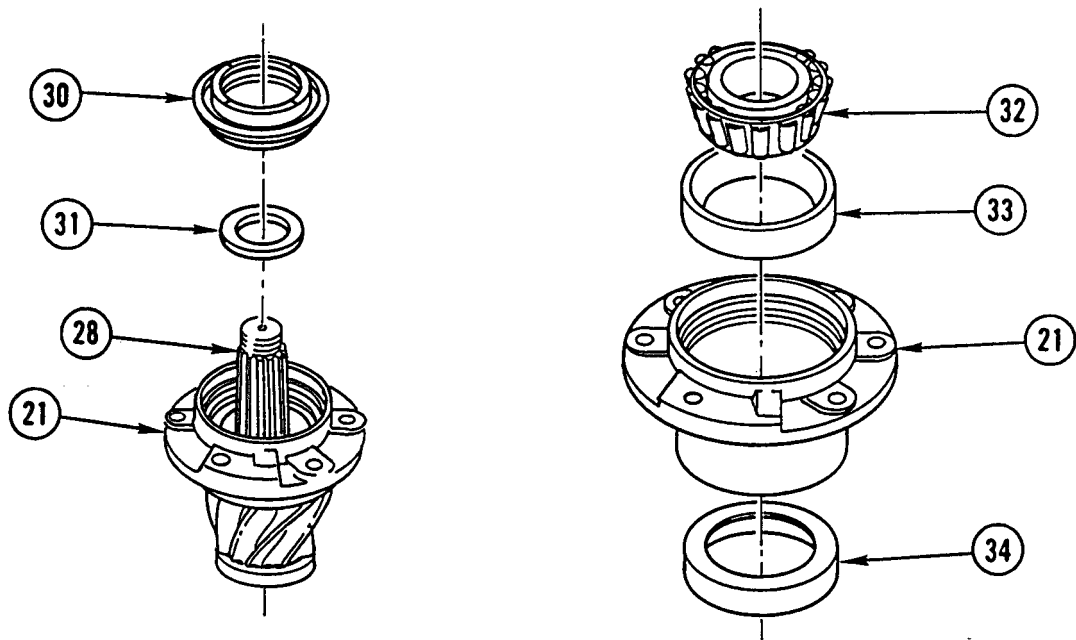
17. REMOVE 12 LOCK NUTS (18), 12 WASHERS (19), AND 12 SCREWS (20). DISCARD LOCK NUTS.

18. REMOVE RING GEAR (2) FROM DIFFERENTIAL CASE FLANGED HALF (17).

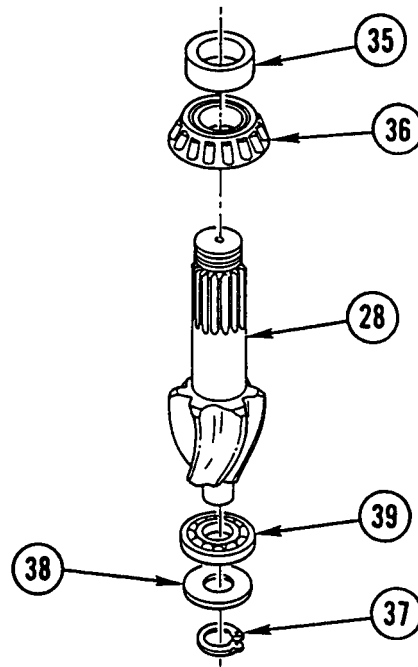
## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)



19. MATCHMARK BEARING CAGE ASSEMBLY (21) AND DIFFERENTIAL CARRIER (1).
20. REMOVE EIGHT SCREWS (22) AND EIGHT WASHERS (23) FROM BEARING CAGE ASSEMBLY (21).
21. REMOVE BEARING CAGE ASSEMBLY (21) FROM DIFFERENTIAL CARRIER (1).
22. REMOVE SHIMS (24) FROM DIFFERENTIAL CARRIER (1). RECORD NUMBER AND SIZE OF SHIMS (24).
23. REMOVE PLUG (25) FROM DIFFERENTIAL CARRIER (1).
24. USING YOKE HOLDER BAR, REMOVE LOCK NUT (26) AND WASHER (27) FROM PINION (28). DISCARD LOCK NUT,
25. REMOVE YOKE (29) FROM PINION (28).



26. REMOVE OIL SEAL (30) AND SPACER (31). DISCARD OIL SEAL.
27. PRESS PINION (28) FROM BEARING CAGE (21).
28. REMOVE OUTER BEARING CONE (32), OUTER BEARING CUP (33), AND INNER BEARING CUP (34) FROM BEARING CAGE (21).



29. REMOVE SPACER WASHER (35) AND INNER BEARING CONE (36) FROM PINION (28).
30. REMOVE LOCK RING (37) AND RETAINER (38).
31. REMOVE PILOT BEARING (39) FROM PINION (28).

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## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)

---

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

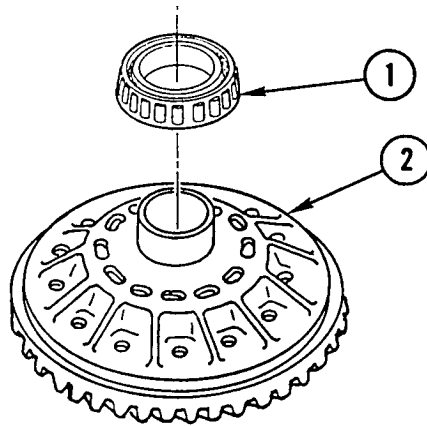
### INSPECTION

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. IF PINION OR RING GEAR IS DAMAGED, REPLACE BOTH AS MATCHED SET.
3. INSPECT BEARINGS IN ACCORDANCE WITH TM 9-214.

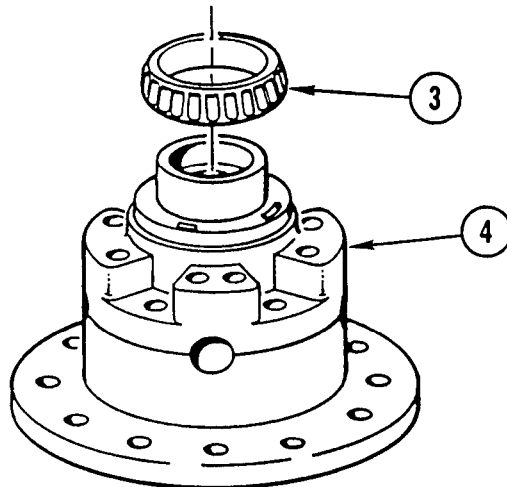
### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

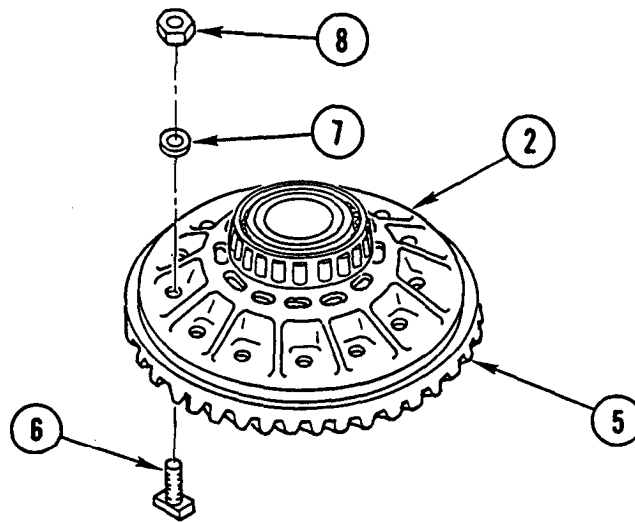
### ASSEMBLY



1. INSTALL BEARING CONE (1) ON DIFFERENTIAL CASE FLANGED HALF (2).



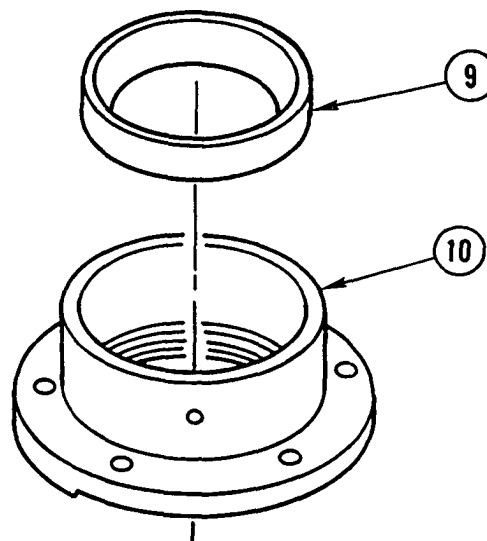
2. INSTALL BEARING CONE (3) ON DIFFERENTIAL CASE PLAIN HALF (4).



**CAUTION**

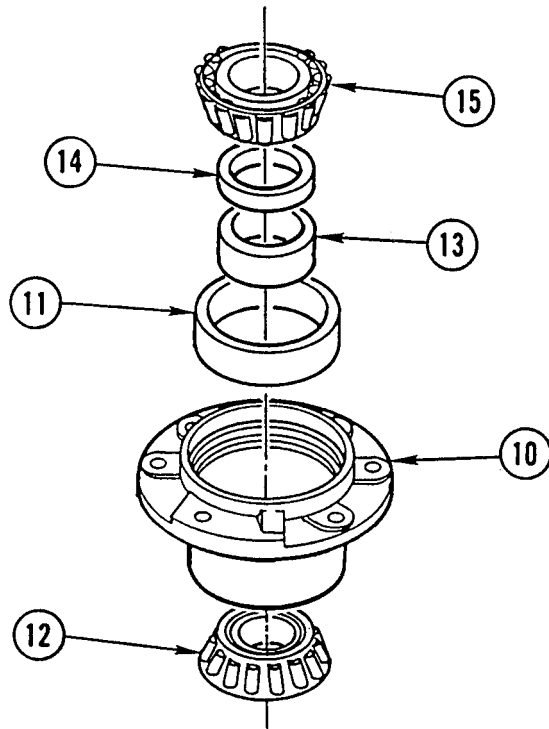
Square head of screw must be seated in machined groove of ring gear to prevent damage to ring gear or screws.

3. INSTALL RING GEAR (5) ON DIFFERENTIAL CASE FLANGED HALF (2) WITH 12 SCREWS (6), 12 WASHERS (7), AND 12 NEW LOCK NUTS (8). TIGHTEN LOCK NUTS TO 180-220 LB-FT (224-298 N.m).

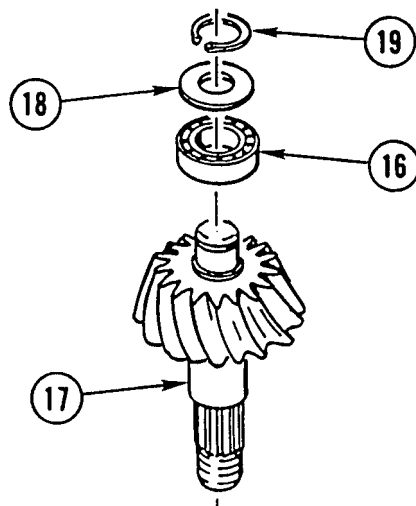


4. INSTALL INNER BEARING CUP (9) IN BEARING CAGE (10).

## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)

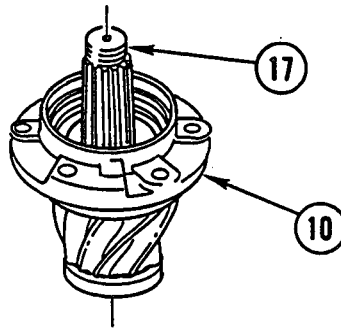


5. TURN BEARING CAGE (10) OVER SO THAT FLANGE IS UP.
6. INSTALL OUTER BEARING CUP (11) IN BEARING CAGE (10).
7. LUBRICATE AND INSTALL INNER BEARING CONE (12).
8. INSTALL SPACER WASHER (13) AND SPACER (14) IN BEARING CAGE (10).
9. LUBRICATE AND INSTALL OUTER BEARING CONE (15) IN OUTER BEARING CUP (11),

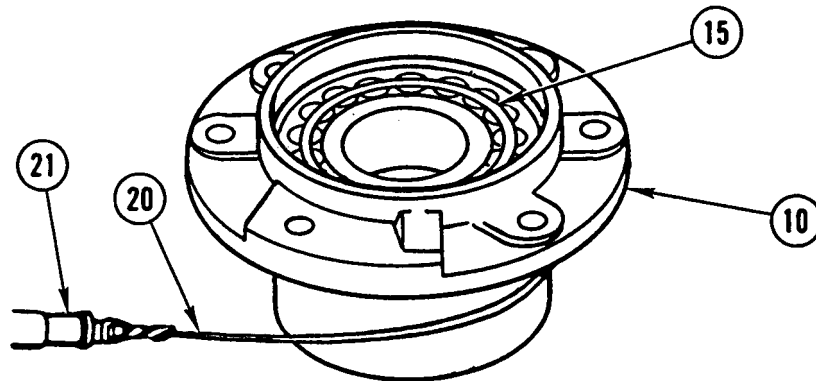


10. LUBRICATE AND INSTALL PILOT BEARING (16) ON PINION (17).
11. INSTALL RETAINER (18) AND LOCK RING (19).





12. USING PRESS, INSTALL PINION (17) IN BEARING CAGE (10).



**NOTE**

Pinion not shown, for clarity.

13. POSITION BEARING CAGE (10) IN PRESS SO THAT OUTER BEARING CONE (15) IS ON TOP.

**CAUTION**

- To make sure bearings and bearing cups are well lubricated, turn bearing cage back and forth while applying pressure.
- Stop if bearing cage becomes hard to turn while applying pressure. Bearings can be damaged if too much pressure is applied. Get next larger spacer and go to step 17.

14. LOWER PRESS RAM FOR LOAD OF 18-27 TONS (24-49 METRIC TONS) AGAINST OUTER BEARING CONE (15).

**NOTE**

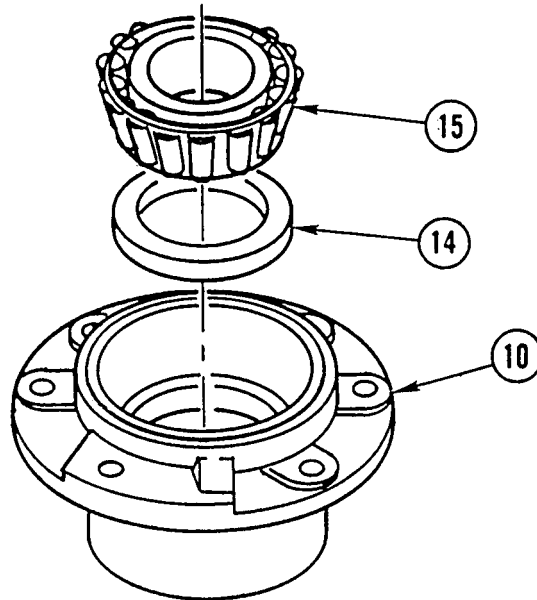
To perform steps 15 and 16, a 20-in. piece of 18 gauge wire must be used.

15. WRAP WIRE (20) AROUND BEARING CAGE (10) TWICE AND FASTEN ONE END OF WIRE IN BEARING CAGE (10) SCREW HOLE. FASTEN OTHER END OF WIRE (20) TO SPRING SCALE (21).
16. PULL ON SPRING SCALE (21) UNTIL BEARING CAGE (10) BEGINS TO TURN. MULTIPLY READING BY 3.66. (FOR NEW BEARING, RESULT MUST BE 5-45 LB-IN. FOR USED BEARING, RESULT MUST BE 10-30 LB-IN.) IF READING IS TOO LOW, GO TO STEP 20. IF READING IS TOO HIGH, CONTINUE WITH STEP 17. IF READING IS CORRECT, GO TO STEP 22.

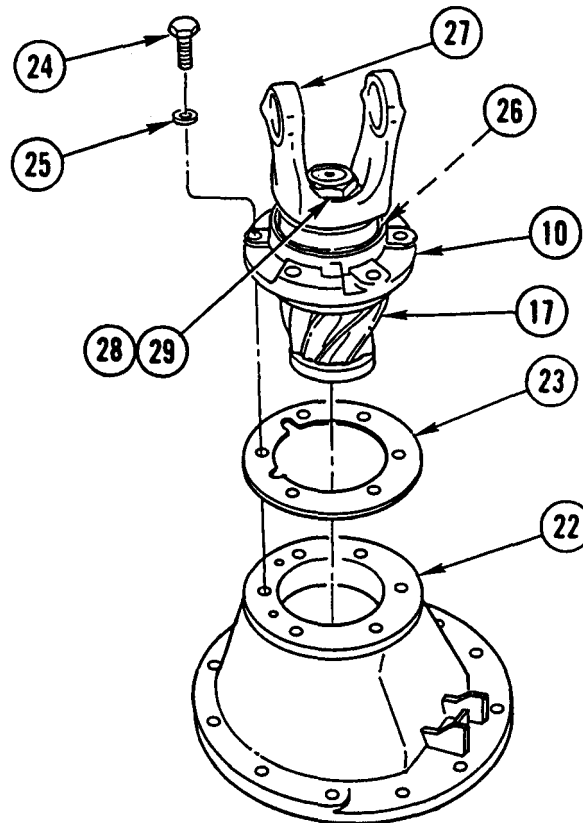
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## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)

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17. REMOVE OUTER BEARING CONE (15) AND SPACER (14) FROM BEARING CAGE (10).
18. USE 0.001-IN. (0.025-mm) THICKER SPACER (14) AND INSTALL SPACER (14) AND OUTER BEARING CONE (15) IN BEARING CAGE (10).
19. REPEAT STEPS 13 THRU 16.
20. REMOVE OUTER BEARING CONE (15) AND SPACER (14). USE 0.001-IN (0.025-mm) THINNER SPACER (14) AND INSTALL SPACER (14) AND OUTER BEARING CONE (15) IN BEARING CAGE (10).
21. REPEAT STEPS 13 THRU 16.



#### WARNING

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

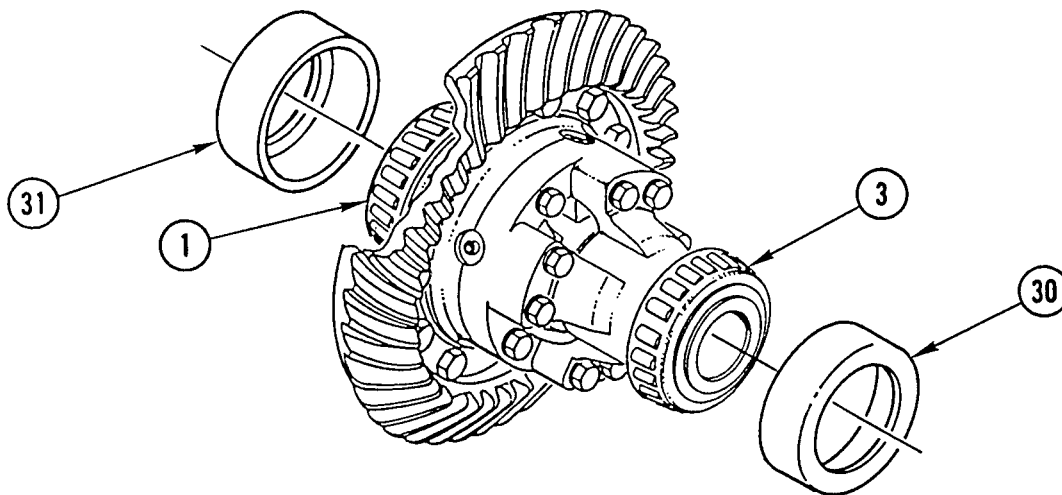
22. APPLY SEALING COMPOUND TO FLANGE OF BEARING CAGE (10) AND DIFFERENTIAL CARRIER (22).

#### NOTE

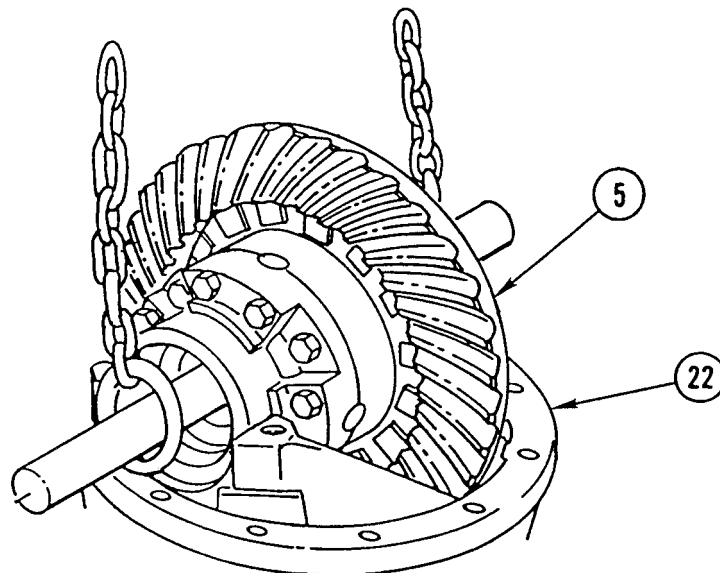
If gear set is reused, install same shims as removed. If new gear set is used, install 0.023-in. (0.6-mm) shim pack.

23. INSTALL SHIMS (23) ON DIFFERENTIAL CARRIER (22).
24. ALINE MATCHMARKS AND INSTALL BEARING CAGE (10) ON DIFFERENTIAL CARRIER (22).
25. APPLY THREAD LOCKING COMPOUND AND INSTALL EIGHT SCREWS (24) AND EIGHT WASHERS (25) ON DIFFERENTIAL CARRIER (22). TIGHTEN SCREWS TO 160-176 LB-FT (217-239 N.m).
26. APPLY COAT OF SEALING COMPOUND AROUND OUTSIDE EDGE OF SHIMS (23).
27. INSTALL NEW OIL SEAL (26), YOKE (27), WASHER (28), AND NEW LOCK NUT (29) ON PINION (17). USING YOKE HOLDER BAR, TIGHTEN NUT TO 450-600 LB-FT (610-814 N.m).

## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)



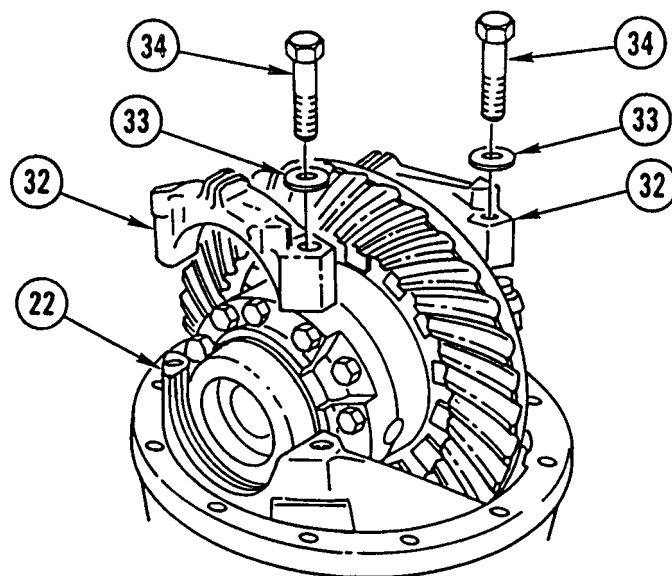
28. LUBRICATE TWO BEARING CONES (1 AND 3) WITH OIL AND INSTALL TWO BEARING CUPS (30 AND 31) ON TWO BEARING CONES (1 AND 3).



### NOTE

Ring gear must be tilted to clear casting inside carrier.

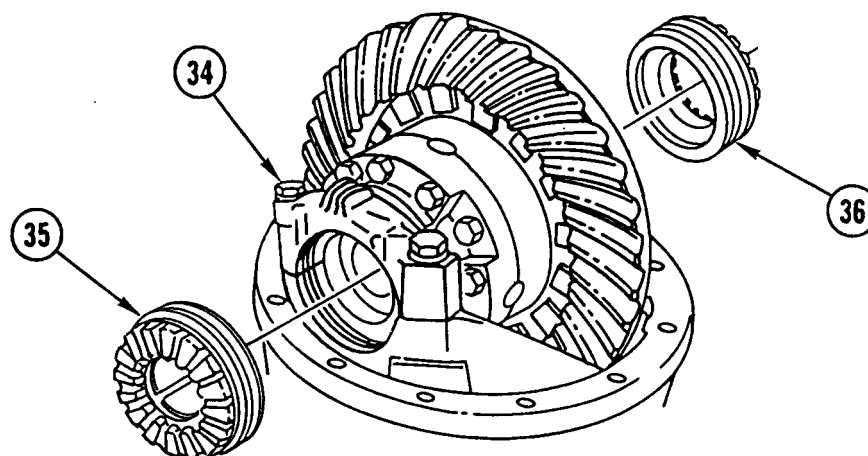
29. ATTACH SUITABLE LIFTING DEVICE TO RING GEAR (5).
30. GUIDE ASSEMBLED RING GEAR (5) INTO DIFFERENTIAL CARRIER (22) UNTIL RING GEAR TEETH MESH WITH PINION INSIDE CARRIER.
31. REMOVE LIFTING DEVICE.



**NOTE**

Make sure matchmarks are alined.

- 32. INSTALL TWO BEARING CAPS (32), FOUR WASHERS (33), AND FOUR SCREWS (34) ON DIFFERENTIAL CARRIER (22).
- 33. TIGHTEN FOUR SCREWS (34) HAND-TIGHT.

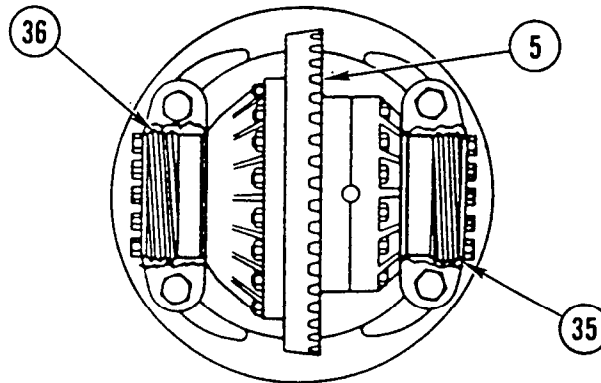


**CAUTION**

Carefully install bearing adjusters to prevent damage to threads.

- 34. INSTALL BEARING ADJUSTER (35) HAND-TIGHT.
- 35. INSTALL BEARING ADJUSTER (36) HAND-TIGHT.
- 36. TIGHTEN FOUR SCREWS (34) TO 40-50 LB-FT (54-68 N.m).

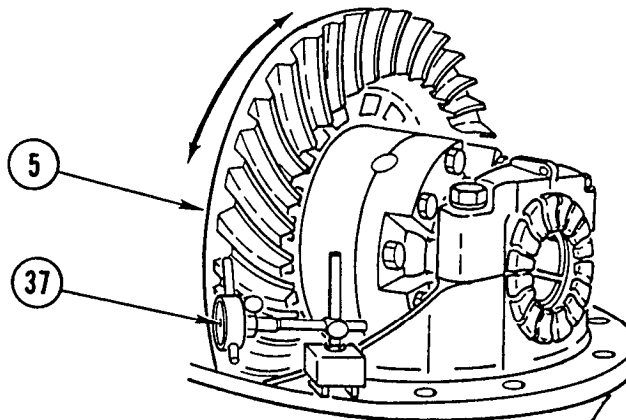
## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)



### NOTE

Align notch in bearing adjusters with mark on bearing caps.

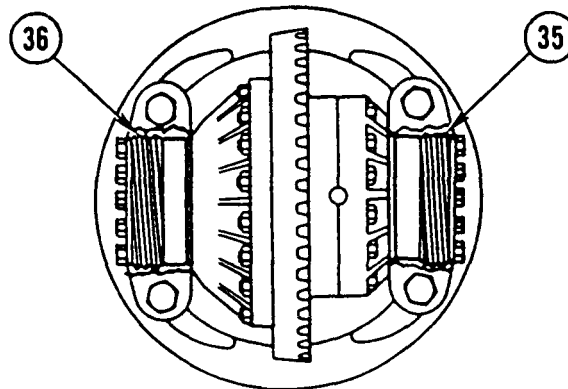
37. TIGHTEN BEARING ADJUSTER (35) UNTIL ONE THREAD SHOWS.
38. TIGHTEN BEARING ADJUSTER (36) UNTIL RING GEAR (5) CANNOT BE ROCKED BACK AND FORTH TOWARD TWO BEARING ADJUSTERS (35 AND 36) AND THERE IS NO BACKLASH.
39. ROTATE RING GEAR (5) AND CHECK FOR BIND. IF RING GEAR (5) BINDS, LOOSEN BEARING ADJUSTER (36) THEN TIGHTEN UNTIL RING GEAR (5) DOES NOT BIND.
40. TIGHTEN BEARING ADJUSTER (35) UNTIL BEARING ADJUSTER CONTACTS BEARING CUP OR RESISTS TURNING.
41. TIGHTEN BEARING ADJUSTER (35) TWO OR THREE NOTCHES UNTIL RING GEAR (5) HAS BACKLASH.



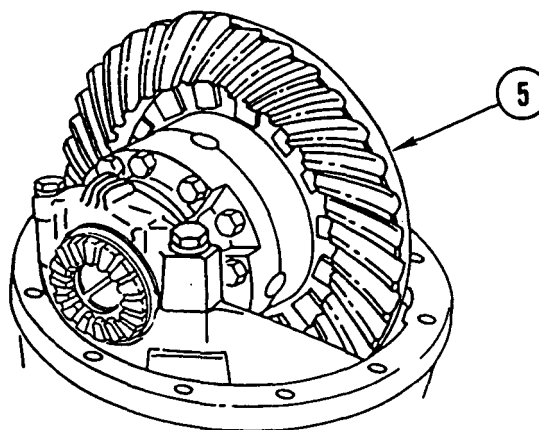
### NOTE

If old pinion and ring gear are used, backlash should be same as recorded in Disassembly, step 5. If new pinion and ring gear are used, backlash should be 0.008-0.018 in. (0.203-0.457 mm).

42. MOVE RING GEAR (5) BACK AND FORTH TO MEASURE BACKLASH. USE DIAL INDICATOR (37). IF BACKLASH IS CORRECT, GO TO STEP 51. IF THERE IS TOO MUCH BACKLASH, GO TO STEP 47. IF THERE IS NOT ENOUGH BACKLASH, CONTINUE WITH STEP 43.



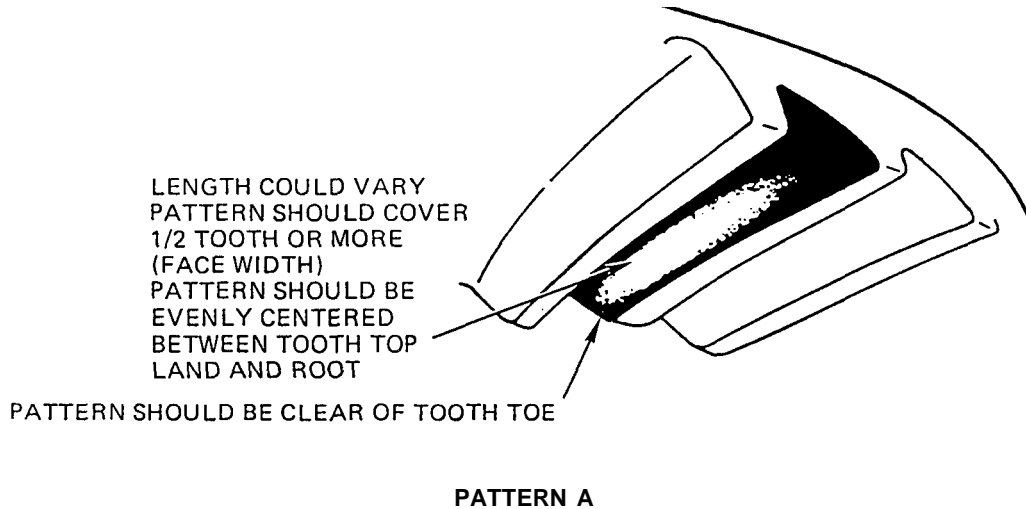
43. TO ADD BACKLASH, LOOSEN BEARING ADJUSTER (35) FIVE OR SIX NOTCHES.
44. LOOSEN BEARING ADJUSTER (36) ONE NOTCH.
45. TIGHTEN BEARING ADJUSTER (35) UNTIL BEARING ADJUSTER (35) RESISTS MOVEMENT, THEN TIGHTEN TWO OR THREE MORE NOTCHES.
46. REPEAT STEP 42.
47. TO REMOVE BACKLASH, LOOSEN BEARING ADJUSTER (35) FIVE OR SIX NOTCHES.
48. TIGHTEN BEARING ADJUSTER (36) ONE NOTCH.
49. TIGHTEN BEARING ADJUSTER (35) UNTIL BEARING ADJUSTER (35) RESISTS MOVEMENT, THEN TIGHTEN TWO OR THREE MORE NOTCHES.
50. REPEAT STEP 42.



51. PAINT ONE-THIRD OF TEETH ON RING GEAR (5) WITH PRUSSIAN BLUE DYE.
52. ROLL RING GEAR (5) ONE-THIRD TURN, THEN ROCK RING GEAR (5) FORWARD AND BACKWARD TO SET PATTERN IN DYE.

## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)

CORRECT PATTERN (NEW GEARING)



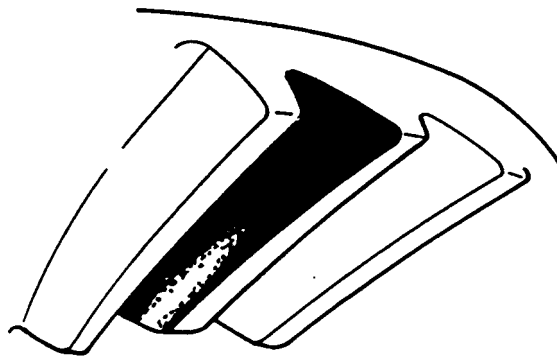
### NOTE

- Correct gear pattern for used pinion and ring gear is clear of toe and centers evenly along face of gear tooth, but can be any length or shape and is acceptable as long as pattern does not run off gear tooth at any point.
- Correct gear pattern for used pinion and ring gear does not have to match PATTERN A (correct pattern for new gearing).
- If new pinion and ring gear are used, tooth pattern should match PATTERN A. If not, check patterns B thru E to find one that looks close to ring gear tooth pattern, then do appropriate step 54, 55, 56, or 57.

53. IF TOOTH CONTACT IS LIKE PATTERN A, DO NOT ADJUST BACKLASH. GO TO STEP 58.



INCORRECT PATTERN

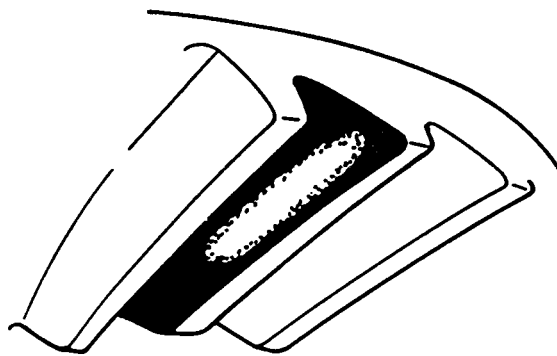


PATTERN TOO CLOSE TO EDGE OF TOOTH TOE

PATTERN B

54. IF TOOTH CONTACT IS LIKE PATTERN B, ADD BACKLASH (STEPS 43 THRU 46). REPEAT STEPS 51 AND 52.

INCORRECT PATTERN

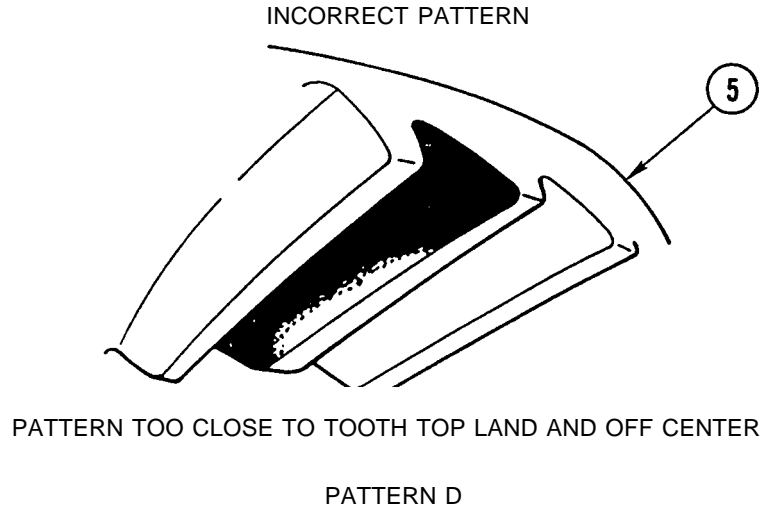
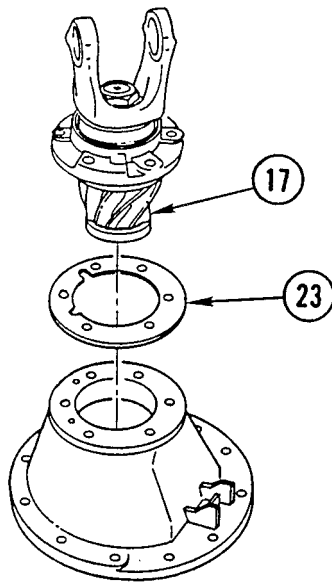


PATTERN TOO FAR ALONG TOOTH TOWARD TOOTH HEEL

PATTERN C

55. IF TOOTH CONTACT IS LIKE PATTERN C, REMOVE BACKLASH (STEPS 47 THRU 50). REPEAT STEPS 51 AND 52.

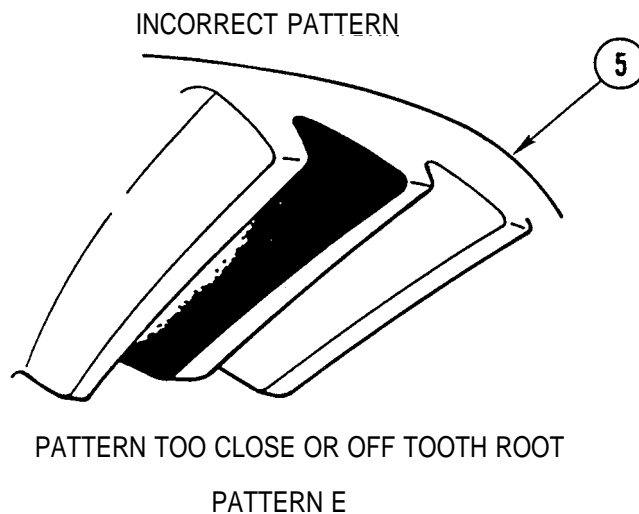
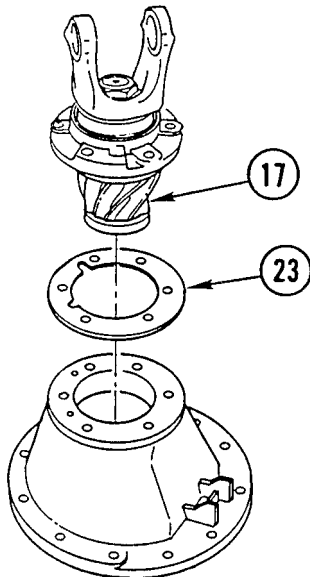
## FRONT DIFFERENTIAL CARRIER REPAIR (CONT)



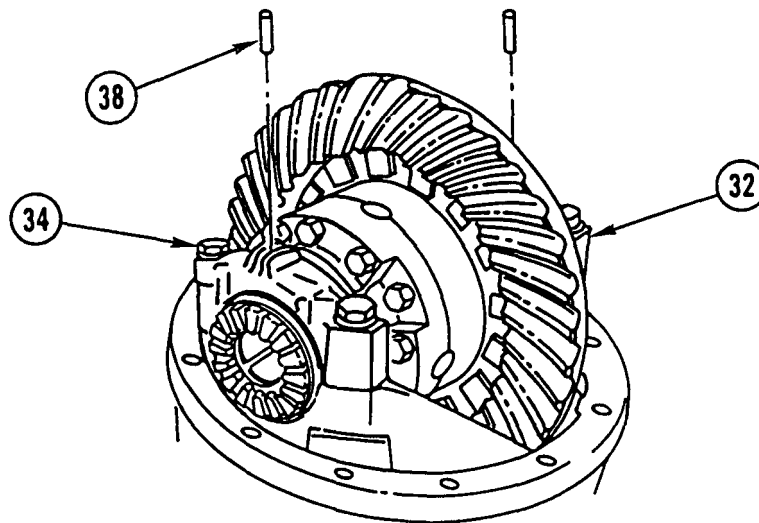
### NOTE

To add or remove shims in steps 56 and 57, remove ring gear and differential assembly (steps 7 thru 13 in Disassembly) and pinion (steps 18 thru 20 in Disassembly). Add or remove shims, then install pinion, ring gear, and differential assembly (steps 28 thru 41).

56. IF TOOTH CONTACT IS LIKE PATTERN D, MOVE PINION (17) CLOSER TO RING GEAR (5) BY REMOVING SHIMS (23). REPEAT STEPS 42 THRU 53.



57. IF TOOTH CONTACT IS LIKE PATTERN E, MOVE PINION (17) AWAY FROM RING GEAR (5) BY ADDING SHIMS (23). REPEAT STEPS 42 THRU 53.

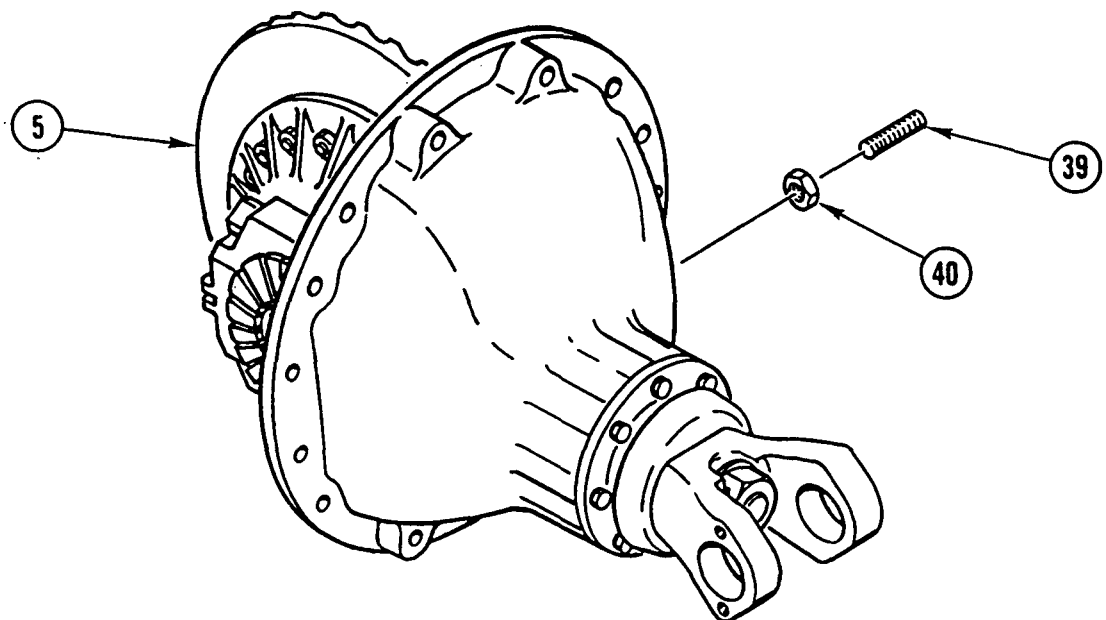


58. TIGHTEN FOUR SCREWS (34) TO 370-430 LB-FT (502-583 N.m).

**NOTE**

Bearing adjuster may be turned slightly to aline lock.

59. INSTALL TWO PINS (38) ON TWO BEARING CAPS (32).



60. INSTALL THRUST SCREW (39) UNTIL SCREW TOUCHES RING GEAR (5), THEN BACK OUT 1/2 TURN. TIGHTEN NUT (40).

**NOTE**

Follow-on Maintenance:  
Install front differential carrier (page 5-34).



# CHAPTER 17 FORWARD-REAR AND REAR-REAR AXLE REPAIR INSTRUCTIONS

## **OVERVIEW**

This chapter illustrates and describes procedures for maintenance of the forward-rear and rear-rear axle and related parts.

	Page
Section I. Forward-Rear Axle Differential Carrier Repair . . . . .	17-2
Section II. Rear-Rear Axle Differential Carrier Repair . . . . .	17-47
Section III. Rear Axle Housing Repair . . . . .	17-72



## Section I. FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the forward-rear axle differential carrier.

Repair of the forward-rear axle differential carrier is general support maintenance.

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## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR

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This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Yoke Holder Bar, J3453

#### Equipment Condition:

Reference	Condition Description
Page 6-2	Differential Carrier Removed

#### Materials/Parts:

Seal	P/N A-3261-L-350
Seal, Oil (M915A2)	P/N A-1205-W-1895
Seal, Oil (All except M915A2)	PIN A-1205-B-1926
Packing (2)	P/N 5X-1034
Nut, Lock	P/N 40X-1026
Nut, Lock	P/N 40X-1027
Adhesive, Rockwell	Appendix B, Item 5
Oil, Lubricating	Appendix 6, Item 40
Dye, Prussian Blue	Appendix 6, Item 17
Lead	Appendix 6, Item 31

#### General Safety Instructions:

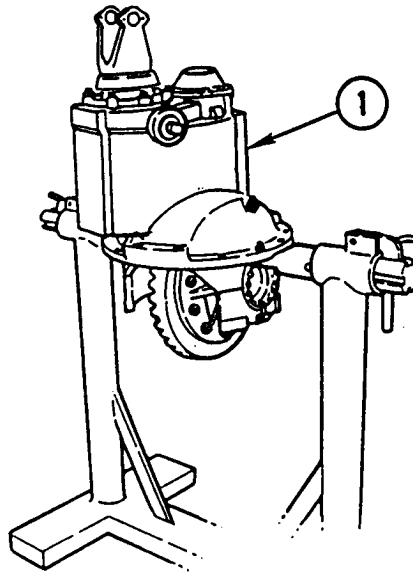
### WARNING

- Forward-rear axle differential carrier weighs 1,160 lb (526 kg). Attach suitable floor jack prior to disassembly or assembly to prevent possible injury to personnel.
- Hot gear can cause burns. Wear heat-resistant gloves.
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

#### Personnel Required: (2)

#### References:

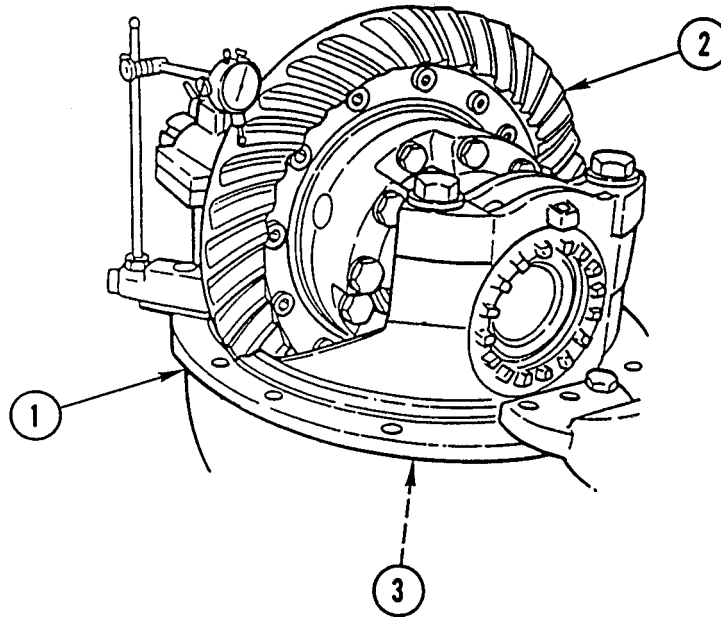
TM 9-214

**DISASSEMBLY****WARNING**

Forward-rear axle differential carrier weighs 1,160 lb (526 kg). Attach suitable floor jack prior to disassembly to prevent possible injury to personnel.

1. INSTALL DIFFERENTIAL CARRIER (1) ON REPAIR STAND.

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



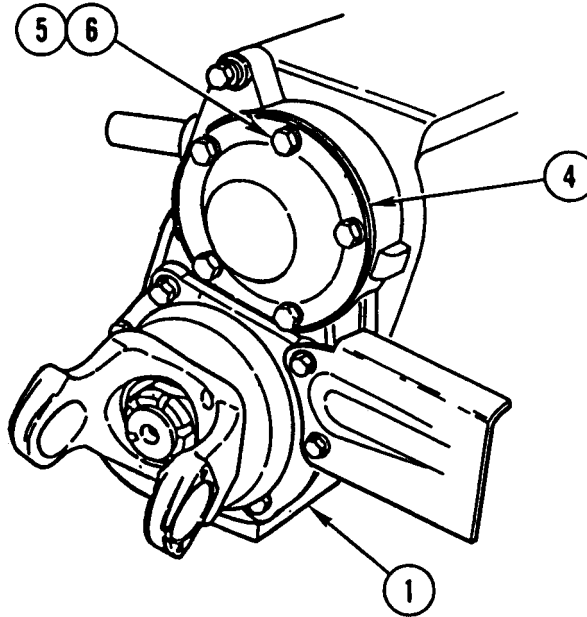
2. TURN DIFFERENTIAL CARRIER (1) SO RING GEAR (2) IS UP.

### **NOTE**

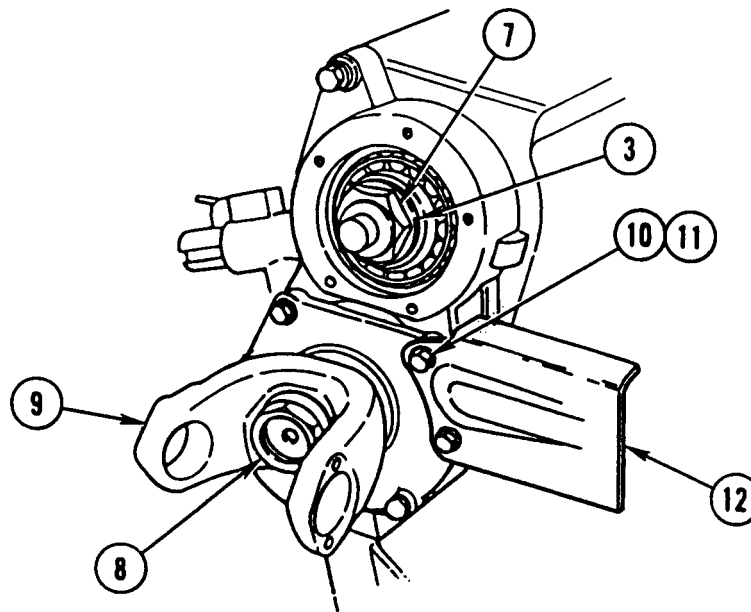
If reinstalling same ring gear and drive pinion, perform steps 3 thru 6 to measure backlash.

3. MOVE RING GEAR (2) SO RING GEAR (2) TEETH FULLY ENGAGE WITH DRIVE PINION (3) TEETH.
4. INSTALL DIAL INDICATOR ON FLANGE OF DIFFERENTIAL CARRIER (1) SO THAT TIP OF INDICATOR IS AGAINST DRIVE SIDE OF TOOTH ON RING GEAR (2). ADJUST DIAL INDICATOR TO ZERO.
5. ROTATE RING GEAR (2) IN BOTH DIRECTIONS AND RECORD READING.
6. REPEAT STEP 5 TWICE MORE IN DIFFERENT LOCATIONS.



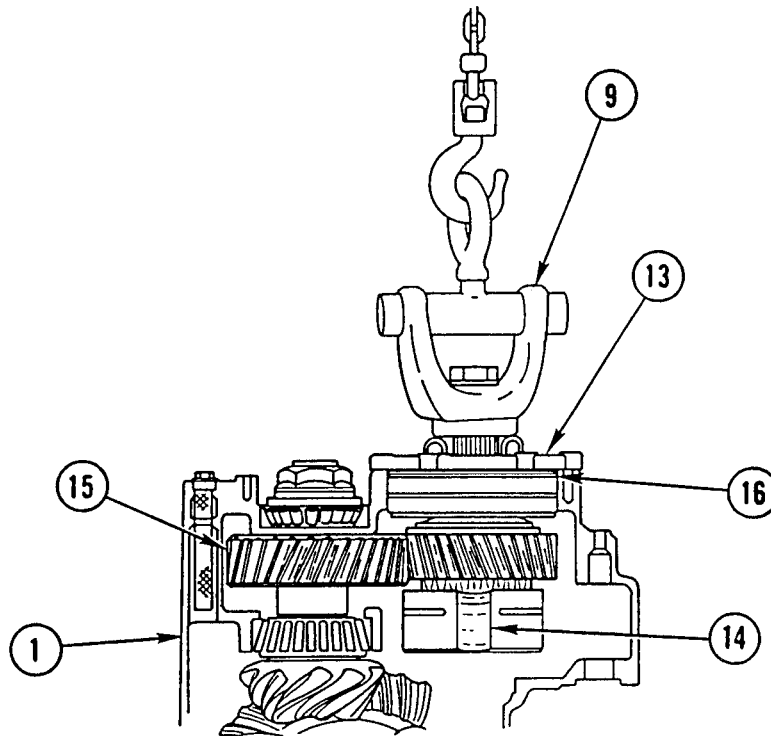


7. ROTATE DIFFERENTIAL CARRIER (1) TO HORIZONTAL POSITION WITH PINION COVER (4) AT TOP.
8. REMOVE FIVE CAPSCREWS (5), FIVE WASHERS (6), AND PINION COVER (4).



9. LOOSEN NUT (7) ON DRIVE PINION (3).
10. USING YOKE HOLDER BAR, LOOSEN LOCK NUT (8) ON YOKE (9).
11. REMOVE SEVEN CAPSCREWS (10), SEVEN WASHERS (11), AND FILTER SHIELD (12).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

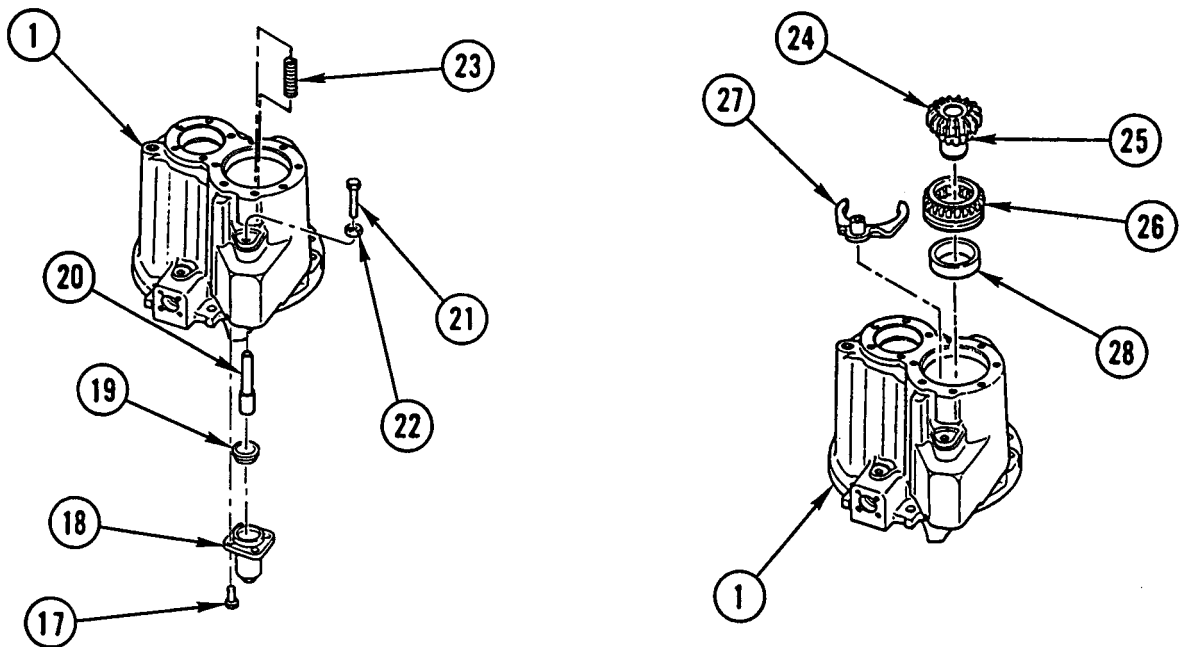


12. ROTATE DIFFERENTIAL CARRIER (1) UNTIL YOKE (9) FACES UP AND INSTALL SUITABLE LIFTING DEVICE THRU YOKE (9).

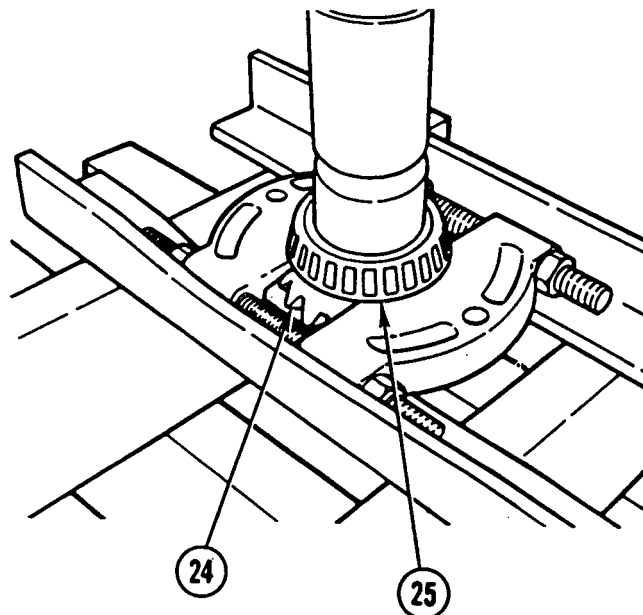
### NOTE

There are two notches on side of pinion differential case. When one is aligned with helical driven gear, pinion differential case can be removed.

13. ROTATE INPUT SHAFT (13) UNTIL ONE NOTCH ON PINION DIFFERENTIAL CASE (14) IS ALINED OVER HELICAL DRIVEN GEAR (15).
14. LIFT INPUT SHAFT (13) FROM DIFFERENTIAL CARRIER (1).
15. REMOVE SHIMS (16). MEASURE AND RECORD THICKNESS OF SHIM PACK.

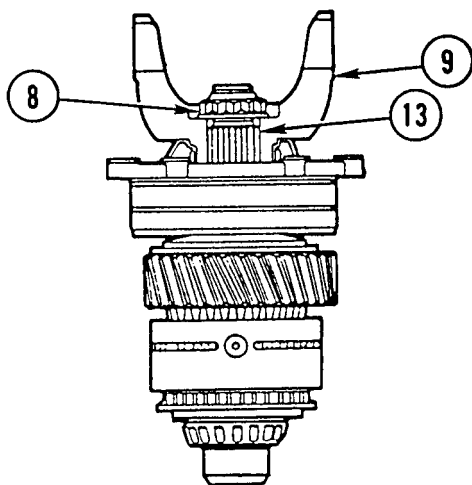


16. REMOVE FOUR SOCKET HEAD SCREWS (17), COVER (18), SEAL (19) AND SHIFT SHAFT (20). DISCARD SEAL.
17. REMOVE ADJUSTING SCREW (21) AND JAM NUT (22) FROM DIFFERENTIAL CARRIER (1).
18. REMOVE SPRING (23) FROM DIFFERENTIAL CARRIER (1).
19. REMOVE SIDE GEAR (24) WITH BEARING CONE (25), CLUTCH (26), AND FORK (27) FROM DIFFERENTIAL CARRIER (1).
20. REMOVE BEARING CUP (28) FROM DIFFERENTIAL CARRIER (1).

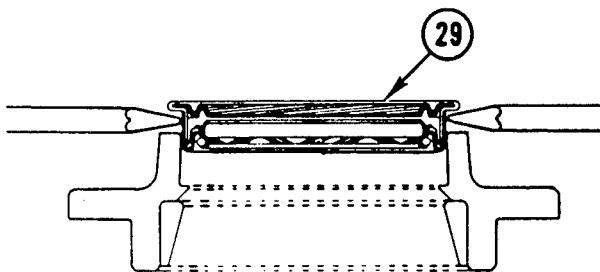


21. REMOVE BEARING CONE (25) FROM SIDE GEAR (24).

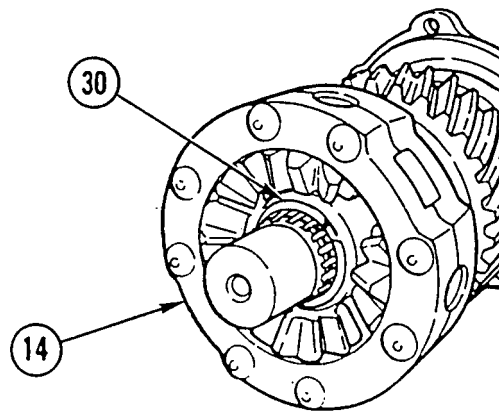
## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



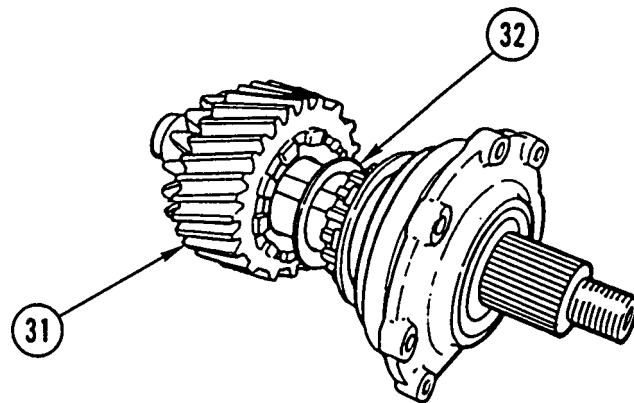
- 22. REMOVE AND DISCARD LOCK NUT (8) FROM YOKE (9).
- 23. USING YOKE PULLER, REMOVE YOKE (9) FROM INPUT SHAFT (13).



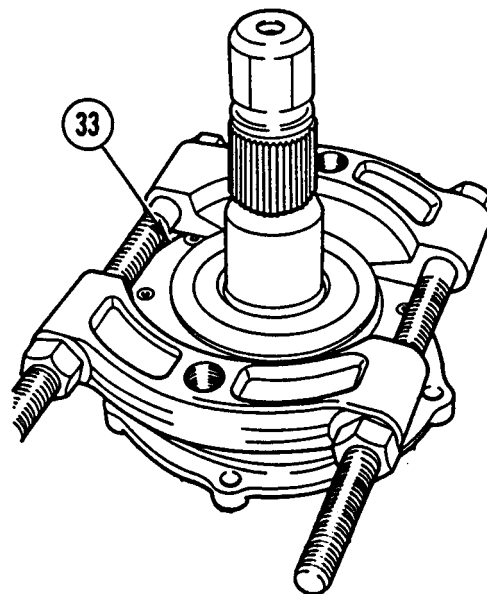
- 24. REMOVE AND DISCARD OIL SEAL (29).



- 25. REMOVE SNAP RING (30) AND PINION DIFFERENTIAL CASE (14).



26. REMOVE GEAR (31) AND THRUST WASHER (32).



**CAUTION**

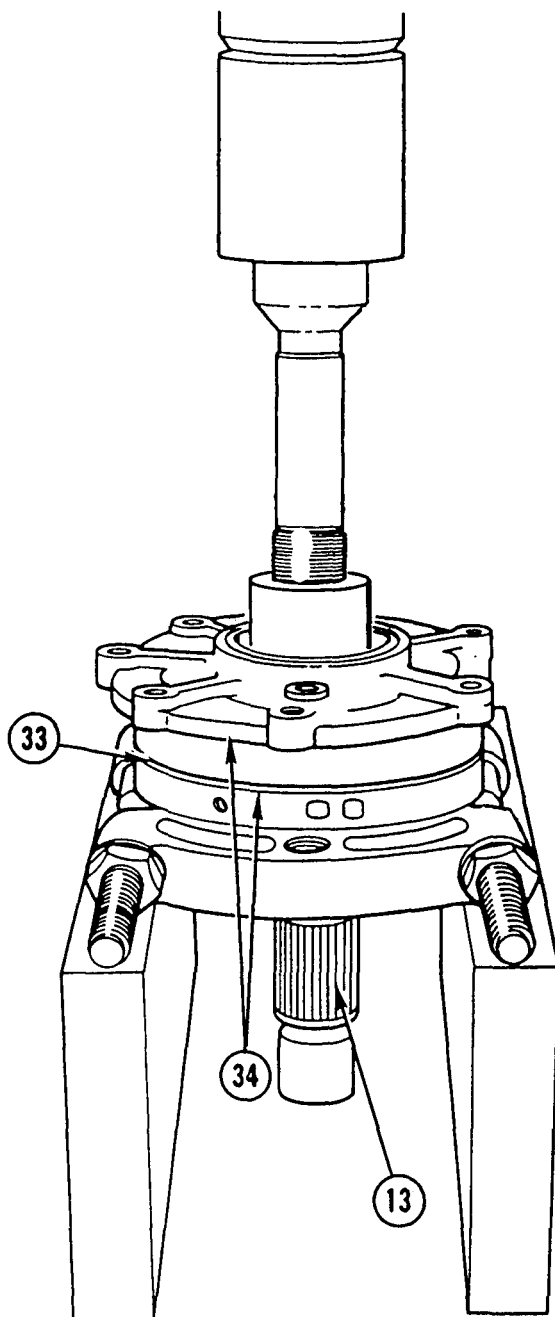
Be careful when installing bearing puller. If puller touches rivets, oil pump could be damaged.

27. INSTALL BEARING PULLER UNDER OIL PUMP (33).

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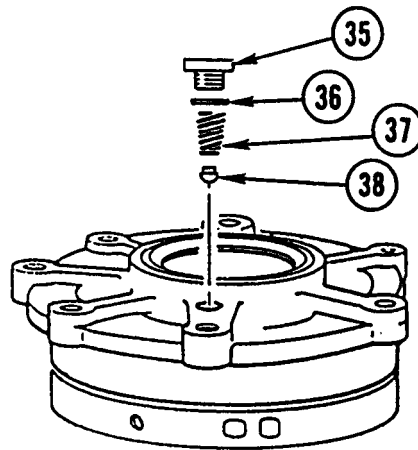
## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

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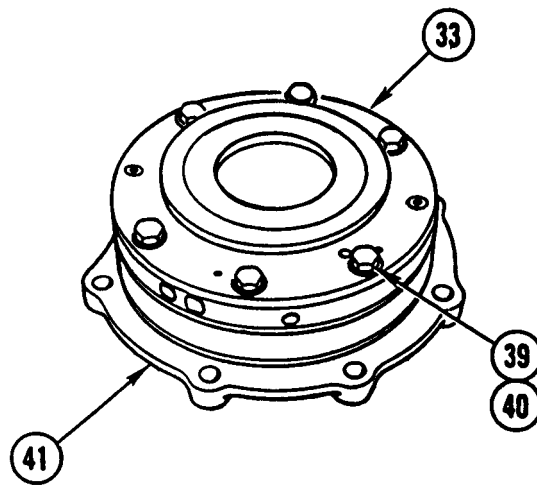


28. USING PRESS, WITH BEARING PULLER DOWN, PRESS INPUT SHAFT (13) FROM OIL PUMP (33).

29. REMOVE AND DISCARD TWO PACKINGS (34).

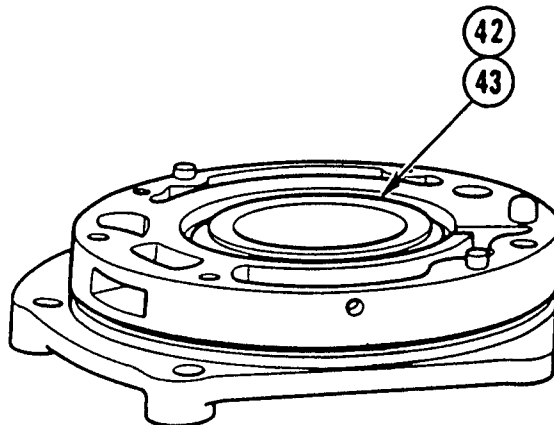


30. REMOVE PLUG (35), WASHER (36), SPRING (37), AND RELIEF VALVE (38).

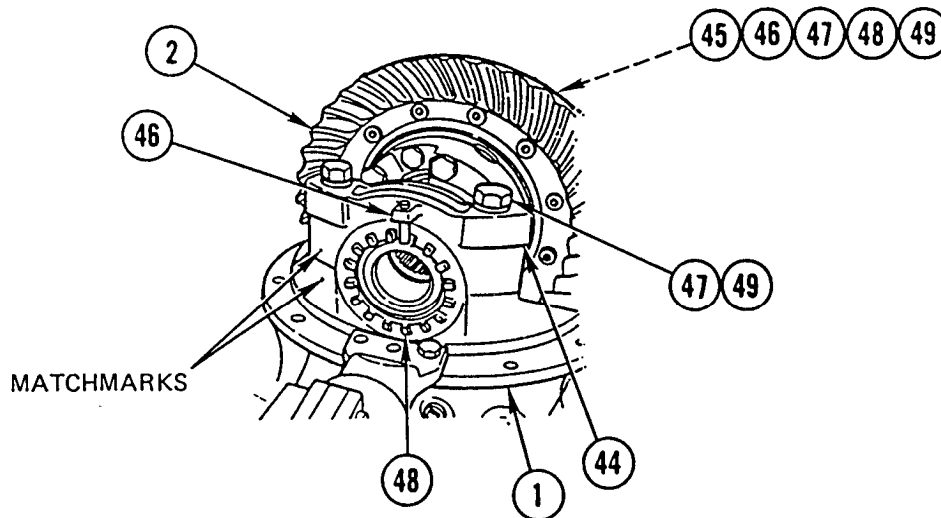


31. REMOVE SIX CAPSCREWS (39), SIX WASHERS (40), AND OIL PUMP (33) FROM BEARING CAGE (41).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



32. REMOVE BEARING CONE (42) AND BEARING CUP (43).



33. ROTATE DIFFERENTIAL CARRIER (1) UNTIL RING GEAR (2) FACES UP.

34. MATCHMARK POSITION OF TWO BEARING CAPS (44 AND 45) ON DIFFERENTIAL CARRIER (1).

35. REMOVE PIN (46) FROM TWO BEARING CAPS (44 AND 45).

36. LOOSEN FOUR CAP SCREWS (47).

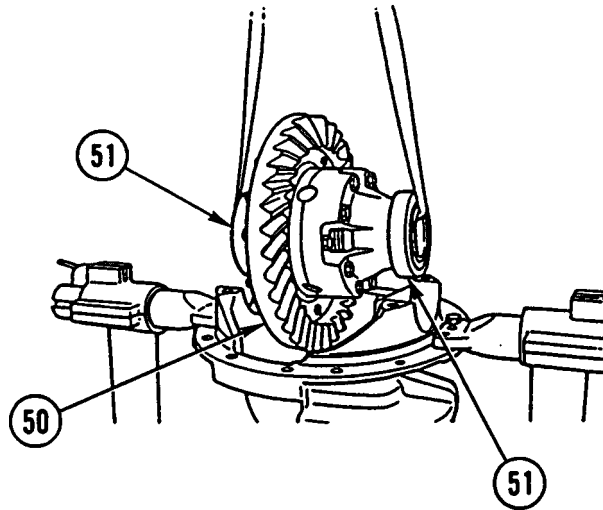
### CAUTION

To prevent damage to adjusting rings, do not hit adjusting rings with hammer or use hammer and drift pin to loosen rings.

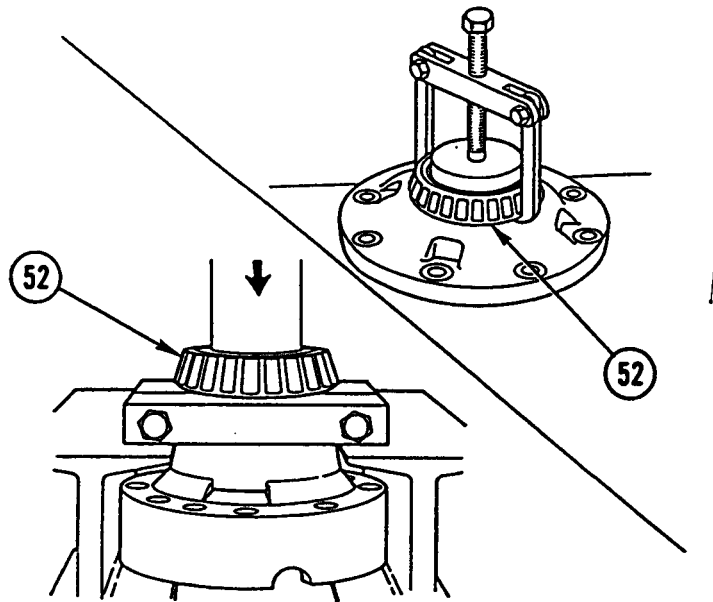
37. LOOSEN TWO ADJUSTING RINGS (48).

38. REMOVE FOUR CAPSCREWS (47), FOUR WASHERS (49), TWO BEARING CAPS (44 AND 45), AND TWO ADJUSTING RINGS (48).



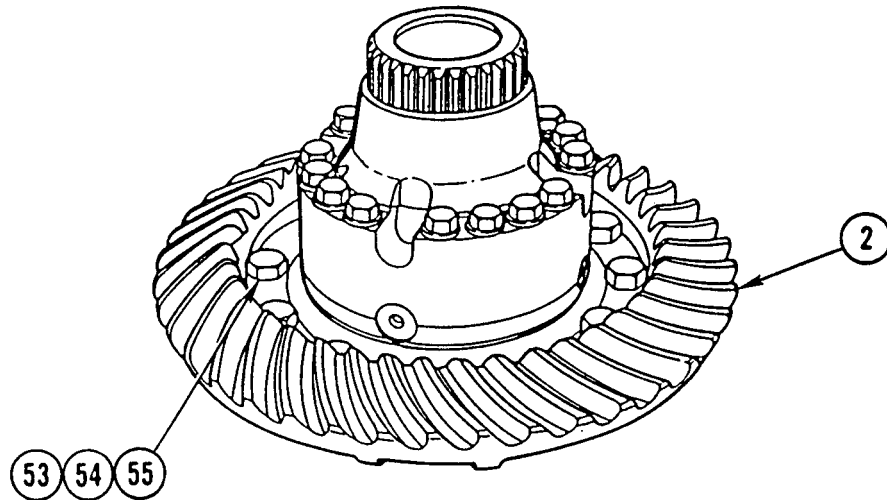


39. USING SUITABLE LIFTING DEVICE, REMOVE RING GEAR SUBASSEMBLY (50) AND TWO BEARING CUPS (51).

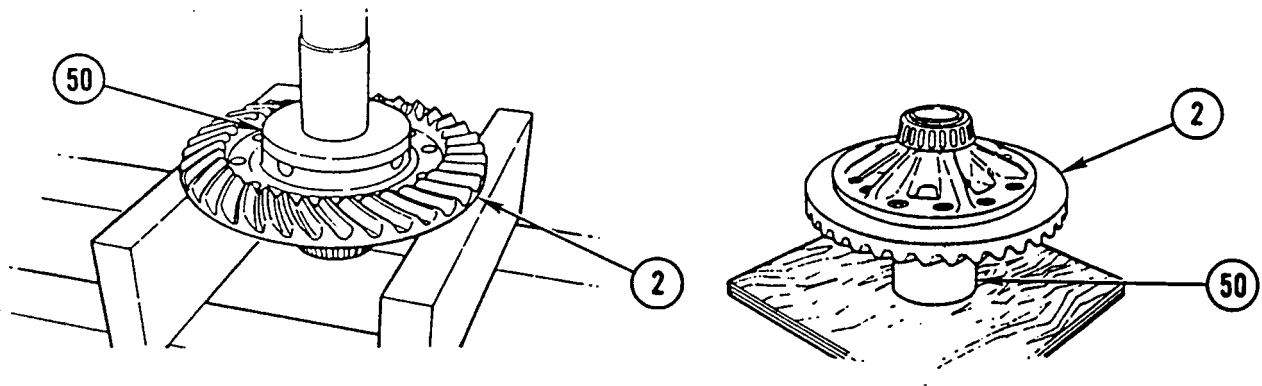


40. USING BEARING PULLER, REMOVE TWO BEARING CONES (52).

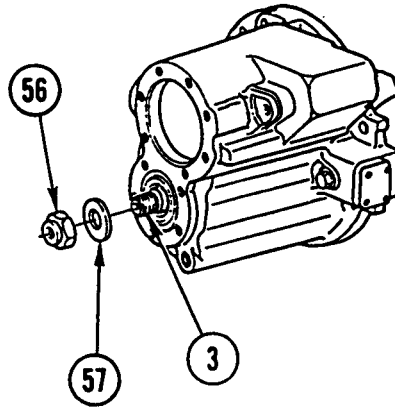
## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



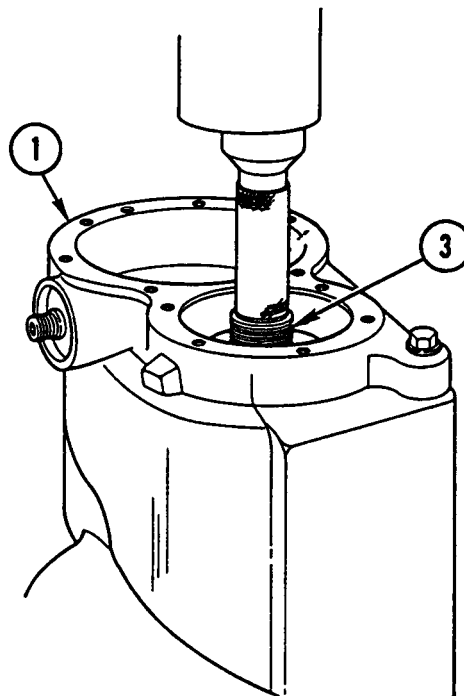
41. REMOVE 12 NUTS (53), 12 WASHERS (54), AND 12 BOLTS (55) FROM RING GEAR (2).



42. REMOVE RING GEAR (2) FROM RING GEAR SUBASSEMBLY (50).

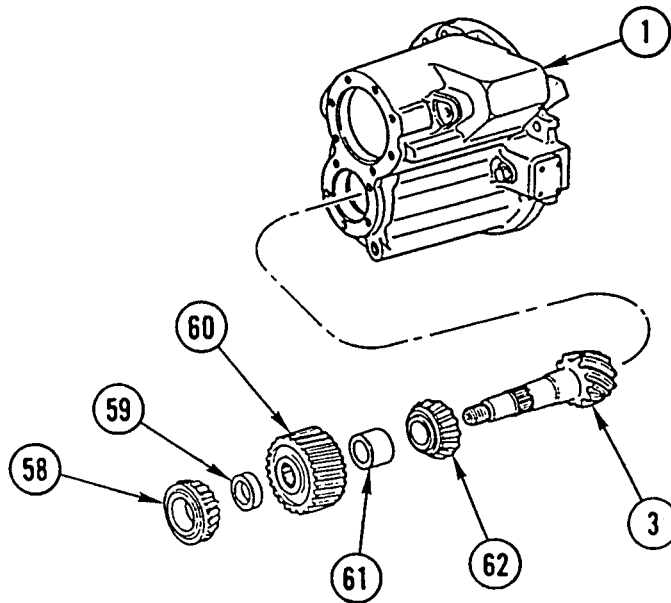


43. REMOVE NUT (56) AND WASHER (57) FROM DRIVE PINION (3).

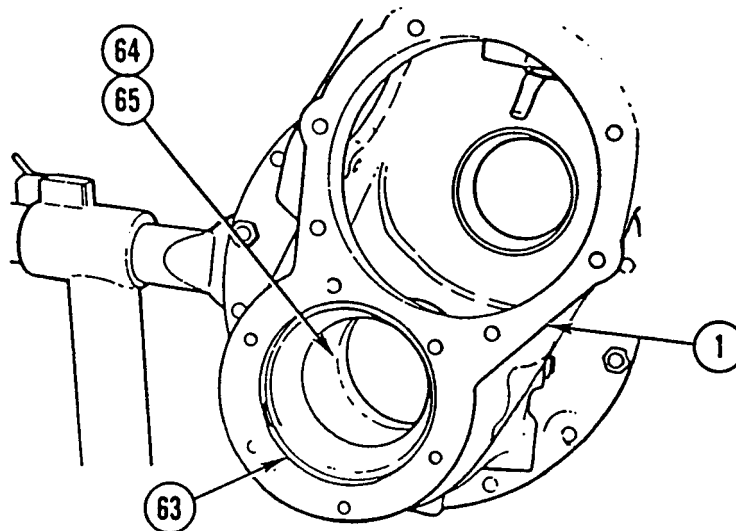


44. USING PRESS, REMOVE DRIVE PINION (3) FROM DIFFERENTIAL CARRIER (1).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



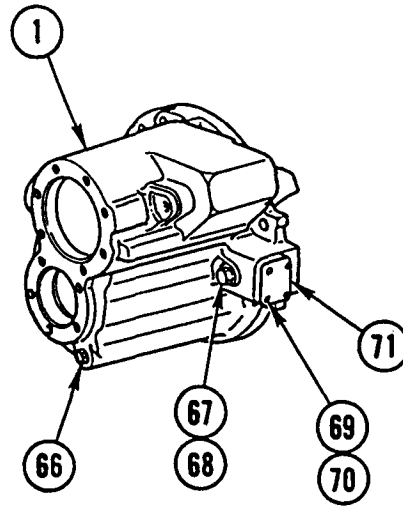
45. REMOVE BEARING CONE (58), SPACER (59), AND GEAR (60) FROM DIFFERENTIAL CARRIER (1).
46. REMOVE SPACER (61) AND BEARING CONE (62) FROM DRIVE PINION (3).



### NOTE

Perform steps 47 and 48 only if bearings are damaged or if pinion and ring gear are being replaced.

47. REMOVE OUTER BEARING CUP (63).
48. REMOVE INNER BEARING CUP (64) AND SHIM(S) (65) FROM DIFFERENTIAL CARRIER (1). MEASURE AND RECORD THICKNESS OF SHIM(S).



49. REMOVE SCREEN/PLUG ASSEMBLY (66), PLUG (67), WASHER (68), FOUR CAPSCREWS (69), FOUR WASHERS (70), AND COVER (71) FROM DIFFERENTIAL CARRIER (1).

## **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

## **INSPECTION**

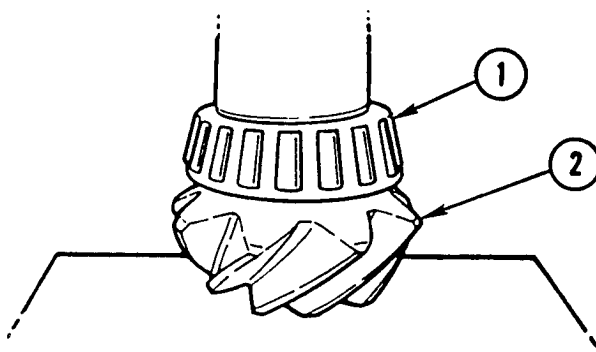
Inspect all parts for wear or damage.

## **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

### ASSEMBLY



#### WARNING

Forward-rear axle differential carrier weighs 1,160 lb (526 kg). Attach suitable floor jack prior to assembly to prevent possible injury to personnel.

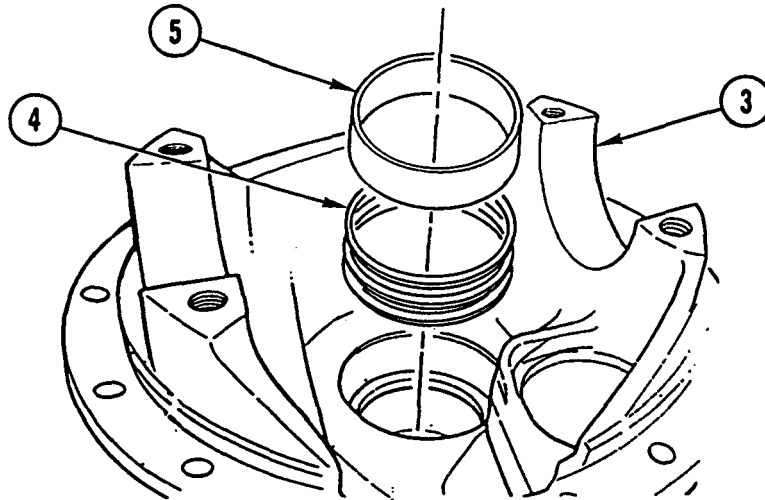
#### NOTE

- If installing new ring gear and drive pinion, perform steps 1 thru 6.
  - Replace ring gear and drive pinion as matched set. Gear set match number is on gear head of drive pinion and front face or outer diameter of ring gear.
  - Pinion cone variation number is used to adjust depth of pinion in differential carrier. Pinion cone variation number is on end of gear head of drive pinion or outer diameter of ring gear.
1. RECORD NEW PINION CONE VARIATION NUMBER.
  2. RECORD OLD PINION CONE VARIATION NUMBER.
  3. IF OLD PINION CONE VARIATION NUMBER IS +, SUBTRACT NUMBER FROM SHIM PACK THICKNESS IN DISASSEMBLY STEP 47.
  4. IF OLD PINION CONE VARIATION NUMBER IS -, ADD NUMBER TO SHIM PACK THICKNESS IN DISASSEMBLY STEP 47.
  5. IF NEW PINION CONE VARIATION NUMBER IS +, ADD NUMBER TO SHIM PACK THICKNESS DETERMINED IN STEP 3 OR 4.
  6. IF NEW PINION CONE VARIATION NUMBER IS -, SUBTRACT NUMBER FROM SHIM PACK THICKNESS DETERMINED IN STEP 3 OR 4.

**NOTE**

Coat all bearing cones and bearing cups with axle oil prior to installation.

7. USING PRESS, INSTALL INNER BEARING CONE (1) ON DRIVE PINION (2) UNTIL BOTTOM OF INNER BEARING CONE (1) TOUCHES BOTTOM OF DRIVE PINION (2).



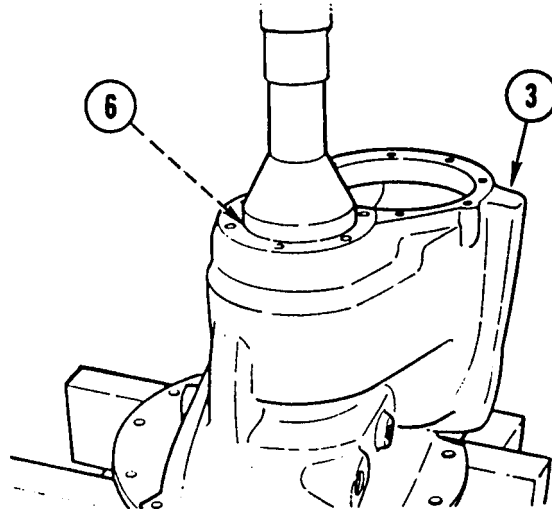
8. INSTALL DIFFERENTIAL CARRIER (3) ON PRESS WITH LEGS OF DIFFERENTIAL CARRIER (3) TOWARD TOP OF PRESS.

**NOTE**

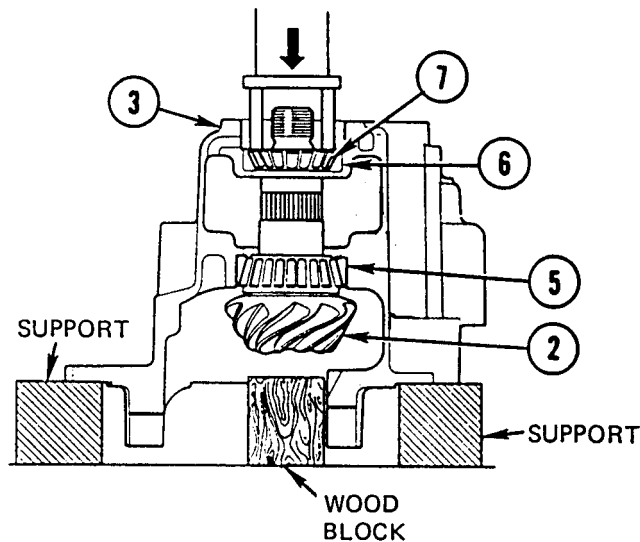
If installing new ring gear and drive pinion, use shim pack thickness determined in step 5 or 6. If installing same ring gear and drive pinion, use shim pack removed in Disassembly step 48.

9. INSTALL SHIM PACK (4). USING PRESS, INSTALL INNER BEARING CUP (5) IN DIFFERENTIAL CARRIER (3) UNTIL BOTTOM OF INNER BEARING CUP (5) TOUCHES SHIM PACK (4).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



10. TURN DIFFERENTIAL CARRIER (3) OVER AND INSTALL SUPPORTS SO THAT DIFFERENTIAL CARRIER (3) IS LEVEL ON PRESS.
11. USING PRESS, INSTALL OUTER BEARING CUP (6) UNTIL BOTTOM OF OUTER BEARING CUP (6) TOUCHES BOTTOM OF BORE.



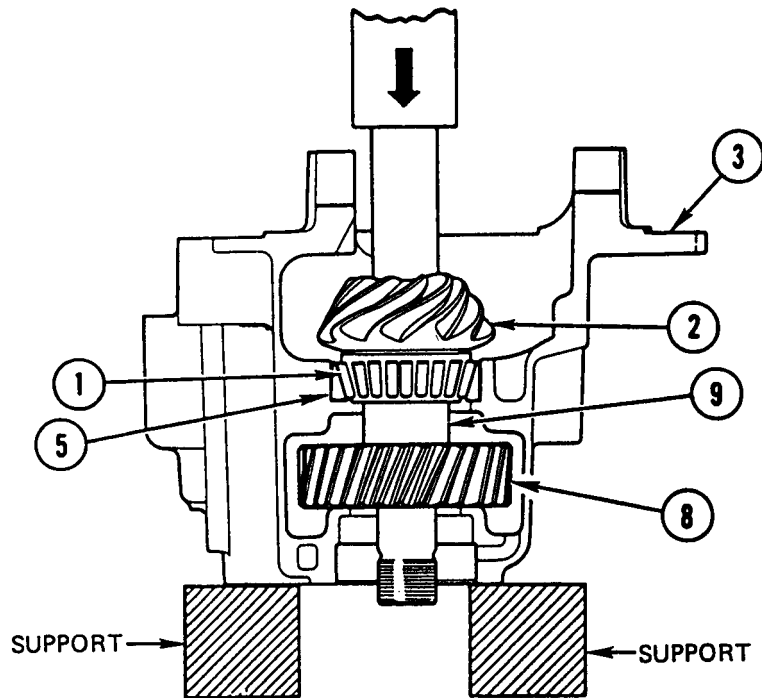
12. INSTALL DRIVE PINION (2) FROM BOTTOM OF DIFFERENTIAL CARRIER (3). INSTALL SUPPORT UNDER HEAD OF DRIVE PINION (2).



**NOTE**

Apply no more than two tons of pressure to seat bearing cups.

13. INSTALL OUTER BEARING CONE (7) ON SHAFT OF DRIVE PINION (2). USING PRESS, SEAT TWO BEARING CUPS (5 AND 6).
14. USING PRESS, REMOVE DRIVE PINION (2).
15. REMOVE OUTER BEARING CONE (7).



16. INSTALL DIFFERENTIAL CARRIER (3) ON PRESS WITH LEGS OF DIFFERENTIAL CARRIER (3) TOWARD TOP OF PRESS.
17. INSTALL GEAR (8) WITH SPLINES TOWARD FRONT OF DIFFERENTIAL CARRIER (3).
18. INSTALL LARGE DIAMETER SPACER (9) ON TOP OF GEAR (8) WITH SPACER (9) TOWARD INNER BEARING CUP (5).
19. INSTALL DRIVE PINION (2) IN GEAR (8). MAKE SURE SPLINES ON DRIVE PINION (2) ENGAGE SPLINES IN GEAR (8).

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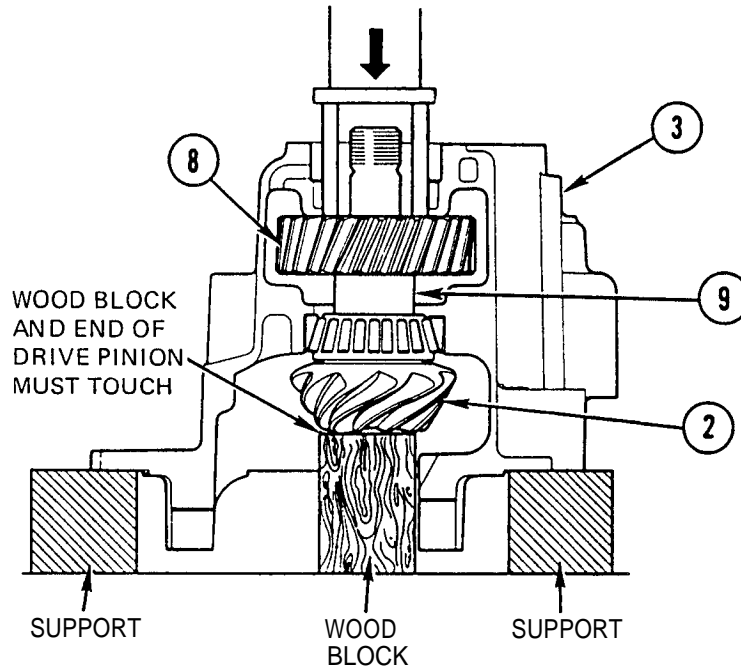
**CAUTION**

To prevent damage to cup, cone, and drive pinion, do not apply pressure after inner bearing cone touches inner bearing cup.

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20. USING PRESS, PRESS DRIVE PINION (2) INTO GEAR (8) UNTIL INNER BEARING CONE (1) TOUCHES INNER BEARING CUP (5).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

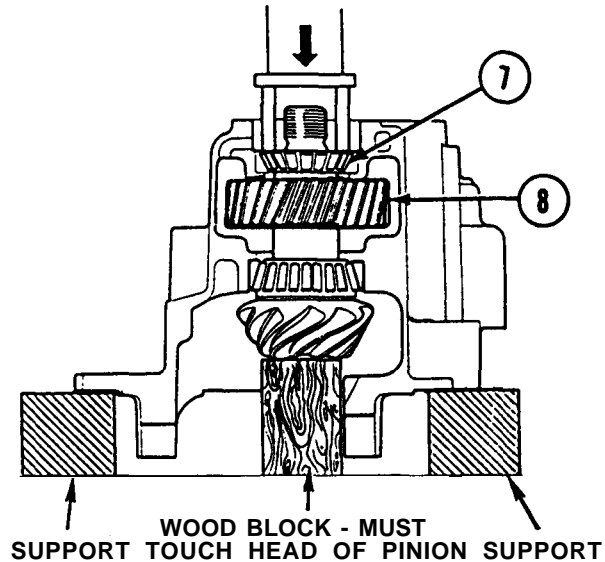


21. TURN DIFFERENTIAL CARRIER (3) OVER AND INSTALL SUPPORTS SO THAT DIFFERENTIAL CARRIER (3) IS LEVEL ON PRESS.

### CAUTION

To prevent damage to spacer, do not apply pressure after gear touches spacer in front of inner bearing on drive pinion.

22. USING PRESS AND SLEEVE THAT FITS INSIDE PINION BORE OF DIFFERENTIAL CARRIER (3), PRESS GEAR (8) ON DRIVE PINION (2) UNTIL GEAR (8) TOUCHES SPACER (9).



23. CUT TWO PIECES OF LEAD OR SOLDER APPROXIMATELY 9/16-IN. LONG, 5/8-IN. WIDE, AND THICKER THAN SPACER REMOVED IN DISASSEMBLY STEP 45.
24. INSTALL TWO LEAD PIECES OPPOSITE EACH OTHER ON TOP OF GEAR (8).
25. INSTALL OUTER BEARING CONE (7) ON TOP OF LEAD PIECES.
26. USING PRESS, APPLY TWO TONS OF PRESSURE TO OUTER BEARING CONE (7).
27. RELEASE PRESSURE AND REMOVE WOOD BLOCK.

**CAUTION**

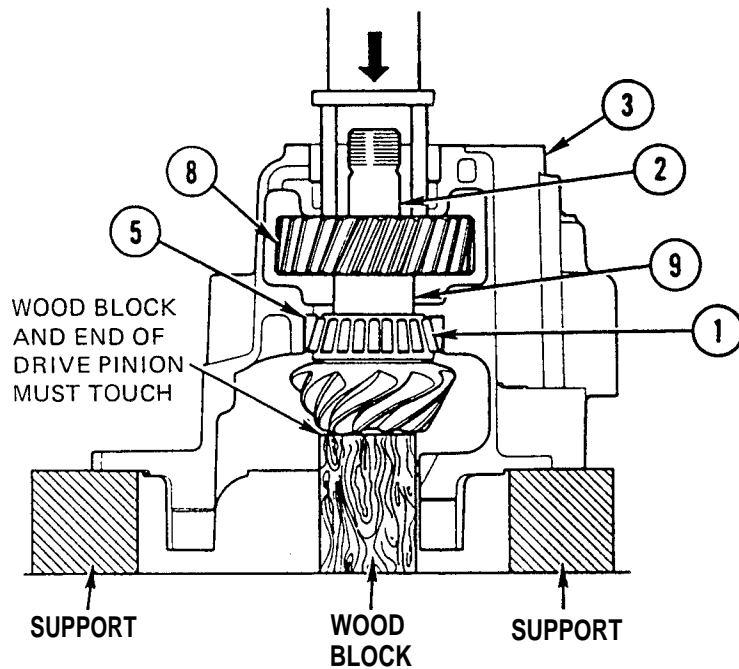
Do not press shaft of drive pinion out of gear to prevent damage to equipment.

28. USING PRESS, REMOVE OUTER BEARING CONE (7) AND LEAD PIECES.
29. MEASURE THICKNESSES OF COMPRESSED LEAD PIECES. ADD MEASUREMENTS OF TWO LEAD PIECES AND DIVIDE BY TWO TO DETERMINE AVERAGE SIZE OF PIECES. ADD 0.004 IN. (0.100 mm) TO AVERAGE SIZE. USE THIS DIMENSION TO DETERMINE SIZE OF SPACER (REMOVED IN DISASSEMBLY, STEP 45) TO BE INSTALLED BETWEEN GEAR (8) AND OUTER BEARING CONE (7).

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## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

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30. PLACE WOOD BLOCK UNDER HEAD OF DRIVE PINION (2) SO THAT INNER BEARING CONE (1) TOUCHES INNER BEARING CUP (5). REMOVE SUPPORTS FROM UNDER DIFFERENTIAL CARRIER (3).

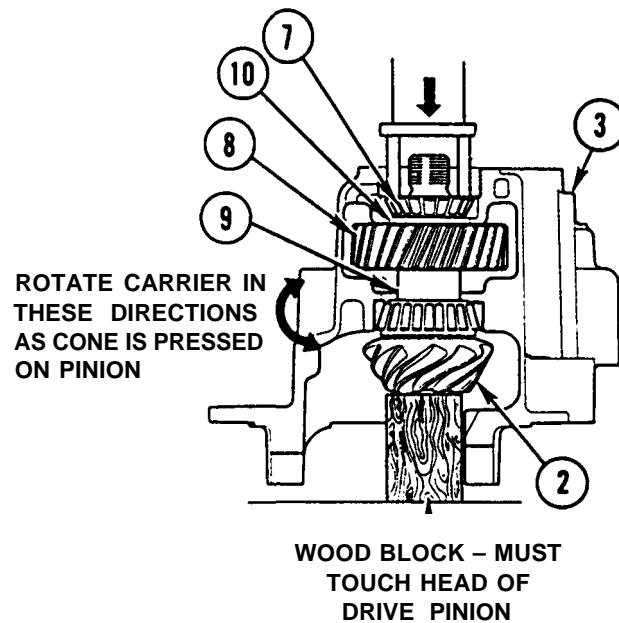
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### CAUTION

To prevent damage to spacer, do not apply pressure after gear touches spacer in front of inner bearing on drive pinion.

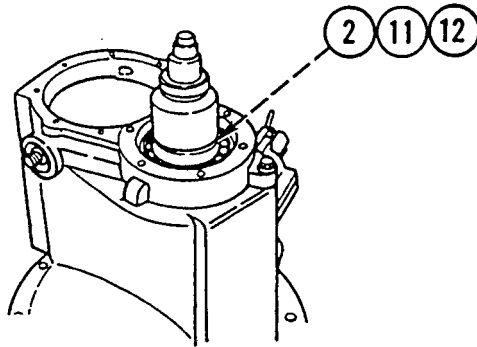
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31. USING PRESS AND SLEEVE THAT FITS INSIDE PINION BORE OF DIFFERENTIAL CARRIER (3), PRESS GEAR (8) ON DRIVE PINION (2) UNTIL GEAR (8) TOUCHES SPACER (9). DO NOT REMOVE WOOD BLOCK.



32. INSTALL SPACER (10) IN FRONT OF GEAR (8).
33. INSTALL OUTER BEARING CONE (7).
34. USING PRESS, APPLY TWO TONS OF PRESSURE TO OUTER BEARING CONE (7). MOVE DIFFERENTIAL CARRIER (3) IN BOTH DIRECTIONS WHILE INSTALLING OUTER BEARING CONE ( 7 ) .
35. RELIEVE PRESSURE AND REMOVE DIFFERENTIAL CARRIER (3) FROM PRESS. INSTALL DIFFERENTIAL CARRIER (3) ON REPAIR STAND.

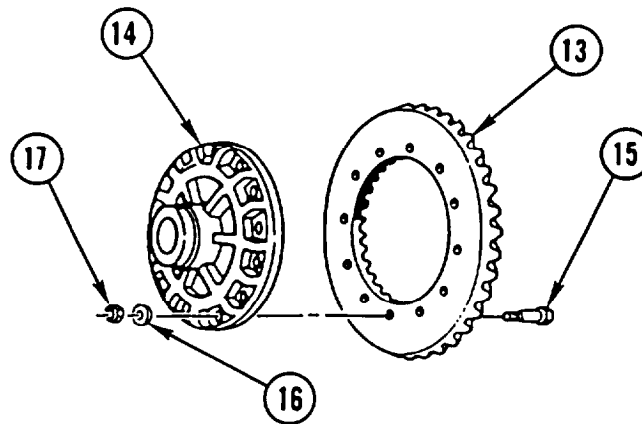
## **FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)**



### **NOTE**

Drive pinion must be held in place with fixture holding gear teeth or with wood blocks between pinion gear and differential carrier case.

36. INSTALL WASHER (11) AND NUT (12) ON DRIVE PINION (2) AND TIGHTEN TO 1,200-1,500 LB-FT (1625-2035 N.m).
37. USING INCH-POUND TORQUE WRENCH, ROTATE DRIVE PINION (2). CHECK READING ON DIAL WHILE TURNING TORQUE WRENCH. NEW DRIVE PINION GEAR READING MUST BE 5-45 LB-IN. (0.56-5.08 N.m). USED DRIVE PINION GEAR READING MUST BE 10-30 LB-IN. (1.13-3.39 N.m).
38. IF PRELOAD IS NOT WITHIN LIMITS, REMOVE AND REPLACE SPACERS, DISASSEMBLY STEPS 45 AND 46. INSTALL THICKER SPACER TO DECREASE PRELOAD OR THINNER SPACER TO INCREASE PRELOAD. REPEAT STEPS 32 THRU 37 UNTIL CORRECT PRELOAD IS OBTAINED.



### CAUTION

- To prevent damage to case, do not press cold ring gear on flanged half of case assembly.
- To maintain temper of metal and reliability of part, do not use open flame to heat ring gear.

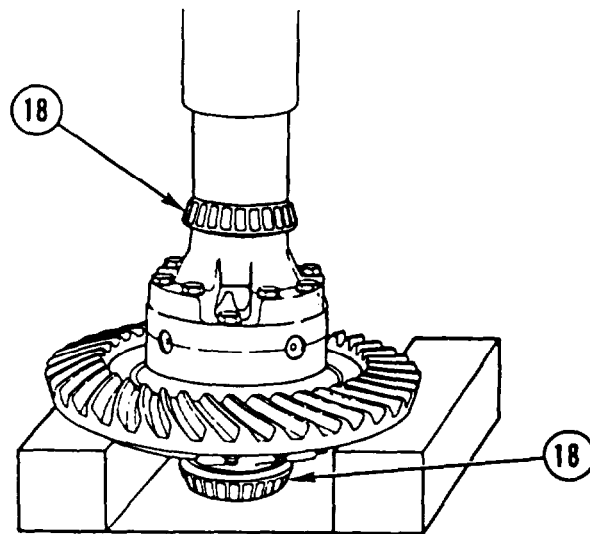
39. EXPAND RING GEAR (13) IN TANK OF WATER HEATED TO 160°-180°F (71°-82°C) FOR 10-15 MINUTES.

### WARNING

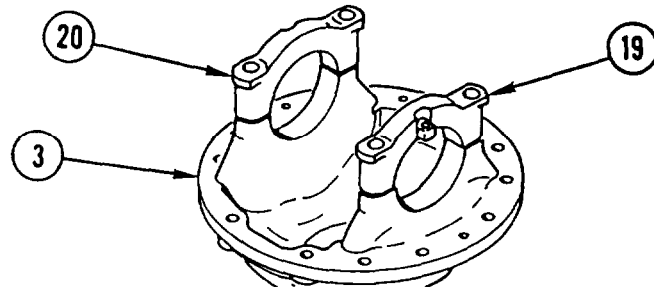
Hot gear can cause burns. Wear heat-resistant gloves.

40. REMOVE RING GEAR (13) FROM TANK AND INSTALL ON FLANGED HALF OF CASE ASSEMBLY (14). IF RING GEAR (13) DOES NOT FIT EASILY, REHEAT AND INSTALL AGAIN.
41. INSTALL 12 BOLTS (15), 12 WASHERS (16), AND 12 NUTS (17). ALL EXCEPT M915A2: TIGHTEN NUTS TO 195-260 LB-FT (265-350 N.m). M915A2: TIGHTEN NUTS TO 190-225 LB-FT (260-350 N.m).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



42. INSTALL TWO BEARING CONES (18).



### WARNING

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

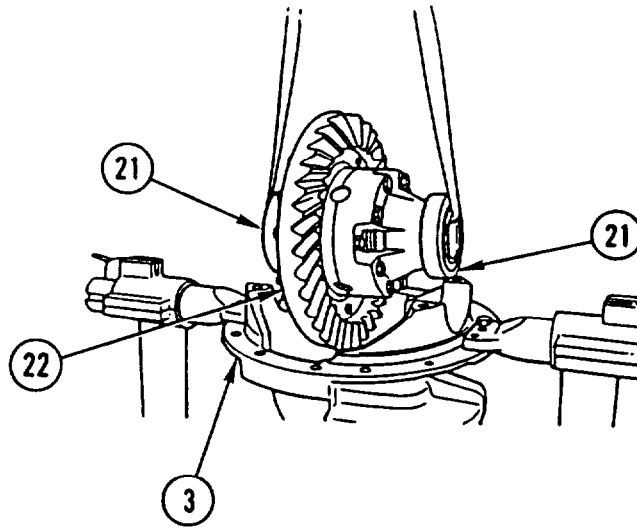
### CAUTION

Make sure all old adhesive has been removed from differential carrier and bearing caps to prevent damage to equipment.

43. SET TWO BEARING CAPS (19 AND 20) ON DIFFERENTIAL CARRIER (3) AND APPLY CONTINUOUS BEAD OF ROCKWELL ADHESIVE AROUND ENTIRE SMOOTH GROUND SURFACES ON BOTH SIDES. DO NOT APPLY ADHESIVE TO THREADED AREAS.

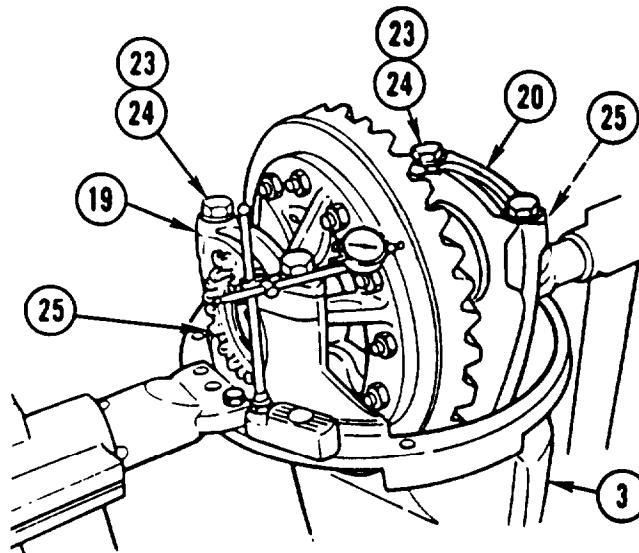


44. REMOVE TWO BEARING CAPS (19 AND 20).



45. INSTALL TWO BEARING CUPS (21).

46. USING SUITABLE LIFTING DEVICE, INSTALL RING GEAR SUBASSEMBLY (22) IN DIFFERENTIAL CARRIER (3).

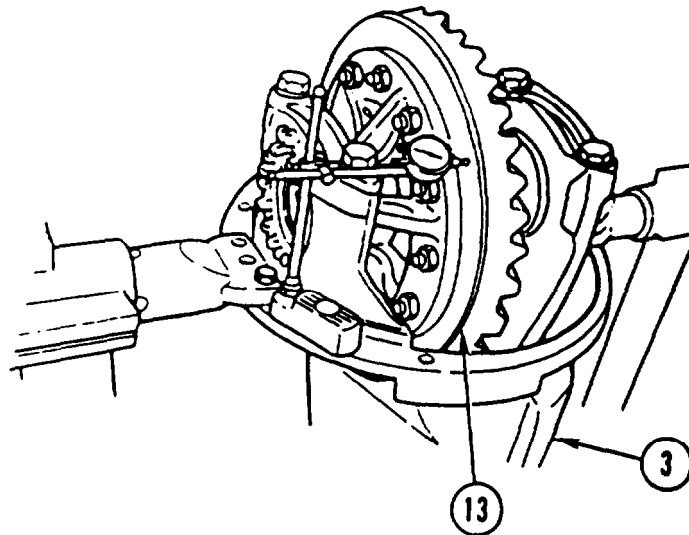


47. INSTALL TWO BEARING CAPS (19 AND 20), FOUR WASHERS (23), AND FOUR CAPSCREWS (24).

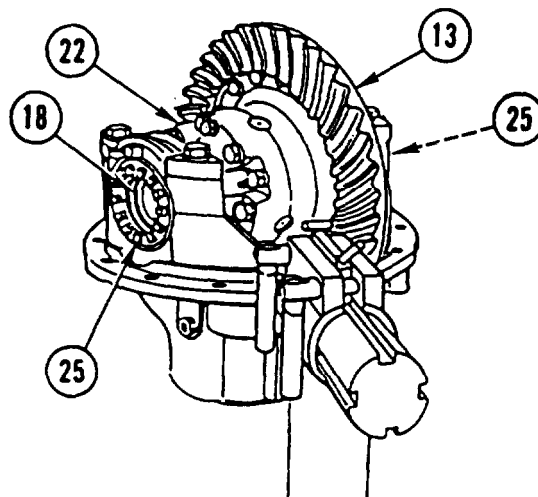
48. INSTALL TWO ADJUSTING RINGS (25) IN DIFFERENTIAL CARRIER (3).

49. ALL EXCEPT M915A2: TIGHTEN FOUR CAPSCREWS (24) TO 480-600 LB-FT (650-810 N.m).  
 M915A2: TIGHTEN FOUR CAPSCREWS (24) TO 345-430 LB-FT (470-585 N.m).

## **FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)**



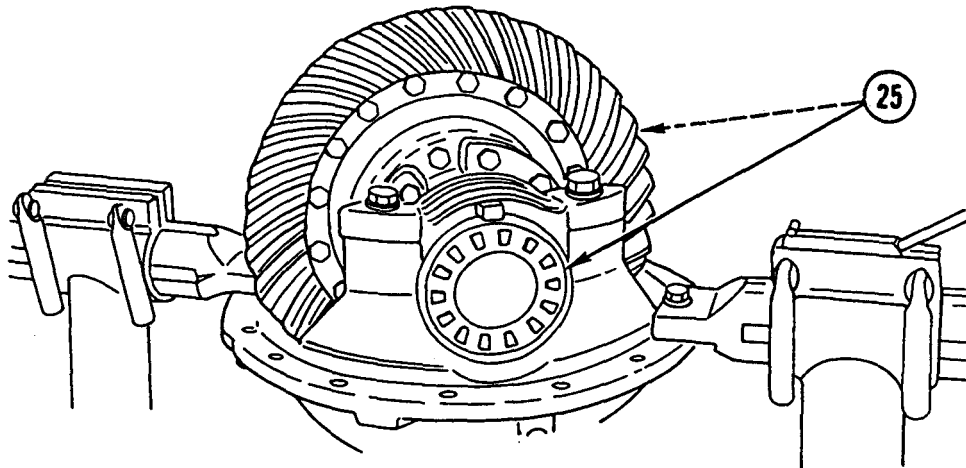
50. INSTALL DIAL INDICATOR ON FLANGE OF DIFFERENTIAL CARRIER (3) WITH PLUNGER AGAINST BACK SURFACE OF RING GEAR (13).



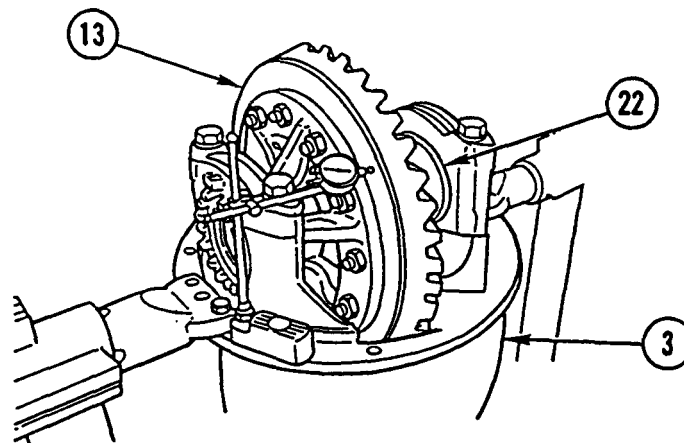
### **CAUTION**

Pry bars must not touch bearing cones (18) to prevent damage to equipment.

51. LOOSEN ADJUSTING RING (25) ON GEAR SIDE OF RING GEAR (13) UNTIL SMALL AMOUNT OF END PLAY SHOWS ON DIAL INDICATOR WHEN RING GEAR (13) IS MOVED LEFT AND RIGHT WITH TWO PRY BARS. USE PRY BARS BETWEEN TWO ADJUSTING RINGS (25) AND ENDS OF RING GEAR SUBASSEMBLY (22).
52. TIGHTEN ADJUSTING RING (25) LOOSENED IN STEP 51 UNTIL NO END PLAY SHOWS ON DIAL INDICATOR.

