

## Mack TC15 & TC25 Series Transfer Case Service Manual