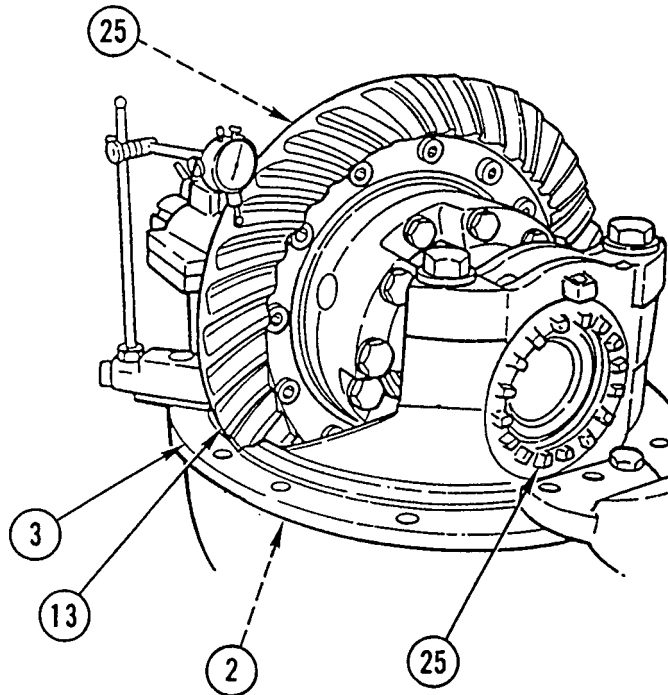


53. TIGHTEN TWO ADJUSTING RINGS (25) ONE NOTCH FROM ZERO END PLAY MEASURED IN STEP 52. BEARING PRELOAD IS NOW SET.



54. ADJUST DIAL INDICATOR TO ZERO.
55. ROTATE RING GEAR (13) WHILE READING DIAL INDICATOR. RUNOUT MUST NOT EXCEED 0.008 IN. (0.200 mm).
56. IF RUNOUT IS EXCEEDED, PERFORM DISASSEMBLY STEPS 37 AND 38.
57. INSPECT ALL RING GEAR SUBASSEMBLY (22) PARTS AND DIFFERENTIAL CARRIER (3) FOR POSSIBLE EXCESSIVE RUNOUT CAUSES. REPLACE DEFECTIVE PART(S).
58. REPEAT STEPS 45 THRU 55.

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



59. ATTACH DIAL INDICATOR ON MOUNTING FLANGE OF DIFFERENTIAL CARRIER (3) SO PLUNGER IS AGAINST TOOTH SURFACE ON DRIVE SIDE OF RING GEAR (13). ZERO INDICATOR.

**NOTE**

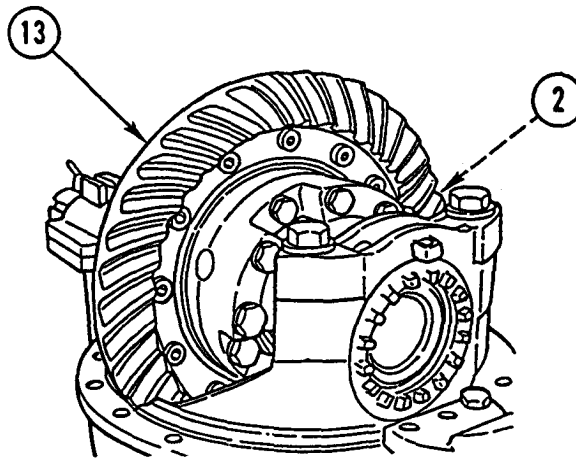
Move ring gear only when adjusting backlash.

60. WHILE HOLDING DRIVE PINION (2) IN POSITION, ROTATE RING GEAR (13) SLIGHTLY IN BOTH DIRECTIONS AGAINST DRIVE PINION (2) TEETH. NOTE MEASUREMENT.

**NOTE**

- If same ring gear and drive pinion has been installed, adjust backlash to setting recorded in Disassembly step 5.
- If new ring gear and drive pinion has been installed, adjust backlash to 0.01 in. (0.25 mm).

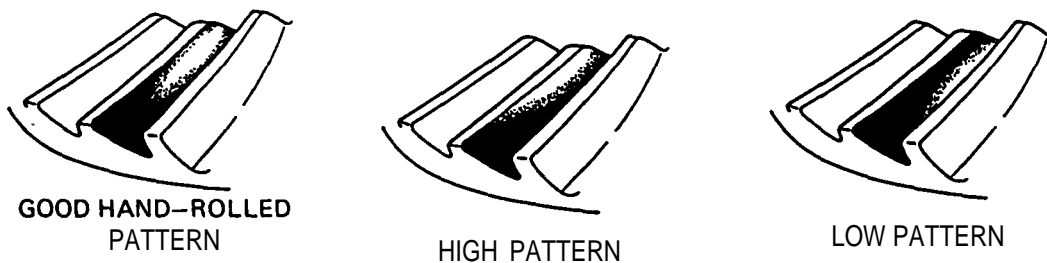
61. IF BACKLASH MEASUREMENT IS LESS THAN SPECIFIED, LOOSEN ADJUSTING RING (25) ON BACK SURFACE OF RING GEAR (13) AND EQUALLY TIGHTEN ADJUSTING RING (25) ON TOOTH SIDE OF RING GEAR (13). REPEAT STEP 60.
62. IF BACKLASH MEASUREMENT IS MORE THAN SPECIFIED, LOOSEN ADJUSTING RING (25) ON TOOTH SIDE OF RING GEAR (13) AND EQUALLY TIGHTEN ADJUSTING RING (25) ON BACK SURFACE OF RING GEAR (13). REPEAT STEP 60.
63. REPEAT STEPS 59 THRU 62 UNTIL BACKLASH MEETS SPECIFICATION. RECORD SETTING FOR USE WHEN ADJUSTING PINION BEARING PRELOAD.



**NOTE**

Always check tooth contact pattern on drive side of ring gear teeth.

64. APPLY PRUSSIAN BLUE DYE TO APPROXIMATELY 12 TEETH OF RING GEAR (13). ROTATE RING GEAR (13) SO MARKED GEAR TEETH ARE NEXT TO DRIVE PINION (2).
65. TO GET CONTACT PATTERN, ROTATE RING GEAR (13) FORWARD AND BACKWARD UNTIL MARKED GEAR TEETH GO PAST DRIVE PINION (2) SIX TIMES. REPEAT, IF NEEDED, FOR CLEARER PATTERN.



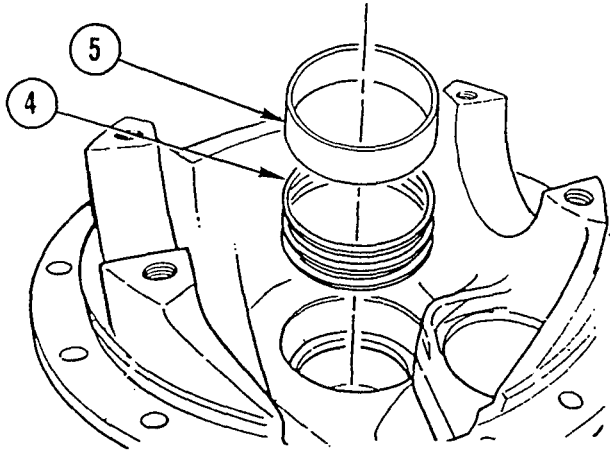
**NOTE**

- Location of good hand-rolled contact pattern for new gear set is toward toe of gear tooth and in center between top and bottom of tooth.
  - Location of good hand-rolled contact pattern for used gear set must match wear pattern in ring gear. Contact pattern will be smaller than wear pattern.
  - During tooth contact pattern checks, backlash can be adjusted within specification limits, if needed, to change pattern location.
66. COMPARE CONTACT PATTERN WITH EXAMPLES SHOWN.
  67. IF CONTACT PATTERN REQUIRES ADJUSTMENT, PERFORM DISASSEMBLY STEPS 38, 39, AND 43 THRU 45.

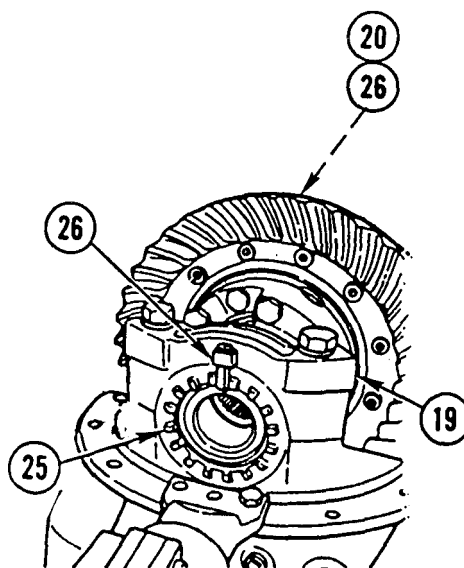
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## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

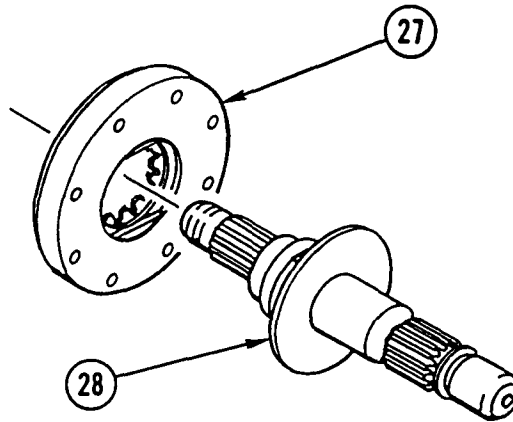
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68. REMOVE INNER BEARING CUP (5) AND SHIM PACK (4).
69. TO CORRECT HIGH CONTACT PATTERN, ADD SHIM(S) TO SHIM PACK (4).
70. TO CORRECT LOW CONTACT PATTERN, REMOVE SHIM(S) FROM SHIM PACK (4).
71. PERFORM STEPS 8 THRU 66 TO DETERMINE CONTACT PATTERN.
72. IF CONTACT PATTERN IS TOO FAR TOWARD HEEL OF GEAR TEETH, REPEAT STEP 62 TO DECREASE BACKLASH TO MOVE PATTERN TOWARD TOE OF GEAR TEETH.
73. IF CONTACT PATTERN IS TOO FAR TOWARD TOE OF GEAR TEETH, REPEAT STEP 61 TO INCREASE BACKLASH TO MOVE PATTERN TOWARD HEEL OF GEAR TEETH.



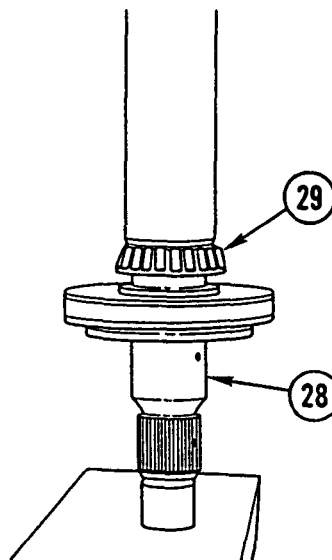
74. INSTALL PIN (26) IN BEARING CAPS (19 AND 20) SO PIN (26) IS BETWEEN LUGS OF ADJUSTING RING (25).



**CAUTION**

To prevent damage to oil pump, make sure drive flats in bore of oil pump are alined with input shaft.

75. INSTALL OIL PUMP (27) ON INPUT SHAFT (28).

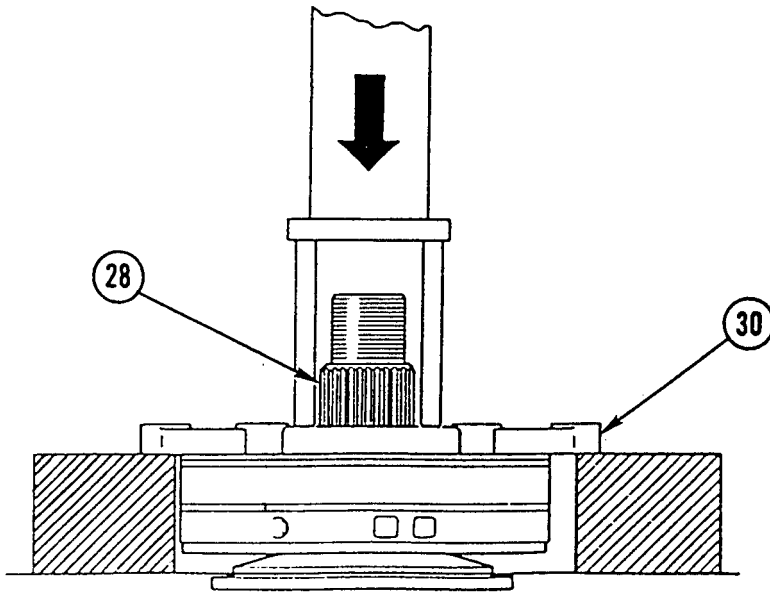


**CAUTION**

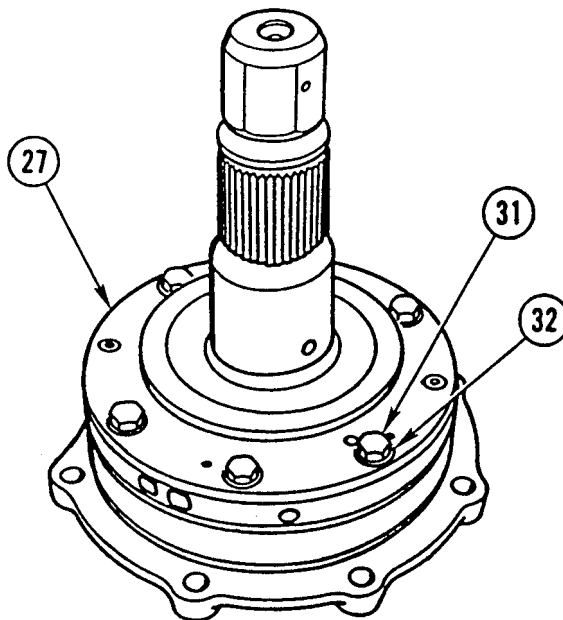
When pressing bearing, make sure supports are under input shaft, not clutch to prevent damage to equipment.

76. INSTALL BEARING CONE (29) ON INPUT SHAFT (28).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

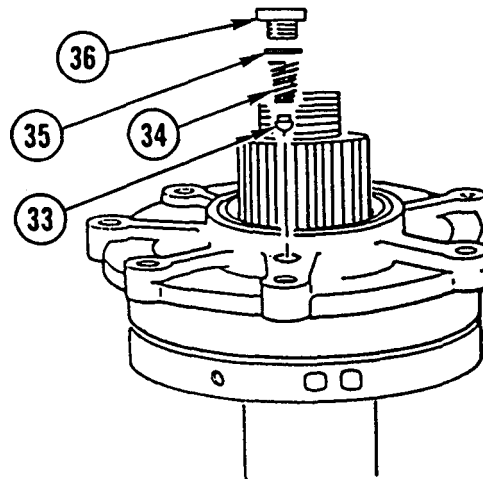


77. INSTALL BEARING CAGE (30) ON INPUT SHAFT (28).

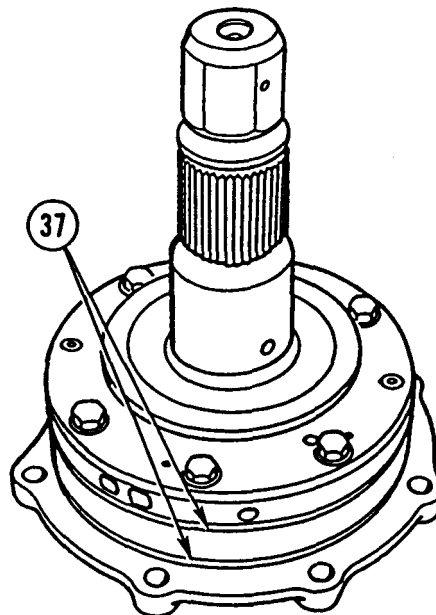


78. INSTALL SIX CAPSCREWS (31) AND SIX WASHERS (32) IN OIL PUMP (27). TIGHTEN CAPSCREWS (31) TO 21-26 LB-FT (28-35 N.m).





79. INSTALL RELIEF VALVE (33), SPRING (34), WASHER (35), AND PLUG (36).

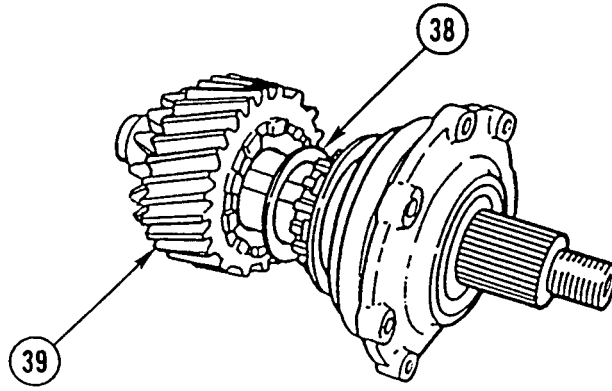


80. INSTALL TWO NEW PACKINGS (37).

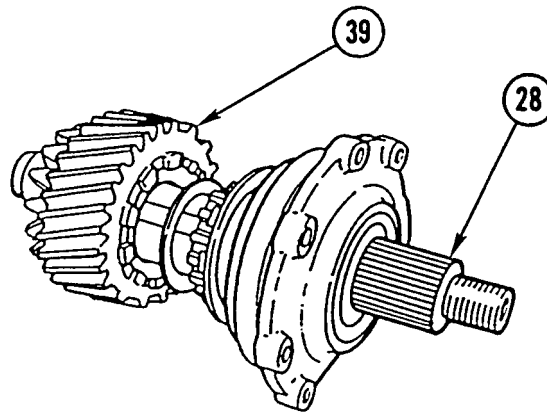
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## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

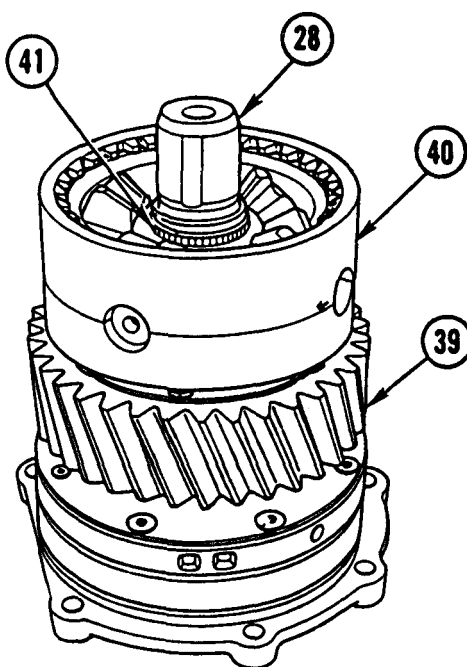
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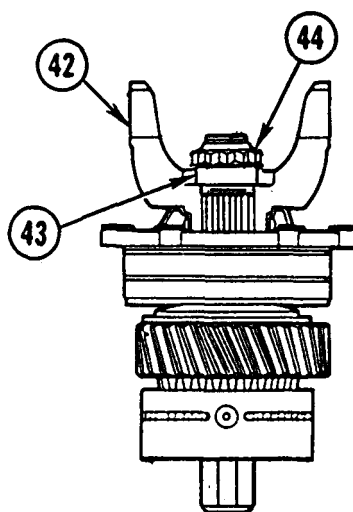
81. INSTALL THRUST WASHER (38) IN PILOT BORE ON GEAR (39).



82. INSTALL GEAR (39) ON INPUT SHAFT (28).

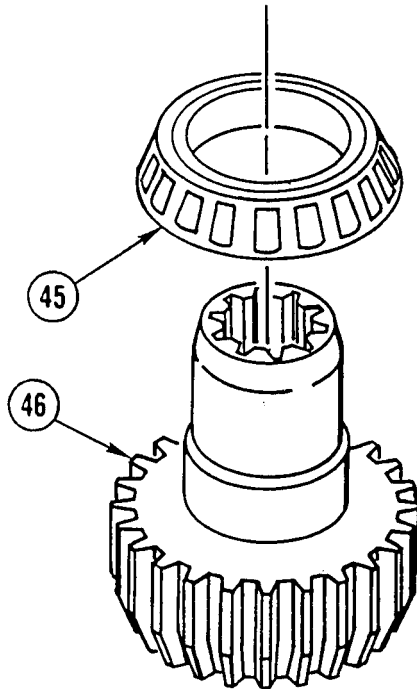


83. INSTALL PINION DIFFERENTIAL CASE (40) WITH SCREW HEADS FACING GEAR (39) AND SNAP RING (41) ON INPUT SHAFT (28).

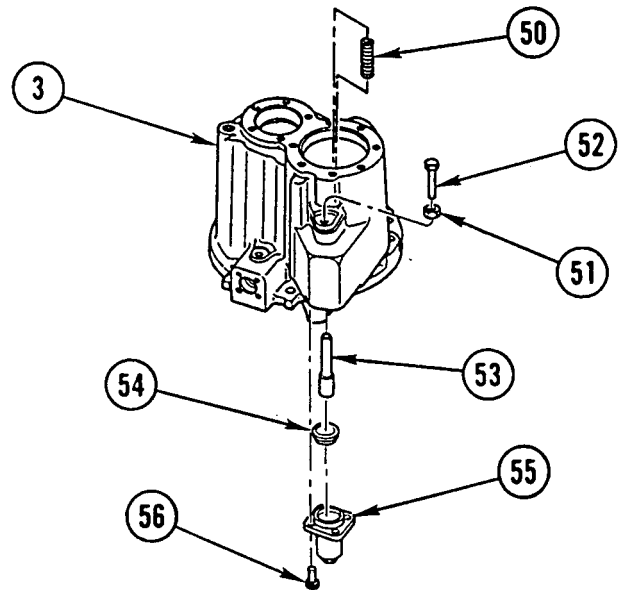
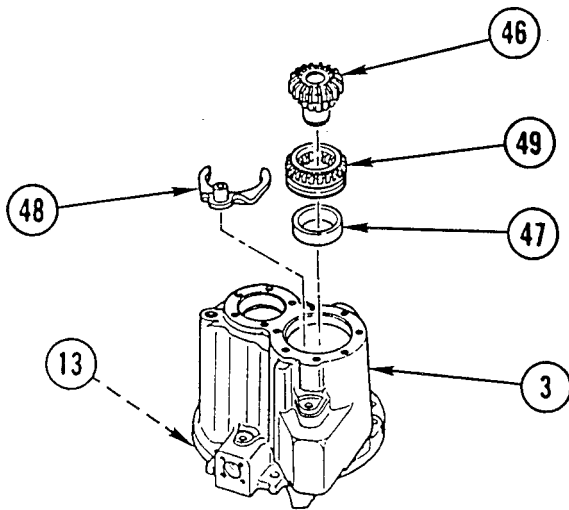


84. INSTALL YOKE (42), 0.5-IN. (12.7-mm) SPACER (43), AND NUT (44). HAND-TIGHTEN NUT.

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



85. INSTALL BEARING CONE (45) ON SIDE GEAR (46).



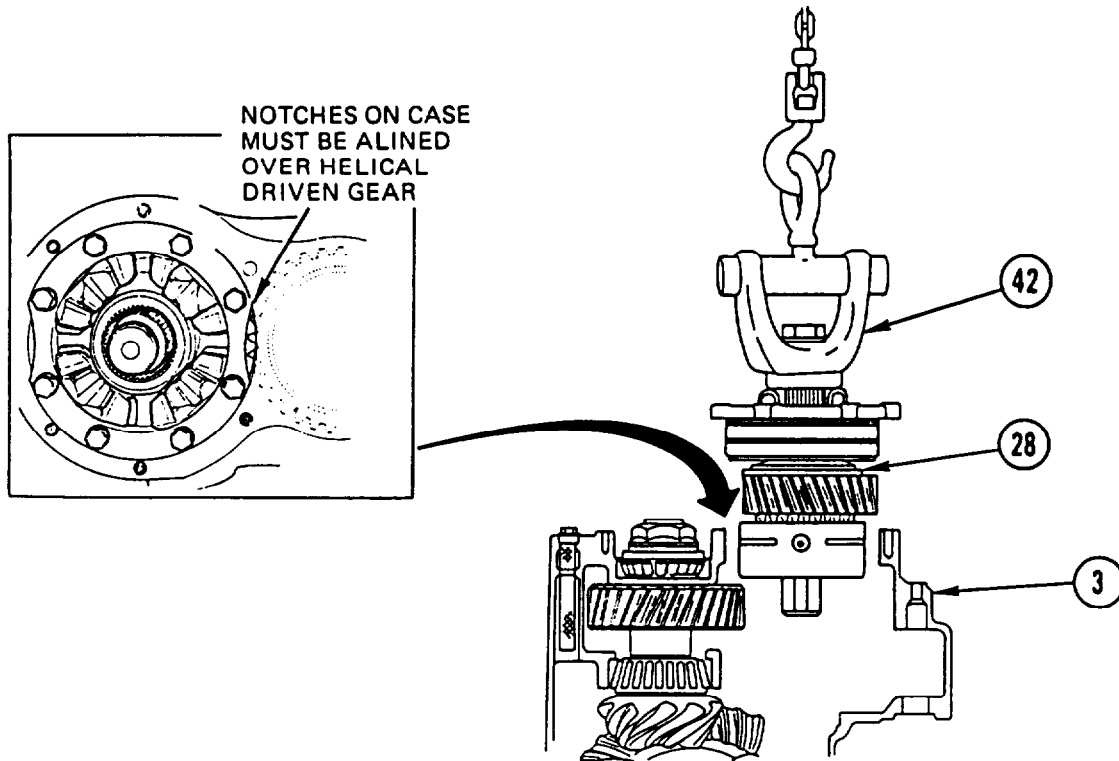
86. ROTATE DIFFERENTIAL CARRIER (3) SO RING GEAR (13) IS TOWARD FLOOR.

87. INSTALL BEARING CUP (47) IN DIFFERENTIAL CARRIER (3).

88. INSTALL FORK (48), CLUTCH (49), AND SIDE GEAR (46) IN DIFFERENTIAL CARRIER (3).

89. INSTALL SPRING (50) IN DIFFERENTIAL CARRIER (3).

90. INSTALL JAM NUT (51) AND ADJUSTING SCREW (52) IN DIFFERENTIAL CARRIER (3).
91. INSTALL SHIFT SHAFT (53), NEW SEAL (54), COVER (55) AND FOUR SOCKET HEAD SCREWS (56). TIGHTEN FOUR SOCKET HEAD SCREWS TO 49-76 LB-IN. (5.5-8.5 N.m).

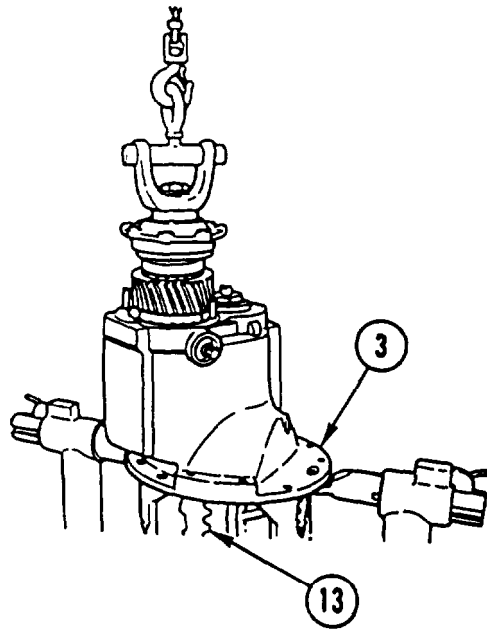


**CAUTION**

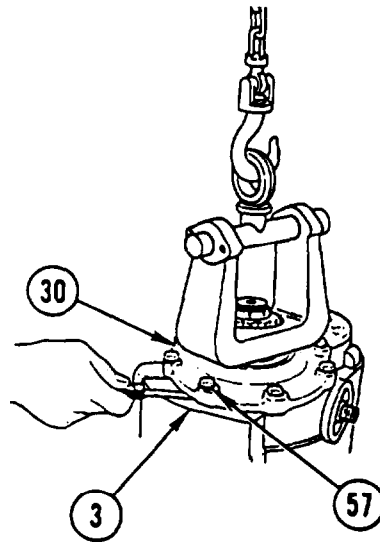
ALL EXCEPT M915A2: Make sure one of two notches on pinion differential case is aligned with helical driven gear. Failure to do so may prevent proper installation of input shaft.

92. CONNECT SUITABLE LIFTING DEVICE THRU YOKE (42) AND INSTALL INPUT SHAFT (28) IN DIFFERENTIAL CARRIER (3).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



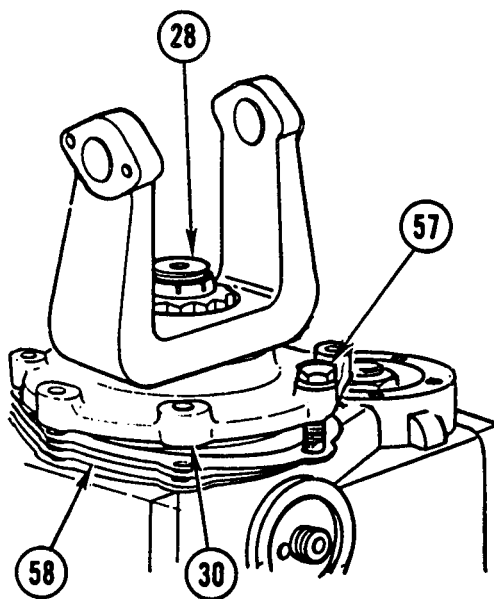
93. INSTALL WOOD BLOCK BETWEEN RING GEAR (13) AND DIFFERENTIAL CARRIER (3) TO PREVENT RING GEAR (13) FROM ROTATING.



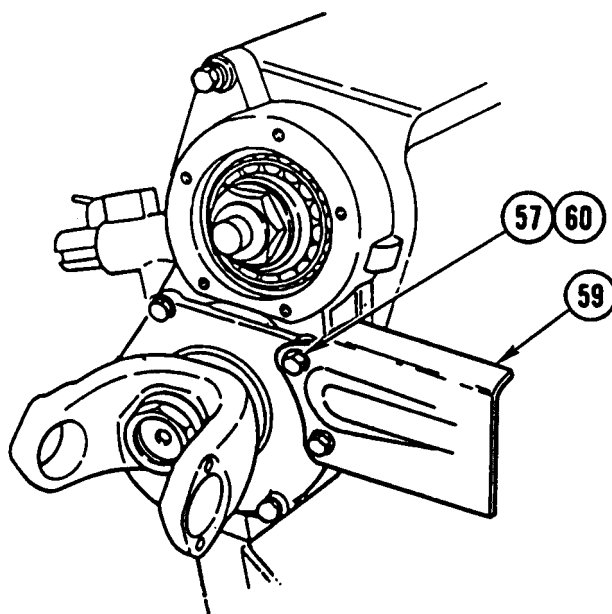
### NOTE

Rotate input shaft in both directions to make sure bearings are correctly installed.

94. INSTALL SEVEN CAPSCREWS (57) AND HAND-TIGHTEN.
95. USING FEELER GAGE, MEASURE GAP BETWEEN BEARING CAGE (30) AND DIFFERENTIAL CARRIER (3) AT FOUR EQUALLY SPACED PLACES ON BEARING CAGE (30). NOTE MEASUREMENTS.
96. ADD FOUR MEASUREMENTS OBTAINED IN STEP 95 AND DIVIDE BY FOUR TO GET AVERAGE. ADD 0.005 IN. (0.13 mm) TO DETERMINE THICKNESS OF SHIM PACK TO BE INSTALLED.

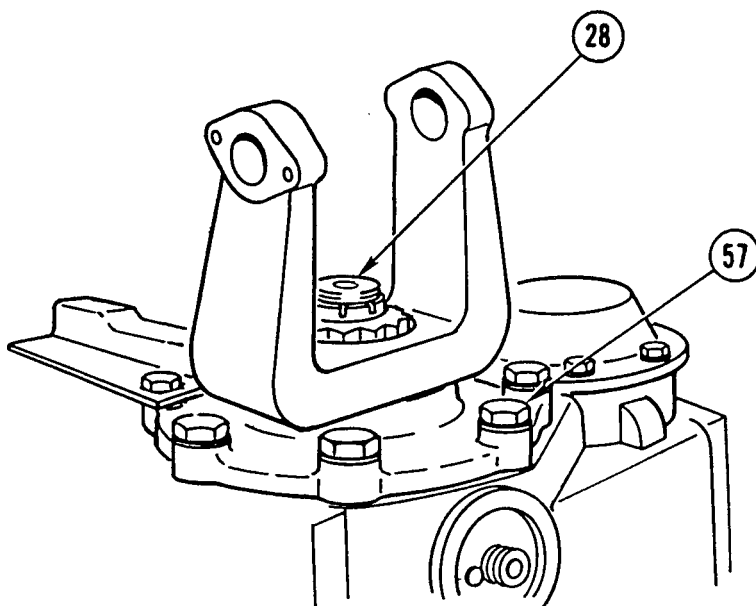


97. USING AT LEAST THREE SHIMS WITH THICKEST IN MIDDLE, ASSEMBLE NEW SHIM PACK (58).
98. REMOVE SEVEN CAPSCREWS (57).
99. USING SUITABLE LIFTING DEVICE, LIFT INPUT SHAFT (28) 1/4-1/2 IN. (6-12 mm).
100. INSTALL SHIM PACK (58) UNDER BEARING CAGE (30). MAKE SURE SHIM PACK (58) INSTALLATION PATTERN MATCHES BEARING CAGE (30) INSTALLATION PATTERN.

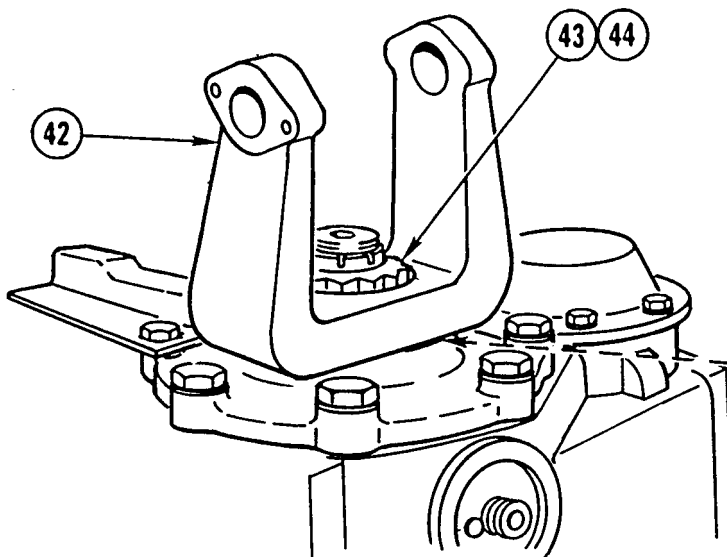


101. INSTALL FILTER SHIELD (59), SEVEN WASHERS (60), AND SEVEN CAPSCREWS (57).

## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

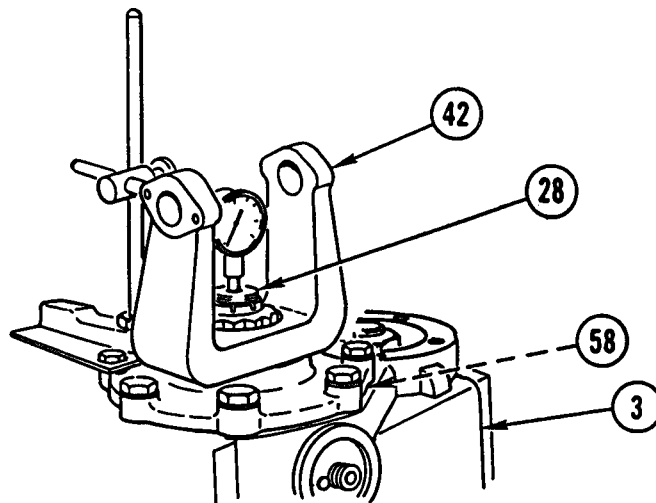


- 102. LOWER INPUT SHAFT (28) AND REMOVE LIFTING DEVICE.
- 103. TIGHTEN SEVEN CAPSCREWS (57) TO 75-95 LB-FT (100-130 N.m). ROTATE INPUT SHAFT (28) IN EACH DIRECTION TO MAKE SURE BEARINGS ARE INSTALLED CORRECTLY.

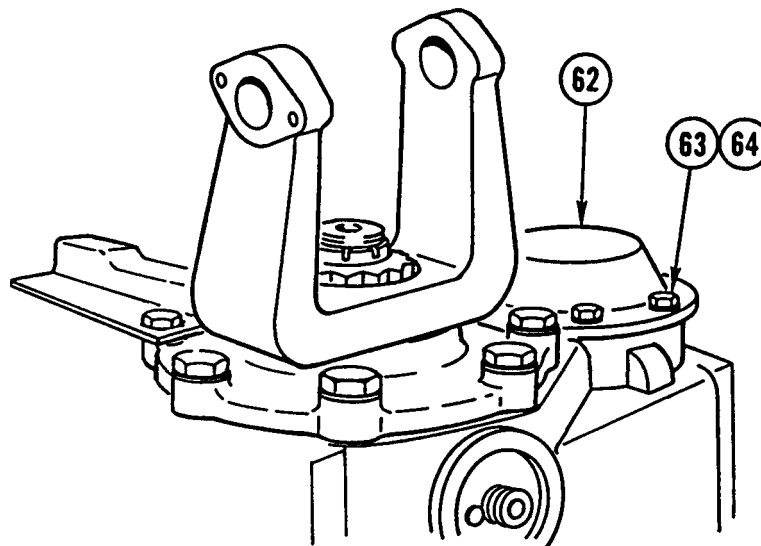


- 104. REMOVE NUT (44), SPACER (43), AND YOKE (42).
- 105. INSTALL NEW OIL SEAL (61), YOKE (42), AND NEW LOCK NUT (44). USING YOKE HOLDER BAR, TIGHTEN LOCK NUT TO 450-600 LB-FT (610-815 N.m).





106. ROTATE INPUT SHAFT (28) AND PUSH YOKE (42) TOWARD DIFFERENTIAL CARRIER (3) TO MAKE SURE INPUT SHAFT (28) IS AT BOTTOM OF TRAVEL.
107. INSTALL DIAL INDICATOR WITH POINT ON END OF INPUT SHAFT (28). ZERO DIAL INDICATOR.
108. USING PRY BAR, PRY UP ON FLANGE OF YOKE (42) AND READ DIAL INDICATOR. ACCEPTABLE READING IS 0.002-0.008 IN. (0.05-0.2 mm).
109. IF INPUT BEARING END PLAY IS NOT WITHIN SPECIFICATION, ADD OR REMOVE SHIM(S) FROM SHIM PACK (58). REPEAT STEPS 98 THRU 103.

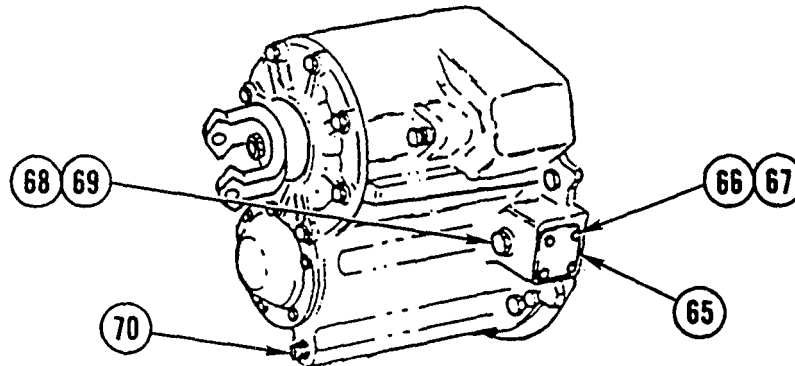


110. INSTALL COVER (62), FIVE WASHERS (63), AND FIVE CAPSCREWS (64). TIGHTEN CAPSCREWS TO 45-55 LB-FT (60-75 N.m).

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## FORWARD-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

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111. INSTALL COVER (65), FOUR WASHERS (66), FOUR CAPSCREWS (67), WASHER (68), PLUG (69), AND SCREEN/PLUG ASSEMBLY (70).

**NOTE**

Follow-on Maintenance:  
Install differential carrier (page 6-2).

## Section II. REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the rear-rear axle differential carrier.

Repair of the rear-rear axle differential carrier is general support maintenance.

### REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Yoke Holder Bar, J-3453

#### Materials/Parts:

Seal, Oil (All except M915A2)	P/N A-1205-U-1945
Seal, Oil (M915A2)	P/N A-1205-Y-1897
Spigot Bearing Assembly (All except M915A2)	P/N 1228-P-1004
Nut, Lock	P/N 40X-26
Oil, Lubricating	Appendix B, Item 40
Loctite 635	Appendix B, Item 32
Adhesive, Rockwell	Appendix B, Item 5
Dye, Prussian Blue	Appendix B, Item 17
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26
Wire, 14 Gauge	Appendix C, Item 66

**Personnel Required: (2)**

#### Equipment Condition:

Reference	Condition	Description
Page 6-2	Differential Carrier Removed	

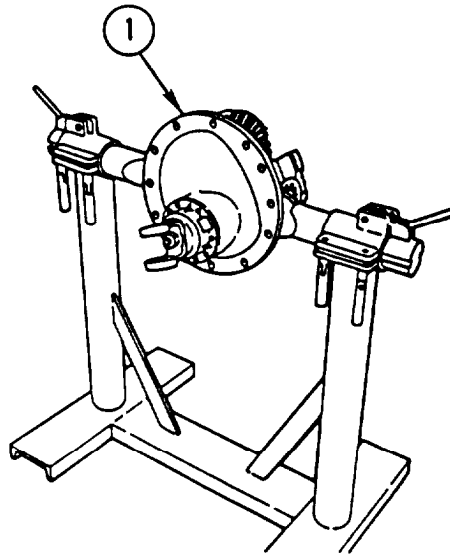
#### General Safety Instructions:

#### WARNING

- Rear-rear axle differential carrier weighs 860 lb (390 kg). Attach suitable floor jack prior to disassembly or assembly to prevent possible injury to personnel.
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Ring gear is heavy and can injure personnel if dropped. Do not put hands under ring gear.

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

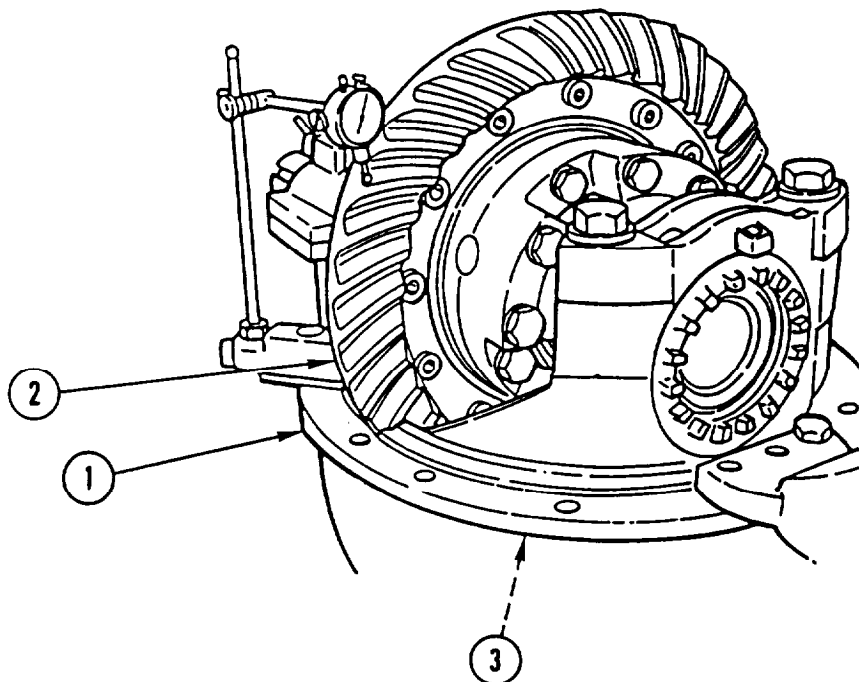
### DISASSEMBLY



### WARNING

Rear-rear axle differential carrier weighs 860 lb (390 kg), Attach suitable floor jack prior to disassembly to prevent possible injury to personnel.

1. INSTALL DIFFERENTIAL CARRIER (1) ON REPAIR STAND.

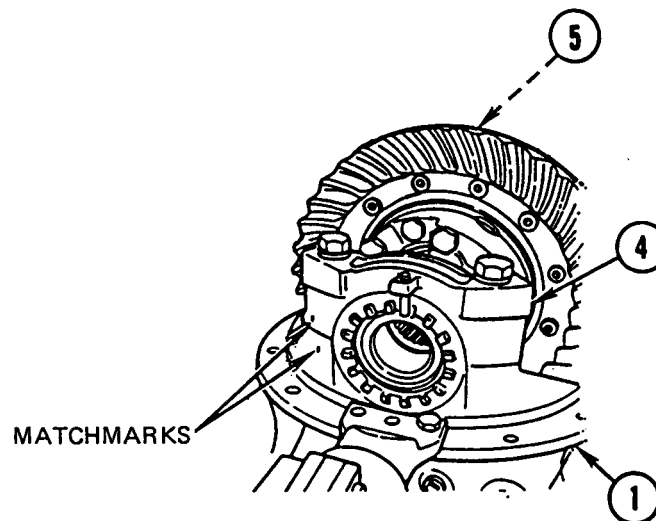


2. TURN DIFFERENTIAL CARRIER (1) SO RING GEAR (2) IS UP.

**NOTE**

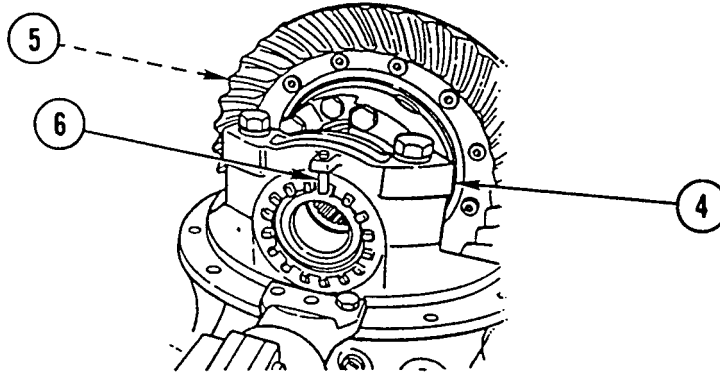
If reinstalling same ring gear and drive pinion, perform steps 3 thru 5 to measure backlash.

3. MOVE RING GEAR (2) SO RING GEAR (2) TEETH FULLY ENGAGE WITH DRIVE PINION (3) TEETH.
4. INSTALL DIAL INDICATOR ON FLANGE OF DIFFERENTIAL CARRIER (1) SO THAT TIP OF INDICATOR IS AGAINST DRIVE SIDE OF TOOTH ON RING GEAR (2). ADJUST DIAL INDICATOR TO ZERO.
5. ROTATE RING GEAR (2) IN BOTH DIRECTIONS AND RECORD READING.
6. REPEAT STEP 5 TWO MORE TIMES IN DIFFERENT LOCATIONS.

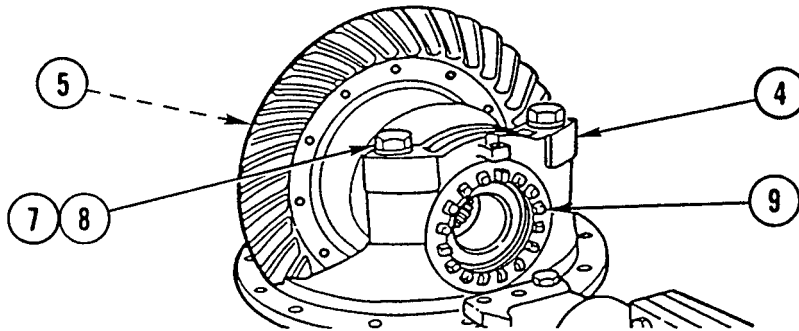


7. MATCHMARK POSITION OF TWO BEARING CAPS (4 AND 5) ON DIFFERENTIAL CARRIER (1).

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



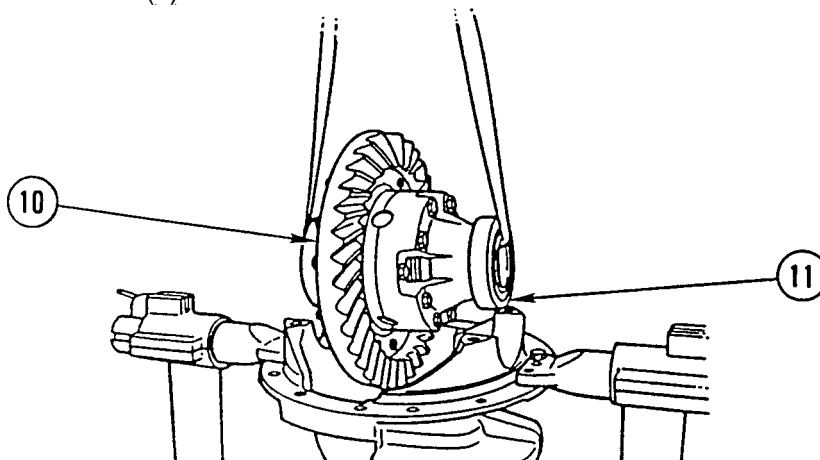
8. REMOVE PIN (6) FROM TWO BEARING CAPS (4 AND 5).



### CAUTION

To prevent damage to adjusting rings, do not hit adjusting rings with hammer or use hammer and drift pin to loosen rings.

9. REMOVE FOUR CAPSCREWS (7), FOUR WASHERS (8), TWO BEARING CAPS (4 AND 5), AND TWO ADJUSTING RINGS (9).

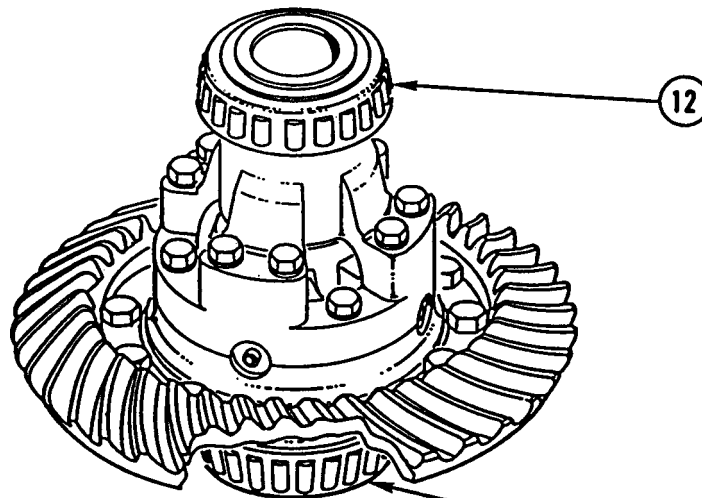


10. ATTACH LIFTING DEVICE TO RING GEAR SUBASSEMBLY (10).

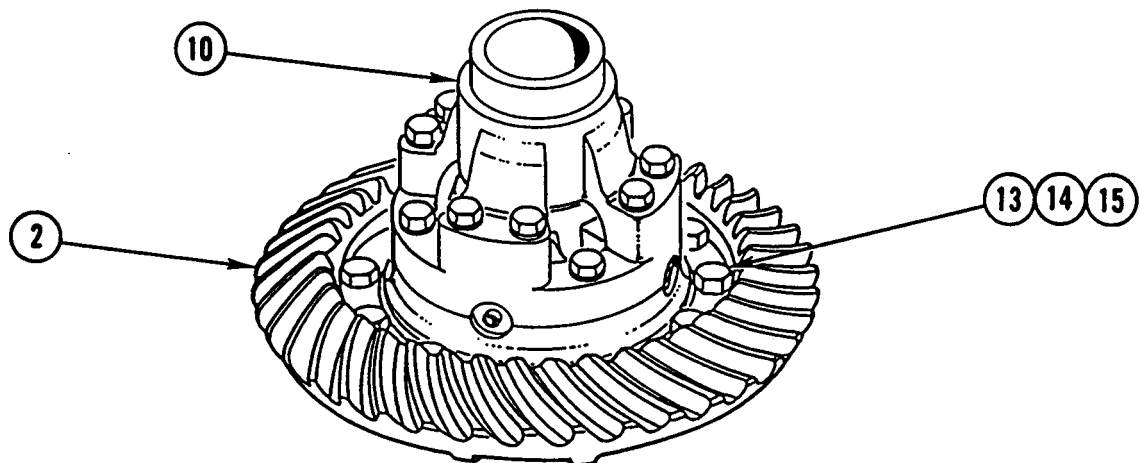
**NOTE**

Ring gear and assembled parts must be tilted to clear casting inside carrier.

11. REMOVE RING GEAR SUBASSEMBLY (10) AND TWO BEARING CUPS (11).
12. PLACE RING GEAR SUBASSEMBLY (10) ON CLEAN WORK SURFACE AND REMOVE LIFTING DEVICE.



13. REMOVE TWO BEARING CONES (12).



14. REMOVE 12 NUTS (13), 12 WASHERS (14), AND 12 BOLTS (15) FROM RING GEAR (2).

**WARNING**

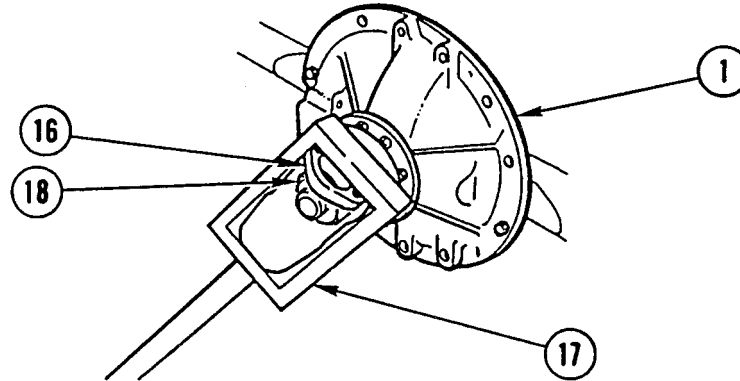
Ring gear is heavy and can injure personnel if dropped. Do not put hands under ring gear.

15. REMOVE RING GEAR (2) FROM RING GEAR SUBASSEMBLY (10).

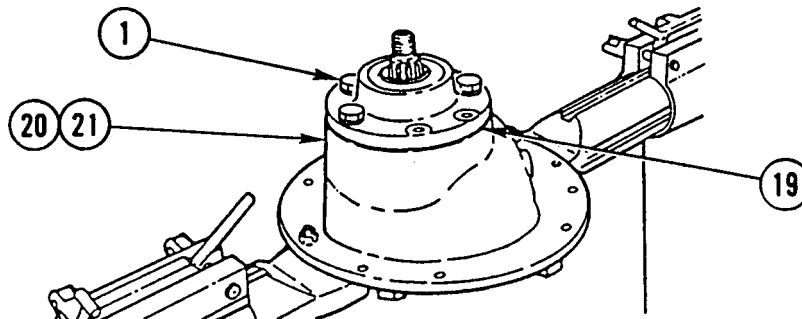
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## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

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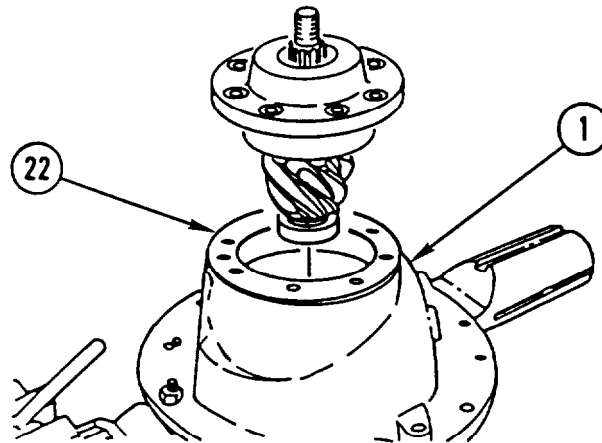


16. ROTATE DIFFERENTIAL CARRIER (1) SO THAT YOKE (16) IS IN HORIZONTAL POSITION.
17. USING YOKE HOLDER BAR (17) TO HOLD YOKE (16) IN PLACE, LOOSEN LOCK NUT (18).
18. ROTATE DIFFERENTIAL CARRIER (1) SO THAT YOKE (16) FACES UP.
19. REMOVE LOCK NUT (18) AND YOKE (16). DISCARD LOCK NUT.



20. MATCHMARK BEARING CAGE ASSEMBLY (19) AND DIFFERENTIAL CARRIER (1). REMOVE EIGHT CAPSCREWS (20), EIGHT WASHERS (21), AND BEARING CAGE ASSEMBLY (19).

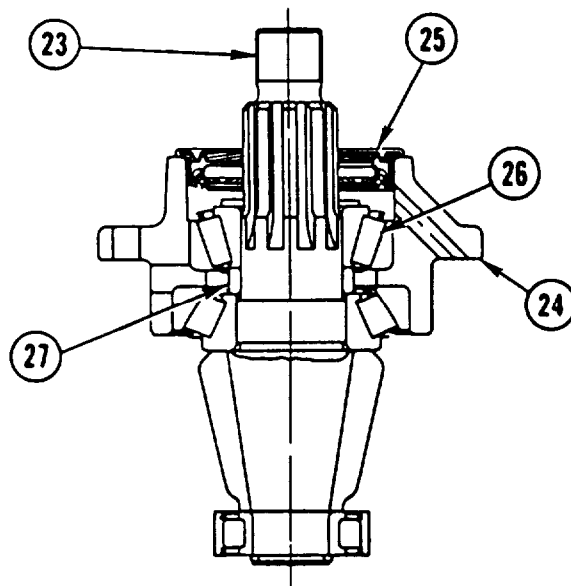




**NOTE**

- shims are in good condition, keep shims together to use for assembly.
- If shims are damaged, measure and record thickness of shim pack before discarding shims.

21. REMOVE SHIM(S) (22) FROM DIFFERENTIAL CARRIER (1).



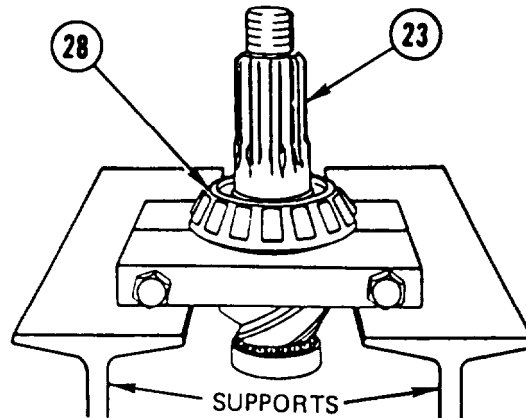
22. PRESS DRIVE PINION SHAFT (23) THRU BEARING CAGE (24).

23. REMOVE AND DISCARD OIL SEAL (25).

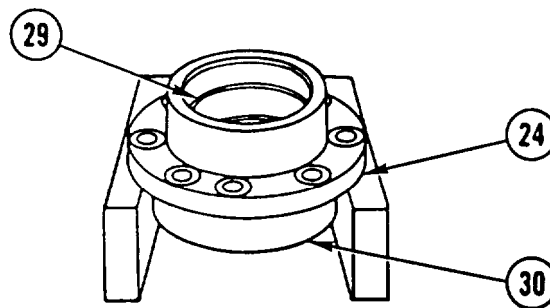
24. REMOVE OUTER BEARING CONE (26) FROM BEARING CAGE (24).

25. REMOVE SPACER(S) (27) FROM DRIVE PINION SHAFT (23).

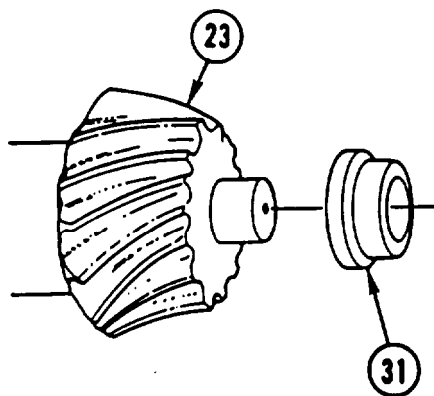
## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



26. REMOVE INNER BEARING CONE (28) FROM DRIVE PINION SHAFT (23).



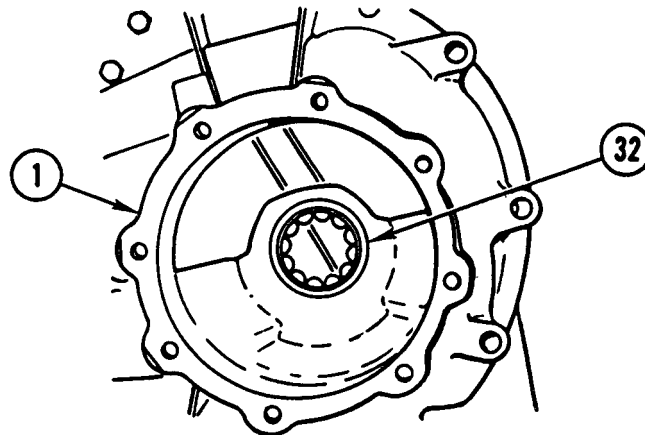
27. REMOVE TWO BEARING CUPS (29 AND 30) FROM BEARING CAGE (24).



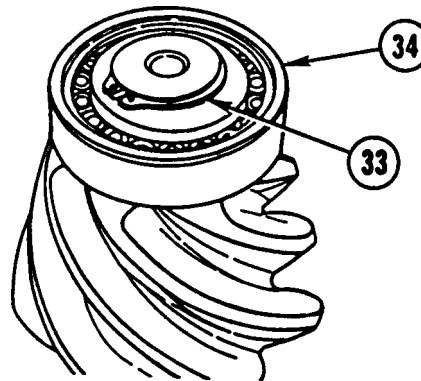
### NOTE

- Perform steps 28 and 29 on all except M915A2.
- On all except M915A2, spigot bearing is two-piece bearing.

28. REMOVE AND DISCARD SPIGOT BEARING INNER RACE (31) FROM DRIVE PINION SHAFT (23).



29. REMOVE AND DISCARD SPIGOT BEARING OUTER RACE AND ROLLER BEARING ASSEMBLY (32) FROM DIFFERENTIAL CARRIER (1).



**NOTE**

Perform step 30 on M915A2 only.

30. REMOVE RETAINING RING (33) AND SPIGOT BEARING (34).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

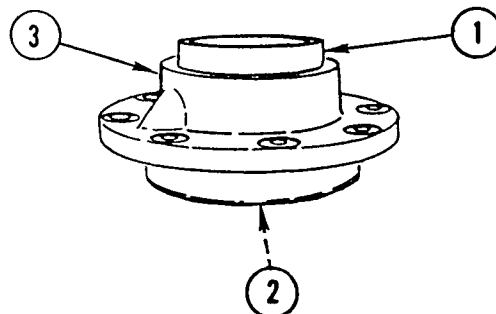
Inspect all parts for wear or damage.

**REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

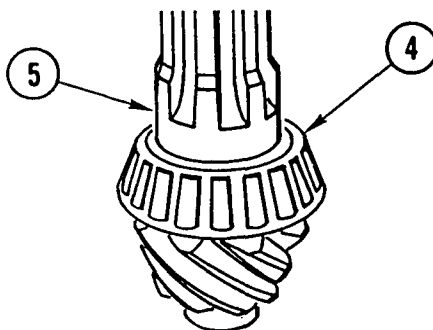
### ASSEMBLY



#### WARNING

Rear-rear axle differential carrier weighs 860 lb (390 kg). Attach suitable floor jack prior to disassembly to prevent possible injury to personnel.

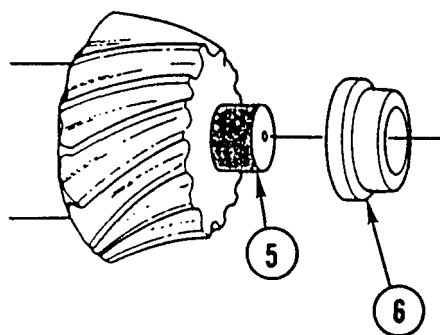
1. INSTALL BEARING CUPS (1 AND 2) IN BEARING CAGE (3).



#### NOTE

Coat all bearing cones and bearing cups with axle oil prior to installation.

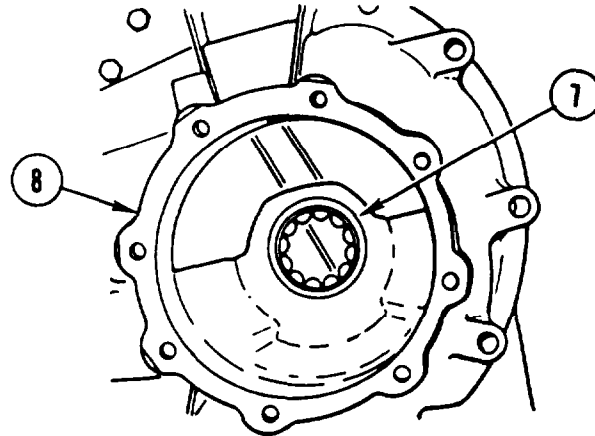
2. INSTALL INNER BEARING CONE (4) ON DRIVE PINION SHAFT (5) UNTIL BEARING CONE (4) IS FLAT AGAINST DRIVE PINION SHAFT (5) GEAR HEAD.



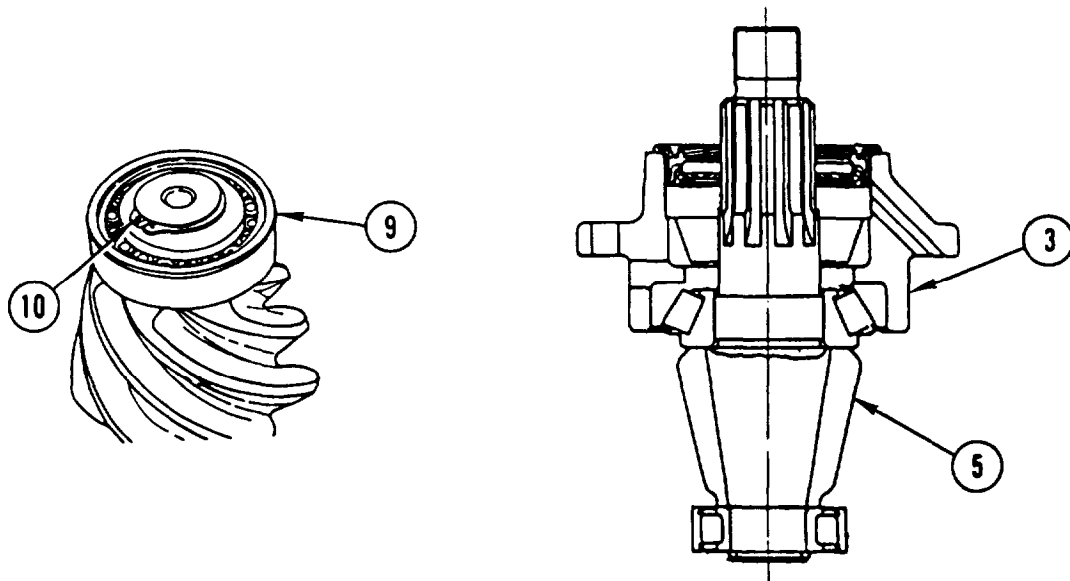
**NOTE**

Perform steps 3 and 4 on all except M915A2.

3. COAT END OF DRIVE PINION SHAFT (5) WITH THIN LAYER OF LOCTITE 635 AND INSTALL NEW SPIGOT BEARING INNER RACE (6) ON DRIVE PINION SHAFT (5).



4. INSTALL NEW SPIGOT BEARING OUTER RACE AND ROLLER BEARING ASSEMBLY (7) IN DIFFERENTIAL CARRIER (8).

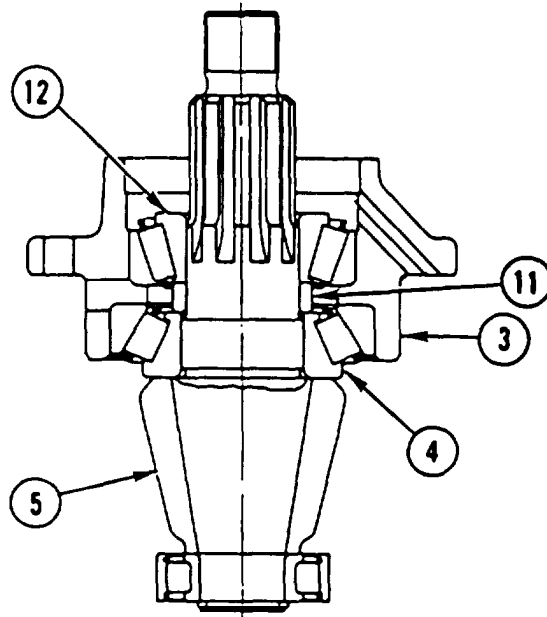


**NOTE**

Perform step 5 on M915A2 only.

5. INSTALL SPIGOT BEARING (9) AND RETAINING RING (10).
6. INSTALL DRIVE PINION SHAFT (5) IN BEARING CAGE (3).

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

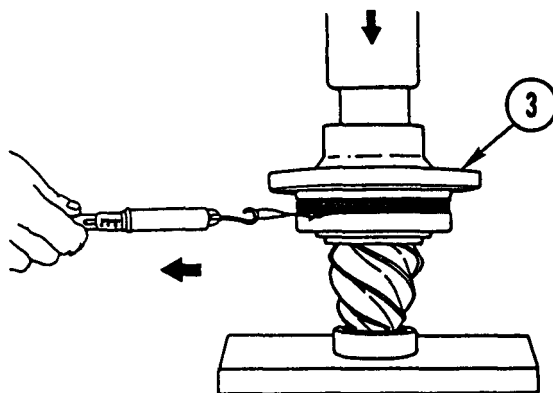


7. INSTALL SPACER(S) (11) ON DRIVE PINION SHAFT (5).
8. INSTALL OUTER BEARING CONE (12) ON DRIVE PINION SHAFT (5) AGAINST SPACER(S) (11).

### NOTE

- All except M915A2: Apply 26 tons (23.6 Mt) of pressure.
  - M915A2: Apply 25 tons (22.7 Mt) of pressure.
9. APPLY PRESSURE TO TWO BEARING CONES (4 AND 12) AND AS PRESSURE IS APPLIED, ROTATE BEARING CAGE (3) SEVERAL TIMES SO THAT TWO BEARING CONES (4 AND 12) MAKE NORMAL CONTACT.

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



### NOTE

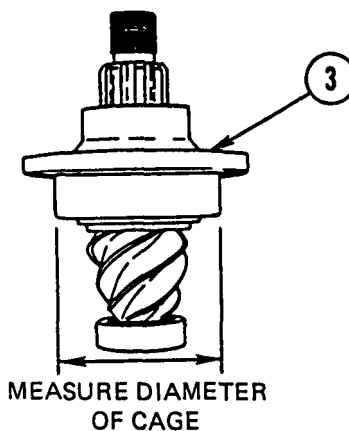
To perform steps 10 and 11, 20-in. piece of 14-gauge wire must be used.

10. MAINTAIN PRESSURE AND WRAP 14-GAUGE WIRE AROUND BEARING CAGE (3) SEVERAL TIMES.

### NOTE

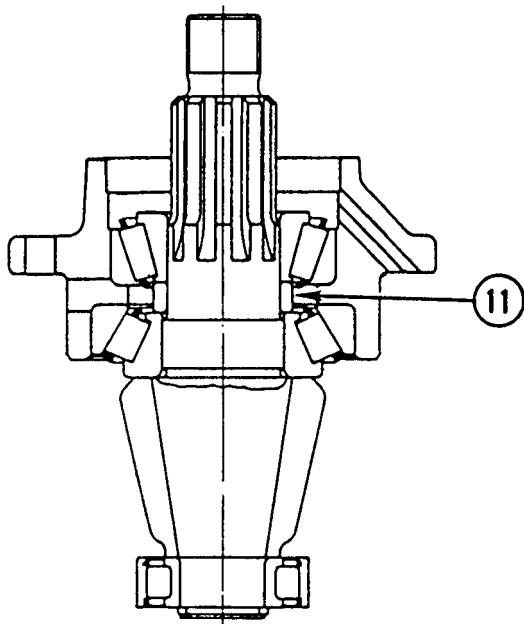
For accuracy, reading must be taken while bearing cage is rotating.

11. ATTACH SPRING SCALE TO END OF WIRE AND PULL. AS BEARING CAGE (3) ROTATES, READ AND RECORD VALUE ON SCALE.

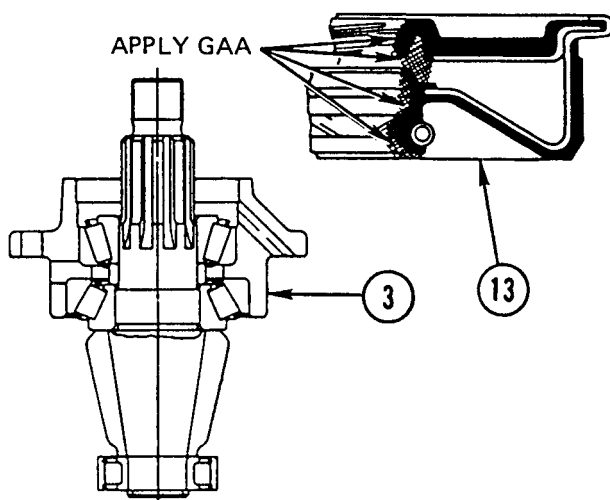


12. MEASURE DIAMETER OF BEARING CAGE (3) WHERE WIRE WAS WRAPPED AND DIVIDE MEASUREMENT IN HALF TO DETERMINE RADIUS.
13. MULTIPLY READING FROM STEP 11 AND RADIUS FROM STEP 12 TO DETERMINE PRELOAD. NEW PINION DRIVE GEAR PRELOAD MUST BE 5-45 LB-IN. (0.56-5.08 N.m). USED PINION DRIVE GEAR PRELOAD MUST BE 10-30 LB-IN. (1.13-3.39 N.m).

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

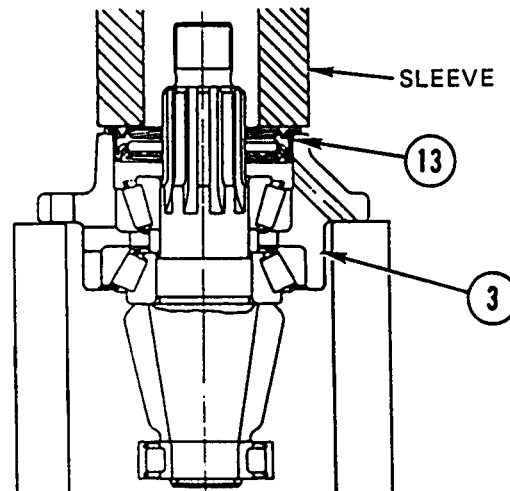


14. IF PRELOAD IS NOT WITHIN LIMITS, INSTALL THICKER SPACER (11) TO DECREASE PRELOAD OR THINNER SPACER (11) TO INCREASE PRELOAD.
15. REPEAT STEPS 7 THRU 13 UNTIL CORRECT PRELOAD IS OBTAINED.

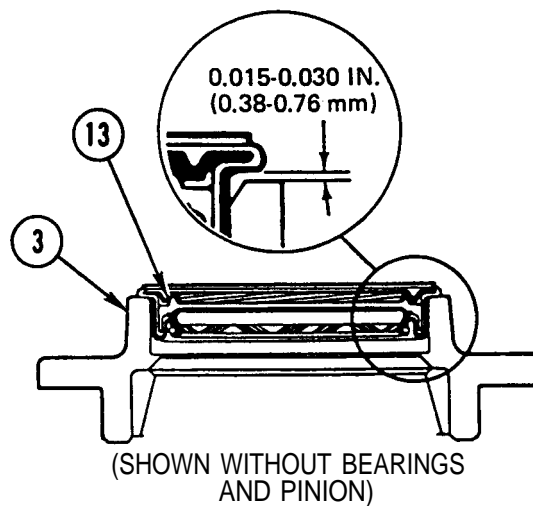


16. COAT OUTSIDE OF NEW OIL SEAL (13) AND BORE OF BEARING CAGE (3) WITH GAA.



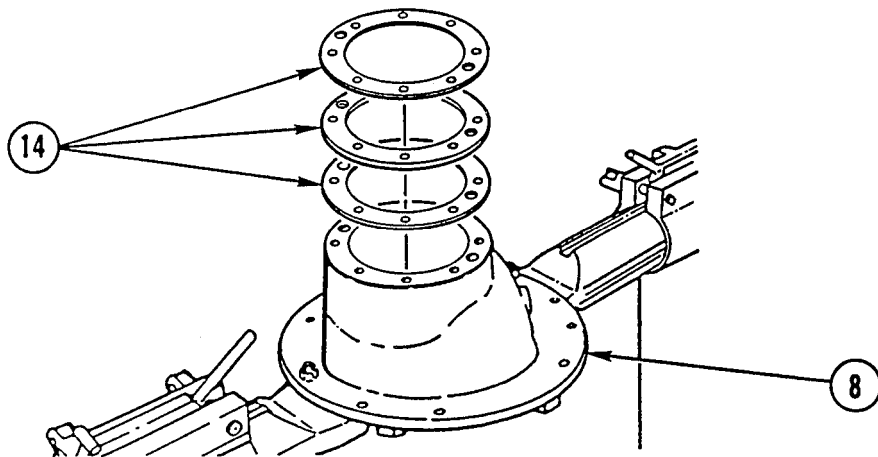


17. INSTALL OIL SEAL (13) IN BEARING CAGE (3).



18. USING FEELER GAGE, CHECK GAP BETWEEN OIL SEAL (13) AND BEARING CAGE (3) AT SEVERAL POINTS AROUND OIL SEAL (13). GAP MUST BE WITHIN 0.015-0.030 IN. (0.38-0.76 mm). DIFFERENCE BETWEEN LARGEST AND SMALLEST GAP MUST NOT EXCEED 0.01 IN. (0.25 mm).

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



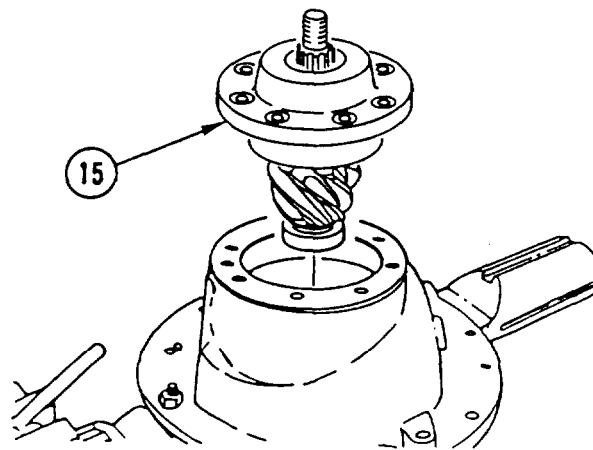
### NOTE

- If installing new ring gear and drive pinion, perform steps 19 thru 24.
- Replace ring gear and drive pinion as matched set. Gear set match number is on gear head of drive pinion and front face or outer diameter of ring gear.
- Pinion cone variation number is used to adjust depth of pinion in differential carrier. Pinion cone variation number is on end of gear head of drive pinion or outer diameter of ring gear.

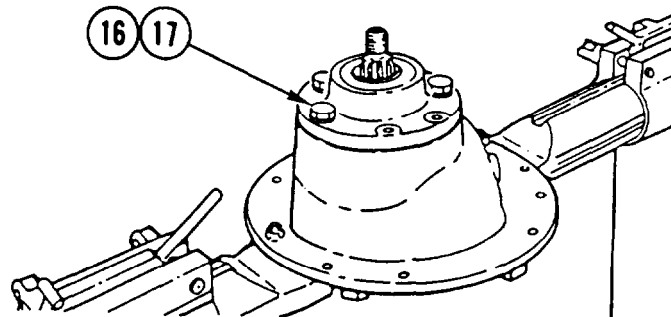
19. RECORD NEW PINION CONE VARIATION NUMBER.
20. RECORD OLD PINION CONE VARIATION NUMBER.
21. IF OLD PINION CONE VARIATION NUMBER IS +, SUBTRACT NUMBER FROM SHIM PACK THICKNESS IN DISASSEMBLY, STEP 21.
22. IF OLD PINION CONE VARIATION NUMBER IS -, ADD NUMBER TO SHIM PACK THICKNESS IN DISASSEMBLY, STEP 21.
23. IF NEW PINION CONE VARIATION NUMBER IS +, ADD NUMBER TO SHIM PACK THICKNESS DETERMINED IN STEP 21 OR 22.
24. IF NEW PINION CONE VARIATION NUMBER IS -, SUBTRACT NUMBER FROM SHIM PACK THICKNESS DETERMINED IN STEP 21 OR 22.

### NOTE

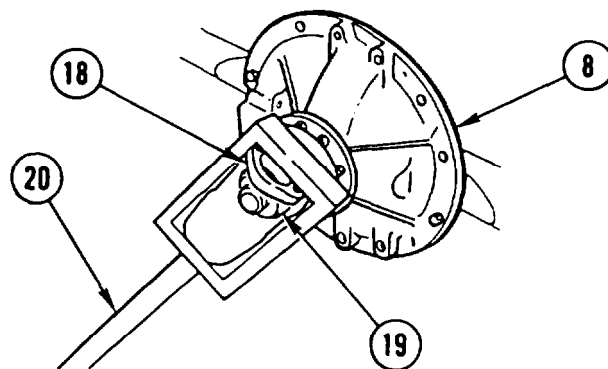
- If installing same ring gear and drive pinion, use shim pack removed in Disassembly, step 21.
  - If installing new shim pack, use at least three shims with thickest shim in middle of pack.
25. ALINE OIL SLOTS ON SHIM PACK (14) WITH OIL SLOTS ON DIFFERENTIAL CARRIER (8) AND INSTALL SHIM PACK (14).



26. INSTALL BEARING CAGE AND PINION ASSEMBLY (15).



27. INSTALL EIGHT WASHERS (16) AND EIGHT CAPSCREWS (17) AND TIGHTEN CAPSCREWS TO 74-96 LB-FT (100-130 N.m).

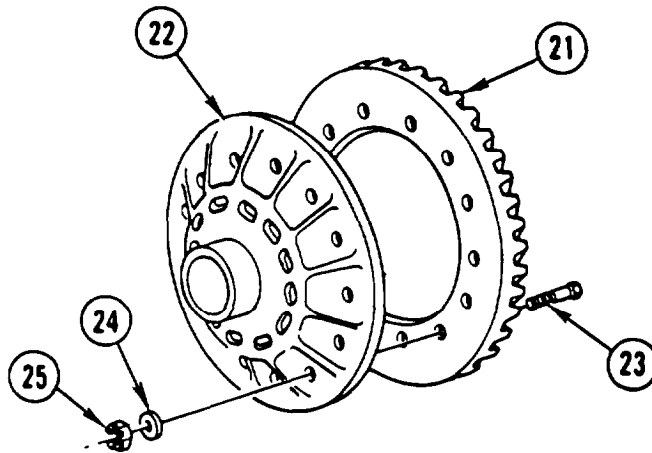


28. INSTALL YOKE (18) AND NEW LOCK NUT (19).

29. ROTATE DIFFERENTIAL CARRIER (8) SO YOKE (18) IS IN HORIZONTAL POSITION.

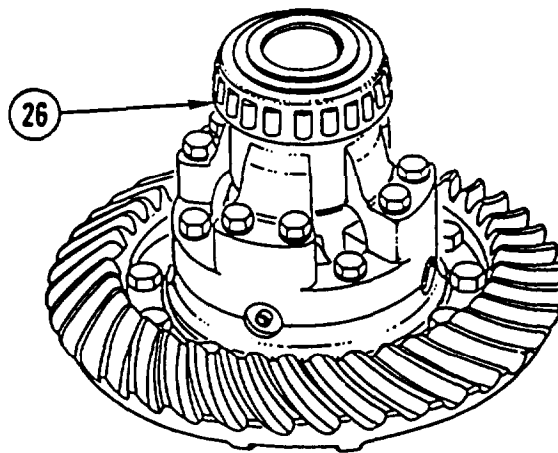
30. USING YOKE HOLDER BAR (20) TO HOLD YOKE (18) IN PLACE, TIGHTEN LOCK NUT (19) TO 1,000-1,230 LB-FT (1356-1666 N.m).

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

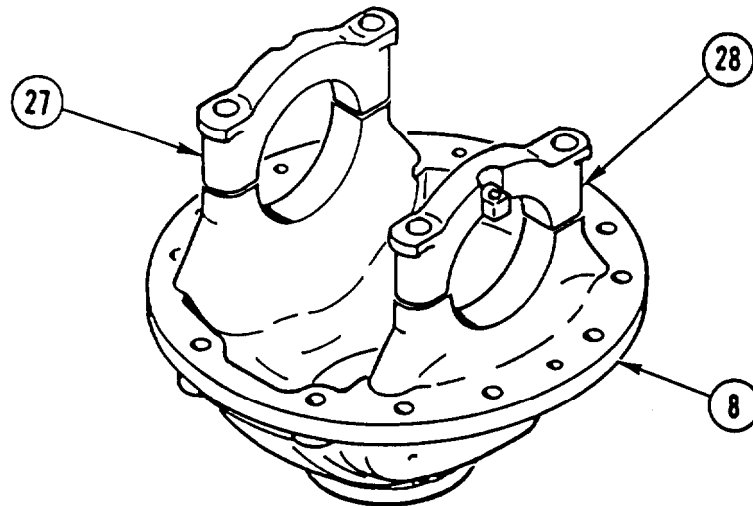


31. INSTALL RING GEAR (21) ON FLANGED HALF OF CASE ASSEMBLY (22).

32. INSTALL 12 BOLTS (23), 12 WASHERS (24), AND 12 NUTS (25). ALL EXCEPT M915A2: TIGHTEN NUTS TO 180-230 LB-FT (244-312 N.m). M915A2: TIGHTEN NUTS TO 190-225 LB-FT (260-350 N.m).



33. INSTALL TWO BEARING CONES (26).

**WARNING**

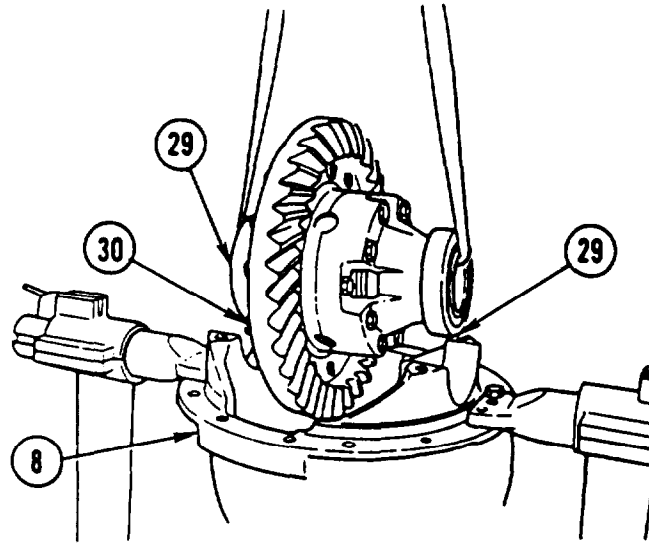
Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap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

**CAUTION**

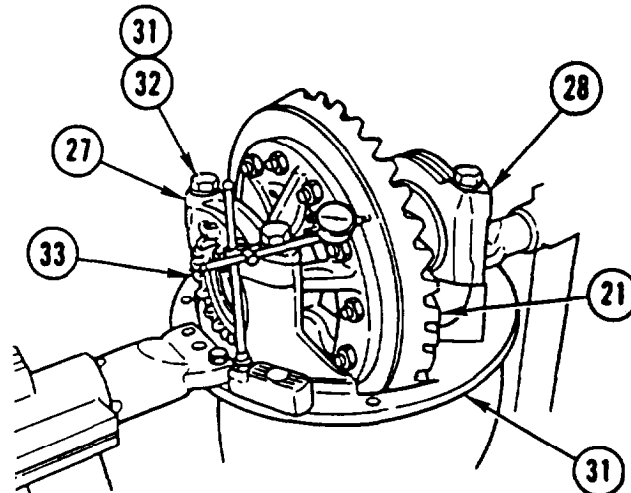
Make sure all old adhesive has been removed from differential carrier and bearing caps to prevent damage to equipment.

34. SET TWO BEARING CAPS (27 AND 28) ON DIFFERENTIAL CARRIER (8) AND APPLY CONTINUOUS BEAD OF ROCKWELL ADHESIVE AROUND ENTIRE SMOOTH GROUND SURFACES ON BOTH SIDES. DO NOT APPLY ADHESIVE TO THREADED AREAS.
35. REMOVE TWO BEARING CAPS (27 AND 28).

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



36. INSTALL TWO BEARING CUPS (29).
37. USING SUITABLE LIFTING DEVICE, INSTALL RING GEAR SUBASSEMBLY (30) IN DIFFERENTIAL CARRIER (8).

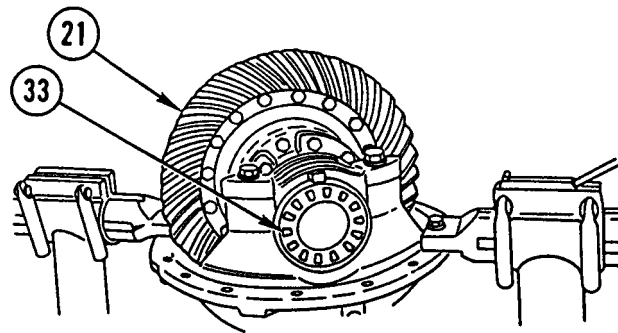


38. INSTALL TWO BEARING CAPS (27 AND 28), FOUR WASHERS (31), AND FOUR CAPSCREWS (32).

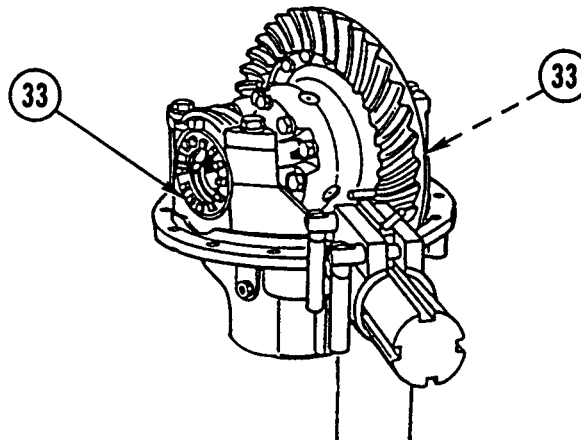
### NOTE

If there is a problem performing step 39, tighten four cap screws to 10-20 lb-ft (14-27 N.m).

39. INSTALL TWO ADJUSTING RINGS (33) IN DIFFERENTIAL CARRIER (8).
40. ALL EXCEPT M915A2: TIGHTEN FOUR CAPSCREWS (32) TO 270-350 LB-FT (366-475 N.m).  
M915A2: TIGHTEN FOUR CAPSCREWS (32) TO 347-431 LB-FT (470-585 N.m).
41. INSTALL DIAL INDICATOR ON FLANGE OF DIFFERENTIAL CARRIER (8) WITH PLUNGER AGAINST BACK SURFACE OF RING GEAR (21).

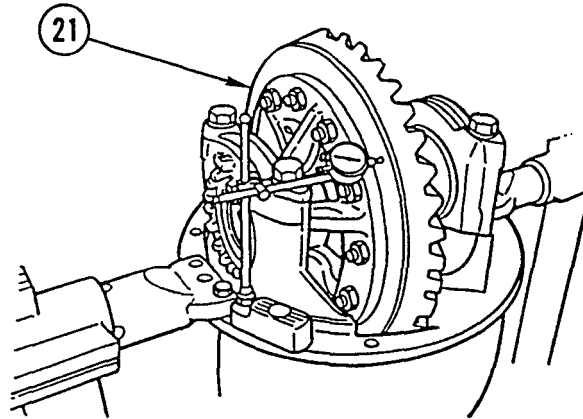


42. LOOSEN ADJUSTING RING (33) ON GEAR SIDE OF RING GEAR (21) SO SMALL AMOUNT OF END PLAY SHOWS ON DIAL INDICATOR WHEN RING GEAR IS MOVED LEFT AND RIGHT.

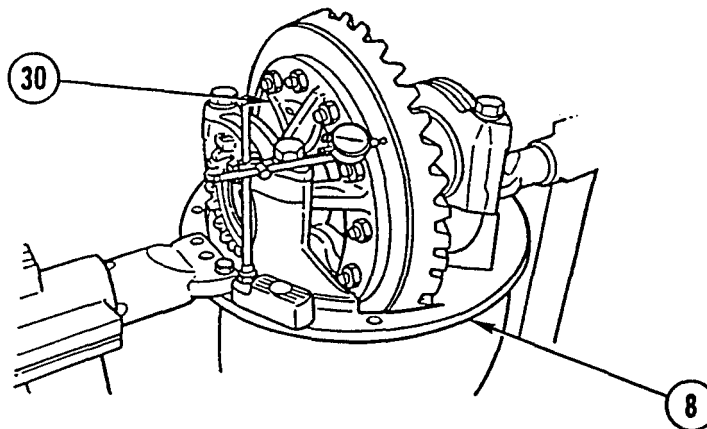


43. TIGHTEN ADJUSTING RING (33) LOOSENED IN STEP 42 SO NO END PLAY SHOWS ON DIAL INDICATOR.
44. TIGHTEN TWO ADJUSTING RINGS (33) ONE NOTCH FROM ZERO END PLAY MEASURED IN STEP 43. BEARING PRELOAD IS NOW SET.
45. ADJUST DIAL INDICATOR TO ZERO.

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

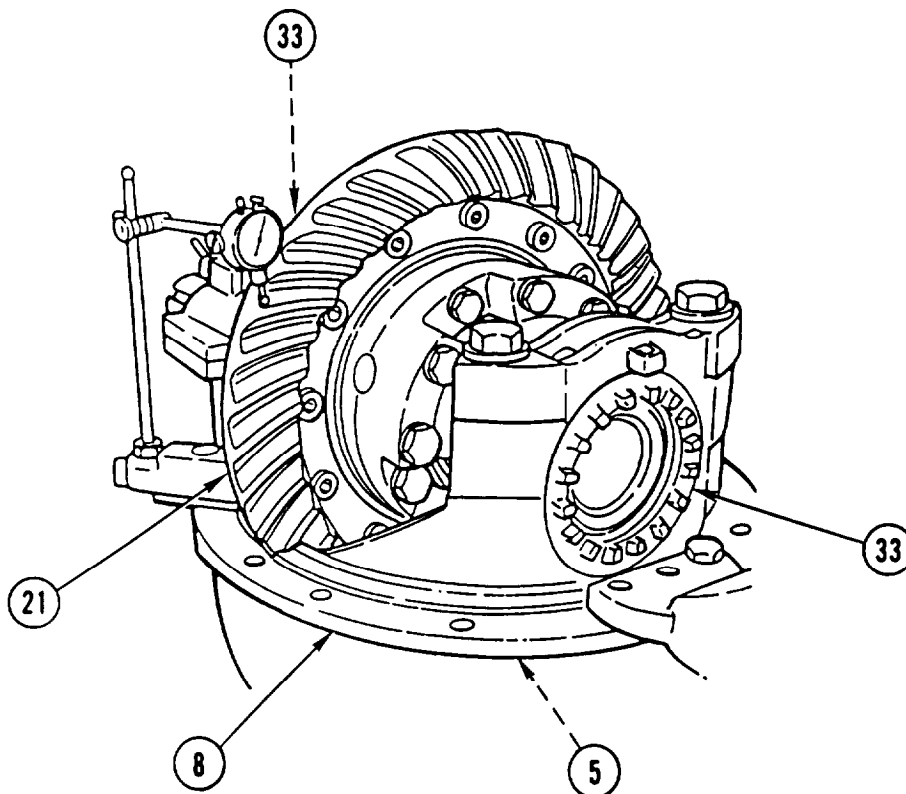


46. ROTATE RING GEAR (21) WHILE READING DIAL INDICATOR. RUNOUT MUST NOT EXCEED 0.008 IN. (0.200 mm).
47. IF RUNOUT IS EXCEEDED, PERFORM DISASSEMBLY STEPS 9 THRU 11.



48. INSPECT ALL RING GEAR SUBASSEMBLY (30) PARTS AND DIFFERENTIAL CARRIER (8) FOR POSSIBLE EXCESSIVE RUNOUT CAUSES. REPLACE DEFECTIVE PART(S).
49. REPEAT STEPS 36 THRU 46.





50. ATTACH DIAL INDICATOR ON MOUNTING FLANGE OF DIFFERENTIAL CARRIER (8) SO PLUNGER IS AGAINST TOOTH SURFACE ON DRIVE SIDE OF RING GEAR (21) AND ZERO INDICATOR.

**NOTE**

Move ring gear only when adjusting backlash.

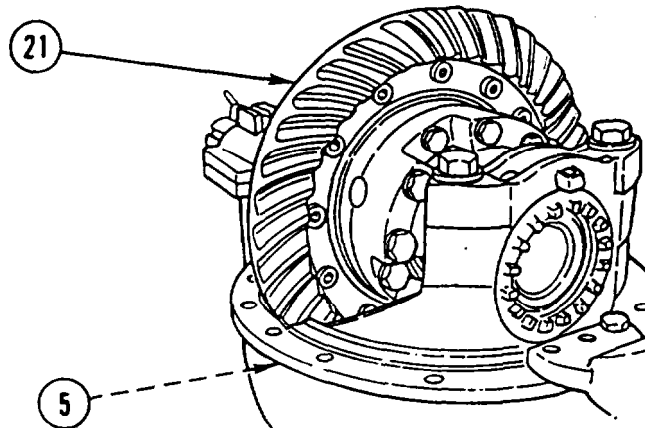
51. WHILE HOLDING DRIVE PINION SHAFT (5) IN POSITION, ROTATE RING GEAR (21) SLIGHTLY IN BOTH DIRECTIONS AGAINST DRIVE PINION SHAFT (5) TEETH. NOTE MEASUREMENT.

**NOTE**

- If same ring gear and drive pinion have been installed, adjust backlash to setting recorded in Disassembly, step 5.
- If new ring gear and drive pinion have been installed, adjust backlash. ALL EXCEPT M915A2: 0.015 in. (0.380 mm). M915A2: 0.012 in. (0.305 mm).

52. IF BACKLASH MEASUREMENT IS LESS THAN SPECIFIED, LOOSEN ADJUSTING RING (33) ON BACK SURFACE OF RING GEAR (21) AND EQUALLY TIGHTEN ADJUSTING RING (33) ON TOOTH SIDE OF RING GEAR (21). REPEAT STEP 51.
53. IF BACKLASH MEASUREMENT IS MORE THAN SPECIFIED, LOOSEN ADJUSTING RING (33) ON TOOTH SIDE OF RING GEAR (21) AND EQUALLY TIGHTEN ADJUSTING RING (33) ON BACK SURFACE OF RING GEAR (21). REPEAT STEP 51.
54. REPEAT STEPS 51 THRU 53 UNTIL BACKLASH MEETS SPECIFICATION. RECORD SETTING FOR USE WHEN ADJUSTING PINION BEARING PRELOAD.

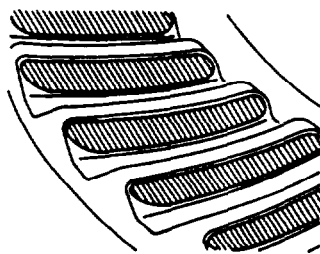
## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)



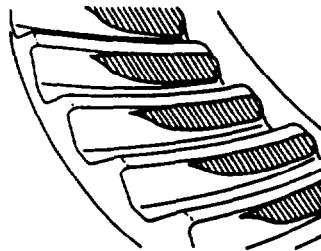
### NOTE

Always check tooth contact pattern on drive side of ring gear teeth.

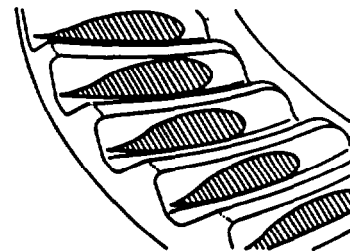
55. APPLY PRUSSIAN BLUE DYE TO APPROXIMATELY 12 TEETH OF RING GEAR (21). ROTATE RING GEAR (21) SO MARKED GEAR TEETH ARE NEXT TO DRIVE PINION SHAFT (5).
56. TO GET CONTACT PATTERN, ROTATE RING GEAR (21) FORWARD AND BACKWARD UNTIL MARKED GEAR TEETH GO PAST DRIVE PINION SHAFT (5) SIX TIMES. REPEAT, IF NEEDED, FOR CLEARER PATTERN.



GOOD HAND-ROLLED PATTERN



HIGH PATTERN



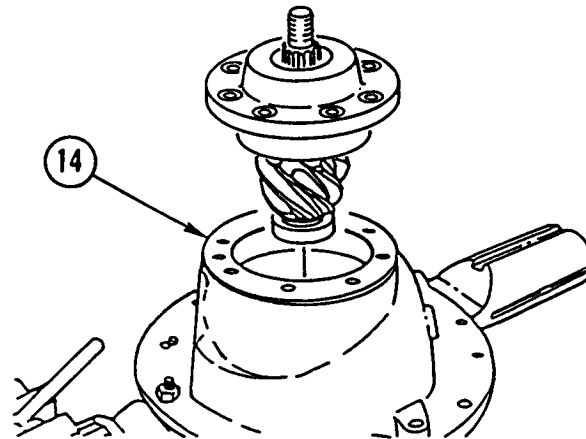
LOW PATTERN

### NOTE

- Location of good hand-rolled contact pattern for new gear set is toward toe of gear tooth and in center between top and bottom of tooth.
- Location of good hand-rolled contact pattern for used gear set must match wear pattern in ring gear. Contact pattern will be smaller than wear pattern.
- During tooth contact pattern checks, backlash can be adjusted within specification limits, if needed, to change pattern location.

57. COMPARE CONTACT PAT-TERN WITH EXAMPLES SHOWN.
58. IF CONTACT PAT-TERN REQUIRES ADJUSTMENT, PERFORM DISASSEMBLY STEPS 16 THRU 21.

## REAR-REAR AXLE DIFFERENTIAL CARRIER REPAIR (CONT)

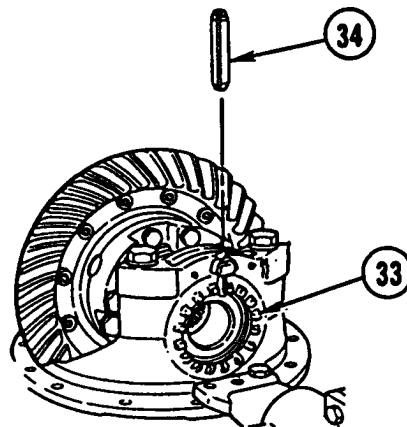


59. PERFORM STEPS 25 THRU 30 AND 55 THRU 57.

- TO CORRECT HIGH CONTACT PATTERN, DECREASE THICKNESS OF SHIM PACK (14).
- TO CORRECT LOW CONTACT PATTERN, INCREASE THICKNESS OF SHIM PACK (14).

60. IF CONTACT PATTERN IS TOO FAR TOWARD HEEL OF TOOTH, REPEAT STEP 52.

61. IF CONTACT PATTERN IS TOO FAR TOWARD TOE OF TOOTH, REPEAT STEP 53.



62. INSTALL TWO PINS (34) BETWEEN LUGS OF TWO ADJUSTING RINGS (33).

**NOSTE**

Follow-on Maintenance:  
Install differential carrier (page 6-2).

## Section III. REAR AXLE HOUSING REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the rear axle housing.

---

### REAR AXLE HOUSING REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05

Equipment Condition:

Reference

Page 6-16 or 6-22

Condition Description

Rear Axle Removed

---

### DISASSEMBLY

#### NOTE

Procedure is the same for all rear axles.

REMOVE THREE PLUGS (1) AND BREATHER (2) FROM AXLE HOUSING (3).

### CLEANING

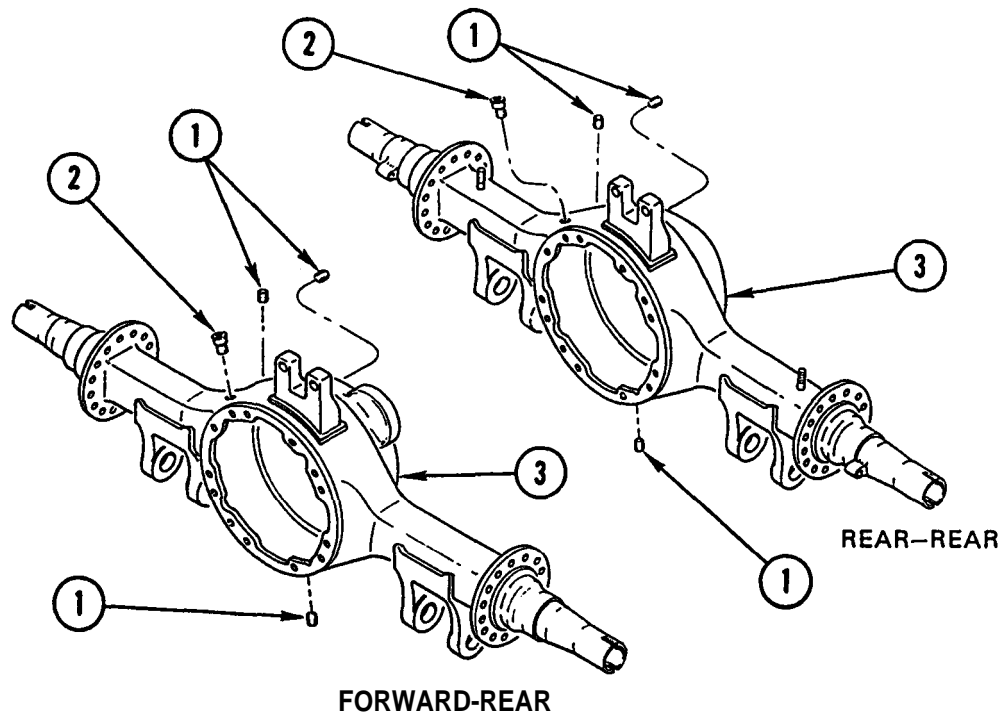
Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.

### REPAIR

Use general repair methods to repair damaged parts (page 2-33).



**ASSEMBLY**

**NOTE**

Procedure is the same for all rear axles.

INSTALL THREE PLUGS (1) AND BREATHER (2) IN AXLE HOUSING (3).

**NOTE**

Follow-on Maintenance:  
Install rear axle (page 6-16 or 6-22)



# CHAPTER 18

## BRAKE SYSTEM AND WHEELS REPAIR INSTRUCTIONS

### OVERVIEW

This chapter illustrates and describes procedures for repair of brake system and wheel components.

	Page
Brake Drum Repair .....	18-2
Foot Brake Valve Repair .....	18-4
Air Dryer Repair (M917A1 and M917A1 w/MCS) .....	18-9

---

## BRAKE DRUM REPAIR

---

This task covers: Repair

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Cloth, Abrasive                      Appendix B, Item 10

#### References:

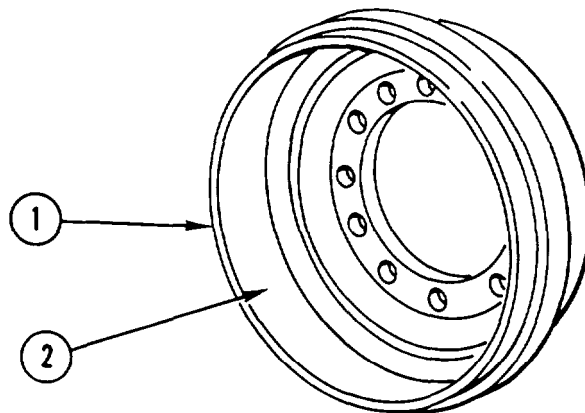
TM 9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Brake Drum Removed

---

### REPAIR



1. BRAKE DRUM (1) MUST BE ROUND WITHIN 0.003 IN. (0.076 mm). IF BRAKE DRUM IS OUT-OF-ROUND, MACHINE BRAKE DRUM. REFER TO TABLE BELOW FOR MACHINING SPECIFICATIONS.
2. CHECK BRAKE DRUM SURFACE (2) FOR CRACKS OR BADLY SCORED FINISH. IF BRAKE DRUM IS CRACKED OR SCORED, MACHINE BRAKE DRUM. REFER TO MACHINING SPECIFICATIONS ON FOLLOWING PAGE.
3. CHECK BRAKE DRUM SURFACE (2) FOR GLOSSY OR HEAT SPOTS. IF GLOSSY OR HEAT SPOTS ARE VISIBLE, CLEAN BRAKE DRUM SURFACE WITH EMERY CLOTH.
4. CHECK BRAKE DRUM (1) FOR EXTERNAL OR MATING SURFACE CRACKS, IF CRACKS ARE VISIBLE, BRAKE DRUM MUST BE REPLACED.
5. CHECK BRAKE DRUM (1) FOR BALANCING WEIGHT. IF BALANCING WEIGHT IS MISSING, BRAKE DRUM MUST BE REPLACED.



## MACHINING SPECIFICATIONS

**CAUTION**

Brake drum must be replaced if maximum diameter is exceeded to prevent damage to equipment

	Diameter (new)		Machine Brake Drum		Maximum Diameter	
	In.	(mm)	In.	(mm)	In.	(mm)
M915A2 (Front)	15.0	(381.0)	0.12	(4.00)	15.12	(384.00)
M915A2 (Rear)	16.5	(419.1)	0.12	(4.00)	16.62	(422.15)
M916A1 (Front)	16.5	(419.1)	0.12	(4.00)	16.62	(422.15)
M916A1 (Rear)	16.5	(419.1)	0.12	(4.00)	16.62	(422.15)
M916A2 (Front)	16.5	(419.1)	0.12	(4.00)	16.62	(422.15)
M916A2 (Rear)	16.5	(419.1)	0.12	(4.00)	16.62	(422.15)
M917A1/M917A1 w/MCS (Front)	16.5	(419.1)	0.12	(4.00)	16.62	(422.15)
M917A1/M917A1 w/MCS (Rear)	16.5	(419.1)	0.12	(4.00)	16.62	(422.15)

## FOOT BRAKE VALVE REPAIR

This Task Covers: a. Disassembly b. Cleaning/Inspection c. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N26

#### Materials/Parts:

Kit, Repair P/N 82TV196  
 Grease, Aircraft Appendix B, Item 25.1

#### References:

TM 9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Foot Brake Valve Removed

### DISASSEMBLY

#### NOTE

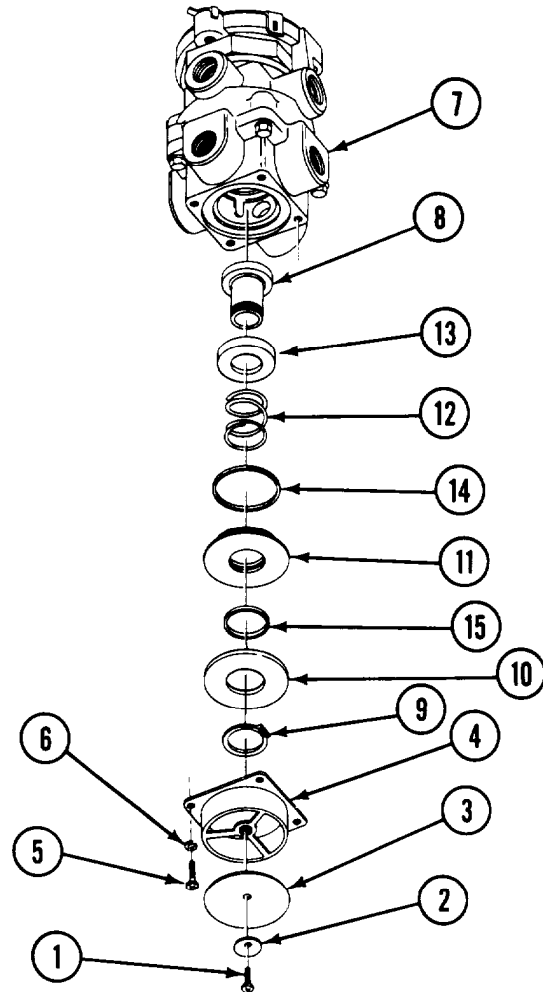
Discard all components of parts kit,

1. REMOVE SCREW (1), WASHER (2) AND DIAPHRAGM (3) FROM COVER (4).
2. REMOVE FOUR SCREWS (5) FOUR LOCK WASHERS (6) AND COVER (4) FROM LOWER BODY (7).
3. REMOVE VALVE (8) ASSEMBLY FROM LOWER BODY (7).

#### NOTE

Perform steps 4 and 5 to disassemble valve assembly.

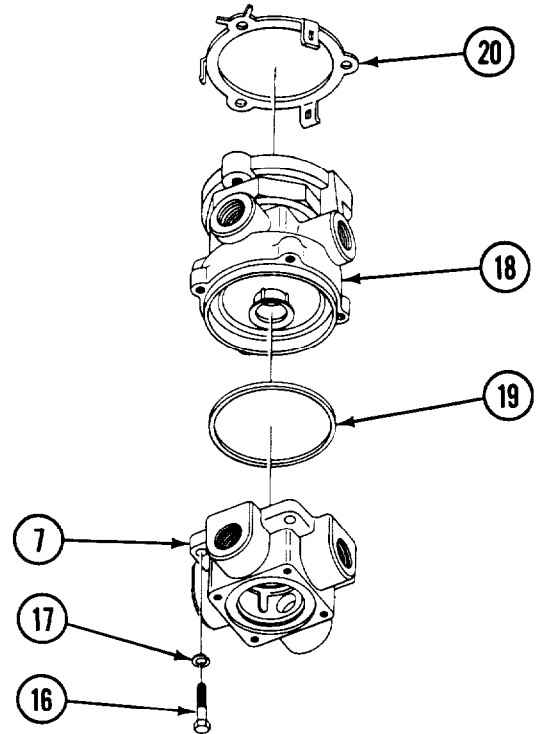
4. WHILE HOLDING VALVE (8) ASSEMBLY IN COLLAPSED POSITION, REMOVE RETAINING RING (9) FROM VALVE.
5. RELEASE WASHER (10) AND REMOVE WASHER, RETAINER (11), SPRING (12) AND SEAT (13) FROM VALVE (8). REMOVE TWO PREFORMED PACKINGS (14 AND 15) FROM RETAINER.



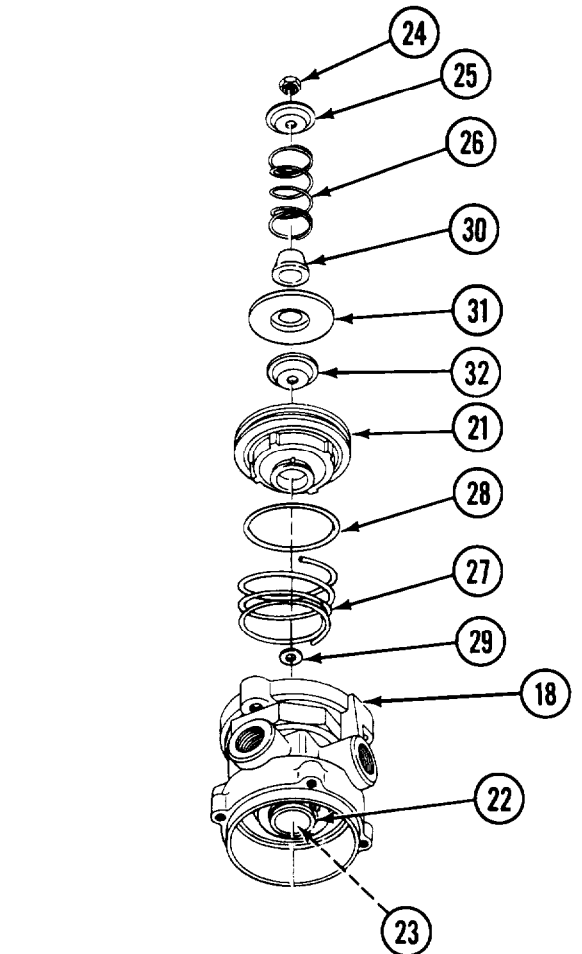
6. REMOVE FOUR SCREWS (16) LOCK WASHERS (17) AND LOWER BODY (7) FROM UPPER BODY (18). REMOVE PREFORMED PACKING (19) FROM LOWER BODY.
7. REMOVE PRIMARY PISTON RETAINER (20) FROM UPPER BODY (18).

**WARNING**

Internal components are under spring pressure. Use care when disassembling or assembling. Failure to hold components in position may result in injury to personnel.



8. WHILE HOLDING PRIMARY PISTON (21) AND PISTON (22) IN POSITION IN UPPER BODY (18) USE A SCREWDRIVER IN HEAD OF SCREW (23) TO PREVENT SCREW FROM TURNING.
9. REMOVE LOCK NUT (24), RETAINER (25) AND SPRING (26) FROM SCREW (23). REMOVE SCREWDRIVER AND GRADUALLY RELEASE PRIMARY PISTON (21) AND PISTON (22).
10. REMOVE PRIMARY PISTON (21) AND SPRING (27) FROM UPPER BODY (18). REMOVE PREFORMED PACKING (28) AND RUBBER WASHER (29) FROM PRIMARY PISTON.
11. REMOVE SLEEVE NUT (30), SPRING SEAT (31) AND RUBBER SPRING (32) FROM PRIMARY PISTON (21).



## FOOT BRAKE VALVE REPAIR (CONT)

- REMOVE SCREW (23) PISTON (22) SPRING (33) AND RETAINER (34) FROM UPPER BODY (18). REMOVE TWO PREFORMED PACKINGS (35 AND 36) FROM PISTON.

**NOTE**

Perform step 13 to remove valve assembly from upper body.

- REMOVE RETAINING RING (37) RETAINING CLIP (38) WASHER (39) RETAINER (40) PREFORMED PACKING (41) SPRING (42), SEAT (43) AND VALVE (44) FROM UPPER BODY (18).

**CLEANING/INSPECTION**

Clean and inspect all parts in accordance with Chapter 2.

**ASSEMBLY**

**NOTE**

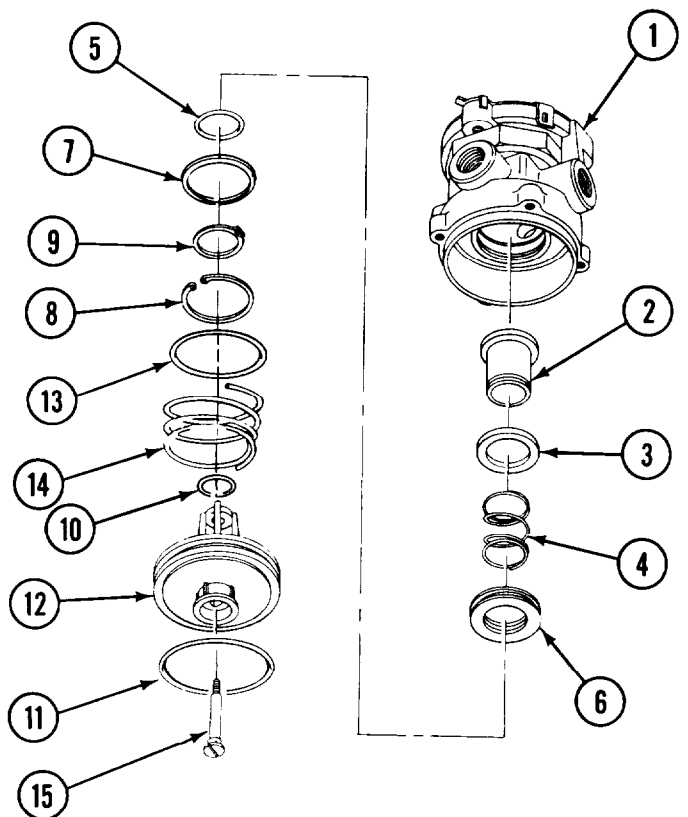
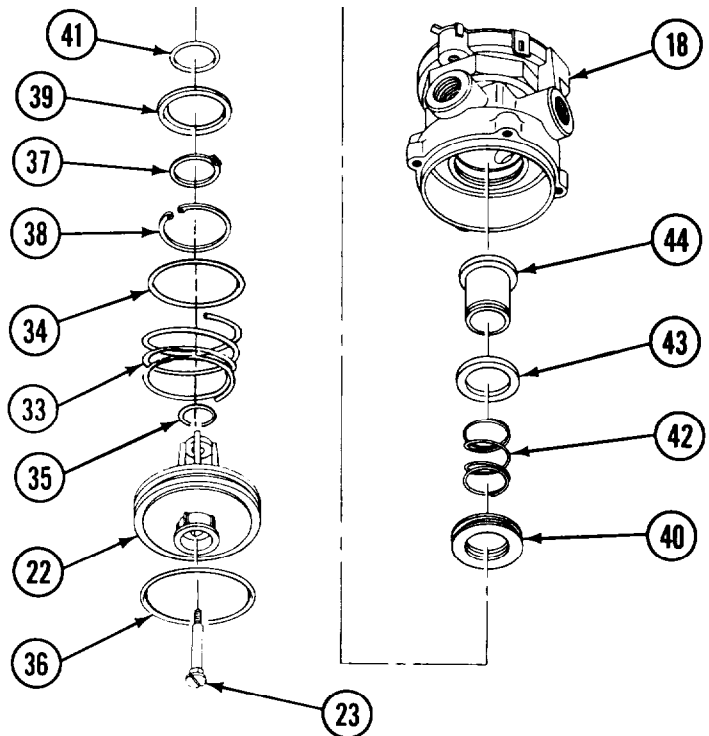
Install new kit parts on assembly.

- LIGHTLY APPLY GREASE TO SURFACES OF PREFORMED PACKINGS, PREFORMED PACKING GROOVES AND PISTON BORES OF UPPER BODY (1).

**NOTE**

Perform step 2 to install valve assembly to upper body.

- INSTALL VALVE (2) SEAT (3) SPRING (4), PREFORMED PACKING (5) RETAINER (6) WASHER (7) AND RETAINING CLIP (8) TO UPPER BODY (1) WITH RETAINING RING (9).
- INSTALL TWO PREFORMED PACKINGS (10 AND 11) TO PISTON (12) AND INSTALL RETAINER (13) SPRING (14), PISTON (12) AND SCREW (15) TO UPPER BODY (1).



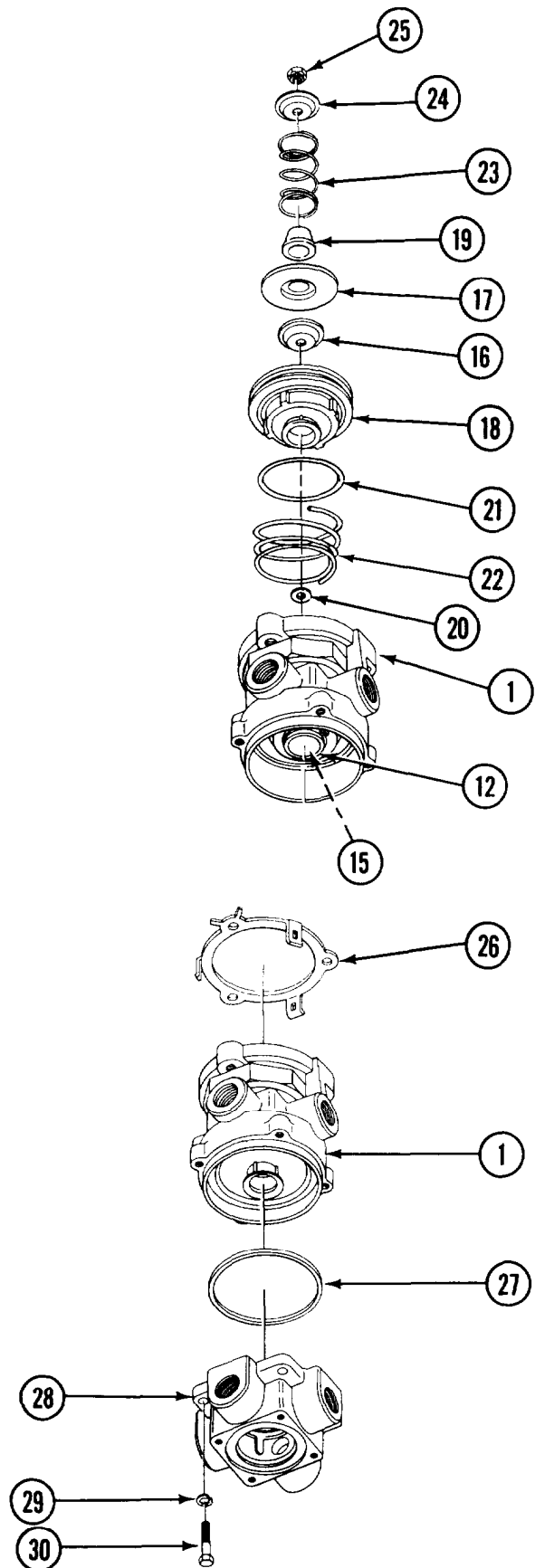
4. INSTALL RUBBER SPRING (16) AND SPRING SEAT (17) TO PRIMARY PISTON (18) WITH SLEEVE NUT (19).
5. INSTALL RUBBER WASHER (20) AND PREFORMED PACKING (21) TO PRIMARY PISTON (18) AND INSTALL SPRING (22) AND PRIMARY PISTON TO UPPER BODY (1).

**WARNING**

Internal components are under spring pressure. Use care when disassembling or assembling. Failure to hold components in position may result in injury to personnel.

6. WHILE HOLDING PRIMARY PISTON (18) AND PISTON (12) COMPRESSED, AND USING A SCREWDRIVER TO PREVENT SCREW (15) FROM TURNING, INSTALL SPRING (23) AND RETAINER (24) TO SCREW WITH LOCK NUT (25).

7. INSTALL PRIMARY PISTON RETAINER (26) TO UPPER BODY (1).
8. INSTALL PREFORMED PACKING (27) TO LOWER BODY (28) AND INSTALL LOWER BODY TO UPPER BODY (1) WITH FOUR LOCK WASHERS (29) AND SCREWS (30).

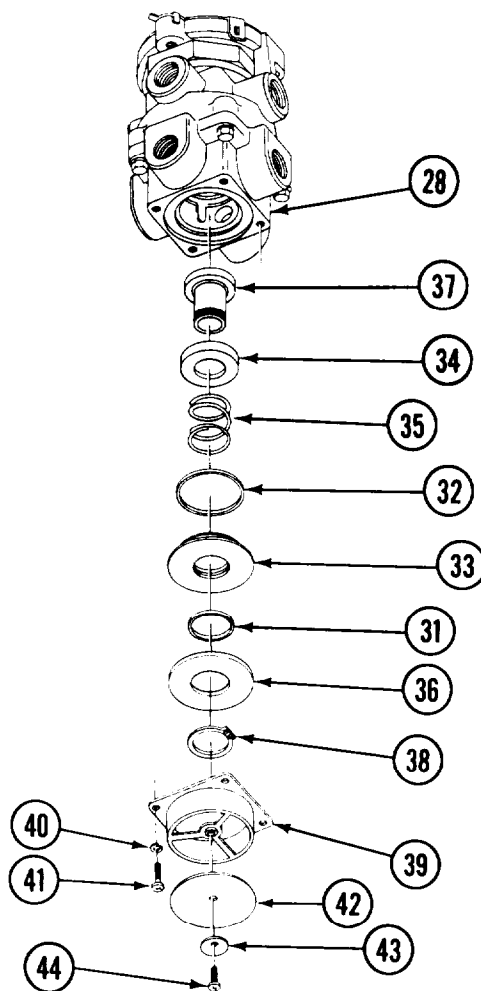


## FOOT BRAKE VALVE REPAIR (CONT)

### NOTE

Perform step 9 to assemble valve assembly.

9. INSTALL TWO PREFORMED PACKINGS (31 AND 32) TO RETAINER (33) AND INSTALL SEAT (34), SPRING (35), RETAINER, AND WASHER (36) TO VALVE (37) WITH RETAINING RING (38).
10. INSTALL VALVE (37) ASSEMBLY TO LOWER BODY (28).
11. INSTALL COVER (39) TO LOWER BODY (28) WITH FOUR LOCK WASHERS (40) AND FOUR SCREWS (41).
12. INSTALL DIAPHRAGM (42) TO COVER (39) WITH WASHER (43) AND SCREW (44).



### NOTE

Follow-on Maintenance:

Install foot brake valve (TM 9-2320-363-20).

## AIR DRYER REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

### INITIAL SETUP

#### Applicable Configuration:

M917A1 and M917A1 w/MCS

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05  
Strap Wrench

#### Materials/Parts:

Desiccant Cartridge (2)	P/NR950011
Orifice Set (2)	P/N R955049
Seal and Spring Set	P/NR955041
Charging Valve Set	P/N R955053
Solenoid Parts Set	P/N R955046
Seal and Spring Set	P/N R955043
Heater Parts Set	P/N R950016
Outlet Check Valve	P/N R955048

#### Materials/Parts (Cont):

Purge Valve Set	P/N R950014
Hard Parts Set	P/N R955042
Parts Set	P/N R955044
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26

#### References:

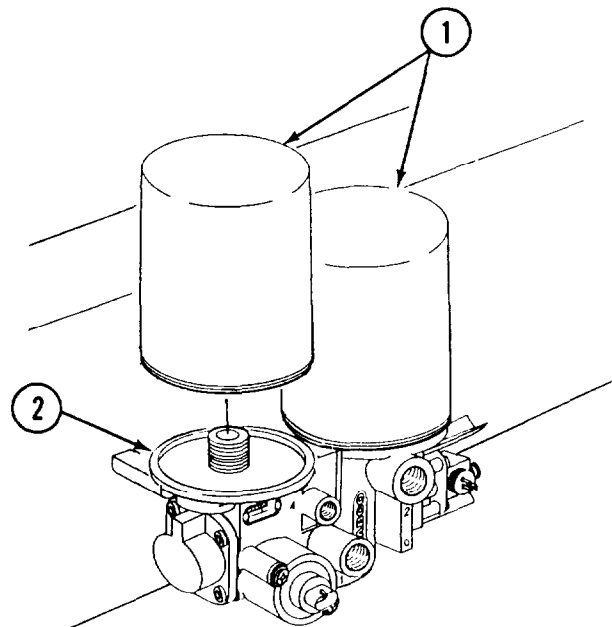
TM 9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Air Dryer Removed

### DISASSEMBLY

1. USING STRAP WRENCH, REMOVE TWO AIR DRYER DESICCANT CARTRIDGES (1) FROM TOP OF AIR DRYER HOUSING (2). DISCARD CARTRIDGES.

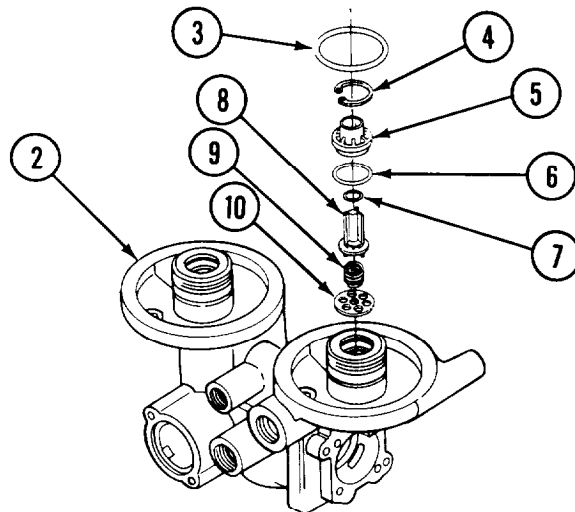


## AIR DRYER REPAIR (CONT)

### NOTE

Perform steps 2 and 3 to remove each of two orifice sets.

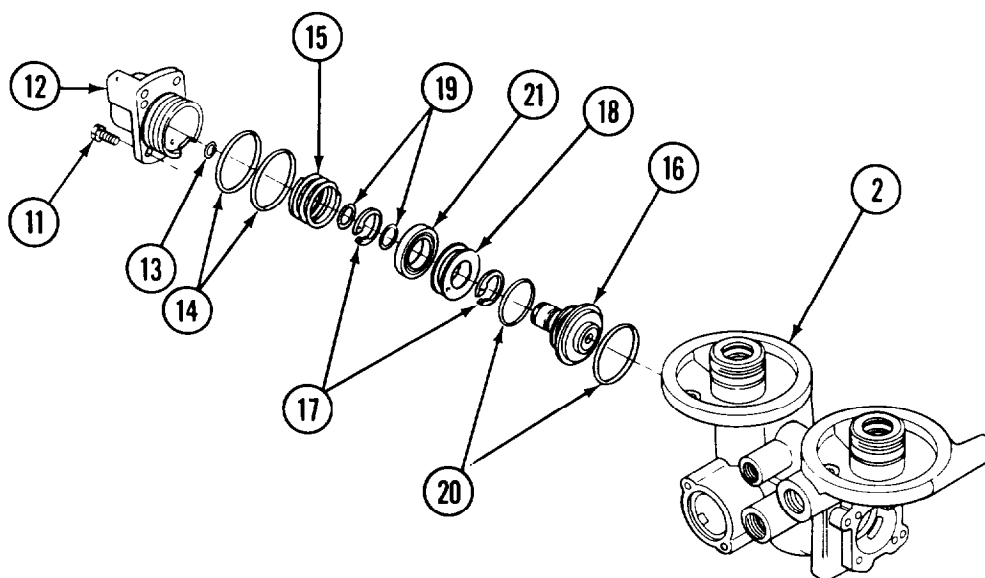
2. REMOVE LARGE PACKING (3) SNAP RING (4), ORIFICE (5), MEDIUM PACKING (6) AND SMALL PACKING (7) FROM AIR DRYER HOUSING (2). DISCARD PACKINGS.
3. REMOVE CHECK VALVE (8) SPRING (9) AND PERFORATED WASHER (10).



### NOTE

Perform steps 4 thru 8 to remove left piston seal and spring set.

4. REMOVE FOUR SCREWS (11) AND COVER (12) FROM AIR DRYER HOUSING (2).
5. REMOVE SMALL PACKING (13) AND TWO LARGE PACKINGS (14) FROM COVER (12). DISCARD PACKINGS.
6. REMOVE SPRING (15) AND PISTON (16) ASSEMBLY FROM AIR DRYER HOUSING (2).
7. REMOVE TWO SNAP RINGS (17) SPOOL (18) ASSEMBLY, TWO SMALL PACKINGS (19) AND TWO LARGE PACKINGS (20) FROM PISTON (16). DISCARD PACKINGS.
8. REMOVE LIP SEAL (21) FROM SPOOL (18). DISCARD LIP SEAL.

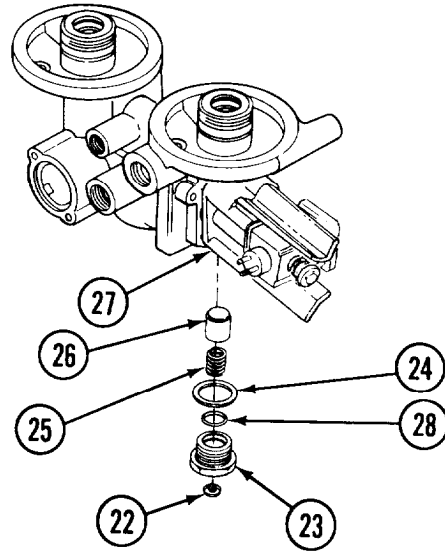




**NOTE**

Perform steps 9 thru 11 to remove charging valve set.

9. REMOVE PLUG (22) FROM NUT (23).
10. REMOVE NUT (23) WASHER (24), SPRING (25) AND PISTON (26) FROM COVER (27).
11. REMOVE PACKING (28) FROM NUT (23). DISCARD PACKING.



**NOTE**

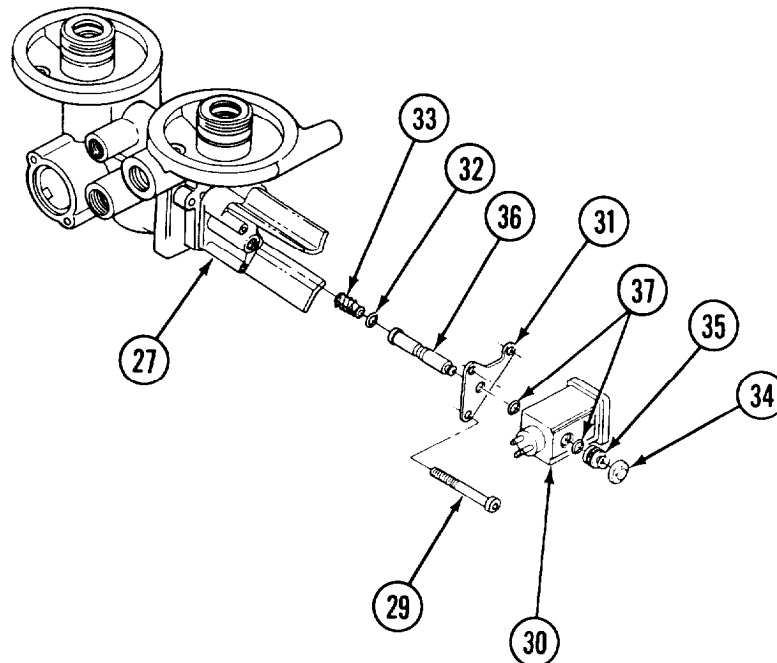
Perform steps 12 thru 15 to remove solenoid parts set.

12. REMOVE FOUR SCREWS (29) SOLENOID (30) AND MOUNTING PLATE (31) FROM COVER (27).

**NOTE**

Note position of armature for assembly.

13. REMOVE PACKING (32) AND ARMATURE AND SPRING (33) FROM COVER (27). DISCARD PACKING.
14. REMOVE BREATHER (34) NUT (35) AND SOLENOID SLEEVE (36) FROM SOLENOID (30).
15. REMOVE TWO PACKINGS (37) FROM SOLENOID (30). DISCARD PACKINGS.



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## AIR DRYER REPAIR (CONT)

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**NOTE**

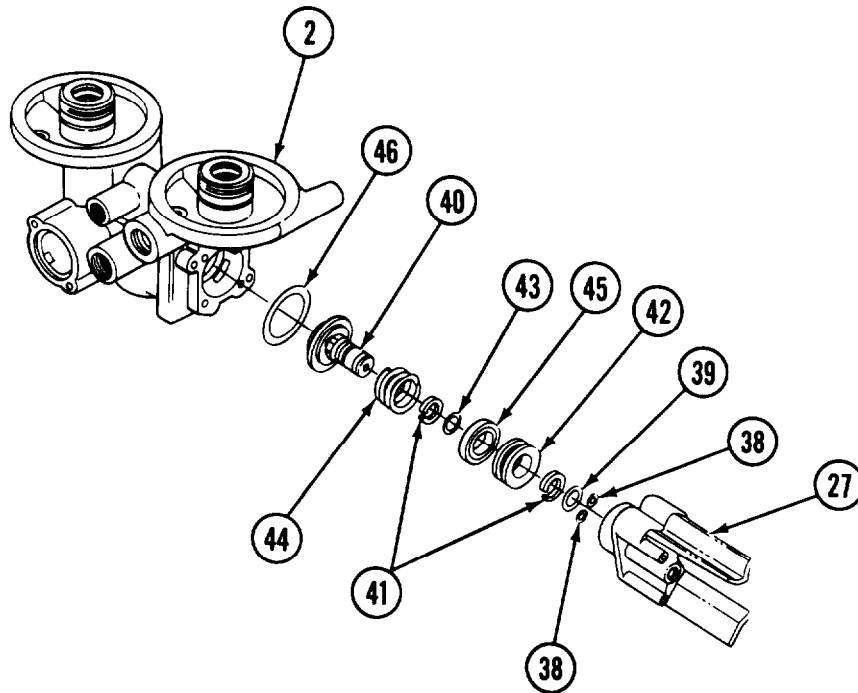
Perform steps 16 thru 21 to remove right piston seal and spring set.

16. REMOVE COVER (27) FROM AIR DRYER HOUSING (2).
17. REMOVE TWO SMALL PACKINGS (38) AND LARGE PACKING (39) FROM COVER (27). DISCARD PACKINGS.
18. REMOVE PISTON (40) ASSEMBLY FROM AIR DRYER HOUSING (2).
19. REMOVE TWO SNAP RINGS (41) SPOOL (42) ASSEMBLY, PACKING (43) AND SPRING (44) FROM PISTON (40). DISCARD PACKING.

**NOTE**

Note position of lip seal for assembly.

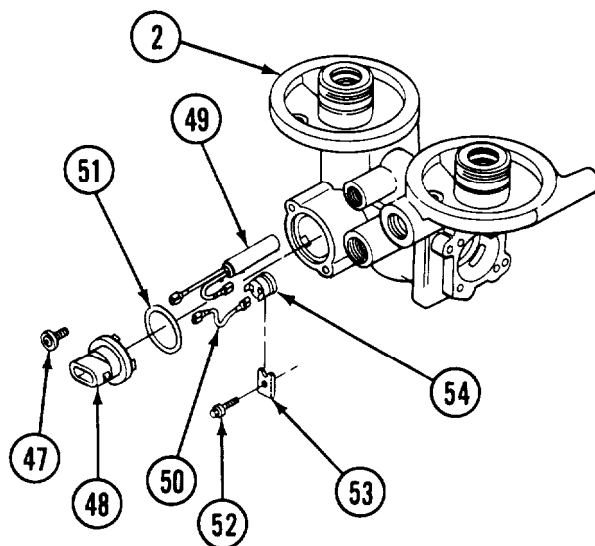
20. REMOVE LIP SEAL (45) FROM SPOOL (42). DISCARD LIP SEAL.
21. REMOVE LARGE PACKING (46) FROM PISTON (40). DISCARD PACKING.



**NOTE**

Perform steps 22 thru 25 to remove heater parts set.

22. REMOVE TWO SCREWS (47) AND PULL CONNECTOR (48) OUTWARD ENOUGH TO DISCONNECT HEATER (49) AND WIRE (50) FROM CONNECTOR.
23. REMOVE PACKING (51) FROM CONNECTOR (48). DISCARD PACKING.
24. REMOVE SCREW (52) FROM THERMOSTAT RETAINER (53) AND REMOVE WIRE (50), THERMOSTAT (54), THERMOSTAT RETAINER, AND HEATER (49) FROM AIR DRYER HOUSING (2).
25. DISCONNECT THERMOSTAT (54) FROM WIRE (50) AND HEATER (49).



**NOTE**

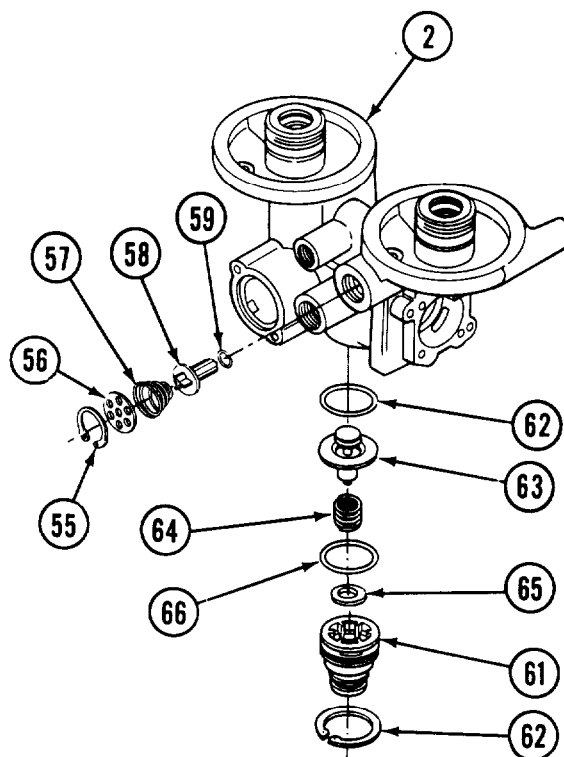
Perform steps 26 and 27 to remove outlet check valve.

26. REMOVE SNAP RING (55), PERFORATED WASHER (56), SPRING (57), AND CHECK VALVE (58) FROM AIR DRYER HOUSING (2).
27. REMOVE PACKING (59) FROM CHECK VALVE (58). DISCARD PACKING.

**NOTE**

Perform steps 28 and 29 to remove purge valve set.

28. REMOVE SNAP RING (60), PURGE VALVE (61) ASSEMBLY AND PACKING (62) FROM AIR DRYER HOUSING (2). DISCARD PACKING.
29. REMOVE PISTON ASSEMBLY (63), SPRING (64), SHIM (65) (IF EQUIPPED) AND PACKING (66) FROM PURGE VALVE (61). DISCARD PACKING.



## AIR DRYER REPAIR (CONT)

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

1. INSPECT VALVES AND PISTONS FOR WEAR OR DAMAGE.
2. INSPECT BORES AND SURFACES OF AIR DRYER HOUSING FOR DAMAGE.

### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

### ASSEMBLY

#### NOTE

Lubricate all preformed packings and seals with grease prior to installing.

#### NOTE

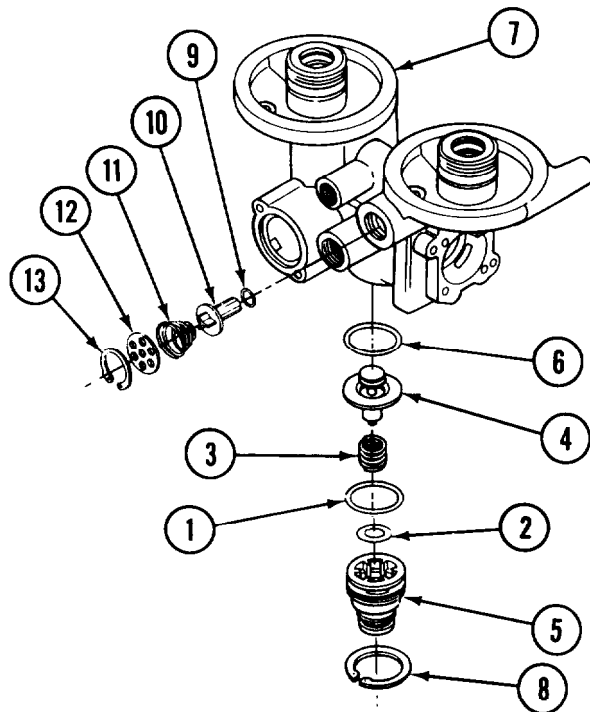
Perform steps 1 and 2 to install purge valve set.

1. INSTALL NEW PACKING (1) SHIM (2) (IF EQUIPPED), SPRING (3), AND PISTON ASSEMBLY (4) TO PURGE VALVE (5).
2. INSTALL NEW PACKING (6) AND PURGE VALVE (5) ASSEMBLY TO AIR DRYER HOUSING (7) WITH SNAP RING (8).

#### NOTE

Perform steps 3 and 4 to install outlet check valve.

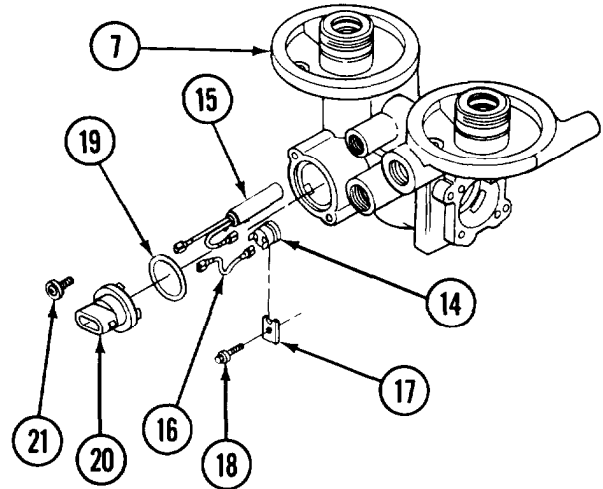
3. INSTALL NEW PACKING (9) TO CHECK VALVE (10).
4. INSTALL CHECK VALVE (10), SPRING (11), AND PERFORATED WASHER (12) TO AIR DRYER HOUSING (7) WITH SNAP RING (13).



**NOTE**

Perform steps 5 thru 8 to install heater parts set.

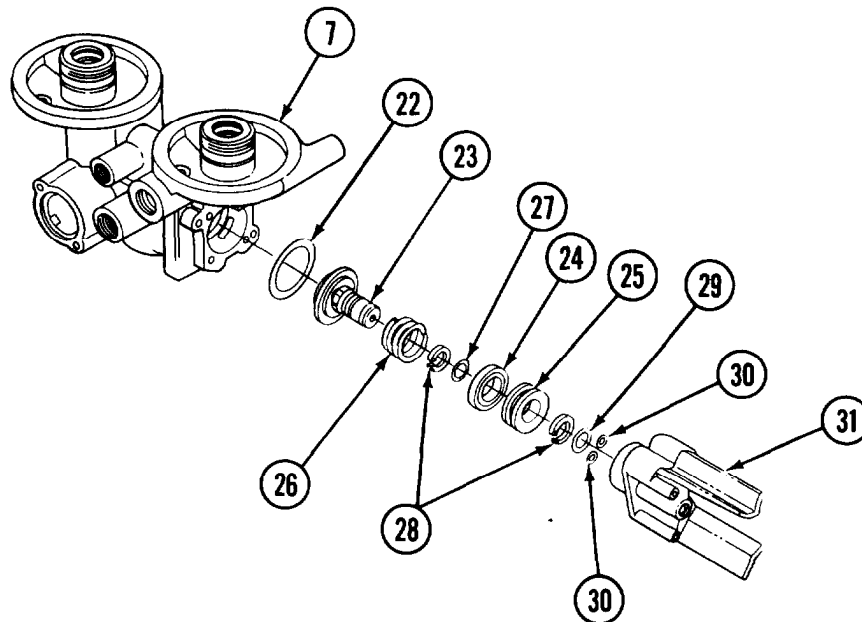
5. CONNECT THERMOSTAT (14) TO HEATER (15) AND WIRE (16).
6. INSTALL HEATER (15) THERMOSTAT (14) AND WIRE (16) INTO AIR DRYER HOUSING (7). SECURE THERMOSTAT WITH THERMOSTAT RETAINER (17) AND SCREW (18).
7. INSTALL NEW PACKING (19) TO CONNECTOR (20).
8. CONNECT WIRE (16) AND HEATER (15) TO CONNECTOR (20) AND INSTALL CONNECTOR WITH TWO SCREWS (21).



**NOTE**

Perform steps 9 thru 14 to install right piston seal and spring set.

9. INSTALL NEW LARGE PACKING (22) TO PISTON (23).
10. INSTALL NEW LIP SEAL (24) TO SPOOL (25).
11. INSTALL SPRING (26) NEW PACKING (27) AND SPOOL (25) ASSEMBLY TO PISTON (23) WITH TWO SNAP RINGS (28).
12. INSTALL PISTON (23) ASSEMBLY TO AIR DRYER HOUSING (7).
13. INSTALL NEW LARGE PACKING (29) AND TWO NEW SMALL PACKINGS (30) TO COVER (31).
14. POSITION COVER (31) TO AIR DRYER HOUSING (7).

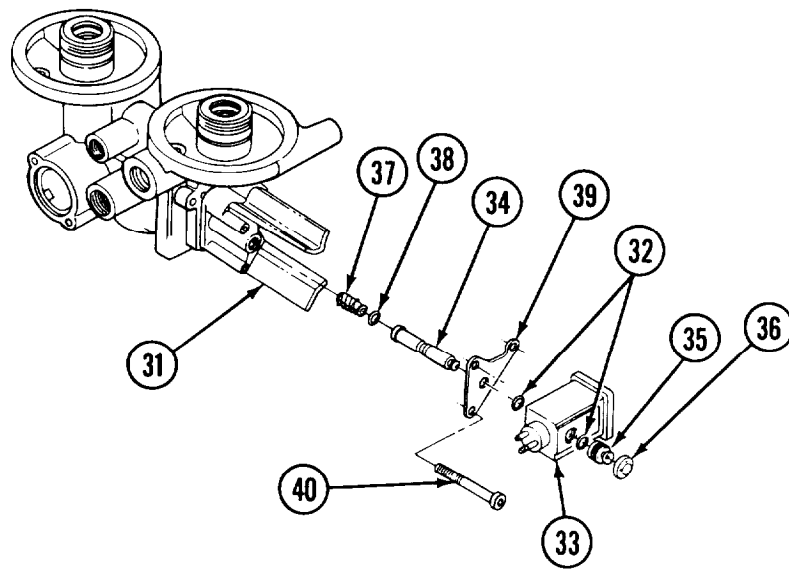


## AIR DRYER REPAIR (CONT)

### NOTE

Perform steps 15 thru 18 to install solenoid parts set.

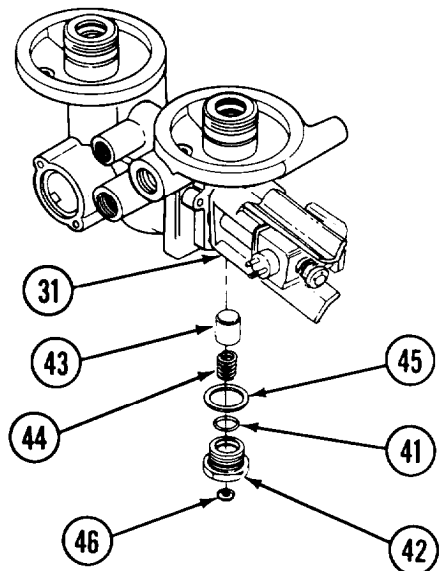
15. INSTALL TWO NEW PACKINGS (32) TO SOLENOID (33).
16. INSTALL SOLENOID SLEEVE (34), NUT (35) AND BREATHER (36).
17. INSTALL ARMATURE AND SPRING ASSEMBLY (37) AND NEW PACKING (38) TO COVER (31).
18. INSTALL MOUNTING PLATE (39) AND SOLENOID (33) ASSEMBLY TO COVER (31) WITH FOUR SCREWS (40).



### NOTE

Perform steps 19 thru 21 to install charging valve set.

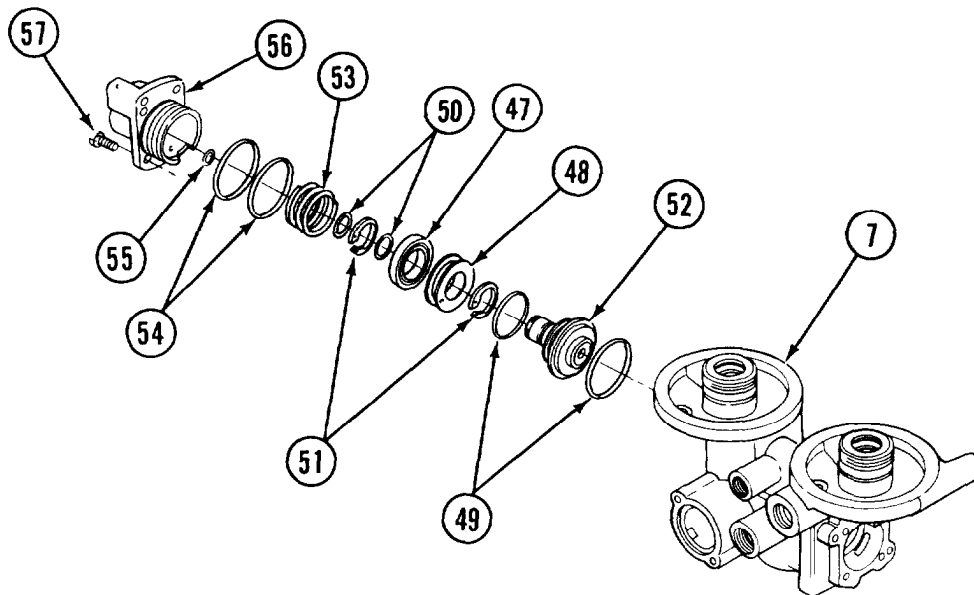
19. INSTALL NEW PACKING (41) TO NUT (42).
20. INSTALL PISTON (43) SPRING (44) WASHER (45) AND NUT (42) TO COVER (31).
21. INSTALL PLUG (46) TO NUT (42).



**NOTE**

Perform steps 22 thru 26 to install left piston seal and spring set.

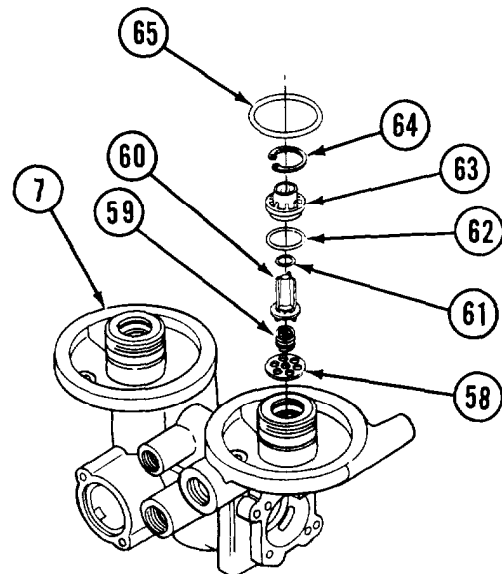
22. INSTALL NEW LIP SEAL (47) TO SPOOL (48).
23. INSTALL TWO NEW LARGE PACKINGS (49), TWO NEW SMALL PACKINGS (50), SPOOL (48). AND TWO SNAP RINGS (51) TO PISTON (52).
24. INSTALL PISTON (52) AND SPRING (53) TO AIR DRYER HOUSING (7).
25. INSTALL TWO NEW LARGE PACKINGS (54) AND SMALL PACKING (55) TO COVER (56).
26. INSTALL COVER (56) TO AIR DRYER HOUSING (7) WITH FOUR SCREWS (57).



**NOTE**

Perform steps 27 and 28 to install each of two orifice sets.

27. INSTALL PERFORATED WASHER (58), SPRING (59) AND CHECK VALVE (60) TO AIR DRYER HOUSING (7).
28. INSTALL NEW SMALL PACKING (61), NEW MEDIUM PACKING (62), ORIFICE (63), SNAP RING (64), AND NEW LARGE PACKING (65).



## AIR DRYER REPAIR (CONT)

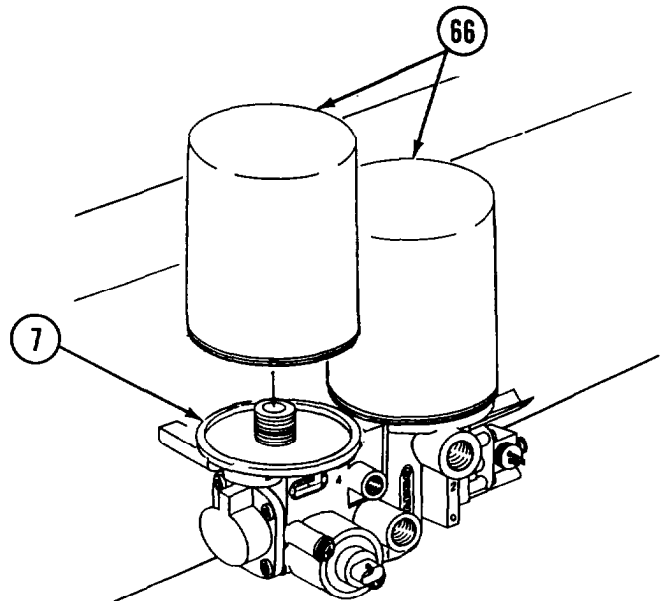
29. APPLY GREASE TO SEALING SURFACES AND TO PREFORMED PACKING ON DESICCANT CARTRIDGES (66).

INSTALL TWO NEW AIR DRYER DESICCANT CARTRIDGES (66) TO AIR DRYER HOUSING (7) AND HAND TIGHTEN UNTIL EACH CARTRIDGE CONTACTS TOP OF AIR DRYER.

### CAUTION

Over tightening of desiccant cartridges may damage cartridges.

31. USING STRAP WRENCH, TIGHTEN EACH DESICCANT CARTRIDGE (66) AN ADDITIONAL ONE-HALF TURN.



### NOTE

Follow-on Maintenance:  
Install air dryer (TM 9-2320-363-20).



# CHAPTER 19 STEERING REPAIR INSTRUCTIONS

## OVERVIEW

This chapter illustrates and describes procedures for maintenance of the steering and related parts.

	Page
Section I. Power Steering Pump Repair . . . . .	19-2
Section II. Steering Gear Repair . . . . .	19-8

## Section I. POWER STEERING PUMP REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the power steering pump and related parts.

### POWER STEERING PUMP REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Packing	P/N 230514-401003
Kit, Service	P/N ERS-28000
Kit, Service	P/N ERS-28310
Oil, Lubricating	Appendix B, Item 37

#### Equipment Condition:

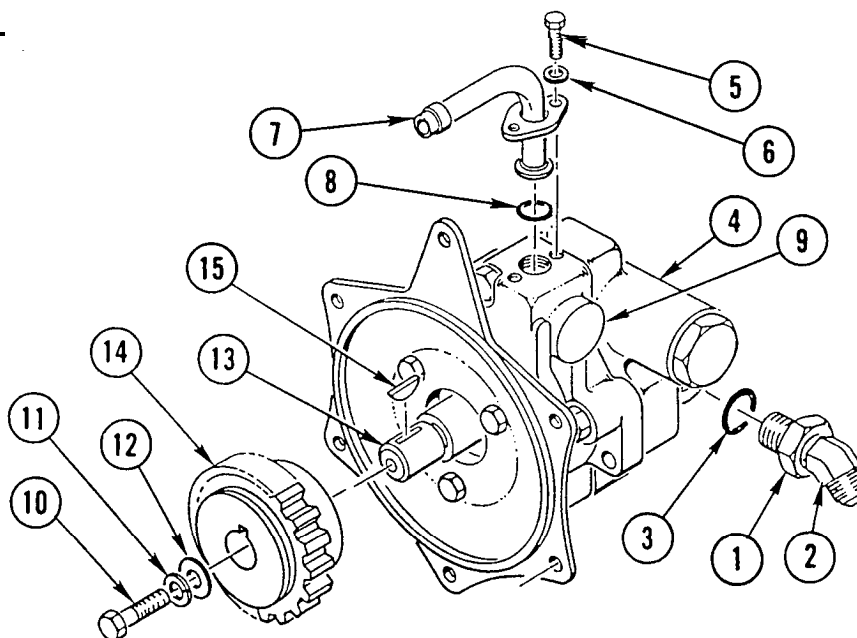
Reference

Page 7-2

#### Condition Description

Power Steering Pump  
Removed

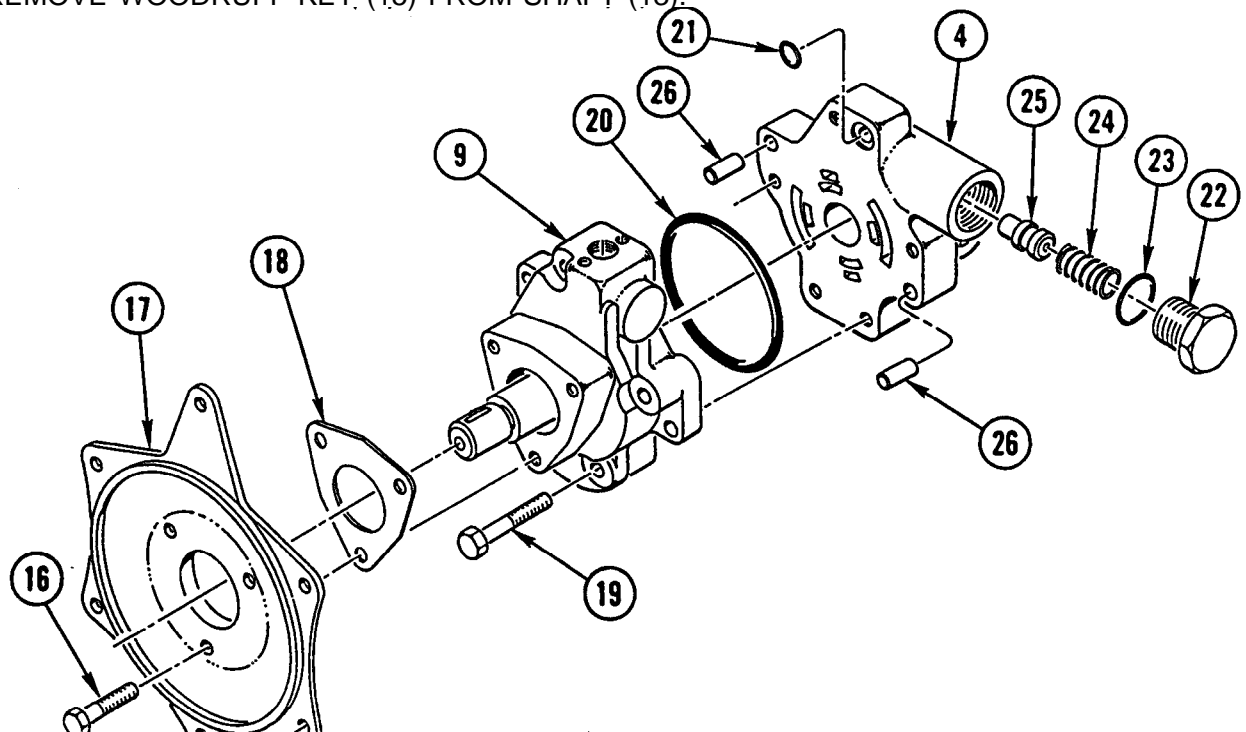
### DISASSEMBLY



**NOTE**

Note position of elbow and tube prior to removal to aid in installation.

1. LOOSEN JAM NUT (1) AND REMOVE ELBOW (2) AND PACKING (3) FROM COVER (4). DISCARD PACKING.
2. REMOVE TWO BOLTS (5), TWO LOCK WASHERS (6), TUBE (7), AND GASKET (8) FROM BODY (9). DISCARD GASKET, BOLTS, AND LOCK WASHERS.
3. REMOVE SCREW (10), LOCK WASHER (11), AND WASHER (12) FROM SHAFT (13). DISCARD LOCK WASHER.
4. REMOVE GEAR (14) FROM SHAFT (13).
5. REMOVE WOODRUFF KEY (15) FROM SHAFT (13).



**NOTE**

Note position of flange prior to removal to aid in installation.

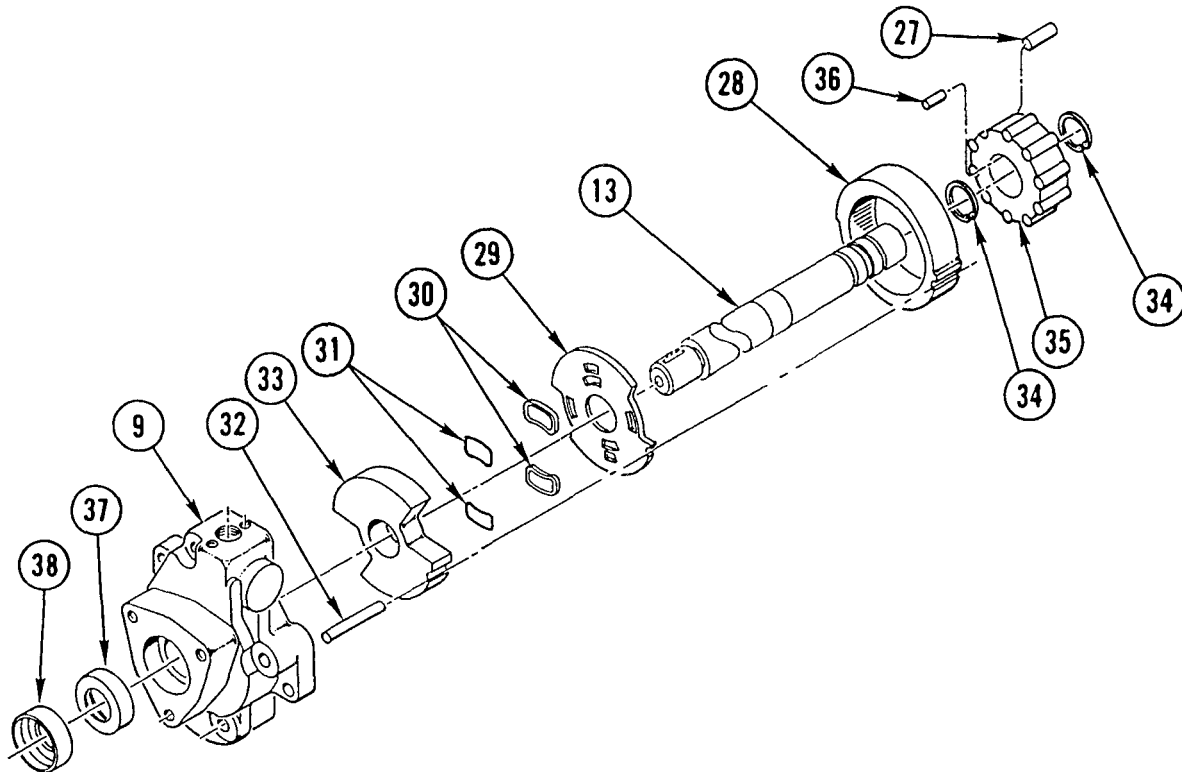
6. REMOVE THREE SCREWS (16), FLANGE (17), AND GASKET (18) FROM BODY (9). DISCARD GASKET.
7. REMOVE FIVE SCREWS (19) AND COVER (4) FROM BODY (9).
8. REMOVE AND DISCARD LARGE PACKING (20) AND SMALL PACKING (21) FROM BODY (9).
9. REMOVE VALVE CAP (22), PACKING (23), SPRING (24), AND VALVE (25) FROM COVER (4). DISCARD PACKING.

**NOTE**

Perform step 10 only if pins are damaged.

10. REMOVE TWO PINS (26) FROM COVER (4).

## POWER STEERING PUMP REPAIR (CONT)



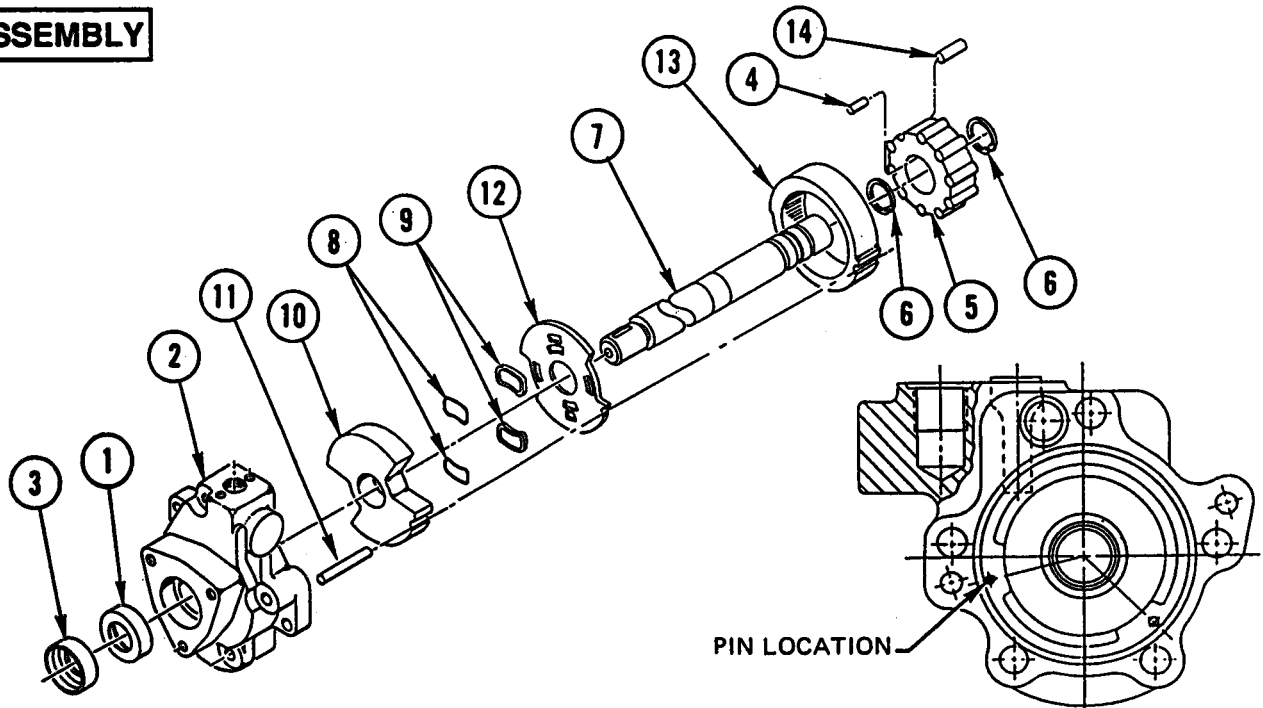
11. REMOVE SHAFT (13) FROM BODY (9).
12. REMOVE 10 ROLLERS (27), CAM (28), PORT PLATE (29), 2 SEALS (30), 2 O-RINGS (31), LOCATING PIN (32), AND END PLATE (33) FROM BODY (9). DISCARD ROLLERS, CAM, PORT PLATE, SEALS, O-RINGS, AND LOCATING PIN.
13. REMOVE TWO SNAP RINGS (34), CARRIER (35), AND DRIVE PIN (36) FROM SHAFT (13). DISCARD CARRIER AND DRIVE PIN.
14. REMOVE AND DISCARD TWO SEALS (37 AND 38) FROM BODY (9).

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

1. INSPECT BUSHINGS LOCATED IN COVER AND BODY FOR EXCESSIVE WEAR OF 0.0002 IN. (0.005 mm) ON FACE OR SCORING GREATER THAN 0.004 IN. (0.1 mm) DEEP. IF BUSHINGS ARE WORN, REPLACE SHAFT, COVER, AND BODY.
2. INSPECT VALVE BORE FOR WEAR CLEARANCE GREATER THAN 0.0015 IN. (0.03 mm). IF WORN, REPLACE COVER, VALVE, AND SPRING.
3. INSPECT ALL OTHER PARTS FOR WEAR OR DAMAGE.
4. IF PUMP HAS BEEN DISASSEMBLED BECAUSE OF HARD STEERING, AND NO OTHER PARTS SHOW ANY WEAR OR DAMAGE, REPLACE VALVE AND SPRING.

**ASSEMBLY****NOTE**

To aid in installation, coat all interior components with light coat of clean engine oil prior to installation.

1. INSTALL NEW SEAL (1) WITH LIP FACING BUSHING UNTIL SEAL (1) IS SEATED AGAINST INSIDE LIP OF BODY (2).
2. INSTALL NEW SEAL (3) WITH LIP FACING OUTWARD UNTIL SEAL (3) IS SEATED AGAINST SEAL (1).
3. INSTALL NEW DRIVE PIN (4), NEW CARRIER (5), AND TWO SNAP RINGS (6) ON SHAFT (7).
4. INSTALL TWO NEW O-RINGS (8) AND TWO NEW SEALS (9) IN END PLATE (10).
5. INSTALL END PLATE (10) IN BODY (2) WITH TWO SEALS (9) FACING UP.

**CAUTION**

Failure to install locating pin as shown will cause pump to operate in reverse, which could result in equipment damage.

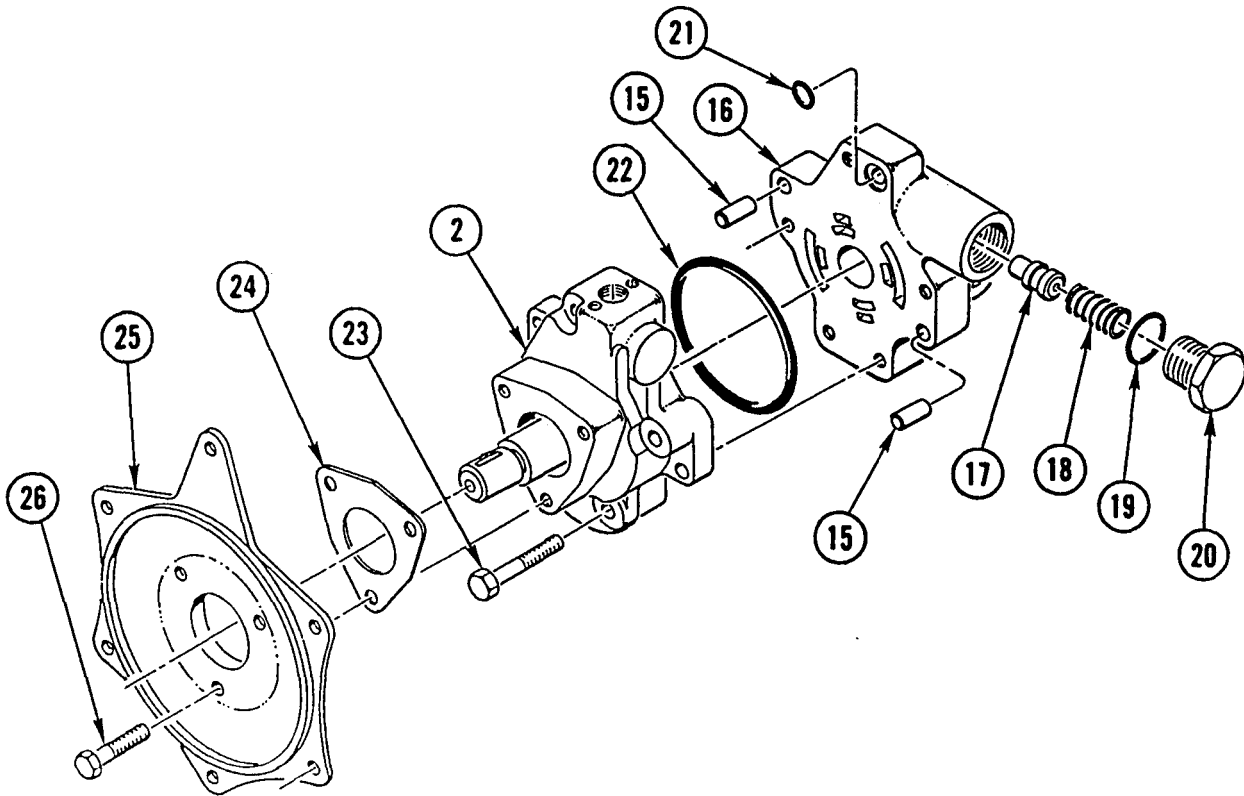
6. INSTALL NEW LOCATING PIN (11) IN LOWER LEFT HOLE OF END PLATE (10).

**NOTE**

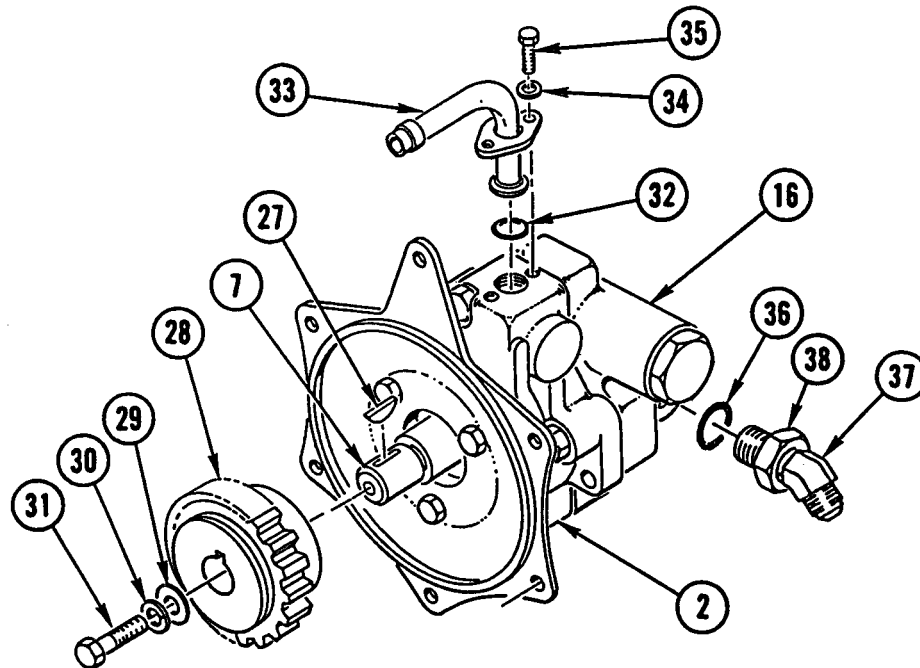
If seals can be seen, port plate must be reversed.

7. INSTALL NEW PORT PLATE (12) AND NEW CAM (13) WITH ARROW ON CAM (13) POINTING UP TOWARD LOCATING PIN (11).
8. INSTALL SHAFT (7) AND 10 NEW ROLLERS (14).

## POWER STEERING PUMP REPAIR (CONT)



9. IF REMOVED, INSTALL TWO NEW PINS (15) IN COVER (16).
10. INSTALL VALVE (17), SPRING (18), NEW PACKING (19), AND VALVE CAP (20).
11. INSTALL NEW SMALL PACKING (21) AND NEW LARGE PACKING (22) IN BODY (2).
12. INSTALL COVER (16) AND FIVE SCREWS (23) ON BODY (2).
13. INSTALL NEW GASKET (24) ON BODY (2).
14. INSTALL FLANGE (25) AS NOTED DURING REMOVAL STEP 6 AND INSTALL THREE SCREWS (26).



15. INSTALL WOODRUFF KEY (27) IN SHAFT (7).
16. INSTALL GEAR (28) ON SHAFT (7) UNTIL GEAR (28) BOTTOMS OUT.
17. INSTALL WASHER (29), NEW LOCK WASHER (30), AND SCREW (31) IN SHAFT (7).
18. INSTALL NEW GASKET (32), TUBE (33), TWO NEW LOCK WASHERS (34), AND TWO NEW BOLTS (35) ON BODY (2).
19. INSTALL NEW PACKING (36) AND ELBOW (37) ON COVER (16).
20. TIGHTEN JAM NUT (38).

**NOTE**

Follow-on Maintenance:  
Install power steering pump (page 7-2).

## Section II. STEERING GEAR REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the steering gear and related parts.

	Page
Steering Gear Repair . . . . .	19-6

### STEERING GEAR REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

#### INITIAL SETUP

##### Tools and Special Equipment:

- Shop Equipment, SC 4910-95-CL-A31
- Tool Kit, SC 5180-90-CL-N05
- Torx Socket, XE-16
- Spanner Wrench, J37070
- Spanner Wrench, J37464
- Trunnion Installer, J37071
- Drive Handle, J8092
- Input Seal Installer, J37073

##### Materials/Parts:

Kit, Seal	P/N TAS650003
Bearing, Roller	P/N 071020
Screw, Adjusting	P/N 021200
Retainer	PIN 062005
Fitting, Grease	P/N 037027
Grease, Automotive and Artillery (GAA)	Appendix B, Item 26
Oil, Lubricating	Appendix B, Item 37
Tape, Masking	Appendix B, Item 58
Cloth, Abrasive	Appendix B, Item 10

##### Equipment Condition:

Reference	Condition Description
Page 7-4	Steering Gear Removed

##### General Safety Instructions:

**WARNING**

- Spilled hydraulic fluid is very slippery. Wipe up any spilled fluid immediately. Failure to do so could result in serious injury to personnel.
- Do not allow valve housing to contact poppet. Such contact could cause steering problems or loss of steering resulting in possible injury to personnel.
- Do not force guide halves into place. Force may damage guide halves, which could cause loss of steering resulting in possible injury to personnel.
- Guide halves must be held in place during installation of balls. Failure to do so will result in balls being trapped outside closed ball track, causing steering lockup and possible injury to personnel.
- Failure to install all 32 balls in guide halves will cause steering problems, resulting in possible injury to personnel.

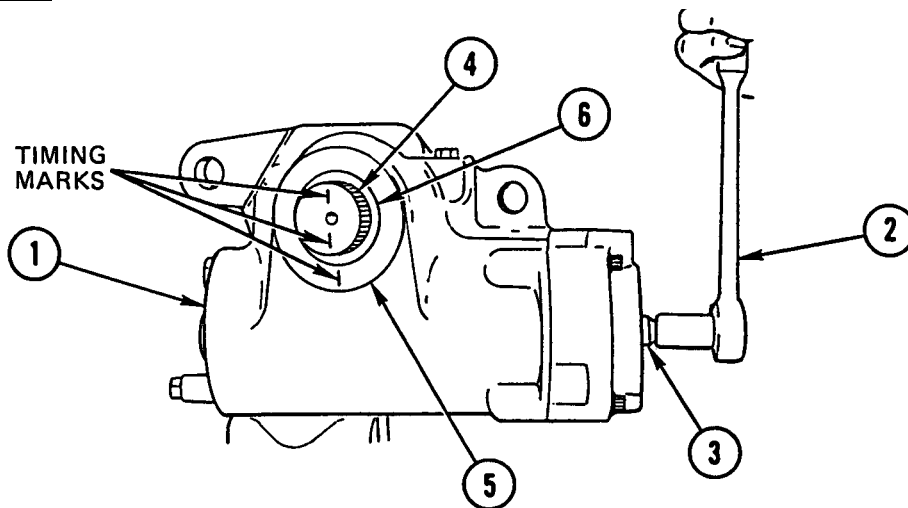


**General Safety Instructions (Cont):****WARNING**

- Do not allow valve housing to move more than 2.72 in. (69.1 mm) away from rack piston. If this occurs, balls will be out of place resulting in possible loss of steering and injury to personnel.
- Rack piston and sector shaft must be meshed correctly. Failure to do so will severely limit gear travel in one direction, resulting in possible injury to personnel.

**General Safety Instructions (Cont):****WARNING**

- Do not rotate input shaft more than 1-1/2 turns from center position. Doing so will incorrectly set poppets, causing steering problems resulting in possible injury to personnel.

**DISASSEMBLY**

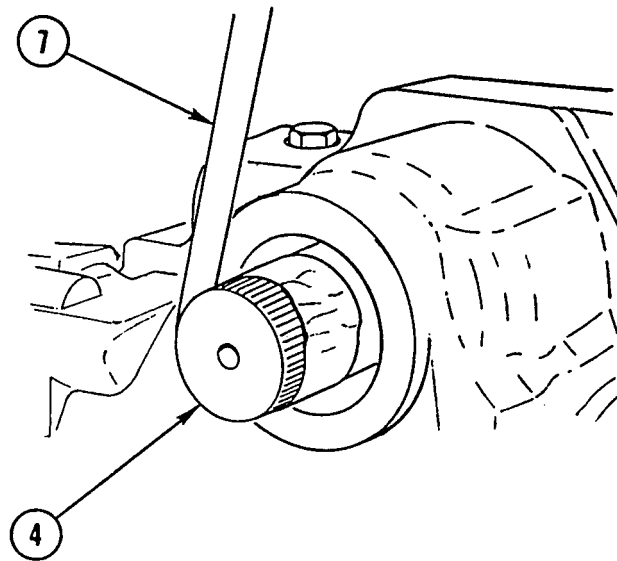
1. PLACE STEERING GEAR ASSEMBLY (1) IN SUITABLE VISE.

**WARNING**

Spilled hydraulic fluid is very slippery. Wipe up any spilled fluid immediately. Failure to do so could result in serious injury to personnel.

2. USING 19 mm 12-POINT DEEP SOCKET (2), ROTATE INPUT SHAFT (3) UNTIL TIMING MARKS ON SECTOR SHAFT (4) AND HOUSING (5) LINE UP.
3. REMOVE AND DISCARD SEAL (6) FROM HOUSING (5).
4. USING FINE EMERY CLOTH, REMOVE PAINT OR CORROSION FROM SECTOR SHAFT (4).

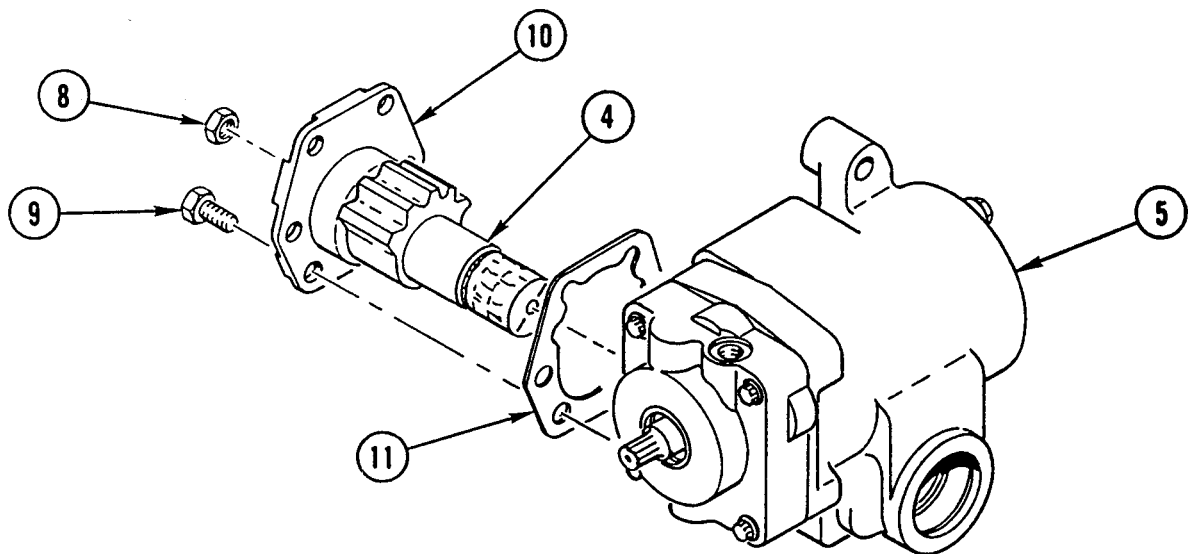
## STEERING GEAR REPAIR (CONT)



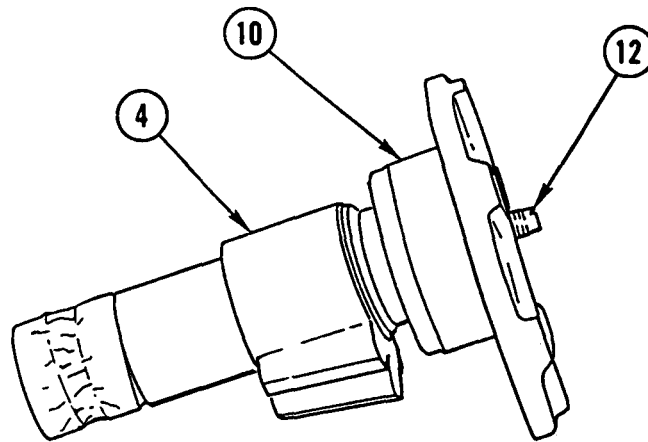
### NOTE

Masking tape should not contact bearing surface.

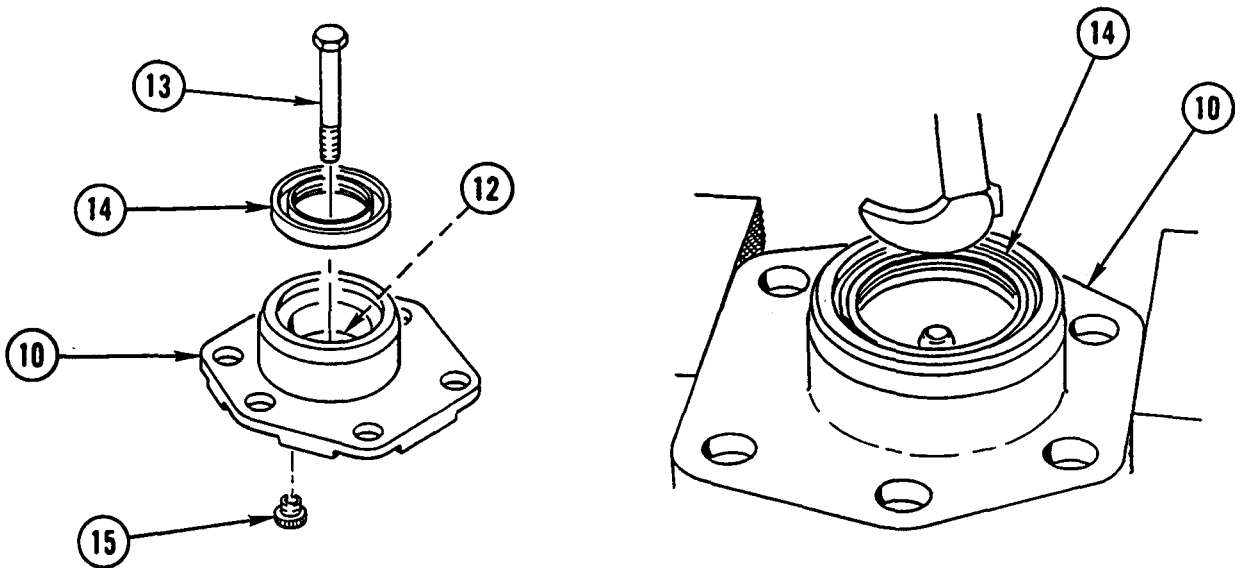
5. COVER SPLINED END OF SECTOR SHAFT (4) WITH ONE LAYER OF MASKING TAPE (7).



6. REMOVE NUT (8), SIX SCREWS (9), SIDE COVER (10), SECTOR SHAFT (4), AND GASKET (11) FROM HOUSING (5). DISCARD GASKET.



7. REMOVE SECTOR SHAFT (4) FROM SIDE COVER (10) BY TURNING ADJUSTING SCREW (12) CLOCKWISE.



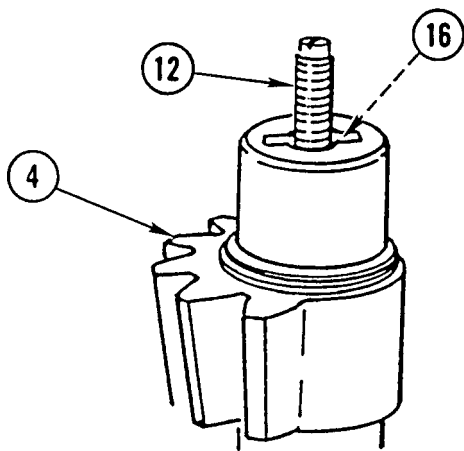
8. INSTALL 1/2-20 UNF 2 X 3 IN. SCREW (13) IN ADJUSTING SCREW (12) HOLE IN SIDE COVER (10).

**CAUTION**

Be careful when removing seal to prevent damage to side cover bushing. Suitable pry bar must be used.

9. REMOVE AND DISCARD SEAL (14) FROM SIDE COVER (10).
10. REMOVE VENT PLUG (15) FROM SIDE COVER (10).

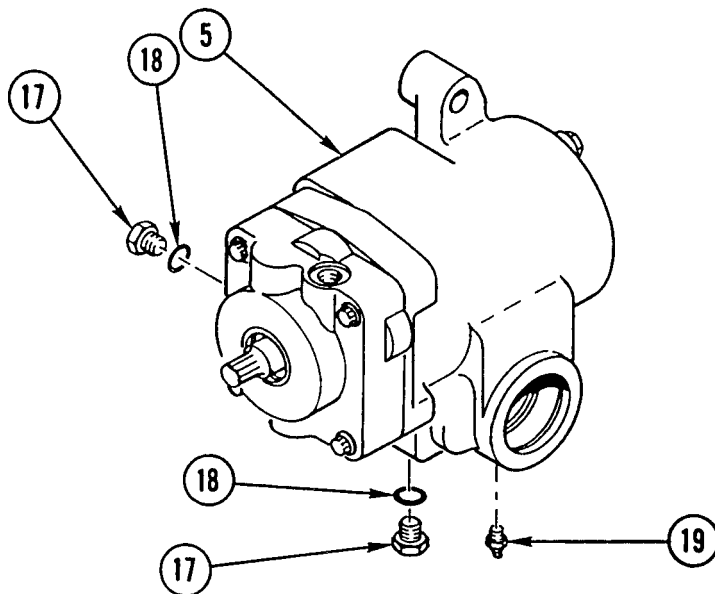
## STEERING GEAR REPAIR (CONT)



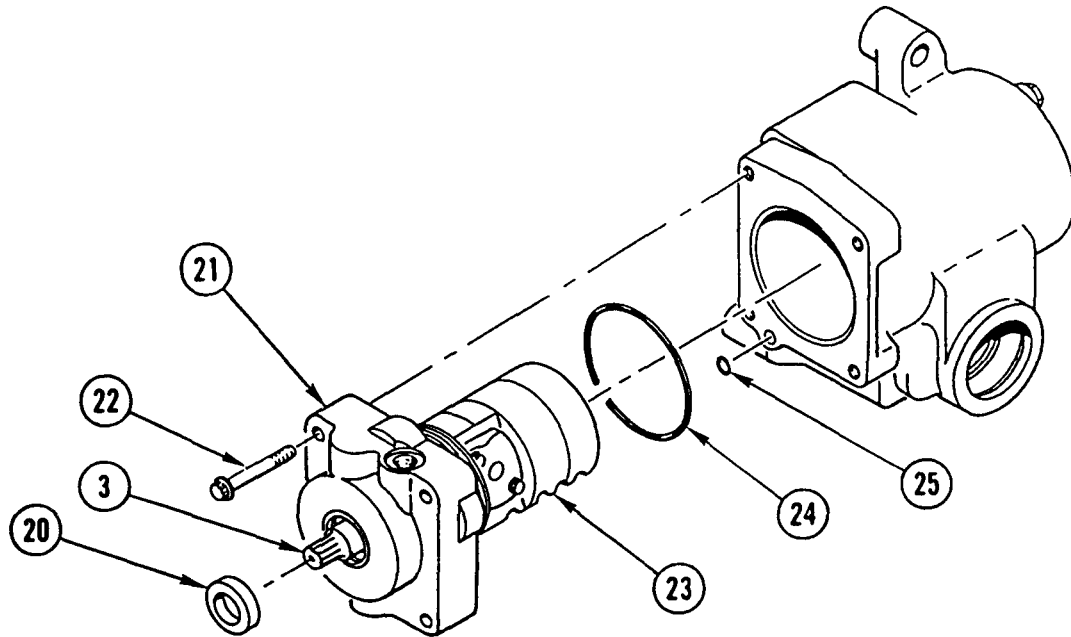
### NOTE

Perform steps 11 and 12 only if adjusting screw or retainer are damaged.

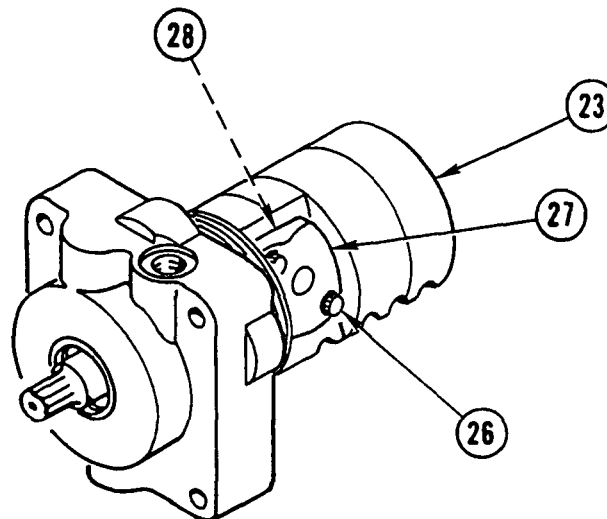
11. PLACE SECTOR SHAFT (4) IN SOFT-JAWED VISE.
12. UNSTAKE, REMOVE, AND DISCARD RETAINER (16) AND ADJUSTING SCREW (12).



13. REMOVE TWO PLUGS (17), TWO PACKINGS (18), AND GREASE FITTING (19) FROM HOUSING (5). DISCARD PACKINGS AND GREASE FITTING.



14. REMOVE AND DISCARD SEAL (20) FROM VALVE HOUSING (21).
15. USING FINE EMERY CLOTH, REMOVE PAINT OR CORROSION FROM INPUT SHAFT (3).
16. USING TORX SOCKET, REMOVE FOUR TORX-HEAD SCREWS (22), VALVE HOUSING (21), INPUT SHAFT (3), AND RACK PISTON (23) AS AN ASSEMBLY. REMOVE AND DISCARD PACKINGS (24 AND 25).

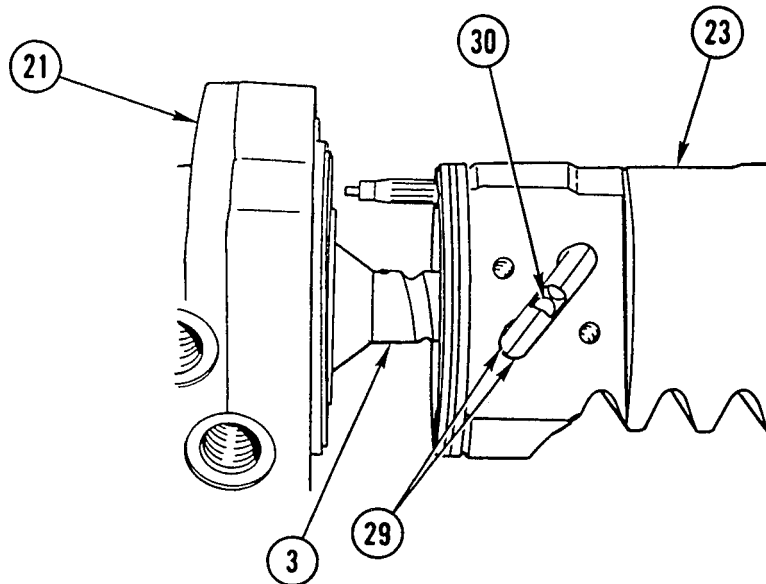


**CAUTION**

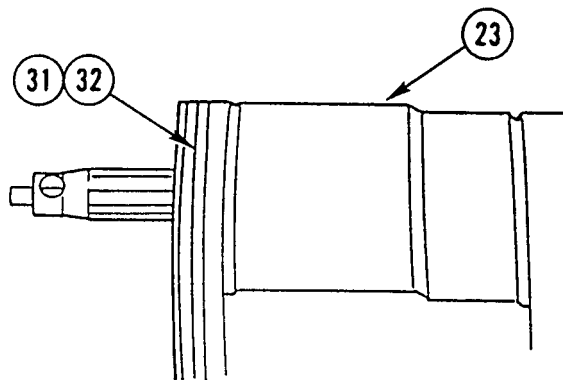
Position rack piston so that return cap faces up during removal. Failure to do so could result in loss of one or more balls of 32-ball set. If any balls are lost or damaged, balls must be replaced as a set.

17. USING TORX SOCKET, REMOVE TWO SCREWS (26), RETURN CAP (27), AND SEAL (28) FROM RACK PISTON (23). DISCARD SCREWS AND SEAL.

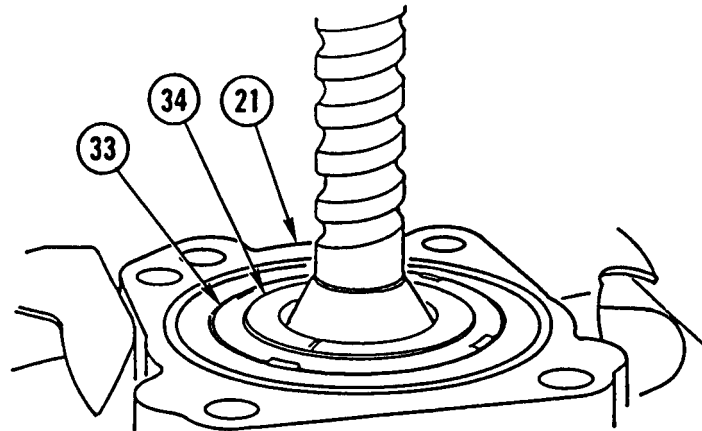
## STEERING GEAR REPAIR (CONT)



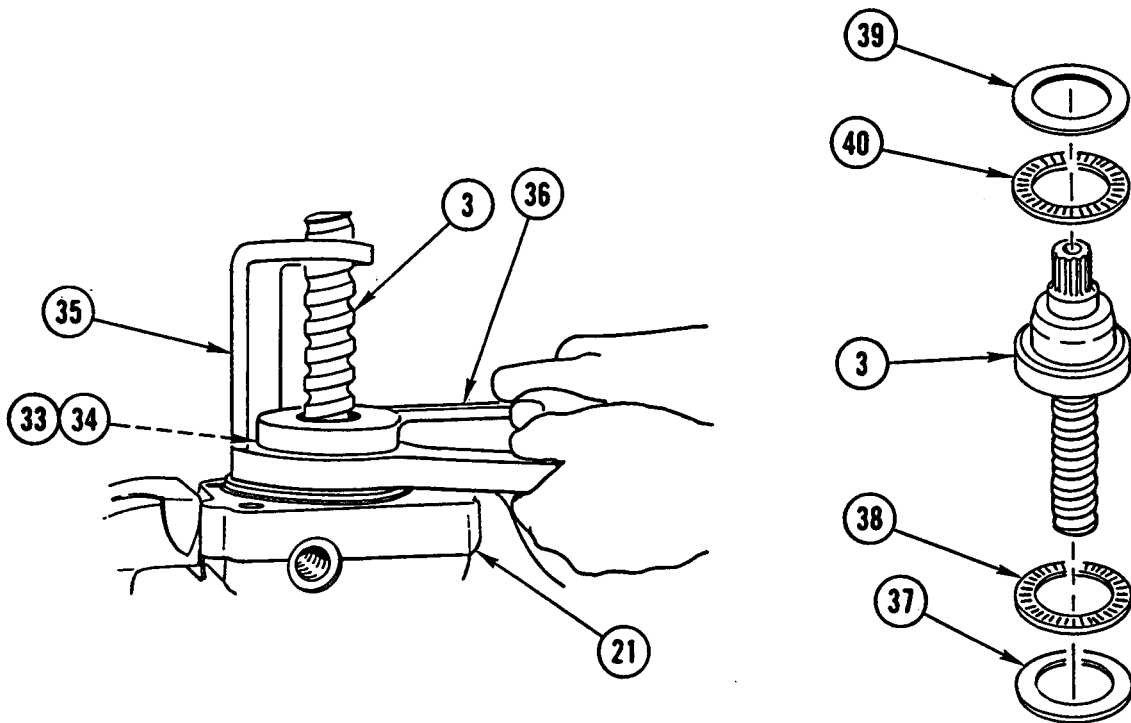
18. REMOVE 2 GUIDE HALVES (29) AND 32 BALLS (30) BY ROTATING INPUT SHAFT (3). DISCARD GUIDE HALVES.
19. REMOVE RACK PISTON (23) FROM VALVE HOUSING (21) AND INPUT SHAFT (3).



20. REMOVE AND DISCARD SEAL RING (31) AND PACKING (32) FROM RACK PISTON (23).



21. PLACE VALVE HOUSING (21) IN SUITABLE VISE.
22. UNSTAKE VALVE HOUSING (21) FROM ADJUSTER LOCK NUT (33). UNSTAKE ADJUSTER LOCK NUT (33) FROM ADJUSTER (34).

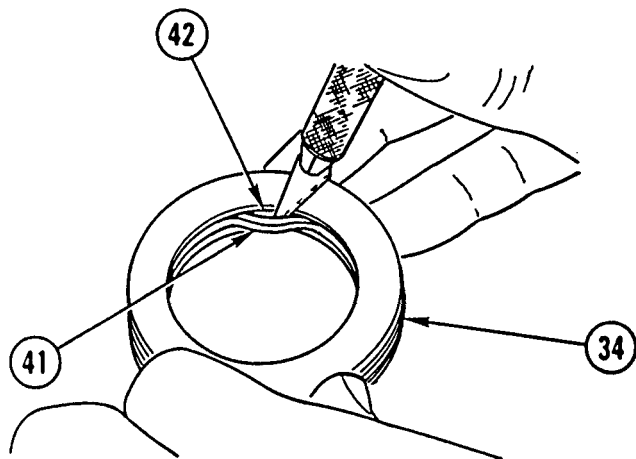


**NOTE**

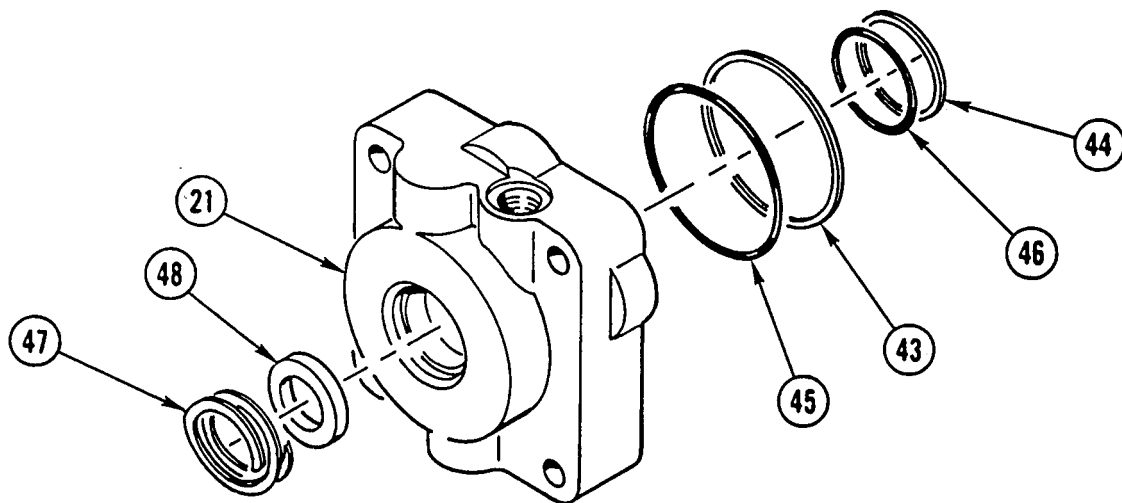
Tag bearings and washers prior to removal to aid in installation.

23. USING SPANNER WRENCHES (35 AND 36), REMOVE ADJUSTER LOCK NUT (33), ADJUSTER (34), INPUT SHAFT (3), WASHER (37), THRUST BEARING (38), WASHER (39), AND THRUST BEARING (40) FROM VALVE HOUSING (21).

**STEERING GEAR REPAIR (CONT)**



24. REMOVE AND DISCARD SEAL RING (41) AND PACKING (42) FROM ADJUSTER (34).

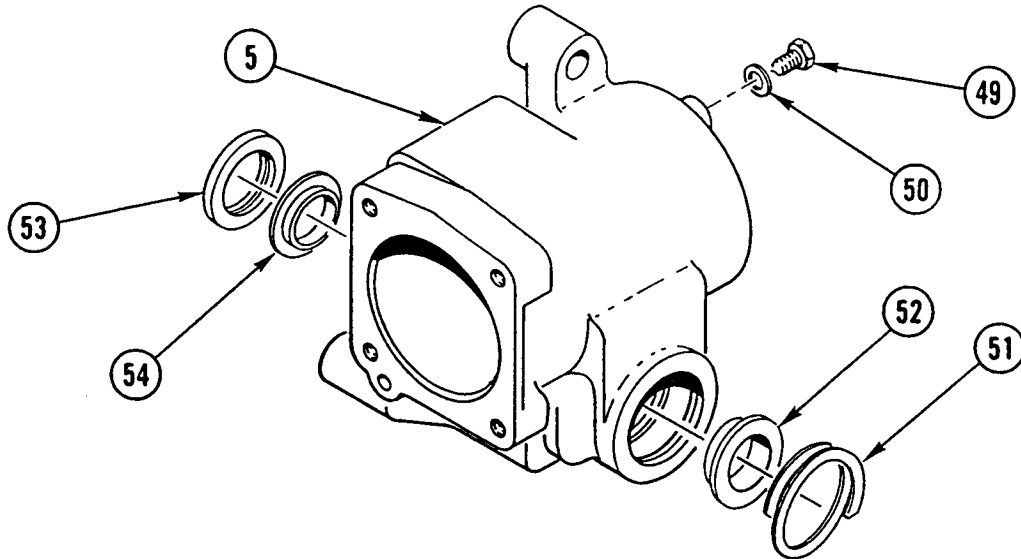


25. REMOVE AND DISCARD TWO SEAL RINGS (43 AND 44) AND TWO PACKINGS (45 AND 46) FROM VALVE HOUSING (21).

26. REVERSE VALVE HOUSING (21) IN VISE AND REMOVE AND DISCARD RETAINING RING (47).

27. REMOVE AND DISCARD SEAL (48).



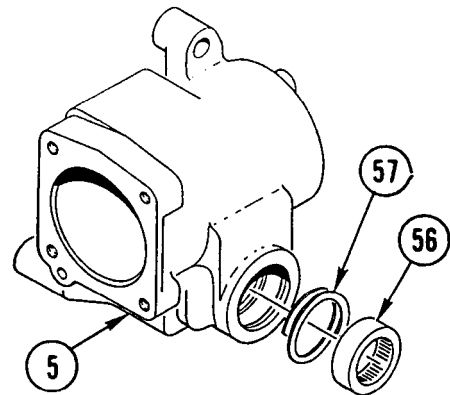
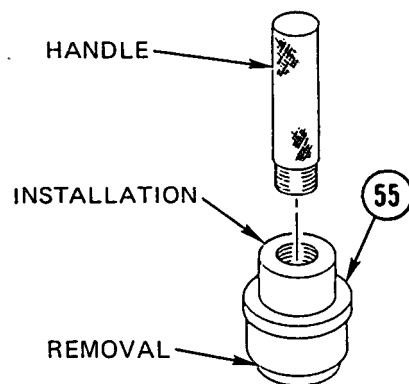


28. REMOVE SCREW (49) AND WASHER (50) FROM HOUSING (5).
29. REMOVE AND DISCARD RETAINING RING (51) AND SEAL (52).

**CAUTION**

Be careful not to tap against housing bore when tapping seal and trunnion washer from housing. Failure to do so will result in damage to housing.

30. TAP SEAL (53) AND TRUNNION WASHER (54) FROM HOUSING (5). DISCARD SEAL.



**CAUTION**

When using removal end of bearing and seal tool, place tool only on roller bearing and not on retaining ring. Failure to do so will result in damage to retaining ring and housing.

31. USING REMOVAL END OF TRUNNION INSTALLER AND DRIVE HANDLE (55), REMOVE AND DISCARD ROLLER BEARING (56).
32. REMOVE AND DISCARD RETAINING RING (57) FROM BEARING SIDE OF HOUSING (5).

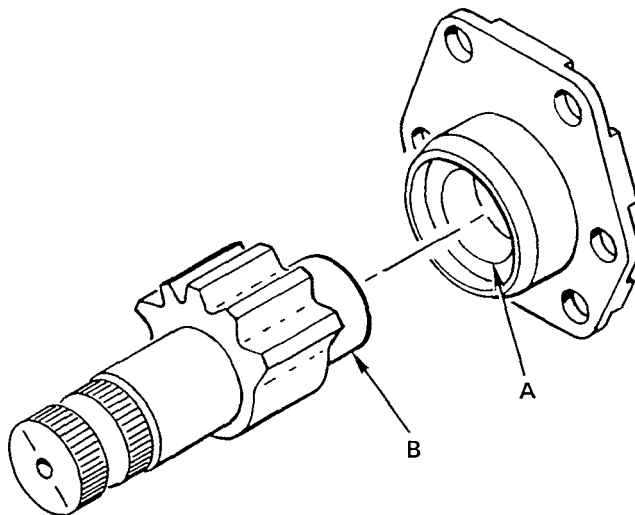
## STEERING GEAR REPAIR (CONT)

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

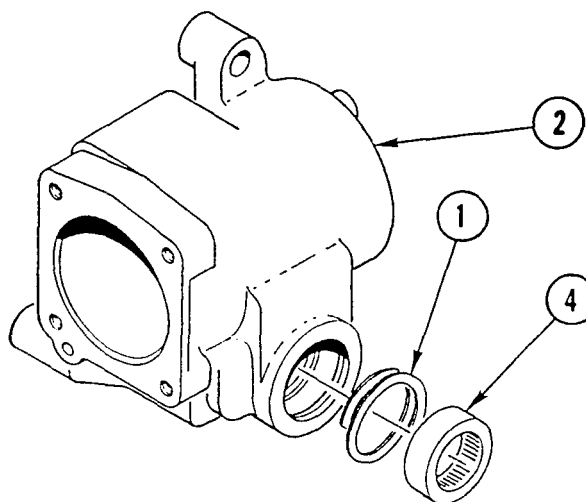
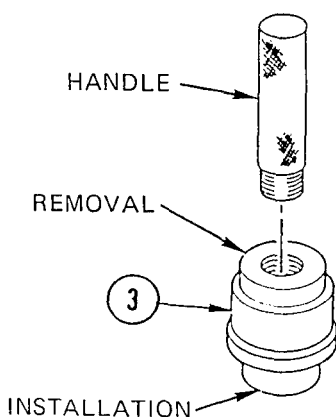
### INSPECTION

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.

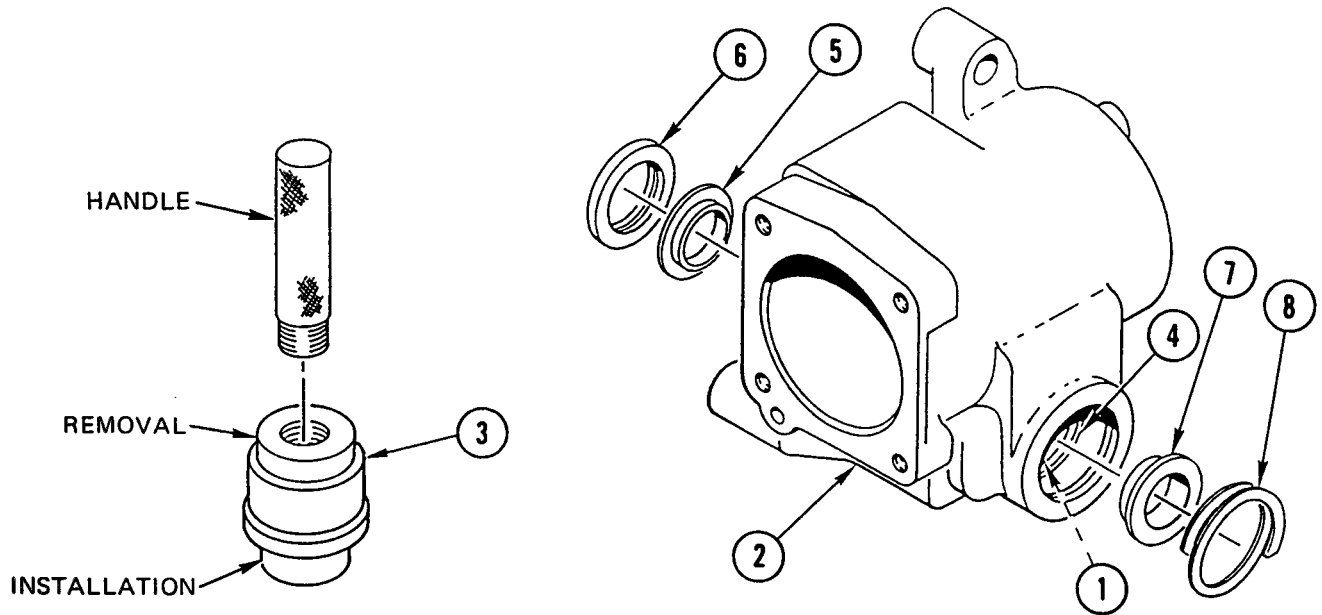


2. USING CALIPERS, MEASURE INSIDE DIAMETER (A) OF SIDE COVER AND OUTSIDE DIAMETER (B) OF SECTOR SHAFT. SUBTRACT MEASUREMENT B FROM A. IF RESULT EXCEEDS 0.008 IN. (0.20 mm), REPLACE SIDE COVER.

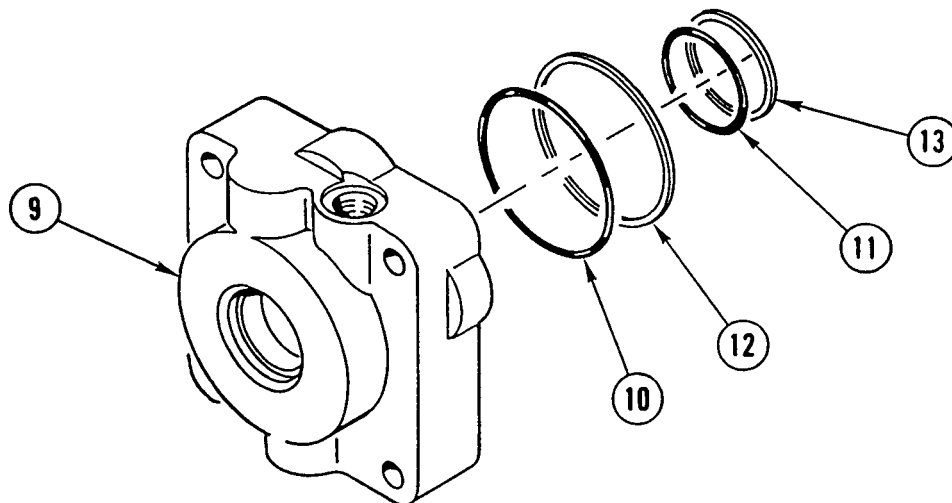
### **ASSEMBLY**



1. INSTALL RETAINING RING (1) IN INSIDE RING GROOVE OF HOUSING (2).
2. USING INSTALLATION END OF TRUNNION INSTALLER AND DRIVE HANDLE (3), INSTALL NEW ROLLER BEARING (4).

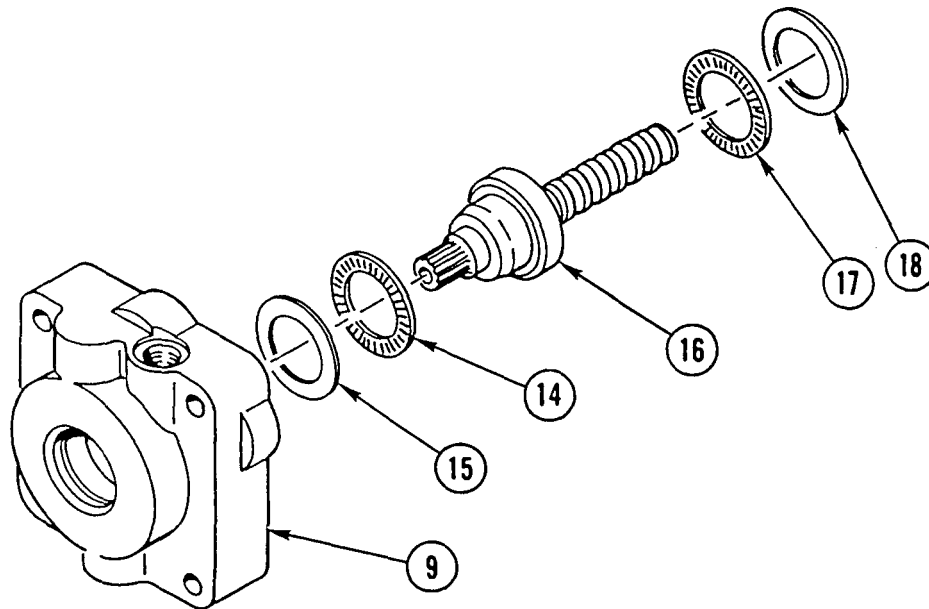


3. INSTALL TRUNNION WASHER (5) IN HOUSING (2) WITH BEVELED SIDE FACING AWAY FROM RETAINING RING (1).
4. INSTALL NEW SEAL (6) ON INSTALLATION END OF TRUNNION INSTALLER (3) WITH SPRING TOWARD SHOULDER OF TOOL.
5. INSTALL SEAL (6).
6. INSTALL NEW SEAL (7) AND NEW RETAINING RING (8). PACK BEARING (4) WITH GAA.

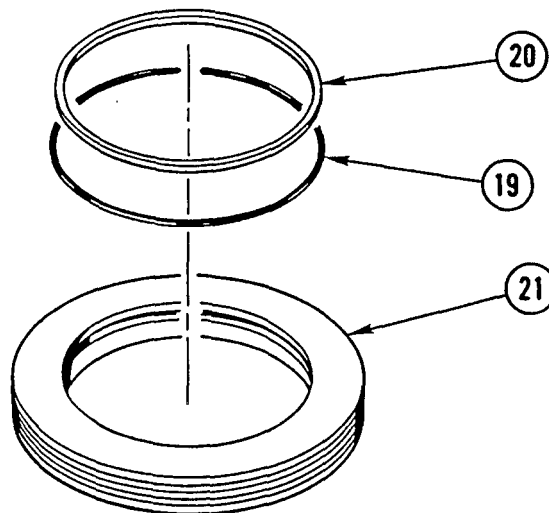


7. PLACE VALVE HOUSING (9) IN SUITABLE VISE. APPLY LIGHT COATING OF OIL TO TWO NEW PACKINGS (10 AND 11) AND TWO NEW SEAL RINGS (12 AND 13). INSTALL TWO PACKINGS (10 AND 11) AND TWO SEAL RINGS (12 AND 13).

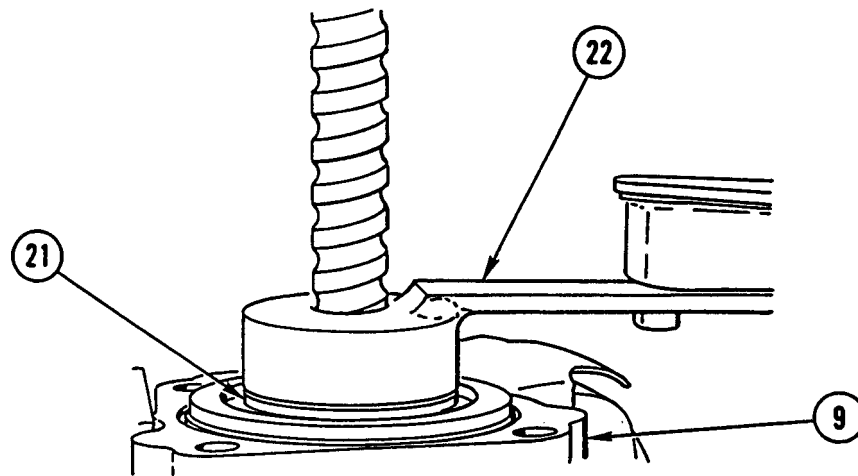
**STEERING GEAR REPAIR (CONT)**



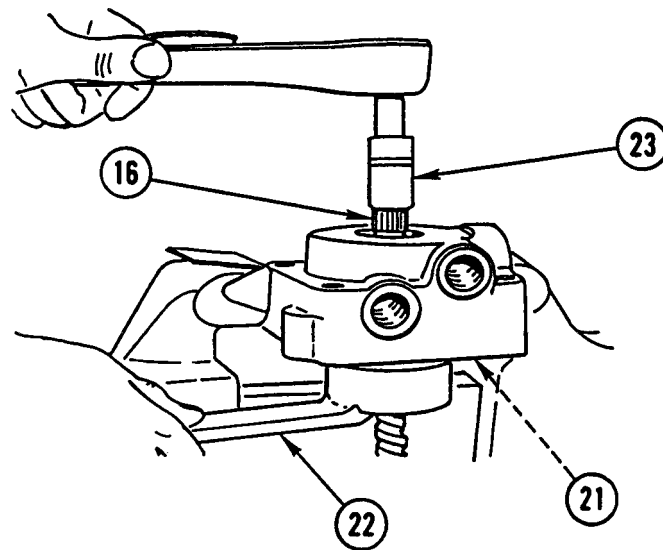
8. APPLY LIGHT COATING OF OIL TO THRUST BEARING (14) AND WASHER (15). INSTALL THRUST BEARING (14) AND WASHER (15) ON INPUT SHAFT (16).
9. INSTALL INPUT SHAFT (16) IN VALVE HOUSING (9).
10. APPLY LIGHT COATING OF GAA TO THRUST BEARING (17) AND WASHER (18). INSTALL THRUST BEARING (17) AND WASHER (18).



11. INSTALL NEW PACKING (19) AND NEW SEAL RING (20) IN ADJUSTER (21).

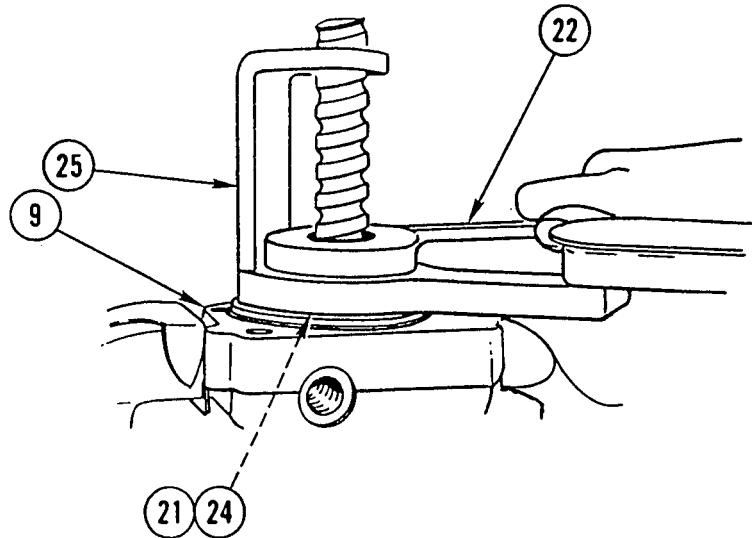


12. USING SPANNER WRENCH (22), INSTALL ADJUSTER (21) IN VALVE HOUSING (9). TIGHTEN ADJUSTER (21) TO 11-15 LB-FT (14.9-20.3 N.m) TO SEAT COMPONENTS, THEN BACK OFF 1/4 TO 1/2 TURN.
13. REVERSE VALVE HOUSING (9) IN VISE.

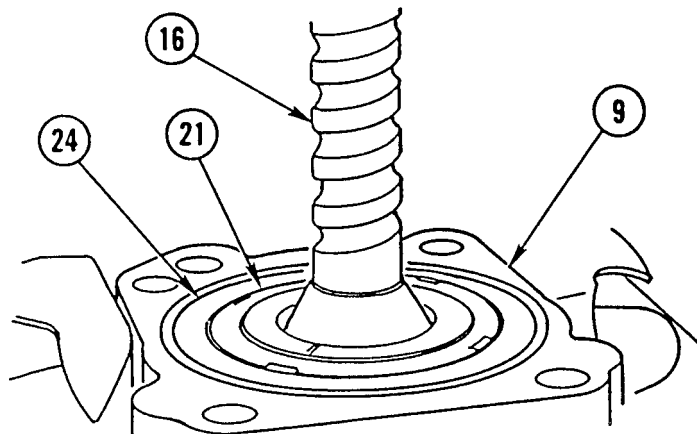


14. USING 19 mm 12-POINT DEEP SOCKET (23), ROTATE INPUT SHAFT (16). NOTE AMOUNT OF TORQUE REQUIRED TO ROTATE INPUT SHAFT IN EACH DIRECTION.
15. USING SPANNER WRENCH (22), TIGHTEN ADJUSTER (21) SO THAT TORQUE READING ON INPUT SHAFT (16) IS 5-10 LB-IN. (0.56-1.13 N.m) HIGHER THAN NOTED IN STEP 14 ABOVE. MAXIMUM TORQUE REQUIRED TO ROTATE INPUT SHAFT MUST NOT EXCEED 22 LB-IN. (2.5 N.m).

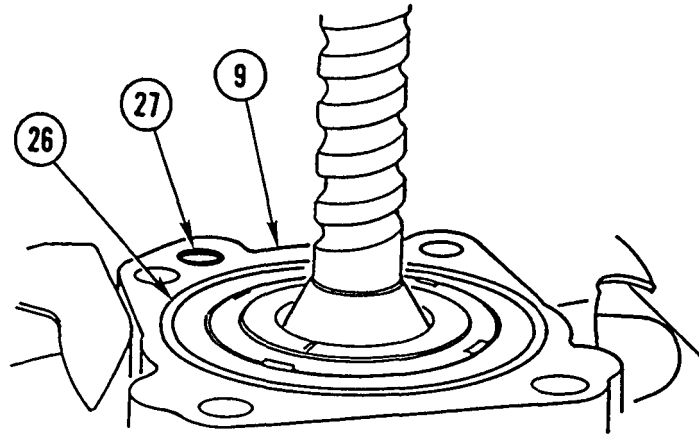
## STEERING GEAR REPAIR (CONT)



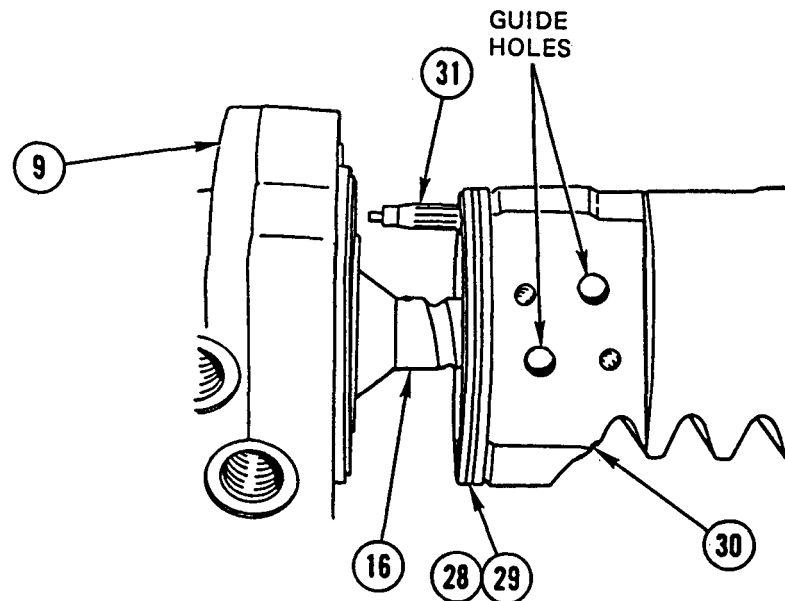
16. REVERSE VALVE HOUSING (9) IN VISE.
17. APPLY LIGHT COATING OF OIL TO NEW ADJUSTER LOCK NUT (24).
18. USING SPANNER WRENCHES (22 AND 25), INSTALL ADJUSTER LOCK NUT (24) WHILE HOLDING ADJUSTER (21) IN PLACE. TIGHTEN ADJUSTER LOCK NUT (24) TO 101-122 LB-FT (136.9- 165.4 N.m). CHECK TORQUE READING NOTED IN STEP 14. IF TORQUE READING IS NOT WITHIN 5-10 LB-IN. (0.56-1.13 N.m) HIGHER, REMOVE ADJUSTER LOCK NUT (24), BACK OFF ADJUSTER (21) 1/2 TURN, AND REPEAT STEPS 13 THRU 18.



19. STAKE VALVE HOUSING (9) IN CLOCKWISE-MOST CORNER OF TWO OPPOSING SLOTS OF ADJUSTER LOCK NUT (24). STAKE ADJUSTER LOCK NUT (24) IN ADJUSTER (21) IN ONE PLACE AT THREADED AREA. CHECK TORQUE READING ON INPUT SHAFT (16). READING MUST NOT EXCEED 22 LB-IN. (2.5 N.m).



20. APPLY LIGHT COATING OF OIL TO TWO NEW PACKINGS (26 AND 27). INSTALL TWO PACKINGS (26 AND 27) IN VALVE HOUSING (9).



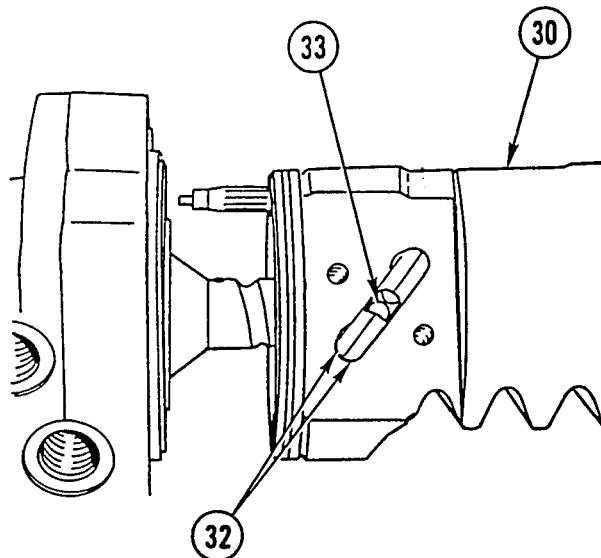
21. APPLY LIGHT COATING OF OIL TO NEW PACKING (28) AND NEW SEAL RING (29). INSTALL PACKING (28) AND SEAL RING (29) ON RACK PISTON (30).

**WARNING**

Do not allow valve housing to contact poppet. Such contact could cause steering problems or loss of steering resulting in possible injury to personnel.

22. PLACE RACK PISTON (30), WITH GUIDE HOLES UP, ON PADDED PEDESTAL HIGH ENOUGH SO THAT VALVE HOUSING (9) CAN ROTATE WHEN ASSEMBLED. INSERT WORM END OF INPUT SHAFT (16) INTO RACK PISTON (30) CLOSE TO MAXIMUM DEPTH. MAKE SURE VALVE HOUSING (9) DOES NOT CONTACT POPPET (31). LINE UP RACK PISTON (30) GUIDE HOLES WITH WORM TRACK GROOVES ON INPUT SHAFT (16).

## STEERING GEAR REPAIR (CONT)



### **WARNING**

Do not force guide halves into place. Force may damage guide halves, which could cause loss of steering resulting in possible injury to personnel.

### **NOTE**

Rotate input shaft slightly if necessary, to make sure guide halves are properly seated.

23. INSTALL TWO NEW GUIDE HALVES (32) BY HAND IN RACK PISTON (30).

### **WARNING**

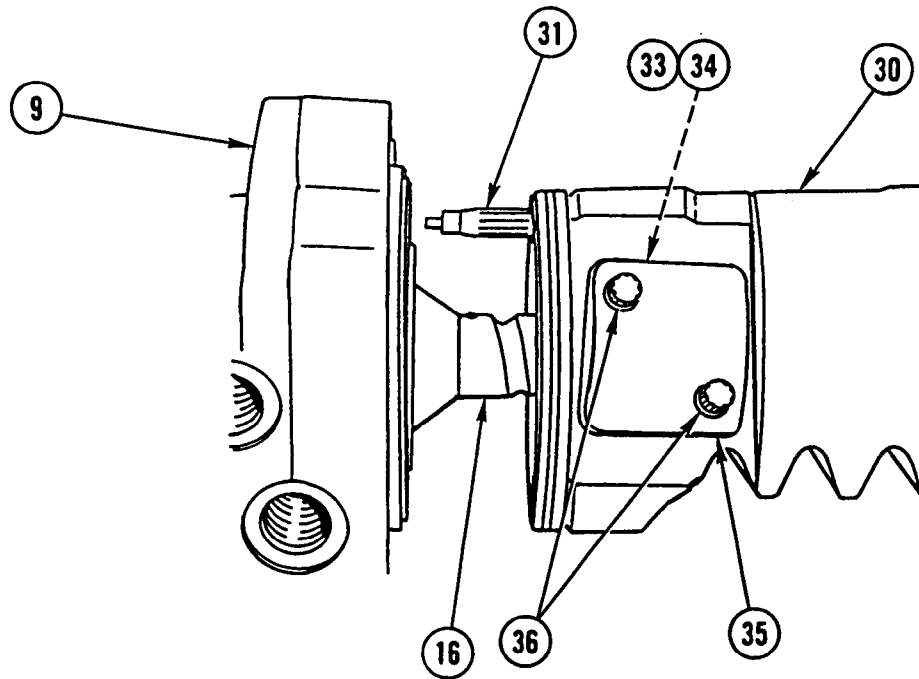
- Guide halves must be held in place during installation of balls. Failure to do so will result in balls being trapped outside closed ball track, causing steering lockup and possible injury to personnel.
- Failure to install all 32 balls in guide halves will cause steering problems, resulting in possible injury to personnel.

### **NOTE**

- Rotate input shaft slightly if necessary, to make sure guide halves are properly seated.
- If guide halves are unseated during or after ball loading, remove all balls and input shaft from rack piston and repeat steps 21 and 22.
- Make sure all 32 balls are installed.

24. INSTALL 32 BALLS (33) IN SLOT IN GUIDE HALVES (32).





25. APPLY LIGHT COATING OF GAA TO NEW SEAL (34) AND INSTALL SEAL (34) IN RETURN CAP (35).
26. USING TORX SOCKET, INSTALL RETURN CAP (35) AND TWO NEW SCREWS (36) IN RACK PISTON (30). TIGHTEN SCREWS ALTERNATELY TO 14-22 LB-FT (19-30 N.m).

**WARNING**

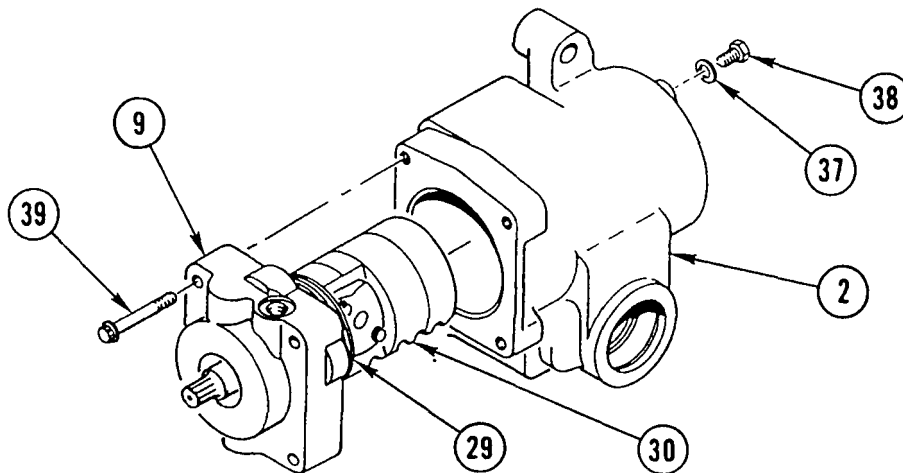
Do not allow valve housing to move more than 2.72 in. (69.1 mm) away from rack piston. If this occurs, balls will be out of place resulting in possible loss of steering and injury to personnel.

**CAUTION**

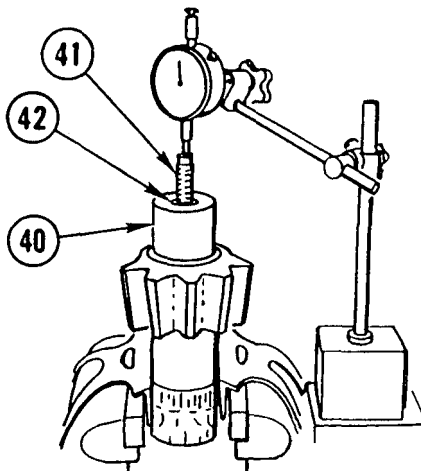
During step 27, do not allow poppet (31) to touch valve housing (9). To do so will result in incorrectly preset poppet.

27. ROTATE INPUT SHAFT (16) INTO AND OUT OF RACK PISTON (30) SEVERAL TIMES WHILE CHECKING FOR SMOOTH MOVEMENT.
28. IF INPUT SHAFT (16) DOES NOT MOVE SMOOTHLY, REMOVE BALLS (33) AND RACK PISTON (30) AND REPEAT STEPS 21 THRU 27.

## STEERING GEAR REPAIR (CONT)



29. PLACE HOUSING (2) IN SUITABLE VISE. INSTALL WASHER (37) AND SCREW (38) ON HOUSING (2) AND TIGHTEN SCREW TO 38-42 LB-FT (52-57 N.m). APPLY LIGHT COATING OF OIL TO BORE OF HOUSING (2).
30. APPLY LIGHT COATING OF OIL TO SEAL RING (29).
31. INSTALL RACK PISTON (30) AND VALVE HOUSING (9) ASSEMBLY IN HOUSING (2).
32. APPLY LIGHT COATING OF OIL TO FOUR TORX-HEAD SCREWS (39). USING TORX SOCKET, INSTALL FOUR TORX-HEAD SCREWS (39) IN HOUSING (2) AND TIGHTEN SCREWS ALTERNATELY TO 75-85 LB-FT (102-115 N.m).

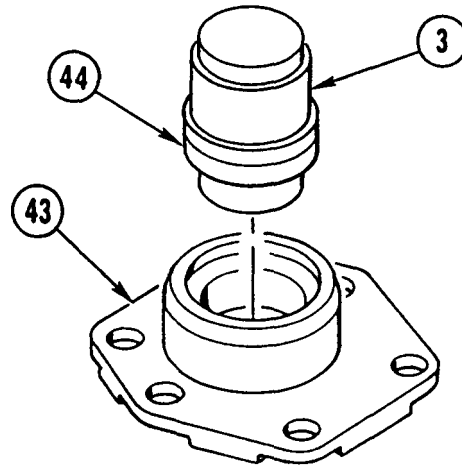


**NOTE**

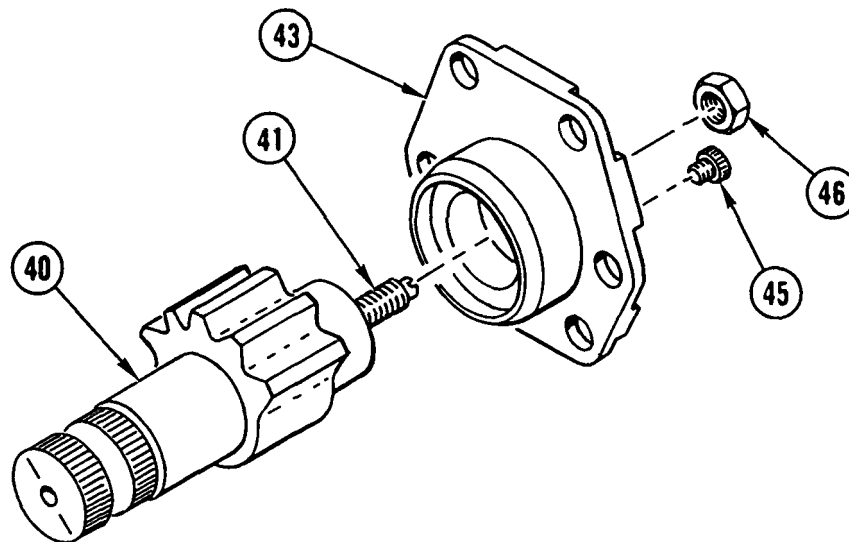
If adjusting screw was removed, perform steps 33 thru 36.

33. PLACE SECTOR SHAFT (40) IN SOFT-JAWED VISE. APPLY LIGHT COATING OF GAA TO NEW ADJUSTING SCREW (41) AND INSTALL ADJUSTING SCREW (41) AND NEW RETAINER (42).
34. TIGHTEN ADJUSTING SCREW (41) SO THAT END PLAY IS 0-0.002 IN. (0-0.05 mm) BUT ADJUSTING SCREW (41) CAN STILL BE TURNED BY HAND. CHECK END PLAY BY HAND WITH DIAL INDICATOR.

35. STAKE NEW RETAINER (42) INTO TWO SLOTS IN SECTOR SHAFT (40).
36. MAKE SURE ADJUSTING SCREW (41) CAN STILL BE TURNED BY HAND AND END PLAY IS STILL 0-0.002 IN. (0-0.05 mm). IF NOT, REPEAT REMOVAL STEP 12 AND INSTALLATION STEPS 32 THRU 35.

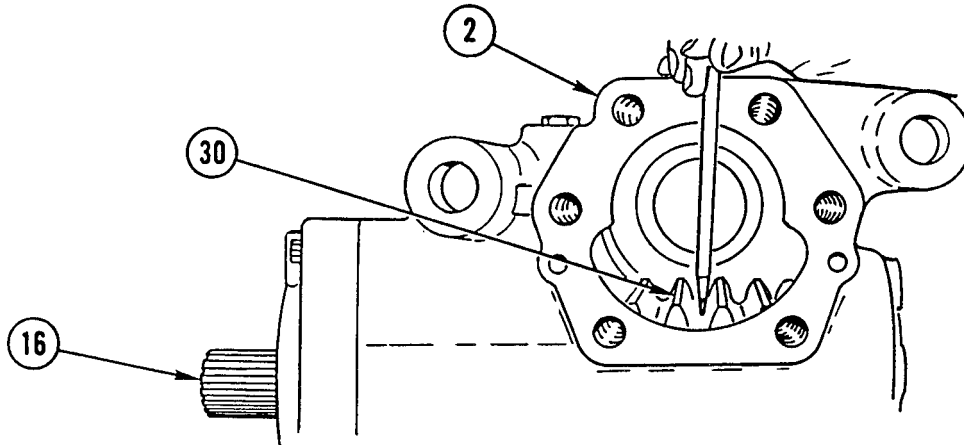


37. APPLY LIGHT COATING OF OIL TO BUSHING INSIDE COVER (43) AND NEW SEAL (44). INSTALL SEAL (44) ON INSTALLATION END OF TRUNNION INSTALLER (3) WITH SPRING SIDE TOWARD SHOULDER OF TOOL.
38. INSTALL SEAL (44) INSIDE COVER (43).



39. APPLY LIGHT COATING OF OIL TO BEARING SURFACE OF SECTOR SHAFT (40). INSTALL SECTOR SHAFT (40) IN SIDE COVER (43) BY THREADING ADJUSTING SCREW (41) COUNTERCLOCKWISE UNTIL SOLID, THEN BACK OFF 1/2 TURN SO SIDE COVER (43) ROTATES FREELY.
40. INSTALL VENT PLUG (45) AND NUT (46) HAND-TIGHT.

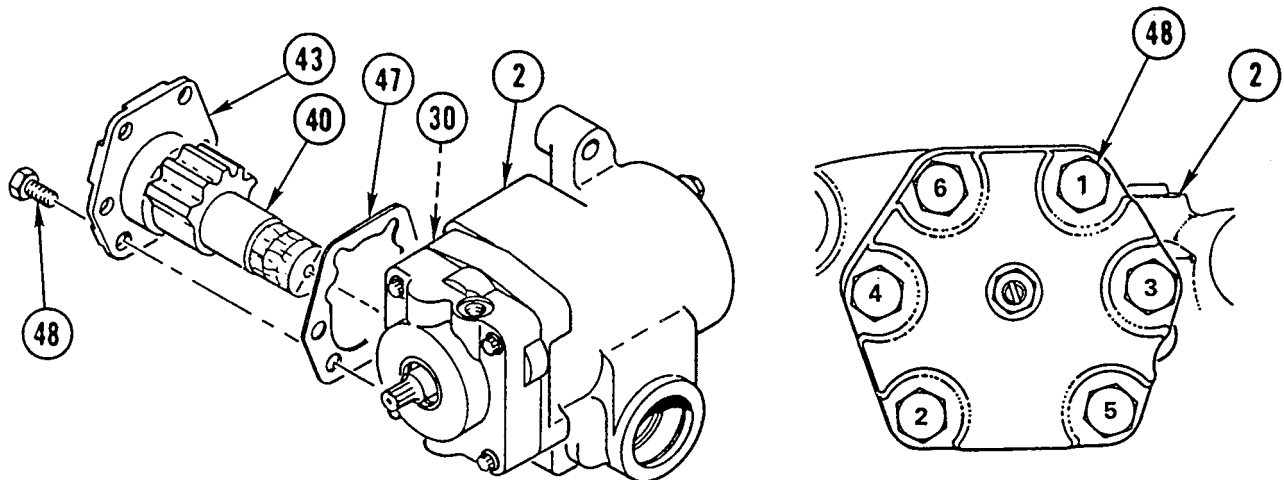
## STEERING GEAR REPAIR (CONT)



### WARNING

Rack piston and sector shaft must be meshed correctly. Failure to do so will severely limit gear travel in one direction, resulting in possible injury to personnel.

41. ROTATE INPUT SHAFT (16) SO THAT VALLEY BETWEEN SECOND AND THIRD TOOTH OF RACK PISTON (30) IS EVEN WITH AND CENTERED IN OPENING OF HOUSING (2).

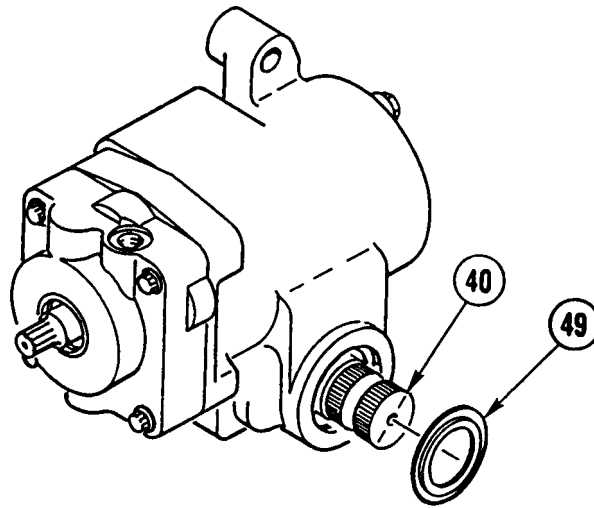


42. REPLACE MASKING TAPE ON SECTOR SHAFT (40) WITH ONE LAYER OF NEW MASKING TAPE.

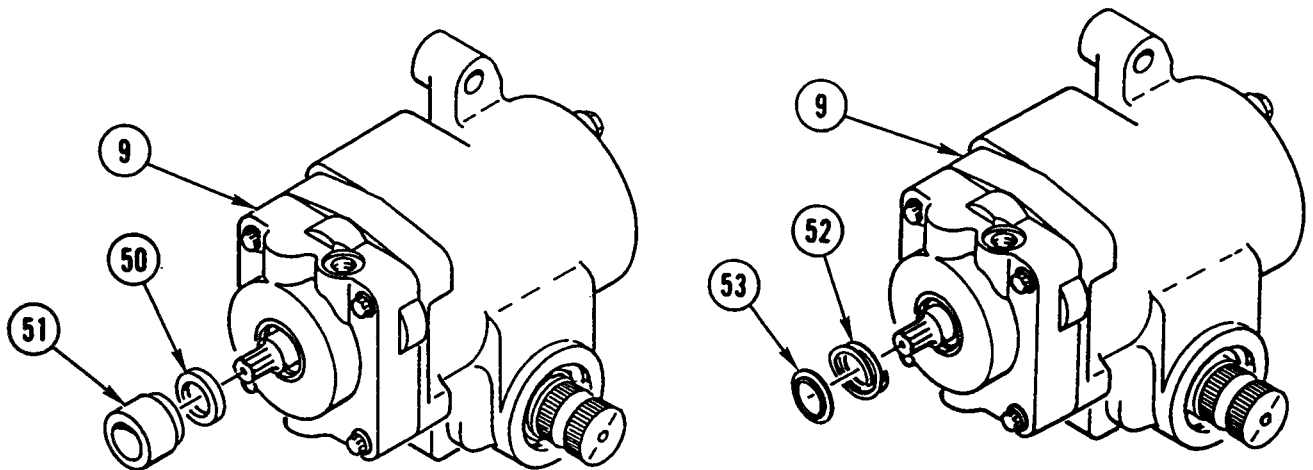
### NOTE

If necessary, use rubber mallet to tap side cover in place.

43. INSTALL NEW GASKET (47), SECTOR SHAFT (40), AND SIDE COVER (43) AS AN ASSEMBLY IN HOUSING (2). CENTER TOOTH OF SECTOR SHAFT (40) MUST BE IN VALLEY BETWEEN SECOND AND THIRD TOOTH OF RACK PISTON (30).
44. APPLY LIGHT COATING OF OIL TO SIX SCREWS (48). INSTALL SIX SCREWS (48) IN HOUSING (2) AND TIGHTEN SCREWS TO 160-180 LB-FT (217-244 N.m) IN SEQUENCE SHOWN.

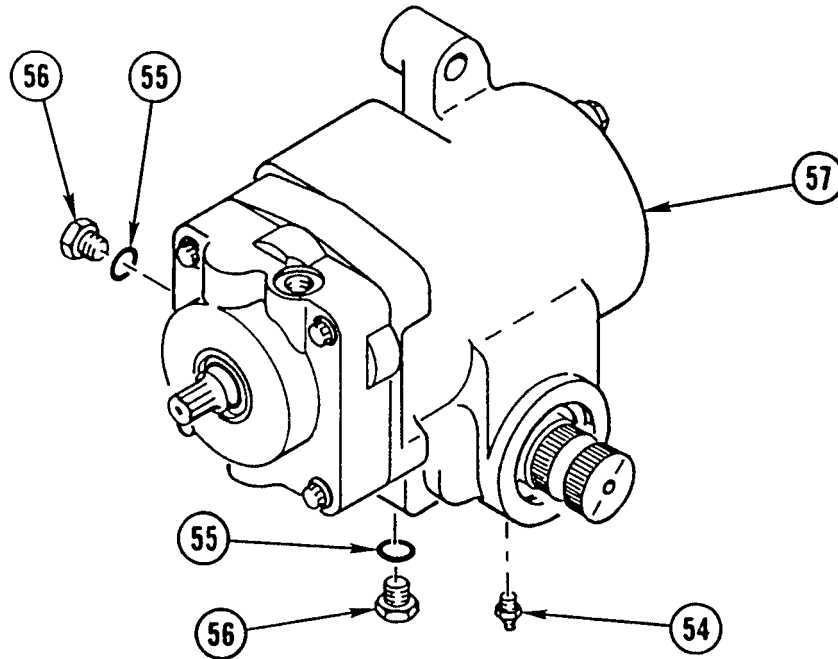


45. PACK TRUNNION AREA OF SECTOR SHAFT (40) WITH GAA APPLY LIGHT COATING OF GAA TO NEW SEAL (49) AND INSTALL SEAL (49) IN SECTOR SHAFT (40).



46. APPLY LIGHT COATING OF GAA TO NEW SEAL (50). USING SMALL END OF INPUT SEAL INSTALLER (51), TAP SEAL (50) INTO VALVE HOUSING (9) UNTIL SHOULDER OF INPUT SEAL INSTALLER (51) RESTS AGAINST VALVE HOUSING (9). CLEAN OFF ANY SEAL MATERIAL THAT MAY HAVE SHREDDED OFF.
47. INSTALL NEW RETAINING RING (52) AND PACK END OF VALVE HOUSING (9) WITH GAA
48. APPLY LIGHT COATING OF GAA TO NEW SEAL (53) AND INSTALL SEAL (53) IN VALVE HOUSING (9).

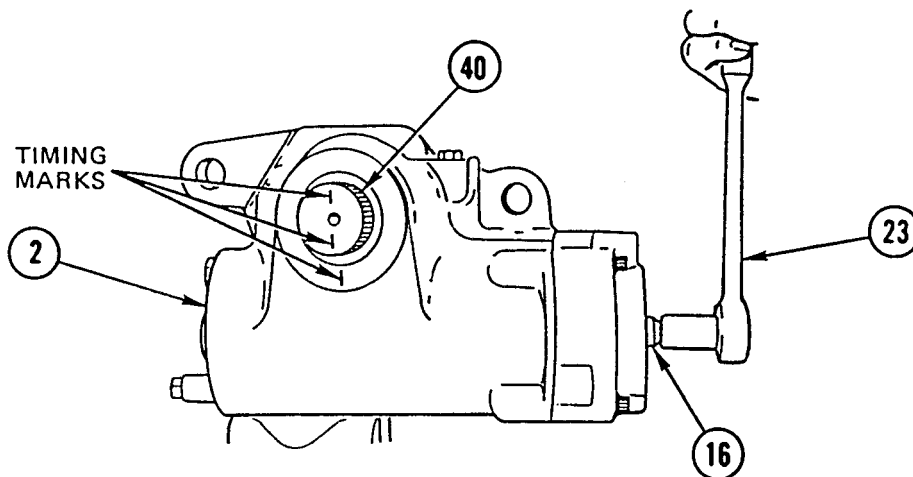
## STEERING GEAR REPAIR (CONT)



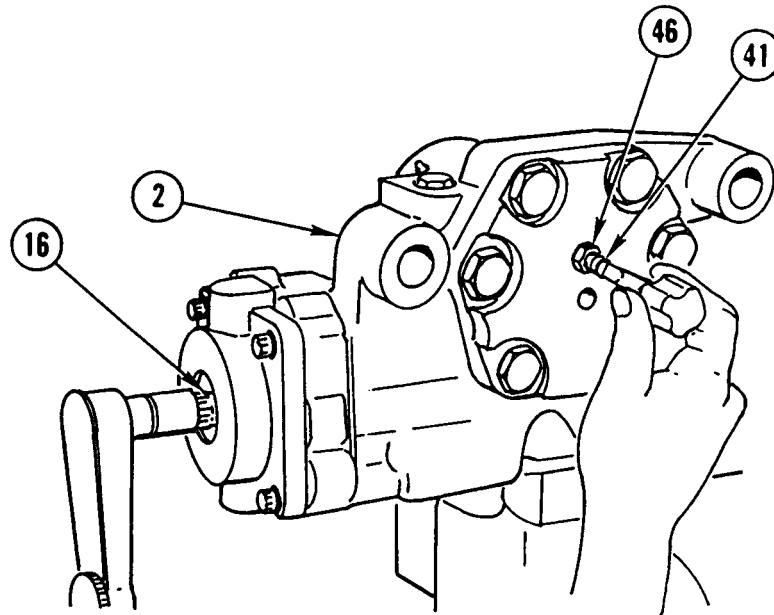
### NOTE

A piece of metal tubing that will clear fitting head can be used as grease fitting installer.

49. INSTALL NEW GREASE FITTING (54), TWO NEW PACKINGS (55), AND TWO PLUGS (56) IN STEERING GEAR ASSEMBLY (57).



50. MAKE SURE TIMING MARKS ON SECTOR SHAFT (40) AND HOUSING (2) ARE ALINED. IF NOT, USE 19 mm 12-POINT DEEP SOCKET (23) TO TURN INPUT SHAFT (16) TO ALINE TIMING MARKS.



### WARNING

Do not rotate input shaft more than 1-1/2 turns from center position. Doing so will incorrectly set poppets, causing steering problems resulting in possible injury to personnel.

51. LOOSEN NUT (46).
52. USING LB-IN. TORQUE WRENCH ON INPUT SHAFT (16), TIGHTEN ADJUSTING SCREW (41) SO THAT INPUT SHAFT (16) REQUIRES TORQUE OF 45-50 LB-IN. (5.1-5.6 N.m) TO TURN 180 DEGREES FROM CENTER IN BOTH DIRECTIONS.
53. BACK OFF ADJUSTING SCREW (41) 1/2 TURN AND NOTE TORQUE REQUIRED TO TURN INPUT SHAFT (16) 180 DEGREES FROM CENTER IN BOTH DIRECTIONS.
54. TIGHTEN ADJUSTING SCREW (41) SO THAT TORQUE REQUIRED TO TURN INPUT SHAFT (16) 180 DEGREES FROM CENTER IN BOTH DIRECTIONS INCREASES 6-8 LB-IN. (0.68-0.90 N.m) FROM READING NOTED IN STEP 53.
55. HOLD ADJUSTING SCREW (41) FIRMLY AGAINST HOUSING (2) AND TIGHTEN NUT (46) TO 40-45 LB-FT (54-61 N.m).
56. CHECK TORQUE READING ON INPUT SHAFT (16). IF READING EXCEEDS 40 LB-IN. (4.5 N.m), REPEAT STEPS 51 THRU 56.

### NOTE

Follow-on Maintenance:  
Install steering gear (page 7-4).





## CHAPTER 20 FRAME AND TOWING ATTACHMENTS REPAIR INSTRUCTIONS

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the frame and towing attachments and related parts.

		Page
Section I.	Fifth Wheel Replacement . . . . .	20-2
Section II.	Slide Bracket and Plate Repair (M915A2) . . . . .	20-8
Section III.	Top Plate Replacement (M915A2) . . . . .	20-12
Section IV.	Top Plate Repair (M915A2) . . . . .	20-15
Section V.	Slide Bracket and Base Repair (M916A1 and M916A2) . . . . .	20-20
Section VI.	Top Plate Replacement (M916A1 and M916A2) . . . . .	20-30
Section VII.	Top Plate Repair (M916A1 and M916A2) . . . . .	20-33
Section VIII.	Ramp Replacement . . . . .	20-38
Section IX.	Frame Alinement . . . . .	20-40

## Section I. FIFTH WHEEL REPLACEMENT

### OVERVIEW

This section illustrates and describes procedures for removal, cleaning, inspection, and installation of the fifth wheel.

	Page
Fifth Wheel Replacement (M915A2) . . . . .	20-3
Fifth Wheel Replacement (M916A1 and M916A2) . . . . .	20-6

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## FIFTH WHEEL REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### **INITIAL SETUP**

**Applicable Configuration:**

M915A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Nut, Lock (14)

Nut, Lock

**Personnel Required:** (2)

**References:**

TM 9-2320-363-20

**Equipment Condition:**

Reference	Condition Description
TM 9-2320-363-20	Air System Drained

**General Safety Instructions:**

**WARNING**

Fifth wheel weighs 550 lb (249.7 kg). Use hoist with lifting capacity of 800 lb (363.2 kg) to remove or install fifth wheel. Failure to do so could result in injury to personnel.

## **FIFTH WHEEL. REPLACEMENT (CONT)**

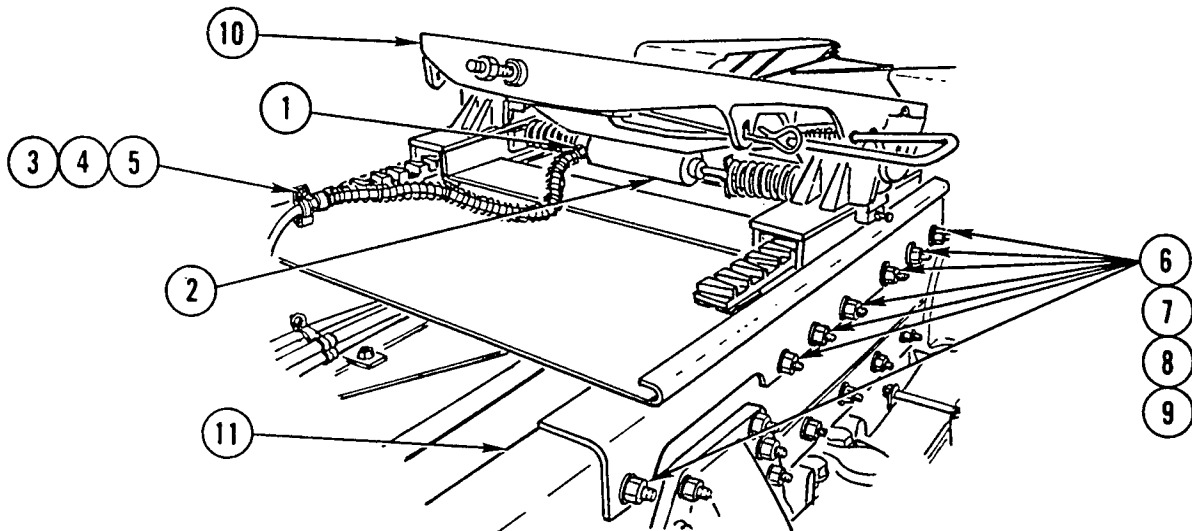
### **REMOVAL**

1. DISCONNECT AIR HOSE (1) FROM CYLINDER (2).
2. REMOVE LOCK NUT (3), SCREW (4), AND CLAMP (5). DISCARD LOCK NUT.
3. REMOVE 14 LOCK NUTS (6), 14 WASHERS (7), 14 SCREWS (8), AND 14 WASHERS (9) FROM FIFTH WHEEL (10). DISCARD LOCK NUTS.

### **WARNING**

Fifth wheel weighs 550 lb (249.7 kg). Use hoist with lifting capacity of 800 lb (363.2 kg) to remove fifth wheel. Failure to do so could result in injury to personnel.

4. USING SUITABLE LIFTING DEVICE, REMOVE FIFTH WHEEL (10) FROM FRAME (11).



### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

Inspect all parts for wear or damage.

**INSTALLATION****WARNING**

Fifth wheel weighs 550 lb (249.7 kg). Use hoist with lifting capacity of 800 lb (363.2 kg) to install fifth wheel. Failure to do so could result in injury to personnel.

1. USING SUITABLE LIFTING DEVICE, ALINE AND INSTALL FIFTH WHEEL (10) ON FRAME (11).
2. INSTALL 14 WASHERS (9), 14 SCREWS (8), 14 WASHERS (7), AND 14 NEW LOCK NUTS (6).
3. INSTALL CLAMP (5), SCREW (4), AND NEW LOCK NUT (3).
4. CONNECT AIR HOSE (1) TO CYLINDER (2).

---

## FIFTH WHEEL REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Nut, Lock (14)

**Personnel Required:** (2)

**References:**

TM 9-2320-363-20

**Equipment Condition:**

Reference	Condition Description
TM 9-2320-363-20	Grate Removed

**General Safety Instructions:**

**WARNING**  
Fifth wheel weighs 700 lb (317.8 kg). Use hoist with lifting capacity of 1,000 lb (454 kg) to remove or install fifth wheel. Failure to do so could result in injury to personnel.

---

### REMOVAL

1. REMOVE 14 LOCK NUTS (1), 14 WASHERS (2), 14 SCREWS (3), AND 14 WASHERS (4) FROM FIFTH WHEEL (5). DISCARD LOCK NUTS.

**WARNING**  
Fifth wheel weighs 700 lb (317.8 kg). Use hoist with lifting capacity of 1,000 lb (454 kg) to remove fifth wheel. Failure to do so could result in injury to personnel.

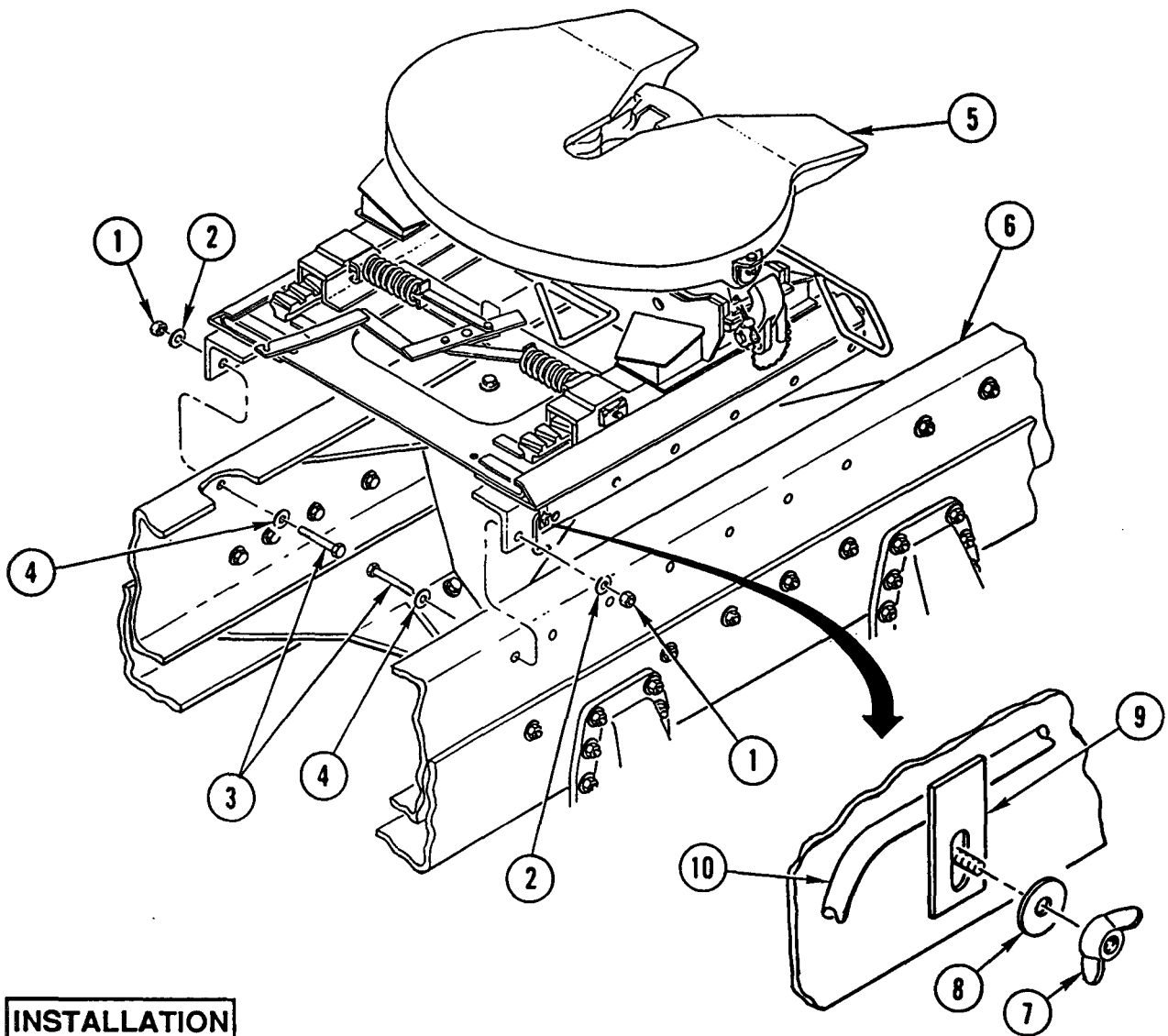
2. USING SUITABLE LIFTING DEVICE, REMOVE FIFTH WHEEL (5) FROM FRAME (6).
3. REMOVE WING NUT (7), WASHER (8), BRACKET (9), AND HANDLE (10) FROM FIFTH WHEEL (5).

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.



**INSTALLATION**

1. INSTALL HANDLE (10), BRACKET (9), WASHER (8), AND WING NUT (7) ON FIFTH WHEEL (5).

**WARNING**

Fifth wheel weighs 700 lb (317.8 kg). Use hoist with lifting capacity of 1,000 lb (454 kg) to install fifth wheel. Failure to do so could result in injury to personnel.

2. USING SUITABLE LIFTING DEVICE, ALINE AND INSTALL FIFTH WHEEL (5) ON FRAME (6).
3. INSTALL 14 WASHERS (4), 14 SCREWS (3), 14 WASHERS (2), AND 14 NEW LOCK NUTS (1).

**NOTE**

Follow-on Maintenance:  
Install grate (TM 9-2320-363-20).

## Section II. SLIDE BRACKET AND PLATE REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, cleaning, inspection, and installation of the slide bracket and plate.

---

### SLIDE BRACKET AND PLATE REPAIR

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

M915A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05  
Spring Compressor, TF-TLN-2500

**References:**

TM 9-2320-363-20

**Equipment Condition:**

**Reference**

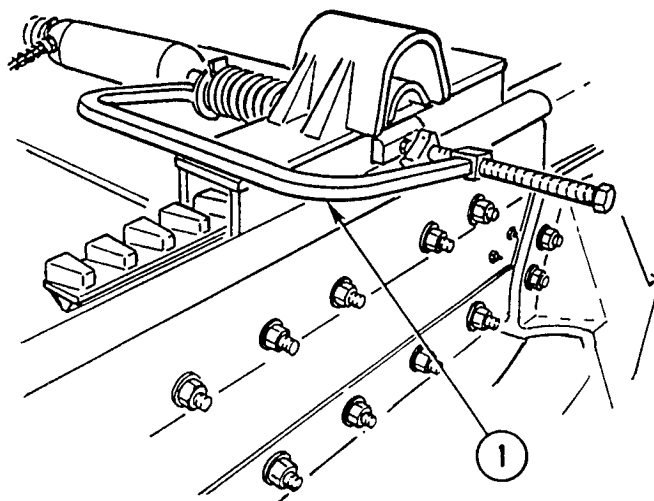
Page 20-12

**Condition Description**

Top Plate Removed

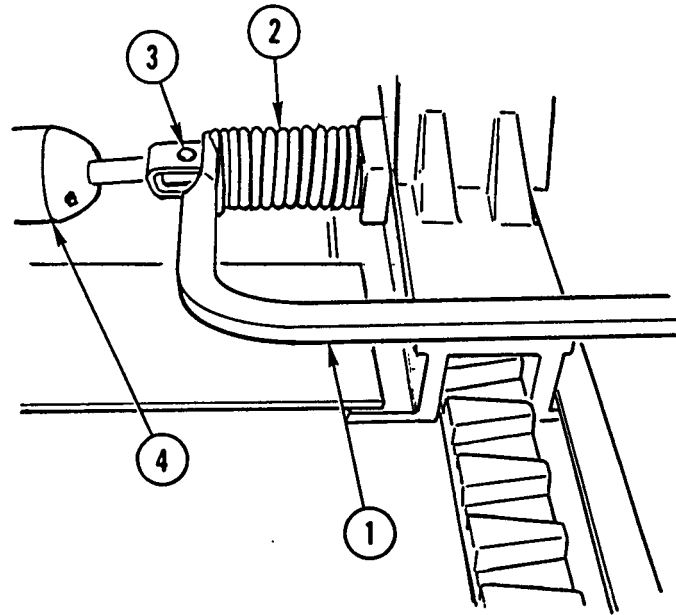
---

### REMOVAL

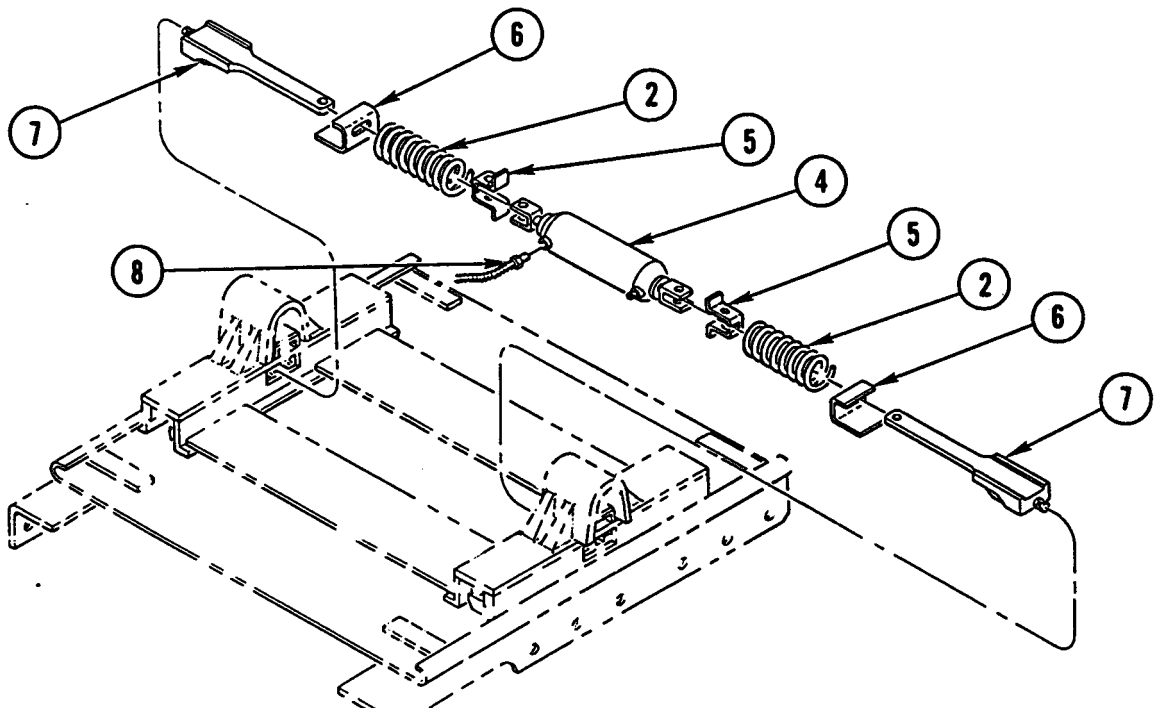


1. INSTALL SPRING COMPRESSOR (1).





2. COMPRESS SPRING (2). REMOVE PIN (3) AND SWING AIR CYLINDER (4) OUT OF THE WAY.
3. REMOVE SPRING COMPRESSOR (1).



4. REMOVE SPRING RETAINER (5), SPRING (2), PIN RETAINER (6), AND PLUNGER ASSEMBLY (7).
5. REPEAT STEPS 1 THRU 4 FOR OPPOSITE SIDE PLUNGER ASSEMBLY.
6. DISCONNECT AIR HOSE (8) AND REMOVE AIR CYLINDER (4).

## SLIDE BRACKET AND PLATE REPAIR (CONT)

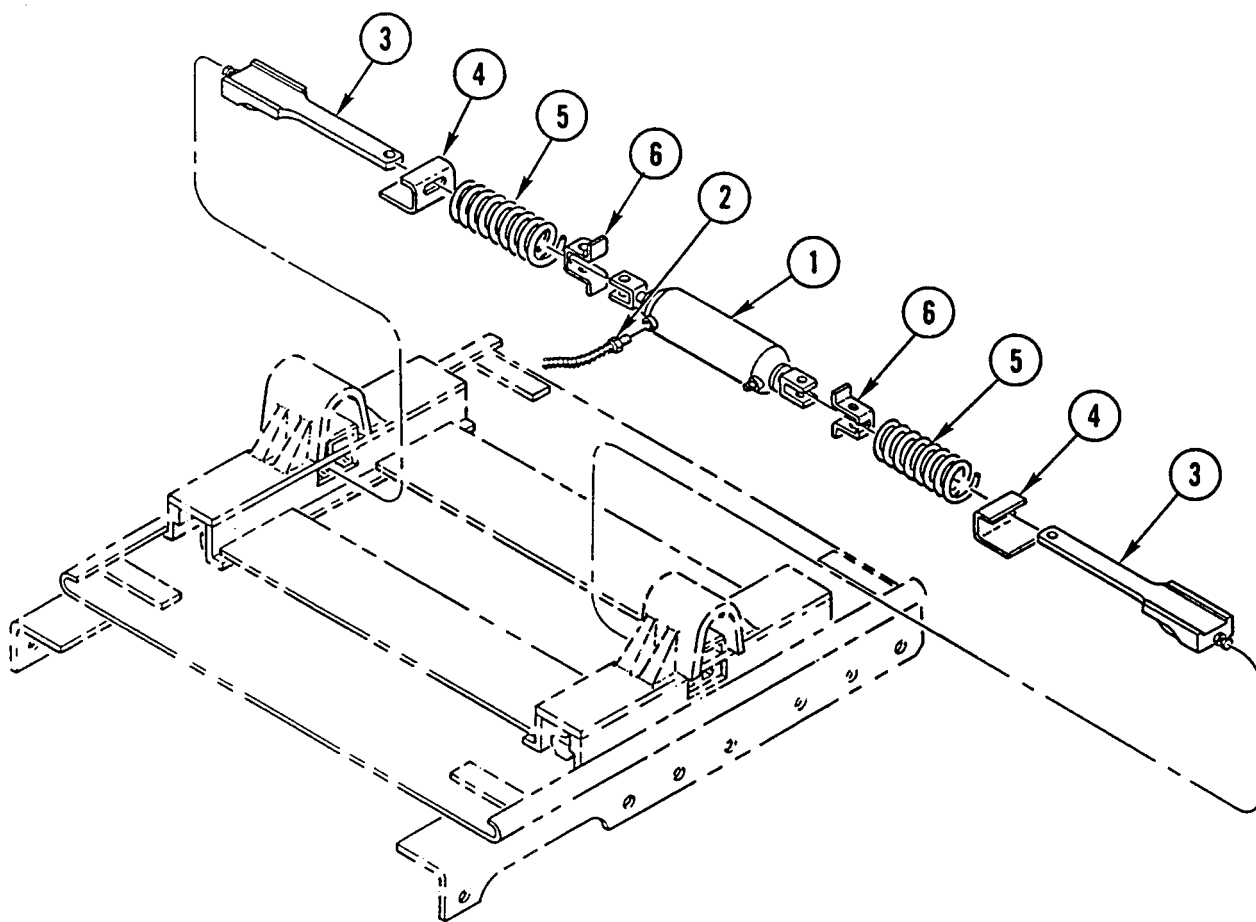
### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

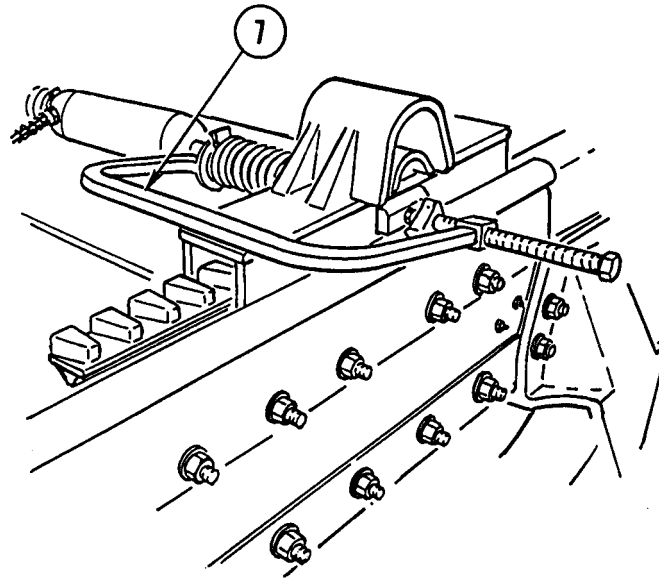
### INSPECTION

Inspect all parts for wear or damage.

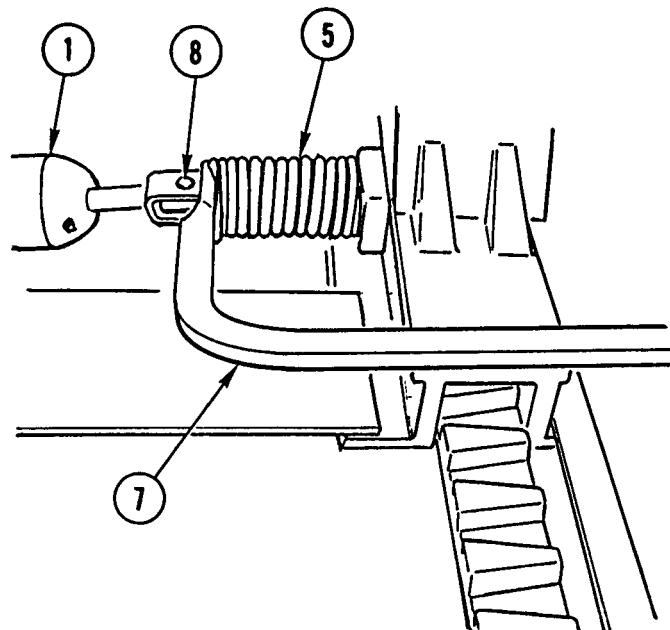
### INSTALLATION



1. INSTALL AIR CYLINDER (1) AND CONNECT AIR HOSE (2).
2. INSTALL PLUNGER ASSEMBLY (3), PIN RETAINER (4), SPRING (5), AND SPRING RETAINER (6).



3. INSTALL SPRING COMPRESSOR (7).



4. COMPRESS SPRING (5) AND PLACE AIR CYLINDER (1) IN POSITION.
5. INSTALL PIN (8) AND RELEASE SPRING COMPRESSOR (7).
6. REPEAT STEPS 2 THRU 5 FOR OPPOSITE SIDE PLUNGER ASSEMBLY.

**NOTE**

Follow-on Maintenance:

Install top plate (page 20-12).  
Adjust fifth wheel (TM 9-2320-363-20).

## Section III. TOP PLATE REPLACEMENT

### OVERVIEW

This section illustrates and describes procedures for removal, cleaning, inspection, and installation of the top plate.

---

### TOP PLATE REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

#### Applicable Configuration:

M915A2

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05

Personnel Required: (2)

#### Materials/Parts:

Kit

P/N RK-04413

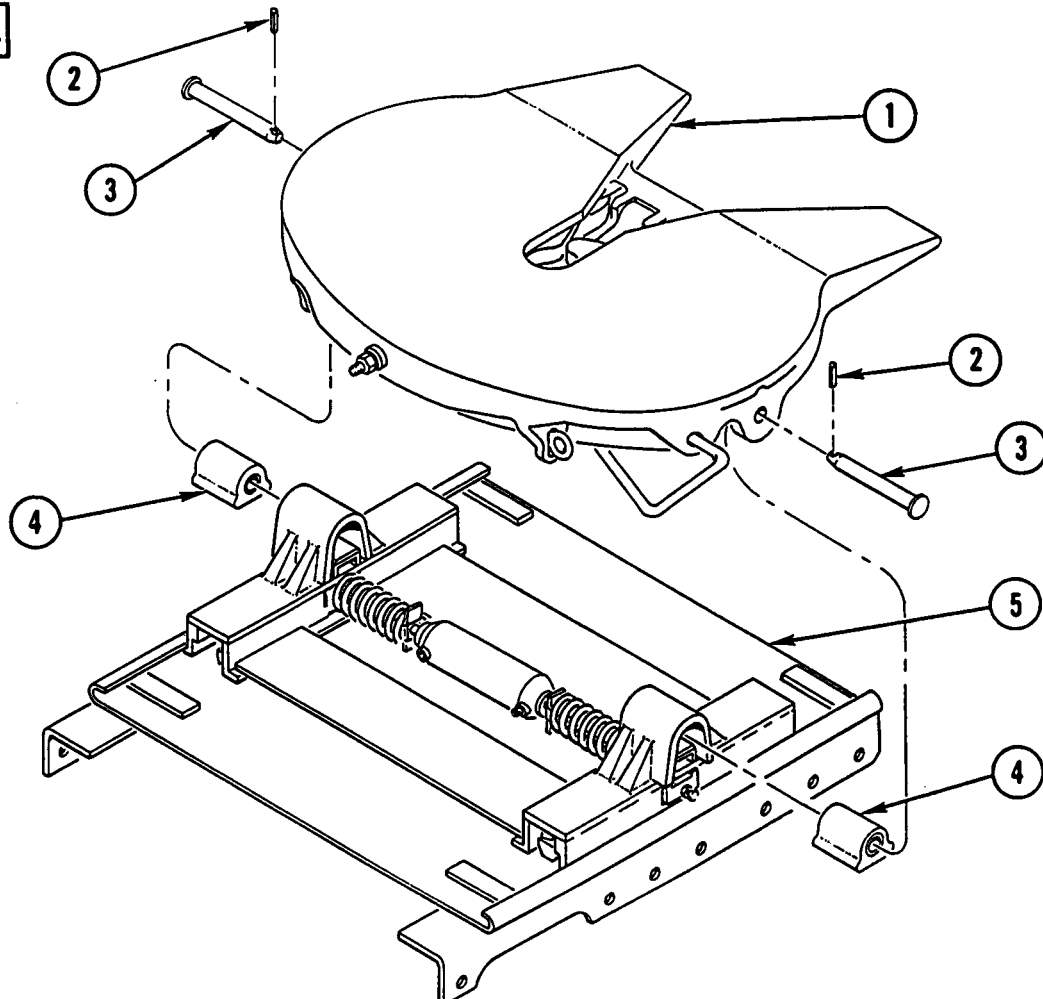
Compound,  
Antiseize

Appendix B, Item 11

#### General Safety Instructions:

##### **W A R N I N G**

Top plate weighs 320 lb (145 kg). Use hoist with lifting capacity of 500 lb (227 kg) to remove or install top plate. Failure to do so could result in injury to personnel.

**REMOVAL****WARNING**

Top plate weighs 320 lb (145 kg). Use hoist with lifting capacity of 500 lb (227 kg) to remove top plate. Failure to do so could result in injury to personnel.

1. USING SUITABLE LIFTING DEVICE, SUPPORT TOP PLATE (1) AND REMOVE TWO ROLL PINS (2). DISCARD ROLL PINS.
2. REMOVE TWO PIVOT PINS (3) AND TOP PLATE (1). DISCARD PIVOT PINS.
3. REMOVE AND DISCARD TWO CUSHION SUPPORTS (4) FROM SLIDE BRACKET (5).

**CLEANING**

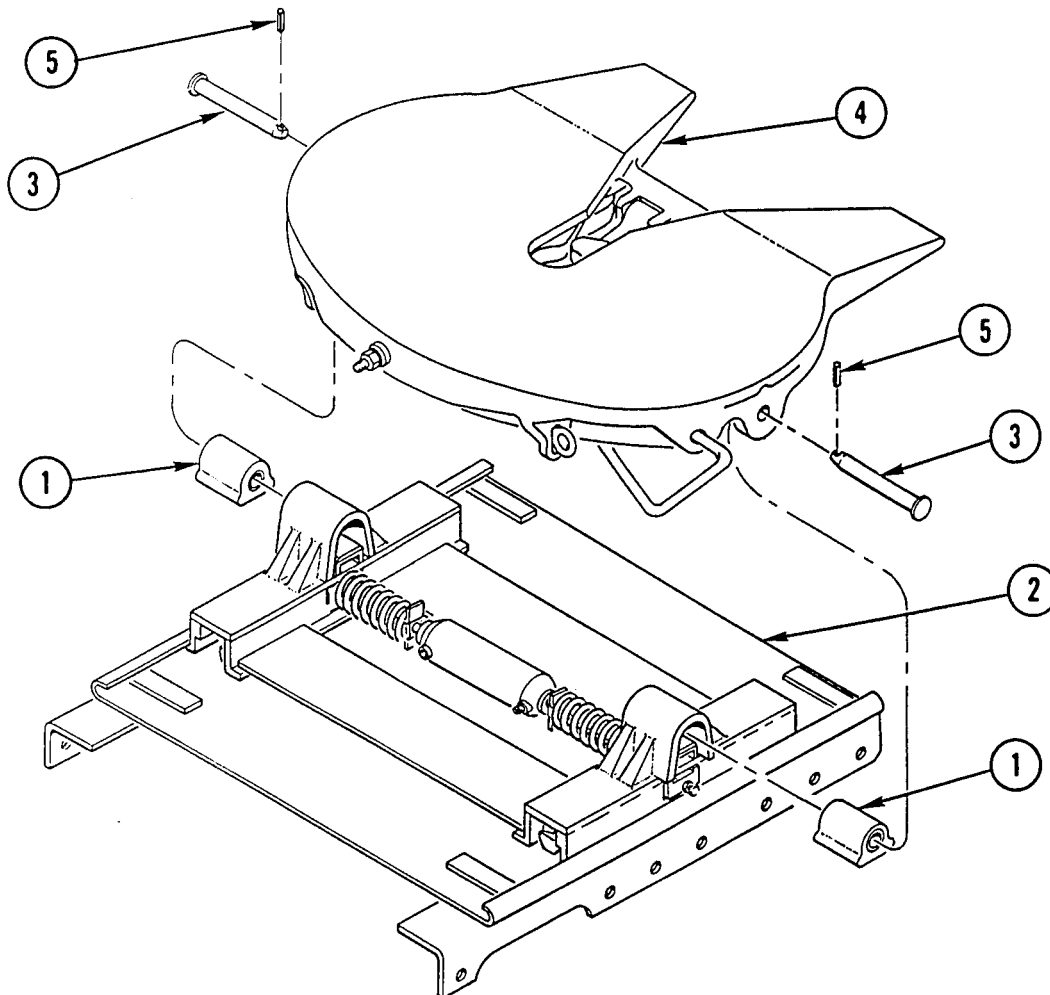
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

## TOP PLATE REPLACEMENT (CONT)

### INSTALLATION



1. INSTALL TWO NEW CUSHION SUPPORTS (1) IN SLIDE BRACKET (2).
2. COAT TWO NEW PIVOT PINS (3) WITH ANTISEIZE COMPOUND.

#### WARNING

Top plate weighs 320 lb (145 kg). Use hoist with lifting capacity of 500 lb (227 kg) to install top plate. Failure to do so could result in injury to personnel.

3. USING SUITABLE LIFTING DEVICE, ALINE TOP PLATE (4) WITH SLIDE BRACKET (2) AND INSTALL TWO NEW PIVOT PINS (3) AND TWO NEW ROLL PINS (5).

## Section IV. TOP PLATE REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, and assembly of the top plate.

---

### TOP PLATE REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M915A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Plug, TF-0237

**Materials/Parts:**

Kit	P/N RK-63503
Kit	P/N RK-63506
Compound, Antiseize	Appendix B, Item 11

**Personnel Required: (2)**

**References:**

TM 9-2320-363-20  
 TM 9-237

**Equipment Condition:**

Reference	Condition Description
Page 20-12	Top Plate Removed

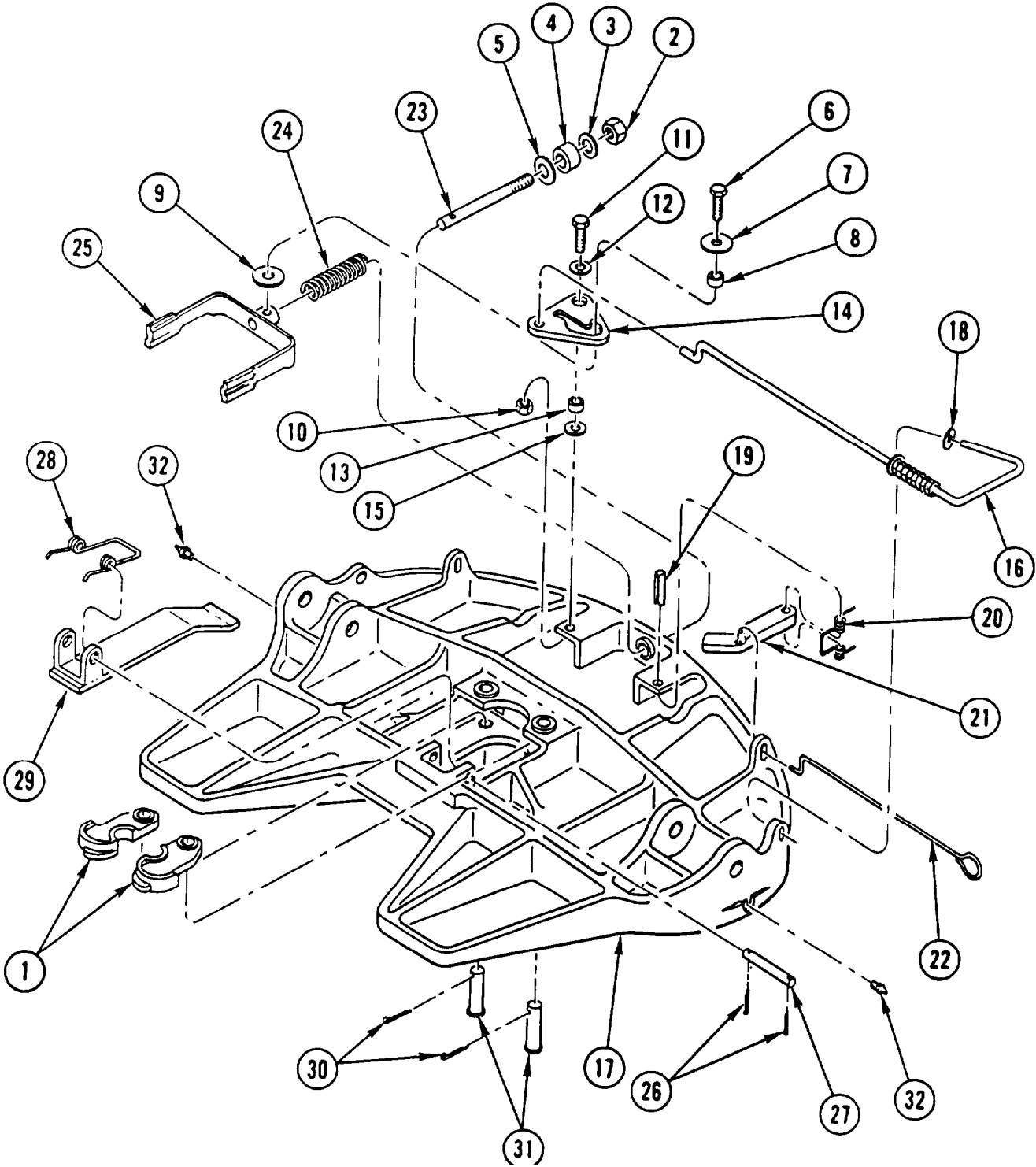
**General Safety Instructions:**

**WARNING**

- When removing spring, compress spring slightly and relieve tension slowly. Failure to do so could cause spring to fly off, resulting in injury to personnel.
- Locks must be closed while adjusting to make sure contact is made with locks, yoke, and top plate. Failure to do so will result in loss of trailer and possible injury to personnel.

# TOP PLATE REPAIR (CONT)

## DISASSEMBLY





1. MAKE SURE LOCKS (1) ARE IN CLOSED POSITION.
2. REMOVE AND DISCARD NUT (2), WASHER (3), RUBBER WASHER (4), AND LOCK-ADJUST TAG (5).
3. REMOVE AND DISCARD SCREW (6), WASHER (7), ROLLER (8), AND WASHER (9).
4. REMOVE AND DISCARD LOCK NUT (10), SCREW (11), WASHER (12), ROLLER (13), CAM PLATE (14), AND WASHER (15).
5. REMOVE PRIMARY LOCK HANDLE (16) FROM TOP PLATE (17),
6. REMOVE AND DISCARD WASHER (18) FROM PRIMARY LOCK HANDLE (16).
7. REMOVE ROLL PIN (19), SPRING (20), LOCK BAR (21), AND HANDLE (22). DISCARD ROLL PIN, SPRING, AND LOCK BAR.

**WARNING**

When removing spring, compress spring slightly and relieve tension slowly. Failure to do so could cause spring to fly off, resulting in injury to personnel.

8. REMOVE AND DISCARD SHAFT (23), SPRING (24), AND YOKE (25) FROM TOP PLATE (17).
9. REMOVE TWO COTTER PINS (26), PIN (27), SPRING (28), AND LOCK GUARD (29). DISCARD COTTER PINS, PIN, AND LOCK GUARD.
10. REMOVE TWO COTTER PINS (30), TWO PINS (31), AND TWO LOCKS (1). DISCARD COTTER PINS AND PINS.
11. IF DAMAGED, REMOVE TWO GREASE FITTINGS (32) FROM TOP PLATE (17).

**CLEANING**

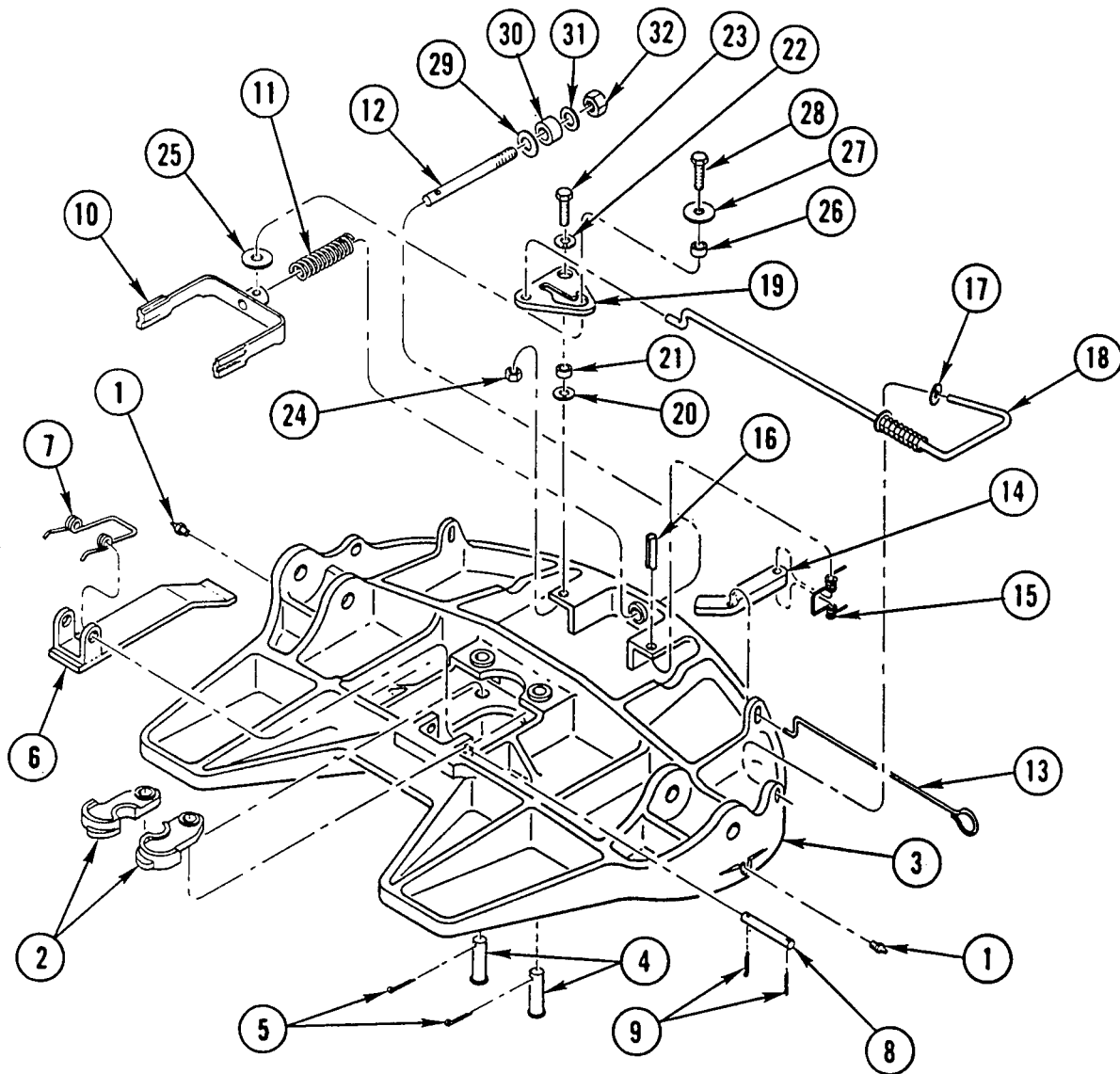
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

## TOP PLATE REPAIR (CONT)

### ASSEMBLY



1. IF REMOVED, INSTALL TWO NEW GREASE FITTINGS (1).
2. COAT PIN HOLES OF TWO LOCKS (2) WITH ANTISEIZE COMPOUND AND INSTALL TWO LOCKS (2) WITH LARGER OPENING FACING TOWARD TOP OF TOP PLATE (3).
3. INSTALL TWO NEW PINS (4) AND TWO NEW COTTER PINS (5).
4. INSTALL NEW LOCK GUARD (6), SPRING (7), NEW PIN (8), AND TWO NEW COTTER PINS (9).

5. INSTALL PLUG (P/N TF-0237) BETWEEN TWO LOCKS (2) AND CLOSE TWO LOCKS (2).

**NOTE**

Tips of yoke must be flush (1/32 in.) with ends of two locks. If yoke falls short, grind outside edges of yoke tips evenly until yoke fits exactly. If yoke extends beyond two locks, build up outside edges of yoke tips using low-hydrogen E70XX welding rod. After welding, grind beads smooth and even until yoke fits exactly.

6. INSTALL NEW YOKE (10) WITH THREADED HOLE UP AND TAP INTO PLACE.

**NOTE**

Make sure threaded hole is up when installing shaft.

7. INSTALL NEW SPRING (11) AND NEW SHAFT (12) ON YOKE (10).
8. INSTALL HANDLE (13), NEW LOCK BAR (14), NEW SPRING (15), AND NEW ROLL PIN (16).
9. INSTALL NEW WASHER (17) ON PRIMARY LOCK HANDLE (18).
10. INSTALL PRIMARY LOCK HANDLE (18) IN TOP PLATE (3).
11. INSTALL NEW CAM PLATE (19) ON PRIMARY LOCK HANDLE (18).

**NOTE**

Install washers with rounded side facing away from cam plate.

12. INSTALL NEW WASHER (20), NEW ROLLER (21), NEW WASHER (22), NEW SCREW (23), AND NEW LOCK NUT (24) IN TOP PLATE (3).
13. INSTALL NEW WASHER (25), NEW ROLLER (26), NEW WASHER (27), AND NEW SCREW (28) IN CAM PLATE (19).
14. INSTALL NEW LOCK-ADJUST TAG (29), NEW RUBBER WASHER (30), NEW WASHER (31), AND NEW NUT (32) ON SHAFT (12).

**WARNING**

**Locks must be closed while adjusting to make sure contact is made with locks, yoke, and top plate. Failure to do so will result in loss of trailer and possible injury to personnel.**

15. TIGHTEN NUT (32) UNTIL PLUG (P/N TF-0237) FITS SNUGLY, BUT CAN JUST BE ROTATED BY HAND.
16. OPEN TWO LOCKS (2) AND REMOVE PLUG (P/N TF-0237).

**NOTE**

Follow-on Maintenance:

Install top plate (page 20-12).  
 Lubricate fifth wheel (TM 9-2320-363-20).  
 Adjust fifth wheel (TM 9-2320-363-20).

## Section V. SLIDE BRACKET AND BASE REPAIR

### OVERVIEW

This section illustrates and describes procedures for removal, cleaning, inspection, and installation of the slide bracket and base.

---

### SLIDE BRACKET AND BASE REPAIR

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-NO5  
Spring Compressor, TF-TLN-2500

**Materials/Parts:**

Kit, Repair                      P/N RK-01370

**Equipment Condition:**

**Reference**

Page 20-30

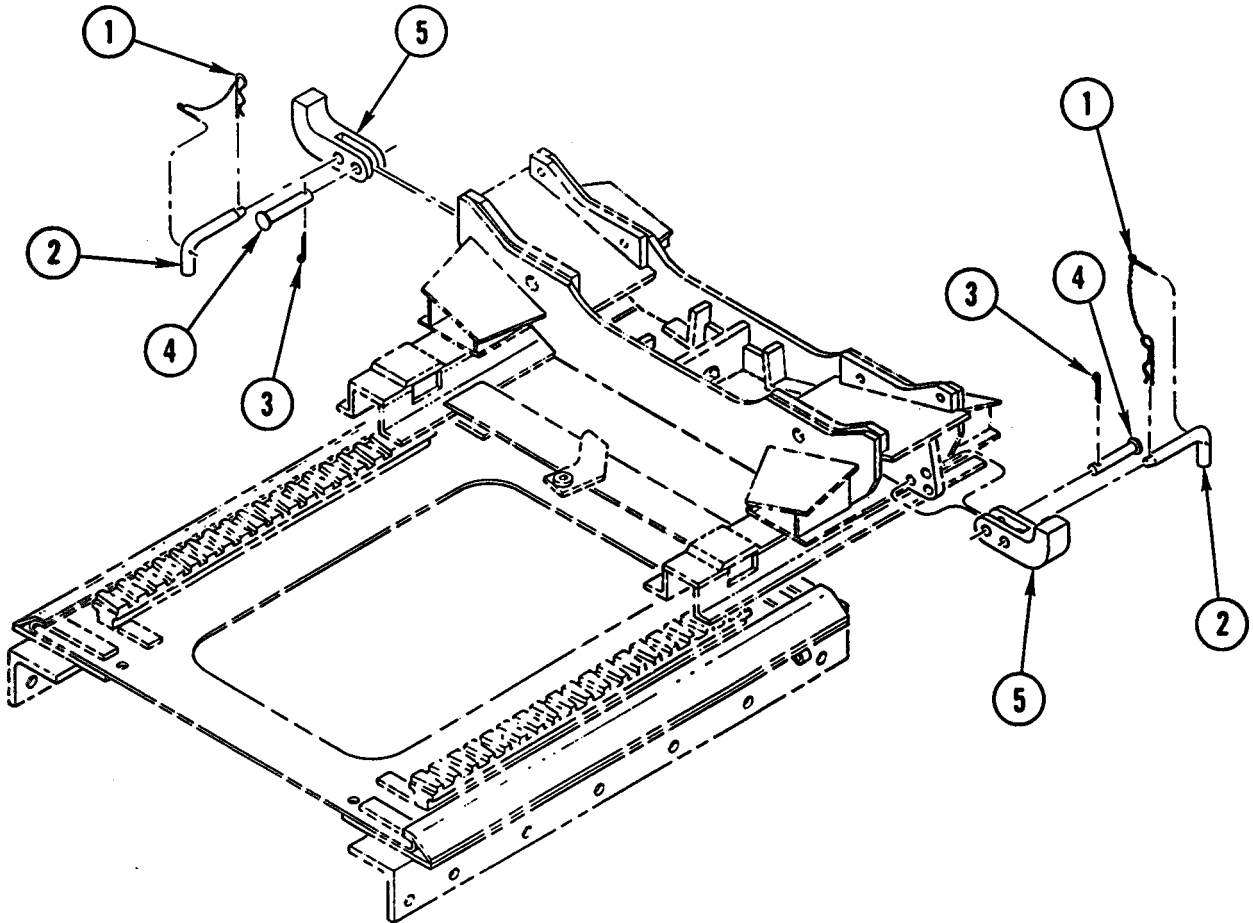
Page 20-6

**Condition Description**

Top Plate Removed

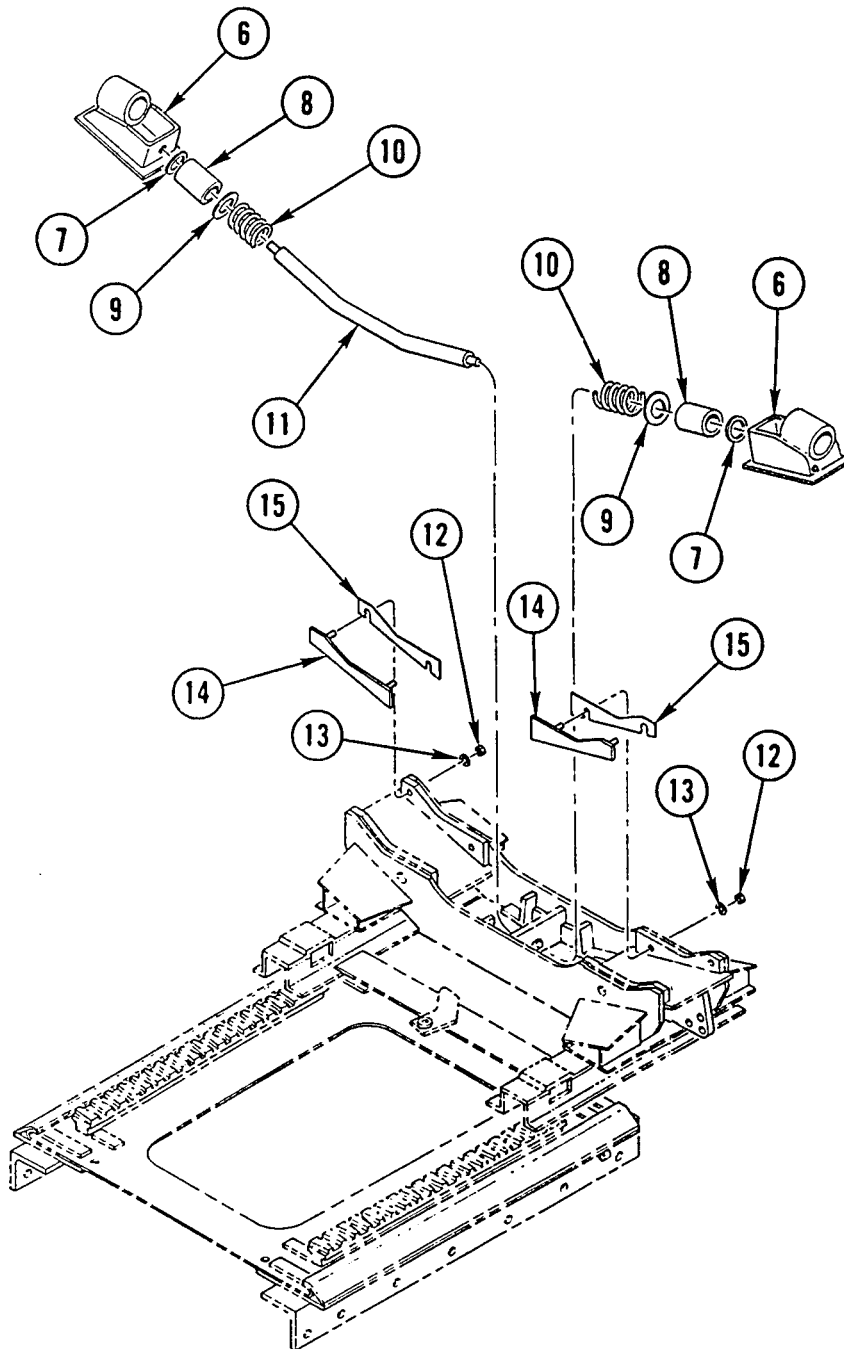
Fifth Wheel Removed

**REMOVAL**

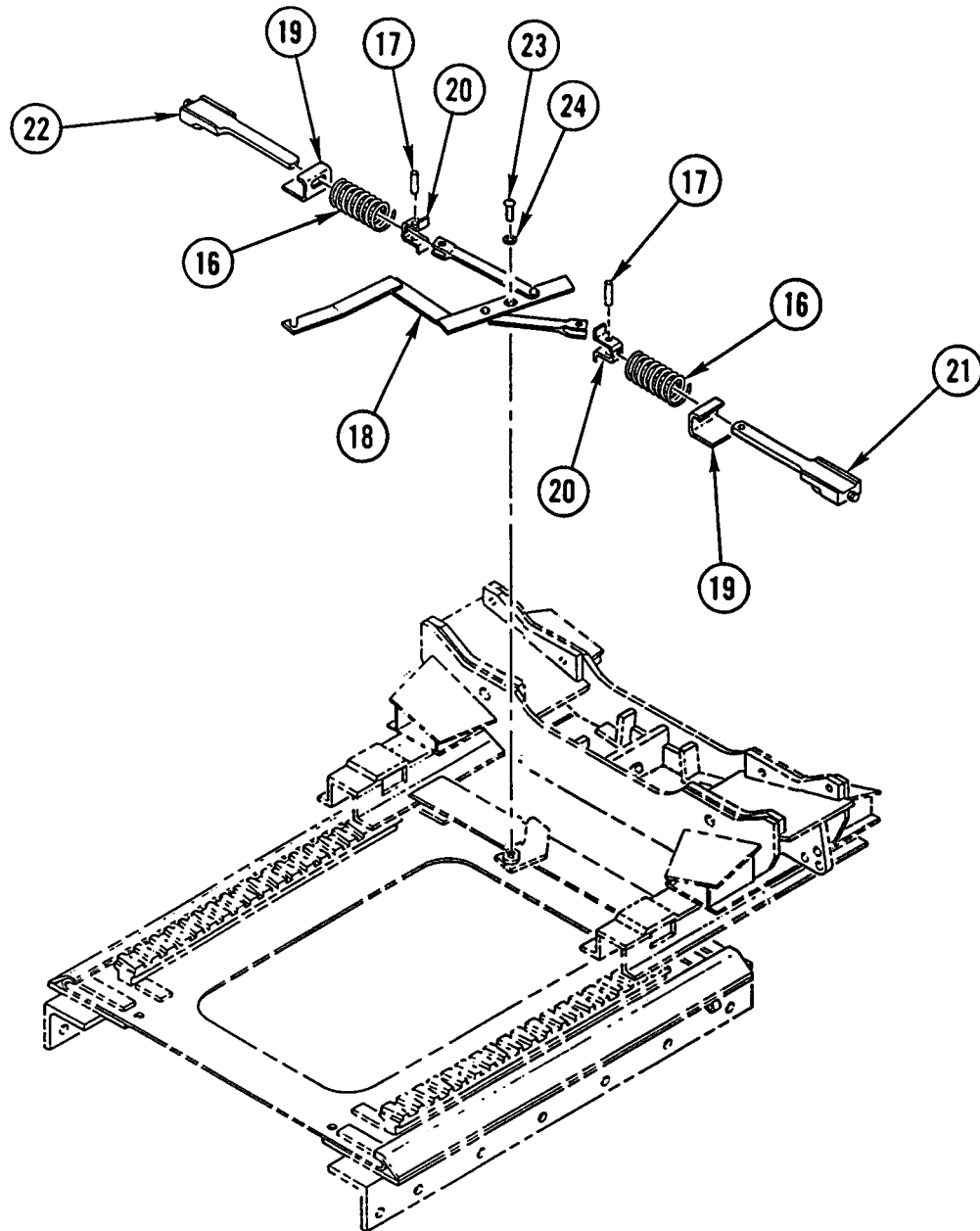


1. REMOVE AND DISCARD TWO PINS (1) AND TWO LOCKING PINS (2).
2. REMOVE AND DISCARD TWO COTTER PINS (3), TWO PINS (4), AND TWO LOCKOUTS (5).

## SLIDE BRACKET AND BASE REPAIR (CONT)

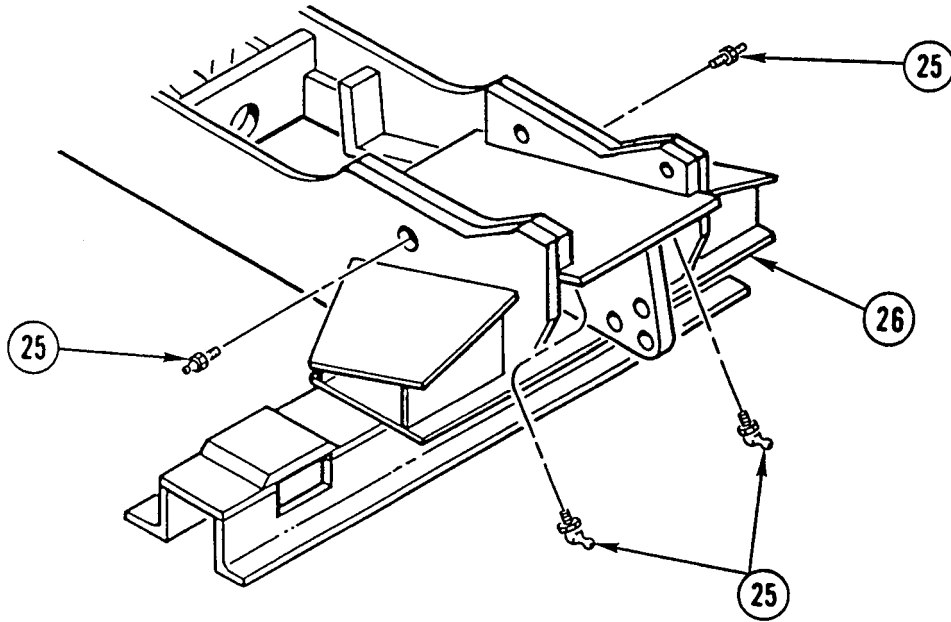


3. REMOVE TWO SHOES (6), TWO WASHERS (7), TWO CUSHIONS (8), TWO WASHERS (9), TWO SPRINGS (10), AND TIE BAR (11).
4. REMOVE FOUR NUTS (12), FOUR LOCK WASHERS (13), TWO BEARING PLATES (14), AND TWO SHIMS (15). DISCARD LOCK WASHERS.

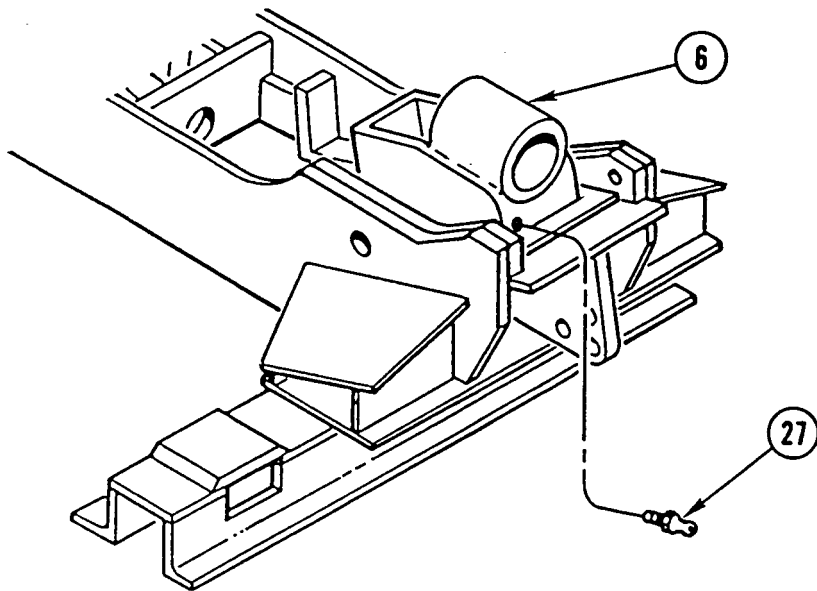


5. USING SPRING COMPRESSOR, COMPRESS SPRING (16). REMOVE PIN (17) AND DISCONNECT RELEASE LEVER (18).
6. REMOVE SPRING COMPRESSOR.
7. REMOVE SPRING RETAINER (19), SPRING (16), PIN RETAINER (20), AND PLUNGER (21).
8. REPEAT STEPS 5 THRU 7 FOR REMOVAL OF OPPOSITE PLUNGER (22).
9. REMOVE SCREW (23), BUSHING (24), AND RELEASE LEVER (18).

**SLIDE BRACKET AND BASE REPAIR (CONT)**



10. REMOVE EIGHT GREASE FITTINGS (25) FROM SLIDE BRACKET FRAME (26).



11. REMOVE TWO GREASE FITTINGS (27) FROM TWO SHOES (6).

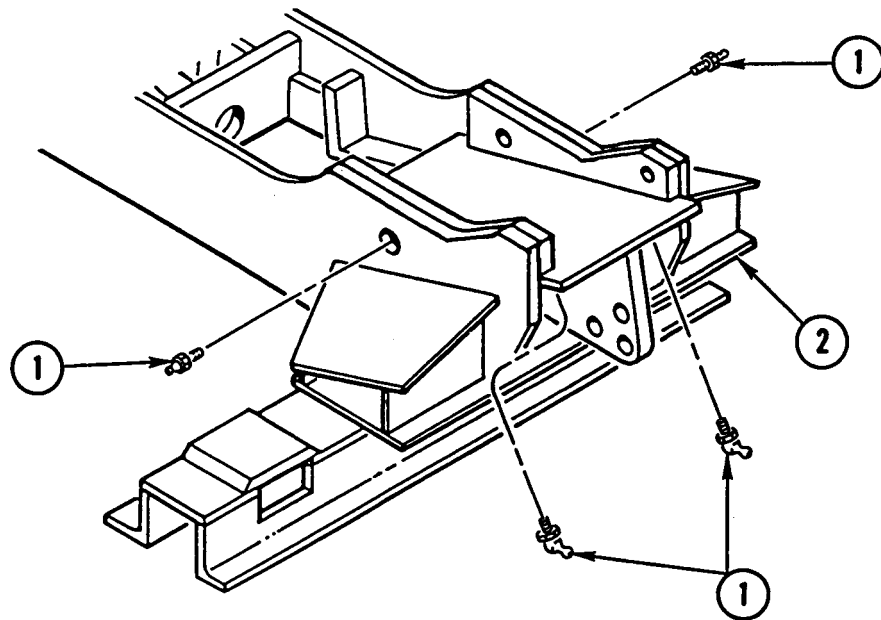


**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

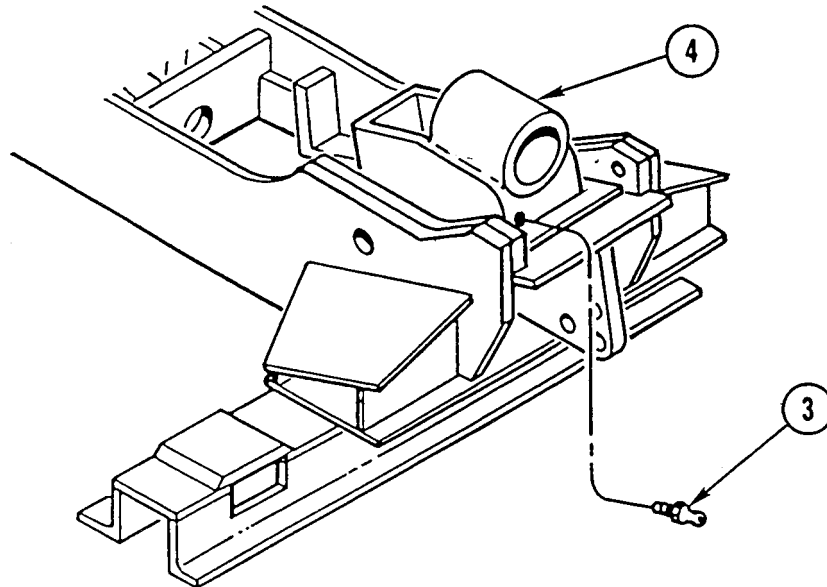
**INSPECTION**

1. INSPECT ALL PARTS FOR WEAR OR DAMAGE.
2. MEASURE THICKNESS OF BOTTOM PLATE OF SHOE. MINIMUM ALLOWABLE THICKNESS IS 0.30 IN. (7.35 mm). IF MEASUREMENT IS LESS THAN MINIMUM ALLOWED, REPLACE SHOE.

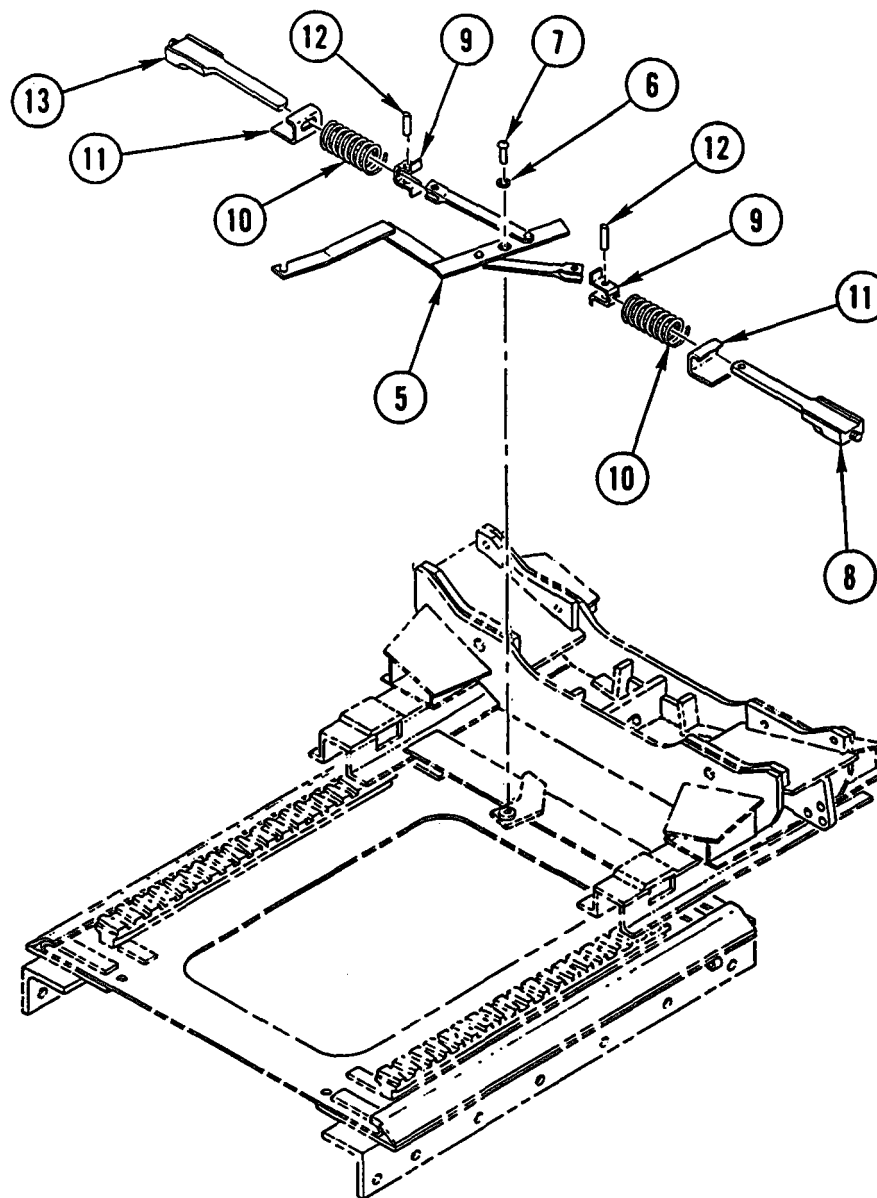
**INSTALLATION**

1. INSTALL EIGHT GREASE FITTINGS (1) IN SLIDE BRACKET (2).

## SLIDE BRACKET AND BASE REPAIR (CONT)

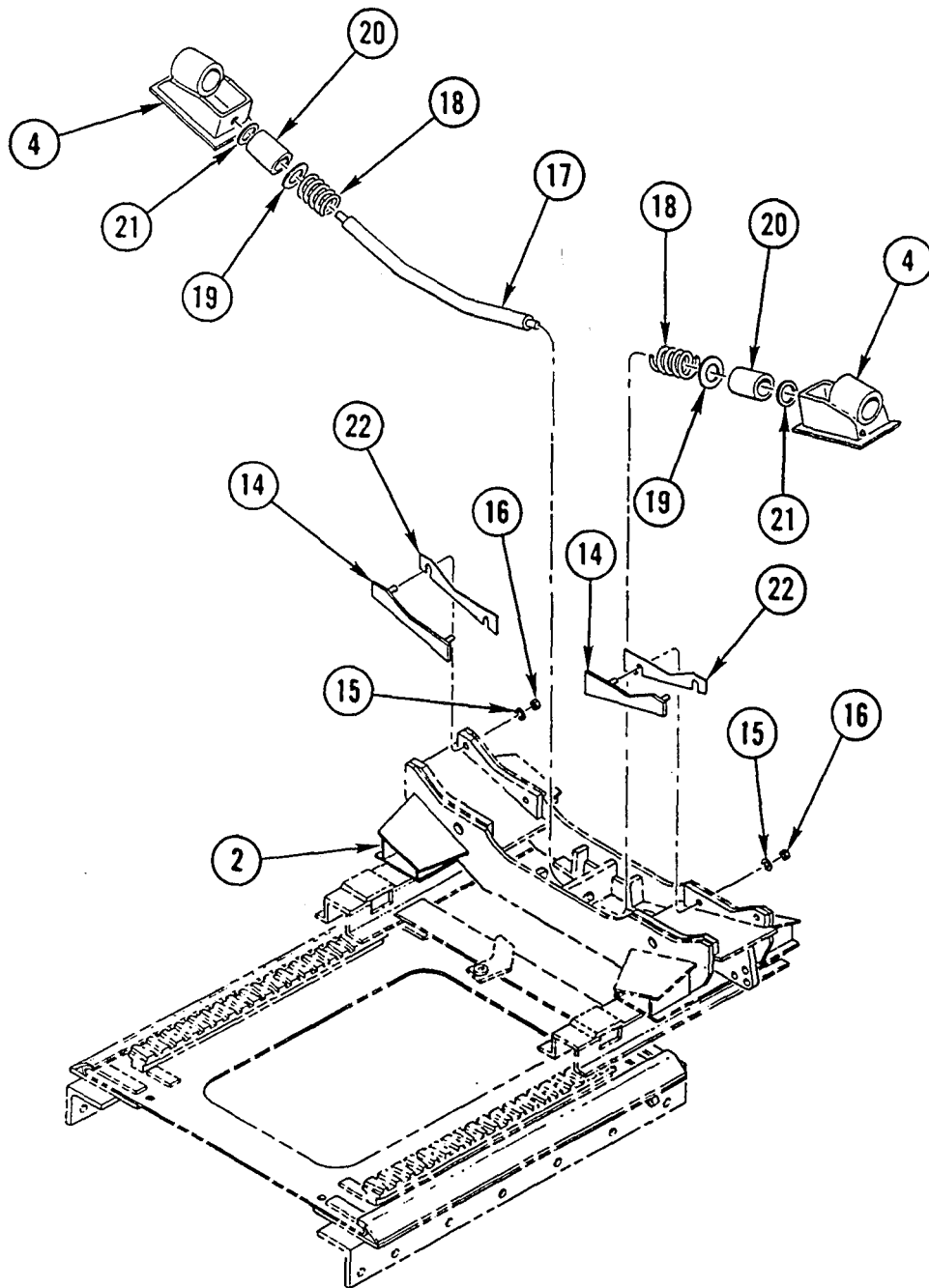


2. INSTALL TWO GREASE FITTINGS (3) IN TWO SHOES (4).



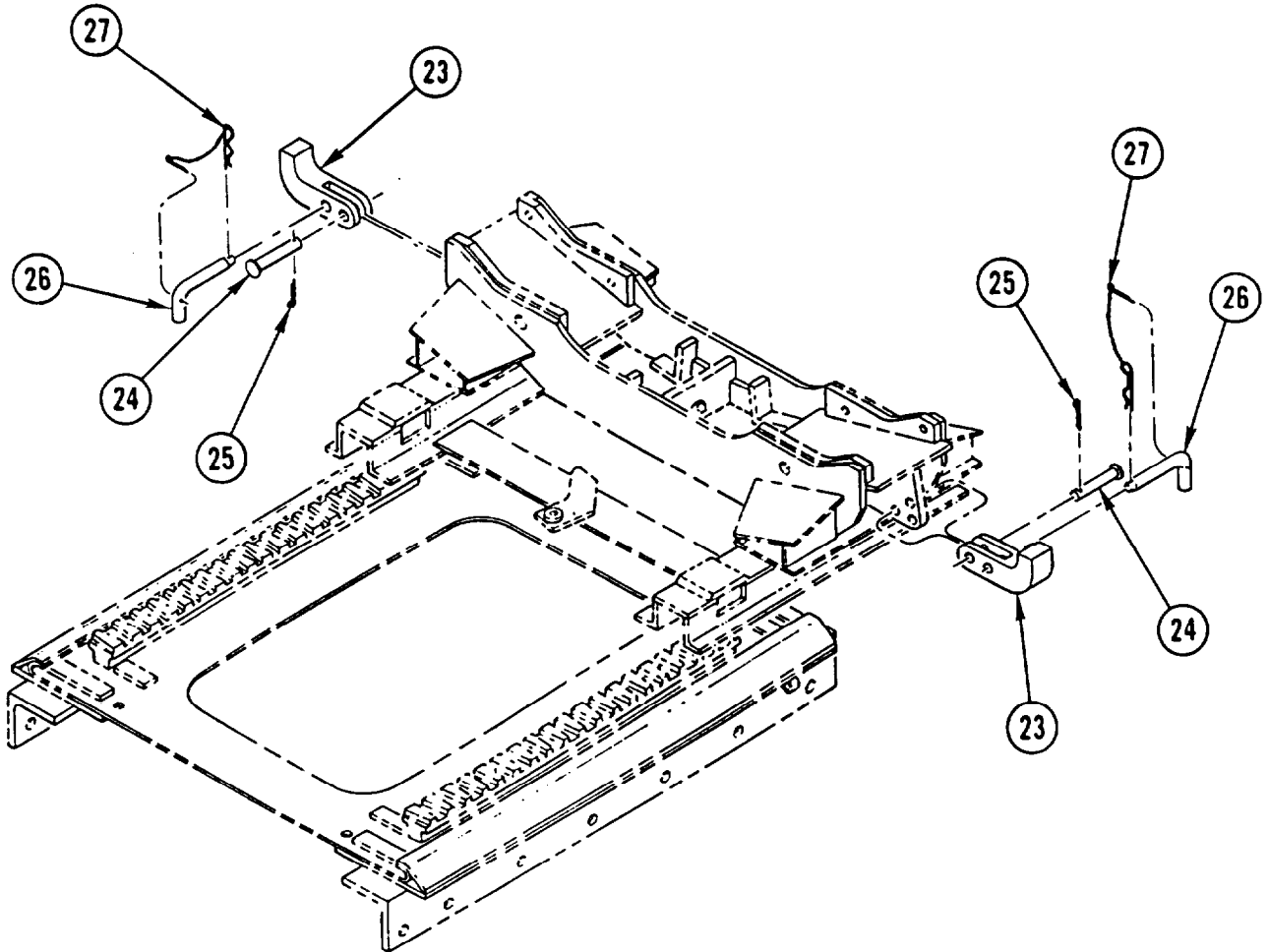
3. INSTALL RELEASE LEVER (5), BUSHING (6), AND SCREW (7).
4. INSTALL PLUNGER (8), PIN RETAINER (9), SPRING (10), AND SPRING RETAINER (11).
5. USING SPRING COMPRESSOR, COMPRESS SPRING (10). CONNECT RELEASE LEVER (5) AND INSTALL PIN (12).
6. REMOVE SPRING COMPRESSOR.
7. REPEAT STEPS 4 THRU 6 FOR INSTALLATION OF OPPOSITE PLUNGER (13).

## SLIDE BRACKET AND BASE REPAIR (CONT)



8. INSTALL TWO BEARING PLATES (14), FOUR NEW LOCK WASHERS (15), AND FOUR NUTS (16).
9. INSTALL TIE BAR (17), TWO SPRINGS (18), TWO WASHERS (19), TWO CUSHIONS (20), TWO WASHERS (21), AND TWO SHOES (4).
10. USING FEELER GAGE, MEASURE DISTANCE BETWEEN TWO SHOES (4) AND SLIDE BRACKET (2) FOR SIDE PLAY. MAXIMUM ALLOWABLE SIDE PLAY IS 0.060 IN. (1.524 mm); MINIMUM ALLOWABLE SIDE PLAY IS 0.015 IN. (0.381 mm). INSTALL SHIM(S) (22) AS NEEDED.

11. USING PRY BAR LIFT TWO SHOES (4) AND MEASURE DISTANCE BETWEEN BOTTOM OF SHOES AND SLIDE BRACKET (2). IF PLAY IS MORE THAN 0.5 IN. (12.3 mm), REPLACE TWO BEARING PLATES (14).



12. INSTALL TWO NEW LOCKOUTS (23), TWO NEW PINS (24), AND TWO NEW COTTER PINS (25).

13. INSTALL TWO NEW LOCKING PINS (26) AND TWO NEW PINS (27).

**NOTE**

Follow-on Maintenance:

- Install top plate (page 20-30).
- Install fifth wheel (page 20-6).

## Section VI. TOP PLATE REPLACEMENT

### OVERVIEW

This section illustrates and describes procedures for removal, cleaning, inspection, and installation of the top plate.

---

### TOP PLATE REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Compound,  
Antiseize

Appendix B, Item 11

**References:**

TM 9-2320-363-10

**Equipment Condition:**

**Reference**

TM 9-2320-363-10

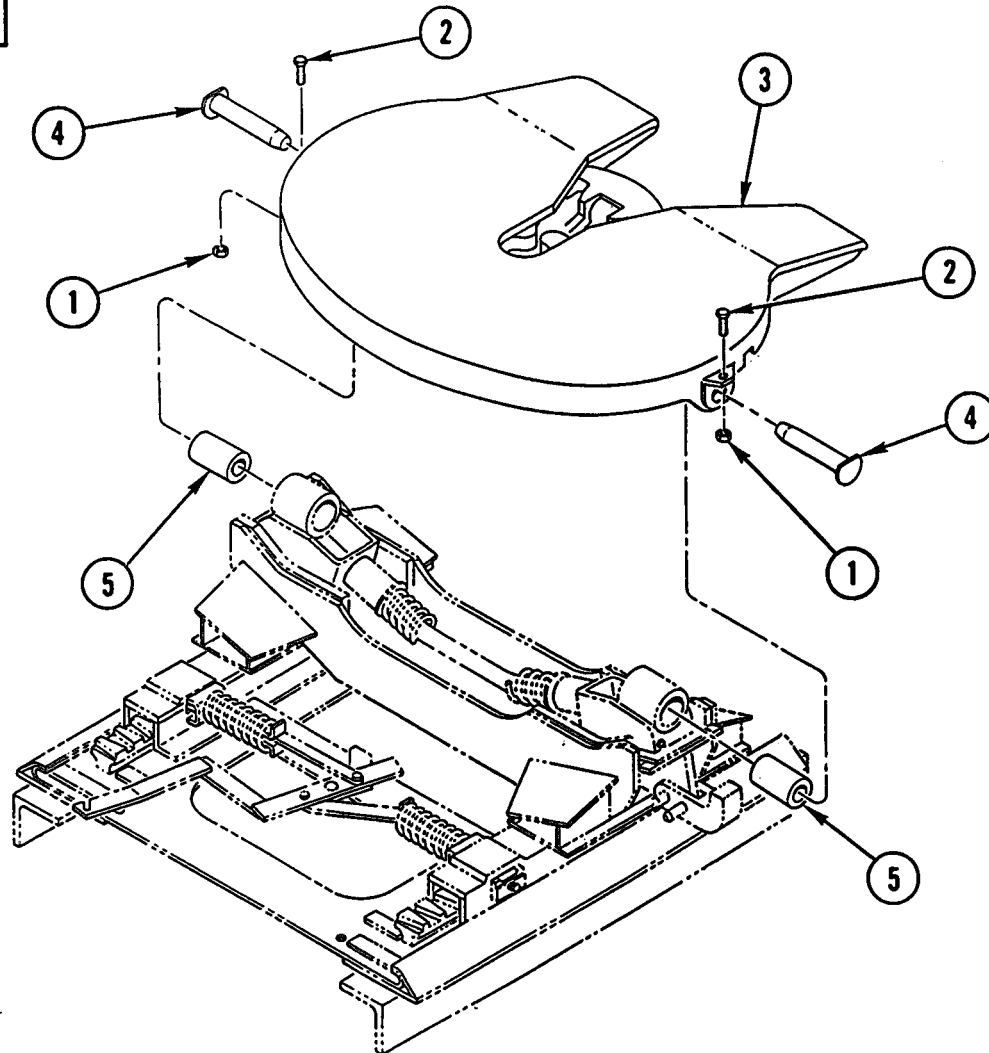
**Condition Description**

Travel Locks in Unlock  
Position

**General Safety Instructions:**

**WARNING**

Top plate weighs 700 lb (318 kg). Use hoist with lifting capacity of 900 lb (409 kg) to remove or install top plate. Failure to do so could result in injury to personnel.

**REMOVAL**

1. REMOVE TWO NUTS (1) AND TWO SCREWS (2) FROM TOP PLATE (3).

**WARNING**

Top plate weighs 700 lb (318 kg). Use hoist with lifting capacity of 900 lb (409 kg) to remove top plate. Failure to do so could result in injury to personnel.

2. USING SUITABLE LIFTING DEVICE, SUPPORT TOP PLATE (3) AND REMOVE TWO PINS (4), TOP PLATE (3), AND TWO CUSHIONS (5).

**CLEANING**

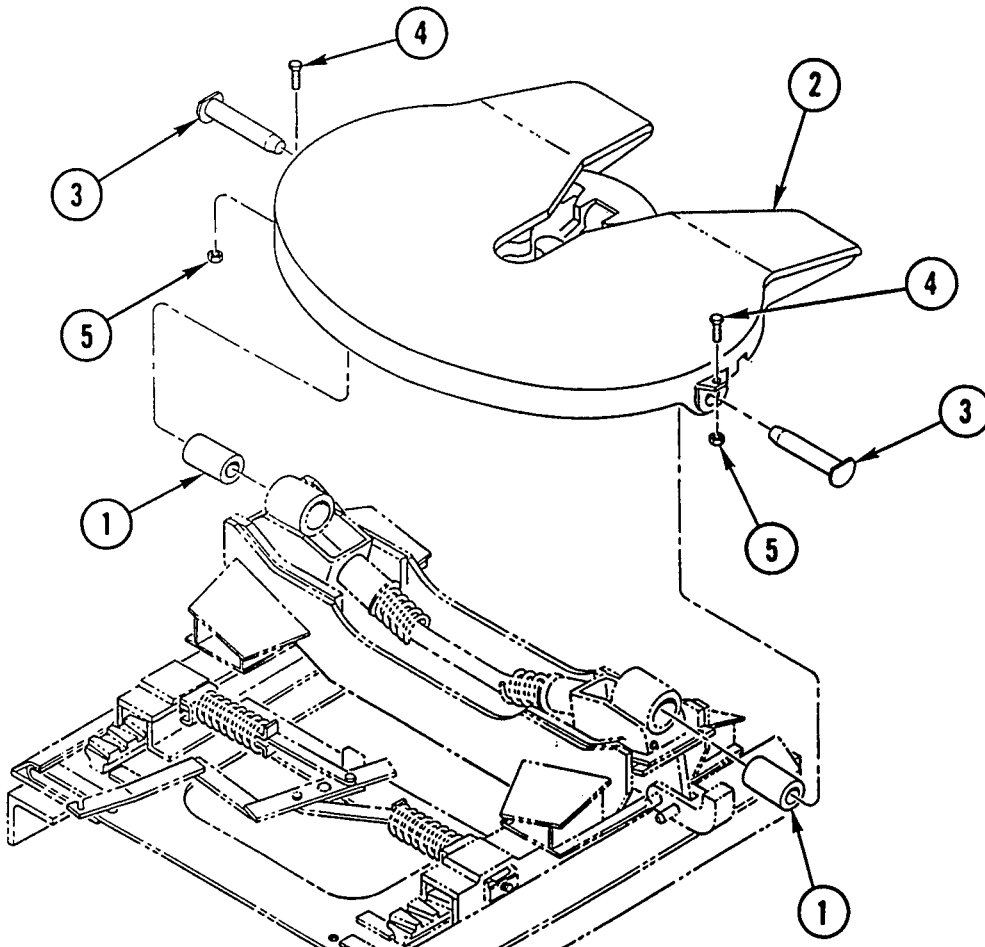
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

## TOP PLATE REPLACEMENT (CONT)

### INSTALLATION



1. INSTALL TWO CUSHIONS (1).

---

#### WARNING

Top plate weighs 700 lb (318 kg). Use hoist with lifting capacity of 900 lb (409 kg) to install top plate. Failure to do so could result in injury to personnel.

---

2. USING SUITABLE LIFTING DEVICE, INSTALL TOP PLATE (2).
3. COAT TWO PINS (3) WITH ANTISEIZE COMPOUND AND INSTALL THRU TOP PLATE (2).
4. INSTALL TWO SCREWS (4) AND TWO NUTS (5) IN TOP PLATE (2).



## Section VII. TOP PLATE REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, and assembly of the top plate.

---

### TOP PLATE REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Pin, Cotter

Kit, Repair

Grease,  
Automotive and  
Artillery (GAA)

Compound,  
Antiseize

P/N RK-65015

Appendix B, Item 26

Appendix B, Item 11

**References:**

TM 9-2320-363-20

**Equipment Condition:**

**Reference**

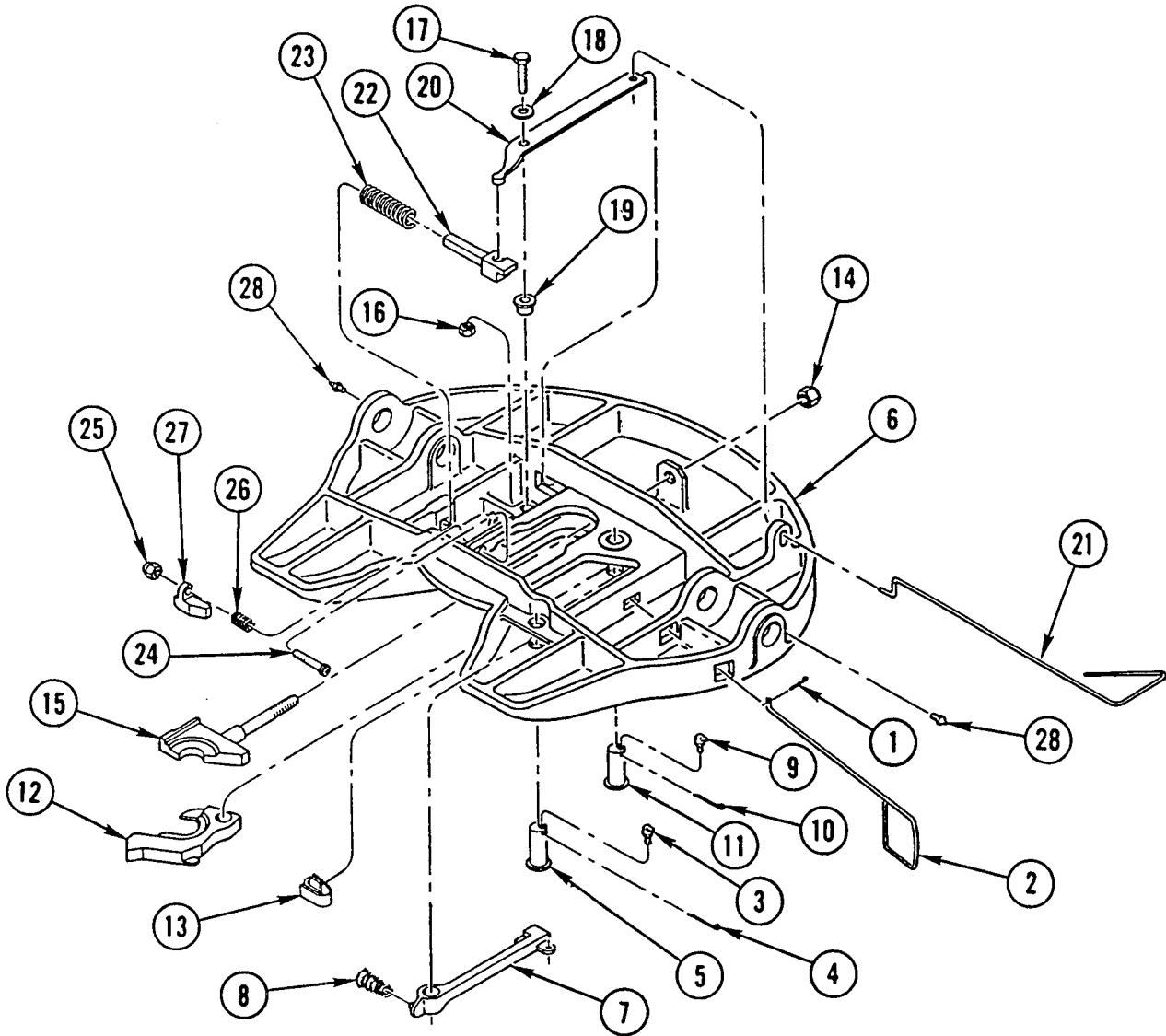
Page 20-30

**Condition Description**

Top Plate Removed

## TOP PLATE REPAIR (CONT)

### DISASSEMBLY



1. CLOSE PRIMARY AND SECONDARY LOCKS.
2. REMOVE COTTER PIN (1) AND SECONDARY RELEASE HANDLE (2). DISCARD COTTER PIN.
3. REMOVE GREASE FITTING (3) AND COTTER PIN (4) FROM PIN (5). DISCARD COTTER PIN.

**CAUTION**

Use extreme care in performance of step 4 to avoid damaging grease fitting hole.

**NOTE**

Note position of cotter pin hole prior to removal to aid in installation.

4. USING BRASS DRIFT PIN OR PRESS, REMOVE PIN (5) FROM TOP PLATE (6). DISCARD PIN.
5. REMOVE AND DISCARD SECONDARY RELEASE LEVER (7) AND SPRING (8).
6. REMOVE GREASE FITTING (9) AND COTTER PIN (10) FROM PIN (11). DISCARD COTTER PIN.

**CAUTION**

Use extreme care in performance of step 7 to avoid damaging grease fitting hole.

7. USING BRASS DRIFT PIN OR PRESS, REMOVE PIN (11) FROM TOP PLATE (6). DISCARD PIN.
8. REMOVE JAW (12) AND SPRING (13) FROM TOP PLATE (6). DISCARD SPRING.
9. REMOVE LOCK NUT (14) AND JAW (15) FROM TOP PLATE (6). DISCARD LOCK NUT.
10. REMOVE LOCK NUT (16), SCREW (17), WASHER (18), AND BUSHING (19) FROM RELEASE LEVER (20). DISCARD LOCK NUT AND BUSHING.

**NOTE**

It may be necessary to remove paint from surfaces to have sufficient clearance for removal of primary release handle.

11. DISCONNECT PRIMARY RELEASE HANDLE (21) FROM RELEASE LEVER (20).
12. REMOVE PRIMARY RELEASE HANDLE (21) AND RELEASE LEVER (20) FROM TOP PLATE (6). DISCARD RELEASE LEVER.
13. REMOVE AND DISCARD PLUNGER (22) AND SPRING (23) FROM TOP PLATE (6).
14. REMOVE SOCKET HEAD SCREW (24), LOCK NUT (25), SPRING (26), AND ADJUSTING WEDGE (27). DISCARD SOCKET HEAD SCREW, LOCK NUT, AND ADJUSTING WEDGE.
15. REMOVE TWO GREASE FITTINGS (28) FROM TOP PLATE (6).

**CLEANING**

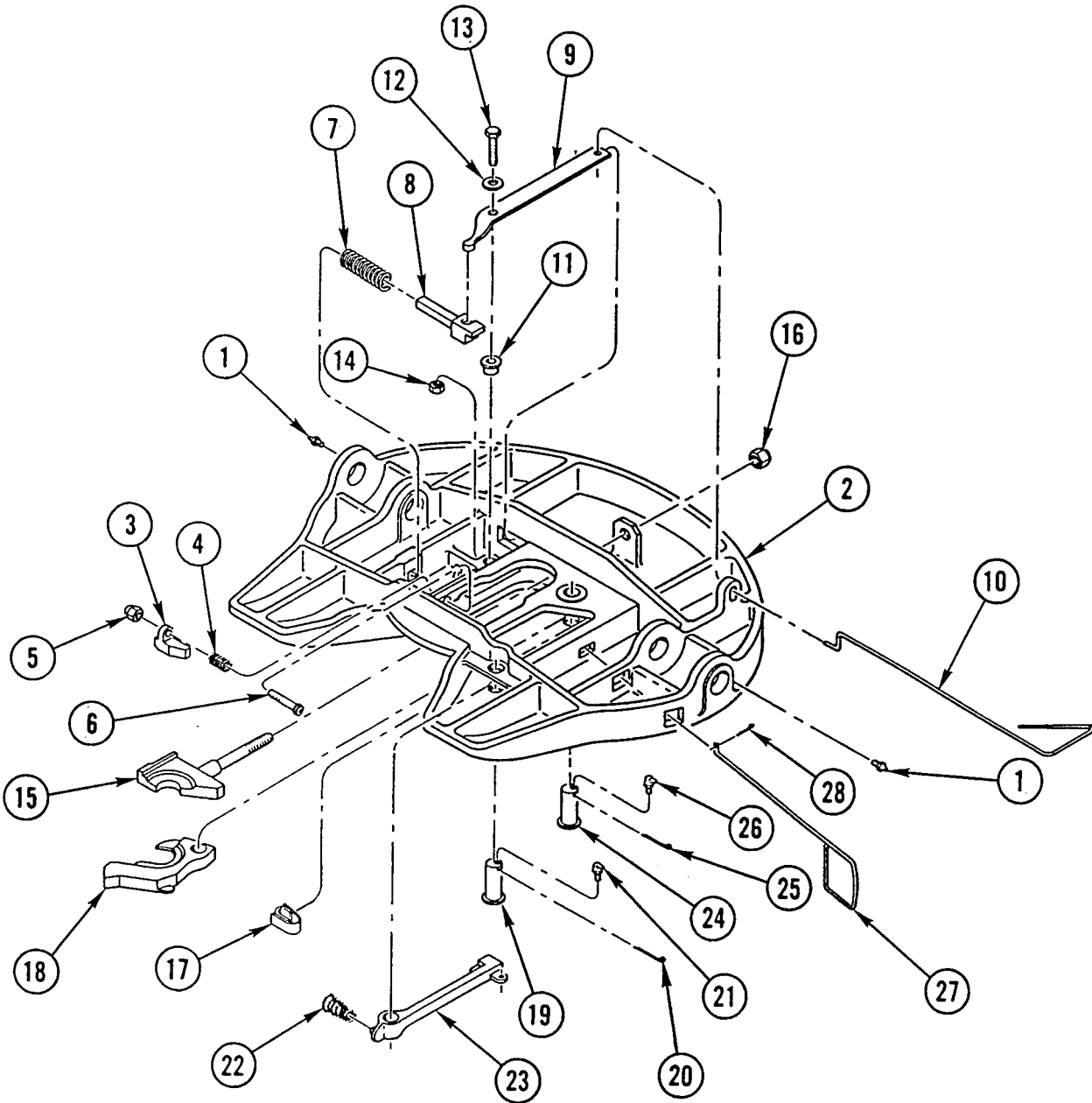
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

## TOP PLATE REPAIR (CONT)

### ASSEMBLY



1. INSTALL TWO GREASE FITTINGS (1) IN TOP PLATE (2).
2. INSTALL NEW ADJUSTING WEDGE (3), SPRING (4), NEW LOCK NUT (5), AND NEW SOCKET HEAD SCREW (6).
3. INSTALL NEW SPRING (7) AND NEW PLUNGER (8) IN TOP PLATE (2).

4. INSTALL NEW RELEASE LEVER (9) AND PRIMARY RELEASE HANDLE (10) IN TOP PLATE (2).
5. CONNECT PRIMARY RELEASE HANDLE (10) TO RELEASE LEVER (9).
6. INSTALL NEW BUSHING (11), WASHER (12), AND SCREW (13) IN RELEASE LEVER (9). BACK SCREW (13) OUT 1/2 TURN. MAKE SURE RELEASE LEVER (9) MOVES FREELY.
7. INSTALL NEW LOCK NUT (14) ON SCREW (13).
8. INSTALL JAW (15) AND NEW LOCK NUT (16) IN TOP PLATE (2). BACK LOCK NUT (16) OUT 1/2 TURN. MAKE SURE JAW (15) WILL ROTATE.
9. COAT NEW SPRING (17) WITH GAA AND INSTALL SPRING (17) AND JAW (18) IN TOP PLATE (2).
10. COAT NEW PIN (19) WITH ANTISEIZE COMPOUND.
11. USING BRASS DRIFT PIN OR PRESS, INSTALL PIN (19) IN TOP PLATE (2) AS NOTED IN REMOVAL STEP 7.
12. INSTALL NEW COTTER PIN (20) AND GREASE FITTING (21) IN PIN (19).
13. INSTALL NEW SPRING (22) AND NEW SECONDARY RELEASE LEVER (23).
14. COAT NEW PIN (24) WITH ANTISEIZE COMPOUND.
15. USING BRASS DRIFT PIN OR PRESS, INSTALL PIN (24) IN TOP PLATE (2) AS NOTED IN REMOVAL STEP 4.
16. INSTALL NEW COTTER PIN (25) AND GREASE FITTING (26) IN PIN (24).
17. INSTALL SECONDARY RELEASE HANDLE (27) AND NEW COTTER PIN (28).
18. OPEN PRIMARY AND SECONDARY LOCKS.

**NOTE**

Follow-on Maintenance:

Install top plate (page 20-30).  
Lubricate fifth wheel (TM 9-2320-363-20).  
Adjust fifth wheel (TM 9-2320-363-20).

## Section VIII. RAMP REPLACEMENT

### OVERVIEW

This section illustrates and describes procedures for removal, cleaning, inspection, and installation of the ramp.

---

### RAMP REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05

---

### REMOVAL

#### NOTE

Procedure is the same for all vehicles. M916A1 and M916A2 are shown.

1. REMOVE THREE NUTS (1), THREE WASHERS (2), THREE SCREWS (3), AND THREE WASHERS (4).
2. REMOVE THREE NUTS (5), THREE WASHERS (6), THREE SCREWS (7), AND THREE WASHERS (8) FROM LEFT RAMP (9).
3. REPEAT STEPS 1 AND 2 FOR RIGHT RAMP (10).

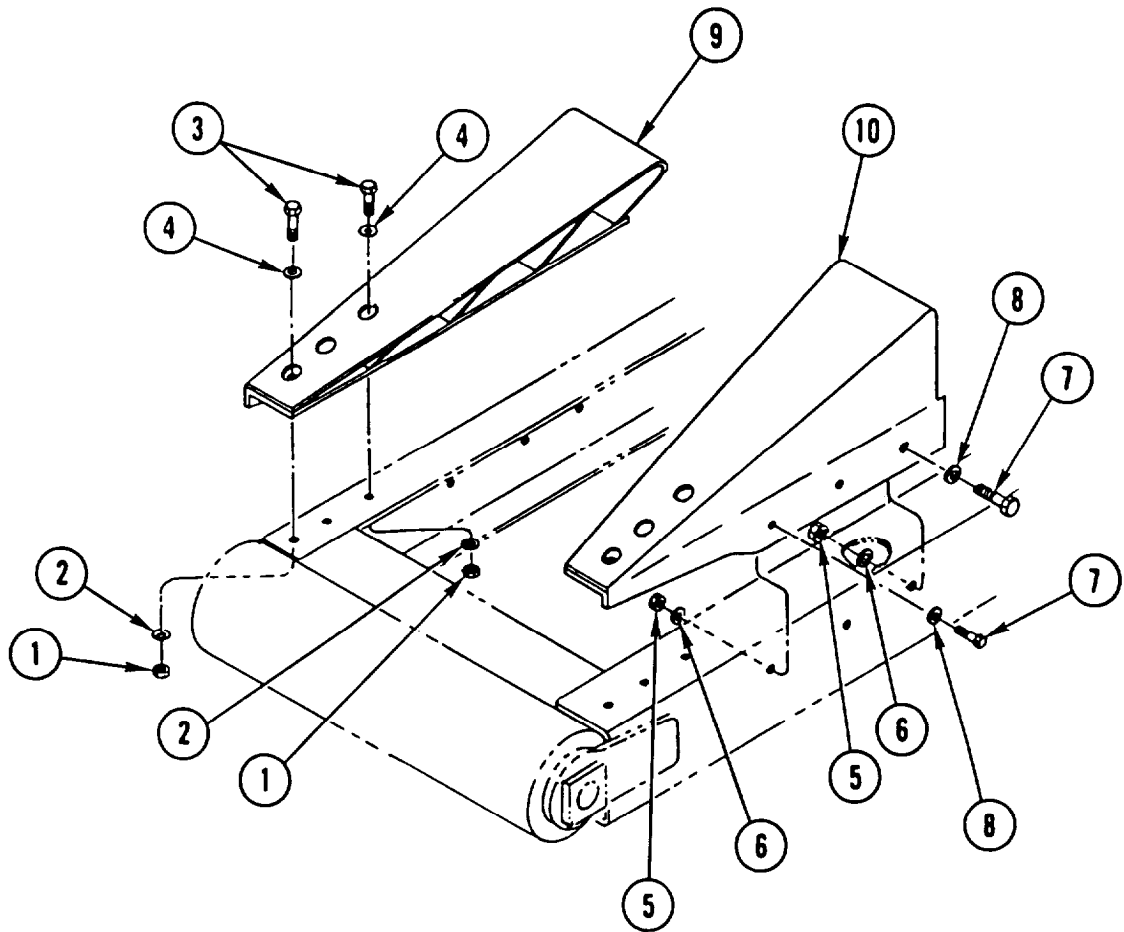
### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.

## INSTALLATION



### NOTE

Procedure is the same for all vehicles. M916A1 and M916A2 are shown.

1. INSTALL LEFT RAMP (9), THREE WASHERS (8), THREE SCREWS (7), THREE WASHERS (6), AND THREE NUTS (5).
2. INSTALL THREE WASHERS (4), THREE SCREWS (3), THREE WASHERS (2), AND THREE NUTS (1).
3. REPEAT STEPS 1 AND 2 FOR RIGHT RAMP (10).

## Section IX. FRAME ALINEMENT

### OVERVIEW

This section illustrates and describes procedures for alinement check and inspection of the frame.

---

### FRAME ALINEMENT

---

This task covers: a. Alinement Check b. Inspection c. Repair

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Bob, Plumb  
Line, Chalk  
Measure, Tape

#### Personnel Required: (2)

#### References:

TM 9-237  
TM 9-2320-363-10  
TM 9-2320-363-20  
TB 9-2300-247-40

#### Equipment Condition:

##### Reference

TM 9-2320-363-10

TM 9-2320-363-20

TM 9-2320-363-20

##### Condition Description

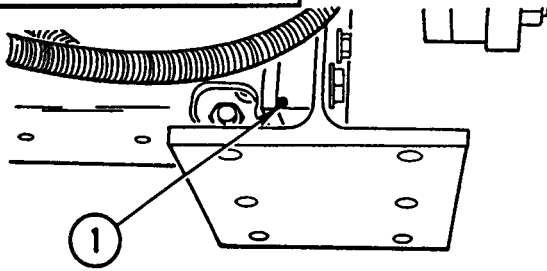
Vehicle Parked on Level  
Surface and Parking  
Brakes Applied

Front Bumper Removed

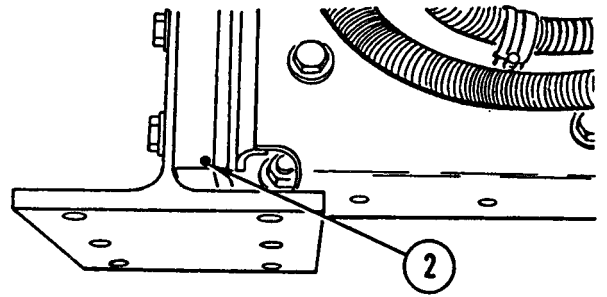
Trailer Connector Cover  
Removed (M916A1)



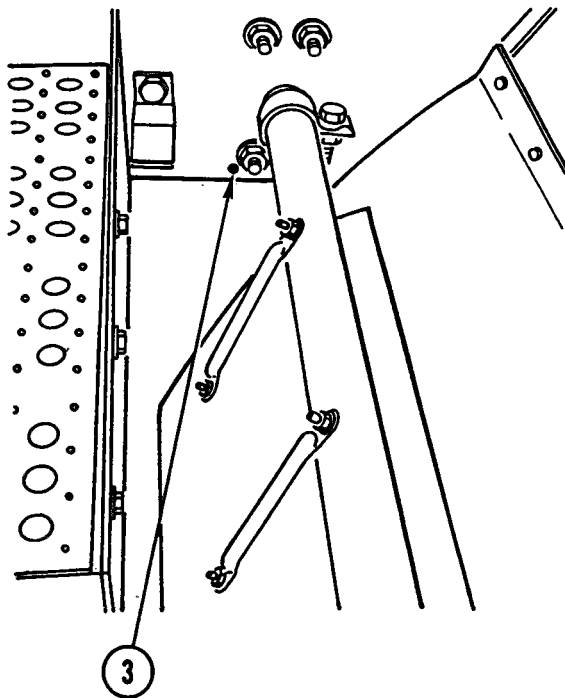
**ALINEMENT CHECK**



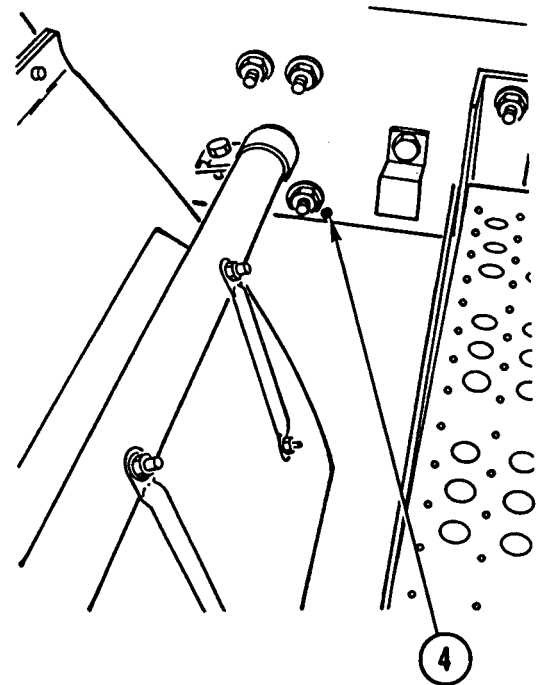
LEFT SIDE - POINT 1



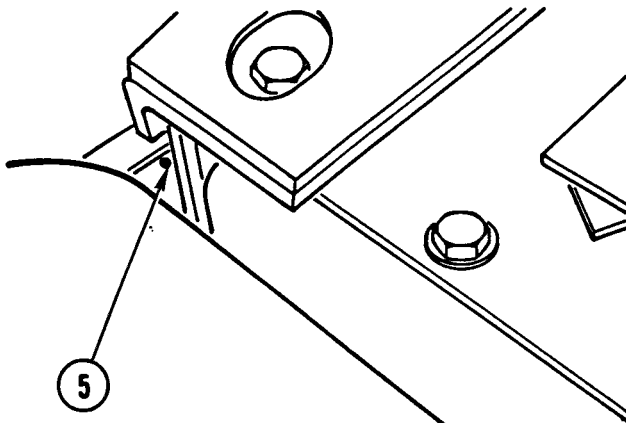
RIGHT SIDE - POINT 2



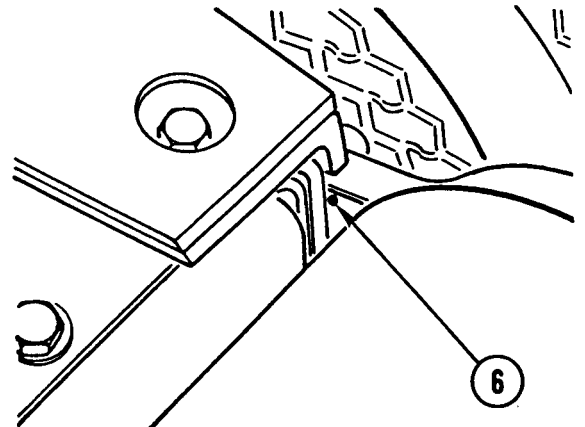
LEFT SIDE - POINT 3



RIGHT SIDE - POINT 4

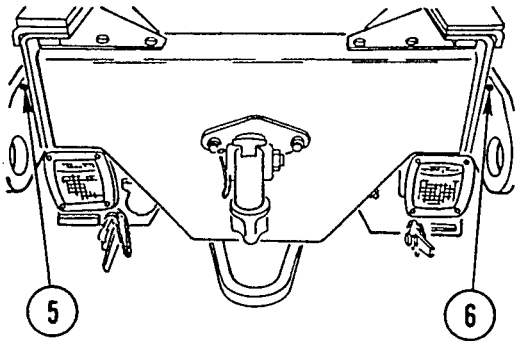


REAR LEFT - POINT 5  
M916A1

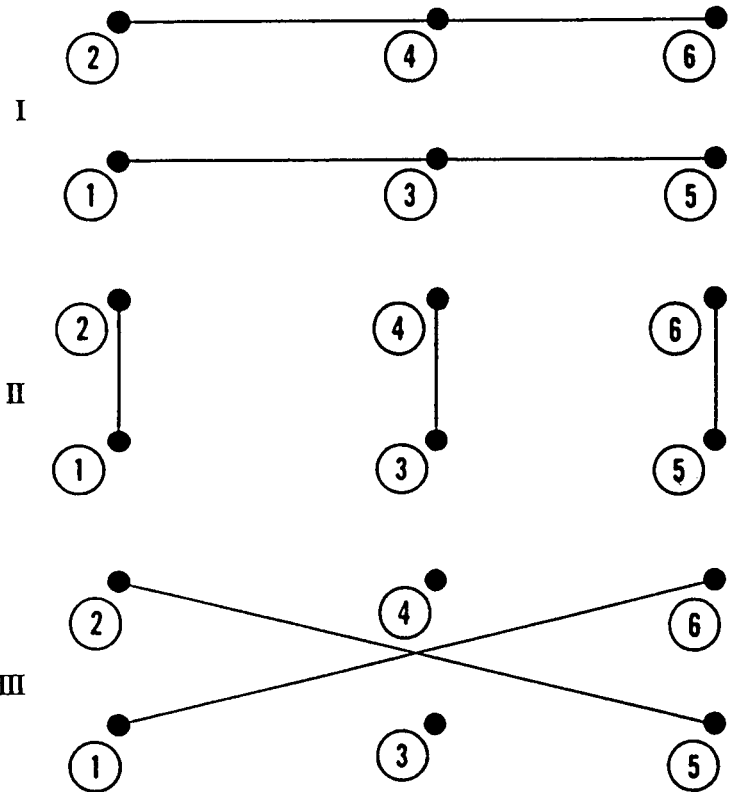


REAR RIGHT - POINT 6  
M916A1

**FRAME ALINEMENT (CONT)**



REAR - POINTS 5 AND 6  
M915A2



**NOTE**

Make sure vehicle is parked in straight line on level floor so rear axles are not on twist or binding from turning action.

1. TAPE PAPER TO FLOOR UNDER SIX POINTS (1, 2, 3, 4, 5, AND 6) OF VEHICLE.
2. USING PLUMB BOB AND PENCIL, CAREFULLY MARK POINT ON PAPER BELOW OUTER SIDES OF FRAME AT EACH POINT (1, 2, 3, 4, 5, AND 6).
3. START ENGINE AND DRIVE VEHICLE OFF MARKED PAPER.

**NOTE**

To perform steps 4 and 5, refer to item I.

4. USING CHALK LINE, MARK LINE BETWEEN POINTS (1 AND 5) ON LEFT SIDE AND (2 AND 6) ON RIGHT SIDE.
5. CHECK LOCATION OF POINTS (3 AND 4) IN RELATION TO CHALK LINE. IF POINT (3 AND/OR 4) IS ON EITHER SIDE OF CHALK LINE, FRAME IS BENT.

**NOTE**

To perform step 6, refer to item II.

6. USING TAPE MEASURE, MEASURE DISTANCE BETWEEN THREE SETS OF POINTS (1 AND 2), (3 AND 4), AND (5 AND 6). IF DISTANCE IS NOT 33.5 IN. (85.1 cm), FRAME IS BENT.

**NOTE**

To perform step 7, refer to item III.

7. MEASURE AND NOTE DISTANCE BETWEEN POINTS (1 AND 6) AND (2 AND 5). DISTANCES SHOULD BE EQUAL  $\pm 0.125$  IN. ( $\pm 3.2$  mm). IF NOT EQUAL, FRAME IS OUT OF ALINEMENT.

**INSPECTION**

1. INSPECT FRAME RAILS FOR CRACKS, BENDS, OR MISALINEMENT.
2. INSPECT ALL CROSSMEMBERS FOR CRACKS OR OTHER DAMAGE.
3. INSPECT ALL BOLTED BRACKETS AND SUPPORTS FOR CRACKS OR OTHER DAMAGE.

**REPAIR**

1. IF FRAME RAILS, CROSSMEMBERS, BRACKETS, OR SUPPORTS ARE DAMAGED, REPAIR IN ACCORDANCE WITH TB 9-2300-247-40.
2. IF BRACKETS OR SUPPORTS ARE DAMAGED AND CAN BE REPAIRED BY WELDING, REFER TO TM 9-237 FOR WELDING PROCEDURES.

**NOTE**

Follow-on Maintenance:

Install front bumper (TM 9-2320-363-20).

Install trailer connector cover (M916A1) (TM 9-2320-363-20).



# CHAPTER 21 SUSPENSION REPAIR INSTRUCTIONS

## **OVERVIEW**

This chapter illustrates and describes procedures for removal, cleaning, inspection, and installation of the equalizing beam.

	Page
Equalizing Beam Repair . . . . .	21-2

## EQUALIZING BEAM REPAIR

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

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N205  
 Press Plate, PIN 51100  
 Removing Adapter, P/N 302027  
 Removing Adapter, P/N 302030  
 Removing Adapter, P/N 38095  
 Installing Adapter, P/N 204266  
 Installing Adapter, P/N 302026  
 Installing Adapter Clamp, P/N 42052  
 Plate Clamp, P/N 206459  
 Press Adapter, PIN 206457  
 Set, Pin Adapter. P/N 1747

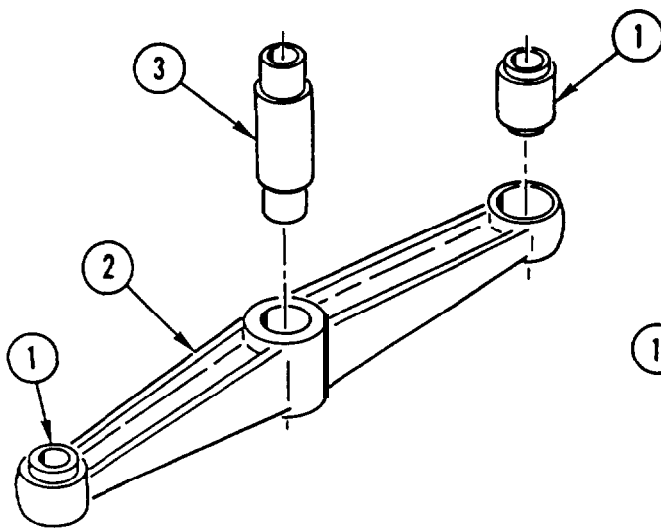
#### Materials/Parts:

Bushing, End (2) P/N 45407  
 (M916A1)  
 Bushing Assembly, P/N 30240-2  
 Center (M916A1)  
 Seal (2) P/N 30334  
 (M916A1)  
 Bushing Kit, Beam P/N 34013-88  
 End (M916A2, M917A1  
 and M917A1 w/MCS)  
 Grease, Automotive Appendix B. Item 26  
 and Artillery (GAA)

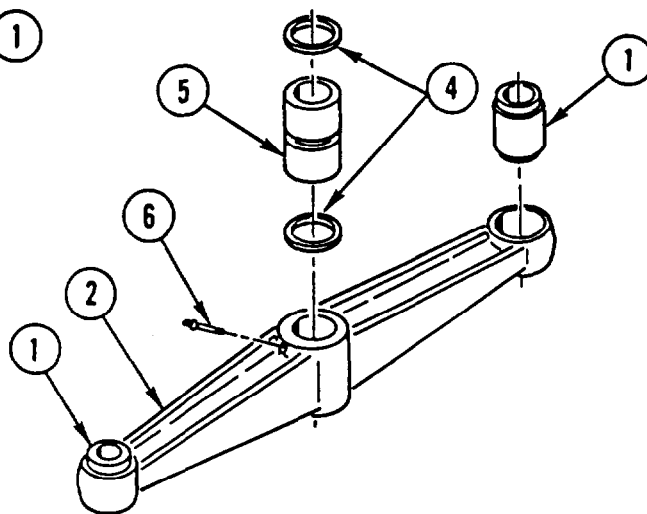
#### Equipment Condition:

Reference	Condition Description
Page 9-22 or 9-28	Equalizing Beam Removed

### REMOVAL



M915A2



M916A1

**CAUTION**

Use press plate, P/N 51100, or support equalizing beam bore square on press bed. Failure to do so could result in bent beam, requiring replacement

**NOTE**

- Procedure is the same for all vehicles except as noted.
- M915A2 Only: Removal of bushings requires 50-ton or larger press
- M916A1 Only: Removal of bushings requires 100-ton or larger press

1. USING SUITABLE PRESS, REMOVING ADAPTER P/N 302030, PRESS ADAPTER PIN 206457, REMOVE AND DISCARD TWO END BUSHINGS (1) FROM EQUALIZING BEAM (2)

**NOTE**

Perform step 2 on M915A2 only.

2. USING SUITABLE PRESS, REMOVING ADAPTER P/N 302027, AND PRESS ADAPTER P/N 206457 REMOVE AND DISCARD CENTER BUSHING (3) FROM EQUALIZING BEAM (2)

**NOTE**

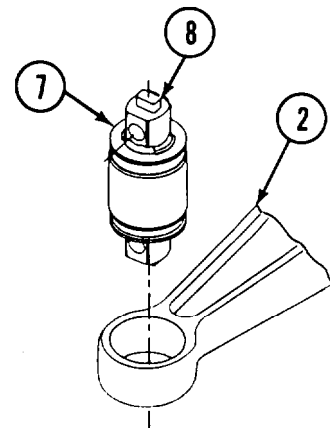
Perform step 3 on M916A1 only

3. USING SUITABLE PRESS AND REMOVING ADAPTER P/N 38095. REMOVE AND DISCARD TWO SEALS (4) AND CENTER BUSHING ASSEMBLY (5).

**NOTE**

Perform steps 3.1 and 3.2 on M916A2, M917A1, and M917A1 w/MCS only.

- 3.1. USING CHISEL AND HAMMER, CUT AND REMOVE BUSHING RETAINING WASHER (7). REMOVE ANY PROTRUDING RUBBER TO PREVENT INTERFERENCE WHILE PRESSING BAR PIN BUSHING OUT.
- 3.2. USING SUITABLE PRESS AND PIN ADAPTER SET P/N 1747, REMOVE AND DISCARD TWO BAR PIN BUSHINGS (8) FROM EQUALIZING BEAM (2).

**NOTE**

Perform step 4 on all except M915A2 only.

4. REMOVE GREASE FITTING (6) FROM EQUALIZING BEAM (2).

---

## EQUALIZING BEAM REPAIR (CONT)

---

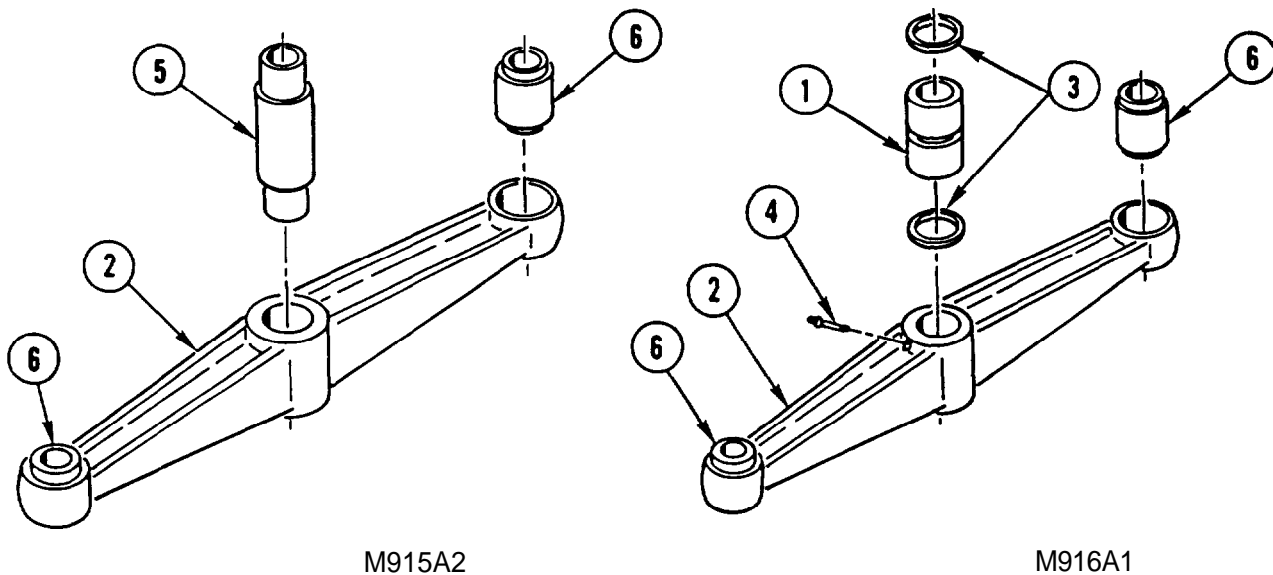
### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.

### INSTALLATION



#### CAUTION

Use press plate, P/N 51100, or support equalizing beam bore square on press bed. Failure to do so could result in bent beam, requiring replacement.

#### NOTE

- Procedure is the same for all vehicles except as noted.
- M915A2 Only: Installation of bushings requires 50-ton or larger press.
- M916A1 Only: Installation of bushings requires 100-ton or larger press.

COAT ALL METAL SURFACES OF BUSHINGS WITH GAA.



**NOTE**

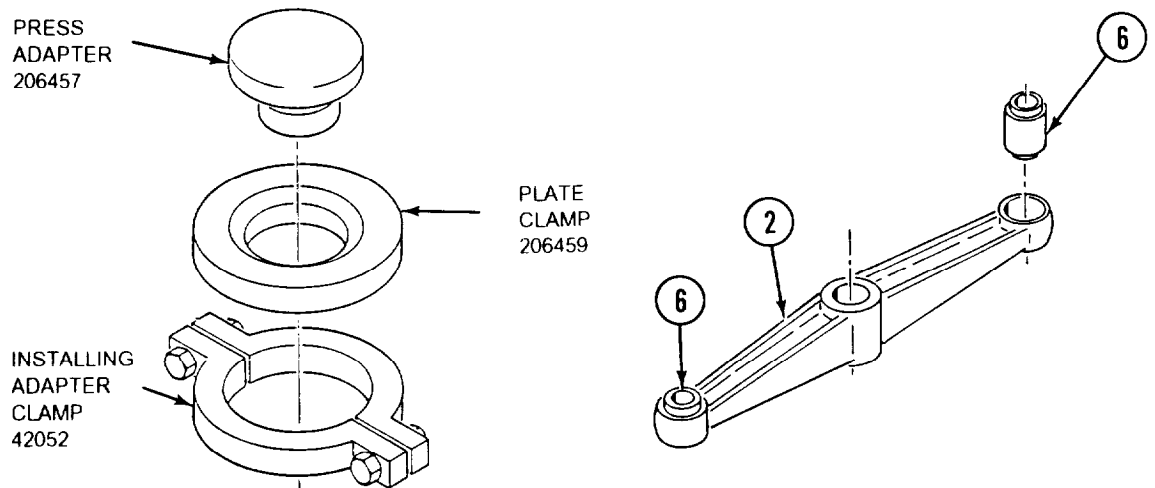
Perform steps 2 and 3 on M916A1 only.

2. USING SUITABLE PRESS, INSTALLING ADAPTER P/N 204266, AND REMOVING ADAPTER P/N 38095, PRESS NEW CENTER BUSHING ASSEMBLY (1) IN UNTIL INSTALLING ADAPTER IS FLUSH WITH EQUALIZING BEAM (2).
3. INSTALL TWO NEW SEALS (3) AND GREASE FITTING (4).

**NOTE**

Perform step 4 on M915A2 only.

4. USING SUITABLE PRESS, INSTALLING ADAPTER P/N 302026, AND PRESS ADAPTER P/N 206457, INSTALL NEW CENTER BUSHING (5) IN EQUALIZING BEAM (2).

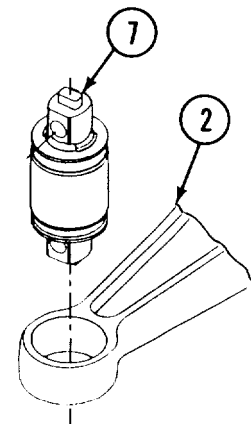


5. USING SUITABLE PRESS, INSTALLING ADAPTER CLAMP P/N 42052, PLATE CLAMP P/N 206459, AND PRESS ADAPTER P/N 206457, CLAMP INSTALLING ADAPTER CLAMP TO NEW BUSHING (6). WITH PLATE CLAMP AND PRESS ADAPTER ASSEMBLED AS SHOWN, PRESS BUSHING (6) UNTIL COMPLETELY INSTALLED AND CENTERED IN EQUALIZING BEAM (2).
6. REPEAT STEP 4 FOR OTHER BUSHING (6).

**NOTE**

Perform step 7 on M916A2, M917A1, and M917A1 w/MCS only.

7. USING SUITABLE PRESS AND PIN ADAPTER SET P/N 1747, INSTALL TWO NEW BAR PIN BUSHINGS (7) IN EQUALIZING BEAM (2).



**NOTE**

Follow-on Maintenance:  
Install equalizing beam (page 9-22 or 9-28).



## CHAPTER 22 BODY, CAB, HOOD, AND HULL REPAIR INSTRUCTIONS

### **OVERVIEW**

This chapter illustrates and describes procedures for maintenance of the body, cab, hood, and hull and related parts.

	Page
Section I. Hood Repair . . . . .	22-2
Section II. Hood SMC Repair . . . . .	22-4
Section III. Cab Body Repair . . . . .	22-12
Section IV. Cab Door Repair . . . . .	22-28

## Section I. HOOD REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, and assembly of the hood.

---

### HOOD REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Assembly

---

### INITIAL SETUP

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Nut, Lock (4)

**References:**

TM 9-2320-363-20

**Equipment Condition:**

**Reference**

TM 9-2320-363-20

**Condition Description**

Hood Removed

---

### DISASSEMBLY

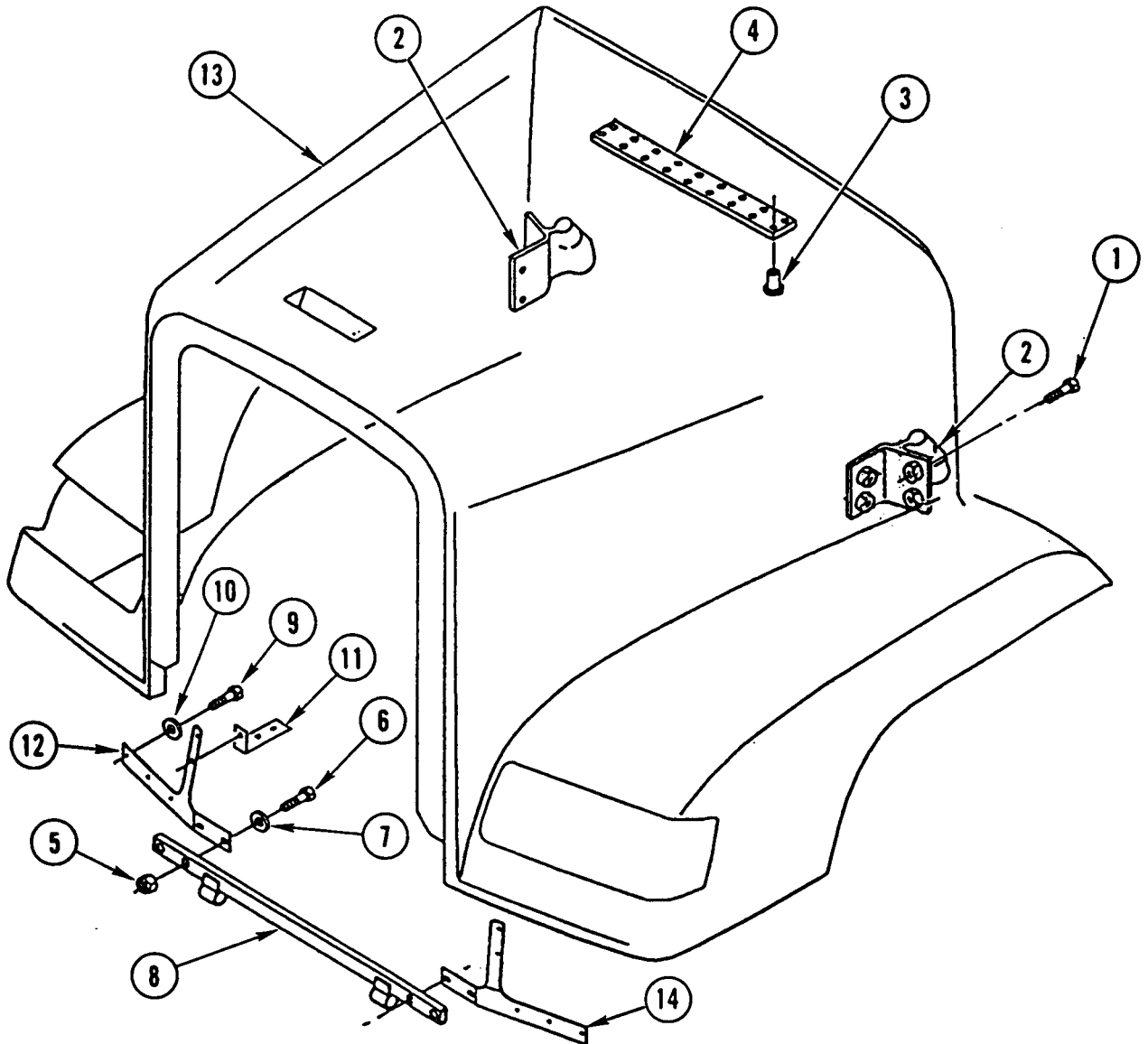
1. REMOVE FOUR SCREWS (1) AND TWO MOUNTS (2).
2. REMOVE 16 RIVETS (3) AND REINFORCEMENT PLATE (4).
3. REMOVE FOUR LOCK NUTS (5), FOUR SCREWS (6), FOUR WASHERS (7), AND CROSSTIE (8). DISCARD LOCK NUTS.
4. REMOVE FOUR SCREWS (9), FOUR WASHERS (10), BRACKET (11), AND CROSSTIE PLATE (12) FROM HOOD (13).
5. REPEAT STEP 4 FOR REMOVAL OF OPPOSITE CROSSTIE PLATE (14)

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.



**ASSEMBLY**

1. INSTALL CROSSTIE PLATE (12), BRACKET (11), FOUR WASHERS (10), AND FOUR SCREWS (9) ON HOOD (13).
2. REPEAT STEP 1 FOR ASSEMBLY OF OPPOSITE CROSSTIE PLATE (14).
3. INSTALL CROSSTIE (8), FOUR WASHERS (7), FOUR SCREWS (6), AND FOUR NEW LOCK NUTS (5).
4. INSTALL REINFORCEMENT PLATE (4) AND 16 RIVETS (3).
5. INSTALL TWO MOUNTS (2) AND FOUR SCREWS (1).

## Section II. HOOD SMC REPAIR

### OVERVIEW

This section illustrates and describes procedures for inspection and repair of the hood SMC.

---

### HOOD SMC REPAIR

---

This task covers: a. Inspection b. Repair

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Glass, Reinforced  
Plastic

Kit, Lamination                      Appendix B, Item 30  
Repair

#### General Safety Instructions:

#### WARNING

- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.
- Wear goggles and air purifying respirator when cutting, grinding, or sanding during fiberglass repairs. Ground dust and particles could cause temporary or permanent damage to eyes, and if inhaled, could cause respiratory irritation.
- To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

**INSPECTION**

The SMC (sheet molded compound) hood consists of several parts including fenders, hood, and inner reinforcements which are bonded together with a structural adhesive and rivets. If the hood is damaged, determine which parts are affected.

Damage at any joint between two parts is not repairable. For example, if fender and reinforcements bonded inside the fender are damaged, replace the entire hood assembly.

If a joint between two parts has separated and there is no damage at the joint, the parts can be rebonded. Or, if a part is damaged and adjoining parts are not, the damaged part can be separated from the hood and new or used parts can be bonded in place. A section of a part can be replaced as long as the section does not include a joint between two parts. Fenders and headlight reinforcements are available as replacement parts or for use in section replacements. If the damage is such that parts cannot be replaced or a section replacement cannot be done, replace the entire hood assembly.

For repairing a small crack or hole, refer to Crack or Small Hole Repair, below.

For repairing larger areas, refer to Section Replacement (Repair of Punctures and Large Fractures), below.

For replacing or rebonding parts, refer to Hood Component Rebonding, below.

**REPAIR****Crack or Small Hole Repair**

A crack (fracture) or small hole through the laminate requires repair with a fiberglass reinforced patch.

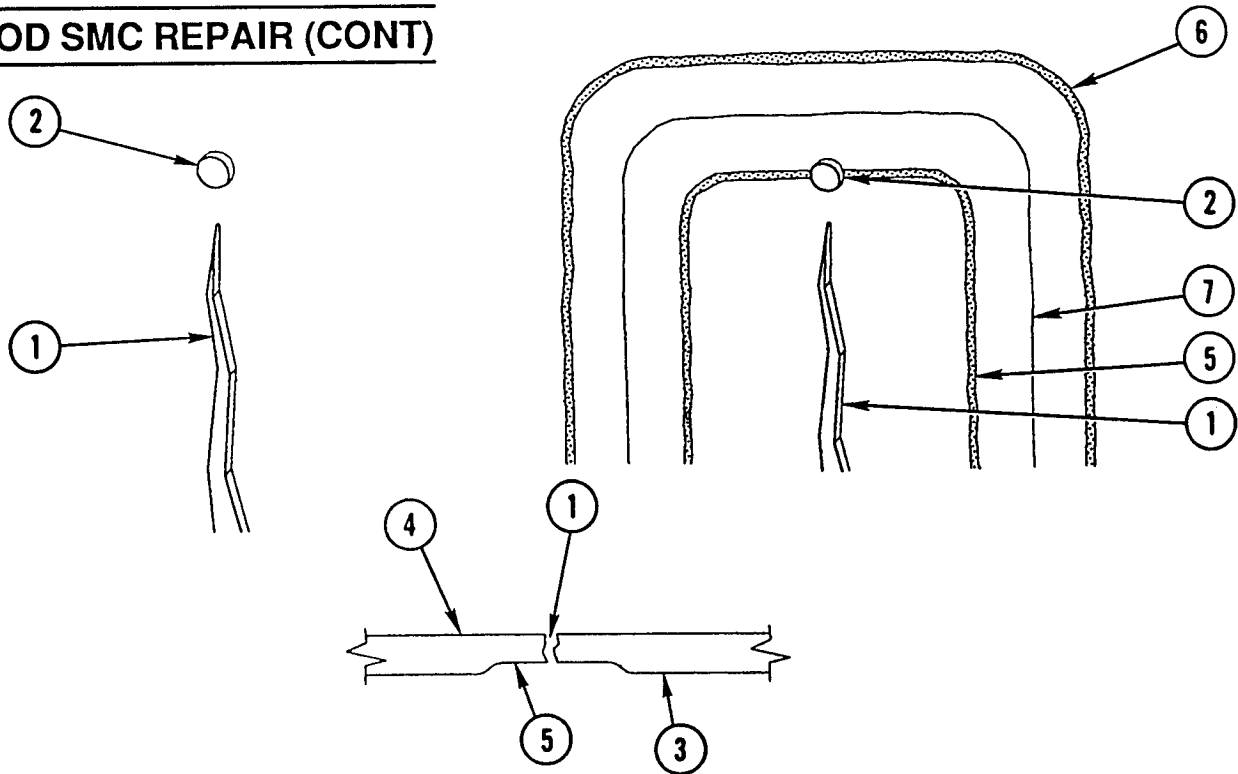
1. LOCATE DAMAGE ON HOOD. APPLY HAND PRESSURE ALL AROUND DAMAGED AREA TO CHECK FOR CONCEALED DAMAGE.

**WARNING**

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

2. CLEAN AREA WITH XYLENE OR EQUIVALENT SOLVENT. INSPECT AREA CLOSELY.
3. IF SOUND ABSORBENT LINER IS PRESENT ON UNDERSIDE OF DAMAGED AREA, REMOVE PANEL(S) TO PROVIDE ADEQUATE WORKING AREA.

## HOOD SMC REPAIR (CONT)



4. IF REPAIRING CRACK (1), USE 1/8-IN. DIAMETER BIT TO DRILL HOLE (2) COMPLETELY THRU UNCRACKED LAMINATE. DRILL HOLE (2) 1/8 IN. (3 mm) FROM EACH END OF CRACK (1) TO PREVENT CRACK (1) FROM LENGTHENING.

### WARNING

Wear goggles and air purifying respirator when cutting, grinding, or sanding during fiberglass repairs. Ground dust and particles could cause temporary or permanent damage to eyes, and if inhaled, could cause respiratory irritation.

5. ON ENGINE SIDE OF HOOD (3), USE ROUTER BIT ON GRINDER OR DRILL TO GRIND AWAY SHALLOW RECESS. GRIND RECESS TO ONE-QUARTER DEPTH OF LAMINATE (4) AND 1/2 IN. (13 mm) OUTWARD FROM ALL SIDES OF DAMAGE. TAPER OUTSIDE EDGE OF GROUND AREA (5). IF REPAIRING CRACK (1), GRIND OUTWARD TO DRILLED HOLE (2) AT END OF CRACK (1), BUT NOT BEYOND.
6. USE 100-220 GRIT SANDPAPER TO SCUFF AREA AT LEAST 1 IN. (25 mm) AWAY FROM FRACTURE ON ALL SIDES (6). SCUFF THOROUGHLY TO GIVE SURFACE TO WHICH PATCH CAN STICK.

### WARNING

To prevent injury, compressed air will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment, goggles, shield, and gloves.

7. BLOW DUST AWAY WITH COMPRESSED AIR AND WIPE AREA WITH CLEAN CLOTH.



8. IF NECESSARY, ALINE PANEL SECTIONS ON BOTH SIDES OF CRACK (1) USING WEIGHTS OR CLAMPS TO ESTABLISH ORIGINAL PANEL PROFILE.
9. USING RAZOR KNIFE, CUT SECTION OF WOVEN FIBERGLASS CLOTH (7) TO OVERLAY CRACK (1) ABOUT 3/4 IN. (19 mm).
10. USING WOODEN STIR STICK AND MEASURING IN SPOONFUL, MIX EQUAL VOLUMES OF MAGNOLIA 58 A AND B EPOXY RESINS ON CLEAN SHEET OF GLASS, METAL, OR SECTION OF SCRAP LAMINATE. MIX 15 SECONDS.
11. USE STIR STICK TO SPREAD THIN LAYER OF MIXED EPOXY RESINS OVER SCUFFED AREA (6).
12. LAY FIBERGLASS CLOTH (7) ON REPAIR AREA, CENTERED OVER DAMAGE. USING STIR STICK, FIRMLY PRESS FIBERGLASS CLOTH (7) INTO EPOXY TO COMPLETELY SOAK FIBERGLASS CLOTH (7).
13. APPLY ANOTHER LAYER OF EPOXY RESINS OVER FIBERGLASS CLOTH (7).
14. ALLOW 2-5 MINUTES FOR EPOXY TO START GELLING. IT MAY TAKE MORE TIME IN COOL TEMPERATURES, LESS IN HOT TEMPERATURES.

**NOTE**

For smoother surface, press piece of masking tape, wider than repair, directly over wet epoxy and smooth before epoxy hardens. Tape can be removed when epoxy sets up after 15 minutes.

15. PATCH SHOULD BE HARD ENOUGH IN 15 MINUTES TO ALLOW SANDING TO SMOOTH, FLAT SURFACE, IF REQUIRED.
16. REPAIR DAMAGE ON OUTSIDE SURFACE OF HOOD, AND PAINT SURFACE ON BOTH SIDES.

Section Replacement (Repair of Punctures and Large Fractures)

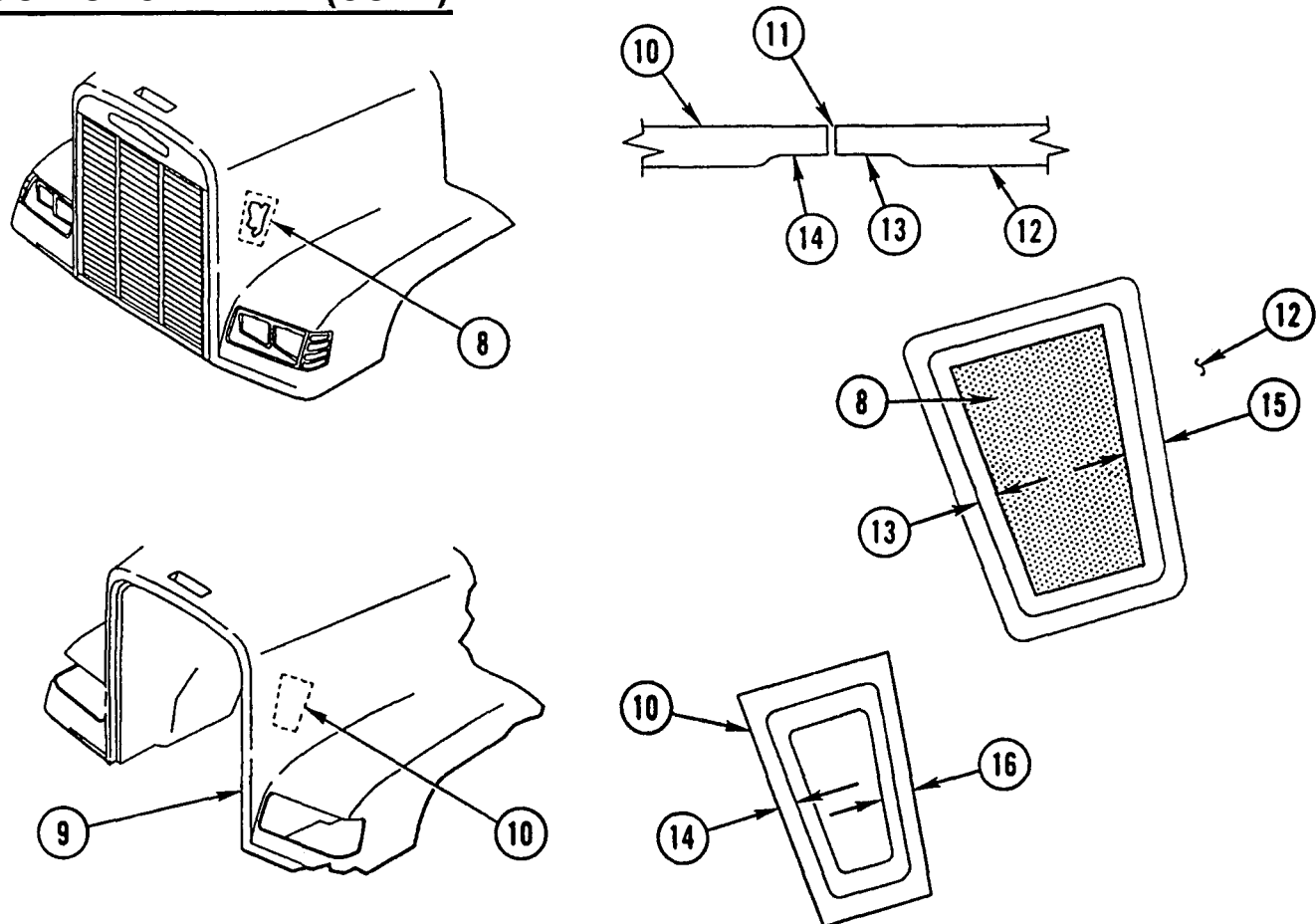
On large damaged areas (for example, structural damage on side surface of the hood covering a square foot area) it may be easier to do a section replacement rather than to make a patch. Fenders and headlight reinforcements are available for use in section replacements, or a second damaged hood must be available as scrap with the needed section intact.

**CAUTION**

Piece of SMC laminate from another SMC laminate hood must be used for section replacement. Use of any other material may not allow necessary bonding for repair.

1. TO DETERMINE EXTENT OF DAMAGE, PUSH IN ON AREA IMMEDIATELY SURROUNDING AND UNDERNEATH DAMAGED AREA.
2. CLEAN AREA WITH XYLENE OR EQUIVALENT SOLVENT. INSPECT AREA CLOSELY.
3. IF SOUND ABSORBENT LINER IS PRESENT ON UNDERSIDE OF DAMAGED AREA, REMOVE PANEL(S) TO PROVIDE ADEQUATE WORKING AREA.

## HOOD SMC REPAIR (CONT)



### NOTE

If damage extends to joint where part is bonded to another, separate part with heat gun and putty knife before cutting.

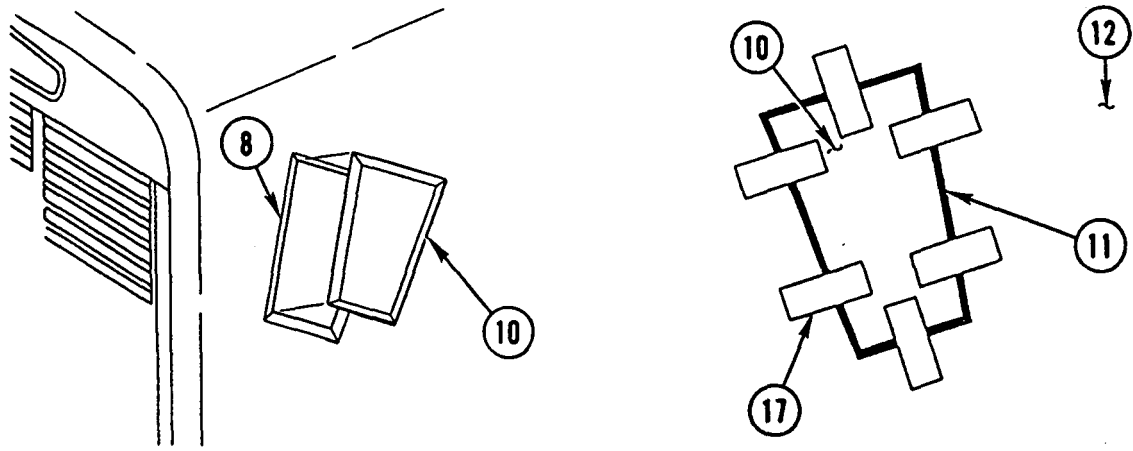
4. USING SABER SAW, CUT OUT LARGE, STRAIGHT-SIDED PANEL (8) CONTAINING DAMAGED AREA.

### NOTE

If damage is next to, but does not include, headlight reinforcement, remove headlight reinforcement from replacement section, not from hood.

5. FROM SCRAP HOOD (9) OR NEW PART, CUT PATCH (10) FROM SAME AREA SLIGHTLY LARGER THAN ORIGINAL PANEL (8). TRIM PATCH (10) TO FIT BOTH SIZE AND CONTOUR OF ORIGINAL PANEL (8).
6. SAND PATCH (10) EDGES TO ALLOW 1/16-1/8 IN. (2-3 mm) GAP (11) AROUND PANEL (8).
7. ON ENGINE SIDE OF HOOD (12), USE ROUTER BIT ON GRINDER OR DRILL TO GRIND AWAY SHALLOW RECESS. GRIND RECESS TO ONE-QUARTER DEPTH OF LAMINATE (13) AND 1/2 IN. (13 mm) OUTWARD FROM ALL SIDES (14) OF PANEL (8) AREA. GRIND 1/2 IN. (13 mm) INWARD FROM ALL SIDES (14) OF ENGINE SIDE OF PATCH (10). SLIGHTLY TAPER OUTSIDE EDGE OF GROUND AREA AROUND PANEL (8) AND INSIDE EDGE OF GROUND AREA ON PATCH (10).

8. USING 100-220 GRIT SANDPAPER, SCUFF AREA AT LEAST 1 IN. (25 mm) OUT FROM SIDES (15) OF PANEL (8) AREA. SCUFF AT LEAST 1 IN. (25 mm) IN FROM SIDES (16) OF PATCH (10). SCUFF THOROUGHLY TO GIVE SURFACE TO WHICH PATCH (10) CAN STICK. COMPLETELY SAND OFF ANY UNDERCOATING SPRAYED ON THESE AREAS.



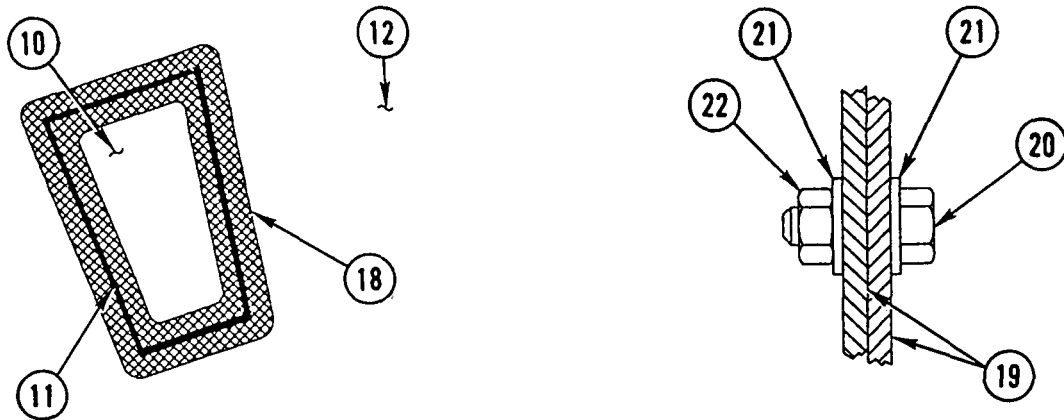
9. BEVEL EDGES OF OUTER SIDES OF BOTH PANEL (8) AND PATCH (10), TO ABOUT 45 DEGREES.
10. USING 220 OR HIGHER GRIT SANDPAPER, GENTLY FEATHER BACK OUTER PAINTED SURFACES ABOUT 1/2 IN. (13 mm) BEYOND EDGES OF REPAIR AREAS OF PANEL (8) AND PATCH (10).
11. BLOW DUST AWAY WITH COMPRESSED AIR AND WIPE AREA WITH CLEAN CLOTH.
12. IF PATCH (10) IS CLOSE ENOUGH TO EDGE, USE CLAMPS TO TEMPORARILY SECURE PATCH (10) DURING REPAIR. IF PATCH (10) IS TOO FAR FROM EDGE TO USE CLAMPS, USE BOND STRIPS (17).
  - A. CUT SCRAP SMC INTO STRIPS (17). MAKE ENOUGH STRIPS (17) TO HOLD PATCH (10) IN PLACE, ABOUT ONE EVERY 6 IN. (15 cm). IF SURFACE OF PATCH (10) IS CONTOURED OR CURVED, USE MANY SMALL STRIPS (17). LARGER STRIPS COULD DEFORM CURVES.
  - B. ON ENGINE SIDE OF HOOD (12), USE 220 GRIT SANDPAPER TO SCUFF-SAND AREAS ON HOOD (12) AND PATCH (10) WHERE STRIPS (17) WILL BE BONDED.

**NOTE**

If joint between parts was separated for repair, rebond joint. Refer to Hood Component Rebonding, below.

- C. HOLD PATCH (10) IN PLACE AND BOND STRIPS (17) TO HOOD (12) AND PATCH (10) WHERE SCUFFED. USE LORD FUSOR 320/322 TO BOND STRIPS (17).
- D. APPLY LIGHT PRESSURE AND HEAT FROM HEAT GUN TO AREA FOR 3-5 MINUTES.
- E. AFTER LORD FUSOR 320/322 HAS HARDENED, USE 100-220 GRIT SANDPAPER TO SCUFF STRIPS (17).
- F. BLOW DUST AWAY WITH COMPRESSED AIR AND WIPE AREA WITH CLEAN CLOTH.

## HOOD SMC REPAIR (CONT)



13. USING RAZOR KNIFE, CUT SECTIONS OF WOVEN FIBERGLASS CLOTH (18) TO FULLY COVER GAP (11) BETWEEN HOOD (12) AND PATCH (10), ALL AROUND PATCH (10). FIBERGLASS CLOTH (18) SHOULD OVERLAY ABOUT 3/4 IN. (19 mm) ON BOTH SIDES OF GAP (11).
14. USING WOODEN STIR STICK AND MEASURING IN SPOONFUL, MIX EQUAL VOLUMES OF MAGNOLIA 58 A AND B EPOXY RESINS ON CLEAN SHEET OF GLASS, METAL, OR SECTION OF SCRAP LAMINATE. MIX 15 SECONDS.
15. USE STIR STICK TO SPREAD THIN LAYER OF MIXED EPOXY RESINS OVER SCUFFED AREA ON UNEXPOSED SIDE OF REPAIR.
16. LAY CUT SECTIONS OF FIBERGLASS CLOTH (18) ON REPAIR AREA, CENTERED OVER GAP (11). USING STIR STICK, FIRMLY PRESS FIBERGLASS CLOTH (18) INTO EPOXY TO COMPLETELY SOAK FIBERGLASS CLOTH (18).
17. APPLY ANOTHER LAYER OF EPOXY RESINS OVER FIBERGLASS CLOTH (18).
18. AFTER 2-5 MINUTES, EPOXY WILL START GELLING. IT MAY TAKE MORE TIME IN COOL TEMPERATURES, LESS IN HOT TEMPERATURES.

### NOTE

For smoother surface, press piece of masking tape, wider than repair, directly over wet epoxy and smooth before epoxy hardens. Tape can be removed when epoxy sets up after 15 minutes.

19. AFTER BODY FILLER HAS HARDENED, SAND UNEXPOSED SIDE OF REPAIR AREA TO SMOOTH FLAT SURFACE, IF REQUIRED.
20. REPAIR DAMAGE ON OUTSIDE SURFACE OF HOOD, AND PAINT SURFACE ON BOTH SIDES.

**Hood Component Rebonding****NOTE**

If parts cannot be separated, work folded medium-grit sandpaper or section of steel hacksaw blade between two surfaces to remove old adhesive.

1. IF REBONDING JOINT THAT HAS SEPARATED OR REPLACING DAMAGED PART, COMPLETELY SEPARATE PART OR PARTS USING HEAT GUN AND PUTTY KNIFE. REMOVE AS MUCH OF OLD ADHESIVE AS POSSIBLE. HEAT GUN WILL SOFTEN ADHESIVE AND ALLOW IT TO BE PEELED OFF SMC.
2. SCUFF SURFACES WITH 100-220 GRIT SANDPAPER.
3. CLEAN SURFACES TO BE BONDED WITH ASHLAND 6036 PRIMER OR METHYLENE CHLORIDE. INSPECT AREA CLOSELY TO BE SURE ALL OLD ADHESIVE IS REMOVED.
4. IF REPLACING LARGE PART, SUCH AS FENDER, ALINE PART ON HOOD AND CLAMP IN PLACE. DRILL HOLE THRU BONDING SURFACES (19) AND INSTALL CLAMPING BOLT (20) IN HOLE. INSTALL TWO WASHERS (21), ONE ON EACH BONDING SURFACE (19). INSTALL NUT (22) ON CLAMPING BOLT (20). THERE SHOULD BE ENOUGH CLAMPING BOLTS (20) TO HOLD HOOD IN PLACE AND KEEP BONDING SURFACES (19) TOGETHER, ONE BOLT EVERY 12-18 IN. (30-45 cm). REMOVE PART FOR APPLICATION OF ADHESIVE.
5. USING MANUFACTURER'S INSTRUCTIONS, MIX ENOUGH ASHLAND PLOGRIP 6600/6622 ADHESIVE TO BOND PARTS TOGETHER ABOUT 3/8-IN. (10-mm) DIAMETER BEAD AT BONDING SURFACE (19). ADHESIVE WILL CURE IN 7-10 MINUTES.
6. PUT ADHESIVE IN STANDARD CAULKING GUN AND CUT NOZZLE SO 3/8 IN. (10-mm) DIAMETER BEAD CAN BE DISPENSED. IF PARTS COULD NOT BE COMPLETELY SEPARATED, CUT NOZZLE SO ADHESIVE CAN BE INJECTED BETWEEN SURFACES.
7. DISPENSE 3/8-IN. (10-mm) DIAMETER BEAD OF ADHESIVE BETWEEN ALL BONDING SURFACES (19).
8. WITHIN 5 MINUTES OF DISPENSING ADHESIVE BEAD, ALINE PART ON HOOD AND CLAMP FIRMLY IN PLACE. IF A LARGE PART (FENDER, FOR EXAMPLE), INSTALL CLAMPING BOLTS. TIGHTEN CLAMPS OR CLAMPING BOLTS JUST ENOUGH TO ENSURE UNIFORM AMOUNT OF PRESSURE IS APPLIED ALONG SEAM. IDEALLY, ADHESIVE SHOULD BE COMPRESSED TO FORM BONDLINE 1 IN. (25 mm) WIDE AND 0.030 IN. (0.76 mm) THICK.
9. BEFORE ADHESIVE CURES, REMOVE EXCESS ADHESIVE THAT SQUEEZES OUT EDGES OF BOND.
10. BOND WILL BE SECURE IN ABOUT 1 HOUR. REMOVE CLAMPS.
11. IF HOLES WERE DRILLED FOR CLAMPING BOLTS, REPAIR HOLES USING INSTRUCTIONS IN CRACK OR SMALL HOLE REPAIR, ABOVE.

## Section III. CAB BODY REPAIR

### OVERVIEW

This section illustrates and describes procedures for general, inspection, rivet replacement, and aluminum repair of the cab body.

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### CAB BODY REPAIR

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This task covers: a. General b. Inspection c. Rivet Replacement d. Aluminum Repair

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### INITIAL SETUP

Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05  
 Tool Kit, SC 5180-90-CL-N19

Materials/Parts:

Kit, Lamination Repair	Appendix B, Item 30
Compound, Sealing	Appendix B, Item 16

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### GENERAL

■ The body is constructed from aluminum alloys that have been heat treated to obtain high strength. Welding cannot be used to make body repairs. Heat generated in welding will reverse the heat treatment process and cause a great reduction in strength of material.

■ The hood is made of SMC (sheet molding compound). Cracks, splits, or holes may be repaired with a glass-reinforced plastic laminate repair kit, MIL-R-19907C.

Solid 3/16-in-diameter aluminum rivets are the primary method of joining body components. Rivets are inserted into a hole through two pieces of metal. A second head is formed by manual or pneumatic impacting or by squeezing the rivet. A bucking bar is used to back up the rivet to form the rivet head. When making repairs, use blind rivets of the same size or oversize diameter with the appropriate grip length.

Blind structural aluminum rivets of 3/16-in. diameter are used in applications where there is access from only one side of the part. Blind rivets are installed using a tool that pulls on the rivet stem causing a bulbed head to form on the back side of the part. Fastening is complete when the stem breaks off. High strength is obtained in blind structural rivets by mechanically locking the remaining stem inside the rivet body.

Steel pull-type lock bolt fasteners in 3/16 and 1/4-in. diameter are used where tension or high-shear loads exist. Lock bolts are two-piece unthreaded fasteners. One part is a high-strength, steel-headed bolt-like part with serrations on its shank. The mating part is a collar which is swaged over the serrations causing the fastener to be locked in place.

To facilitate repairs to body, it is acceptable to replace tool bolts and rivets with 1/4-in. AN4 series bolts. Do not replace lock bolts with rivets. Standard threaded fasteners should not be used as these will quickly wear the aluminum structure. Bolt lengths should be chosen so that the cylindrical portion of the bolt is bearing on all members being joined. Bolts are designated as AN4-XX or AN4C-XX, where XX defines grip length. Tighten all bolts to 70-75 lb-in. (8 N.m).

All riveted joints have adhesive foam between both components riveted together. The purpose of this tape is to ensure watertight joints and to ensure aluminum components will not wear prematurely. Tape may be either 1 in. or 2 in. wide depending on the joint. Replace adhesive tape with the same size removed during disassembly. The only time adhesive foam tape is to be replaced is if a riveted joint is completely taken apart.

## **INSPECTION**

### **General**

The damaged area should be thoroughly cleaned and inspected to determine cause and extent of damage. Body parts should be inspected for holes, cracks, dents, distortion, or breaks. Fasteners should be inspected for breaks, stretching, looseness, cocked heads, or hole elongation. Seams, flanges, and joints should be inspected for straightness or local deformation as an indication that fasteners may have been stretched or holes elongated. It is possible for this to happen and for fasteners to still appear to be tight in their holes. In addition, make a thorough inspection of adjacent areas to determine if high loads have been transmitted from the damaged area to other areas. This can result in secondary damage in the form of distorted panels or seams, loosened or sheared fasteners, elongated fastener holes, and cracks.

### **Classification**

After extent of damage has been determined, affected parts should be classified in one of the following categories:

- Negligible Damage
  - Damage Repairable By Patching
  - Damage Repairable By Insertion
  - Damage Necessitating Replacement Of Parts
1. Negligible Damage. Minor dents, nicks, scores, cracks, and holes in body panels which are within or are brought within reasonable limits by a simple procedure without extensive rework. These defects should be considered more serious if located in main structural members such as body side rails, a pillars, or floor crossmembers rather than in body panels such as cowls or rear wheelhouses. Deep wrinkles of undetermined origin in body panels should not be classed as negligible until the source of wrinkles has been investigated and positively identified. damage other than small dents, holes, nicks, and scratches will require repair or replacement of the part. Refer to repair of negligible damage, below.
    - Negligible Cracks. Isolated cracks less than 0.50 in. (1.27 cm) long may be classified as negligible cracks provided they are stop drilled at each end to stop propagation.

## **CAB BODY REPAIR (CONT)**

- Negligible Holes. Isolated holes no more than 0.50 in. (1.27 cm) diameter after they are made round with smooth edges are classified as negligible holes, provided the distance from the edge of the hole to the nearest line of rivets exceeds the diameter of the hole.
  - Negligible Dents And Distortion. Small dents and distorted areas may be classified as negligible if they can be repaired by hammering or bending without causing the material to crack. Heat may not be used for reforming.
2. **Damage Repairable By Patching.** Damage beyond negligible must be repaired or the section replaced. patches can often be applied over damaged body panels. damaged area must first be trimmed to remove sharp edges or notches which could cause start of new cracks. Patch must then be sized to overlap the area to allow for attaching rivets. refer to repair by patching, below.
  3. **Damage Repairable By Insertion.** In certain cases, patch repairs may not be desirable because of impracticality or because a flush surface is desired. In this case, damaged area must be cut away and a partial replacement of equivalent material inserted flush with adjacent areas and backed up with a doubler. refer to repair by insertion, below.
  4. **Damage Necessitating Replacement Of Parts.** Parts are too badly damaged for repair, or replacement is easier than repair; repair for welded assemblies such as body mounts. welded assemblies cannot be rewelded without destroying their strength and must be replaced.

### **Rivet Failure**

Signs of rivet failure include tipped heads, looseness, and chipped or cracked paint. If heads are tipped in the same direction and rivets are loose in consecutive groups, the joint has undergone excessive load. Rivet heads which are tipped in different directions and are not in groups may be improperly installed. With chipped or cracked paint, it may be necessary to remove paint to check true condition of rivets. Rivets subjected to critical loads, but showing no distortion, should be inspected if failure is suspected. The head should be drilled off, and the shank should be carefully punched out. Failure is indicated by notched rivet shank and misaligned holes. Flush rivets showing head slippage within the dimple or countersink indicate either sheet bearing or rivet shear failure and must be removed for inspection and replacement. If failure of rivets cannot be detected by visual inspection, the joint can be checked by drilling and punching out several rivets. If rivet shanks are notched, rivets should be replaced with next larger size rivets. If rivet holes show elongation due to local failure in tearing of the sheet, next larger size rivet must be used in replacement. Any deformation of the sheet around rivet, tear outs, or cracks between rivets usually indicates partially failed or damaged rivets. Complete repair of the joint will require replacement by the next larger size rivets. Use the next 1/32-in. larger diameter rivet to obtain a tight joint when original hole has been enlarged. If original size rivet is installed, rivet would not be able to carry its share of shear load, and the joint would not meet its strength requirements.

### **Lock Bolt Failure**

Lock bolts are used to withstand tension loads and high-shear loads. These fasteners are installed in holes with an interference fit. No looseness can be permitted. Lock bolts showing evidence of being stretched, broken, loose in holes, or having heads that do not set flat against the surface must be replaced. Guidelines used in Rivet Failure, above, for detecting rivet failures also apply to lock bolts.



**RIVET REPLACEMENT****NOTE**

When removing rivets, be careful not to enlarge rivet holes. This will require use of an oversize or larger rivet for replacement.

**Solid Rivet Removal**

1. FILE FLAT SURFACE ON MANUFACTURED HEAD, IF ACCESSIBLE. IT IS ALWAYS PREFERABLE TO WORK ON MANUFACTURED HEAD RATHER THAN HEAD THAT IS BUCKED OVER. MANUFACTURED HEAD WILL ALWAYS BE MORE SYMMETRICAL AROUND SHANK.
2. INDENT CENTER OF FILED SURFACE WITH CENTER PUNCH.

**CAUTION**

Use drill slightly smaller than diameter of rivet shank to avoid making rivet hole oversized.

3. USING DRILL SLIGHTLY SMALLER THAN DIAMETER OF RIVET SHANK, DRILL THRU RIVET HEAD.
4. SUPPORT BACK SIDE OF RIVET. USING SHARP CHISEL, CUT RIVET HEAD ALONG DIRECTION OF RIVET LINE OR PANEL EDGE, TO PREVENT DISTORTION OF PANEL, AND SHEAR OFF WEAKENED RIVET HEAD.
5. SUPPORT PANEL FROM OPPOSITE SIDE AND DRIVE OUT SHANK WITH PIN PUNCH. IF RIVET IS UNDULY TIGHT BECAUSE OF SWELLING BETWEEN SHEETS, DRILL RIVET SHANK OUT WITH UNDERSIZE DRILL.

**Blind Rivet Removal**

1. FILE SMALL FLAT ON RIVET HEAD.
2. CENTER PUNCH FLAT. SUPPORT RIVET BACKSIDE, IF POSSIBLE.
3. USING SMALL DRILL ABOUT THE SIZE OF RIVET PIN, DRILL OFF TAPERED END OF PIN WHICH FORMS LOCK.
4. SHEAR LOCK USING PIN PUNCH TO DRIVE OUT PIN.
5. PRY OUT REMAINDER OF LOCKING COLLAR.
6. USING DRILL SLIGHTLY SMALLER THAN RIVET SHANK, DRILL ALMOST THRU RIVET HEAD.
7. PRY OFF RIVET HEAD WITH PIN PUNCH.
8. TAP OUT RIVET SHANK WITH PIN PUNCH.

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## **CAB BODY REPAIR (CONT)**

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### **Lock Bolt Removal**

#### **NOTE**

If lock bolt head is inaccessible, locking collar must be removed. Remove collars by grinding or splitting collars axially with sharp chisel.

1. WORK FROM HEAD SIDE OF LOCK BOLT, IF ACCESSIBLE, FILE SMALL FLAT ON HEAD, IF ROUNDED.
2. CENTER PUNCH HEAD.
3. USING HARDENED DRILL SLIGHTLY SMALLER THAN LOCK BOLT, DRILL THRU HEAD. IN CASES WHERE LOCK BOLTS ARE TOO HARD TO BE DRILLED WITH AVAILABLE DRILLS, GRIND HEAD DOWN USING CUTOFF WHEEL OR CARBIDE BIT IN DIE GRINDER. WHEN USING GRINDER METHOD, CUT HEAD DOWN UNTIL VERY THIN, BUT DO NOT GRIND COMPLETELY OFF OR TOUCH BODY PART WITH GRINDING TOOL.
4. SUPPORT HEAD AND USE PIN PUNCH TO PRY OFF HEAD OR SHEAR OFF WITH SHARP CHISEL.

#### **CAUTION**

Be careful not to distort lock bolt or lock bolt hole to prevent damage to equipment.

5. DRIVE LOCK BOLT OUT OF HOLE WITH PIN PUNCH.

### **Rivet Hole Drilling**

1. CENTER PUNCH ALL NEW RIVET LOCATIONS. CENTER PUNCH MARK MUST BE LARGE ENOUGH TO PREVENT DRILL FROM SLIPPING OUT OF POSITION AND MUST NOT DENT SURFACE OF MATERIAL. TO PREVENT DENTING, PLACE BUCKING BAR BEHIND MATERIAL DURING PUNCHING.
2. MAKE SURE DRILL IS CORRECT SIZE (TABLES 1 AND 2) AND POINT IS PROPERLY GROUND. NO. 10 DRILL IS USED TO INSTALL STANDARD 3/16-IN. BLIND RIVETS.

**Table 1. Drill Sizes for Solid Shank Rivets**

Rivet Diameter (In.)	Drill Size	Drill Diameter (In.)
1/16	#51	0.0670
3/32	#41	0.0960
1/8	#30	0.1285
5/32	#21	0.1590
3/16	#10	0.1910
1/4	F	0.2570
5/16	P	0.3230
3/8	W	0.3860

**Table 2. Drill Sizes for Blind Rivets**

Nominal Diameter (In.)				Oversize Diameter (In.)			
Rivet Diameter	Drill Size	Minimum	Maximum	Rivet Diameter	Drill Size	Minimum	Maximum
1/8	#30	0.129	0.132	1/8	#27	0.143	0.146
5/32	#20	0.160	0.164	5/32	#16	0.176	0.180
3/16	#10	0.192	0.196	3/16	#5	0.205	0.209

**NOTE**

- While drilling, hold drill at 90-degree angle to material surface. Avoid letting drill wobble, making oblong holes.
  - Avoid excessive pressure. Let drill bit do cutting.
  - Do not push drill thru material.
3. PLACE DRILL IN CENTER MARK FOR NEW RIVET LOCATIONS OR ALINE DRILL WITH OLD HOLE WHEN REPLACING OLD RIVETS WITH OVERSIZE RIVETS. WHEN USING POWER DRILL, GIVE BIT A FEW TURNS WITH FINGERS BEFORE STARTING MOTOR. THIS WILL HELP ENSURE DRILL DOES NOT JUMP OUT OPPOSITION WHEN MOTOR IS STARTED.
  4. REMOVE ALL BURRS WITH METAL COUNTERSINK OR FILE.

**NOTE**

Make sure no chips are trapped between sheets of metal.

5. CLEAN AWAY ALL DRILL CHIPS.
6. APPLY SEALING COMPOUND TO HOLE AND SURROUNDING AREA.

## **CAB BODY REPAIR (CONT)**

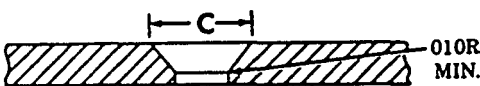
### **Hole Countersinking**

#### **NOTE**

Some rivet installations in body require that rivet head be flush with material surface. In these instances, countersunk or flush head rivets are used.

1. WHEN USING COUNTERSUNK RIVETS, RIVET HOLES MUST BE COUNTERSUNK WITH TOOL HAVING 100-DEGREE TAPER SO RIVET HEAD WILL FIT FLUSH WITH SURFACE.
2. WHEN USING HAND-OPERATED COUNTERSINK, HOLE MUST BE TRIED WITH RIVET SO RECESS WILL NOT BE TOO DEEP OR TOO SHALLOW. IT IS BEST TO USE COUNTERSINK WITH STOP SO DEPTH OF COUNTERSINK CAN BE CONTROLLED, TYPICAL COUNTERSINKING DIMENSIONS FOR BLIND RIVETS ARE SHOWN IN TABLE 3. MINIMUM SHEET THICKNESS THAT CAN BE MACHINED FOR 100-DEGREE COUNTERSINK RIVETS IS GIVEN IN TABLE 4.
3. DO NOT REMOVE EDGE OF HOLE ON BLIND SIDE OF JOINT.

**Table 3. Countersinking Dimensions for 100-Degree Countersunk Blind Rivets**

Countersinking Dimensions (100°)		
		
Rivet Diameter (In.)	C (In.)	
	Minimum	Maximum
1/8	0.222	0.228
5/32	0.283	0.289
3/16	0.350	0.356

**Table 4. Minimum Sheet Gage for 100-Degree Machine Countersink**

Rivet Size (In.)	3/32	1/8	5/32	3/16	1/4
Gage (In.)	0.040	0.050	0.064	0.072	0.072

**Solid Rivet Installation**

**NOTE**

When replacing rivets during repair, use same rivet size and type, if possible. If hole has been damaged, it will be necessary to drill hole over size and use next larger solid rivet or oversize blind rivet.

1. AFTER DRILLING AND PRIOR TO DRIVING RIVETS, PARTS TO BE JOINED MUST BE SECURED TO PREVENT SLIPPING DURING RIVETING. C-CLAMPS MAY BE USED, OR ANY OF SEVERAL VARIETIES OF SKIN FASTENERS MAY BE INSERTED IN PREVIOUSLY DRILLED HOLES.

**CAUTION**

When riveting thin gage materials, be careful handling rivet tools to avoid damaging material.

2. SOLID RIVETS ARE AVAILABLE IN VARIOUS LENGTHS. CORRECT LENGTH RIVET MUST BE CHOSEN SO BUCKED HEAD IS NOT TOO SMALL OR TOO LARGE TO FORM TIGHT FIT. USE TABLE 5 TO DETERMINE PROPER RIVET LENGTH.
3. THREE COMMON METHODS OF DRIVING OR SETTING RIVETS ARE: HAND, SQUEEZE, AND PNEUMATIC GUN. ALL THREE METHODS USE PRINCIPLE OF UPSETTING OR HEADING RIVET SHANK AGAINST BUCKING BAR.

**Table 5. Calculating Correct Solid Rivet Length**

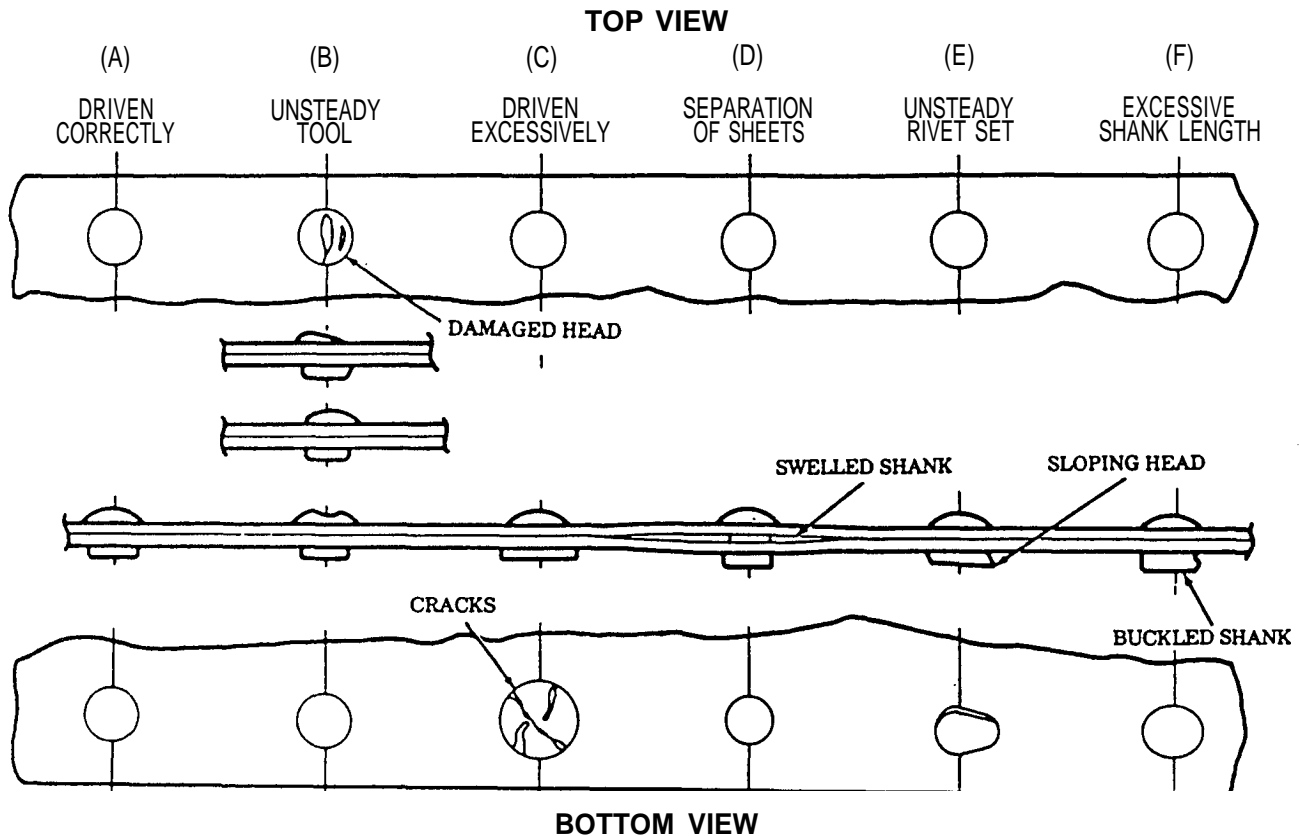
Rivet Diameter	Material Thickness	Add
1/4 in. or less	1/2 in. or less	1-1/2 x diameter of rivet
1/4 in. or less	Over 1/2 in.	1-1/2 x diameter of rivet + 1/16 in. for every 1/2 in. of material thickness
5/16 in. or more	1 in. or less	1-1/2 x diameter of rivet
5/16 in. or more	Over 1 in.	1-1/2 x diameter of rivet + 1/16 in. for every 1 in. of material thickness

**Rivet Driving Practices and Precautions**

Riveting is the major means of joining body parts. Proper procedures must be followed to maintain high-quality workmanship. Table 6 lists types of faulty rivet installations, causes, and corrective action to be taken.

## CAB BODY REPAIR (CONT)

Table 6. Correctly and Incorrectly Driven Rivets



Imperfection	Cause	Remedy	Action
A. None	None	None	None
B. Cut head	Improperly held tools.	Hold riveting tools firmly against work.	Replace rivet.
C. Excessively flat head, resultant head cracks	Excessive driving, too much pressure on bucking bar.	Improve riveting technique.	Replace rivet.
D. Sheet separation	Work not held firmly together and rivet shank swelled.	Fasten work firmly together to prevent slipping.	Replace rivet.
E. Sloping head	a. Bucking bar not held firmly. b. Bucking bar permitted to slide and bounce over rivet.	Hold bucking bar firmly without too much pressure.	Replace rivet.
F. Buckled shank	improper rivet length and E, above.	E, above, and rivet of proper length.	Replace rivet.

**Blind Rivet Driving Practices and Precautions**

1. RIVETS SHOULD BE INSPECTED FOR PROPER INSTALLATION. GRIP LENGTH OF EACH RIVET IS MARKED ON TOP OF RIVET HEAD TO PROVIDE POSITIVE IDENTIFICATION. USE OF PROPER GRIP LENGTH WILL PRODUCE RIVET INSTALLATION WHERE LOCKING COLLAR IS FLUSH WITH TOP SURFACE OF RIVET HEAD. TOLERANCE LIMIT ON FLUSHNESS IS 0.020 IN. (0.5 mm).
2. FOR PROPER RIVET INSTALLATION, IT IS IMPERATIVE THAT HOLES BE PROPERLY PREPARED, TOOLS BE IN GOOD WORKING ORDER, AND RIVETS BE PROPERLY APPLIED. WHEN PROBLEMS OCCUR, SOURCE OF TROUBLE COULD BE IN ANY OF THESE AREAS.

**Blind Rivet Installation****CAUTION**

- Proper length rivet must be selected for each application to prevent damage to equipment. Rivet lengths are sized by range of material thickness that rivet will grip.
- Rivets can tolerate only 1/16 in. variation in material thickness for each particular rivet length to prevent damage to equipment. Rivet grip lengths are called out as dash number at end of manufacturer's part number.
- For double dimpled sheets, add countersunk head height to materials thickness to prevent damage to equipment.

**NOTE**

- Prior to installing blind rivets, hole must be prepared and parts must be aligned and clamped firmly in place. These steps are the same as for solid riveting operations (refer to Rivet Hole Drilling, above).
- Proper drill sizes for standard and oversize blind rivets are given in Table 2.
- Countersinking dimensions and minimum sheet gage for countersunk blind rivets are shown in Tables 3 and 4.
- Grip lengths are determined as shown in Table 7.
- Use rivet installation tool kit, D-100-MIL-1, and puller head adapters, if required, for all blind rivets.

**CAB BODY REPAIR (CONT)**

**Table 7. Rivet Grip Length Determination**

Material Thickness Range (In.)		Rivet Grip No.
Minimum	Maximum	
	1/16	1
	1/8	2
1/8	3/16	3
3/16	1/4	4
1/4	5/16	5
5/16	3/8	6
3/8	7/16	7
7/16	1/2	8
1/2	9/16	9
9/16	5/8	10
5/8	11/16	11
11/16	3/4	12

1. INSERT RIVET STEM INTO PULLING HEAD OF RIVET GUN OR ADAPTER.
2. HOLD RIVET GUN IN LINE WITH AXIS OF RIVET AS ACCURATELY AS POSSIBLE.
3. APPLY STEADY, FIRM PRESSURE AGAINST RIVET HEAD.
4. SQUEEZE HANDLES OF MANUAL GUN. RIVET CLAMPING ACTION WILL PULL SHEETS TOGETHER, SEAT RIVET HEAD, AND BREAK STEM FLUSH WITH HEAD OF RIVET.

**ALUMINUM REPAIR**

**CAUTION**

Repairs should not be made on body using welding or heat for forming. Heat will weaken material and cause further problems.

**Material**

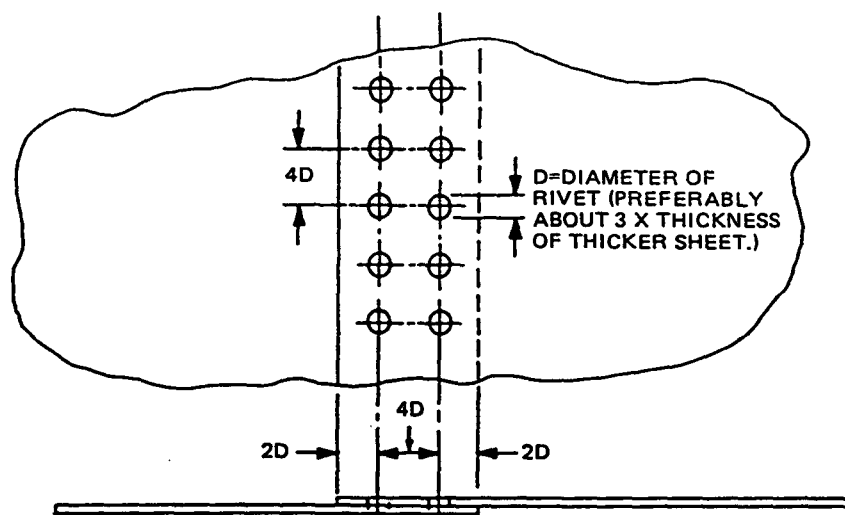
Aluminum material used for repair should be of the same alloy and temper as original, if possible. In general, 6061-T6 should be used. Material thickness must be the same or thicker. This alloy will work well for flat repairs, but is not well suited to bending because it is hard and cracks easily when bent sharply. When bends must be made, use softer 6061-T4 aluminum alloy and increase material thickness by at least 50 percent. As a rule of thumb, 6061-T4 should be bent with minimum bend radius of one to two times material thickness, whereas 6061-T6 requires at least three times material thickness radius for bends. In all cases, bends should be closely inspected for cracks. Suitable method for avoiding bending cracks is to obtain angles that are extruded from 6061-T6 alloy, or use preformed angles for repairs.



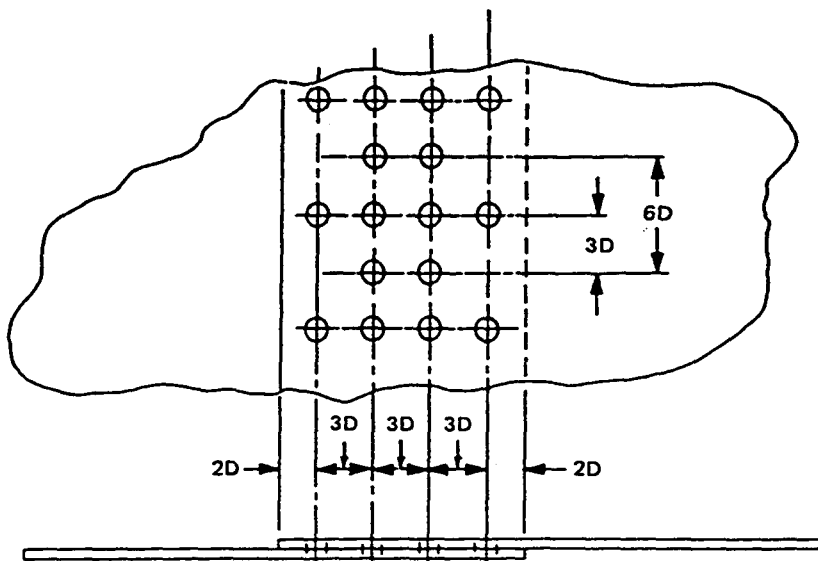
### Foam Adhesive Tape

Where it is necessary to remove parts, note that foam adhesive tape is used in joints. Use care in parts removal to avoid unnecessary distortion. Parts should be separated by peeling them apart using knife or chisel to start peeling action. Before parts are assembled, remove any remaining foam adhesive tape from joints so parts will fit together with good, even contact.

### Rivet Patterns



DOUBLE ROW RIVETING PATTERN



TRIPLE OR MULTIPLE ROW RIVETING PATTERN

1. RIVET PATTERNS ARE DENOTED BY RIVET SPACING AND RIVET EDGE DISTANCE. RIVET EDGE DISTANCE IS DISTANCE FROM CENTER OF RIVET TO NEAREST EDGE OF SHEET. RIVET SPACING IS DEFINED AS DISTANCE FROM CENTER OF RIVET TO CENTER OF ADJACENT RIVET.

## CAB BODY REPAIR (CONT)

2. REQUIRED RIVET SPACING IS DETERMINED BY STRENGTH NEEDED IN JOINT. GENERAL FEEL FOR STRENGTH REQUIRED CAN BE OBTAINED BY INSPECTING RIVET PATTERNS IN SURROUNDING AREAS. BODY REPAIRS MADE USING SINGLE ROWS OF RIVETS SHOULD BE PERFORMED USING RIVET SPACING NOT GREATER THAN 1-1/2 IN. (4 cm), AND NOT LESS THAN 5/8 IN. (16 mm). USE 1 IN. RIVET SPACING AS GENERAL PRACTICE FOR REPAIRS. RIVET SPACING USED IN ORIGINAL CONSTRUCTION MAY BE GREATER DUE TO ADDITIONAL STRENGTH OBTAINED BY USING FOAM ADHESIVE TAPE. DO NOT USE RIVET EDGE DISTANCES LESS THAN 3/8 IN. (5 mm).
3. HIGH-STRENGTH JOINTS OR LARGE AREA PATCHES MAY REQUIRE USE OF DOUBLE OR MULTIPLE ROWS OF RIVETS TO OBTAIN SUFFICIENT STRENGTH.

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### CAUTION

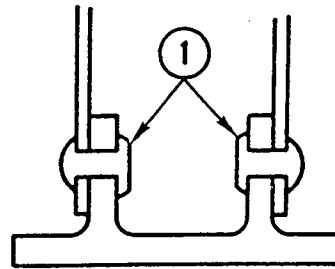
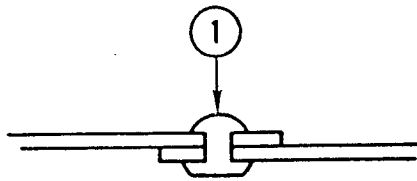
Be careful not to distort original holes to prevent damage to equipment.

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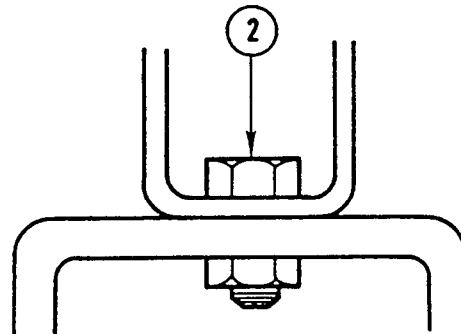
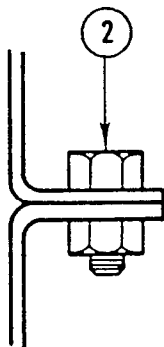
4. CARE MUST BE TAKEN TO ASSURE RIVET HOLE PATTERNS ARE TRANSFERRED ACCURATELY IN CASE WHERE PART WITH NO HOLES IS MATED TO ONE WHICH ALREADY HAS RIVET HOLES. HOLE PATTERNS MAY BE TRANSFERRED USING ONE OF FOLLOWING:

- LAY NEW PART IN PLACE AND USE HOLES IN MATING PART AS DRILL TEMPLATE. NEW PART MUST BE UNDERNEATH MATING PART.
- USE REMOVED PART AS DRILL TEMPLATE BY CLAMPING OLD AND NEW PARTS TOGETHER. PARTS MUST NEST FLAT AND RIVET FLANGE MUST BE UNDISTORTED.

### Joint Design



RIVETS LOADED IN SHEAR



BOLTS REPLACING RIVETS LOADED IN TENSION

1. LOADS ARE APPLIED THRU JOINT TO FASTENERS HOLDING JOINT TOGETHER. THESE LOADS ARE APPLIED TO FASTENERS IN FORM OF SHEAR LOADS OR TENSION LOADS. IF LOAD IS PERPENDICULR TO AXIS OF FASTENERS. FASTENER IS LOADED IN SHEAR. FASTENER IS LOADED IN TENSION WHEN LOAD IS ALONG AXIS OF FASTENER CAUSING PULL ON EACH END OF FASTENER.
2. RIVETS (1) ARE DESIGNED TO BE LOADED IN SHEAR. DO NOT CREATE NEW JOINTS DURING REPAIRS WHICH CAUSE RIVETS TO BE USED IN TENSION APPLICATION. BOLTS (2) SHOULD BE USED FOR TENSION APPLICATIONS OR SUBSTITUTED FOR RIVETS IN VERY HIGH-SHEAR LOAD APPLICATIONS.

**Repair Parts Preparation**

1. PAINT REPAIR PARTS OR PATCHES WITH EPOXY PRIMER BEFORE INSTALLATION.
2. APPLY SEALING COMPOUND TO MATING SURFACES TO PREVENT CORROSION.
3. INSTALL PART OR PATCH AS DETAILED IN REPAIR BY PATCHING AND REPAIR BY INSERTION, BELOW.
4. PAINT REPAIRED AREA WITH EPOXY PRIMER.
5. PAINT REPAIRED AREA WITH POLYURETHANE, AS REQUIRED.

**Repair Negligible Damage**

1. NEGLIGIBLE CRACKS, AS DEFINED IN CLASSIFICATION, ABOVE, ARE REPAIRED BY DRILLING SMALL HOLE AT EACH END OF CRACK TO STOP CRACK PROPAGATION. THIS IS CALLED STOP DRILLING. TABLE 8 GIVES PROPER DRILL SIZES FOR STOP DRILLING CRACKS.
2. NEGLIGIBLE HOLES ARE REPAIRED BY ROUNDING AND SMOOTHING EDGES OF HOLE TO ALLEVIATE STRESS RISERS CAUSED BY SHARP NOTCHES.

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**CAUTION**

Never use heat to reform parts. Heat greatly reduces part strength.

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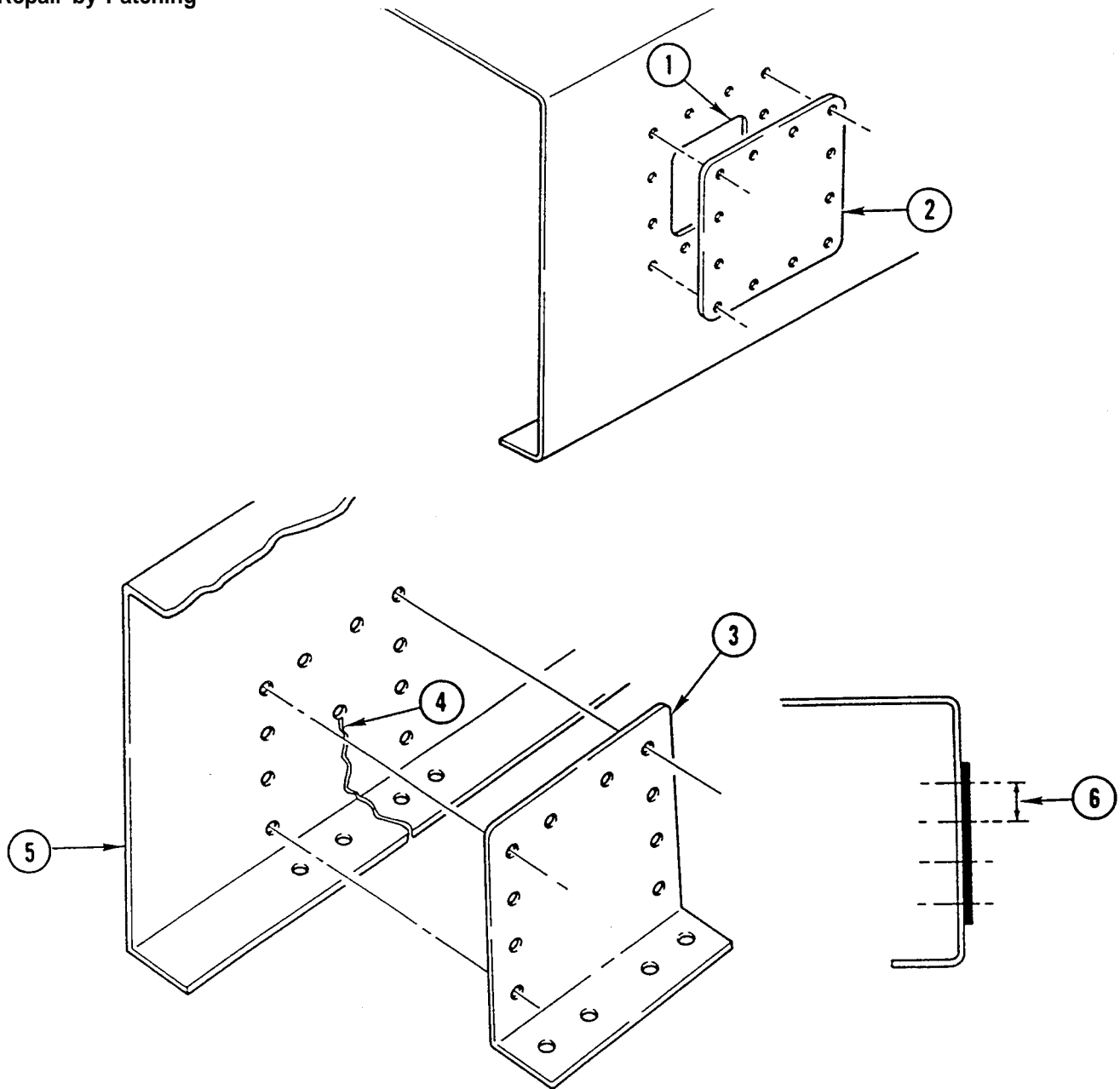
3. SMALL DENTS AND DISTORTED AREAS MAY BE REPAIRED BY BENDING OR HAMMERING AS LONG AS OPERATION DOES NOT CAUSE MATERIALS TO CRACK OR TEAR. SHARP BENDS SHOULD NOT BE ATTEMPTED.

**Table 8. Stop Drill Sizes for Negligible Cracks**

Sheet Thickness (In.)	Minimum Stop Drill Size No.
0-0.032	40
0.033 and thicker	30

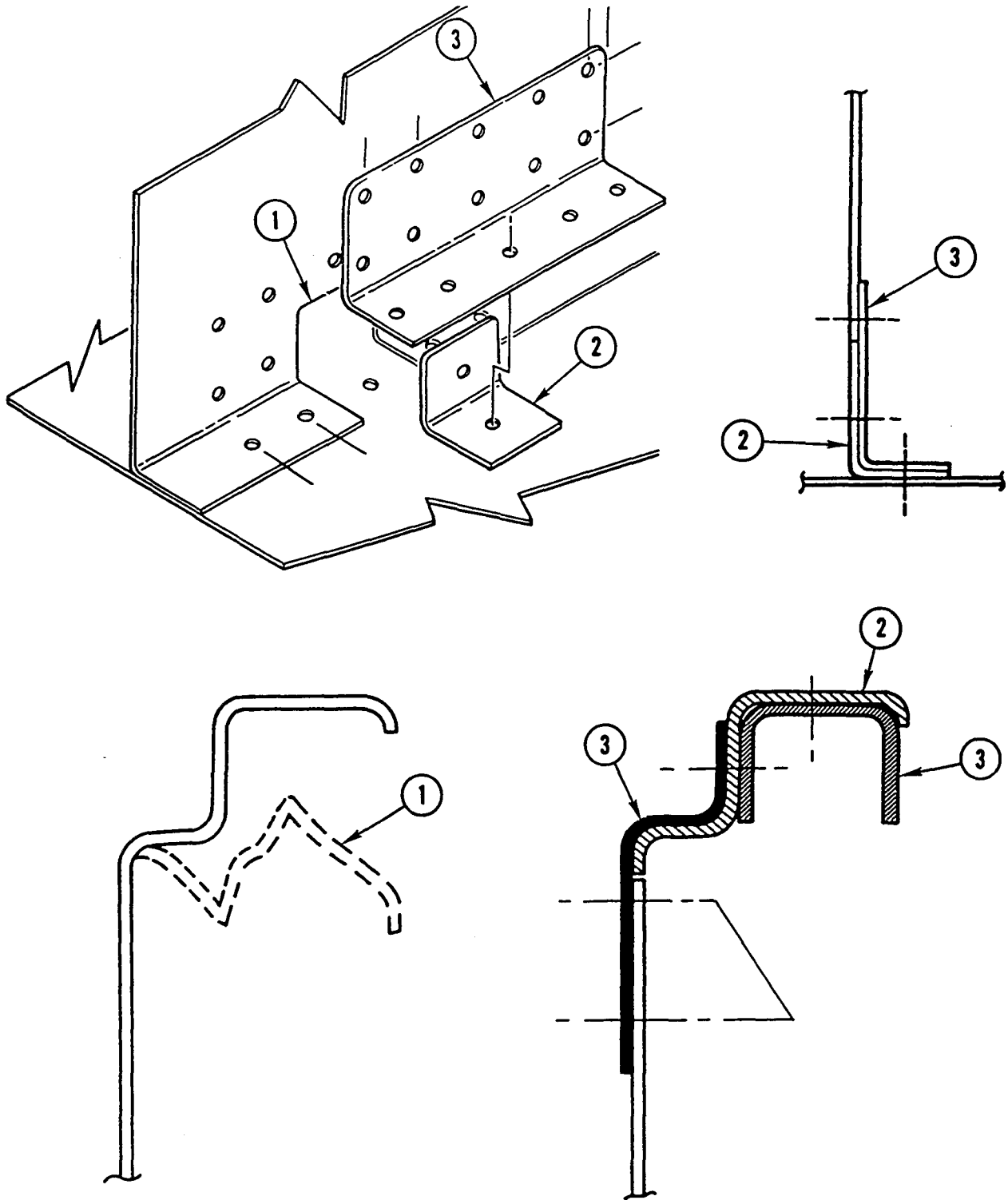
## CAB BODY REPAIR (CONT)

### Repair by Patching



Most body panel damage that exceeds limits of negligible damage may be repaired by patching. this procedure involves removal of damaged area (1) and application of a patch (2) to cover the area (1). The damaged area is prepared by removal of the damage followed by rounding or smoothing of all corners and edges. this helps ensure that cracks will not spread into undamaged areas. In the case of a large crack (4), it may be desirable to stop-drill crack (4) rather than cut out a portion of a panel (5) or structural member. repair is completed by applying a large overlapping patch (3) over the area that was damaged. The overlap must be sufficient to allow the observance of proper rivet edge distance (6) (refer to rivet patterns, above). large areas of damage are best repaired using a patch that is attached with multiple rows of rivets (refer to rivet patterns, above).

Repair by Insertion



For damage large or more severe in nature than crack or hole, it is often desirable to remove damaged area (1), insert piece of material (2) into removed area, and reinforce this with doubler (3). This is repair by insertion. this method of repair is typically stronger and stiffer than an added patch.

## Section IV. CAB DOOR REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the cab door.

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### CAB DOOR REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Compound, Sealing      Appendix B, Item 16

Grease,      Appendix B, Item 26  
Automotive and  
Artillery (GAA)

#### Equipment Condition:

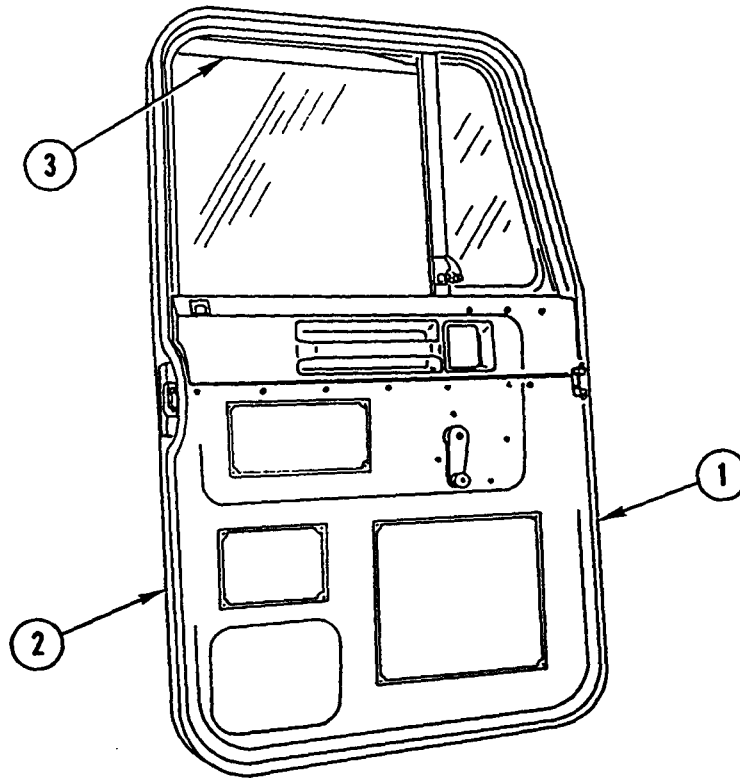
Reference	Condition Description
Page 10-89	Cab Door Removed

#### General Safety Instructions:

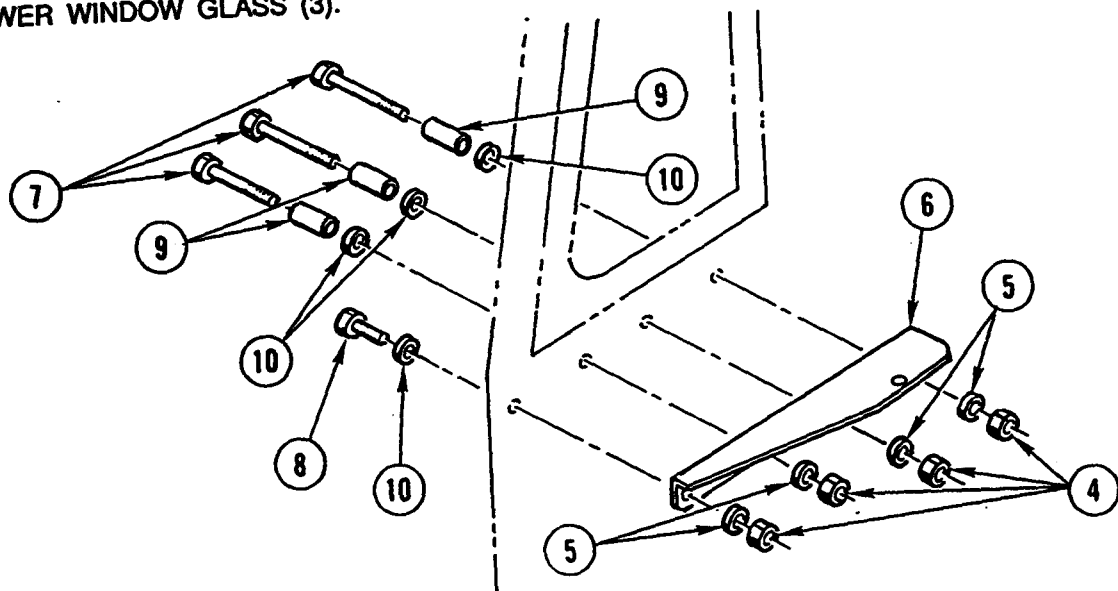
#### **WARNING**

Wear protective gloves when handling glass. Failure to do so could result in injury to personnel.

**DISASSEMBLY**



1. IF DAMAGED, REMOVE AND DISCARD SEAL (1) FROM DOOR (2).
2. LOWER WINDOW GLASS (3).

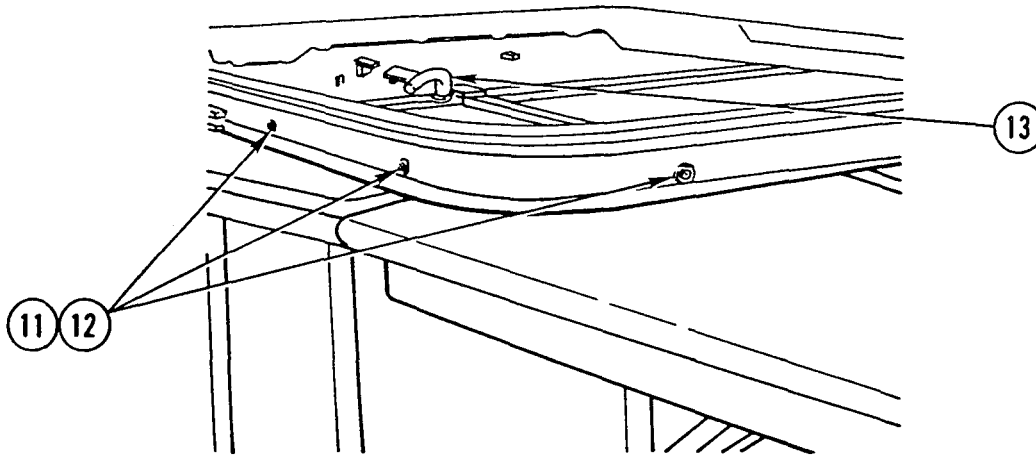


**NOTE**

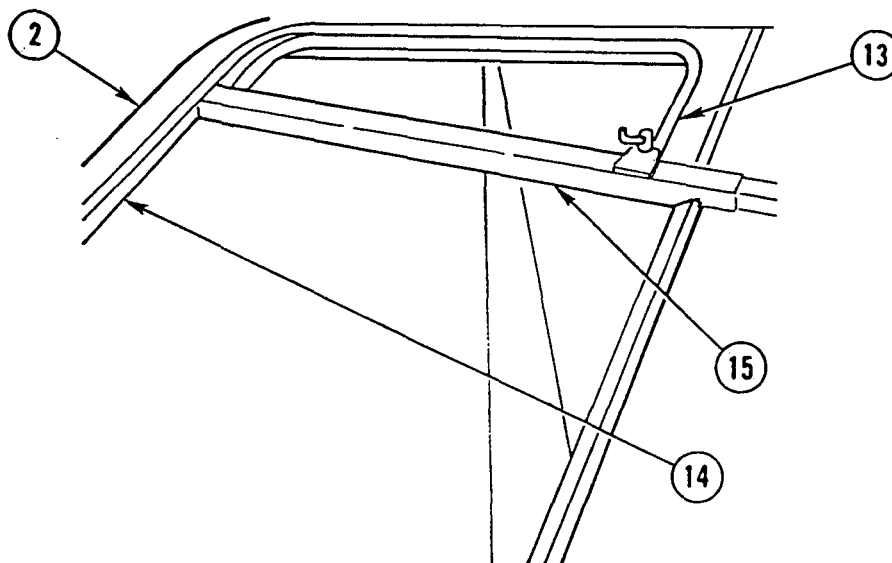
Tag screws, spacers, and washers during removal to aid in installation.

3. REMOVE FOUR NUTS (4), FOUR WASHERS (5), BRACKET (6) THREE SCREWS (7), CAPSCREW (8), THREE SPACERS (9), AND FOUR WASHERS (10).

## CAB DOOR REPAIR (CONT)

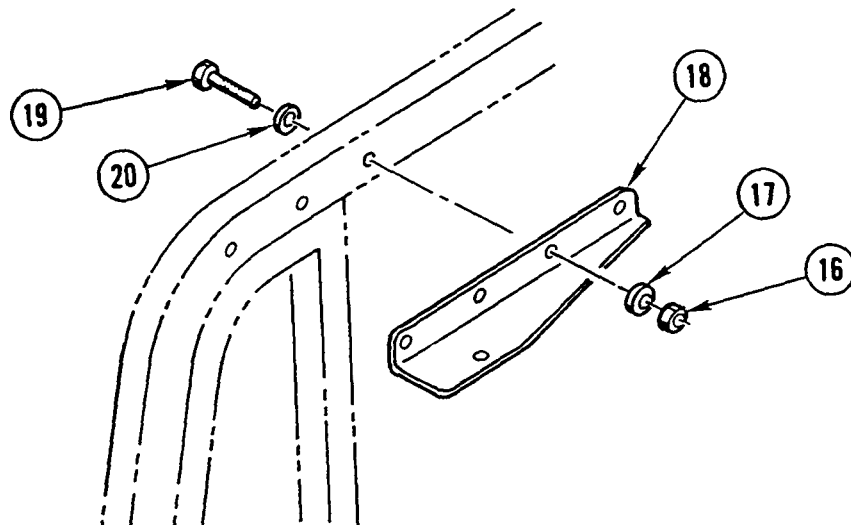


4. REMOVE THREE SCREWS (11) AND THREE WASHERS (12) FROM VENT WINDOW (13).

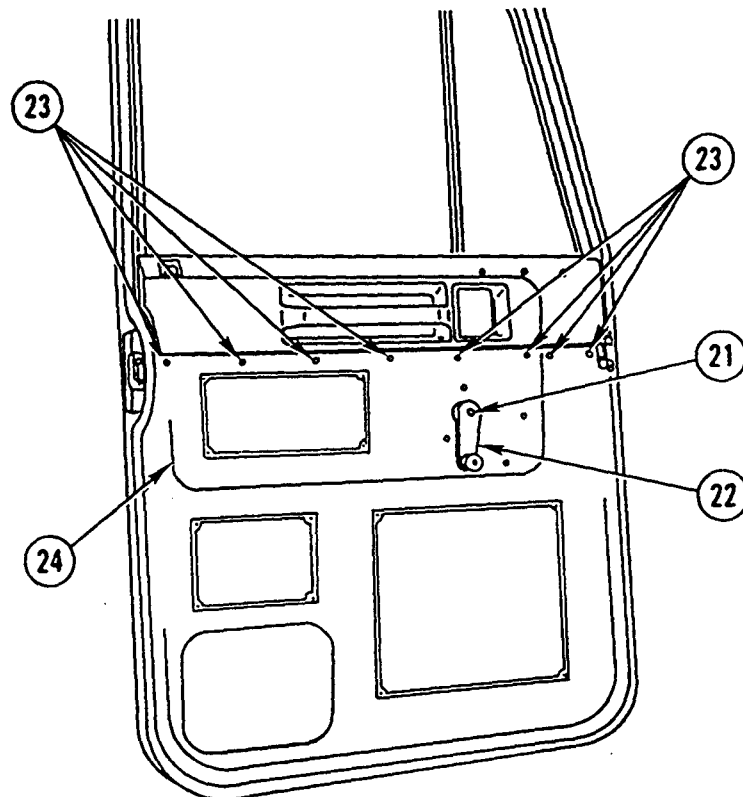


5. REMOVE 10 IN. (25.4 cm) OF WINDOW CHANNEL (14) FROM DOOR (2) TO ALLOW REMOVAL OF VENT WINDOW (13).
6. REMOVE WINDOW CHANNEL (15) FROM VENT WINDOW (13).
7. REMOVE VENT WINDOW (13) FROM DOOR (2).



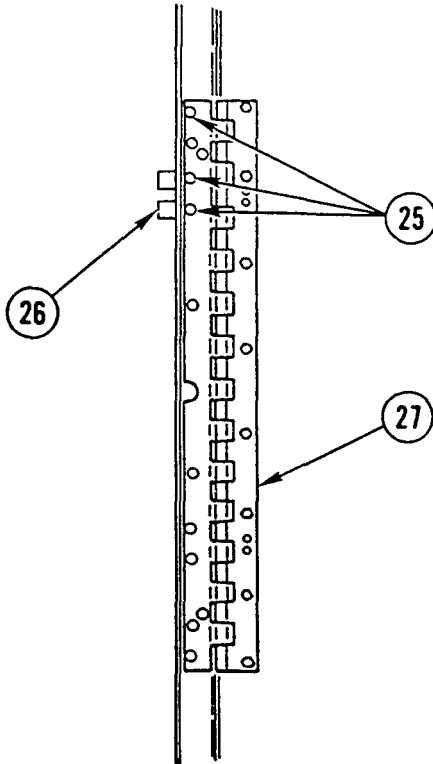


8. REMOVE FOUR NUTS (16), FOUR WASHERS (17), BRACKET (18), FOUR CAPSCREWS (19), AND FOUR WASHERS (20).

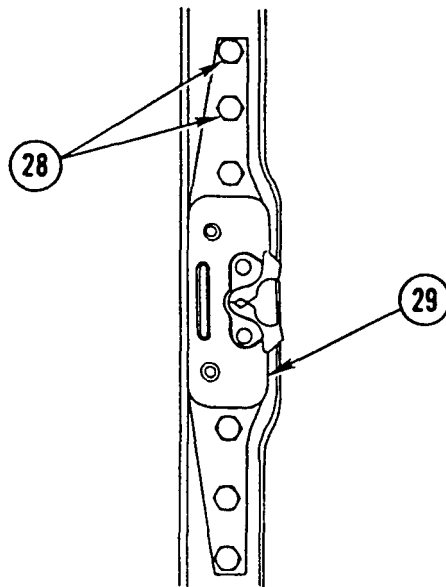


9. REMOVE SCREW (21) AND WINDOW CRANK (22).
10. REMOVE EIGHT SCREWS (23) FROM INSIDE DOOR PANEL (24).

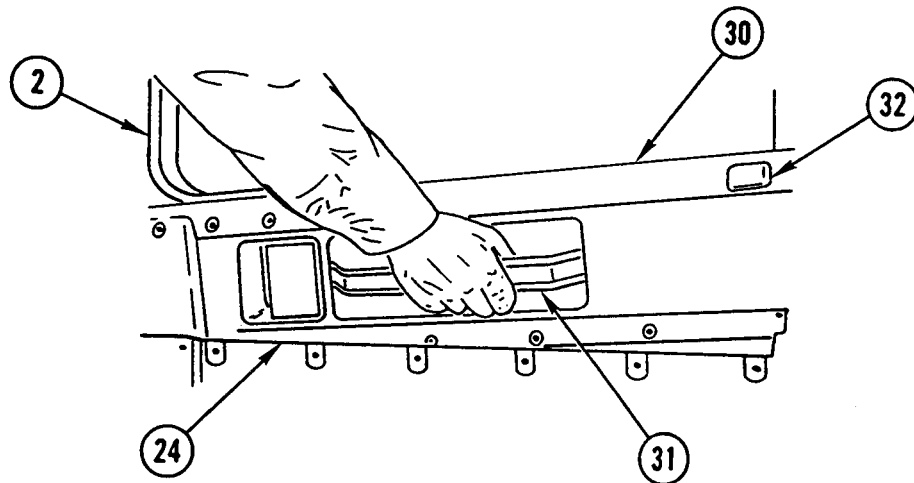
**CAB DOOR REPAIR (CONT)**



11. REMOVE THREE CAPSCREWS (25) AND CHECK ARM BRACKET (26) FROM DOOR HINGE (27).



12. REMOVE TOP TWO CAPSCREWS (28) FROM DOOR LATCH ASSEMBLY (29).

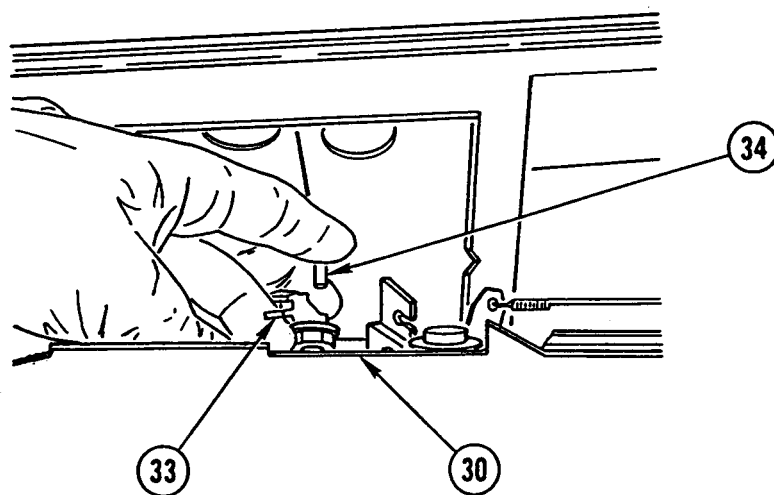


13. REMOVE SILL (30) AS FOLLOWS:

**CAUTION**

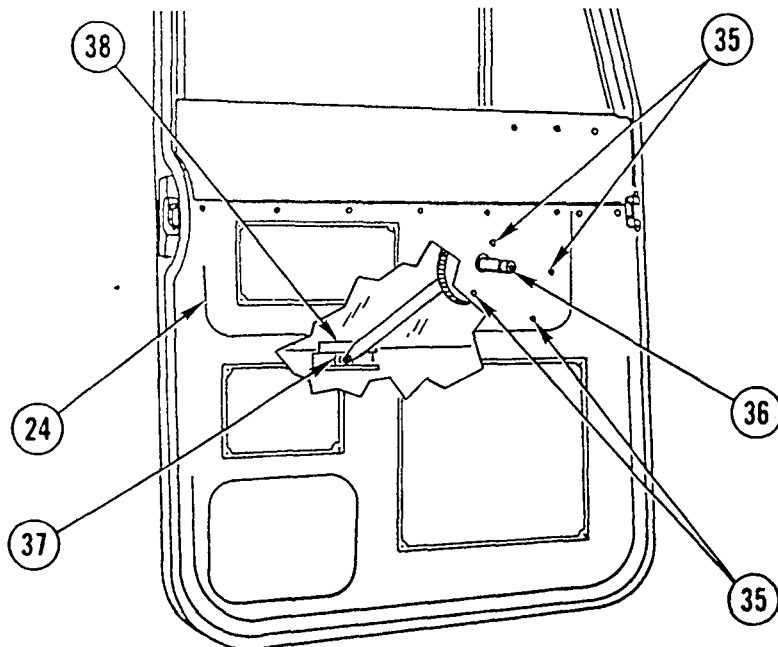
Do not attempt to completely separate sill from door after completion of step B. To do so could damage interior door components.

- A. GRIP SILL DOOR HANDLE (31), LEAN SILL (30) AWAY FROM DOOR (2), AND PULL SILL (30) UPWARD UNTIL ENTIRE LOWER EDGE OF SILL (30) UNSEATS FROM INSIDE DOOR PANEL (24).
- B. LEAN SILL (30) AWAY FROM DOOR (2) AND PUSH DOOR LOCK BUTTON (32) FREE.

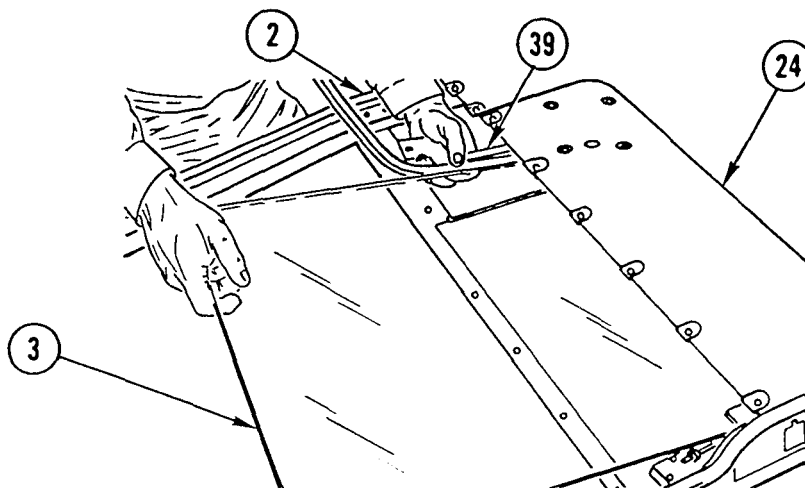


- C. DISCONNECT RELEASE HANDLE ROD RETAINER (33) FROM RELEASE HANDLE ROD (34) AND REMOVE SILL (30).

## CAB DOOR REPAIR (CONT)



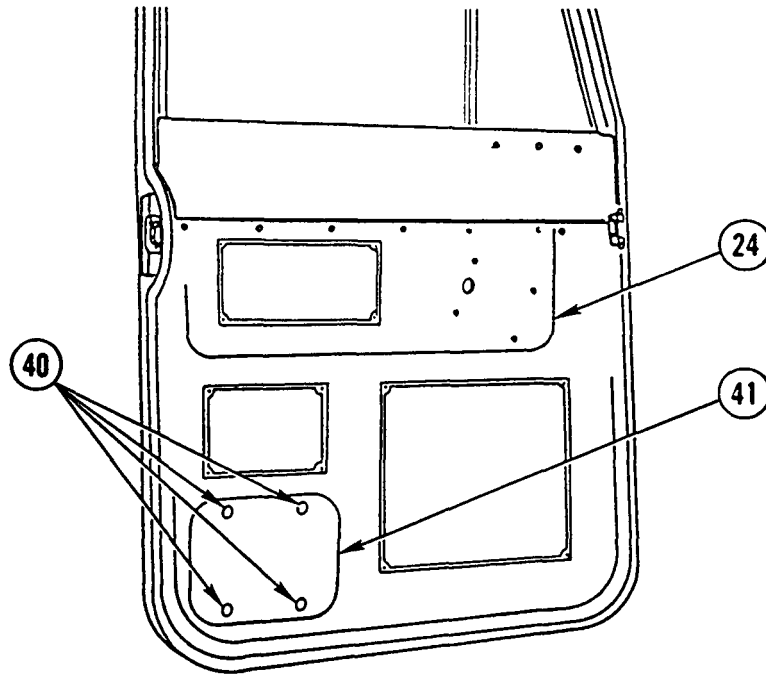
14. REMOVE FOUR SCREWS (35) FROM WINDOW REGULATOR (36).
15. DISENGAGE WINDOW REGULATOR ROLLER (37) FROM ONE END OF WINDOW LIFT CHANNEL (38).
16. REMOVE WINDOW REGULATOR (36) FROM INSIDE DOOR PANEL (24).



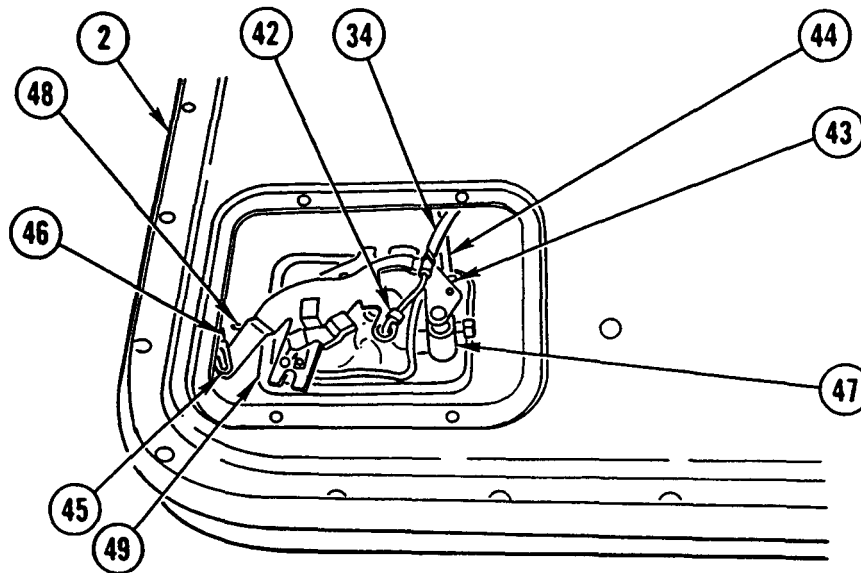
### **WARNING**

Wear protective gloves when handling glass. Failure to do so could result in injury to personnel.

17. TILT WINDOW GUIDE (39) TOWARD HINGE SIDE OF DOOR (2) AND CAREFULLY PULL WINDOW GLASS (3) TOWARD TOP OF DOOR (2). AT SAME TIME, LIFT WINDOW GLASS (3) TOWARD INSIDE DOOR PANEL (24) UNTIL WINDOW GLASS (3) IS COMPLETELY REMOVED FROM DOOR (2).

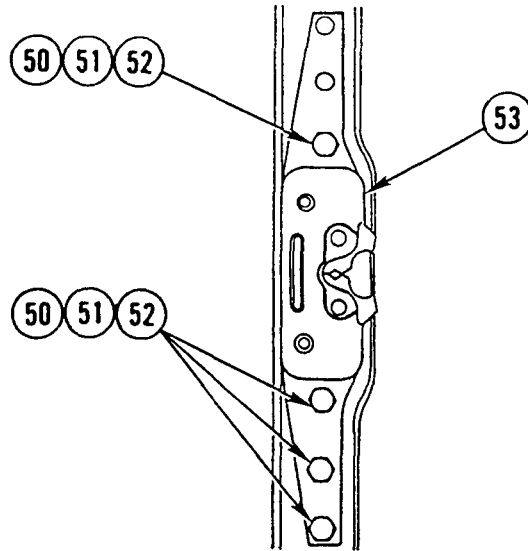


18. REMOVE FOUR SCREWS (40) AND COVER PLATE (41) FROM INSIDE DOOR PANEL (24).

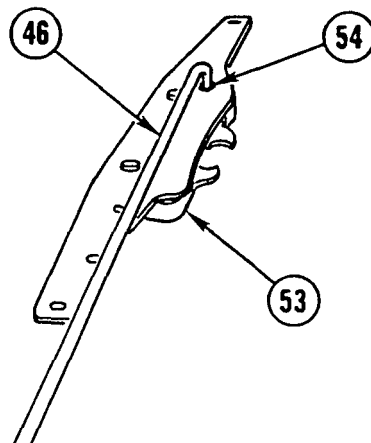


19. DISCONNECT RELEASE HANDLE RETAINER (42) AND REMOVE RELEASE HANDLE ROD (34).
20. DISCONNECT DOOR LOCK RETAINER (43) AND REMOVE DOOR LOCK ROD (44).
21. DISCONNECT DOOR LATCH RETAINER (45) AND REMOVE DOOR LATCH ROD (46) FROM EXTERIOR HANDLE ASSEMBLY (47).
22. REMOVE STUD (48) FROM EXTERIOR HANDLE ASSEMBLY (47).
23. REMOVE FASTENING CLIP (49) AND EXTERIOR HANDLE ASSEMBLY (47) FROM DOOR (2).

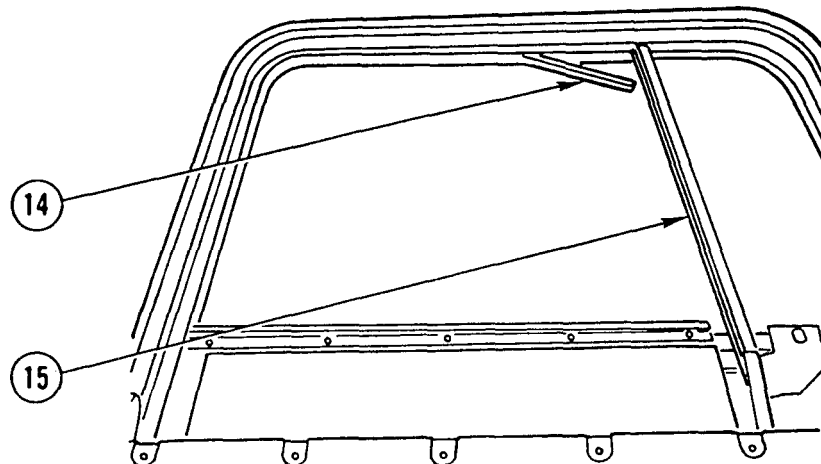
## CAB DOOR REPAIR (CONT)



24. REMOVE FOUR NUTS (50), FOUR WASHERS (51), FOUR CAPSCREWS (52), AND DOOR LATCH ASSEMBLY (53).



25. DISCONNECT DOOR LATCH RETAINER (54) AND REMOVE DOOR LATCH ROD (46) FROM DOOR LATCH ASSEMBLY (53).



26. REMOVE TWO WINDOW CHANNELS (14 AND 15).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

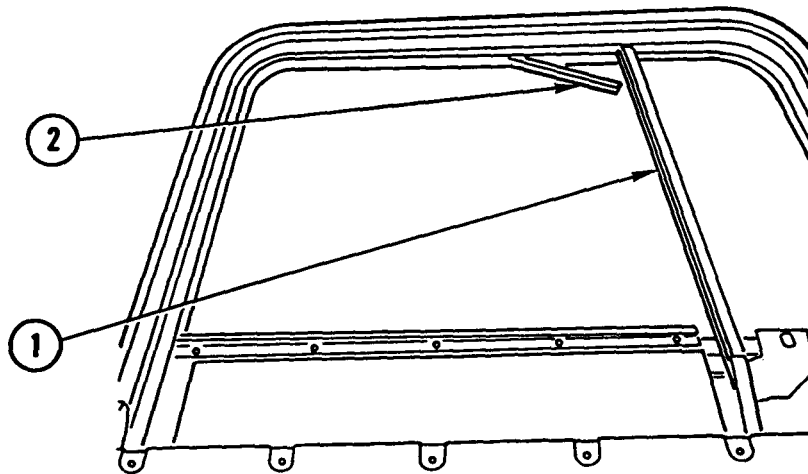
**INSPECTION**

Inspect all parts for wear or damage.

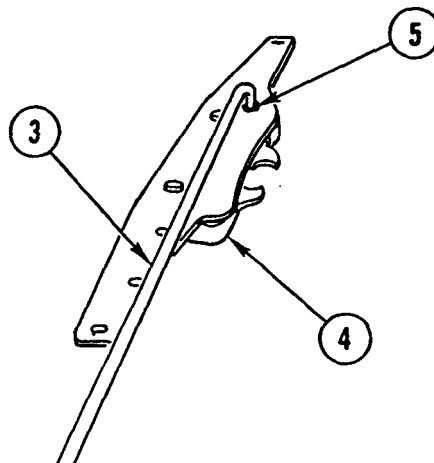
**REPAIR**

Repair of the door is the replacement of any damaged or defective parts.

**ASSEMBLY**

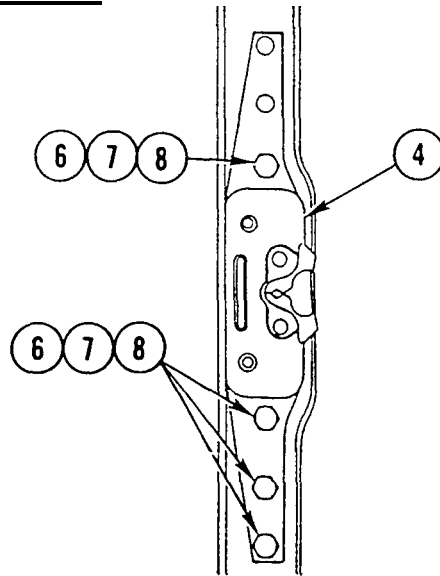


1. INSTALL TWO WINDOW CHANNELS (1 AND 2).

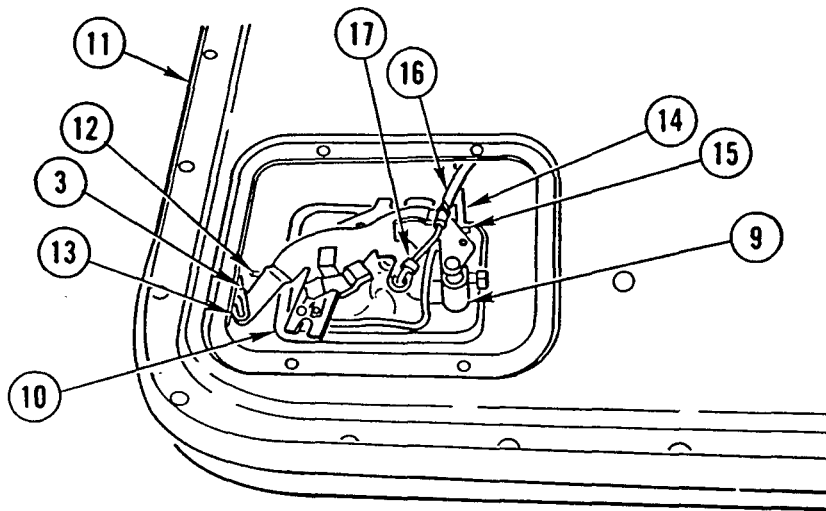


2. INSTALL DOOR LATCH ROD (3) ON DOOR LATCH ASSEMBLY (4) AND CONNECT DOOR LATCH RETAINER (5).

## CAB DOOR REPAIR (CONT)

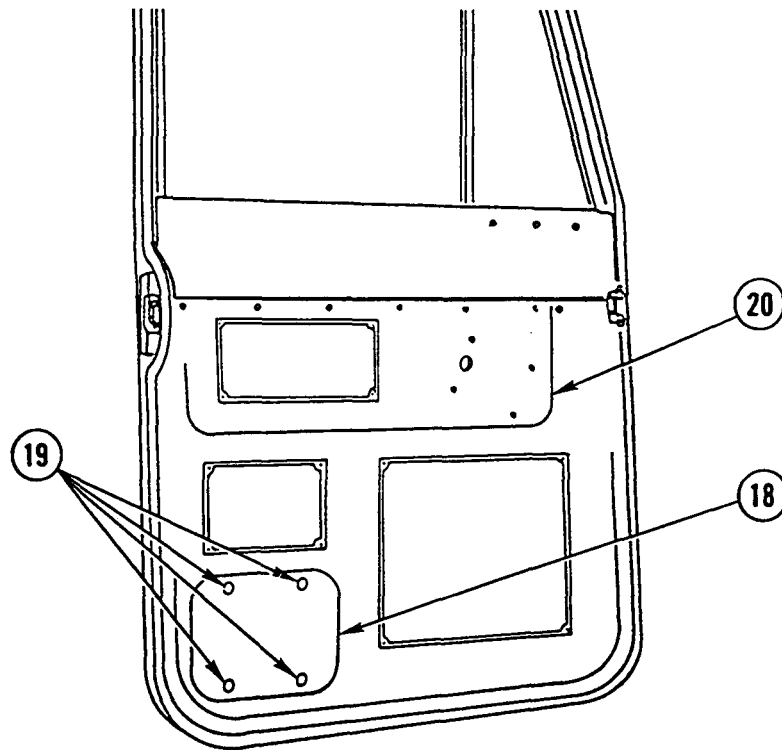


3. INSTALL DOOR LATCH ASSEMBLY (4), FOUR CAPSCREWS (6), FOUR WASHERS (7), AND FOUR NUTS (8).

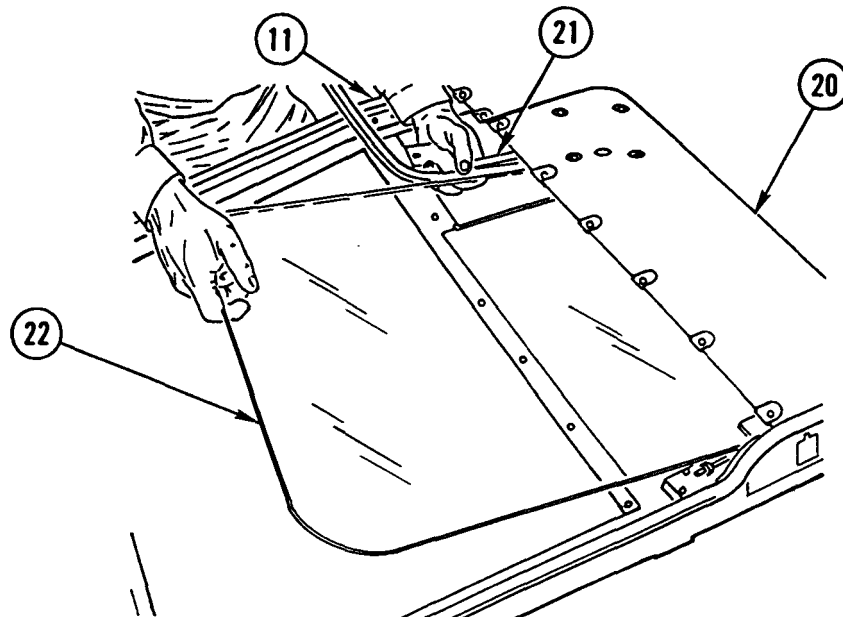


4. LUBRICATE ALL ROTATING POINTS OF EXTERIOR HANDLE ASSEMBLY (9) WITH GAI.
5. INSTALL EXTERIOR HANDLE ASSEMBLY (9) AND FASTENING CLIP (10) IN DOOR (11).
6. INSTALL STUD (12) IN EXTERIOR HANDLE ASSEMBLY (9).
7. INSTALL DOOR LATCH ROD (3) IN EXTERIOR HANDLE ASSEMBLY (9) AND CONNECT DOOR LATCH RETAINER (13).
8. INSTALL DOOR LOCK ROD (14) IN EXTERIOR HANDLE ASSEMBLY (9) AND CONNECT DOOR LOCK RETAINER (15).
9. INSTALL RELEASE HANDLE ROD (16) IN EXTERIOR HANDLE ASSEMBLY (9) AND CONNECT RELEASE HANDLE RETAINER (17).





10. INSTALL COVER PLATE (18) AND FOUR SCREWS (19) ON INSIDE DOOR PANEL (20).

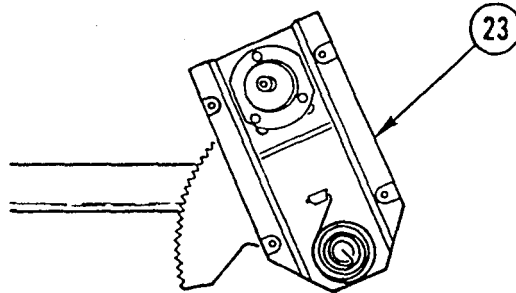


**WARNING**

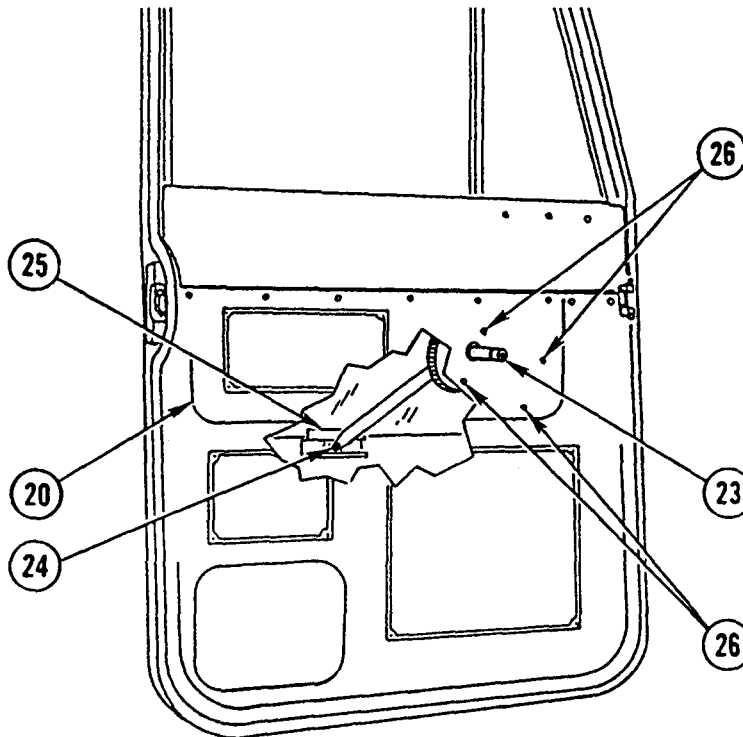
Wear protective gloves when handling glass. Failure to do so could result in injury to personnel.

11. TILT WINDOW GUIDE (21) TOWARD HINGE SIDE OF DOOR (11) AND WITH WINDOW GLASS (22) TILTED TOWARD INSIDE DOOR PANEL (20), CAREFULLY INSTALL WINDOW GLASS (22).

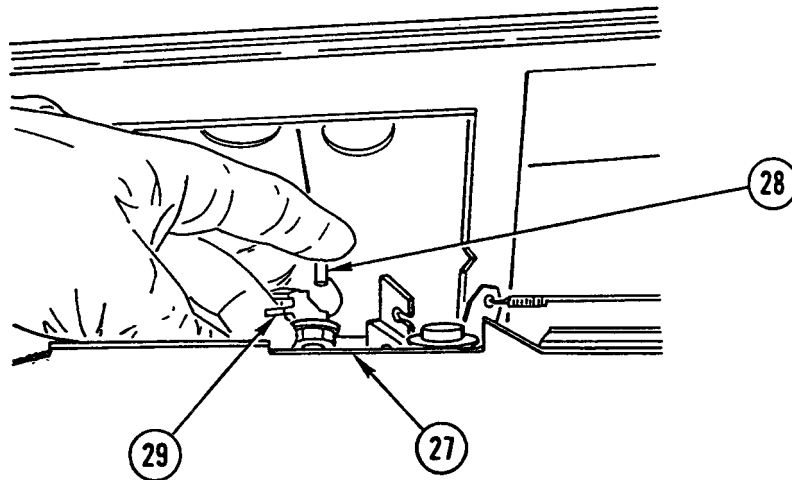
## CAB DOOR REPAIR (CONT)



12. LUBRICATE TEETH ON WINDOW REGULATOR (23) WITH GAA.

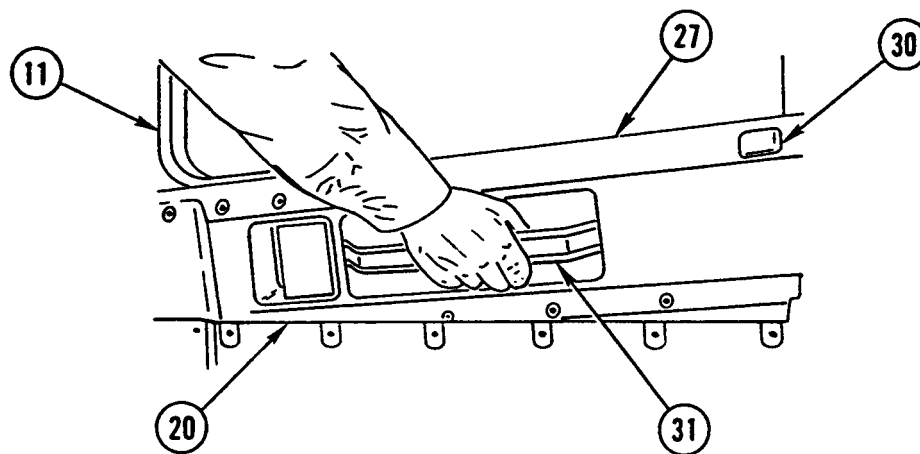


13. INSTALL WINDOW REGULATOR (23) IN INSIDE DOOR PANEL (20).
14. INSERT WINDOW REGULATOR ROLLER (24) IN ONE END OF WINDOW LIFT CHANNEL (25).
15. INSTALL FOUR SCREWS (26) IN WINDOW REGULATOR (23).



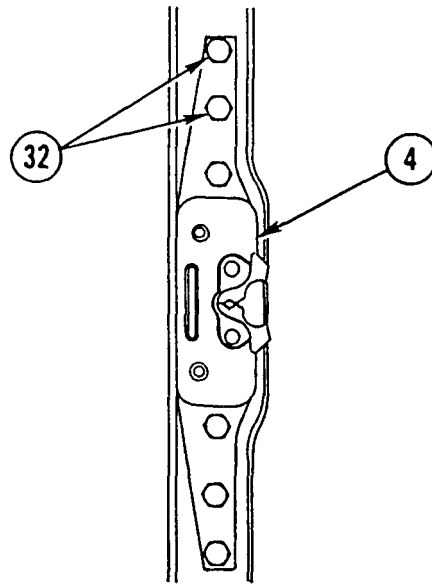
16. INSTALL SILL (27) AS FOLLOWS:

- A. INSTALL SILL (27) JUST ENOUGH TO ALLOW INSTALLATION OF RELEASE HANDLE ROD (28) AND CONNECT RELEASE HANDLE ROD RETAINER (29).

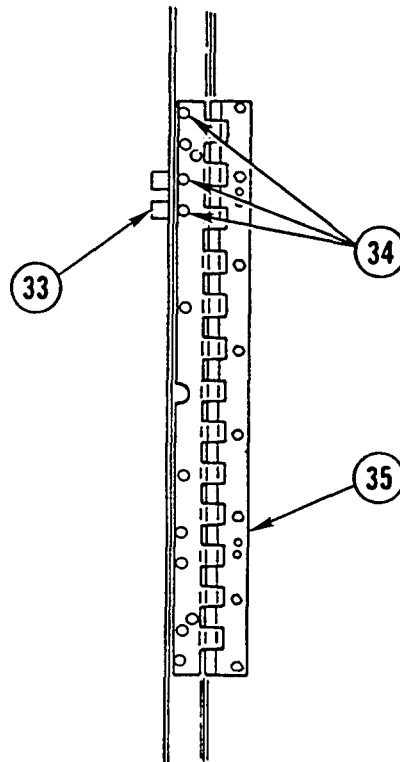


- B. LEAN SILL (27) AWAY FROM DOOR (11) AND INSERT DOOR LOCK BUTTON (30).
- C. GRIP DOOR HANDLE (31), LEAN SILL (27) AWAY FROM DOOR (11), AND PUSH SILL (27) DOWNWARD UNTIL LOWER EDGE OF SILL (27) IS SEATED ON INSIDE DOOR PANEL (20).

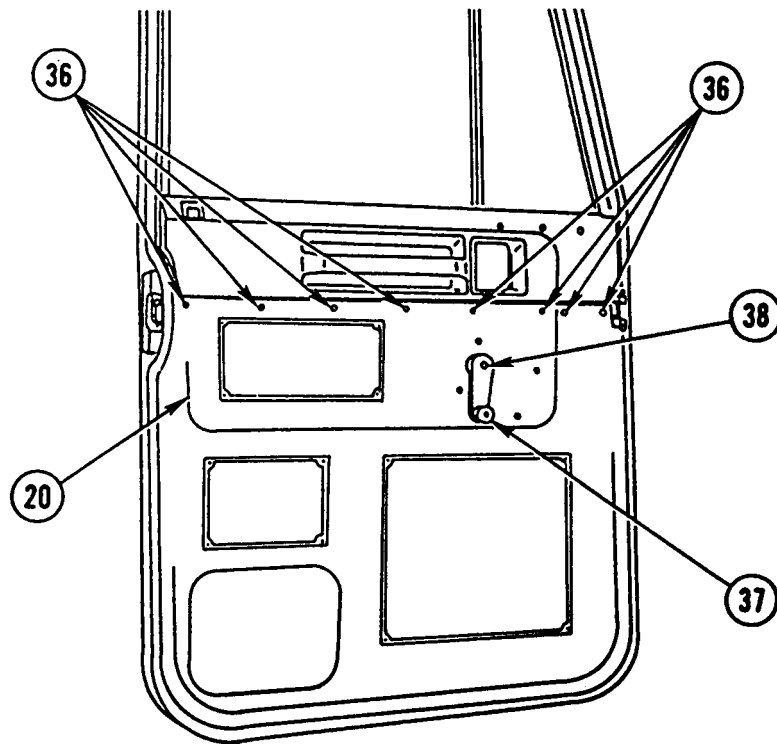
## CAB DOOR REPAIR (CONT)



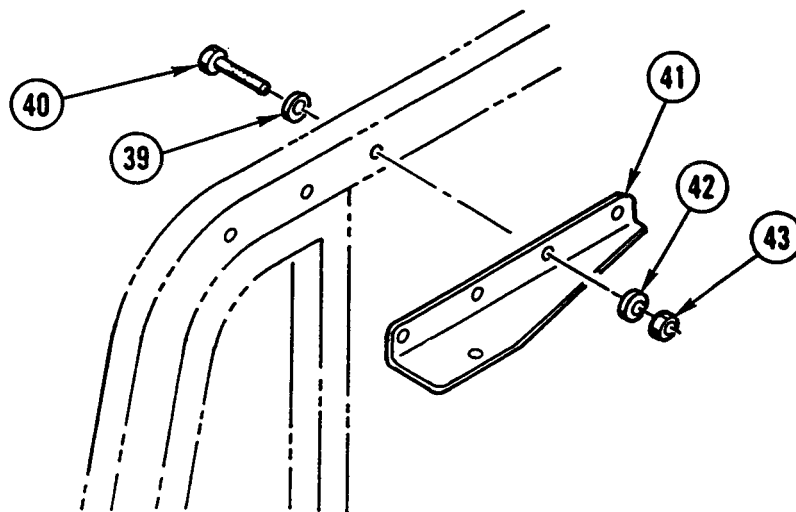
17. INSTALL TOP TWO CAPSCREWS (32) IN DOOR LATCH ASSEMBLY (4).



18. INSTALL CHECK ARM BRACKET (33) AND THREE CAPSCREWS (34) IN DOOR HINGE (35).

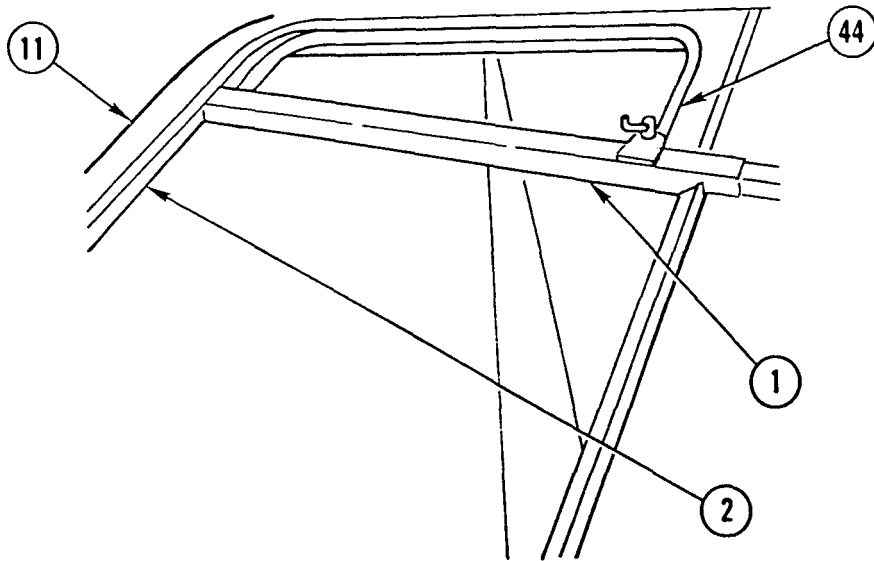


19. INSTALL EIGHT SCREWS (36) IN INSIDE DOOR PANEL (20).
20. INSTALL WINDOW CRANK (37) AND SCREW (38).

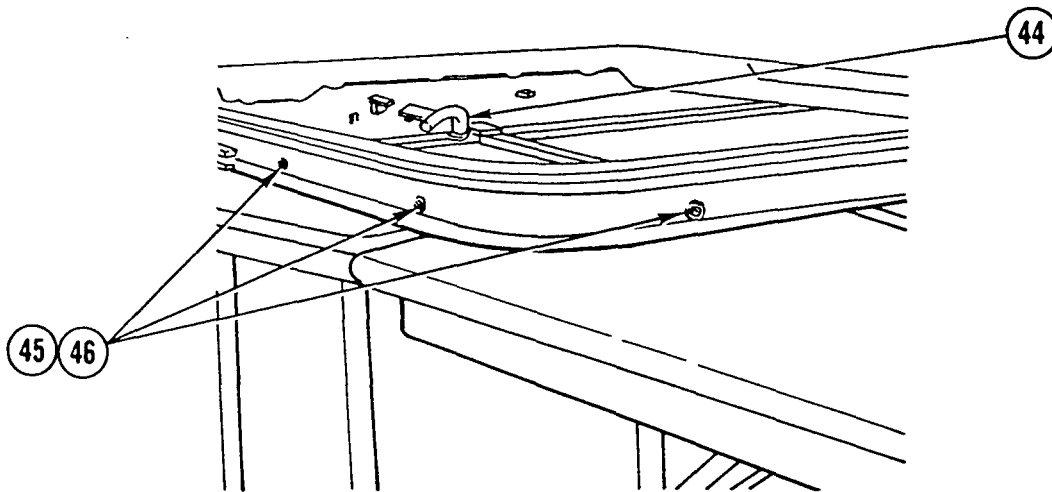


21. INSTALL FOUR WASHERS (39), FOUR CAPSCREWS (40), BRACKET (41), FOUR WASHERS (42), AND FOUR NUTS (43).

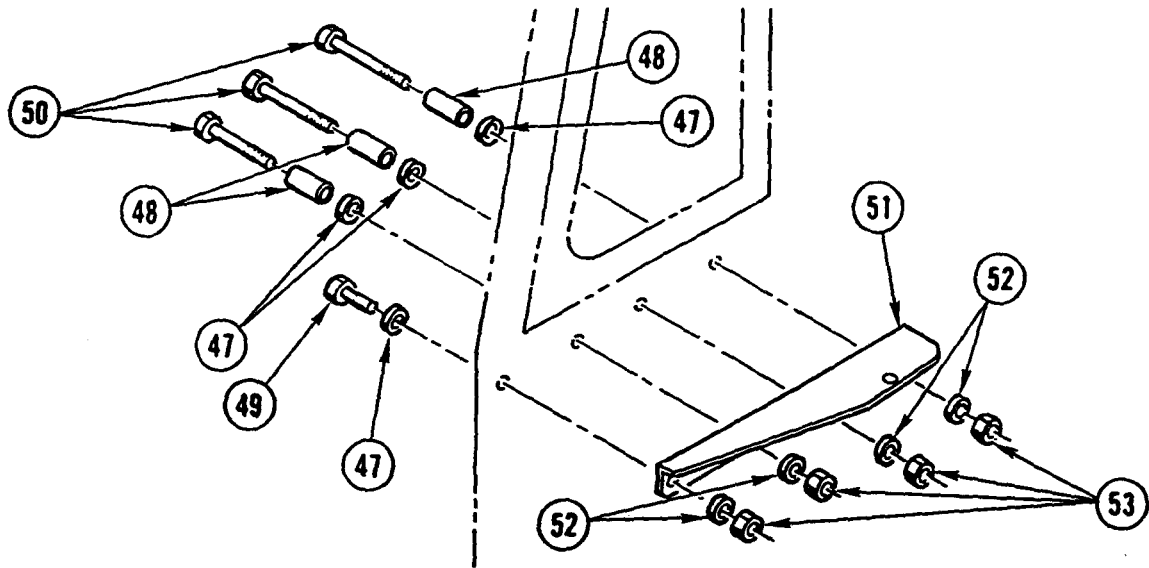
**CAB DOOR REPAIR (CONT)**



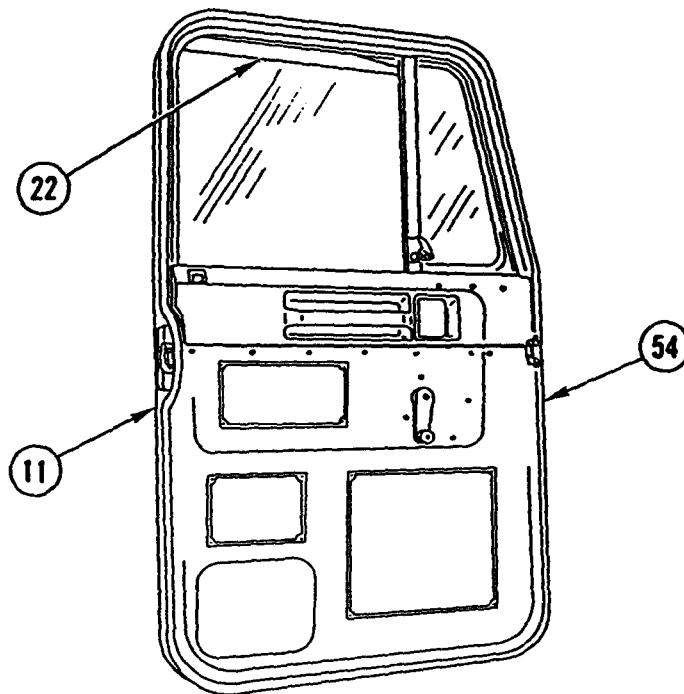
- 22. INSTALL VENT WINDOW (44) IN DOOR (11).
- 23. INSTALL WINDOW CHANNEL (1) IN VENT WINDOW (44).
- 24. INSTALL REMAINDER OF WINDOW CHANNEL (2) IN DOOR (11).



- 25. INSTALL THREE WASHERS (45) AND THREE SCREWS (46) IN VENT WINDOW (44).



26. INSTALL FOUR WASHERS (47), THREE SPACERS (46), CAPSCREW (49), THREE SCREWS (50), BRACKET (51), FOUR WASHERS (52), AND FOUR NUTS (53).



27. RAISE WINDOW GLASS (22).
28. IF REMOVED, INSTALL NEW SEAL (54) ON DOOR (11) AND APPLY SEALING COMPOUND TO EACH END OF SEAL JOINT.

**NOTE**

Follow-on Maintenance:  
Install cab door (page 10-89).





## CHAPTER 23 HYDRAULIC WINCH REPAIR INSTRUCTIONS

### OVERVIEW

This chapter illustrates and describes procedures for maintenance of the hydraulic winch and related parts.

		Page
Section I.	Hydraulic Winch Repair (M916A1 and M916A2) . . . . .	23-2
Section II.	Hydraulic Motor Repair (M916A1 and M916A2) . . . . .	23-9
Section III.	Hydraulic Pump Repair (M916A1 and M916A2) . . . . .	23-12
Section IV.	Speed Control Valve Repair (M916A1 and M91622) . . . . .	23-18
Section V.	Direction Control Valve Repair (M916A1 and M916A2) . . . . .	23-22
Section VI.	Gear End Repair (M916A1 and M916A2) . . . . .	23-26
Section VII.	Motor End Repair (M916A1 and M916A2) . . . . .	23-34

## Section I. HYDRAULIC WINCH REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the hydraulic winch.

Repair of the hydraulic winch is general support maintenance.

---

### HYDRAULIC WINCH REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Seal (2) P/N 9888  
Washer, Lock (8) P/N 1695  
Washer, Lock (2) P/N 1379

**Equipment Condition:**

**Reference**

Page 11-9

Page 23-34

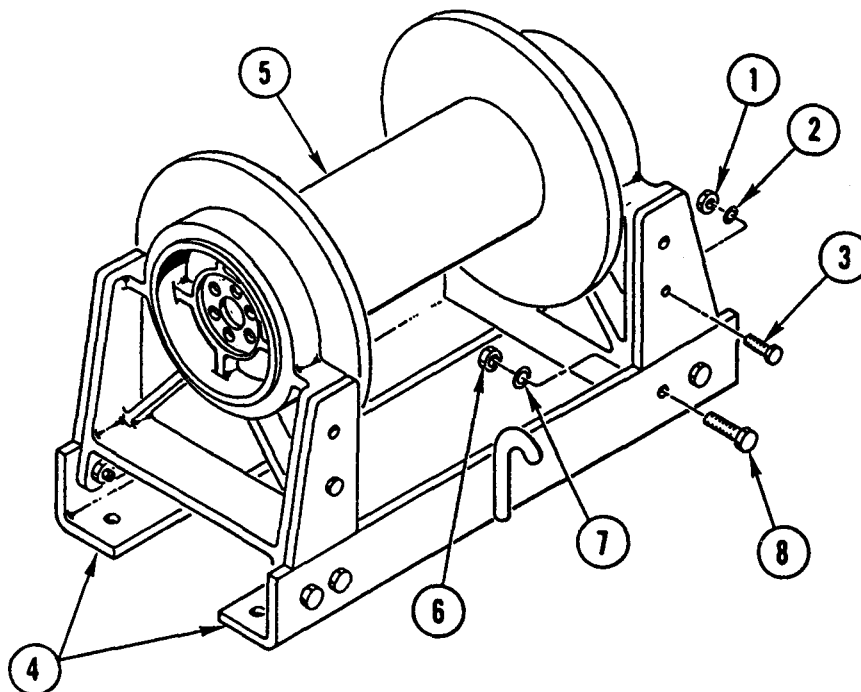
Page 23-26

**Condition Description**

Hydraulic Winch  
Removed

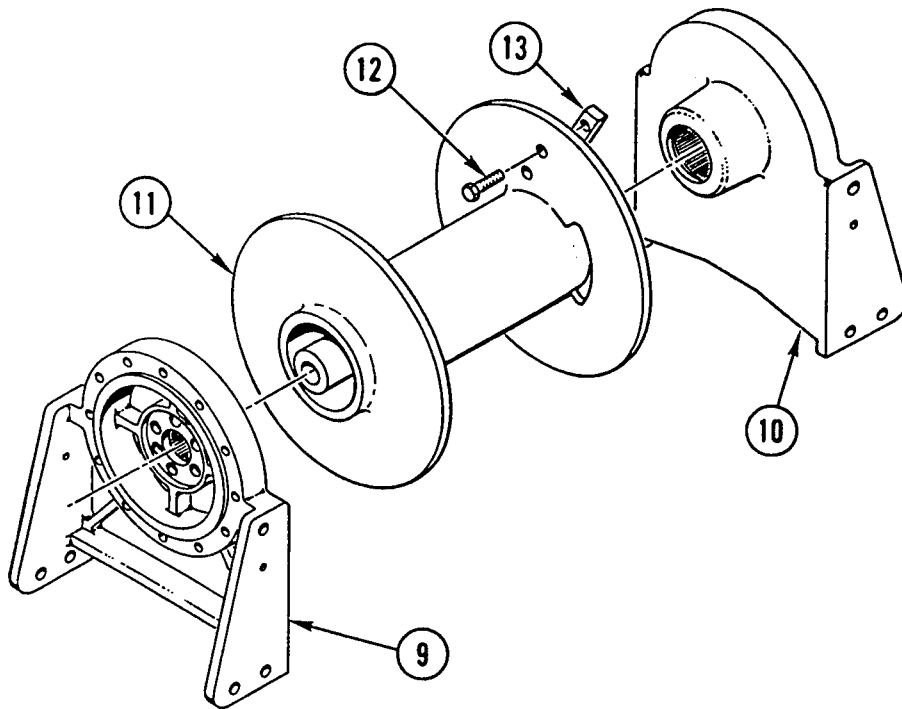
Motor End Disassembled

Gear End Disassembled

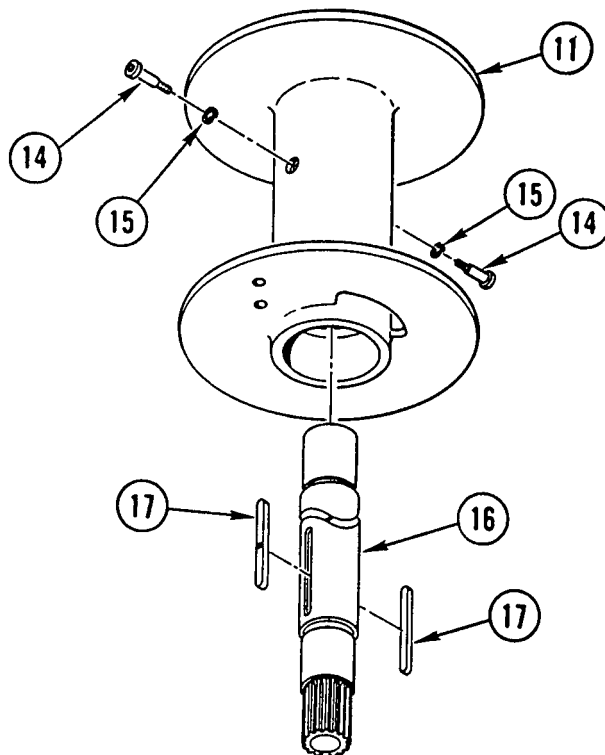
**DISASSEMBLY**

1. REMOVE FOUR NUTS (1), FOUR LOCK WASHERS (2), AND FOUR SCREWS (3) FROM TWO BASES (4). DISCARD LOCK WASHERS.
2. USING SUITABLE HOIST, SUPPORT WINCH DRUM ASSEMBLY (5) AND REMOVE FOUR NUTS (6), FOUR LOCK WASHERS (7), FOUR SCREWS (8), AND TWO BASES (4) FROM WINCH DRUM ASSEMBLY (5). DISCARD LOCK WASHERS.

## HYDRAULIC WINCH REPAIR (CONT)



3. REMOVE MOTOR END SUPPORT (9) AND GEAR END SUPPORT (10) FROM DRUM (11).
4. REMOVE TWO SCREWS (12) AND CLAMP (13), AND REMOVE HOIST.



5. REMOVE TWO SCREWS (14) AND TWO LOCK WASHERS (15) FROM DRUM (11). DISCARD LOCK WASHERS.

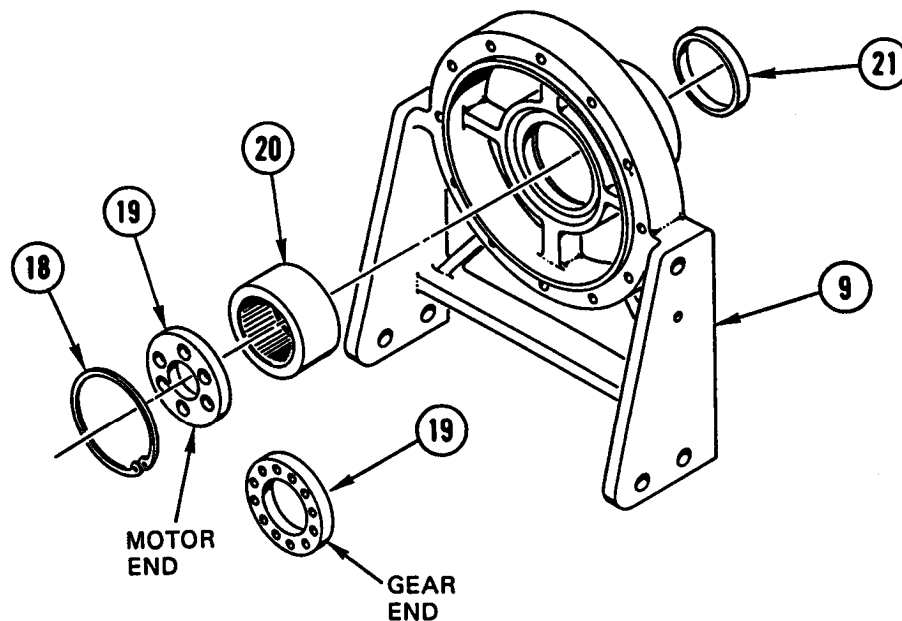
---

**CAUTION**

Drum must be placed in press with splined end down. Failure to do so will cause damage to components.

---

6. USING SUITABLE PRESS, REMOVE SHAFT (16) AND TWO KEYS (17) FROM DRUM (11) AS SHOWN.



7. REMOVE RETAINING RING (18), THRUST PLATE (19), BEARING (20), AND SEAL (21) FROM MOTOR END SUPPORT (9). DISCARD SEAL.
8. REPEAT STEP 7 FOR GEAR END SUPPORT.

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

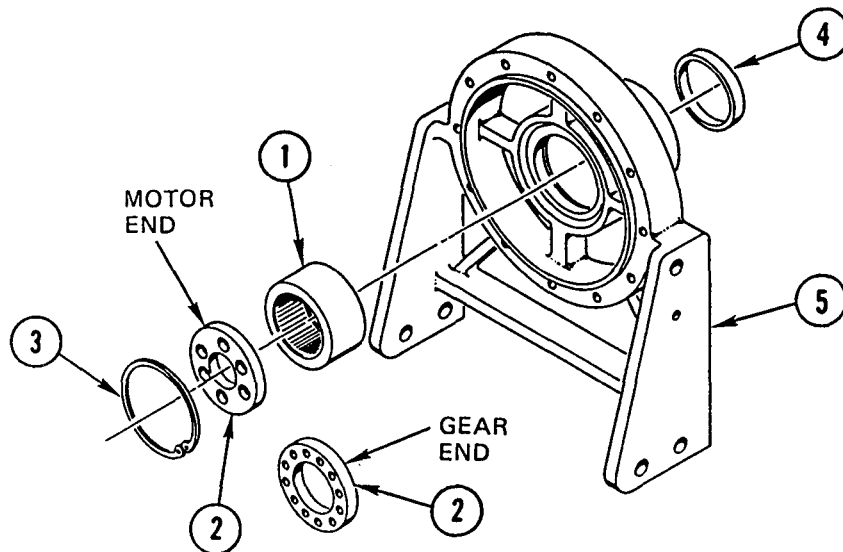
Inspect all parts for wear or damage.

**REPAIR**

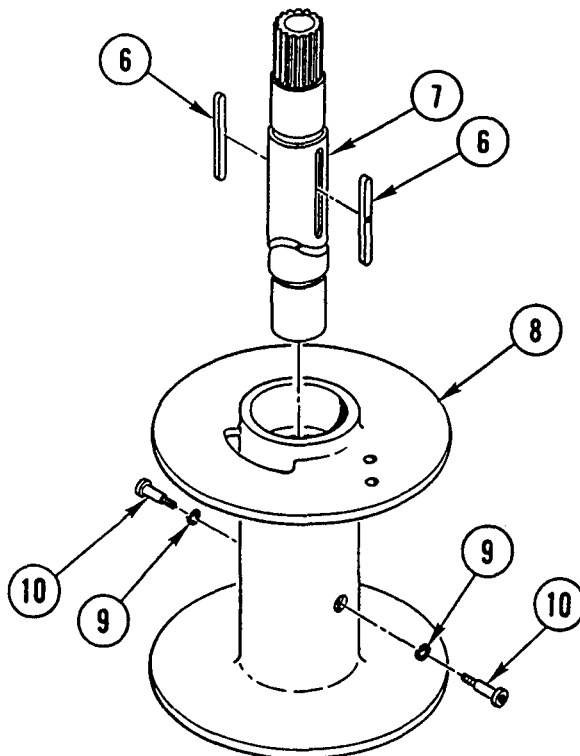
Use general repair methods to repair damaged parts (page 2-33).

# HYDRAULIC WINCH REPAIR (CONT)

## ASSEMBLY



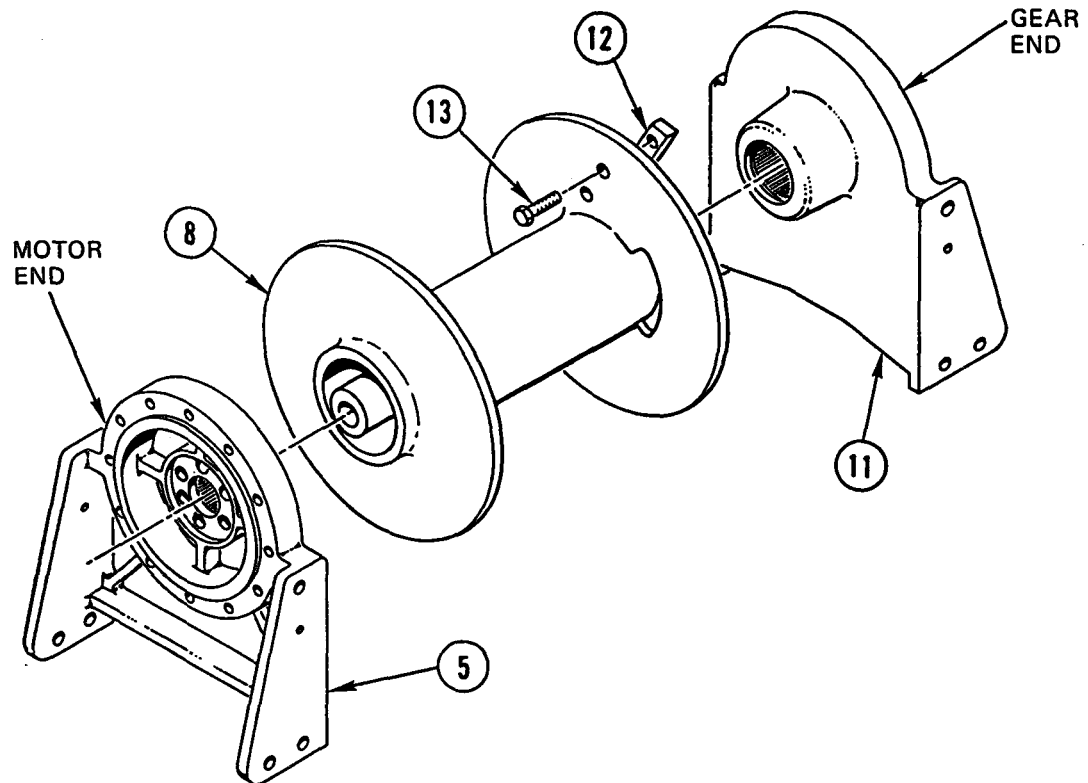
1. INSTALL BEARING (1), THRUST PLATE (2), RETAINING RING (3), AND NEW SEAL (4) IN MOTOR END SUPPORT (5).
2. REPEAT STEP 1 FOR GEAR END SUPPORT.



**CAUTION**

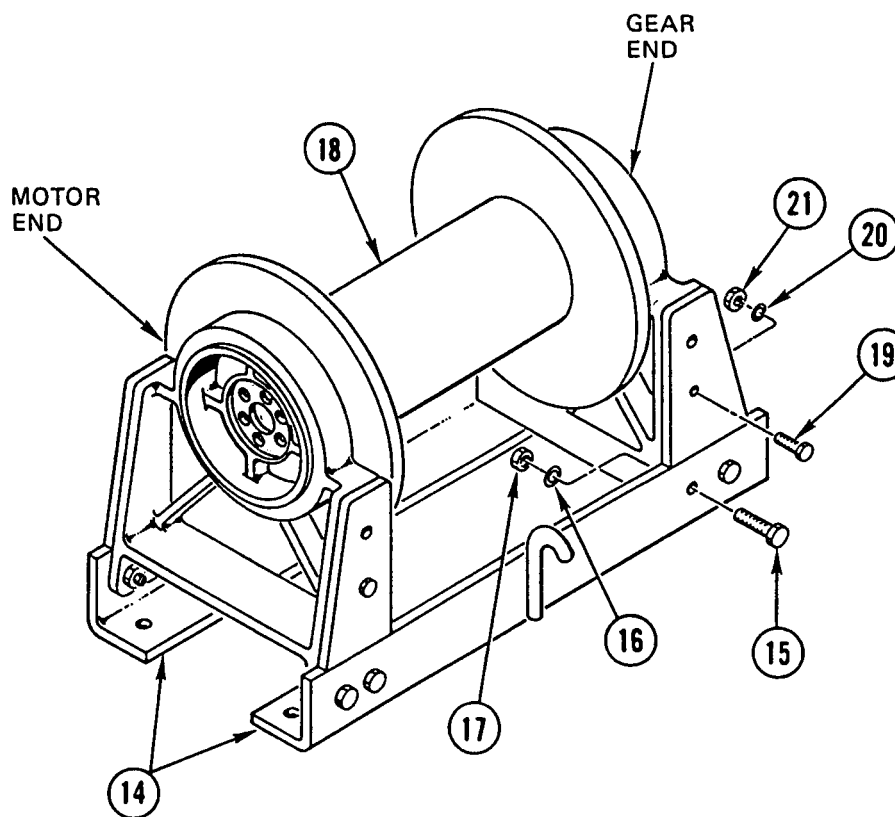
Shaft must be pressed in with splined end up. Failure to do so will cause damage to components.

3. USING SUITABLE PRESS, INSTALL TWO KEYS (6) AND SHAFT (7) IN DRUM (8) AS SHOWN.
4. INSTALL TWO NEW LOCK WASHERS (9) AND TWO SCREWS (10) IN DRUM (8).



5. USING SUITABLE HOIST, LIFT DRUM (8) AND INSTALL MOTOR END SUPPORT (5) AND GEAR END SUPPORT (11) AS SHOWN.
6. INSTALL CLAMP (12) AND TWO SCREWS (13).

## HYDRAULIC WINCH REPAIR (CONT)



7. INSTALL TWO BASES (14), FOUR SCREWS (15), FOUR WASHERS (16), AND FOUR NUTS (17) IN WINCH DRUM ASSEMBLY (18) AS SHOWN.
8. INSTALL FOUR SCREWS (19), FOUR LOCK WASHERS (20), AND FOUR NUTS (21) IN WINCH DRUM ASSEMBLY (18).

### **NOTE**

Follow-on Maintenance:

- Assemble motor end on winch (page 23-34).
- Assemble gear end on winch (page 23-26).
- Install hydraulic winch (page 11-9).



## Section II. HYDRAULIC MOTOR REPAIR

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the hydraulic motor.

---

### HYDRAULIC MOTOR REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

#### **INITIAL SETUP**

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Washer, Lock (4)	PIN 391-3784-028
Seal	P/N 391-2883-115
Seal (2)	P/N 391-2882-051
Seal (2)	P/N 391-2884-021

**References:**

TM 9-2320-363-20

**Equipment Condition:**

**Reference**

TM 9-2320-363-20

Page 11-15

**Condition Description**

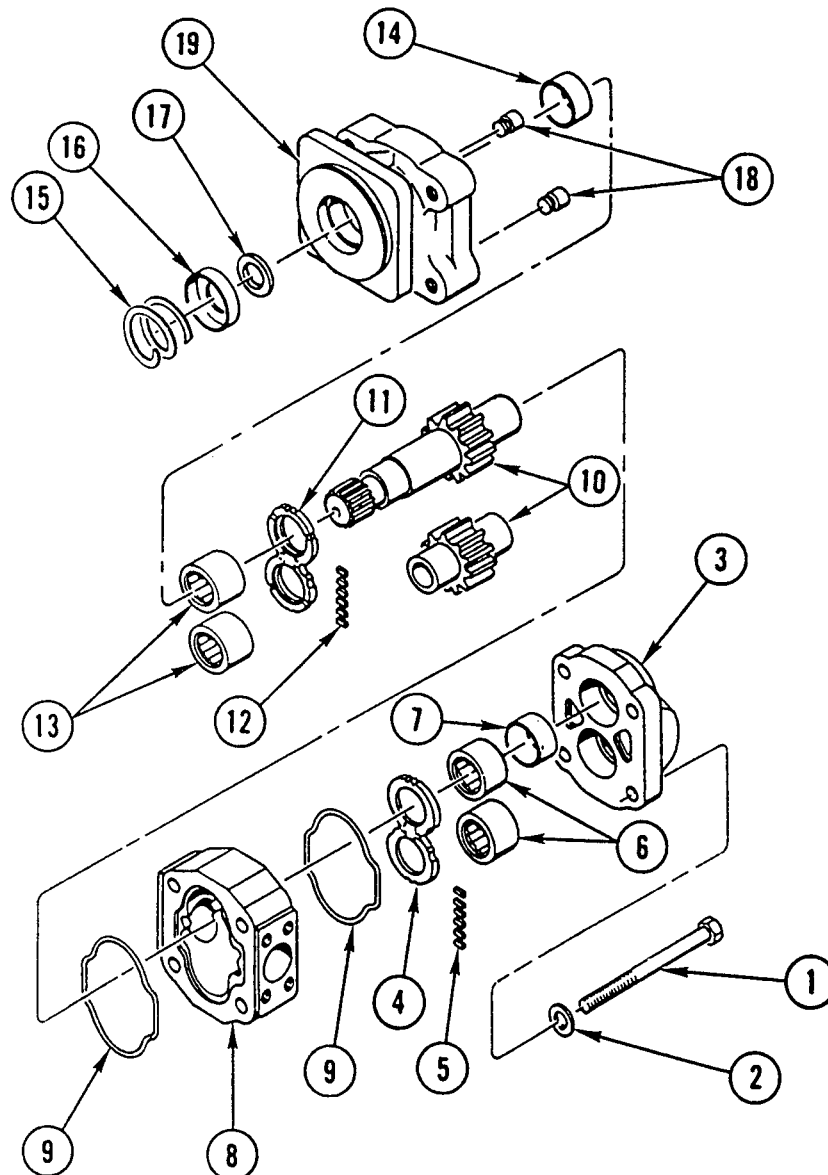
Hydraulic Tank Drained

Hydraulic Motor  
Removed

## HYDRAULIC MOTOR REPAIR (CONT)

### DISASSEMBLY

1. REMOVE FOUR SCREWS (1), FOUR LOCK WASHERS (2), AND COVER (3). DISCARD LOCK WASHERS.
2. REMOVE THRUST PLATE (4), SIX POCKET SEALS (5), TWO BEARINGS (6), AND BUSHING (7). DISCARD POCKET SEALS.
3. REMOVE HOUSING (8), TWO SEALS (9), AND TWO MACHINED GEARS (10). DISCARD SEALS.
4. REMOVE THRUST PLATE (11), SIX POCKET SEALS (12), TWO BEARINGS (13), BUSHING (14), SNAP RING (15), SPACER (16), AND SEAL (17). DISCARD SEALS.
5. REMOVE TWO THREADED CHECK ASSEMBLIES (18) FROM COVER (19).



**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

1. Check gear housing by placing straightedge across bore. If you can slip 0.005 in. feeler gage under straightedge in cut-out area, replace gear housing.
2. Check gears and drive shaft for scoring, grooving, or burring of teeth or splines. Replace if damaged.
3. Check thrust plates for scoring, pitting, or erosion. Replace if damaged.

**REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

**ASSEMBLY****CAUTION**

Replace all seals to prevent leakage or damage to pump.

1. INSTALL NEW SEAL (17) SPACER (16), AND SNAP RING (15).
2. INSTALL TWO THREADED CHECK ASSEMBLIES (18).

**NOTE**

- To make pocket seals, lay seal in pocket of plate and cut to exact length using razor blade or sharp knife.
- Install thrust plates with pocket seals facing bearings.

3. INSTALL BUSHING (14), TWO BEARINGS (13), SIX NEW POCKET SEALS (12) THRUST PLATE (11), AND TWO MACHINED GEARS (10).
4. INSTALL TWO NEW SEALS (9) AND HOUSING (8) ON COVER (19).
5. INSTALL THRUST PLATE (4) AND SIX NEW POCKET SEALS (5).
6. INSTALL BUSHING (7) AND TWO BEARINGS (6) ON COVER (3).
7. INSTALL COVER (3) FOUR NEW LOCK WASHERS (2), AND FOUR SCREWS (1).

**NOTE**

Follow-on Maintenance:

Install hydraulic motor (page 11-15).  
Fill hydraulic tank (TM 9-2320-363-20).

## Section III. HYDRAULIC PUMP REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the hydraulic pump.

Repair of the hydraulic pump is general support maintenance

---

### HYDRAULIC PUMP REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Seal P/N 391-2885-119

Seal (4) P/N 391-7884-050

Seal (4) P/N 391-2884-050

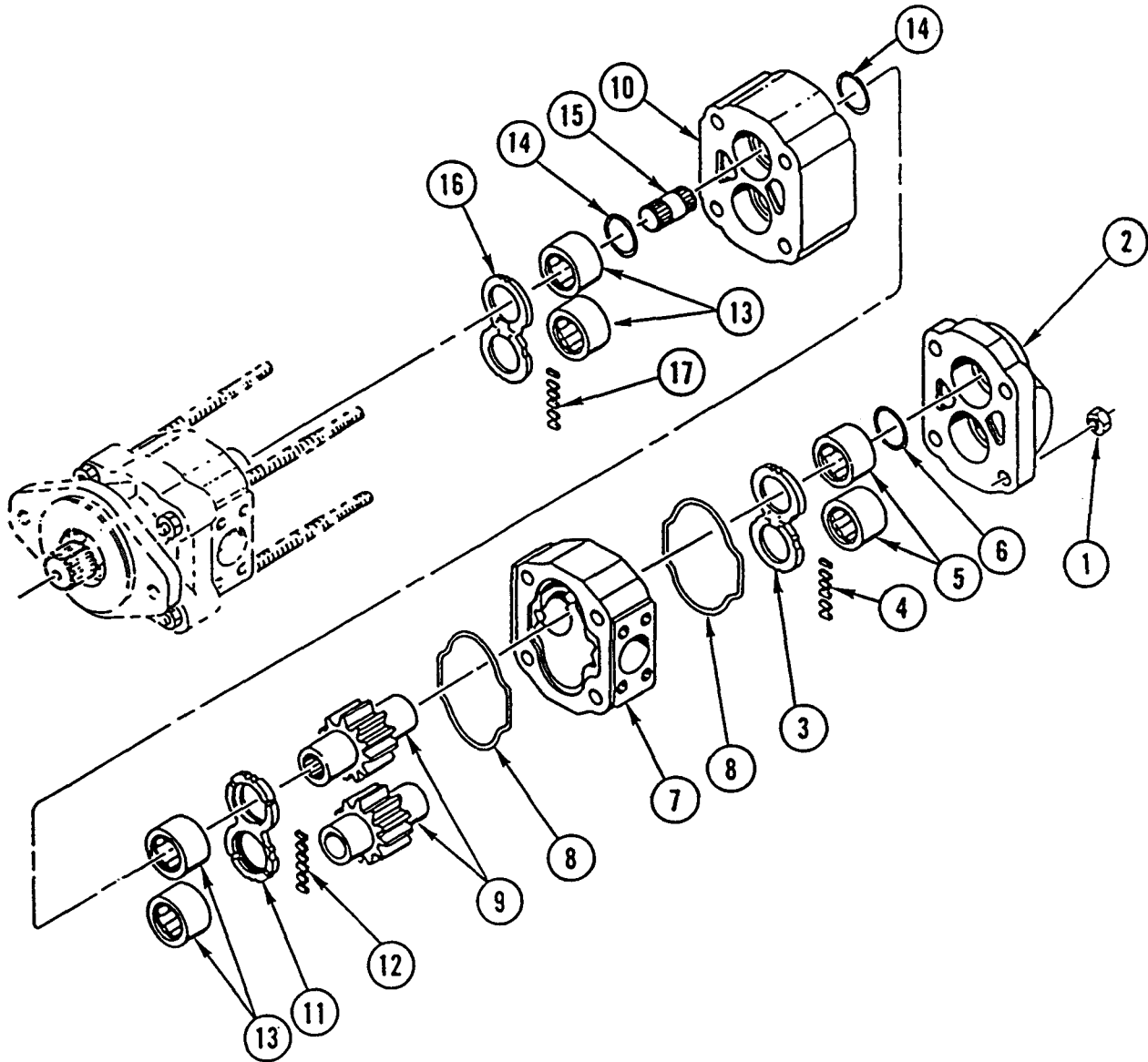
**Equipment Condition:**

**Reference**

Page 11-2

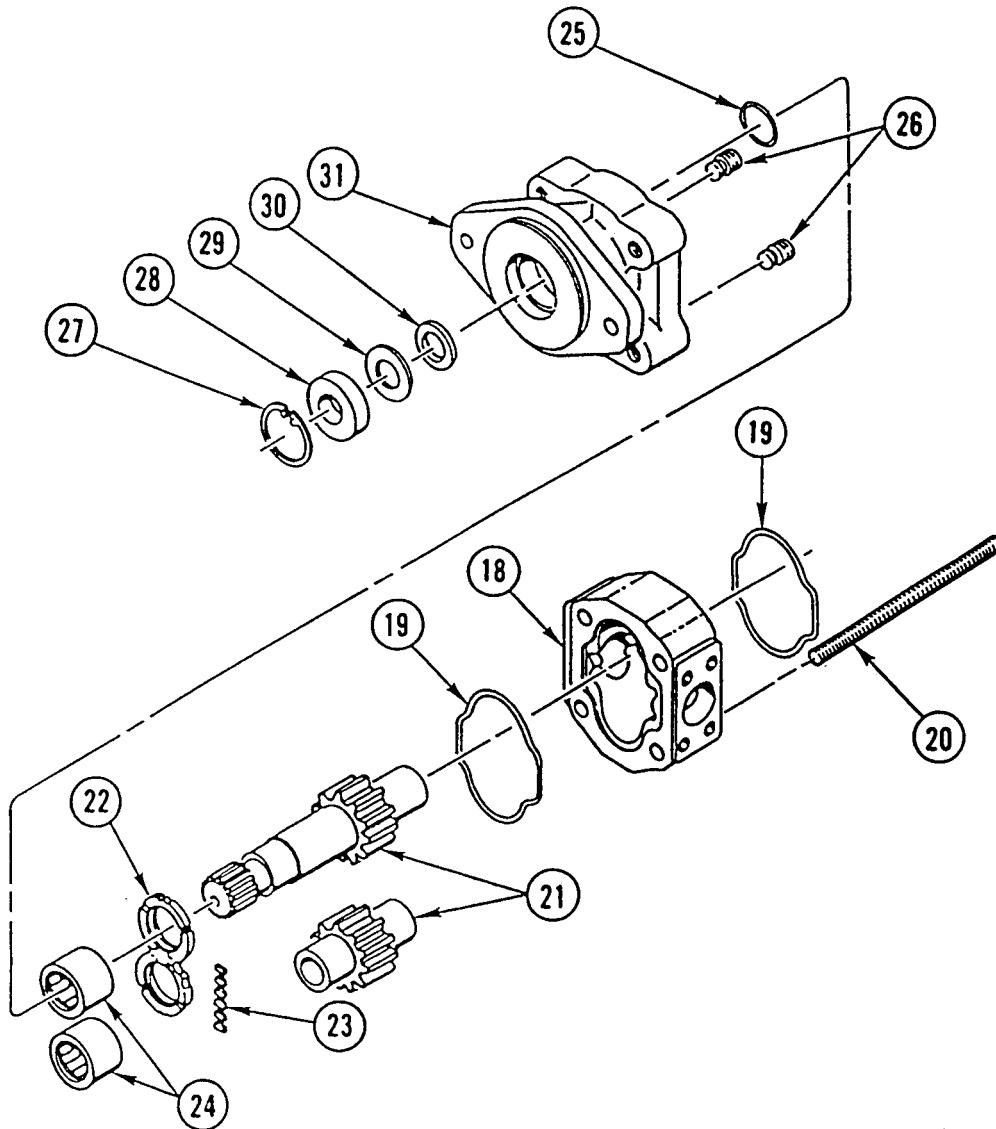
**Condition Description**

Hydraulic Pump  
Removed

**DISASSEMBLY**

1. REMOVE FOUR NUTS (1) AND COVER (2).
2. REMOVE PLATE (3) AND SIX POCKET SEALS (4). DISCARD POCKET SEALS.
3. IF DAMAGED, REMOVE AND DISCARD TWO BEARINGS (5) AND SEAL (6).
4. REMOVE HOUSING (7), TWO SEALS (8), AND TWO MATCHED GEARS (9). DISCARD SEALS.
5. REMOVE CARRIER (10), PLATE (11), AND SIX POCKET SEALS (12). DISCARD POCKET SEALS.
6. IF DAMAGED, REMOVE AND DISCARD FOUR BEARINGS (13) AND TWO SEALS (14).
7. REMOVE SHAFT (15), PLATE (16) AND SIX POCKET SEALS (17). DISCARD POCKET SEALS.

## HYDRAULIC PUMP REPAIR (CONT)



8. REMOVE HOUSING (18) AND TWO SEALS (19). DISCARD SEALS.

### NOTE

Tag studs prior to removal to aid in installation.

9. REMOVE FOUR STUDS (20), SHAFT AND GEAR SET (21), PLATE (22) AND SIX POCKET SEALS (23). DISCARD POCKET SEALS.
10. IF DAMAGED, REMOVE AND DISCARD TWO BEARINGS (24), SEAL (25), AND TWO THREADED CHECK ASSEMBLIES (26).
11. REMOVE SNAP RING (27), SPACER (28), RETAINER (29), AND SEAL (30) FROM COVER (31). DISCARD SEAL.

**CLEANING**

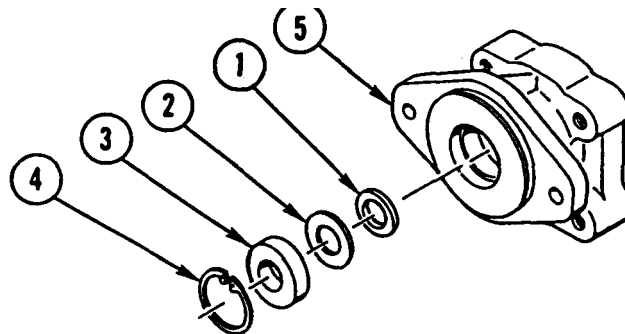
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

1. Check gear housing by placing straightedge across bore. If you can slip 0.005 in. feeler gage under straightedge in cut-out area, replace gear housing.
2. Check gears and drive shaft for scoring, grooving, or burring of teeth or splines. Replace if damaged.
3. Check thrust plates for scoring, pitting, or erosion. Replace if damaged.

**REPAIR**

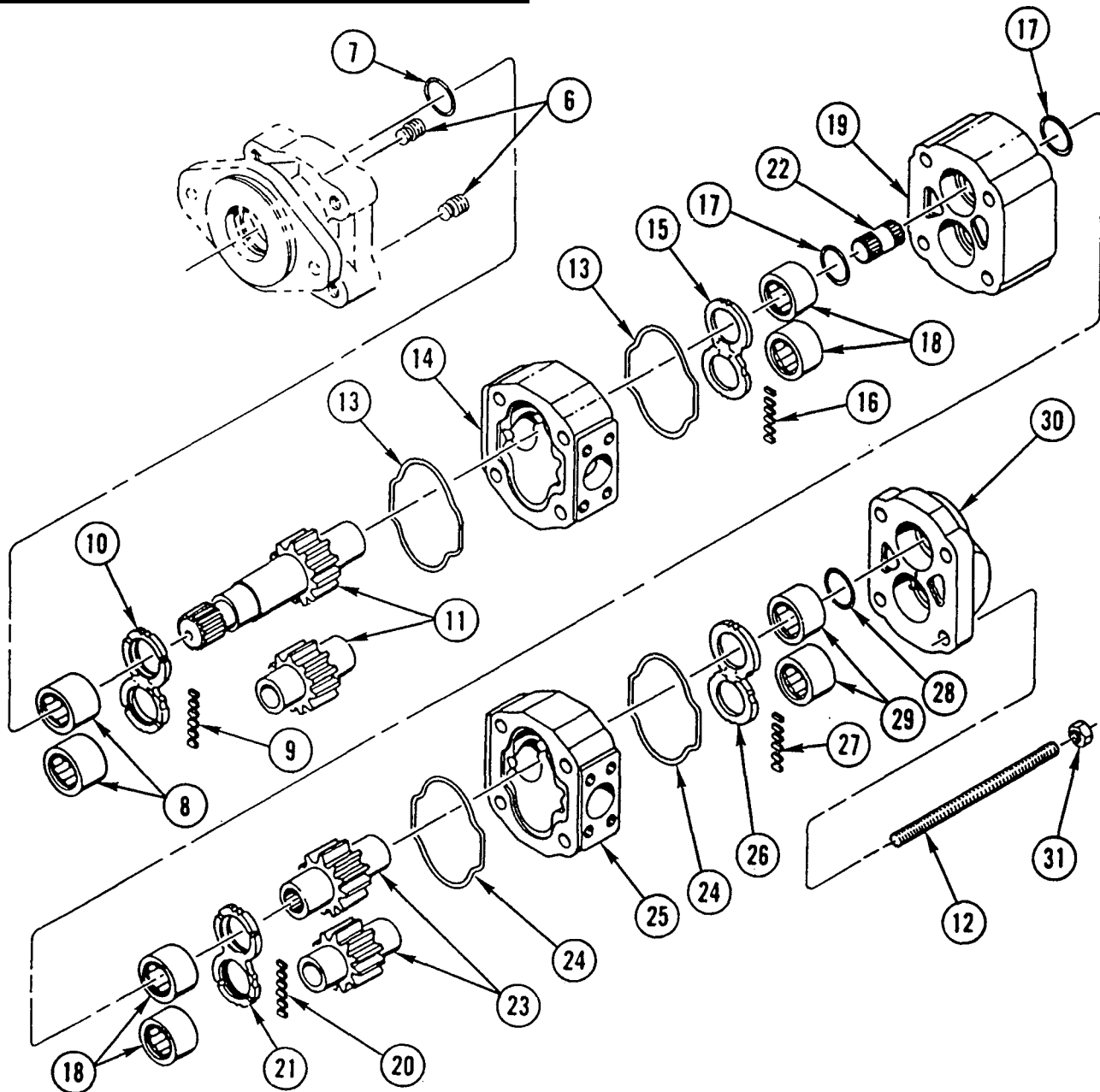
Use general repair methods to repair damaged parts (page 2-33).

**ASSEMBLY****CAUTION**

Replace all seals during assembly. Failure to do so could result in fluid leaks and/or damage to pump.

1. INSTALL NEW SEAL (1), RETAINER (2), SPACER (3), AND SNAP RING (4) IN COVER (5).

## HYDRAULIC PUMP REPAIR (CONT)



2. IF REMOVED, INSTALL TWO NEW THREADED CHECK ASSEMBLIES (6), NEW SEAL (7), AND TWO NEW BEARINGS (8).

### NOTE

- To make pocket seals, lay seal P/N 391-2884-050 into each pocket of plate for which being made and cut to exact length using razor blade or sharp knife.
- Install plates with pocket seals facing bearings.

3. INSTALL SIX NEW POCKET SEALS (9), PLATE (10), SHAFT AND GEAR SET (11), AND FOUR STUDS (12).



4. INSTALL TWO NEW SEALS (13) IN HOUSING (14).
5. INSTALL HOUSING (14).

**NOTE**

- To make pocket seals, lay seal P/N 391-2884-050 into each pocket of plate for which being made and cut to exact length using razor blade or sharp knife.
- Install plates with pocket seals facing bearings.

6. INSTALL PLATE (15) AND SIX NEW POCKET SEALS (16) ON HOUSING (14).
7. IF REMOVED, INSTALL TWO NEW SEALS (17) AND FOUR NEW BEARINGS (18) IN CARRIER (19).
8. INSTALL CARRIER (19).
9. INSTALL SIX NEW POCKET SEALS (20), PLATE (21), SHAFT (22), AND TWO MATCHED GEARS (23) IN CARRIER (19).
10. INSTALL TWO NEW SEALS (24) IN HOUSING (25).
11. INSTALL HOUSING (25).
12. INSTALL PLATE (26) AND SIX NEW POCKET SEALS (27) IN HOUSING (25).
13. IF REMOVED, INSTALL NEW SEAL (28) AND TWO BEARINGS (29) IN COVER (30).
14. INSTALL COVER (30) AND FOUR NUTS (31).

**NOTE**

Install hydraulic pump (page 11-2).  
Follow-on Maintenance:

## Section IV. SPEED CONTROL VALVE REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the speed control valve.

---

### SPEED CONTROL VALVE REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit. SC 5180-90-CL-N05

**Materials/Parts:**

Seal, Dust P/N 1A0795

Seal, Spool (2) P/N 1A9035

Pin, Cotter (3)

**Equipment Condition:**

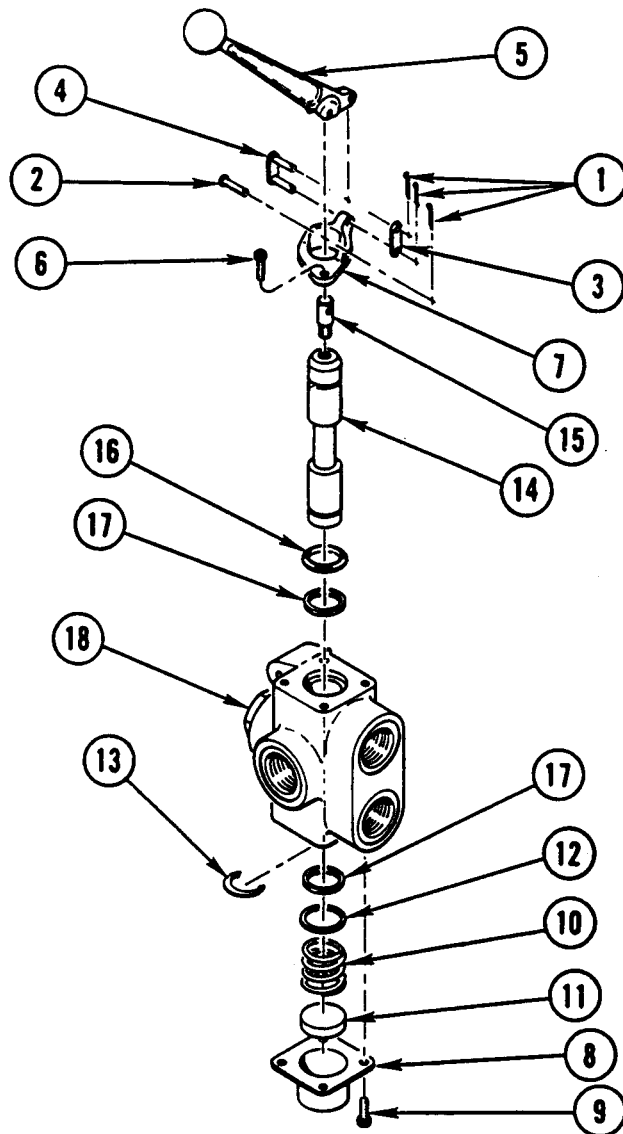
**Reference**

Page 11-26

**Condition Description**

Speed Control Valve  
Removed

**DISASSEMBLY**



1. REMOVE THREE COTTER PINS (1), PIN (2), PLATE (3), PIVOT PIN (4), AND HANDLE (5). DISCARD COTTER PINS.
2. REMOVE TWO SCREWS (6) AND BRACKET (7).
3. WHILE MAINTAINING PRESSURE ON CAP (8), REMOVE FOUR SCREWS (9). RELIEVE PRESSURE SLOWLY AND REMOVE CAP (8), SPRING (10), AND FORWARD STOP (11).
4. REMOVE WASHER (12), SNAP RING (13), AND SPOOL ASSEMBLY (14).
5. IF DAMAGED, REMOVE ADAPTER (15) FROM SPOOL ASSEMBLY (14).
6. REMOVE DUST SEAL (16) AND TWO SPOOL SEALS (17) FROM VALVE HOUSING (18). DISCARD SEALS.

---

## **SPEED CONTROL VALVE REPAIR (CONT)**

---

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

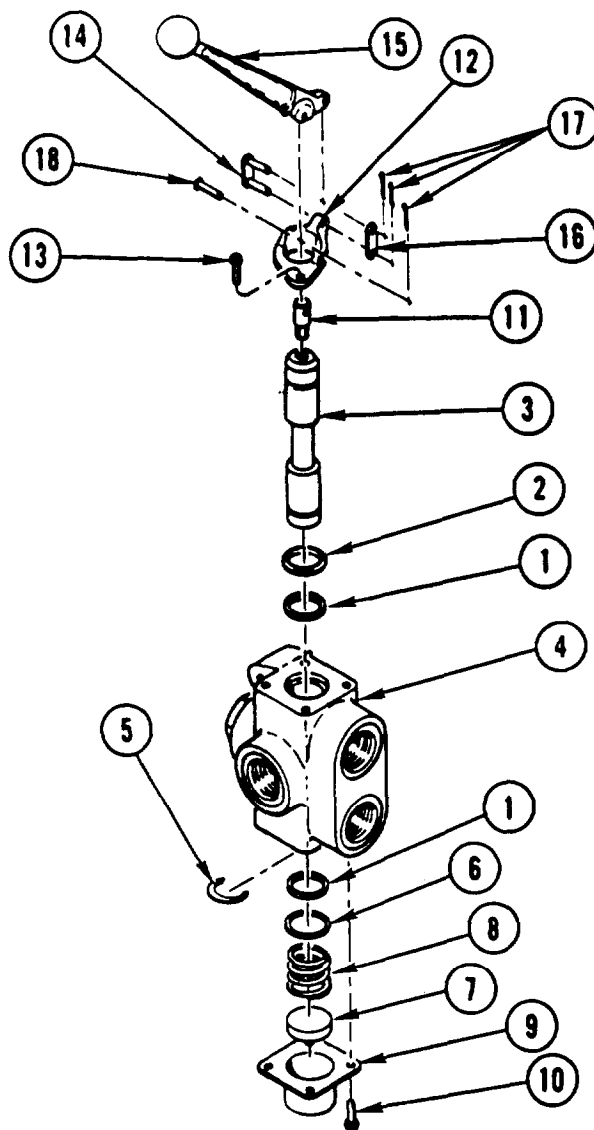
1. Inspect valve housing and spool for scratches, scoring, or wear of mating surfaces. Replace if damaged.
2. Inspect spring for breaks or distortion. Replace if damaged.

### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

### **ASSEMBLY**

1. INSTALL TWO NEW SPOOL SEALS (1), NEW DUST SEAL (2), AND SPOOL ASSEMBLY (3) ON VALVE HOUSING (4).
2. INSTALL SNAP RING (5) AND WASHER (6).
3. INSTALL FORWARD STOP (7) ON SPRING (8) AND INSTALL SPRING (8) IN CAP (9).
4. POSITION CAP (9) ON VALVE HOUSING (4). WHILE MAINTAINING PRESSURE ON CAP (9), INSTALL FOUR SCREWS (10).
5. IF REMOVED, INSTALL NEW ADAPTER (11) ON SPOOL ASSEMBLY (3).
6. INSTALL BRACKET (12) AND TWO SCREWS (13).
7. INSTALL PIVOT PIN (14) THRU BRACKET (12) AND HANDLE (15).
8. INSTALL PLATE (16) AND TWO NEW COTTER PINS (17).



9. INSTALL PIN (18) THRU HANDLE (15) AND SPOOL ASSEMBLY (3).
10. INSTALL NEW COTTER PIN (17) IN PIN (18).

**NOTE**

Follow-on Maintenance:  
Install speed control valve (page 11-26).

## Section V. DIRECTION CONTROL VALVE REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the direction control valve.

---

### DIRECTION CONTROL VALVE REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Packing (2) P/N 1A0711

Packing P/N 1V1725

Pin, Cotter (3)

Valve, Relief P/N 1R0017

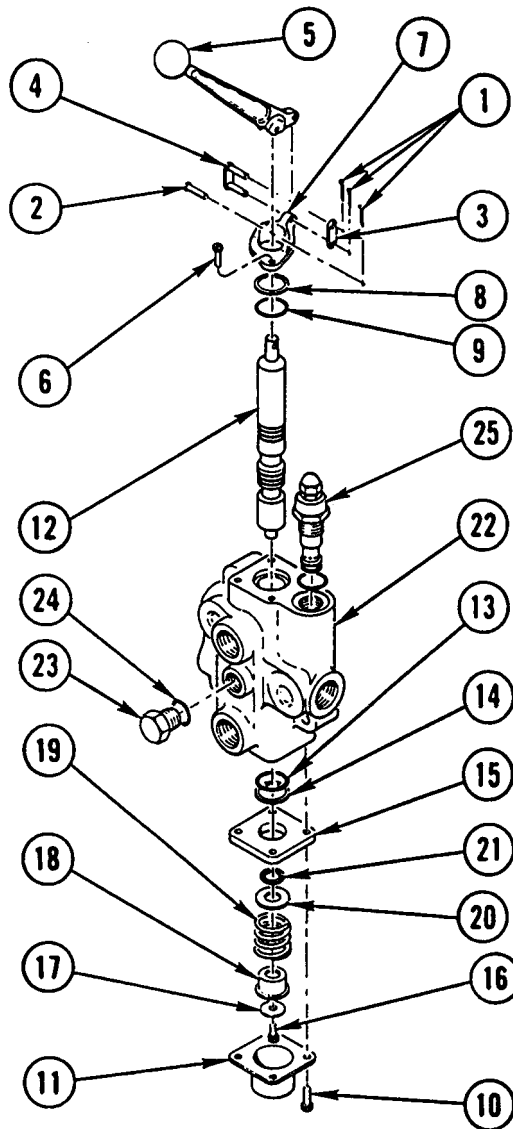
**Equipment Condition:**

**Reference**

Page 11-30

**Condition Description**

Direction Control Valve  
Removed

**DISASSEMBLY**

1. REMOVE THREE COTTER PINS (1), PIN (2), PLATE (3), PIVOT PIN (4), AND HANDLE (5). DISCARD COTTER PINS.
2. REMOVE TWO SCREWS (6), BRACKET (7), WASHER (8), AND PACKING (9). DISCARD PACKING.
3. REMOVE FOUR SCREWS (10), CAP (11), AND SPOOL ASSEMBLY (12).
4. REMOVE PACKING (13), WASHER (14), AND SPACER (15) FROM SPOOL ASSEMBLY (12). DISCARD PACKING.
5. REMOVE SCREW (16), WASHER (17), COLLAR (18), SPRING (19), WASHER (20), AND THRUST WASHER (21) FROM VALVE HOUSING (22).
6. REMOVE PLUG (23) AND PACKING (24) FROM VALVE HOUSING (22). DISCARD PACKING.
7. REMOVE AND DISCARD RELIEF VALVE (25).

---

## **DIRECTION CONTROL VALVE REPAIR (CONT)**

---

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

### **INSPECTION**

1. Inspect valve housing and spool for scratches, scoring, or wear of mating surfaces. Replace if damaged.
2. Inspect spring for breaks or distortion. Replace if damaged.

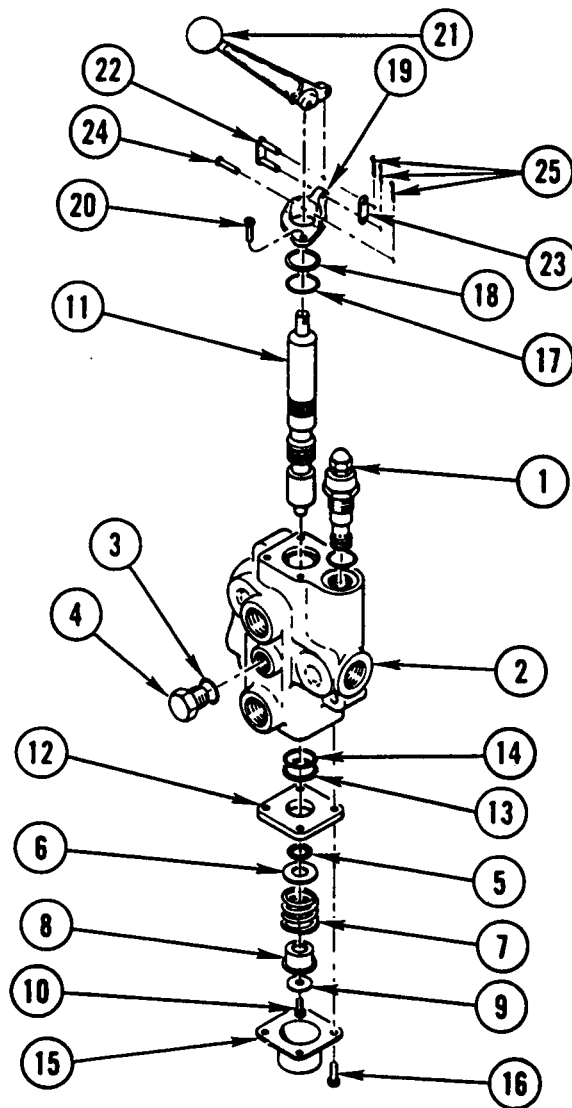
### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

### **ASSEMBLY**

1. INSTALL NEW RELIEF VALVE (1) IN VALVE HOUSING (2).
2. INSTALL NEW PACKING (3) AND PLUG (4).
3. INSTALL THRUST WASHER (5), WASHER (6), SPRING (7), COLLAR (8), WASHER (9), AND SCREW (10) ON SPOOL ASSEMBLY (11).
4. INSTALL SPACER (12), WASHER (13), AND NEW PACKING (14) ON SPOOL ASSEMBLY (11).
5. INSTALL SPOOL ASSEMBLY (11) IN VALVE HOUSING (2).
6. INSTALL CAP (15) AND FOUR SCREWS (16).
7. INSTALL NEW PACKING (17), WASHER (18), BRACKET (19), AND TWO SCREWS (20).
8. INSTALL HANDLE (21) ON BRACKET (19) AND INSTALL PIVOT PIN (22) AND PLATE (23).





9. INSTALL HANDLE (21) ON SPOOL ASSEMBLY (11) AND INSTALL PIN (24).

10. INSTALL THREE NEW COTTER PINS (25).

**NOTE**

Follow-on Maintenance:  
Install direction control valve (page 11-30).

## Section VI. GEAR END REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the gear end.

Repair of the gear end is general support maintenance.

---

### GEAR END REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Equipment Condition:**

**Reference**

Page 11-9

**Condition Description**

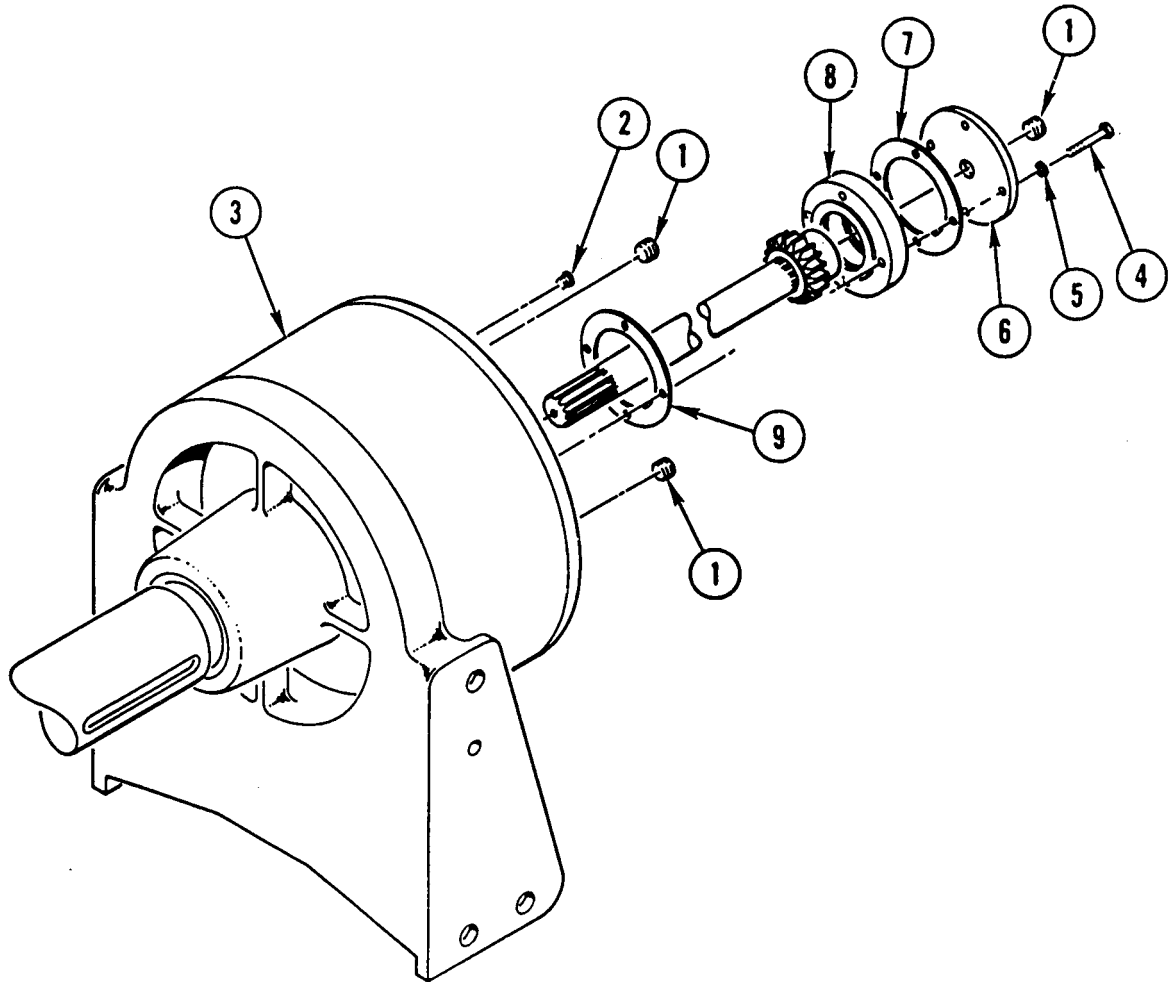
Hydraulic Winch  
Removed

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

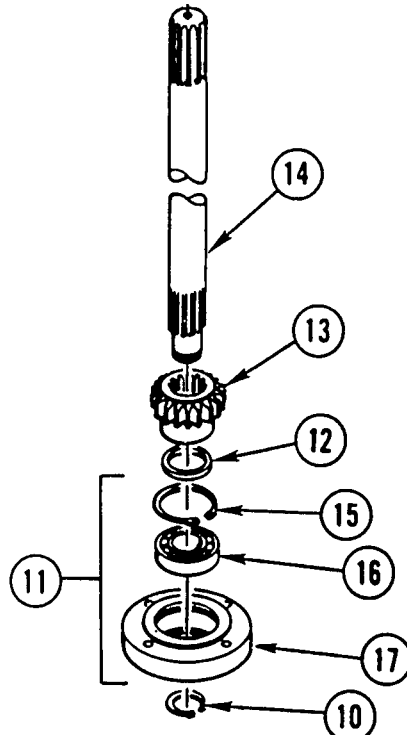
**Materials/Parts:**

Gasket (2)	PIN 9998
Gasket (2)	P/N 9997
Washer, Lock (4)	P/N 1168
Washer, Lock (12)	P/N 1495

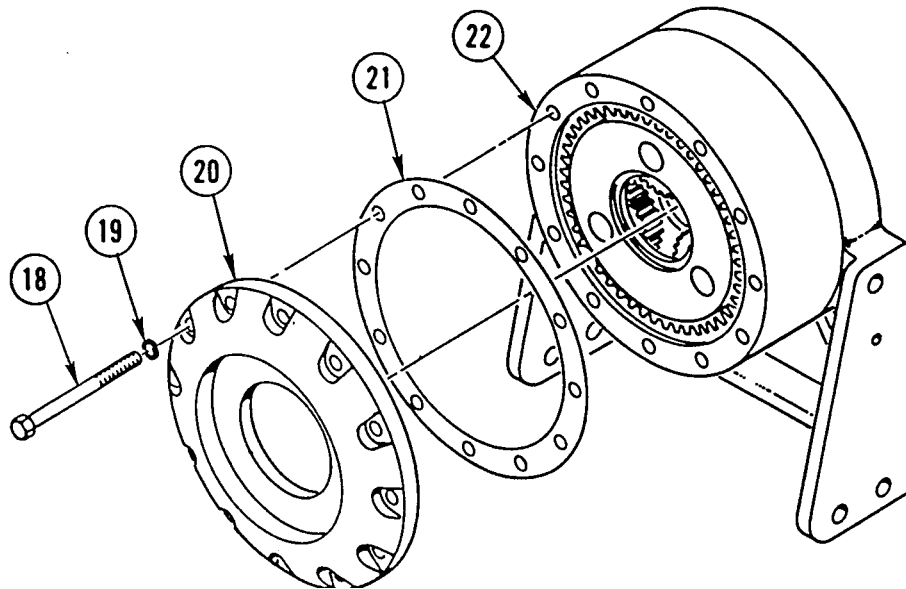
**DISASSEMBLY**

1. REMOVE THREE PLUGS (1) AND RELIEF VALVE (2) FROM END SUPPORT ASSEMBLY (3).
2. REMOVE FOUR SCREWS (4), FOUR LOCK WASHERS (5), COVER (6), GASKET (7), SHAFT ASSEMBLY (8), AND GASKET (9). DISCARD GASKETS AND LOCK WASHERS.

**GEAR END REPAIR (CONT)**



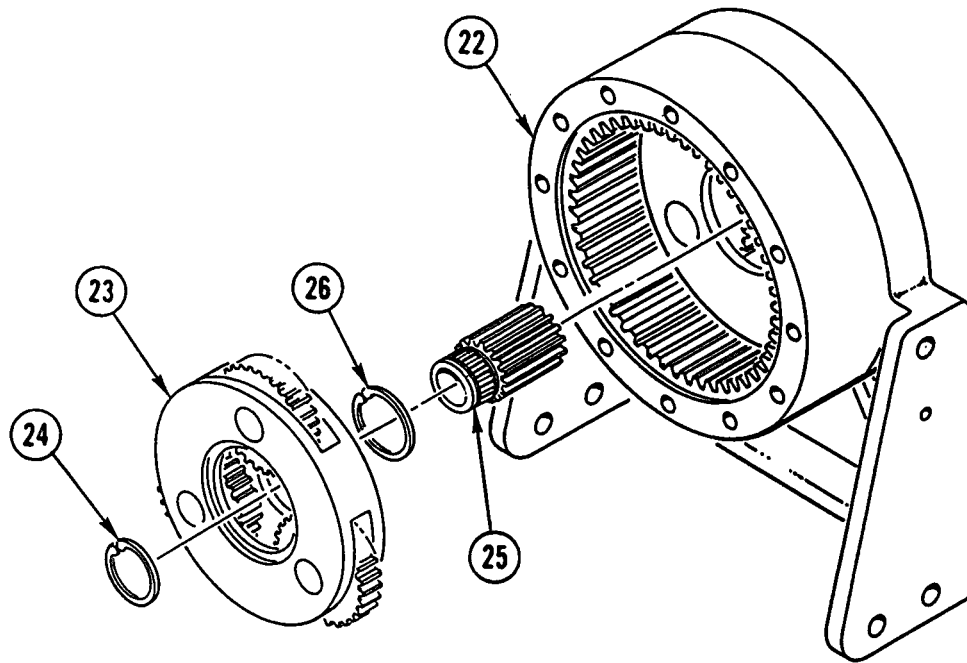
3. REMOVE RETAINING RING (10), BEARING ASSEMBLY (11), SPACER (12), AND GEAR (13) FROM SHAFT (14).
4. REMOVE RETAINING RING (15) AND BEARING (16) FROM BEARING HOUSING (17).



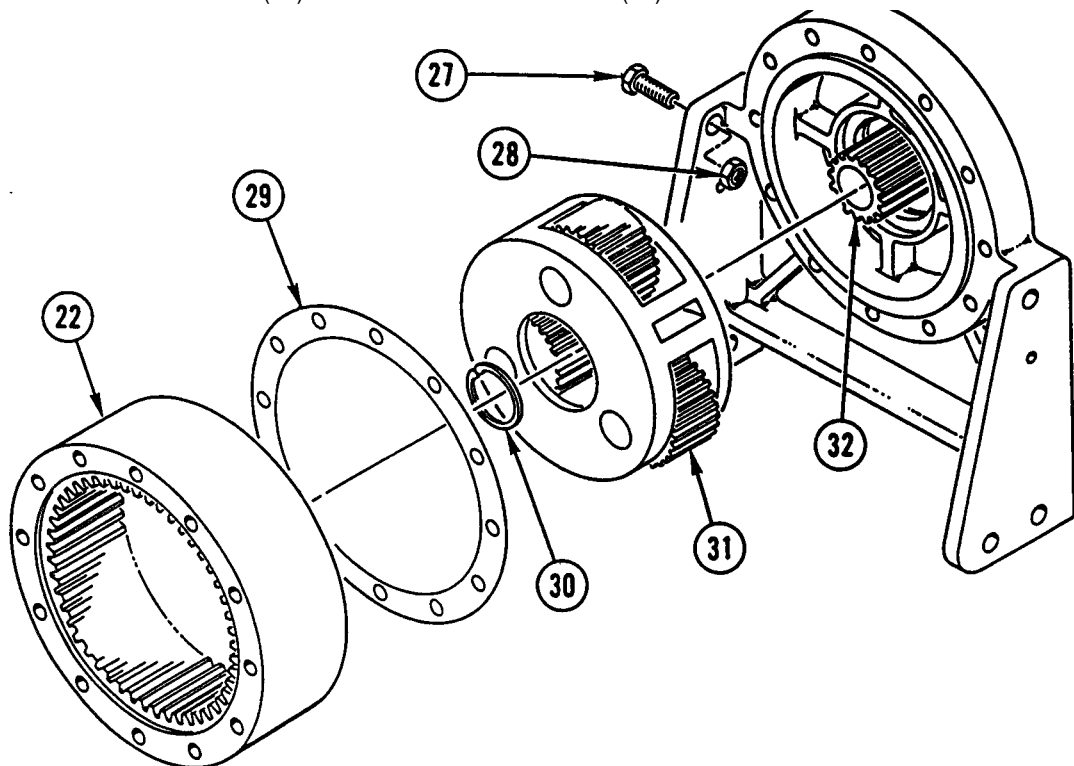
**NOTE**

Scribe top center bolt hole to aid in installation.

5. REMOVE 12 SCREWS (18), 12 LOCK WASHERS (19), COVER (20), AND GASKET (21) FROM RING GEAR (22). DISCARD GASKET AND LOCK WASHERS.



6. REMOVE PLANETARY GEAR (23) FROM RING GEAR (22). REMOVE RETAINING RING (24), GEAR (25), AND RETAINING RING (26) FROM PLANETARY GEAR (23).



7. REMOVE TWO SCREWS (27), TWO NUTS (28), RING GEAR (22), AND GASKET (29). DISCARD GASKET.
8. REMOVE RETAINING RING (30) AND PLANETARY GEAR (31) FROM SHAFT (32).

## **GEAR END REPAIR (CONT)**

### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

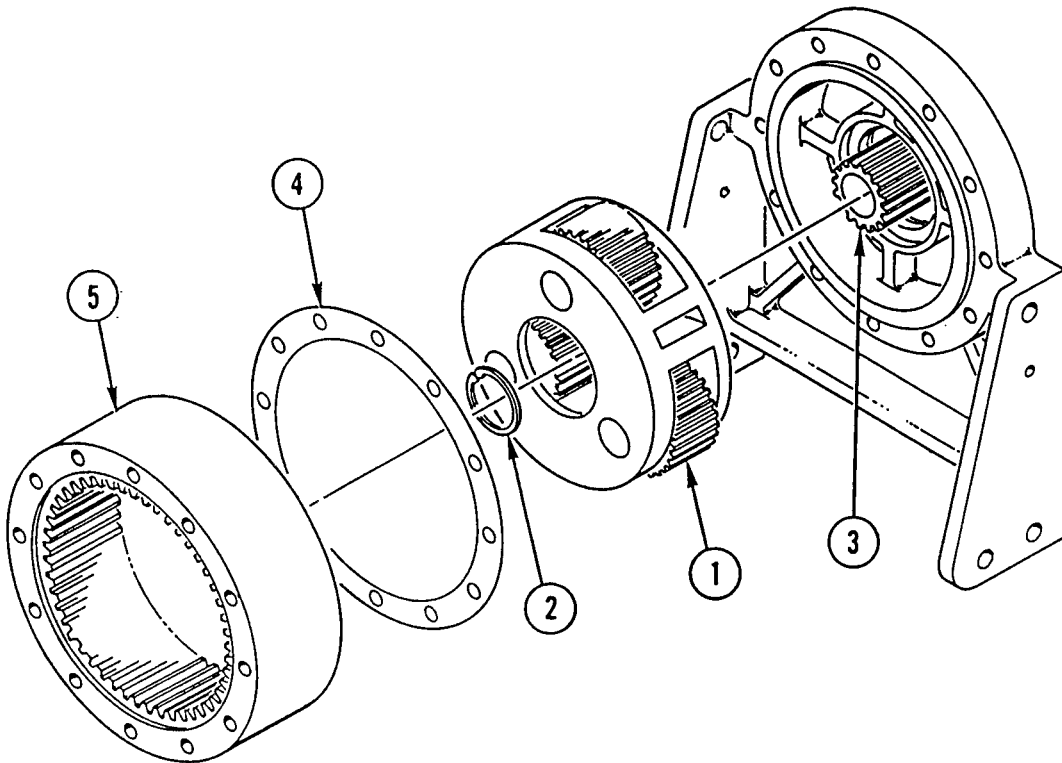
### **INSPECTION**

1. Inspect gear teeth on shaft, ring gears, and planetary gear for chips, uneven wear, or damage. Replace if damaged.
2. Inspect housing bores for pitting or corrosion. Replace if damaged.

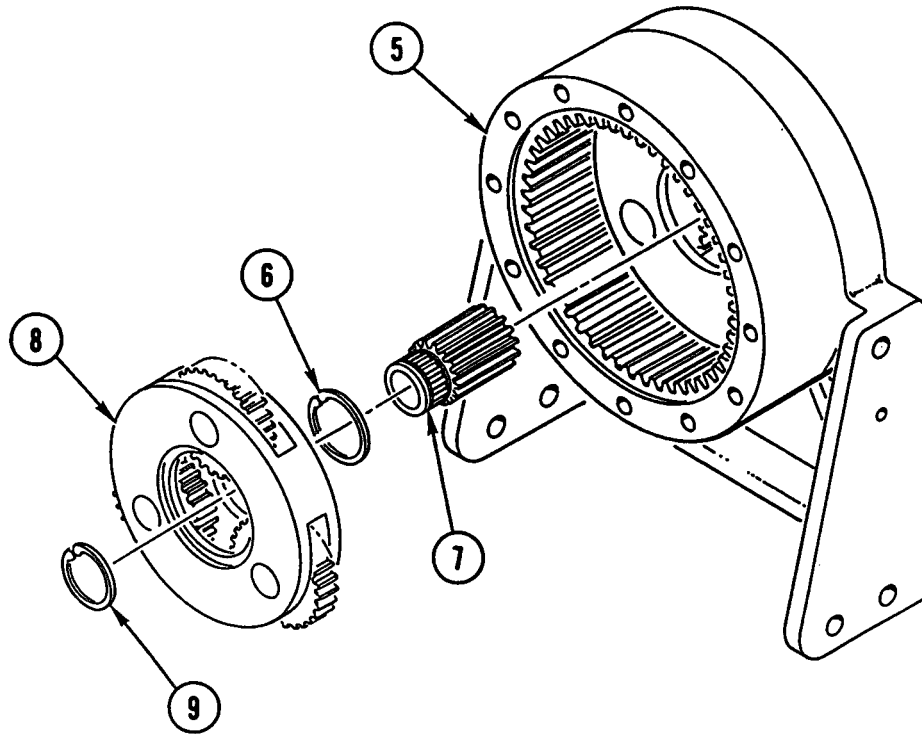
### **REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

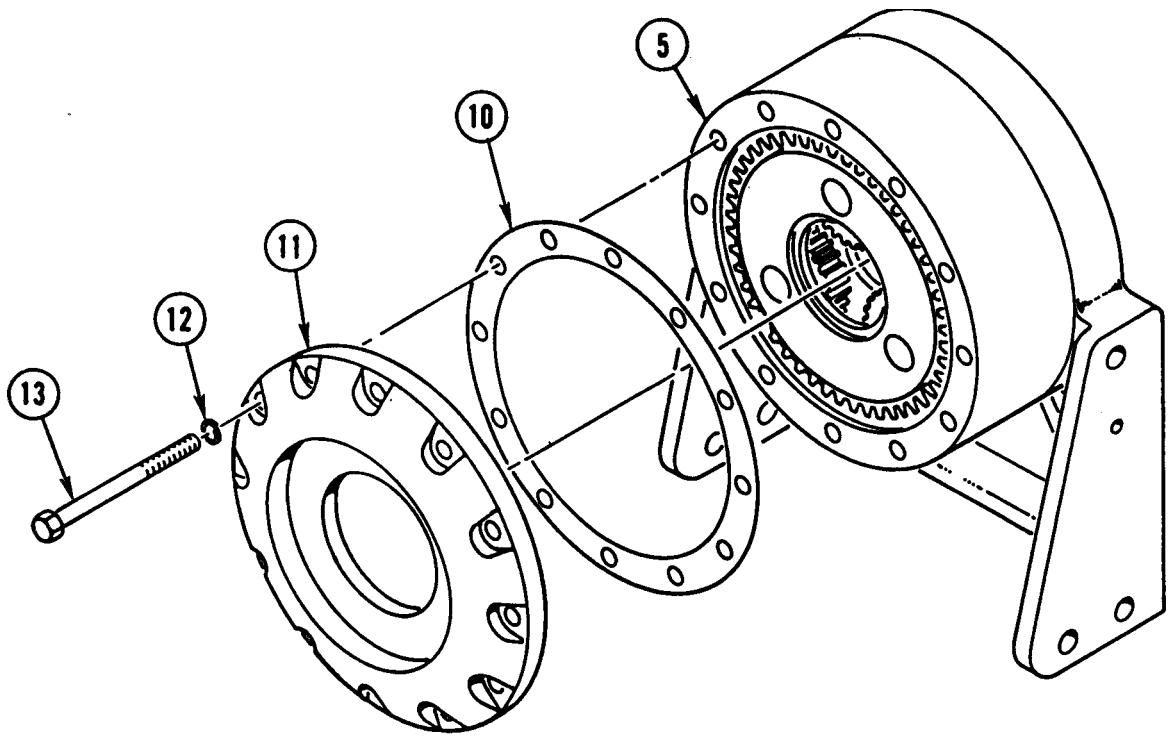
### **ASSEMBLY**



1. INSTALL PLANETARY GEAR (1) AND RETAINING RING (2) ON SHAFT (3).
2. INSTALL NEW GASKET (4) AND RING GEAR (5) OVER PLANETARY GEAR (1).

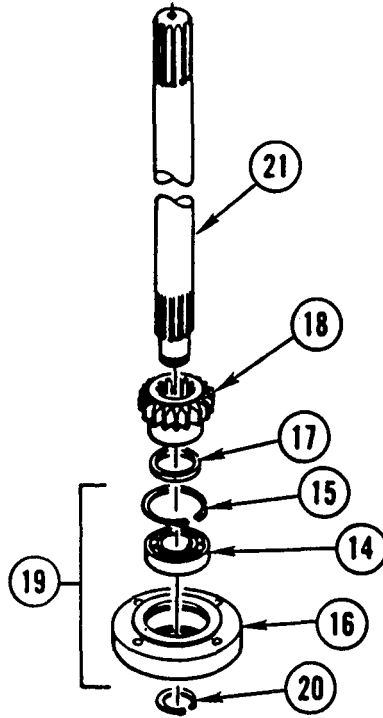


3. INSTALL RETAINING RING (6) ON GEAR (7) AND INSTALL GEAR (7) IN PLANETARY GEAR (8).
4. INSTALL RETAINING RING (9) ON GEAR (7).
5. INSTALL PLANETARY GEAR (8) IN RING GEAR (5).



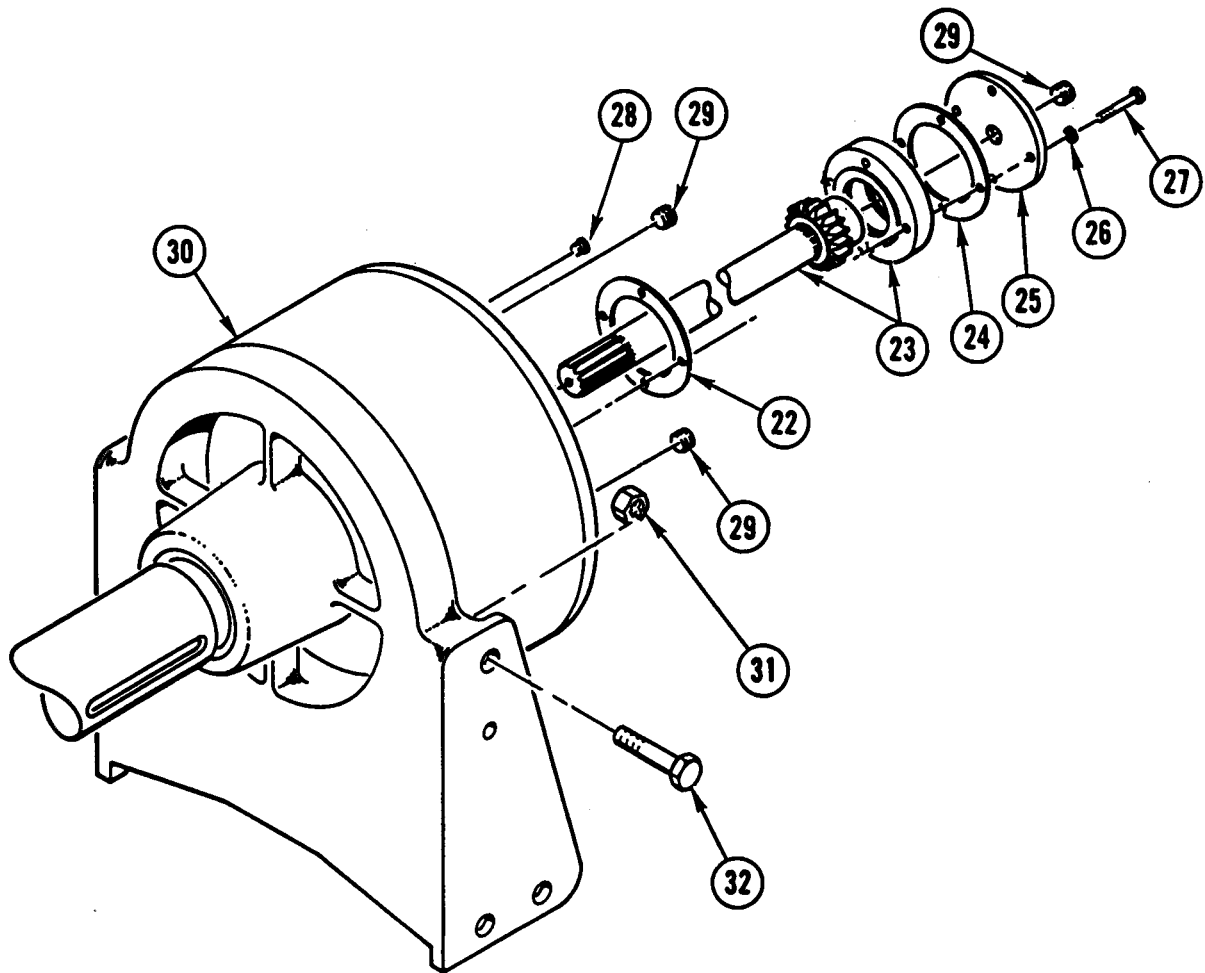
6. INSTALL NEW GASKET (10), COVER (11), 12 NEW LOCK WASHERS (12), AND 12 SCREWS (13) ON RING GEAR (5).

GEAR END REPAIR (CONT)



7. INSTALL BEARING (14) AND RETAINING RING (15) IN BEARING HOUSING (16).
8. INSTALL SPACER (17), GEAR (18), BEARING ASSEMBLY (19), AND RETAINING RING (20) ON SHAFT (21).





9. INSTALL NEW GASKET (22), SHAFT ASSEMBLY (23), NEW GASKET (24), COVER (25), FOUR NEW LOCK WASHERS (26), AND FOUR SCREWS (27).
10. INSTALL RELIEF VALVE (28) AND THREE PLUGS (29) IN END SUPPORT ASSEMBLY (30).
11. INSTALL TWO NUTS (31) AND TWO SCREWS (32) IN END SUPPORT ASSEMBLY (30).

**NOTE**

Follow-on Maintenance:  
 Install hydraulic winch (page 11-9).

## Section VII. MOTOR END REPAIR

### OVERVIEW

This section illustrates and describes procedures for disassembly, cleaning, inspection, repair, and assembly of the motor end.

Repair of the motor end is general support maintenance.

---

### MOTOR END REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

**Applicable Configuration:**

M916A1 and M916A2

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Washer, Lock (4)	P/N 1295
Packing	P/N 9844
Washer, Lock (6)	P/N 1388
Packing (2)	P/N 9851
Washer, Lock (12)	P/N 1495
Packing	P/N 9853
Adhesive-Sealant, Silicone	Appendix B, Item 3

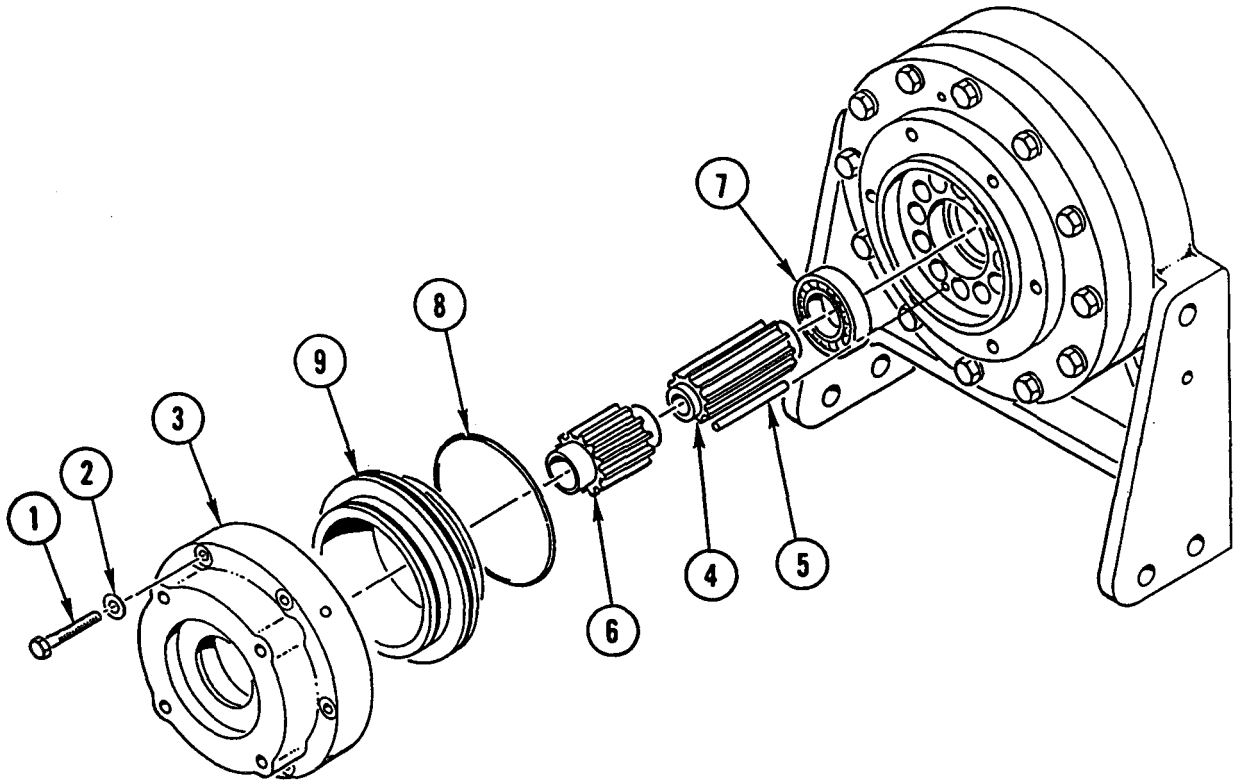
**Equipment Condition:**

Reference	Condition Description
Page 11-9	Hydraulic Winch Removed

**General Safety Instructions:**

#### WARNING

- Brake housing is under approximately 2,500 lb (1134 kg) of spring pressure. Loosen screws evenly until pressure is relieved to prevent possible injury to personnel.
- Be careful if winch is jammed and cable is installed. Winch drum will free wheel and unwind cable, which could cause injury to personnel.
- Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

**DISASSEMBLY****WARNING**

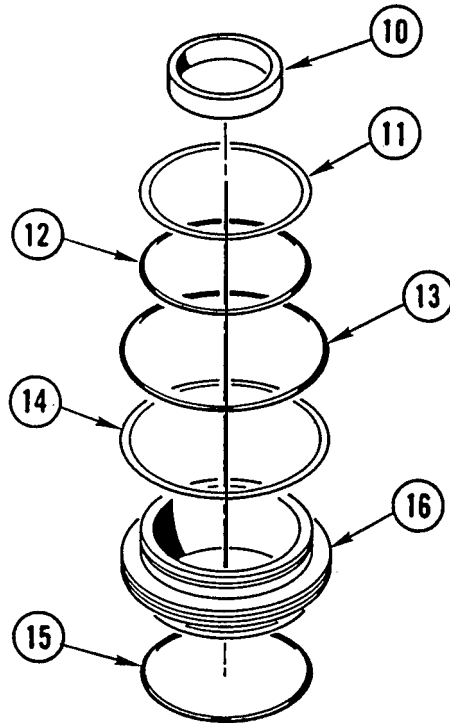
- Brake housing is under approximately 2,500 lb (1134 kg) of spring pressure. Loosen screws evenly until pressure is relieved to prevent possible injury to personnel.
- Be careful if winch is jammed and cable is installed. Winch drum will free wheel and unwind cable, which could cause injury to personnel.

**NOTE**

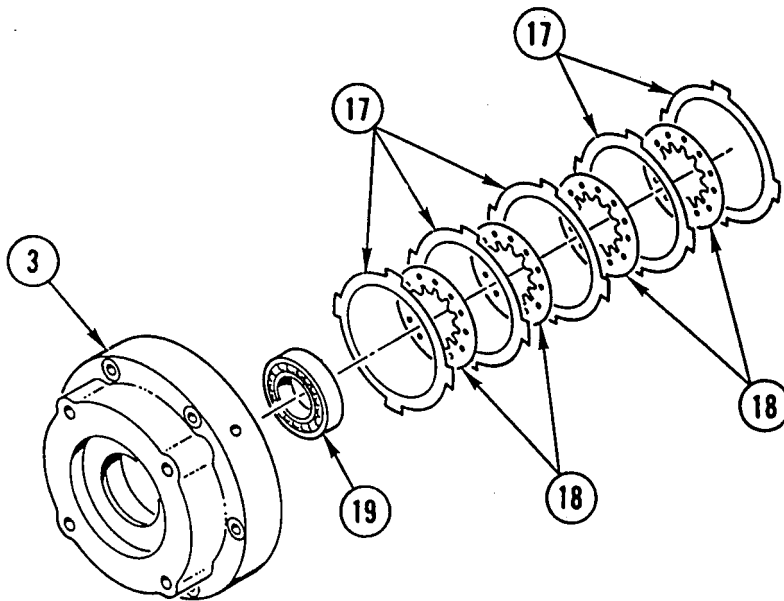
Make sure wire rope is not on winch drum.

1. LOOSEN SIX SCREWS (1) EVENLY UNTIL PRESSURE IS RELIEVED.
2. REMOVE SIX SCREWS (1), SIX LOCK WASHERS (2), AND BRAKE HOUSING (3). DISCARD LOCK WASHERS.
3. REMOVE EXTENSION SHAFT (4), TWO DOWELS (5), SHAFT (6), BEARING (7), PACKING (8), AND PISTON ASSEMBLY (9). DISCARD PACKING.

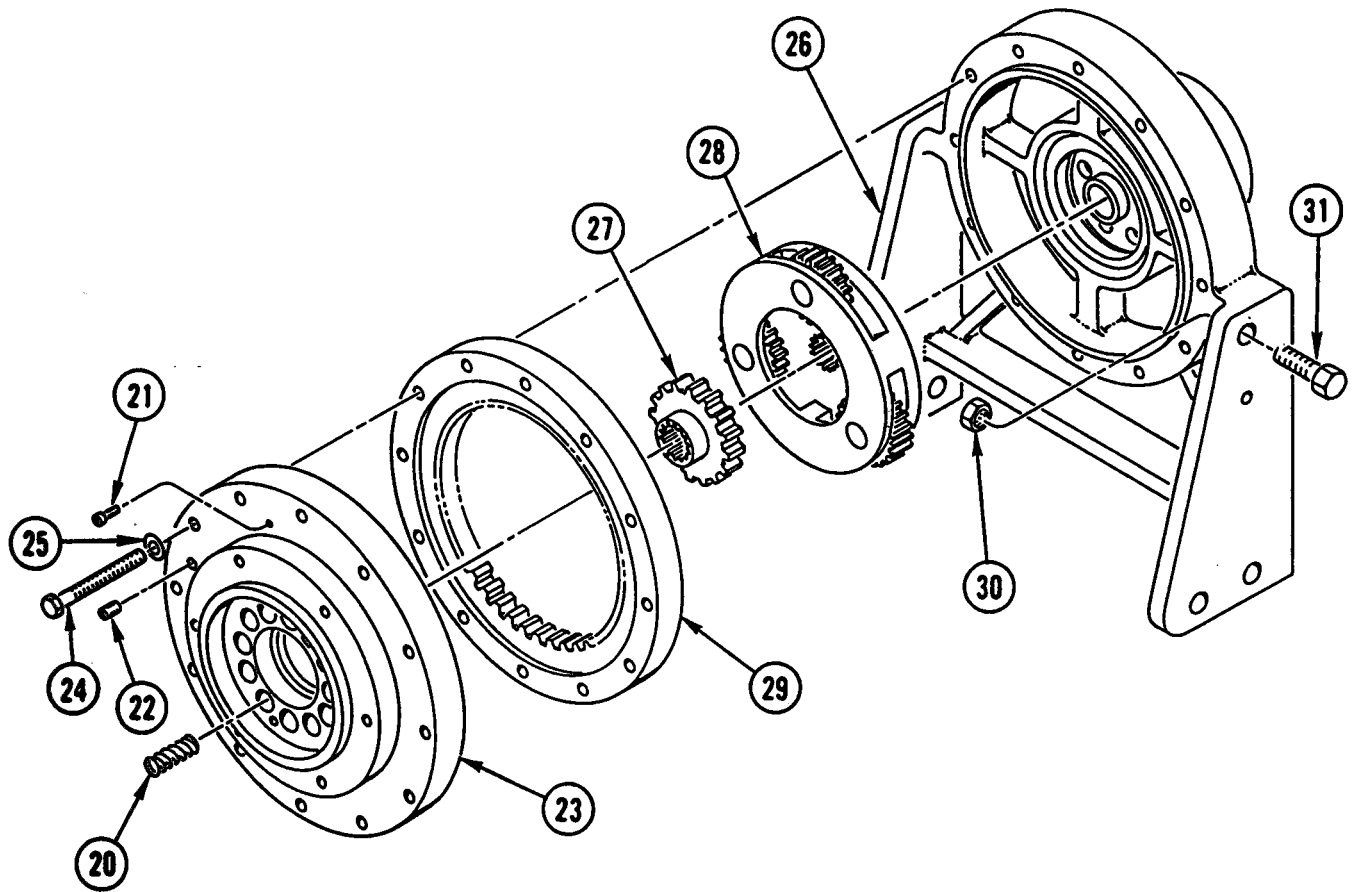
**MOTOR END REPAIR (CONT)**



4. REMOVE SPACER (10), BACKUP RING (11), PACKING (12), PACKING (13), BACKUP RING (14), AND PACKING (15) FROM PISTON (16). DISCARD PACKINGS.



5. REMOVE FIVE DISC PLATES (17), FOUR DRIVE PLATES (18), AND BEARING (19) FROM BRAKE HOUSING (3).



6. REMOVE 12 SPRINGS (20), RELIEF VALVE (21), AND PLUG (22) FROM BRAKE ADAPTER (23).

**NOTE**

Scribe top dead center bolt hole to aid in installation.

7. REMOVE 12 SCREWS (24), 12 LOCK WASHERS (25), AND BRAKE ADAPTER (23) FROM MOTOR END ASSEMBLY (26). DISCARD LOCK WASHERS.
8. REMOVE SUN GEAR (27) AND PLANETARY GEAR (28) FROM SHAFT (29).
9. REMOVE TWO NUTS (30), TWO SCREWS (31), AND RING GEAR (32) FROM MOTOR END (26).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

## MOTOR END REPAIR (CONT)

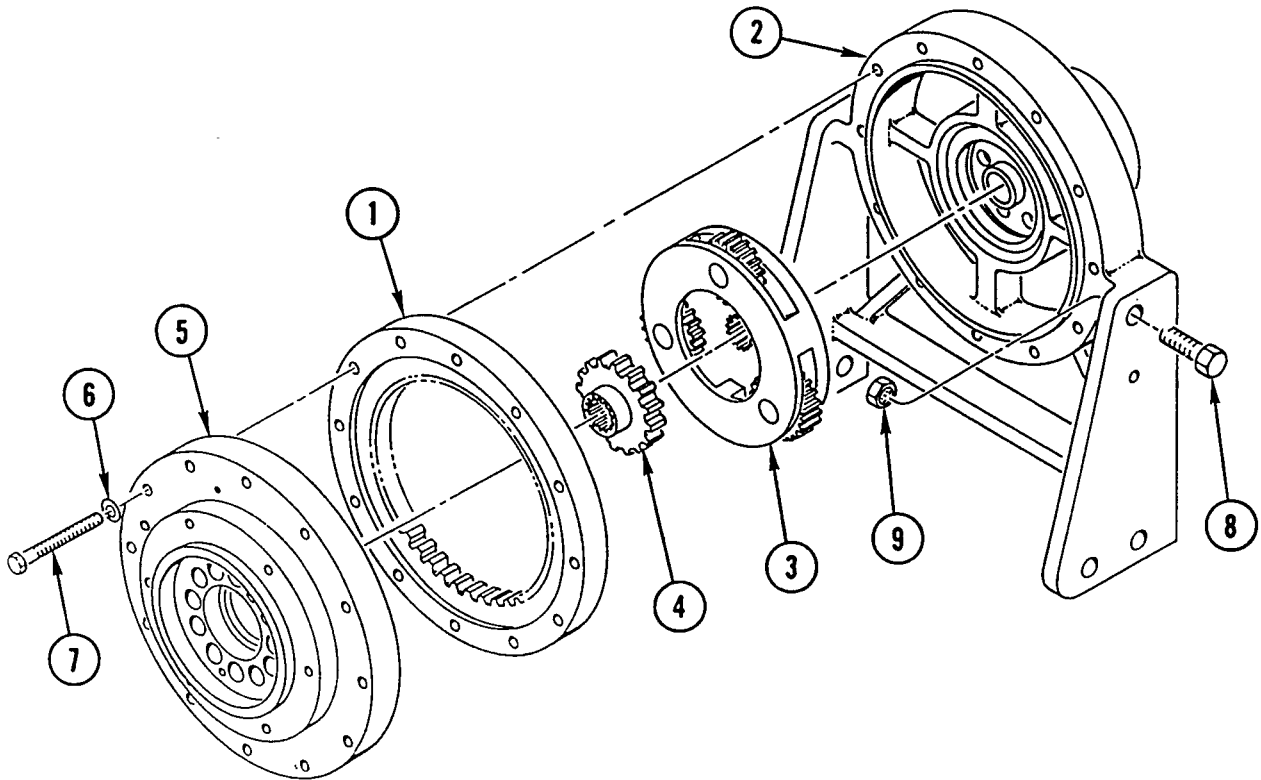
### INSPECTION

1. Inspect gear teeth on shafts, ring gears, sun gears and planetary gears for chips, uneven wear, or damage. Replace if damaged.
2. Replace springs if they will not return to 1-in. free length after being compressed to 3/4-in. length.
3. If thickness of disc plates is less than 0.080 in. or disc plates are warped or bent, replace with new part.
4. If thickness of drive plates is less than 0.055 in. or drive plates will not slide freely on brake shaft, replace with new part.

### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

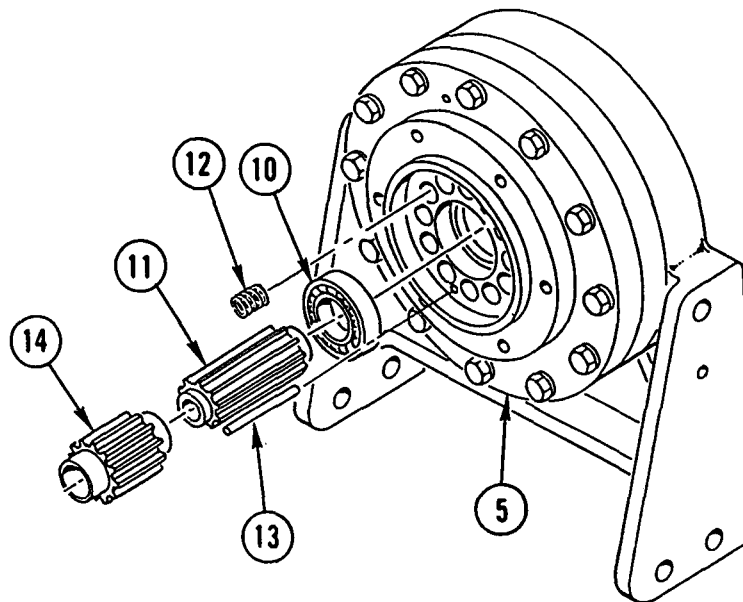
### ASSEMBLY



**WARNING**

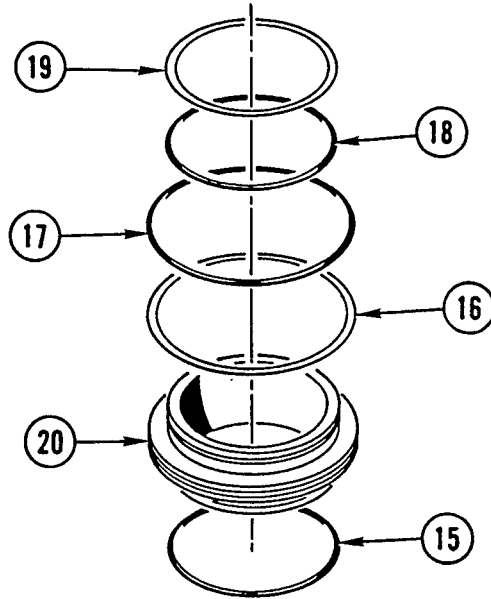
Adhesives, solvents, and sealing compounds can burn easily, can give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open fire and use in well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with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

1. APPLY LIGHT BEAD OF ADHESIVE-SEALANT TO MATING SURFACES OF RING GEAR (1) AND INSTALL ON MOTOR END (2).
2. INSTALL PLANETARY GEAR (3) AND SUN GEAR (4) IN RING GEAR (1).
3. INSTALL BRAKE ADAPTER (5), 12 NEW LOCK WASHERS (6), 12 SCREWS (7), 2 SCREWS (8), AND 2 NUTS (9).



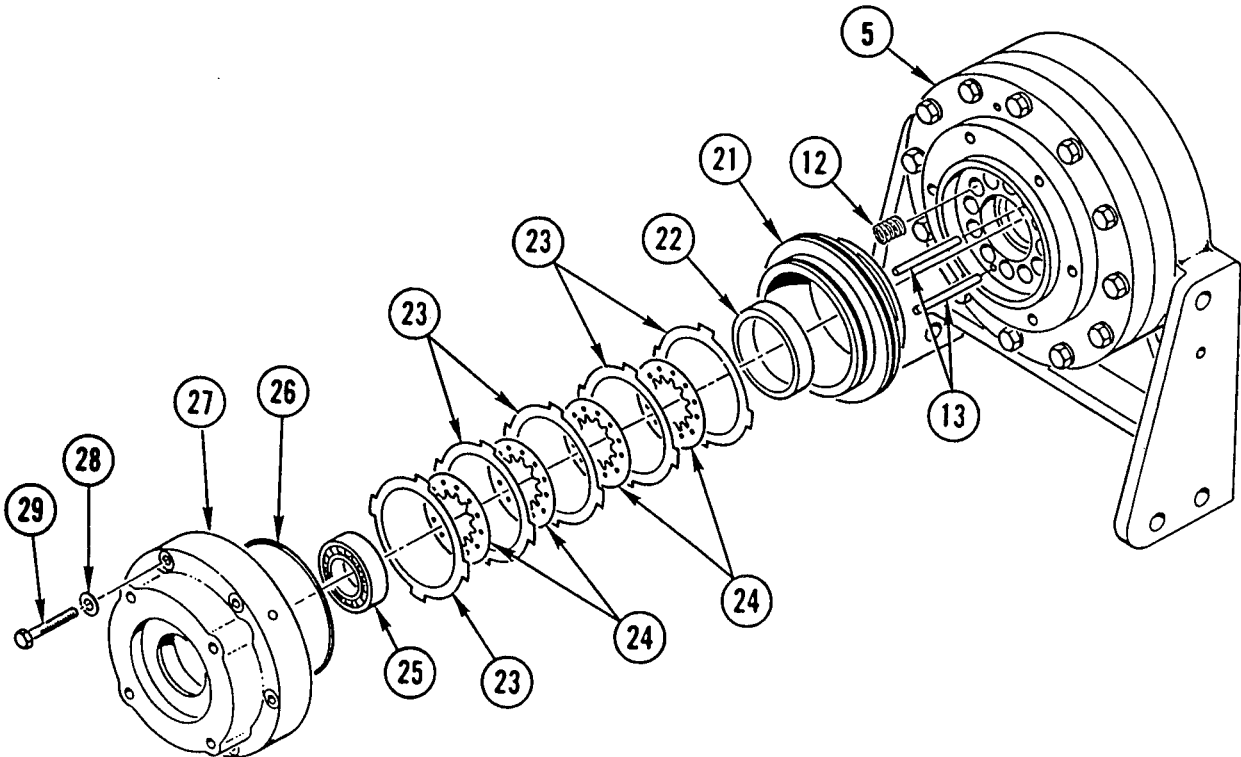
4. INSTALL BEARING (10), EXTENSION SHAFT (11), 12 SPRINGS (12), AND 2 DOWELS (13) IN BRAKE ADAPTER (5).
5. INSTALL SHAFT (14).

**MOTOR END REPAIR (CONT)**



**CAUTION**  
Use extreme care not to damage packings.

6. INSTALL NEW PACKING (15), BACKUP RING (16), NEW PACKING (17), NEW PACKING (18), AND BACKUP RING (19) IN PISTON (20).



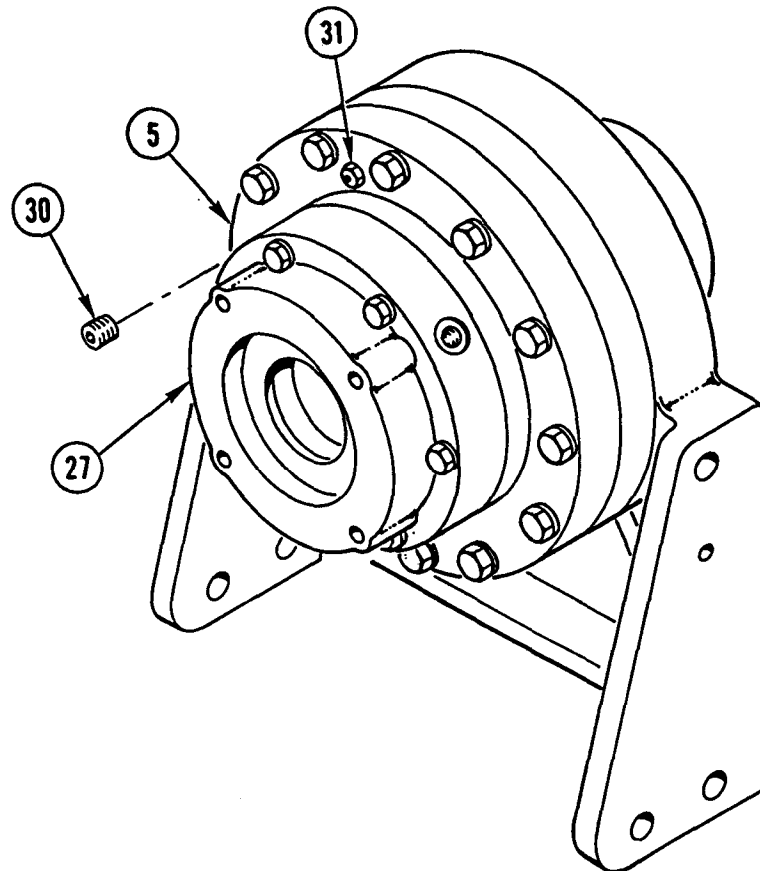


7. INSTALL PISTON ASSEMBLY (21) IN BRAKE ADAPTER (5) AND TAP PISTON ASSEMBLY (21) UNTIL RESTING ON 12 SPRINGS (12).
8. INSTALL SPACER (22) AND FIVE DISC PLATES (23) ALTERNATING WITH FOUR DRIVE PLATES (24) IN PISTON ASSEMBLY (21).
9. INSTALL BEARING (25) AND NEW PACKING (26) IN BRAKE HOUSING (27) AND INSTALL BRAKE HOUSING (27) OVER PISTON ASSEMBLY (21) AND TWO DOWELS (13).

**CAUTION**

Tighten screws evenly to prevent binding and possible damage to drive plates and disc plates.

10. INSTALL SIX NEW LOCK WASHERS (28) AND SIX SCREWS (29). TIGHTEN SCREWS EVENLY UNTIL BRAKE HOUSING (27) COMPRESSES 12 SPRINGS (12) AND IS SEATED. TIGHTEN SIX SCREWS (29) TO 45 LB-FT (61 N.m).



11. INSTALL PLUG (30) AND RELIEF VALVE (31) IN BRAKE ADAPTER (5).

**NOTE**

Follow-on Maintenance:  
Install hydraulic winch (page 11-9).



# CHAPTER 24

## POWER TAKE-OFF (PTO) REPAIR INSTRUCTIONS

### **OVERVIEW**

This chapter illustrates and describes procedures for maintenance of the Power Take-Off (PTO) and related parts.

	Page
Power Take-Off (PTO) Repair (All Except M915A2) . . . . .	24-2

## POWER TAKE-OFF (PTO) REPAIR

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Gasket (2) P/N 22-P-53  
 Seal P/N 28-P-101

**Materials/Parts (Cont):**

Packing (2) P/N 379231  
 Loctite 242 Appendix B, Item 33

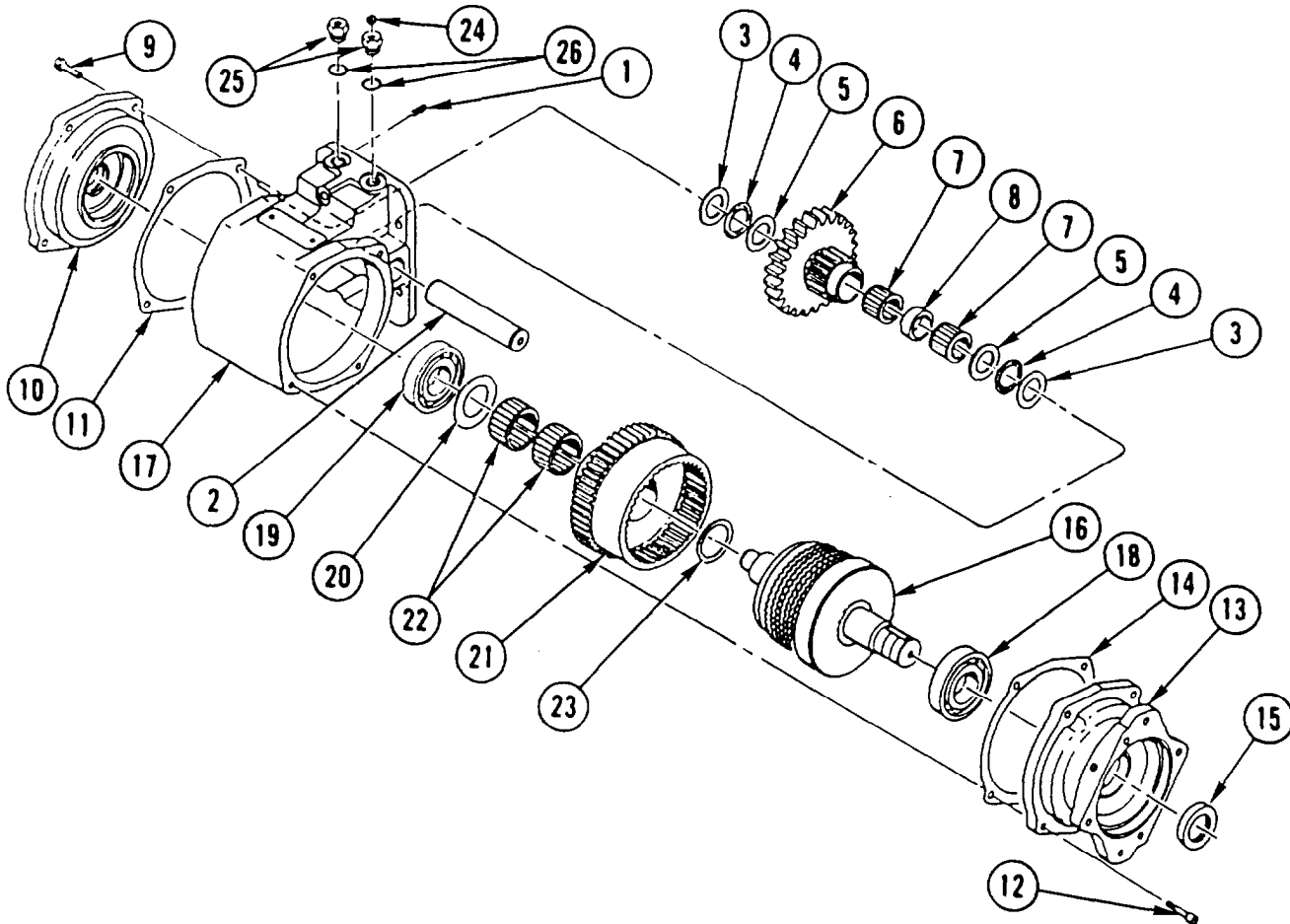
**References:**

TM 9-2320-363-20

**Equipment Condition:**

Reference	Condition Description
TM 9-2320-363-20	PTO Removed

### DISASSEMBLY



1. REMOVE SETSCREW (1), SHAFT (2), TWO RACES (3), TWO BEARINGS (4), TWO RACES (5), AND INPUT GEAR (6).
2. REMOVE TWO BEARINGS (7) AND SPACER (8) FROM INPUT GEAR (6).
3. REMOVE FOUR SCREWS (9), COVER ASSEMBLY (10), AND GASKET (11). DISCARD GASKET.

**NOTE**

Mark pump flange and housing for proper installation.

4. REMOVE FOUR SOCKET HEAD SCREWS (12), PUMP FLANGE ASSEMBLY (13), AND GASKET (14). DISCARD GASKET.
5. REMOVE AND DISCARD SEAL (15) FROM PUMP FLANGE ASSEMBLY (13).
6. REMOVE DRIVE SHAFT AND CLUTCH ASSEMBLY (16) FROM HOUSING (17).
7. REMOVE TWO BEARINGS (18 AND 19), WASHER (20), AND GEAR (21).
8. REMOVE TWO BEARINGS (22) AND SPACER (23) FROM DRIVE SHAFT AND CLUTCH ASSEMBLY (16).
9. REMOVE PLUG (24), TWO ADAPTER PLUGS (25), AND TWO PACKINGS (26). DISCARD PACKINGS.

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

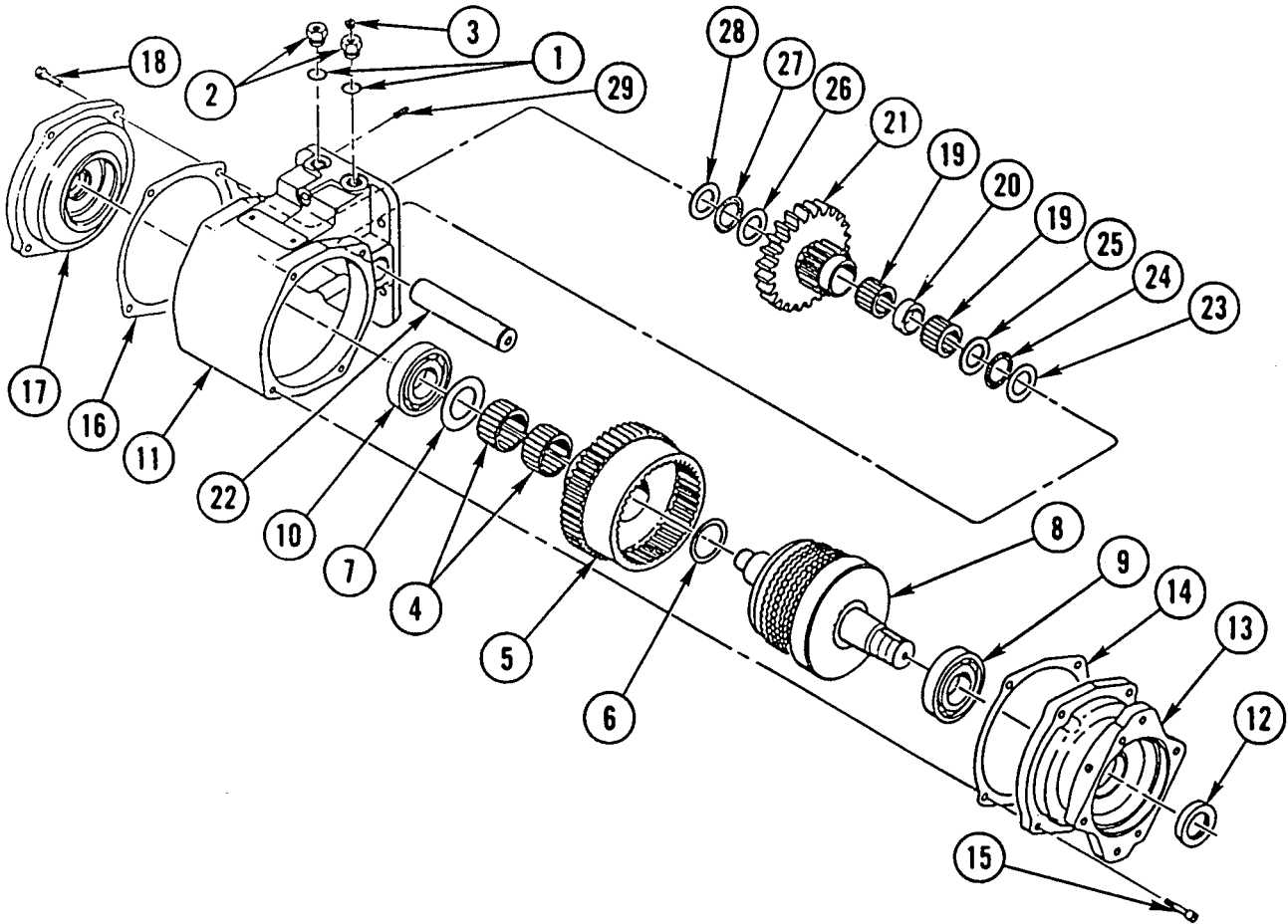
Inspect all parts for wear or damage.

**REPAIR**

Use general repair methods to repair damaged parts (page 2-33).

## POWER TAKE-OFF (PTO) REPAIR

### ASSEMBLY



1. INSTALL TWO NEW PACKINGS (1), TWO ADAPTER PLUGS (2), AND PLUG (3).
2. INSTALL TWO BEARINGS (4) IN GEAR (5).
3. INSTALL SPACER (6), GEAR (5), AND WASHER (7) ON DRIVE SHAFT AND CLUTCH ASSEMBLY (8).
4. INSTALL TWO BEARINGS (9 AND 10).
5. INSTALL DRIVE SHAFT AND CLUTCH ASSEMBLY (8) IN HOUSING (11).
6. INSTALL NEW SEAL (12) IN PUMP FLANGE ASSEMBLY (13).
7. INSTALL NEW GASKET (14) AND PUMP FLANGE ASSEMBLY (13).
8. COAT THREADS OF FOUR SOCKET HEAD SCREWS (15) WITH LOCTITE 242 AND INSTALL IN PUMP FLANGE ASSEMBLY (13).

9. INSTALL NEW GASKET (16), COVER ASSEMBLY (17), AND FOUR SCREWS (18).
10. INSTALL TWO BEARINGS (19) AND SPACER (20) IN INPUT GEAR (21).

**CAUTION**

Make sure all bearings, races, and gear are properly aligned as shaft is installed. Failure to do so may cause damage to equipment.

**NOTE**

Install shaft with slotted end up and toward cover assembly.

11. INSTALL SHAFT (22), THIN RACE (23), BEARING (24), THICK RACE (25), INPUT GEAR (21), THICK RACE (26), BEARING (27), THIN RACE (28), AND SETSCREW (29).





# CHAPTER 25

## ACCESSORY ITEMS REPAIR INSTRUCTIONS

### **OVERVIEW**

This chapter illustrates and describes procedures for maintenance of the accessory items and related parts. A list of tasks contained in this chapter is shown below.

	Page
Section I. Vehicle Heater Repair (M915A2 and M916A1) .....	25-2
Section II. Arctic Personnel Heater Repair .....	25-10
Section III. Vehicle Heater/Air Conditioner Unit Repair (All Except M915A2 and M916A1). .....	25-36

## Section I. VEHICLE HEATER REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the vehicle heater.

---

### VEHICLE HEATER REPAIR

---

This task covers: a. Disassembly b. Cleaning c. Inspection d. Repair e. Assembly

---

### INITIAL SETUP

#### Applicable Configuration:

M915A2 and M916A1

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Washer, Lock (12)

Rivet (12)

#### Materials/Parts (Con?):

Nut, Lock (3)

Nut, Lock (2)

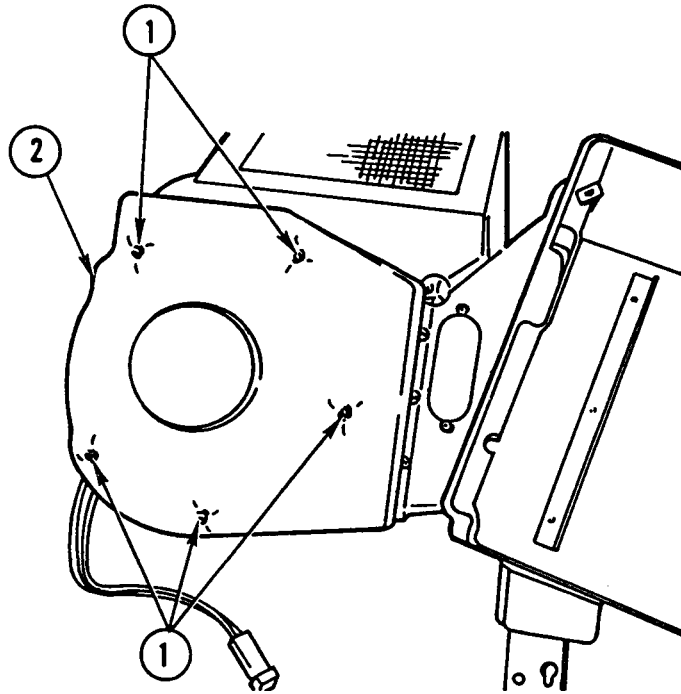
#### References:

FM 43-2  
TM 9-2320-363-20

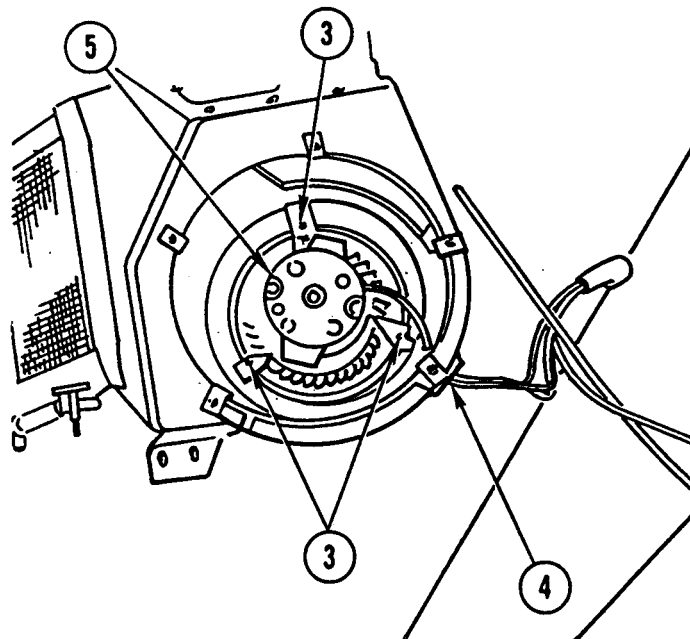
#### Equipment Condition:

Reference	Condition	Description
TM 9-2320-363-20	Vehicle Heater Removed	

**DISASSEMBLY**

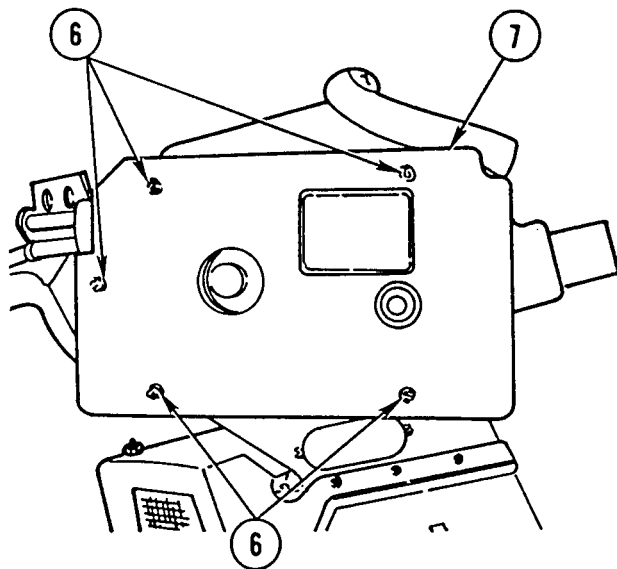


1. REMOVE FIVE SCREWS (1) AND COVER (2).

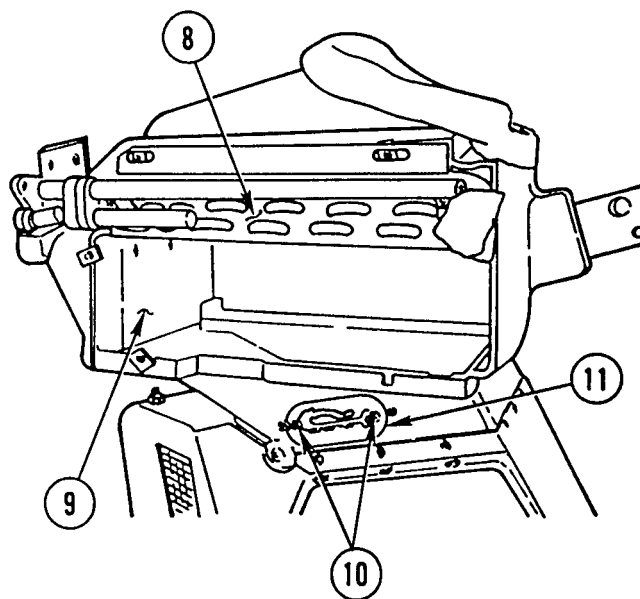


2. REMOVE THREE LOCK NUTS (3), GROMMET (4), AND FAN ASSEMBLY (5). DISCARD LOCK NUTS.

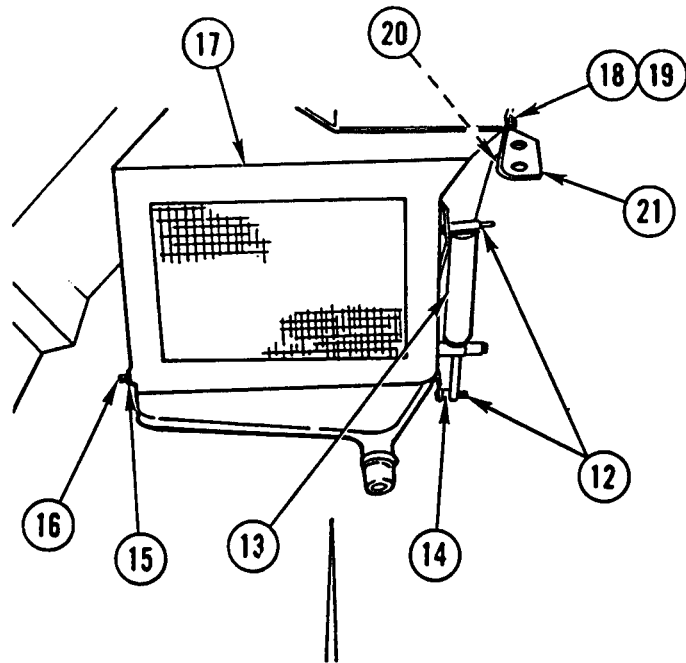
## VEHICLE HEATER REPAIR (CONT)



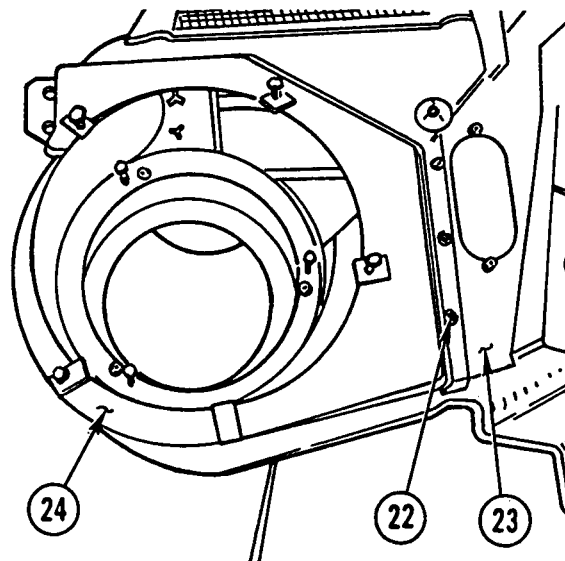
3. REMOVE FIVE SCREWS (6) AND COVER (7).



4. REMOVE HEATER CORE (8) AND PLATE (9).
5. REMOVE TWO LOCK NUTS (10) AND RESISTOR BLOCK (11). DISCARD LOCK NUTS.



6. REMOVE TWO RETAINERS (12), AIR CYLINDER (13), AND TWO SPACERS (14).
7. REMOVE RETAINER (15), SHAFT (16), AND DOOR (17).
8. REMOVE TWO CAPSCREWS (18), TWO LOCK WASHERS (19), MOUNTING PLATE (20), AND BRACKET (21). DISCARD LOCK WASHERS.



9. REMOVE AND DISCARD 12 RIVETS (22) IN ACCORDANCE WITH FM 43-2. SEPARATE CORE COVER (23) FROM MOTOR COVER (24).

## VEHICLE HEATER REPAIR (CONT)

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

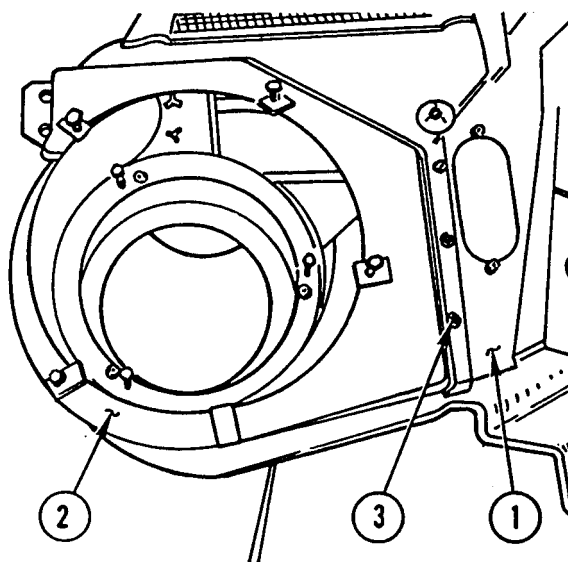
### INSPECTION

Inspect all parts for wear or damage.

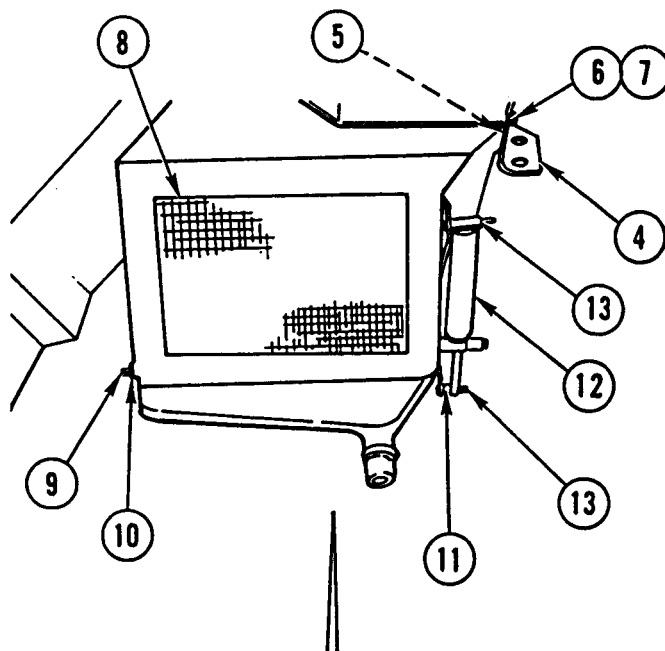
### REPAIR

Use general repair methods to repair damaged parts (page 2-33).

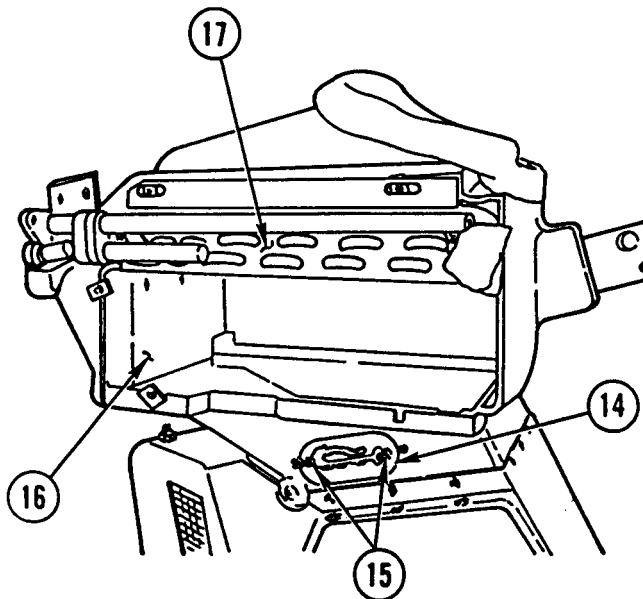
### ASSEMBLY



1. INSTALL CORE COVER (1) IN MOTOR COVER (2). INSTALL 12 NEW RIVETS (3) IN ACCORDANCE WITH FM 43-2.

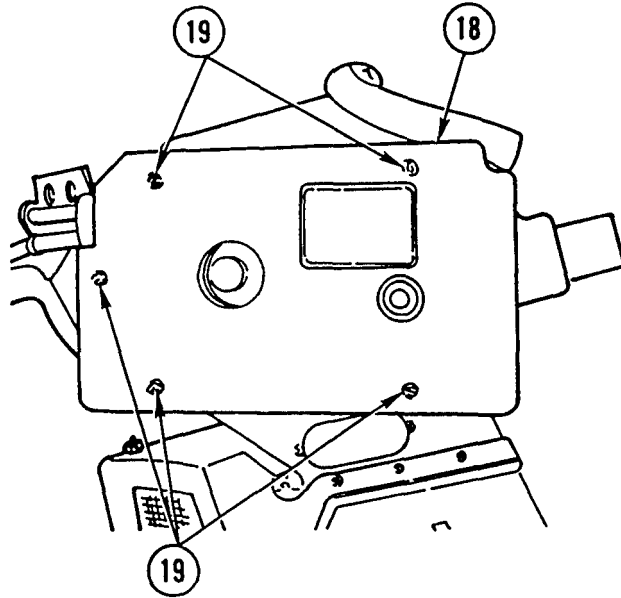


2. INSTALL BRACKET (4), MOUNTING PLATE (5), TWO NEW LOCK WASHERS (6), AND TWO CAPSCREWS (7).
3. INSTALL DOOR (8), SHAFT (9), AND RETAINER (10).
4. INSTALL TWO SPACERS (11), AIR CYLINDER (12), AND TWO RETAINERS (13).

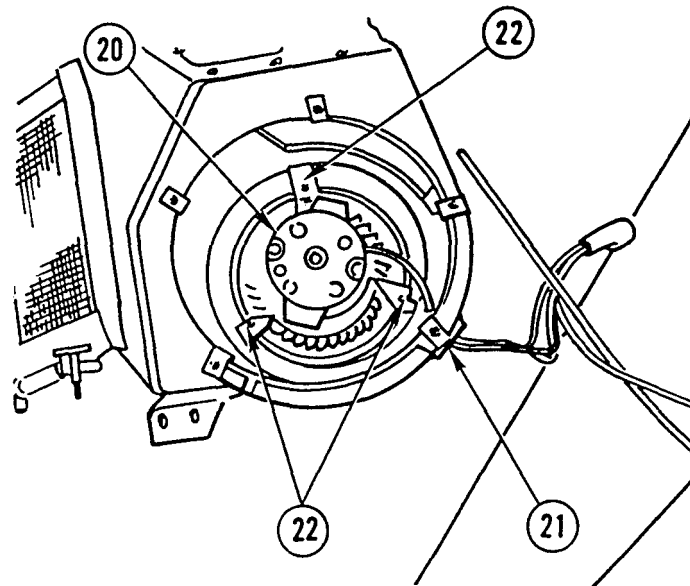


5. INSTALL RESISTOR BLOCK (14) AND TWO NEW LOCK NUTS (15).
6. INSTALL PLATE (16) AND HEATER CORE (17).

**VEHICLE HEATER REPAIR (CONT)**

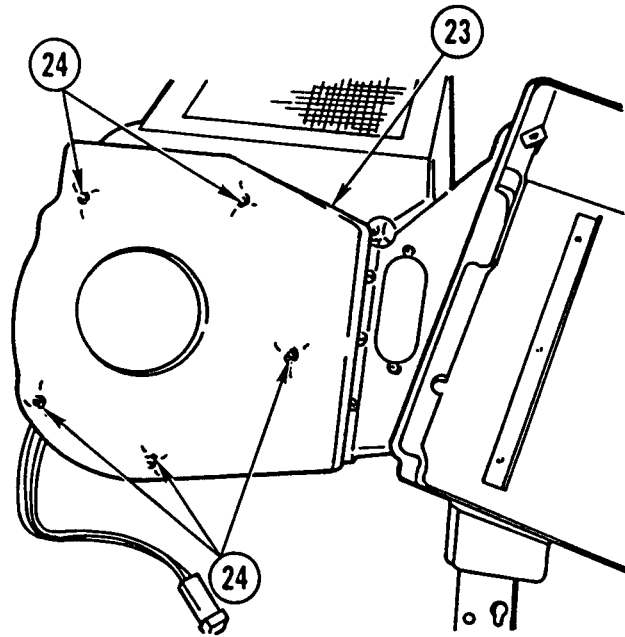


7. INSTALL COVER (18) AND FIVE SCREWS (19).



8. INSTALL FAN ASSEMBLY (20), GROMMET (21), AND THREE NEW LOCK NUTS (22).





9. INSTALL COVER (23) AND FIVE SCREWS (24).

**NOTE**

Follow-on Maintenance:  
Install vehicle heater (TM 9-2320-363-20).

## Section II. ARCTIC PERSONNEL HEATER REPAIR

### OVERVIEW

This section illustrates and describes procedures for maintenance of the arctic personnel heater. A list of tasks contained in this section is shown below.

	Page
Diode and Motor Resistor Replacement . . . . .	25-11
Fuel Control Valve Replacement . . . . .	25-14
Thermostatic Switch Replacement.. . . . .	25-18
Fixed Resistor Replacement . . . . .	25-22
Blower Motor Assembly Replacement. . . . .	25-26
Thermostat Replacement . . . . .	25-28
Flame Detector Switch Replacement and Adjustment . . . . .	25-30
Wiring Harness Replacement . . . . .	25-34

---

## DIODE AND MOTOR RESISTOR REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### **INITIAL SETUP**

**Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A31  
 Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Nut, Kep

**References:**

TM 9-2320-363-20

**Equipment Condition:**

**Reference**

TM 9-2320-363-20

**Condition Description**

Heater Removed from Vehicle

## **DIODE AND MOTOR RESISTOR REPLACEMENT (CONT)**

### **NOTE**

Note position of grooved end of diode prior to removal to aid in installation.

1. REMOVE DIODE (1) FROM HOLDER (2).

### **NOTE**

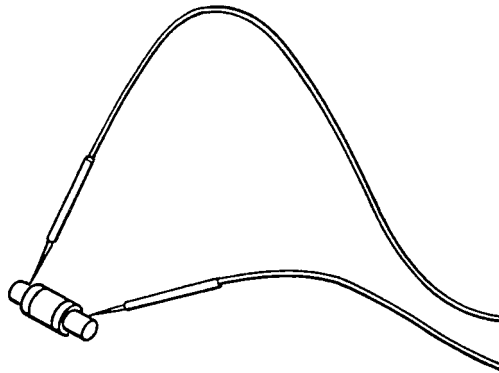
Tag wires prior to disconnecting to aid in connecting.

2. REMOVE TWO SCREWS (3) AND DISCONNECT TWO WIRES (4) FROM TERMINALS 4 AND 6 ON TERMINAL BOARD (5).
3. REMOVE KEP NUT (6), SCREW (7), AND MOTOR RESISTOR (8) FROM BRACKET (9). DISCARD KEP NUT.

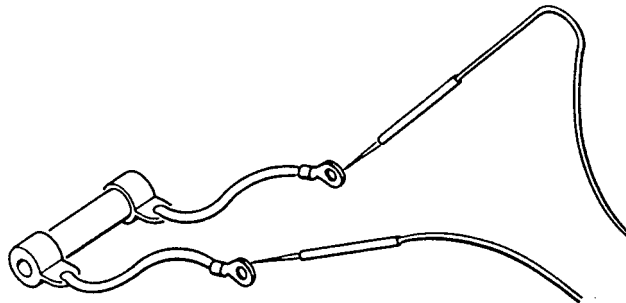
### **CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

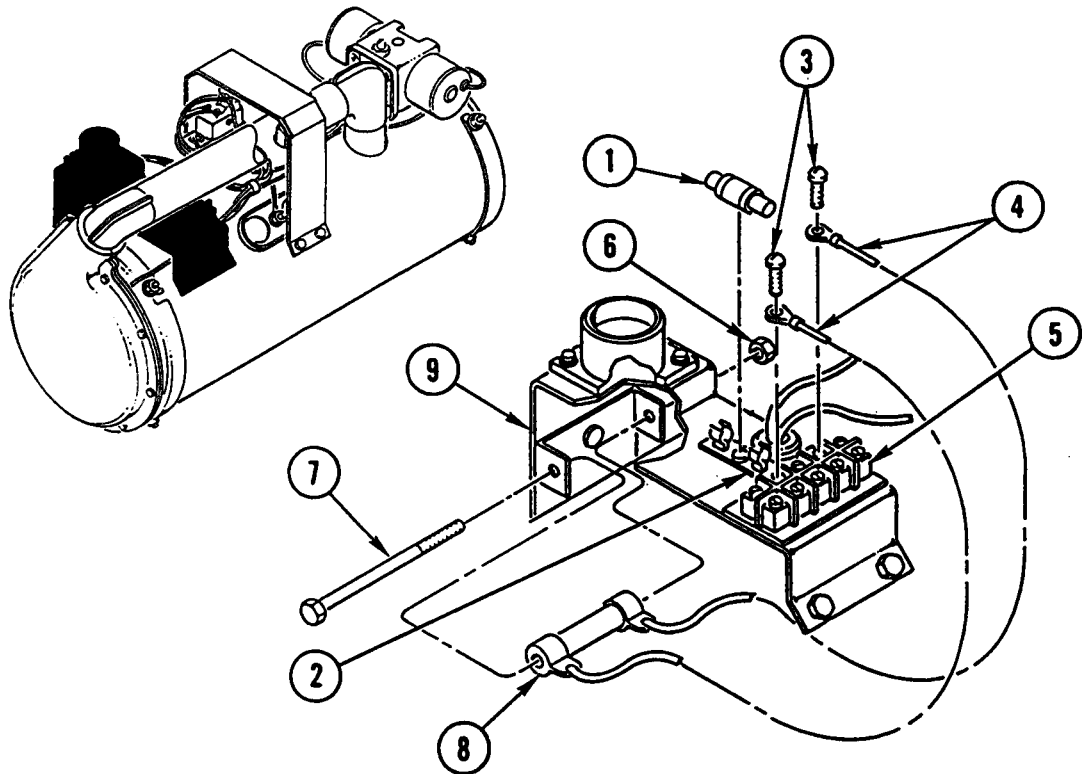
### **INSPECTION**



1. USE MULTIMETER TO CHECK DIODE. SET METER TO ABOVE 200 mv SCALE. PLACE PROBES ON EACH END OF DIODE. SWITCH PROBES. MULTIMETER READING WILL BE INFINITY OR RESISTANCE IN EITHER POSITION. ONE POSITION MUST READ INFINITY AND THE OTHER MUST READ RESISTANCE, AND VICE VERSA, FOR DIODE TO OPERATE PROPERLY.



2. USE MULTIMETER TO CHECK MOTOR RESISTOR. PLACE PROBES ON RESISTOR LEADS. MULTIMETER SHOULD READ 0 OHMS RESISTANCE. REPLACE RESISTOR IF READING IS INFINITY.



## INSTALLATION

1. INSTALL MOTOR RESISTOR (8), SCREW (7), AND NEW KEP NUT (6) ON BRACKET (9).
2. CONNECT TWO WIRES (4) AND INSTALL TWO SCREWS (3) ON TERMINALS 4 AND 6 ON TERMINAL BOARD (5).
3. INSTALL DIODE (1) IN HOLDER (2).

### NOTE

Follow-on Maintenance:  
Install heater in vehicle (TM 9-2320-363-20).

---

## FUEL CONTROL VALVE REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N05

#### References:

TM 9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Heater Removed from Vehicle

#### General Safety Instructions:

#### WARNING

Diesel fuel is flammable. Do not work on fuel system in presence of sparks or open flame. To do so could result in serious injury to personnel.

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### REMOVAL

#### WARNING

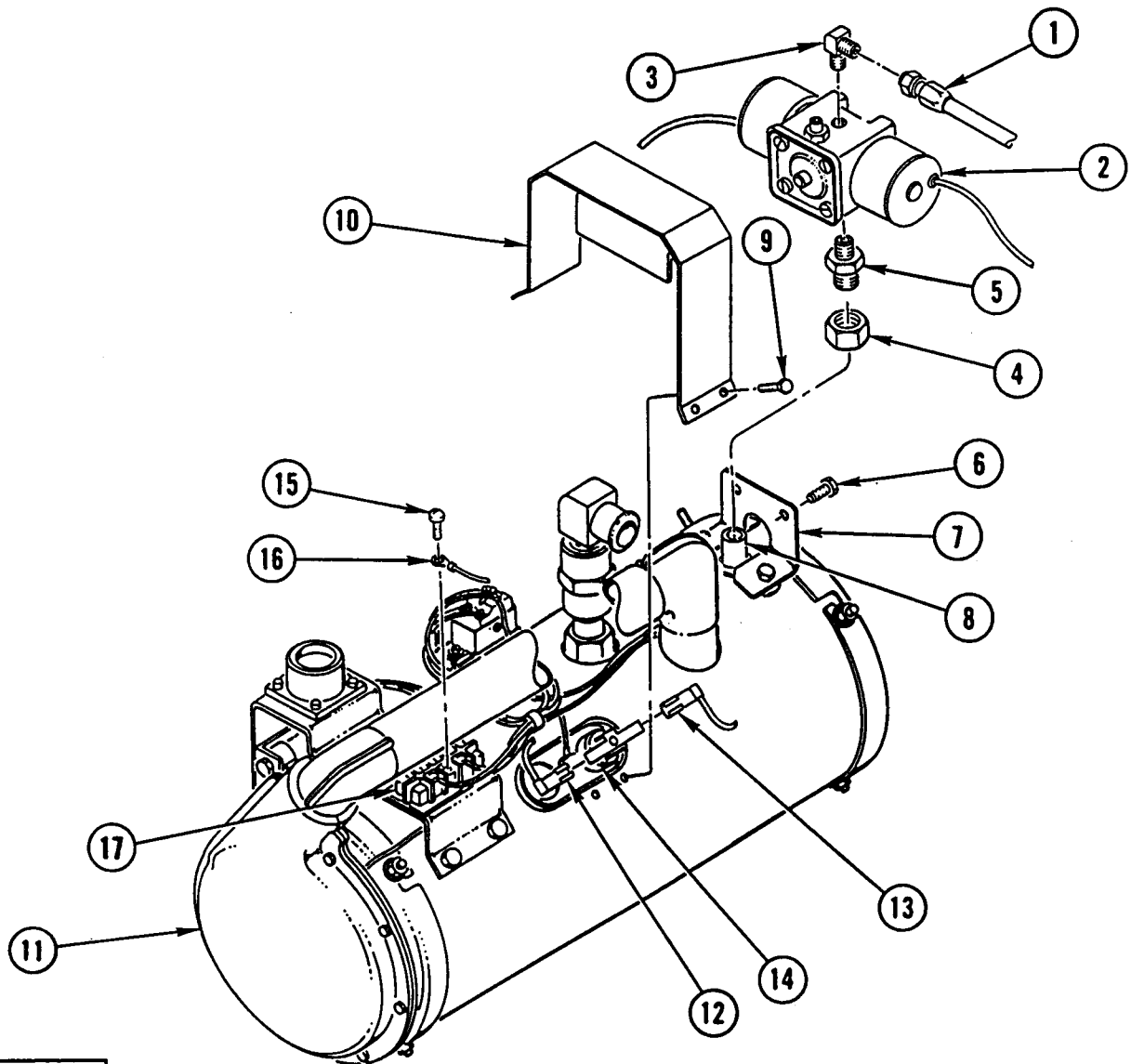
Diesel fuel is flammable. Do not work on fuel system in presence of sparks or open flame. To do so could result in serious injury to personnel.

1. DISCONNECT FUEL HOSE (1) FROM FUEL CONTROL VALVE (2).
2. REMOVE ELBOW (3) FROM FUEL CONTROL VALVE (2).
3. REMOVE NUT (4) FROM UNION (5) BENEATH FUEL CONTROL VALVE (2).
4. REMOVE TWO SCREWS (6) AND FUEL CONTROL VALVE (2) FROM BRACKET (7) AND FUEL TUBE (8).
5. REMOVE FOUR SCREWS (9) AND GUARD (10) FROM HEATER (11).

#### NOTE

Tag all wires prior to disconnecting to aid in connecting.

6. DISCONNECT TWO FUEL CONTROL VALVE WIRES (12 AND 13) FROM THERMOSTATIC SWITCH (14).
7. REMOVE SCREW (15) AND DISCONNECT FUEL CONTROL VALVE WIRE (16) FROM TERMINAL NO. 5 ON TERMINAL BOARD (17).
8. REMOVE UNION (5) FROM FUEL CONTROL VALVE (2).



**CLEANING**

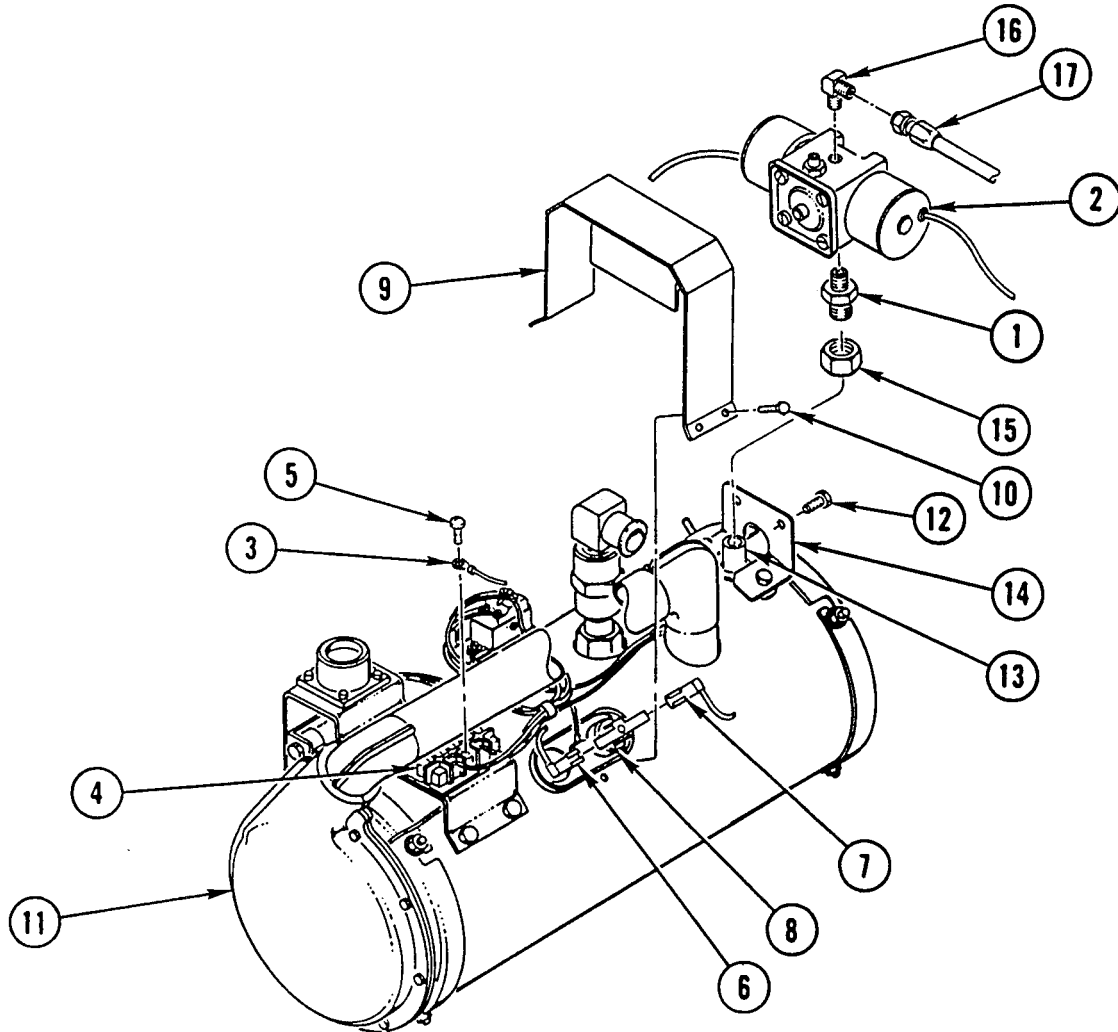
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

## FUEL CONTROL VALVE REPLACEMENT (CONT)

### INSTALLATION



#### WARNING

Diesel fuel is flammable. Do not work on fuel system in presence of sparks or open flame. To do so could result in serious injury to personnel.

1. INSTALL UNION (1) IN FUEL CONTROL VALVE (2).
2. CONNECT FUEL CONTROL VALVE WIRE (3) TO TERMINAL NO. 5 ON TERMINAL BOARD (4) AND INSTALL SCREW (5).
3. CONNECT TWO FUEL CONTROL VALVE WIRES (6 AND 7) TO THERMOSTATIC SWITCH (8).



4. INSTALL GUARD (9) AND FOUR SCREWS (10) ON HEATER (11).
5. INSTALL FUEL CONTROL VALVE (2) AND TWO SCREWS (12) ON FUEL TUBE (13) AND BRACKET (14).
6. INSTALL NUT (15) ON UNION (1) BENEATH FUEL CONTROL VALVE (2).
7. INSTALL ELBOW (16) IN FUEL CONTROL VALVE (2).
8. CONNECT FUEL HOSE (17) TO FUEL CONTROL VALVE (2).

**NOTE**

Follow-on Maintenance:  
Install heater in vehicle (TM 9-2320-363-20).

---

## THERMOSTATIC SWITCH REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Washer, Lock

Packing P/N 730051-1

**References:**

TM 9-2320-363-20

**Equipment Condition:**

**Reference**

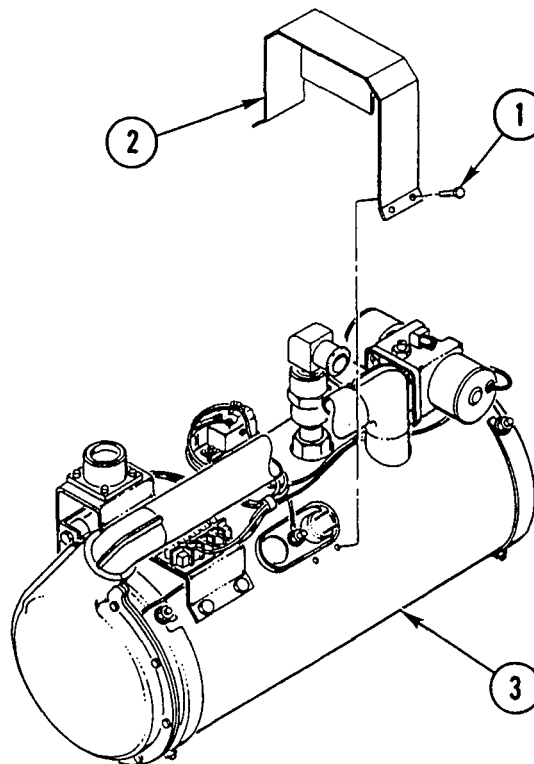
TM 9-2320-363-20

**Condition Description**

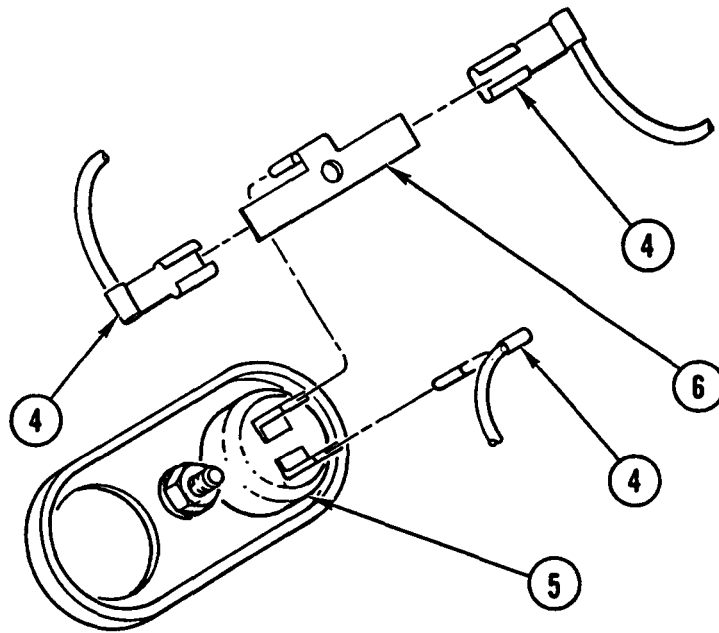
Heater Removed from Vehicle

---

**REMOVAL**



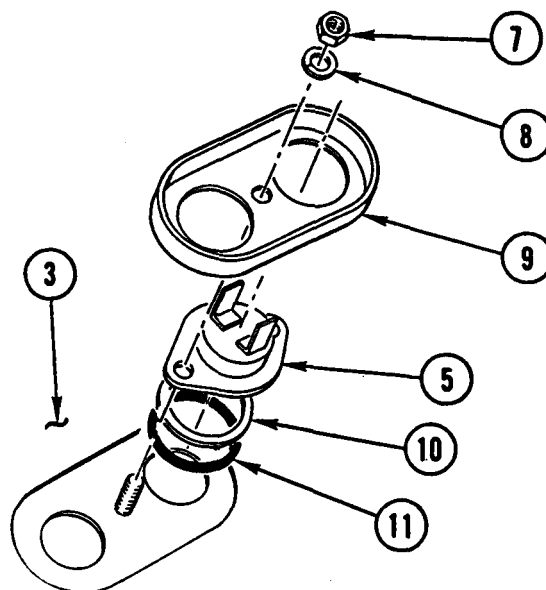
1. REMOVE FOUR SCREWS (1) AND GUARD (2) FROM HEATER (3).



**NOTE**

Tag wires prior to disconnecting to aid in connecting.

2. DISCONNECT THREE WIRES (4) FROM THERMOSTATIC SWITCH (5).
3. REMOVE THREE-WAY CONNECTOR (6) FROM THERMOSTATIC SWITCH (5).



4. REMOVE NUT (7), LOCK WASHER (8), AND COVER (9). DISCARD LOCK WASHER.
5. REMOVE THERMOSTATIC SWITCH (5), WASHER (10), AND PACKING (11) FROM HEATER (3). DISCARD PACKING.

---

## THERMOSTATIC SWITCH REPLACEMENT (CONT)

---

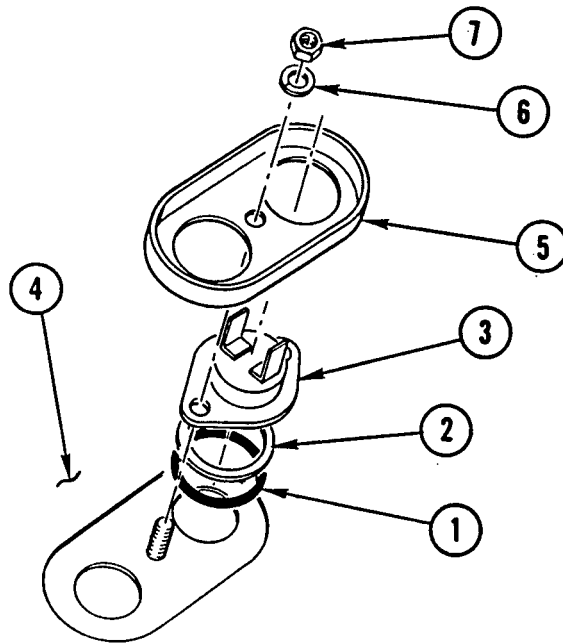
### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

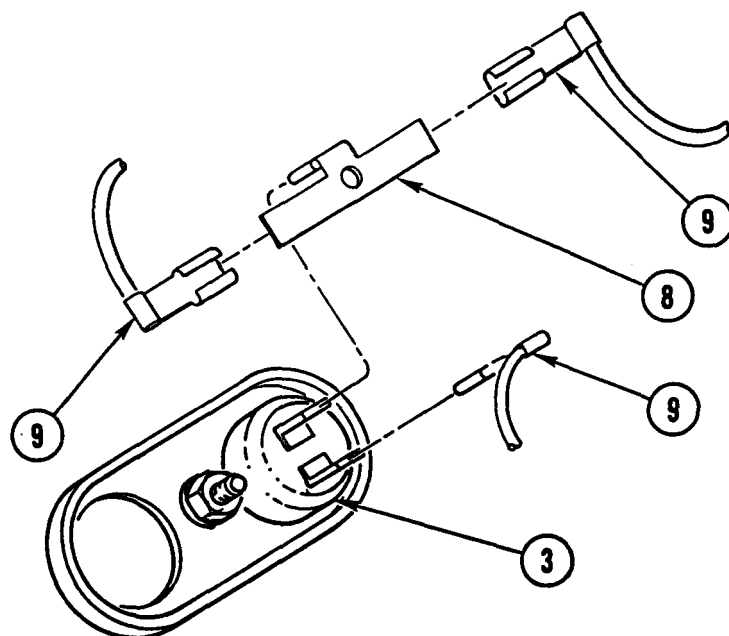
### INSPECTION

Inspect all parts for wear or damage.

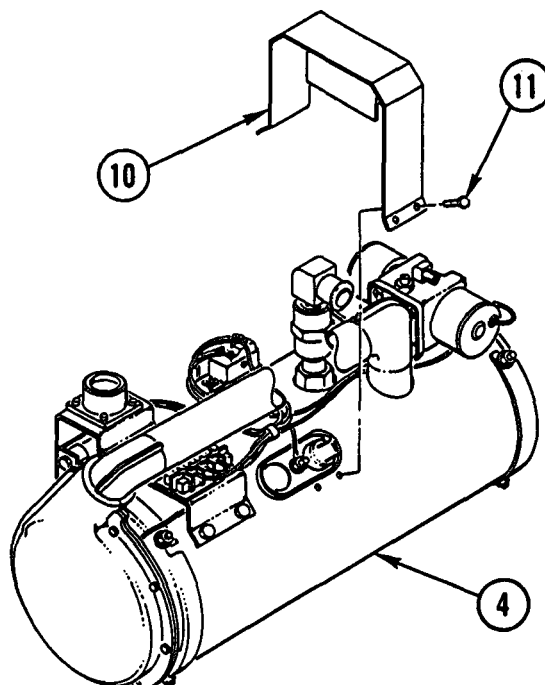
### INSTALLATION



1. INSTALL NEW PACKING (1), WASHER (2), AND THERMOSTATIC SWITCH (3) ON HEATER (4).
2. INSTALL COVER (5), NEW LOCK WASHER (6), AND NUT (7).



3. INSTALL THREE-WAY CONNECTOR (8) ON THERMOSTATIC SWITCH (3).
4. CONNECT THREE WIRES (9) TO THERMOSTATIC SWITCH (3).



5. INSTALL GUARD (10) AND FOUR SCREWS (11) ON HEATER (4).

**NOTE**

Follow-on Maintenance:  
Install heater in vehicle (TM 9-2320-363-20).

---

## FIXED RESISTOR REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

#### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

#### Materials/Parts:

Sleeve, Compression P/N 4208  
Nut, Kep  
Screw, Sems

#### Equipment Condition:

##### Reference

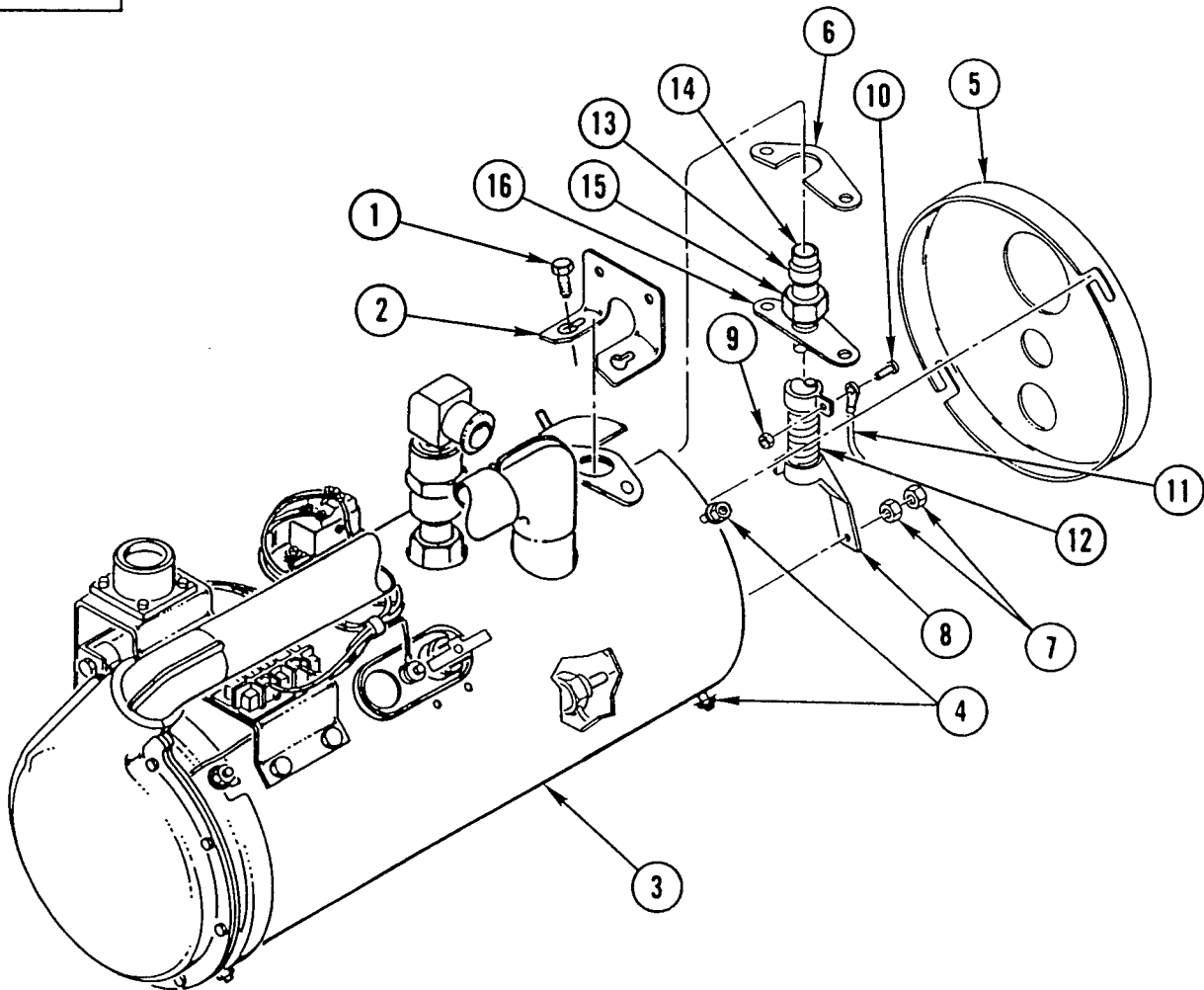
Page 25-14

##### Condition Description

Fuel Control Valve  
Removed

---

### REMOVAL



1. LOOSEN TWO SCREWS (1) AND REMOVE FUEL CONTROL VALVE BRACKET (2) FROM HEATER (3).
2. LOOSEN FOUR NUTS (4) AND REMOVE COVER (5) FROM HEATER (3).
3. REMOVE TWO SCREWS (1) AND TAPPING PLATE (6).
4. REMOVE TWO NUTS (7) AND FIXED RESISTOR ASSEMBLY (8) FROM HEATER (3).
5. REMOVE KEP NUT (9) AND SEMS SCREW (10) AND DISCONNECT WIRE (11) FROM FIXED RESISTOR (12). DISCARD KEP NUT AND SEMS SCREW.

**NOTE**

Perform steps 6 thru 8 only if fixed resistor fails multimeter check in inspection.

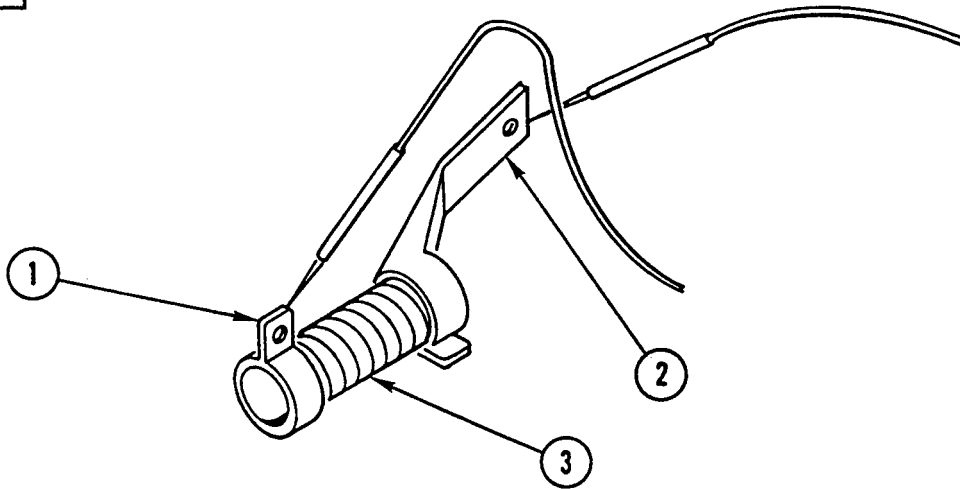
6. GRIND OR CUT COMPRESSION SLEEVE (13) OFF FUEL TUBE (14). DISCARD COMPRESSION SLEEVE.
7. REMOVE NUT (15) AND FLANGE (16) FROM FUEL TUBE (14).
8. REMOVE FUEL TUBE (14) FROM FIXED RESISTOR (12).

**CLEANING**

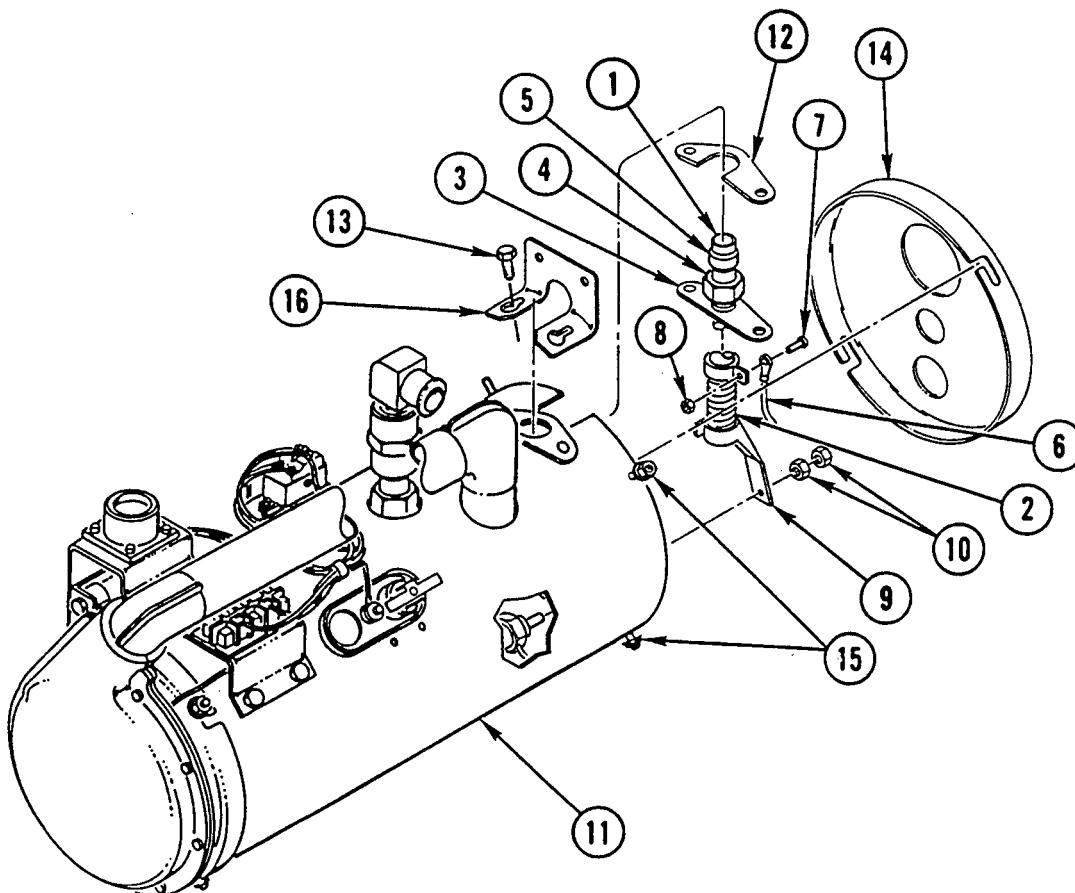
Use general cleaning methods to clean all parts (page 2-30).

## FIXED RESISTOR REPLACEMENT (CONT)

### INSPECTION



1. CHECK RESISTANCE BETWEEN TERMINAL END (1) AND STRAP END (2) OF FIXED RESISTOR (3).
2. MULTIMETER READING SHOULD BE 1.6-1.7 OHMS. IF READING IS NOT WITHIN RANGE, PERFORM REMOVAL STEPS 6 THRU 8 AND REPLACE FIXED RESISTOR (3).





## **INSTALLATION**

### **NOTE**

Perform steps 1 and 2 only if fixed resistor has been replaced.

1. INSTALL FUEL TUBE (1) IN FIXED RESISTOR (2).
2. INSTALL FLANGE (3), NUT (4), AND NEW COMPRESSION SLEEVE (5) ON FUEL TUBE (1).
3. CONNECT WIRE (6) AND INSTALL NEW SEMS SCREW (7) AND NEW KEP NUT (8) ON FIXED RESISTOR (2).
4. INSTALL FIXED RESISTOR ASSEMBLY (9) AND TWO NUTS (10) ON HEATER (11).
5. INSTALL TAPPING PLATE (12) AND TWO SCREWS (13). DO NOT TIGHTEN SCREWS.
6. INSTALL COVER (14) ON HEATER (11) AND TIGHTEN FOUR NUTS (15).
7. INSTALL FUEL CONTROL VALVE BRACKET (16) AND TIGHTEN TWO SCREWS (13).

### **NOTE**

Follow-on Maintenance:  
Install fuel control valve (page 25-14).

---

## BLOWER MOTOR ASSEMBLY REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### Tools and Special Equipment:

Shop Equipment, SC 4910-95-CL-A31  
Tool Kit, SC 5180-90-CL-N05

### Materials/Parts:

Screw, Sems

### References:

TM 9-2320-363-20

### Equipment Condition:

Reference	Condition Description
TM 9-2320-363-20	Heater Removed from Vehicle

---

### REMOVAL

1. REMOVE FOUR SCREWS (1) AND GUARD (2) FROM HEATER (3).
2. REMOVE NUT (4) AND COMBUSTION TUBE ASSEMBLY (5) FROM HEATER (3) AND BLOWER MOTOR ASSEMBLY (6).
3. REMOVE SEMS SCREW (7) AND DISCONNECT WIRE (8) FROM TERMINAL NO. 6 ON TERMINAL BOARD (9). DISCARD SEMS SCREW.

### NOTE

Scribe line on blower motor assembly and heater prior to removal to aid in installation.

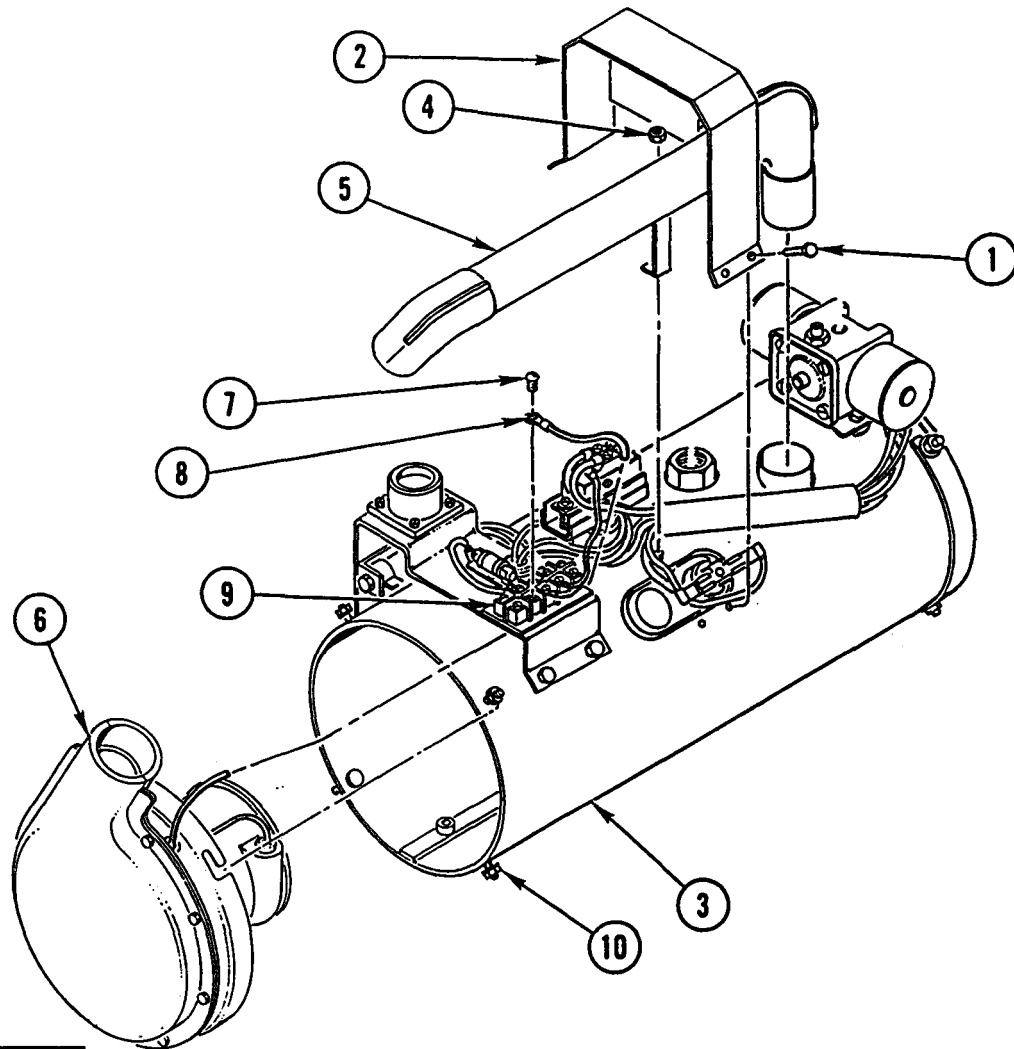
4. LOOSEN FOUR NUTS (10), TURN BLOWER MOTOR ASSEMBLY (6) TO LEFT, AND REMOVE BLOWER MOTOR ASSEMBLY (6) FROM HEATER (3).

### CLEANING

Use general methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.



**INSTALLATION**

1. INSTALL BLOWER MOTOR ASSEMBLY (6) IN HEATER (3), TURN BLOWER MOTOR ASSEMBLY (6) TO RIGHT, AND TIGHTEN FOUR NUTS (10).
2. CONNECT WIRE (8) TO TERMINAL NO. 6 ON TERMINAL BOARD (9) AND INSTALL NEW SEMS SCREW (7).
3. INSTALL COMBUSTION TUBE ASSEMBLY (5) AND NUT (4) ON HEATER (3) AND BLOWER MOTOR ASSEMBLY (6).
4. INSTALL GUARD (2) AND FOUR SCREWS (1) ON HEATER (3).

**NOTE**

Follow-on Maintenance:  
 Install heater in vehicle (TM 9-2320-363-20).

---

## THERMOSTAT REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Nut, Kep (2)

**Equipment Condition:**

**Reference**

Page 25-26

**Condition Description**

Blower Motor Assembly  
Removed

---

### REMOVAL

**NOTE**

Tag wires prior to disconnecting to aid in connecting.

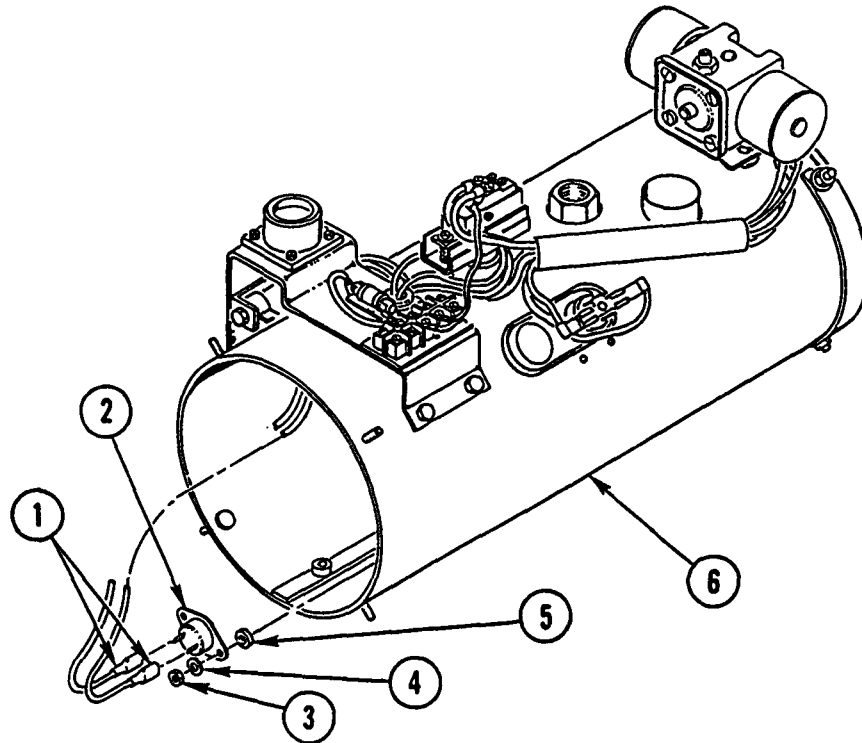
1. DISCONNECT TWO WIRES (1) FROM THERMOSTAT (2).
2. REMOVE TWO KEP NUTS (3), TWO WASHERS (4), THERMOSTAT (2), AND TWO SPACERS (5) FROM HEATER (6). DISCARD KEP NUTS.

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

### INSPECTION

Inspect all parts for wear or damage.



**INSTALLATION**

1. INSTALL TWO SPACERS (5), THERMOSTAT (2), TWO WASHERS (4), AND TWO NEW KEP NUTS (3) ON HEATER (6).
2. CONNECT TWO WIRES (1) ON THERMOSTAT (2).

**NOTE**

Follow-on Maintenance:  
Install blower motor assembly (page 25-26).

## FLAME DETECTOR SWITCH REPLACEMENT AND ADJUSTMENT

This task covers: a. Removal b. Cleaning c. Inspection d. Installation e. Adjustment

### INITIAL SETUP

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**Materials/Parts:**

Screw, Sems (5)

Sleeve, Compression

Varnish, Insulating

Appendix B, Item 64

**References:**

TM 9-2320-363-20

**Equipment Condition:**

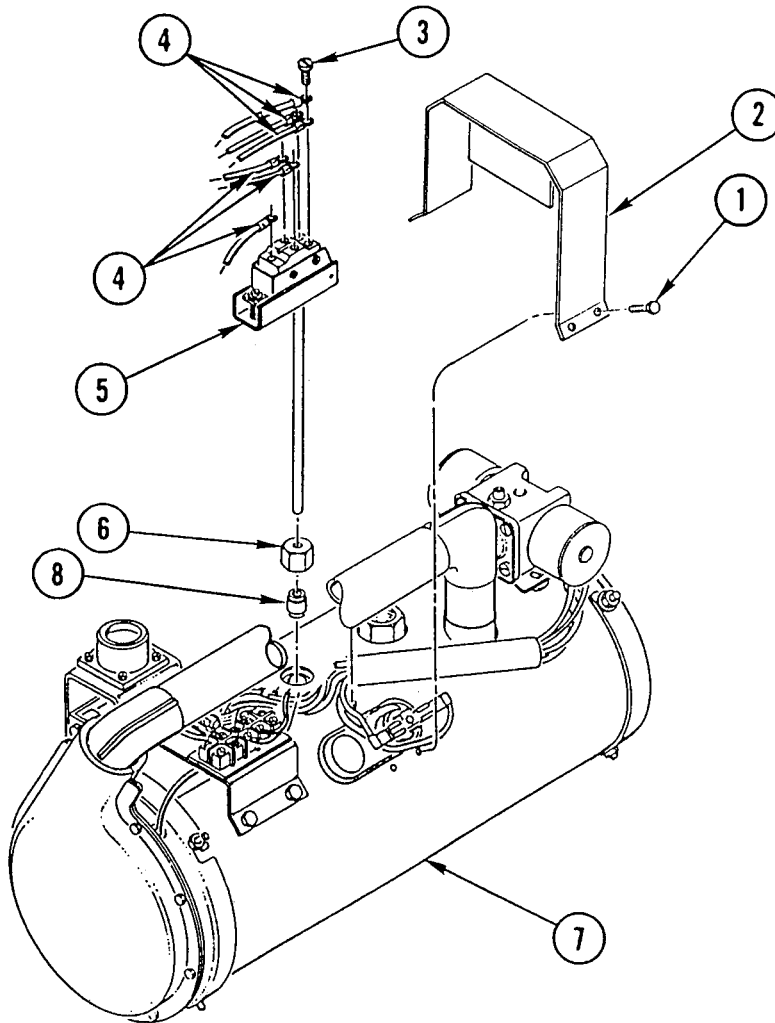
**Reference**

TM 9-2320-363-20

**Condition Description**

Heater Removed from Vehicle

### REMOVAL



1. REMOVE FOUR SCREWS (1) AND GUARD ASSEMBLY (2).

**NOTE**

Tag all wires prior to disconnecting to aid in connecting.

2. REMOVE FIVE SEMS SCREWS (3) AND DISCONNECT SIX WIRES (4) FROM FLAME DETECTOR SWITCH (5).

**CAUTION**

Flame detector switch contains a ceramic rod, and must not be bent during removal to prevent damage to equipment.

3. REMOVE COMPRESSION NUT (6) AND FLAME DETECTOR SWITCH (5) FROM HEATER (7).
4. REMOVE COMPRESSION SLEEVE (8) AND COMPRESSION NUT (6) FROM FLAME DETECTOR SWITCH (5). DISCARD COMPRESSION SLEEVE.

**CLEANING**

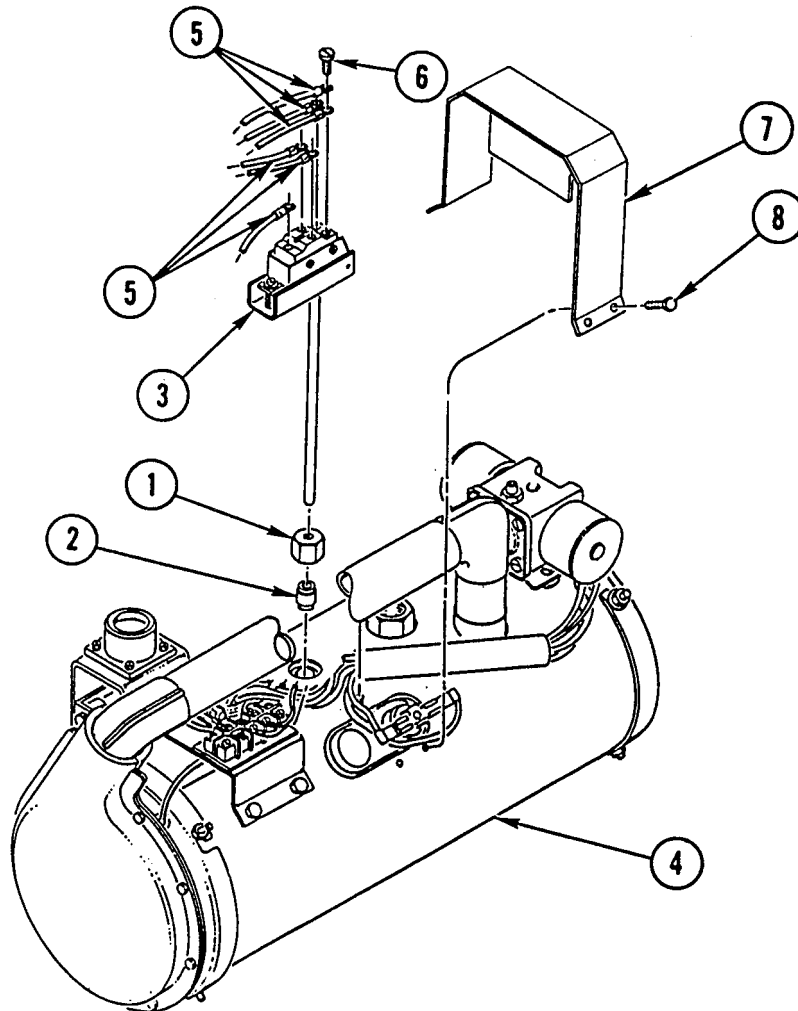
Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

## FLAME DETECTOR SWITCH REPLACEMENT AND ADJUSTMENT (CONT)

### INSTALLATION



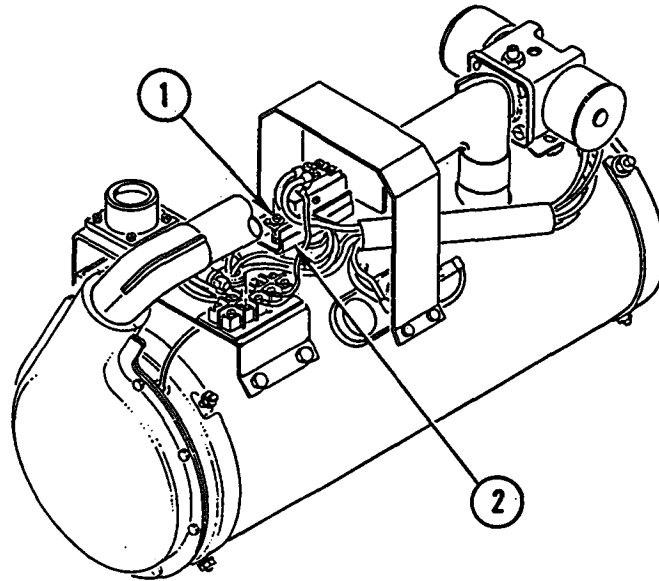
1. INSTALL COMPRESSION NUT (1) AND NEW COMPRESSION SLEEVE (2) ON FLAME DETECTOR SWITCH (3).

#### CAUTION

Flame detector switch contains a ceramic rod, and must not be bent during installation to prevent damage to equipment.

2. INSTALL FLAME DETECTOR SWITCH (3) AND COMPRESSION NUT (1) ON HEATER (4).
3. CONNECT SIX WIRES (5) AND INSTALL FIVE NEW SEMS SCREWS (6) ON FLAME DETECTOR SWITCH (3).
4. INSTALL GUARD ASSEMBLY (7) AND FOUR SCREWS (8).



**ADJUSTMENT**

1. BACK OFF ADJUSTING SCREW (1) BY ROTATING TO LEFT SEVERAL TURNS.
2. ROTATE ADJUSTING SCREW (1) TO RIGHT UNTIL FLAME DETECTOR SWITCH (2) CLICKS.
3. ROTATE ADJUSTING SCREW (1) EXACTLY 3/4-TURN MORE TO RIGHT.
4. SEAL ADJUSTING SCREW (1) BY COATING WITH INSULATING VARNISH.

**NOTE**

Follow-on Maintenance:  
Install heater in vehicle (TM 9-2320-363-20).

---

## WIRING HARNESS REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N05

**References:**

TM 9-2320-363-20

**Equipment Condition:**

**Reference**

TM 9-2320-363-20

**Condition Description**

Batteries Disconnected

---

### REMOVAL

**NOTE**

- Wiring harness and leads are secured in place by wire ties, cushion clamps, and screw terminals.
- Only remove hardware securing harness or lead to be removed.

DISCONNECT AND REMOVE WIRING HARNESS USING ILLUSTRATION AND TABLE AS A GUIDE.

### CLEANING

Use general cleaning methods to clean all parts (page 2-30).

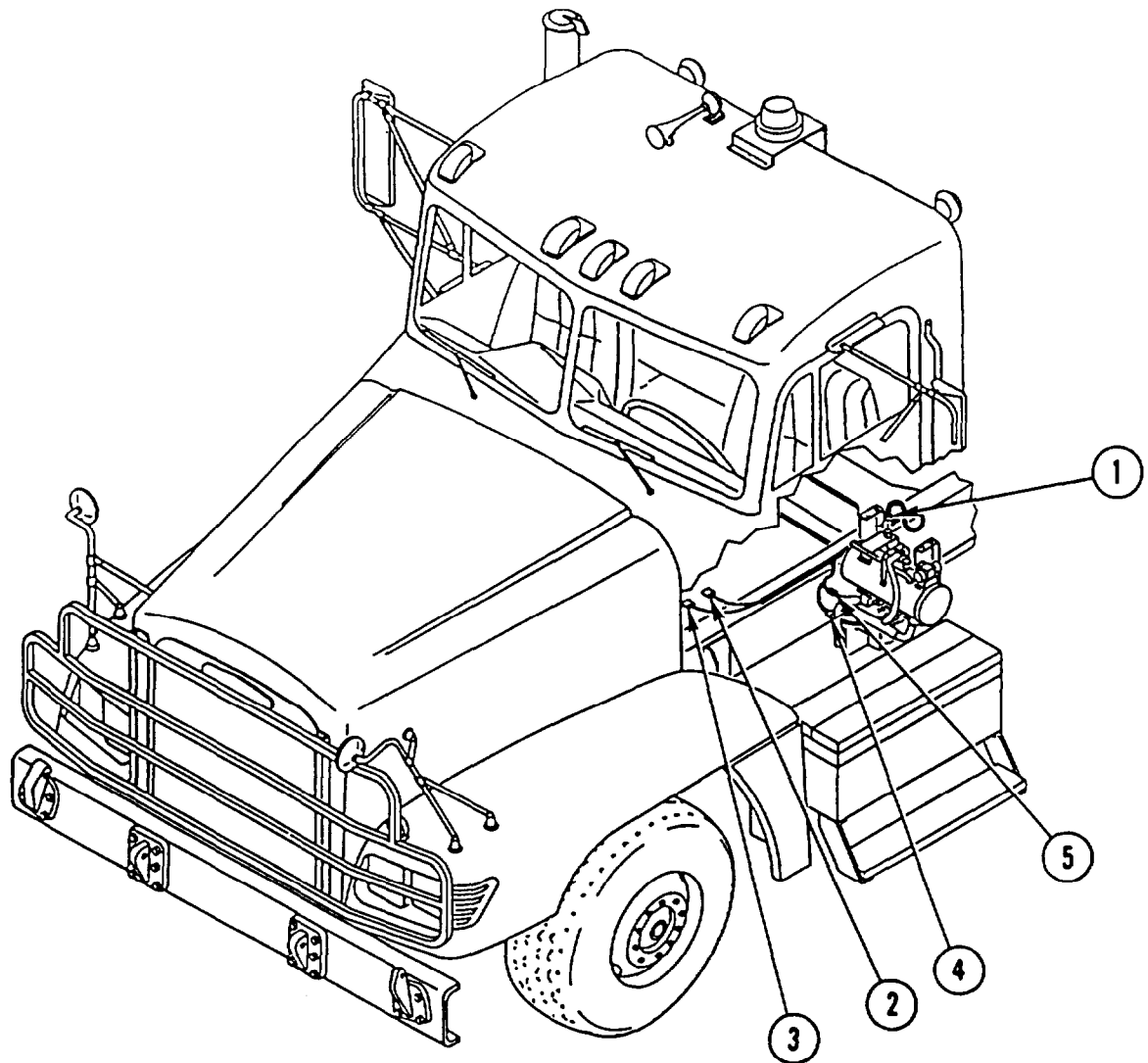
### INSPECTION

Inspect all parts for wear or damage.

**NOTE**

- Wiring harness and leads are secured in place by wire ties, cushion clamps, and screw terminals.
- Make sure harness is secure and all hardware is tight.

INSTALL AND CONNECT WIRING HARNESS USING ILLUSTRATION AND TABLE AS A GUIDE.



**TABLE**

- 1 5 Pin Connector
- 2 4-Pin Male Sealed Connector
- 3 3-Pin Male Sealed Connector
- 4 2-Pin Male Sealed Connector
- 5 1-Pin Male Sealed Connector

**NOTE**

Follow-on Maintenance:  
Connect batteries (TM 9-2320-363-20).

## Section III. VEHICLE HEATER/AIR CONDITIONER UNIT REPAIR

### **OVERVIEW**

This section illustrates and describes procedures for maintenance of the heater/air conditioner unit. A list of tasks contained in this section is shown below.

	Page
Vehicle Heater/Air Conditioner Unit Replacement (All Except M915A2 and M916A1). . . . .	25-37
Air Conditioner Evaporator Coil Replacement (All Except M915A2 and M916A1). . . . .	25-47
Air Conditioner Expansion Valve Replacement (All Except M915A2 and M916A1). . . . .	25-52

---

## VEHICLE HEATER/AIR CONDITIONER UNIT REPLACEMENT

---

This task covers:      a. Removal      b. Installation

---

### **INITIAL SETUP**

#### **Applicable Configuration:**

All except M915A2 and M916A1

#### **Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC 4910-95-CL-A31  
 Leak Detector, 16500  
 Recovery and Recycling System, 34400

#### **Personnel Required: (2)**

#### **Materials/Parts:**

Packing, Preformed	P/N 2-011C944-70
Packing, Preformed	P/N 2-015C944-70
Receiver-Drier	P/N 088335-00
Cap and Plug Set	Appendix B, Item 7.1
Loctite	Appendix B, Item 33
Oil, Refrigerant	Appendix B, Item 43.1
Rag, Wiping	Appendix B, Item 48
Sealant, RTV	Appendix B, Item 52
Tags, Identification	Appendix B, Item 55
Tape, Insulation	Appendix B, Item 57.1

#### **References:**

TM 9-2320-363-10  
 TM 9-2320-363-20

#### **Equipment Condition:**

<b>Reference</b>	<b>Condition Description</b>
TM 9-2320-363-20	Batteries Disconnected
TM 9-2320-363-20	Cooling System Drained
TM 9-2320-363-20	Air System Drained
Page 11.1-2	Refrigerant Recovered

#### **General Safety Instructions:**

### **WARNING**

- Use care to prevent refrigerant from touching your skin or eyes because liquid refrigerant when exposed to air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness could result if you come in contact with liquid refrigerant.
- Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in fire or explosion, which could cause personal injury.
- Use extreme caution when handling heavy parts. Failure to follow this warning may cause serious injury.

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## VEHICLE HEATER/AIR CONDITIONER UNIT REPLACEMENT (CONT)

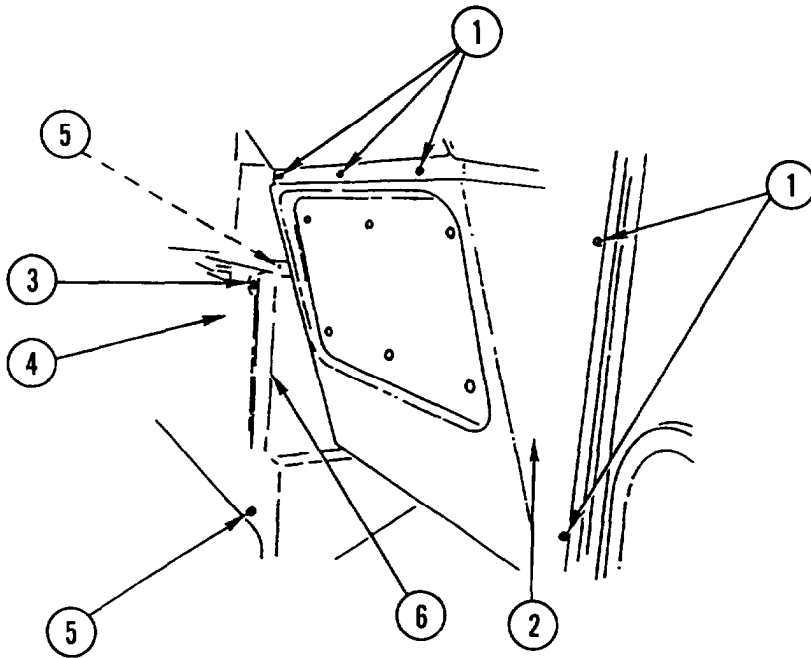
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### REMOVAL

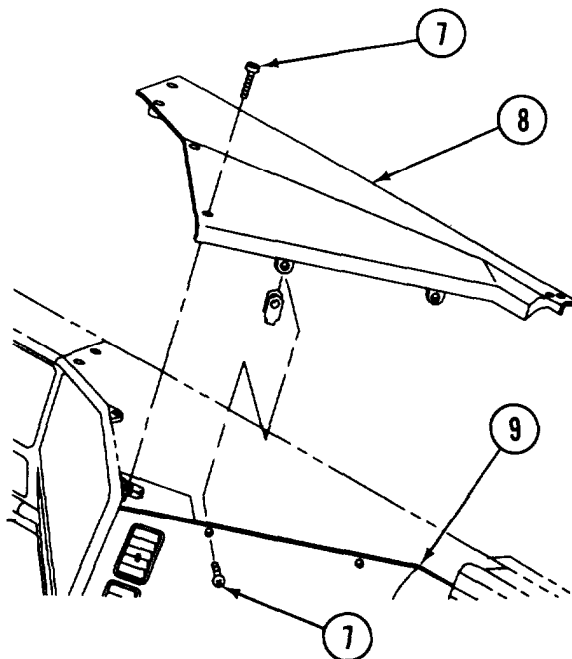
#### NOTE

Tag all lines and wires prior to removal to aid in installation

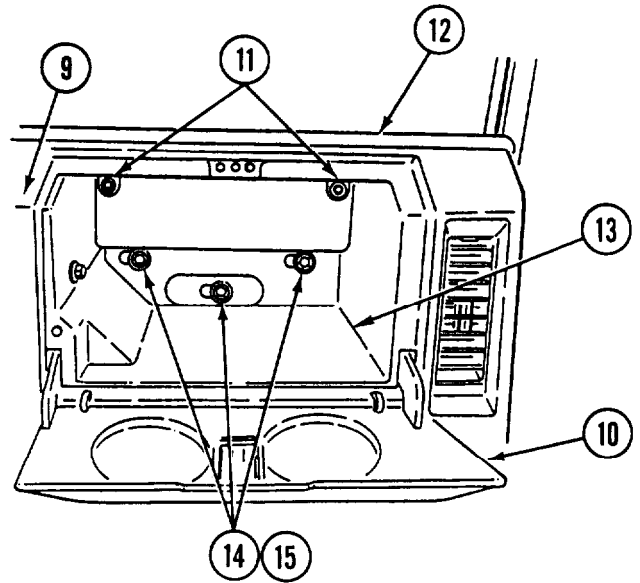
1. REMOVE NINE SCREWS (1) AND COVER (2).
2. REMOVE THREE SCREWS (3) AND COVER (4).
3. REMOVE TWO SCREWS (5) AND COVER (6).



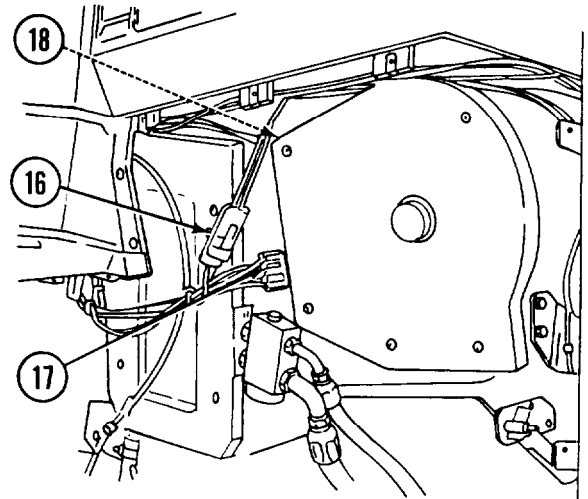
4. REMOVE SEVEN SCREWS (7) AND COVER (8) FROM DASH (9).



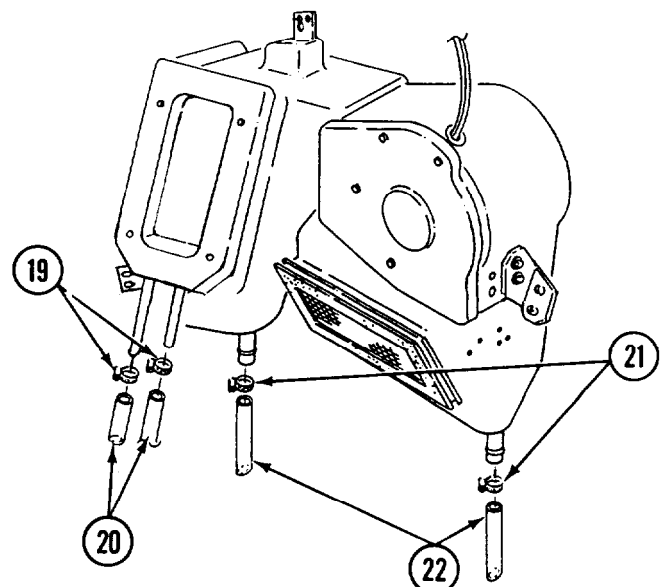
5. OPEN GLOVE BOX DOOR (10) AND REMOVE TWO SCREWS (11) AND TOP PANEL (12) FROM COMPARTMENT (13).
6. REMOVE THREE NUTS (14), THREE SPRING WASHERS (15) AND COMPARTMENT (13) FROM DASH (9).
7. DISCONNECT TWO FLEX HOSES FROM DUCTS BEHIND GLOVE BOX.
8. DISCONNECT BLUE AIR LINE FROM AIR CYLINDER BEHIND GLOVE BOX.



9. DISCONNECT CONNECTORS FOR BLOWER MOTOR (16), RESISTOR BLOCK (17), AND THERMOSTATIC SWITCH (18).



10. PLACE RAGS ON CAB FLOOR, LOOSEN TWO HOSE CLAMPS (19). AND REMOVE HEATER CORE HOSES (20).
11. LOOSEN TWO HOSE CLAMPS (21) AND REMOVE DRAIN TUBES (22).

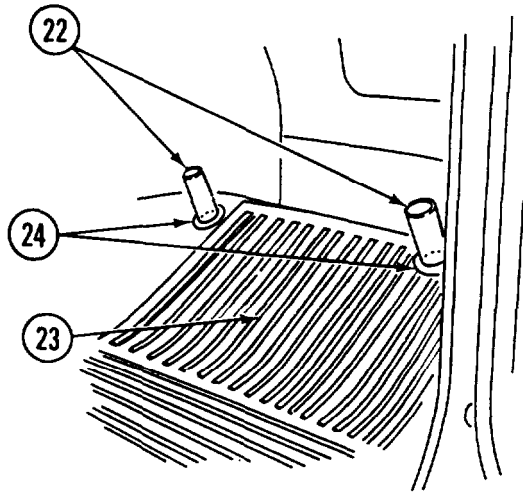


## VEHICLE HEATER/AIR CONDITIONER UNIT REPLACEMENT (CONT)

12. ON CAB FLOOR (23) REMOVE SEALANT (24) FROM AROUND DRAIN TUBES (22) AND REMOVE DRAIN TUBES.

### WARNING

Use care to prevent refrigerant from touching your skin or eyes, because liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness could result if you come in contact with liquid refrigerant.



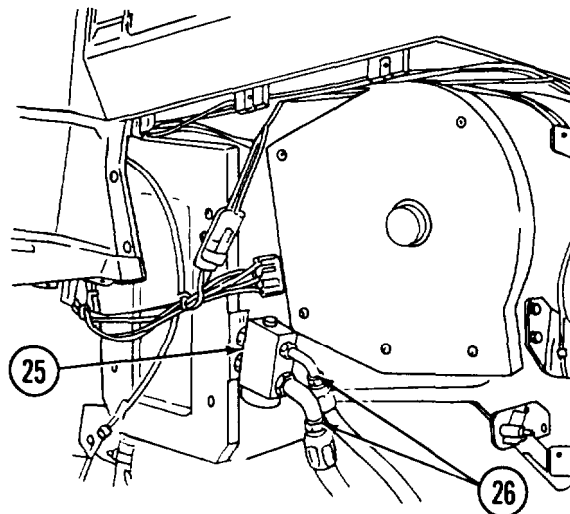
### CAUTION

Water and dirt can damage the refrigerant system. Five minutes of not being capped is the limit for any hose or component. Do not blow shop air through the refrigerant hoses; shop air is wet (humid).

### NOTE

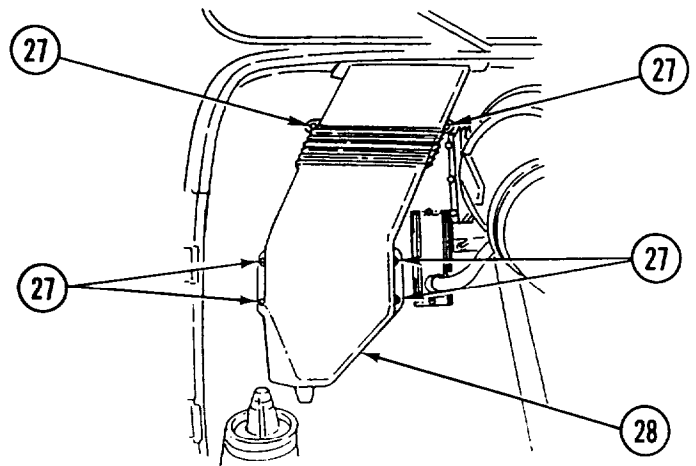
Do not disconnect or connect refrigerant fittings using only one wrench. Hold one fitting in place using a wrench, and turn the other fitting with a second wrench.

13. REMOVE INSULATING TAPE FROM EXPANSION VALVE (25). DISCONNECT TWO REFRIGERANT LINES (26) FROM EXPANSION VALVE.
14. CAP EXPANSION VALVE (25) AND REFRIGERANT LINES (26).

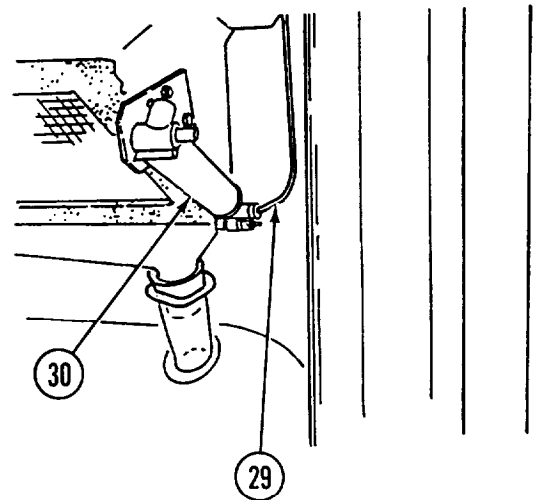




15. REMOVE SIX SCREWS (27) AND FRESH AIR DUCT ASSEMBLY (28) ON ENGINE SIDE OF CAB FIREWALL.
16. REMOVE SEALANT FROM DUCT AND PUSH RUBBER BOOT INSIDE CAB.



17. DISCONNECT AIR LINE (29) FROM AIR CYLINDER (30) BY PUSHING IN ON COVER RING, THEN PULLING OUT ON AIR LINE.

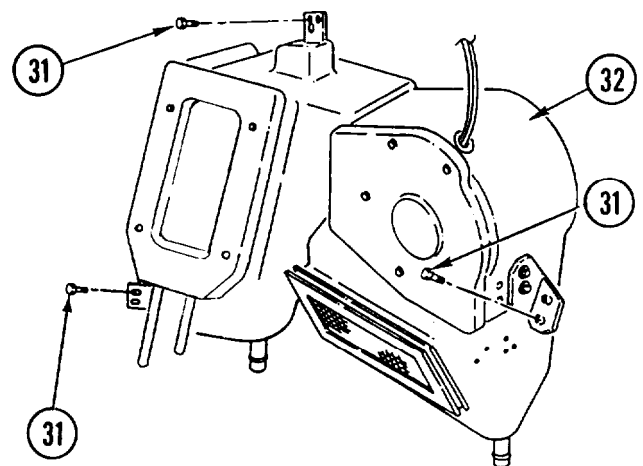


18. REMOVE SIX SCREWS (31) HOLDING HEATER/AIR CONDITIONER UNIT (32) IN PLACE.

**WARNING**

Use extreme caution when handling heavy parts. Failure to follow this warning may cause serious injury.

19. LIFT HEATER/AIR CONDITIONER UNIT (32) FROM VEHICLE.



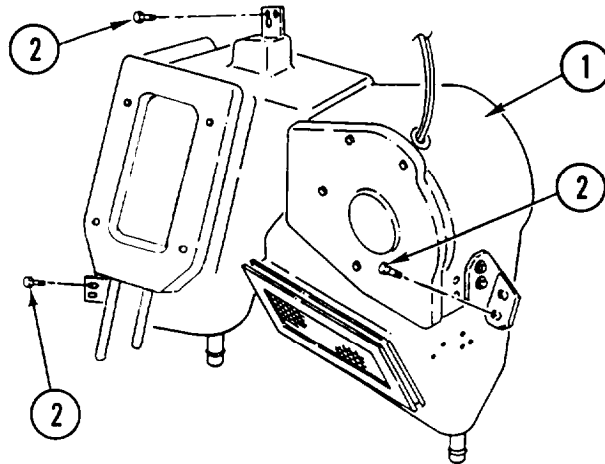
VEHICLE HEATER/AIR CONDITIONER UNIT REPLACEMENT (CONT)

INSTALLATION

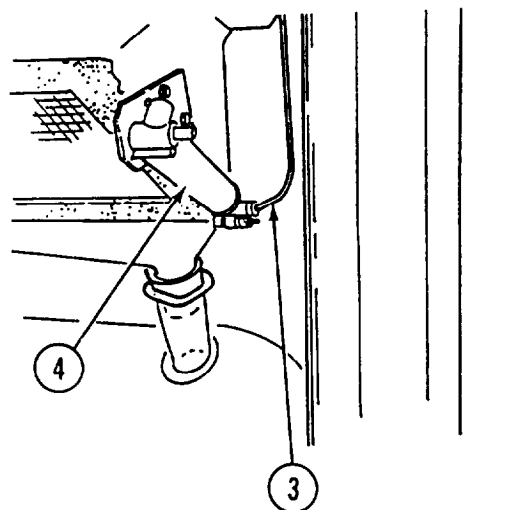
**WARNING**

Use extreme caution when handling heavy parts. Failure to follow this warning may cause serious injury.

1. LIFT HEATER/AIR CONDITIONER UNIT (1) INTO VEHICLE.
2. SECURE HEATER/AIR CONDITIONER (1) WITH SIX SCREWS (2). TORQUE SCREWS TO 48 LB-FT (65 N.m).

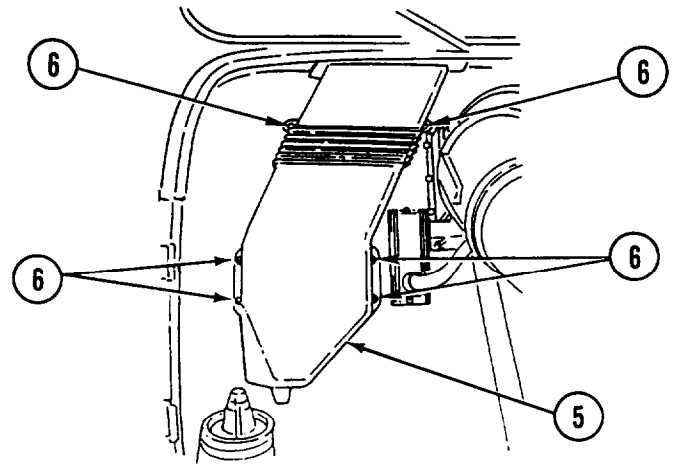


3. CONNECT AIR LINE (3) TO AIR CYLINDER (4) BY PUSHING AIR LINE INTO FITTING AS FAR AS IT WILL GO, THEN GENTLY PULLING BACK ON AIR LINE TO LOCK IT IN PLACE.

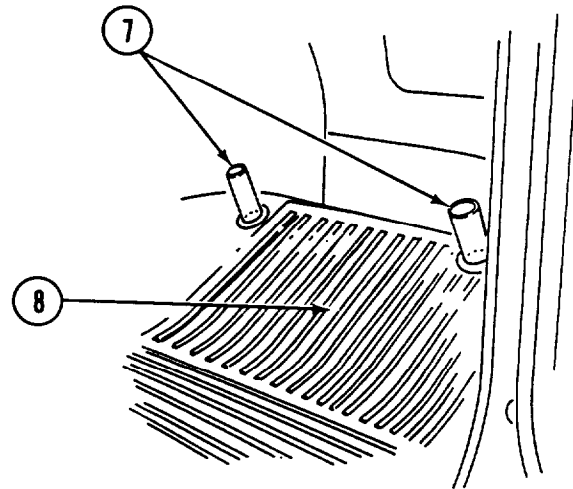


4. PULL RUBBER BOOT THROUGH FIREWALL FROM ENGINE SIDE.

5. ON ENGINE SIDE OF FIREWALL, APPLY SEALANT TO FRESH AIR DUCT ASSEMBLY (5) AND SECURE WITH SIX SCREWS (6).

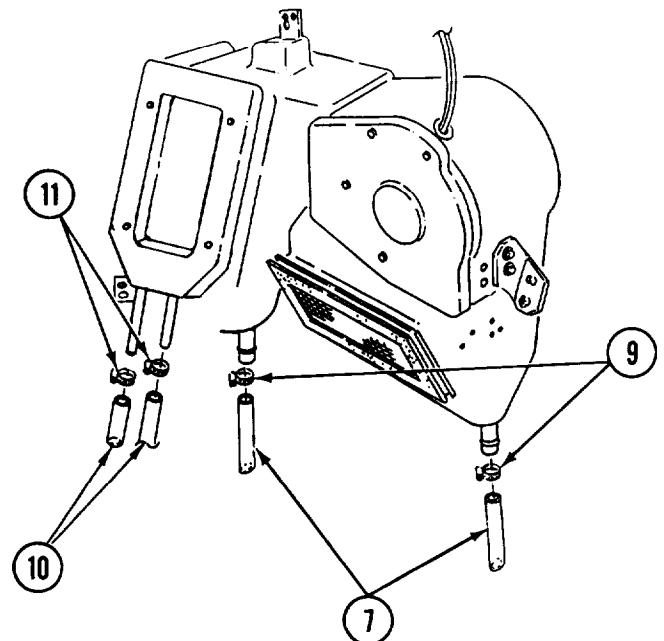


6. SLIDE DRAIN TUBES (7) THROUGH OPENINGS IN CAB FLOOR (8).



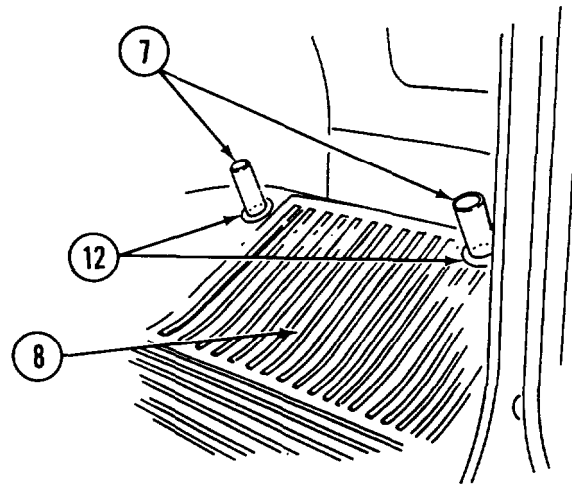
7. CONNECT DRAIN TUBES (7) AND SECURE WITH TWO HOSE CLAMPS (9).

8. INSTALL HEATER CORE HOSES (10) AND TIGHTEN TWO HOSE CLAMPS (11).



**VEHICLE HEATER/AIR CONDITIONER UNIT REPLACEMENT (CONT)**

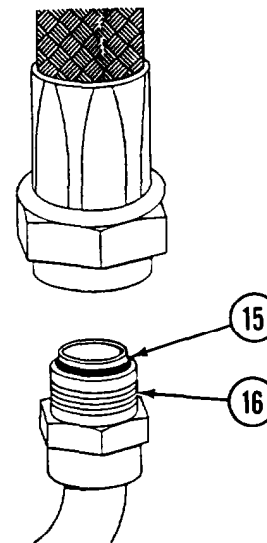
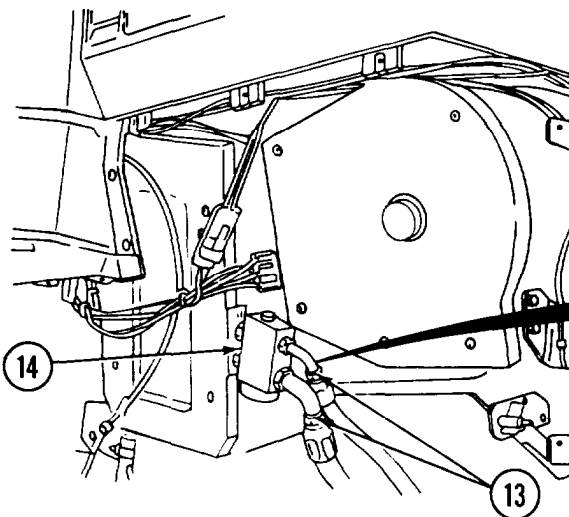
9. APPLY SEALANT (12) AROUND DRAIN TUBES (7) ON CAB FLOOR (8).



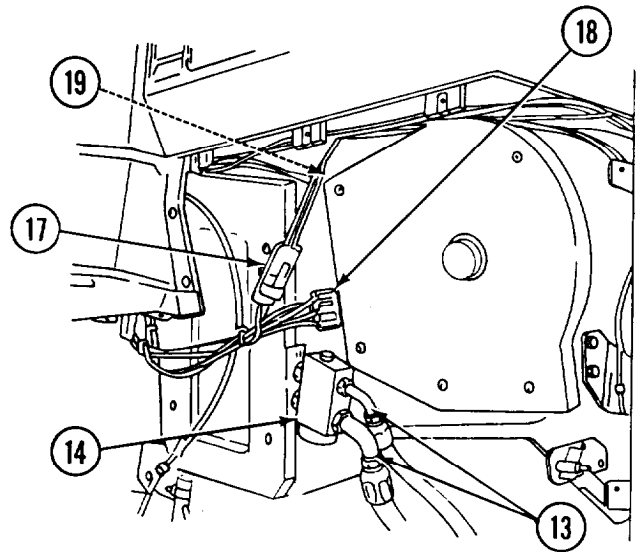
**WARNING**

Use care to prevent refrigerant from touching your skin or eyes, because liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness could result if you come in contact with liquid refrigerant.

10. REMOVE CAPS FROM REFRIGERANT LINES (13) AND EXPANSION VALVE (14).
11. INSTALL NEW PREFORMED PACKINGS (15) AND LUBRICATE THEM WITH REFRIGERANT OIL.
12. APPLY LOCTITE TO MALE FITTING THREADS (16) AND CONNECT TWO REFRIGERANT LINES (13) TO EXPANSION VALVE (14). REMOVE TAGS.
13. TORQUE CONNECTIONS (APPENDIX D, TABLE D-3).



14. APPLY INSULATING TAPE TO REFRIGERANT LINES (13) AND EXPANSION VALVE (14).
15. CONNECT CONNECTORS FOR BLOWER MOTOR (17), RESISTOR BLOCK (18) AND THERMOSTATIC SWITCH (19).
16. CONNECT BLUE AIR LINE TO AIR CYLINDER BEHIND GLOVE BOX.
17. CONNECT TWO FLEX HOSES TO DUCTS BEHIND GLOVE BOX.



**NOTE**

Any time air conditioning system refrigerant is evacuated, replace receiver-drier.

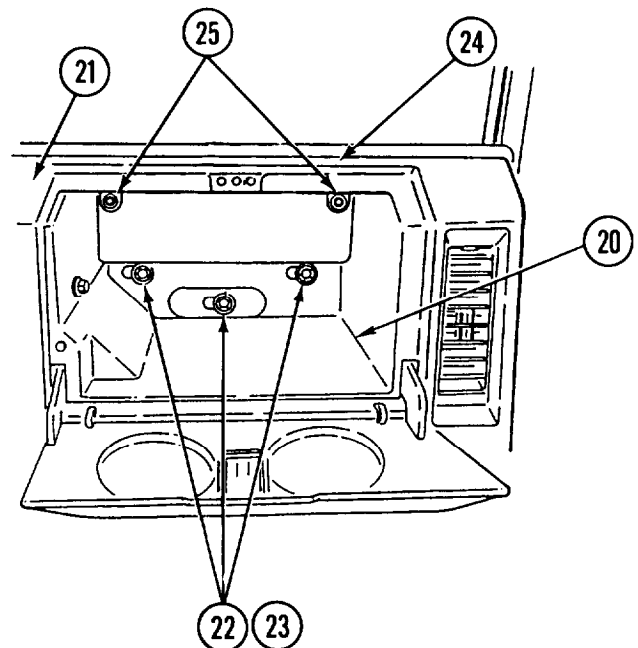
18. REPLACE RECEIVER-DRIER (page 11.1-14).

**WARNING**

Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in fire or explosion, which could cause personal injury.

19. CHARGE SYSTEM WITH REFRIGERANT (page 11.1-2). LEAK TEST SYSTEM (TM 9-2320-363-20).
20. ADD REFRIGERANT OIL TO COMPRESSOR TO REPLACE THAT WHICH WAS LOST WHEN SYSTEM WAS DISCHARGED (page 11.1-23).
21. INSTALL COMPARTMENT (20) INTO DASH (21) AND SECURE WITH THREE NUTS (22) AND THREE SPRING WASHERS (23).

22. INSTALL TOP PANEL (24) TO COMPARTMENT (20) AND SECURE WITH TWO SCREWS (25).

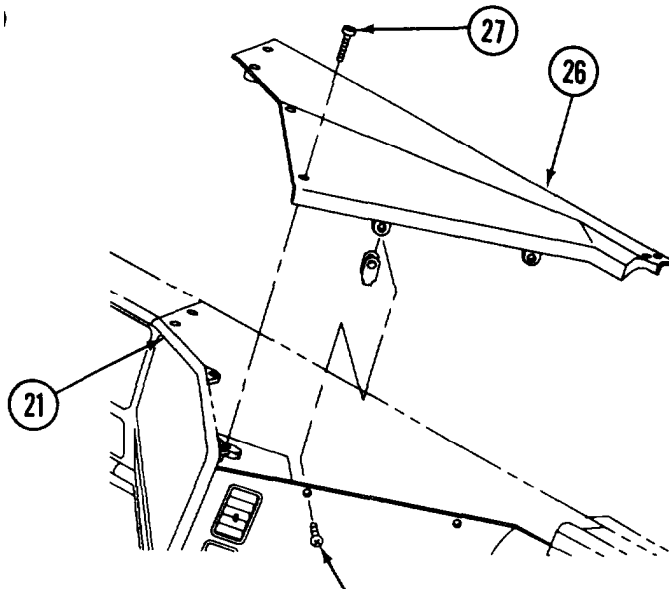


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**VEHICLE HEATER/AIR CONDITIONER UNIT REPLACEMENT (CONT)**

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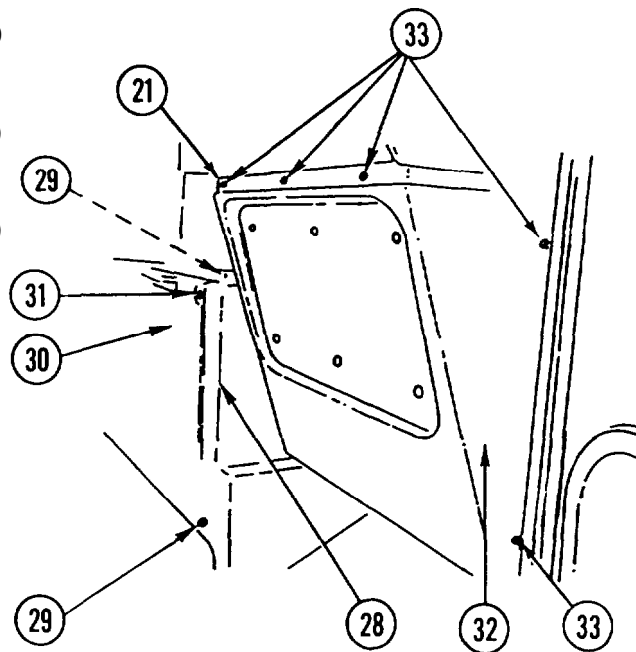
23. POSITION COVER (26) AND SECURE WITH SEVEN SCREWS (27).



24. POSITION COVER (28) ON DASH (21) AND SECURE WITH TWO SCREWS (29).

25. POSITION COVER (30) ON DASH (21) AND SECURE WITH THREE SCREWS (31).

26. POSITION COVER (32) ON DASH (21) AND SECURE WITH NINE SCREWS (33).



**NOTE**

Follow-on Maintenance:

- Connect batteries (TM 9-2320-363-20).
- Fill cooling system (TM 9-2320-363-20).
- Check operation of heater/air conditioner (TM 9-2320-363-10).

**AIR CONDITIONER EVAPORATOR COIL REPLACEMENT**

This task covers: a. Removal b. Installation

**INITIAL SETUP**

**Applicable Configuration:**

All except M915A2 and M916A1

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC 4910-95-CL-A31  
 Gage, Oil Level, 99-431  
 Recovery and Recycling System, 34400  
 Leak Detector, 16500

**Materials/Parts:**

Packing, Preformed	P/N 2-011C944-70
Packing, Preformed	P/N 2-015C944-70
Receiver-Drier	P/N 088335-00
Cap and Plug Set	Appendix B, Item 7.1
Loctite	Appendix B, Item 33
Oil, Refrigerant	Appendix B, Item 43.1
Refrigerant, R-134a	Appendix B, Item 48.1
Tags, Identification	Appendix B, Item 55
Tape, Insulation	Appendix B, Item 57.1

**References:**

TM 9-2320-363-10  
 TM 9-2320-363-20

**Equipment Condition:**

Reference	Condition Description
TM 9-2320-363-20	Batteries Disconnected
Page 11.1-2	Refrigerant Recovered

**General Safety Instructions:**

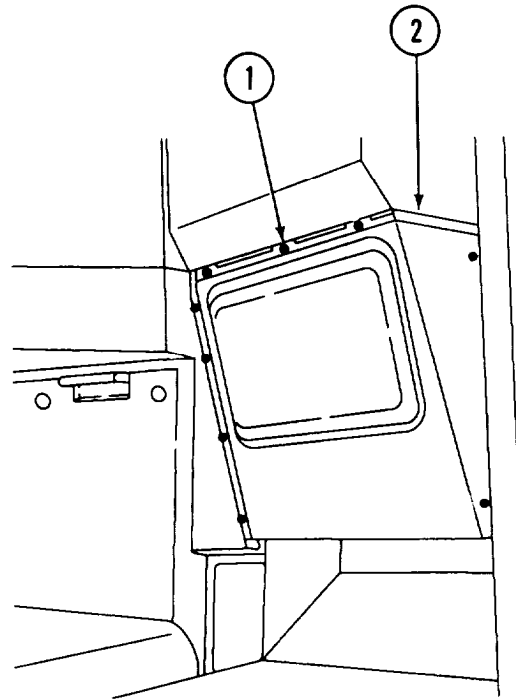
**WARNING**

- Use care to prevent refrigerant from touching your skin or eyes, because liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness could result if you come in contact with liquid refrigerant.
- Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in a fire or explosion, which could cause personal injury.
- Failure to wear protective gloves could result in serious skin cuts due to sharp edges on evaporator coil fins.

**AIR CONDITIONER EVAPORATOR COIL REPLACEMENT (CONT)**

**REMOVAL**

1. REMOVE THE DASH SKIRT PANELS.
  - a. REMOVE NINE SCREWS (1) AND COVER (2) UNDER GLOVE BOX.
  - b. REMOVE THE FIVE FASTENERS THAT ATTACH THE TWO PANELS ON THE RIGHT SIDE OF THE ELECTRICAL ACCESS PANEL, THEN REMOVE THE PANELS.
  - c. REMOVE THE THREE FASTENERS THAT ATTACH THE PANEL ON THE LEFT SIDE OF THE ELECTRICAL ACCESS PANEL, THEN REMOVE THE PANEL.



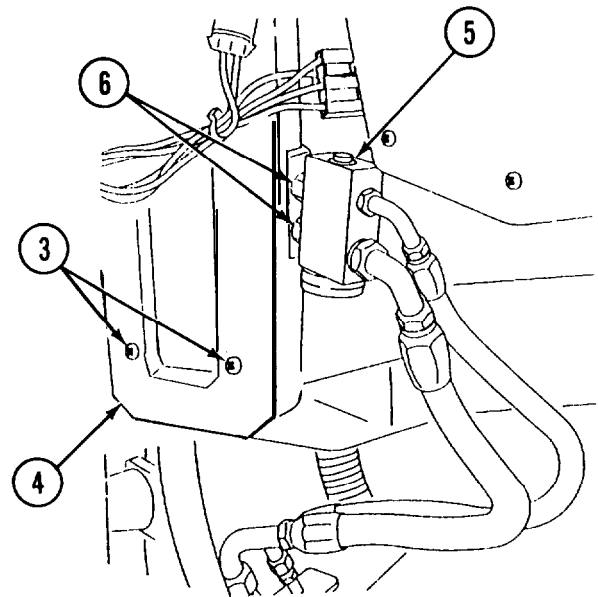
- d. REMOVE THREE SCREWS AND ELECTRICAL ACCESS PANEL. REMOVE THE SIX FASTENERS THAT ATTACH THE ELECTRICAL ACCESS PANEL SUPPORT BRACKET TO THE CAB TUNNEL, THEN REMOVE THE BRACKET.
2. REMOVE THESE ADDITIONAL DASH PANELS.
  - a. REMOVE THREE CAPSCREWS UNDER THE CENTER DASH CONSOLE (ABOVE THE ELECTRICAL ACCESS PANEL).
  - b. REMOVE THE THREE SCREWS THAT ATTACH THE KICK PANEL LOCATED JUST TO THE RIGHT OF THE ACCELERATOR PEDAL. REMOVE THE PANEL.
  - c. MOVE THE WIRING AS NEEDED TO ACCESS AND REMOVE THE SCREW THAT SECURES THE UNDER DASH COVER.
  - d. REMOVE THE TWO BOTTOM SCREWS THAT ATTACH THE HEATER AND AIR CONDITIONER CONTROL PANEL TO THE DASH.
  - e. MOVE THE UNDER DASH PANEL TO ALLOW ACCESS TO THE HEATER CORE COVER.
  - f. REMOVE TWO SCREWS INSIDE THE GLOVE BOX AND REMOVE THE TOP PANEL FROM THE ASSEMBLY. REMOVE THE THREE NUTS AND SPRING WASHERS INSIDE THE BOX. DISCONNECT THE TWO FLEX HOSES FROM THE DUCTS AT THE BACK OF THE GLOVE BOX.
  - g. DISCONNECT THE BLUE AIR LINE FROM THE AIR CYLINDER AT THE BACK OF THE GLOVE BOX. REMOVE THE GLOVE BOX.



3. REMOVE FOUR SCREWS (3) FROM THE HEATER/AIR CONDITIONER CORE COVER (4). REMOVE THE COVER.
4. REMOVE THE INSULATING TAPE FROM AROUND THE EXPANSION VALVE (5).

**CAUTION**

Water and dirt can damage the refrigerant system. Five minutes of not being capped is the limit for any hose or component. Do not blow shop air through the refrigerant hoses, shop air is wet (humid).



**NOTE**

Do not disconnect or connect refrigerant fittings using only one wrench. Hold one fitting in place using a wrench, and turn the other fitting with a second wrench.

5. TAG AND DISCONNECT THE EVAPORATOR COIL LINES (6) FROM THE EXPANSION VALVE (5). INSTALL PLUGS IN THE LINES AND THE EXPANSION VALVE PORTS. DISCARD PREFORMED PACKINGS.
6. REMOVE THE THERMOSTATIC SWITCH AND SENSOR TUBE FROM THE EVAPORATOR COIL (TM 9-2320-363-20).

**WARNING**

Failure to wear protective gloves could result in serious skin cuts due to sharp edges on evaporator coil fins.

7. WEARING PROTECTIVE GLOVES, SLIDE THE EVAPORATOR COIL UP AND OUT OF THE HOUSING.

**INSTALLATION**

1. WEARING PROTECTIVE GLOVES, SLIDE THE EVAPORATOR COIL INTO THE HOUSING.
2. INSERT THE THERMOSTATIC SWITCH AND SENSOR TUBE. THE TIP OF THE SENSOR TUBE MUST BE IN DIRECT CONTACT WITH A FIN AND BE INSERTED AT LEAST 4 INCHES (10 cm) INTO THE EVAPORATOR (TM 9-2320-363-20).
3. REMOVE THE PLUGS FROM THE EVAPORATOR COIL LINES (6) AND THE EXPANSION VALVE (5). INSTALL NEW PREFORMED PACKINGS WITH REFRIGERANT OIL APPLIED TO THE PACKINGS AND LOCTITE APPLIED TO THE THREADS OF MALE FITTINGS. CONNECT THE LINES TO THE EXPANSION VALVE. USING A WRENCH TIGHTEN THE EVAPORATOR COIL LINES 18 LB-FT (24 N.m). TIGHTEN THE LARGE HOSE TO THE COMPRESSOR 24 LB-FT (33 N.m); AND TIGHTEN THE SMALL HOSE FROM THE RECEIVER-DRIER 12 LB-FT (16 N.m).

**AIR CONDITIONER EVAPORATOR COIL REPLACEMENT (CONT)**

**NOTE**

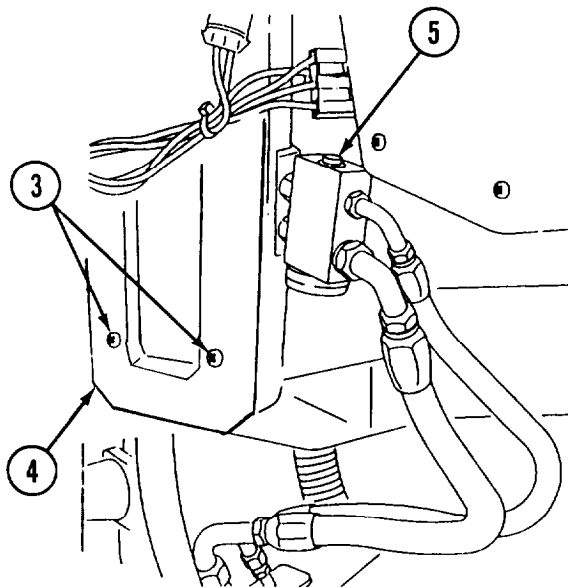
Any time air conditioning system refrigerant is evacuated, replace receiver-drier

4. REPLACE RECEIVER-DRIER (page 11.1-14).

5. EVACUATE AND CHARGE THE SYSTEM WITH REFRIGERANT (page 11.1-2). LEAK TEST THE SYSTEM (TM 9-2320-363-20). BE SURE TO ADD REFRIGERANT OIL TO THE COMPRESSOR TO REPLACE THAT WHICH WAS LOST WHEN THE SYSTEM WAS DISCHARGED (page 11.1-23).

6. WIPE THE EXPANSION VALVE (5) AND REFRIGERANT LINE CONNECTIONS CLEAN, AND WRAP THEM WITH INSULATING TAPE.

7. INSTALL THE HEATER CORE COVER (4), AND TIGHTEN FOUR SCREWS (3) SECURELY.



8. INSTALL THE DASH SKIRT PANELS.

- a. POSITION THE ELECTRICAL ACCESS PANEL SUPPORT BRACKET ON THE CAB TUNNEL, THEN INSTALL THE SIX FASTENERS.
- b. POSITION THE TWO PANELS ON THE RIGHT SIDE OF THE ELECTRICAL ACCESS PANEL, THEN INSTALL THE FIVE FASTENERS THAT ATTACH THE PANELS.
- c. POSITION THE PANEL ON THE LEFT SIDE OF THE ELECTRICAL ACCESS PANEL, THEN INSTALL THE THREE FASTENERS THAT ATTACH THE PANEL.
- d. POSITION THE ELECTRICAL ACCESS PANEL, THEN INSTALL THREE SCREWS.

9. INSTALL THESE ADDITIONAL DASH PANELS.

- a. CONNECT THE FLEX HOSES TO THE DUCTS AT THE BACK OF THE GLOVE BOX ASSEMBLY. MAKE SURE THAT THE HOSES ARE NOT TWISTED. CONNECT THE BLUE AIR LINE TO THE AIR CYLINDER AT THE BACK OF THE GLOVE BOX. INSTALL THE GLOVE BOX ON THE DASH. TIGHTEN THE FASTENERS UNTIL SNUG. INSTALL THE TOP COVER ON THE GLOVE BOX ASSEMBLY.
- b. INSTALL THE DASH SKIRT PANEL ON THE RIGHT SIDE OF THE CAB (BELOW THE GLOVE BOX).
- c. INSTALL THE TWO BOTTOM SCREWS THAT ATTACH THE HEATER AND AIR CONDITIONER CONTROL PANEL TO THE DASH.

- d. MOVE THE WIRING AS NEEDED TO INSTALL THE SCREW THAT SECURES THE UNDER DASH COVER. POSITION THE KICK PANEL LOCATED JUST TO THE RIGHT OF THE ACCELERATOR PEDAL, THEN INSTALL AND TIGHTEN THE THREE SCREWS.
- e. INSTALL THE THREE CAPSCREWS UNDER THE CENTER DASH CONSOLE (ABOVE THE ELECTRICAL ACCESS PANEL).

**NOTE**

Follow-on Maintenance:

Connect batteries (TM 9-2320-363-20).

Check operation of heater/air conditioner (TM 9-2320-363-10).

## AIR CONDITIONER EXPANSION VALVE REPLACEMENT

This task covers: a. Removal b. Installation

### INITIAL SETUP

#### Applicable Configuration:

All except M915A2 and M916A1

#### Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26  
 Shop Equipment, SC 4910-95-CL-A31  
 Gage, Oil Level, 99-431  
 Recovery and Recycling System, 34400  
 Leak Detector, 16500

#### Materials/Parts:

Packing, Preformed	P/N 2-011C944-70
Packing, Preformed	P/N 2-015C944-70
Receiver-Drier	P/N 088335-00
Cap and Plug Set	Appendix B, Item 7.1
Caulk, Strip	Appendix B, Item 7.2
Loctite	Appendix B, Item 33
Oil, Refrigerant	Appendix B, Item 43.1
Refrigerant, R-134a	Appendix B, Item 48.1
Tags, Identification	Appendix B, Item 55
Tape, Insulation	Appendix B, Item 57.1

#### References:

TM 9-2320-363-10  
 TM 9-2320-363-20

#### Equipment Condition:

Reference	Condition Description
Page 11.1-2	Refrigerant Recovered

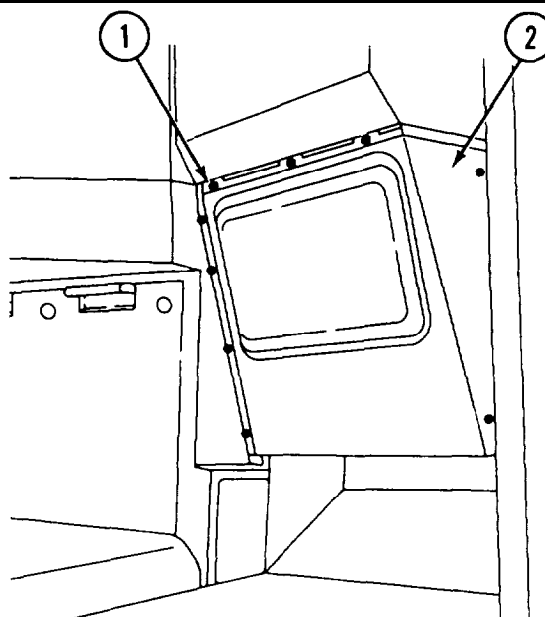
#### General Safety Instructions:

#### WARNING

- Use care to prevent refrigerant from touching your skin or eyes, because liquid refrigerant, when exposed to air, quickly evaporates and will freeze skin or eye tissue. Serious injury or blindness could result if you come in contact with liquid refrigerant.
- Refrigerant R-134a air conditioning systems should not be pressure tested or leak tested with compressed air. Combustible mixtures of air and R-134a may form, resulting in a fire or explosion, which could cause personal injury.

### REMOVAL

1. REMOVE NINE SCREWS (1) AND DASH PANEL (2).
2. REMOVE THE INSULATING TAPE AND STRIP CAULK FROM AROUND EXPANSION VALVE.



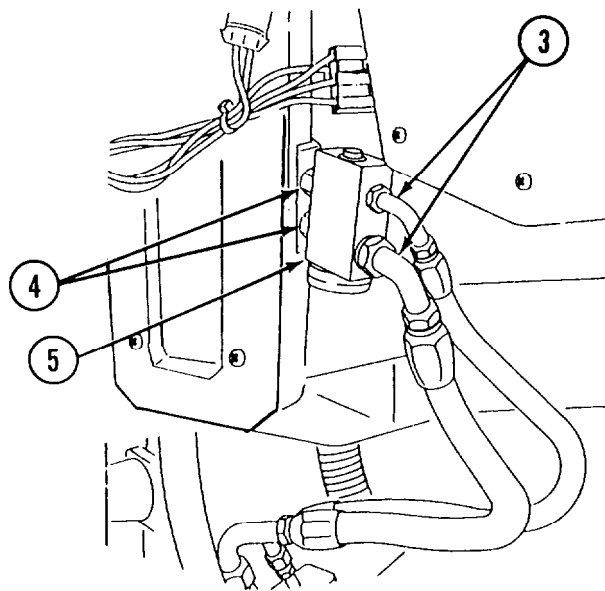
**CAUTION**

Water and dirt can damage the refrigerant system. Five minutes of not being capped is the limit for any hose or component. Do not blow shop air through the refrigerant hoses, shop air is wet (humid).

**NOTE**

Do not disconnect or connect refrigerant fittings using only one wrench. Hold one fitting in place using a wrench, and turn the other fitting with a second wrench.

3. TAG AND DISCONNECT THE REFRIGERANT LINES (3) AND THE EVAPORATOR COIL INLET AND OUTLET LINES (4) FROM THE EXPANSION VALVE (5). INSTALL PLUGS IN THE REFRIGERANT LINES (3) AND EVAPORATOR COIL INLET AND OUTLET LINES (4). DISCARD PREFORMED PACKINGS.
4. REMOVE THE EXPANSION VALVE (5).

**INSTALLATION**

1. REMOVE THE PLUGS FROM THE REFRIGERANT LINES (3), THE EVAPORATOR COIL INLET AND OUTLET LINES (4), AND THE NEW EXPANSION VALVE (5). INSTALL NEW PREFORMED PACKINGS AND LUBRICATE THEM WITH REFRIGERANT OIL. APPLY LOCTITE 242® TO THE MALE FITTING THREADS AND CONNECT THE REFRIGERANT LINES (3) AND EVAPORATOR COIL INLET AND OUTLET LINES (4) TO THE EXPANSION VALVE (5). USING WRENCHES, TIGHTEN THE EVAPORATOR COIL LINES (4) 18 LB-FT (24 N.m). TIGHTEN THE LARGE HOSE TO THE COMPRESSOR 24 LB-FT (33 N.m); TIGHTEN THE SMALL HOSE FROM THE RECEIVER-DRIER 12 LB-FT (16 N.m).

**NOTE**

Any time air conditioning system refrigerant is evacuated, replace receiver-drier.

2. REPLACE RECEIVER-DRIER (page 11.1-14).
3. EVACUATE AND CHARGE THE SYSTEM WITH REFRIGERANT. BE SURE TO ADD REFRIGERANT OIL TO THE COMPRESSOR TO REPLACE THAT WHICH IS LOST WHEN THE SYSTEM WAS DISCHARGED (page 11.1-23). LEAK TEST THE SYSTEM (TM 9-2320-363-20).
4. WIPE THE EXPANSION VALVE (5) AND REFRIGERANT LINE CONNECTIONS (3) CLEAN. WRAP LINE CONNECTIONS WITH INSULATING TAPE.
5. WRAP EXPANSION VALVE (5) WITH STRIP CAULK.
6. INSTALL DASH PANEL (2) AND NINE SCREWS (1).

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**AIR CONDITIONER EXPANSION VALVE REPLACEMENT (CONT)**

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**NOTE**

Follow-on Maintenance:

Check operation of air conditioning system (see TM 9-2320-363-10).

**CHAPTER 26**  
**AIR CONDITIONING SYSTEM REPAIR INSTRUCTIONS**

**OVERVIEW**

This chapter illustrates and describes procedures for repair of the air conditioning system and related parts. A list of tasks contained in this chapter is shown below.

	Page
Air Conditioner Compressor Magnetic Clutch Replacement (All Except M915A2 and M916A1) . . . . .	26-2
Air Conditioner Compressor Shaft Seal Replacement (All Except M915A2 and M916A1) . . . . .	26-4

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## AIR CONDITIONER COMPRESSOR MAGNETIC CLUTCH REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

**Applicable Configuration:**

All except M915A2 and M916A1

**Tools and Special Equipment:**

Tool Kit, SC 5180-90-CL-N26  
Shop Equipment, SC 4910-95-CL-A31  
Holding Tool, Clutch, 99-499  
Remover, Clutch, 99-440 (5/8-11 Bolt)

**Equipment Condition:**

**Reference**

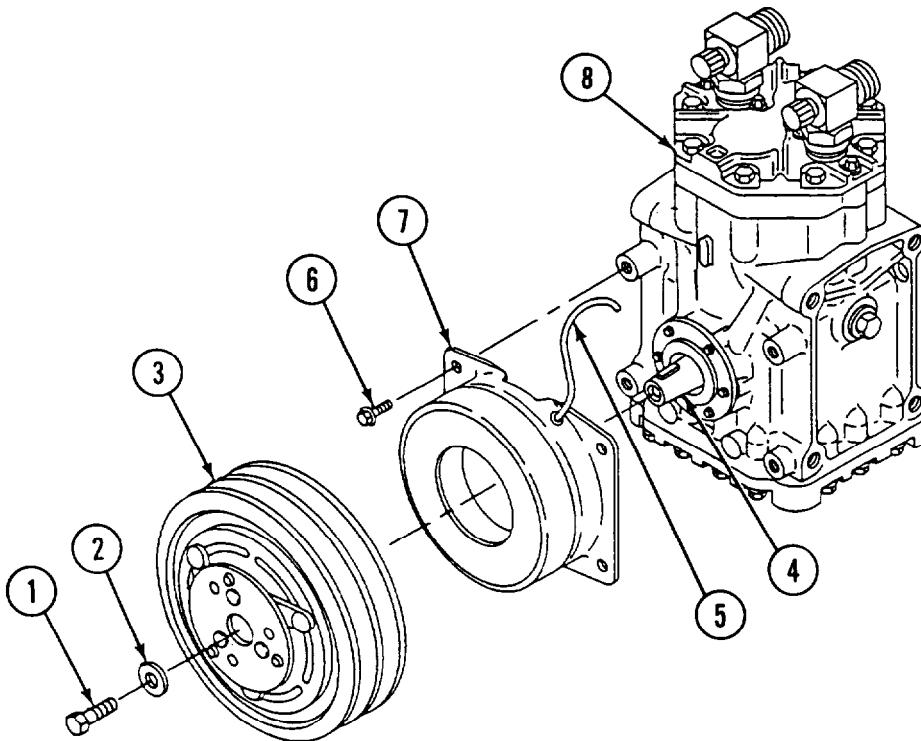
Page 11.1-9

**Condition Description**

Air Conditioner Compressor  
Removed

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### REMOVAL





**NOTE**

The magnetic clutch assembly consists of the pulley rotor assembly and field coil assembly.

1. USING CLUTCH HOLDING TOOL TO KEEP PULLEY FROM ROTATING, REMOVE PULLEY ROTOR RETAINING BOLT (1) AND WASHER (2) FROM CENTER OF PULLEY ROTOR ASSEMBLY (3).
2. INSTALL CLUTCH REMOVER IN HUB OF PULLEY ROTOR ASSEMBLY (3).

**CAUTION**

Do not try to remove pulley rotor assembly by prying or hammering. Failure to follow this caution could result in equipment damage.

3. TIGHTEN CLUTCH REMOVER TO PULL PULLEY ROTOR ASSEMBLY (3) OFF COMPRESSOR SHAFT (4).
4. DISCONNECT FIELD COIL ELECTRICAL LEAD (5).
5. REMOVE FOUR BOLTS (6) AND FIELD COIL ASSEMBLY (7) FROM COMPRESSOR (8).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

**INSTALLATION**

1. POSITION FIELD COIL ASSEMBLY (7) ON COMPRESSOR (8) AND INSTALL FOUR BOLTS (6). TORQUE BOLTS TO 96 LB-IN.(1080 N.cm).
2. INSTALL PULLEY ROTOR ASSEMBLY (3) ON COMPRESSOR SHAFT (4) TAKING CARE TO PROPERLY ALIGN AND SEAT SHAFT AND HUB KEYWAYS.
3. INSTALL WASHER (2) AND PULLEY ROTOR RETAINING BOLT (1). TORQUE RETAINING BOLT TO 20 LB-FT (27 N.m).
4. TURN PULLEY ROTOR ASSEMBLY (3) BY HAND TO MAKE SURE IT MOVES FREELY WITHOUT INTERFERENCE WITH FIELD COIL ASSEMBLY (7).
5. CONNECT FIELD COIL ELECTRICAL LEAD (5).
6. VERIFY CLUTCH ENGAGES WHEN PROPER VOLTAGE IS APPLIED.

**NOTE**

Follow-on Maintenance:  
Install air conditioner compressor (page 11.1-9).

---

## AIR CONDITIONER COMPRESSOR SHAFT SEAL REPLACEMENT

---

This task covers: a. Removal b. Cleaning c. Inspection d. Installation

---

### INITIAL SETUP

Applicable Configuration:

All except M915A2 and M916A1

Tools and Special Equipment:

Tool Kit, SC 5180-90-CL-N26

Shop Equipment, SC 4910-95CL-A31

Remover, Seal, 99-473

Installer, Seal, Clutch, 99-474

Materials/Parts:

Shaft Seal Kit P/N 488-21138

Oil, Refrigerant Appendix B, Item 43.1

Equipment Condition:

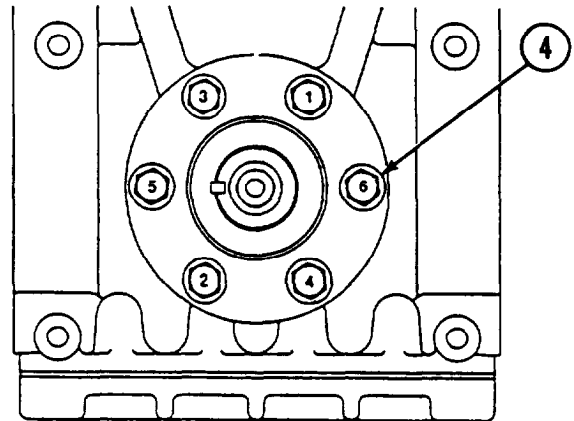
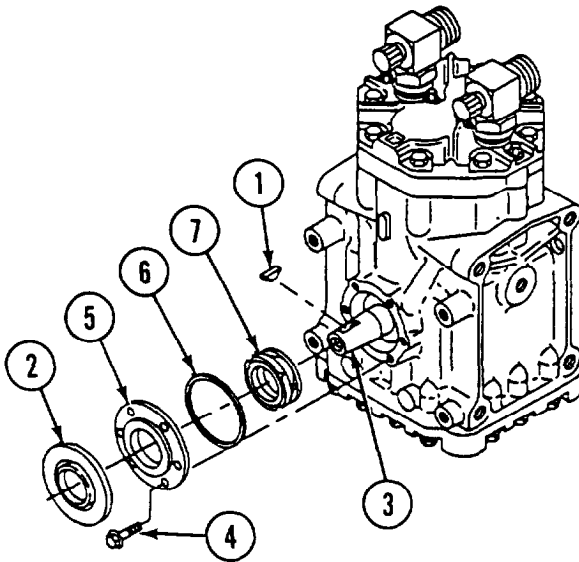
Reference Condition Description

Page 26-2

Air Conditioner Magnetic Clutch Removed

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### REMOVAL



1. REMOVE THE COMPRESSOR SHAFT KEY (1).
2. REMOVE DUST COVER (2) FROM COMPRESSOR SHAFT (3).
3. REMOVE SIX BOLTS (4) AND SEAL COVER PLATE (5).

4. REMOVE AND DISCARD O-RING (6) FROM SEAL COVER PLATE (5).

**CAUTION**

Do not use a screwdriver to pry seal gland from compressor shaft  
Failure to follow this caution could result in damage to equipment

5. USING SEAL REMOVER, PULL OUT AND DISCARD SEAL GLAND (7).

**CLEANING**

Use general cleaning methods to clean all parts (page 2-30).

**INSPECTION**

Inspect all parts for wear or damage.

**INSTALLATION**

1. CLEAN COMPRESSOR SHAFT (3) AND SEAL CAVITY WITH A CLEAN LINT-FREE CLOTH.
2. DIP NEW SEAL GLAND (7) IN REFRIGERANT OIL.
3. REMOVE CARBON RING FROM SEAL GLAND (7) AND PUSH SEAL GLAND OVER END OF COMPRESSOR SHAFT (3) WITH CARBON RING RETAINER FACING OUT
4. USING SEAL INSTALLER TOOL, MOVE SEAL ASSEMBLY INTO POSITION ON COMPRESSOR SHAFT (3).

**NOTE**

Notches in outside edge of carbon ring must engage driving lugs and be firmly seated in retainer.

5. ON SEAL GLAND (7) INSTALL CARBON RING IN RING RETAINER WITH LAPPED SURFACE FACING OUT.
6. COAT NEW O-RING (6) WITH REFRIGERANT OIL AND INSTALL IN GROOVE ON SEAL COVER PLATE (5).
7. INSTALL SEAL COVER PLATE (5) SO THERE IS EQUAL CLEARANCE AROUND COMPRESSOR SHAFT (3).
8. INSTALL SIX BOLTS (4) AND TORQUE IN SEQUENCE SHOWN TO 60-84 LB-IN. (680-940 N.cm).
9. INSTALL DUST COVER (2) ON COMPRESSOR SHAFT (3).
10. INSTALL KEY (1) ON COMPRESSOR SHAFT (3).

**NOTE**

Follow-on Maintenance:

Install air conditioner magnetic clutch (page 26-2).



**APPENDIX A  
REFERENCES**

**PUBLICATION INDEXES**

The following index should be consulted frequently for latest changes or revisions and for new publications relating to material covered in this technical manual:

Consolidated Index of Army Publications and Blank Forms . . . . . DA Pam 25-30

**FORMS**

The following forms pertain to this material. (Refer to DA Pam 25-30 for index of blank forms.)

Optional Form 46, U.S. Government Motor Vehicle Operator's Identification Card

Standard Form 91, Operator Report of Motor Vehicle Accidents

DA Form 2028, Recommended Changes to Publications and Blank Forms

Form SF 368, Product Quality Deficiency Report

DD Form 1397, Processing Record for Shipment, Storage, and Issue of Vehicles and Spare Engines

DA Form 2404, Equipment Inspection and Maintenance Worksheet

Refer to DA Pam 738-750, The Army Maintenance Management Systems (TAMMS), for instructions on the use of maintenance forms pertaining to this material.

**OTHER PUBLICATIONS**

The following publications contain information pertinent to the major item material and associated equipment:

**Operating Vehicle**

Operator's Manual for M915 Family of Vehicles . . . . .	TM 9-2320-363-10
Driver Selection and Training (Wheeled Vehicles) . . . . .	FM 21-300
Army Motor Transport Units and Operation . . . . .	FM 55-30
Manual for the Wheeled Vehicle Driver . . . . .	FM 21-305
Prevention of Motor Vehicle Accidents . . . . .	AR 385-55
Accident Reporting and Records . . . . .	AR 385-40
Rigging . . . . .	TM 5-725

**Maintenance and Repair**

Organizational Maintenance for M915 Family of Vehicles . . . . .	TM 9-2320-363-20
Organizational, Direct Support, and General Support Maintenance Repair Parts and Special Tools List for M915 Family of Vehicles . . . . .	TM 9-2320-363-24P
Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tools List for Decontaminating Apparatus, Portable . . . . .	TM 3-4230-214-12&P
Operator's, Unit, Intermediate Direct Support, and Intermediate General Support Maintenance Manual for Lead Acid Storage Batteries . . . . .	TM 9-6140-200-14
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
Description, Use, Bonding Techniques, and Properties of Adhesives . . . . .	TB ORD 1032
Materials Used for Cleaning, Preserving, Abrading, and Cementing Ordnance Material and Related Materials, Including Chemicals . . . . .	TM 9-247
Metal Body Repair and Related Operations . . . . .	FM 43-2
Painting Instructions for Field Use . . . . .	TM 43-0139
inspection, Care, and Maintenance of Anti-Friction Bearings . . . . .	TM 9-214
Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems . . . . .	TB 750-651
Rust Proofing Procedures for Truck, Utility . . . . .	TB 43-0213
Cooling Systems: Tactical Vehicles . . . . .	TM 750-254
Functional Grouping Codes . . . . .	TB 750-93-1
Welding Theory and Application . . . . .	TM 9-237
Operator's Manual for Repair of Seat Cover and Pad . . . . .	FM 10-16
Fuel Tank Repair . . . . .	FM 43-2

**Cold Weather Operation and Maintenance**

Basic Cold Weather Manual . . . . .	FM 31-70
Northern Operations . . . . .	FM 31-71
Personnel Heater and Winterization Kit Policy for Tank-Automotive Construction and Material Handling Equipment . . . . .	SB 9-16
Operation and Maintenance of Ordnance Material in Extreme Cold Weather (0°F to -65°F) . . . . .	FM 9-207

**Decontamination**

Chemical, Biological, and Radiological (CBR) Decontamination . . . . .	TM 3-220
Chemical, Biological, Radiological, and Nuclear Defense . . . . .	FM 21-40
NBC Decontamination . . . . .	TM 3-5

**General**

Artificial Respiration . . . . .	FM 21-11
Principles of Automotive Vehicles . . . . .	TM 9-8000
Camouflage . . . . .	FM 5-20
Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use. . . . .	TM 750-244-6
Administrative Storage of Equipment . . . . .	TM 740-90-1
Color and Marking of Army Material . . . . .	TB 43-0209
Preservation, Packaging, and Packing of Military Supplies and Equipment. . . . .	TM 38-230-1 &TM 38-230-2
Storage Serviceability Standard, Tracked Vehicles, Wheeled Vehicles, and Component Parts . . . . .	SB 740-98-1
Vehicle, Wheeled, Preparation for Shipment and Limited Storage of . . . . .	MIL-V-62038D
Warranty . . . . .	TB 9-2320-363-15





**APPENDIX B**  
**EXPENDABLE SUPPLIES AND MATERIALS LIST**

**Section I. INTRODUCTION**

**SCOPE**

This appendix lists expendable consumable maintenance supplies you will need to operate and maintain the M915 Family of Vehicles. 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.

**EXPLANATION OF COLUMNS**

**Column (1)** - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, Item 12, Appendix 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

**Column (3) - National Stock Number.** This is the National Stock Number assigned to the item: use it to request or requisition the item.

**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 Contractor and Government Entity (CAGE) Code in parentheses followed by the part number.

**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 SUPPLIES AND MATERIALS

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	F		Acid, Phosphoric, Inhibited	
2	O		Adhesive (64678) 48-00094-951	
3	O		Adhesive-Sealant, Silicone (81348) MIL-A-46106	
4	F		Adhesive, Permatex HiTack (77247) 98D	
5	F		Adhesive, Rockwell (78500) 1199-T-3842	
6	O		Alumilastic DOLLCHEM (71961) DPH/6065	
7	C		Antifreeze, Permanent, Glycol, Inhibited (81348) MIL-A-46153	
		6850-00-181-7929	1 Gal Can	GAL
		6850-00-181-7933	5 Gal Can	GAL
		6850-00-181-7929	55 Gal Can	GAL
7.1	F	5340-00-450-5718	Cap and Plug Set (19207) 10935405	EA
7.2	F		Caulk, Strip (64678) 48-00118-001	EA
8	F		Cement (64678) 48-00094-951	
9	F		Cement (64678) 48-00094-952	
10	H		Cloth, Abrasive (81348) P-C-1673	
		5350-00-584-5654	50-Sheet Pack	EA
11	O	8030-00-597-5367	Compound, Antiseize, High Temperature (8 1349) MIL-A-907A	EA

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
12	C	6850-00-926-2275	Compound, Cleaning, Windshield (81349) O-C-1901  1 Pt	PT
13	F		Compound, Sealing, Thread Locking (05972) 59231	
14	O		Compound, Retaining (81349) MIL-R-46082	
15	O		Compound, Sealing, Pipe Thread (05972) 702350-X	
16	F		Compound, Sealing (81349) MIL-S-46163	
17	H		Dye, Prussian Blue, Permatex (10670) 35V	
18	O		Eliminator, Gasket (33287) PT 7276	EA
19	C		Fuel, Diesel, Regular (81348) VV-F-800	
19		9140-00-286-5294 9140-00-286-5295 9140-00-286-5296 9140-00-286-5297	Bulk 5 Gal Can 55 Gal Drum, 16 GAGE 55 Gal Drum, 18 GAGE	GAL GAL GAL GAL
20	C		Fuel, Diesel, Winter (81348) VV-F-800	
20		9140-00-286-5286 9140-00-286-5287 9140-00-286-5288 9140-00-286-5289	Bulk 5 Gal Can 55 Gal Drum, 16 GAGE 55 Gal Drum, 18 GAGE	GAL GAL GAL GAL
21	O		Fluid, Transmission, OEA (24617) DEXRON II	

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
22	O		Fluid, Transmission, OE/HDO (23034) C-3	
23	F		Form-A-Gasket, Permatex (77247) 2B	
24	F		Gear Shield, Heavy Duty 7321915263	
25	O		Glue 45-94-951	
25.1	F		Grease, Aircraft (81349) MIL-G-4343	
		9150-00-269-8225	1.75 Pound Can	LB
26	C		Grease, Automotive and Artillery (GAA) (81349) MIL-G-10924	
		9150-01-197-7788	2.5 Oz Tube	OZ
		9150-01-197-7693	14 Oz Cartridge	OZ
		9150-01-197-7690	1.75 Pound Can	LB
		9150-01-197-7692	35 Pound Can	LB
		9150-01-197-7691	120 Pound Drum	LB
27	H	9250-01-091-9336	Grease, General Purpose	
28	O		Grease, Mobil HP Heat Resistant (34728) MBL/HP	EA
29	F		International Compound No. 2 5198563	
30	F	5180-00-754-0643	Kit, Lamination Repair	
31	F		Lead (57733) 333308	
32	F		Loctite (05972) 635	
33	F		Loctite (05972) 242	
34	F		Loctite (05972) 290	
34.1	F		Loctite (05972) 510	

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
35	F		Lubriplate 105 LUB/105	
36	F		Oil, Cutting 29700	
37	C		Oil, Lubricating, OE/HDO 10 (81349) MIL-L-2104	
38	C	9150-00-189-6727 9150-00-186-6668 9150-00-191-2772	1 Qt Can 2 Gal Drum 55 Gal Drum, 18 GAGE	QT GAL GAL
39	C	9150-00-189-6730 9150-00-188-9860 9150-00-188-9862	Oil, Lubricating, OE/HDO 40 (81349) MIL-L-2104	QT GAL GAL
40	C	9150-01-152-4117 9150-01-152-4118 9150-01-152-4119	Oil, Lubricating, OE/HDO 15/40 (81349) MIL-L-2104	QT GAL GAL
41	C	9150-01-048-4581 9150-01-035-5345 9150-01-035-5396	Oil, Lubricating, GO 85/140 (81349) MIL-L-2105	QT GAL GAL
42	C	9150-01-035-5392 9150-01-035-5393 9150-01-035-5394	Oil, Lubricating, GO 80/90 (81349) MIL-L-2105	QT GAL GAL
42	C	9150-00-035-5390 9150-00-035-5391	Oil, Lubricating, GO 75 (81349) MIL-L-2105	QT GAL

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
43	C	9150-00-402-4478 9150-00-402-2372 9150-00-402-7197	Oil, Lubricating, OEA, ICE, Subzero (81349) MIL-L-46167  1 Qt Can 5 Gal Drum 55 Gal Drum, 16 GAGE	QT GAL GAL
43.1	F	9150-01-410-8972	Oil, Refrigerant Synthetic-Ester	QT
44	O		Paint. Spray, White KRYLON (87187) A0478/1501	EA
45	F		Paper. Abrasive, Garnet (81348) P-P-121	
46	F		Plastigauge SEAL POWER SPG/1 PRI	
47	F		Preventive, Rust (81349) MIL-C-16173	
48	C	7920-00-205-1711	Rag, Wiping (64067) 7920-00-205-1711	
48.1	F	6830-01-380-4960	50 Lb Bale  Refrigerant (R-134a)	LB  LB
49	F		Rope, ½ in. Nylon	
50	O		Seal 'N' Caulk (21106) MORTITE B-2	
51	F		Sealant, Non-Hardening, Loctite (05972) 620	
52	F		Sealant, RTV (72582) 8922443	
53	F		Shim Stock 3/32-In. W x 0.020-In. TH x 3-In. L	

(1) ITEM NO.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
54	C		Solvent, Drycleaning (SD), Type II (81348)P-D-680	
		1850-00-664-5685	1 Qt Can	QT
		1850-00-281-1985	1 Gal Can	GAL
54.1	O	1975-00-074-2072	Strap, Tie-down 96906) MS3367-1-9 Box of 100	EA
55	O		Tag, Identification (81349) MIL-T-12755	
		3905-00-537-8954	Bundle of 50	EA
56	O	3130-00-395-4130	Tape, Antiseize, Tetrafluoroethylene (81349) MIL-T-27730	EA
57	O		Tape, Electrical, Black (75037) 33	
		5970-00-989-1485	240-In. Roll	EA
57.1	F	5640-00-580-6276	Tape, Insulation (73030) H57495-618	EA
58	O		Tape, Masking (81348) A-A-883	
59	O	9320-00-171-4369	Tape, Neoprene (55899) 632	
60	O		Tape, Teflon (81349) MIL-T-277308	EA
61	F		Tectyl	
62	O		Towel, Shop (58536) A-A-531	
63	O		Toweling, Paper	
64	F		Varnish, Insulating GE Glyptal (24446) No.1201	
65	F	9505-00-191-3680	Wire, Nonelectrical	
66	F		Wire, 14 Gauge	





## APPENDIX C ILLUSTRATED LIST OF MANUFACTURED ITEMS

### INTRODUCTION

This appendix includes complete instructions for making items authorized to be manufactured at direct support maintenance.

A Part No. Index in alphanumeric order is provided for cross-referencing the part number of the item to be manufactured to the table which covers fabrication criteria.

All bulk materials needed for manufacture of an item are listed by part number or specification number.

PART NO.	NAME	TABLE NO.
48-02454-206X12	TAPE, URETH FOAM	C-1
5516170	HOSE	C-1
77551	HOSE	C-1
77620-7.5	HOSE	C-1

**Table C-1. Manufactured Items**

PART NO.	NAME	MFG FROM	DESCRIPTION
48-02454-206X12	TAPE, URETH FOAM	V40624	12 FT LONG
5516170	HOSE	5118149	2-1/2 IN. LONG
77551	HOSE	IC-26-31C	82 IN. LONG
77620-7.5	HOSE	IC-26-31C	90 IN. LONG

FABRICATED TOOLS

ITEM 1

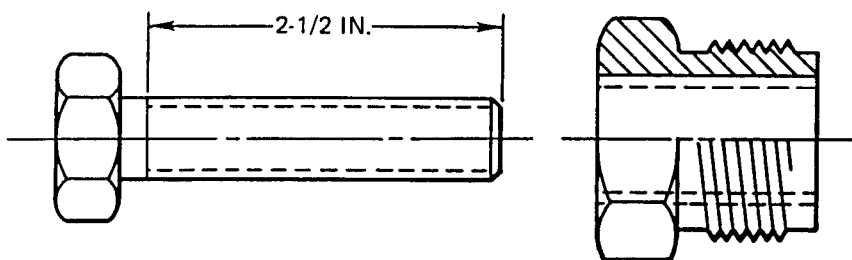
MATERIALS:

CAPSCREW, HEX  
1/2 X 2-1/2 X 13 UNC

P/N 23-9440-300

SLEEVE

P/N 166JX



NOTE:

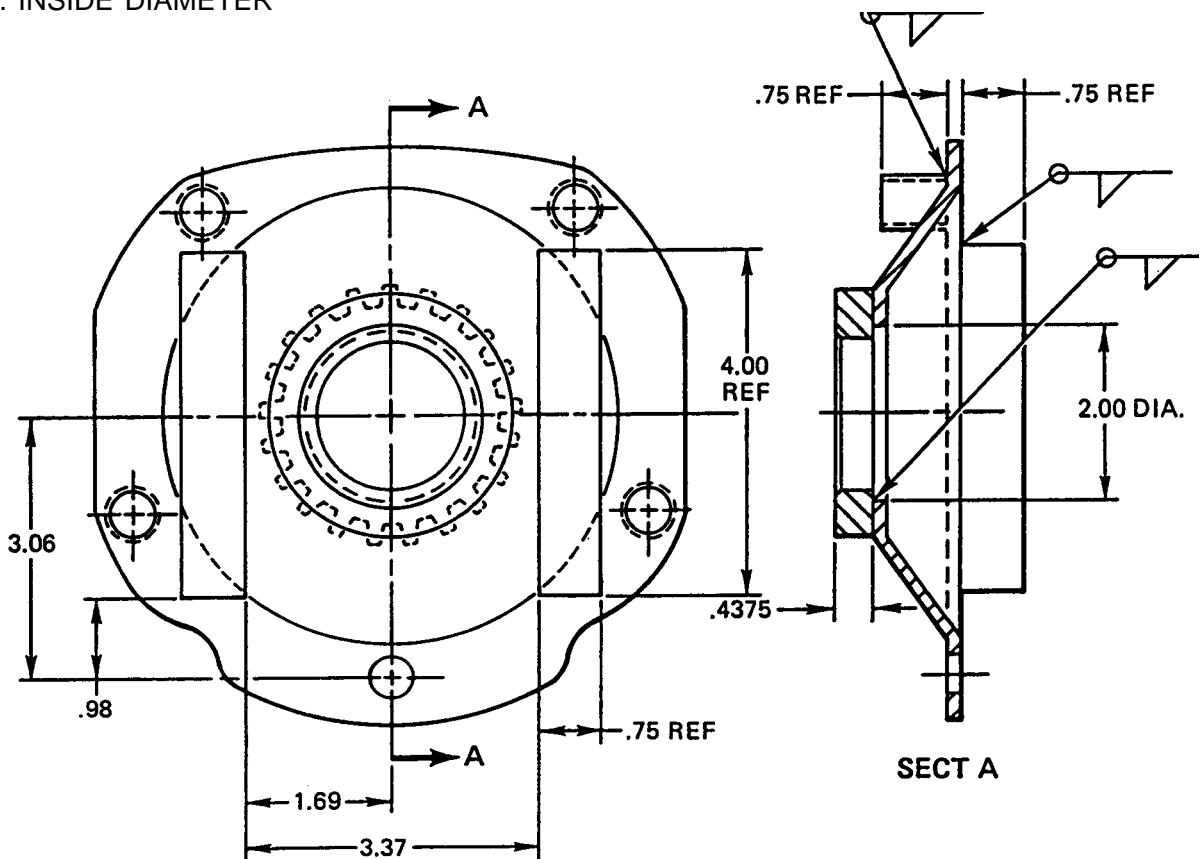
1. DRILL AND TAP SLEEVE P/N 166JX FOR 1/2 X 13 UNC THREAD.
2. EXTEND LENGTH OF THREAD TO 2-1/2 IN.
3. INSTALL SCREW IN SLEEVE AS SHOWN.

FABRICATED TOOLS (CONT)

ITEM 2

MATERIALS:

COVER PLATE	P/N 5122281
COUPLING	P/N 5141773
BAR STOCK	3/4 X 1/2 X 4 IN. (2)
TUBING, HEAVY WALL 1/2-IN. INSIDE DIAMETER	3/4-IN. LONG (4)



NOTE:

1. CUT 2-IN.-DIAMETER HOLE IN CENTER OF RAISED PORTION OF COVER PLATE P/N 5122281.
2. CUT 7/16 IN. FROM END OF COUPLING P/N 5141773.
3. WELD FOUR TUBE SECTIONS ONTO RAISED SIDE OF COVER PLATE, CENTERED ON FOUR BOLT HOLES AS SHOWN.
4. PLACE SHIM(S) AND 7/8-IN. SECTION OF COUPLING IN HUB OF EITHER AIR COMPRESSOR OR AIR COMPRESSOR DRIVE. INSTALL COVER PLATE USING TWO BOLTS TO SECURE IT TO AIR COMPRESSOR OR DRIVE. ENSURE THAT COUPLING CONTACTS COVER PLATE.
5. TACK-WELD COUPLING TO COVER PLATE. REMOVE COVER PLATE FROM AIR COMPRESSOR OR DRIVE AND FINISH WELDING COUPLING TO COVER PLATE. ENSURE THAT INSIDE DIAMETER OF COUPLING IS FREE OF EXCESS WELD.
6. WELD TWO PIECES OF BAR STOCK TO OPPOSITE SIDE OF COVER PLATE AS SHOWN.

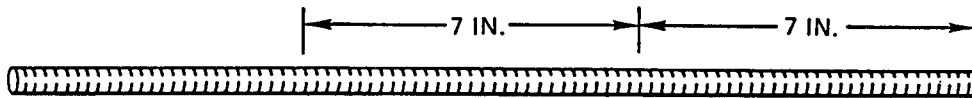
FABRICATED TOOLS (CONT)

ITEM 3

MATERIALS:

ROD  
1/2 X 20 X 13 UNC

P/N 1 213X20INLGSTL



NOTE:

1. CUT TWO 7-IN. LENGTHS.
2. REMOVE ALL BURRS AND SHARP EDGES.

## APPENDIX D TORQUE LIMITS

Use the torque values listed in the maintenance procedures, if they are given. When no torque values are given in the maintenance procedures, use the following guides.

**Table D-1. Torque Value Guide (Pound-Feet)**

Screw Diameter	Torque Lb-Ft No Dashes (SAE Grade 2)	Torque Lb-Ft 3 Dashes (SAE Grade 5)	Torque Lb-Ft 6 Dashes (SAE Grade 8)	Socket Size
1/4-20 UNC	3-5	6-8	10-12	7/16
1/4-28 UNF	4-6	8-10	9-14	7/16
4/16-18 UNC	7-11	13-17	19-24	1/2
5/16-24 UNF	7-11	14-19	23-28	1/2
3/8-16 UNC	14-18	26-31	39-44	9/16
3/8-24 UNF	15-19	30-35	46-51	9/16
7/16-14 UNC	23-28	44-49	65-70	5/8
7/16-20 UNF	23-28	44-54	69-79	5/8
1/2-13 UNC	32-37	65-75	95-105	3/4
1/2-20 UNF	34-41	73-83	113-123	3/4
9/16-12 UNC	46-56	100-110	145-155	13/16
9/16-18 UNF	47-57	107-117	165-175	13/16
5/8-11 UNC	62-72	140-150	200-210	15/16
5/8-18 UNF	67-77	153-163	235-245	15/16
3/4-10 UNC	106-116	200-270	365-375	1-1/4
3/4-16 UNF	115-125	268-278	417-427	1-1/4
7/8-9 UNC	165-175	385-395	595-605	1-5/16
7/8-14 UNF	178-188	424-434	663-673	1 -5/16
1-8 UNC	251-261	580-590	900-910	1-1/2
1-14 UNF	255-265	585-634	943-993	1-1/2
1-1/4-7 UNC	441-461	1070-1120	1767-1817	1-7/8
1-1/4-12 UNF	488-498	1211-1261	1963-2013	1-7/8
1-1/2-6 UNC	727-737	1899-1949	3111-3161	2-1/4
1-1/2-12 UNF	816-826	2144-2194	3506-3556	2-1/4

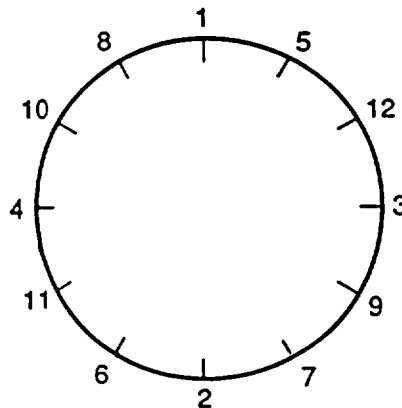
**Table D-2. Torque Value Guide (Newton-Meters)**

Screw Diameter	Torque N.m No Dashes (SAE Grade 2)	Torque N.m 3 Dashes (SAE Grade 5)	Torque N.m 6 Dashes (SAE Grade 8)	Socket Size
1/4-20 UNC	4-7	8-11	14-16	7/16
1/4-28 UNF	5-8	11-14	12-19	7/16
5/16-18 UNC	9-15	18-23	26-33	1/2
5/16-24 UNF	9-15	19-26	31-38	1/2
3/8-16 UNC	19-24	35-42	53-60	9/16
3/8-24 UNF	20-26	41-47	62-69	9/16
7/16-14 UNC	31-38	60-66	88-95	5/8
7/16-20 UNF	31-38	60-73	94-107	5/8
1/2-13 UNC	43-50	88-102	129-142	3/4
1/2-20 UNF	46-56	99-113	153-167	3/4
9/16-12 UNC	62-76	136-149	197-210	13/16
9/16-18 UNF	64-77	145-159	224-237	13/16
5/8-11 UNC	84-98	190-203	271-285	15/16
5/8-18 UNF	91-104	207-221	319-332	15/16
3/4-10 UNC	144-157	353-366	495-508	1-1/4
3/4-16 UNF	156-169	363-377	565-579	1-1/4
7/8-9 UNC	224-237	522-536	807-820	1-5/16
7/8-14 UNF	241-255	575-588	899-912	1-5/16
1-8 UNC	340-354	786-800	1220-1234	1-1/2
1-14 UNF	346-359	793-860	1279-1346	1-1/2
1-1/4-7 UNC	611-625	1451-1518	2396-2463	1-7/8
1-1/4-12 UNF	662-675	1642-1710	2661-2729	1-7/8
1-1/2-6 UNC	986-999	2575-2642	4218-4286	2-1/4
1-1/2-12 UNF	1106-1120	2907-2975	4753-4821	2-1/4

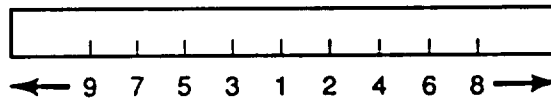
**TORQUE SEQUENCE**

If the maintenance procedures in Chapter 4 do not specify a tightening order, use the following guides:

- Unless otherwise specified, lubricate threads of fasteners with oil (OE/HDO-10 or OEA).
- When tightening fasteners above 30 lb-ft (41 N.m), use the torque pattern but only tighten to 70 percent of final value (multiply final value by 0.7): then repeat the pattern until final value IS reached.
- Tighten circular patterns using the circular torque pattern, and straight patterns using the straight torque pattern.



**CIRCULAR TORQUE PATTERN**



**STRAIGHT TORQUE PATTERN**

**Table D-3. \*Refrigerant Line Torque Specifications**

Outside Diameter of Metal Tube (Inch)	Torque for Steel Tubes† lb-ft (N.m)	Torque for Aluminum or Copper Tubes †
1/4	10-15 (14-20)	60-80 lb-in. (680-940 N.cm)
3/8	30-35 (41-47)	11-13 lb-ft (15-18 N.m)
1/2	30-35 (41-47)	15-20 lb-ft (20-27 N.m)
5/8	30-35 (41-47)	21-27 lb-ft (28-37 N.m)
3/4	30-35 (41-47)	28-33 lb-ft (38-45 N.m)

\* Use two wrenches, one on each side of each fitting. Replace preformed packing and lubricate with oil. Apply Loctite 242® to the male portion of the fitting threads.

† When tightening fittings, always use the torque reading for the softer metal when unlike metals are used.





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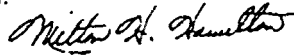
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*General, United States Army*  
*Chief of Staff*

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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 = 1000 Millimeters = 39.37 Inches  
 1 Kilometer = 1000 Meters = 0.621 Miles

### WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces  
 1 Kilogram = 1000 Grams = 2.2 Lb.  
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

### LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces  
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

### SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches  
 1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet  
 1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

### CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches  
 1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

### TEMPERATURE

$\frac{5}{9}(\text{°F} - 32) = \text{°C}$   
 212° Fahrenheit is equivalent to 100° Celsius  
 90° Fahrenheit is equivalent to 32.2° Celsius  
 32° Fahrenheit is equivalent to 0° Celsius  
 $\frac{9}{5}(\text{°C} + 32) = \text{°F}$

## APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
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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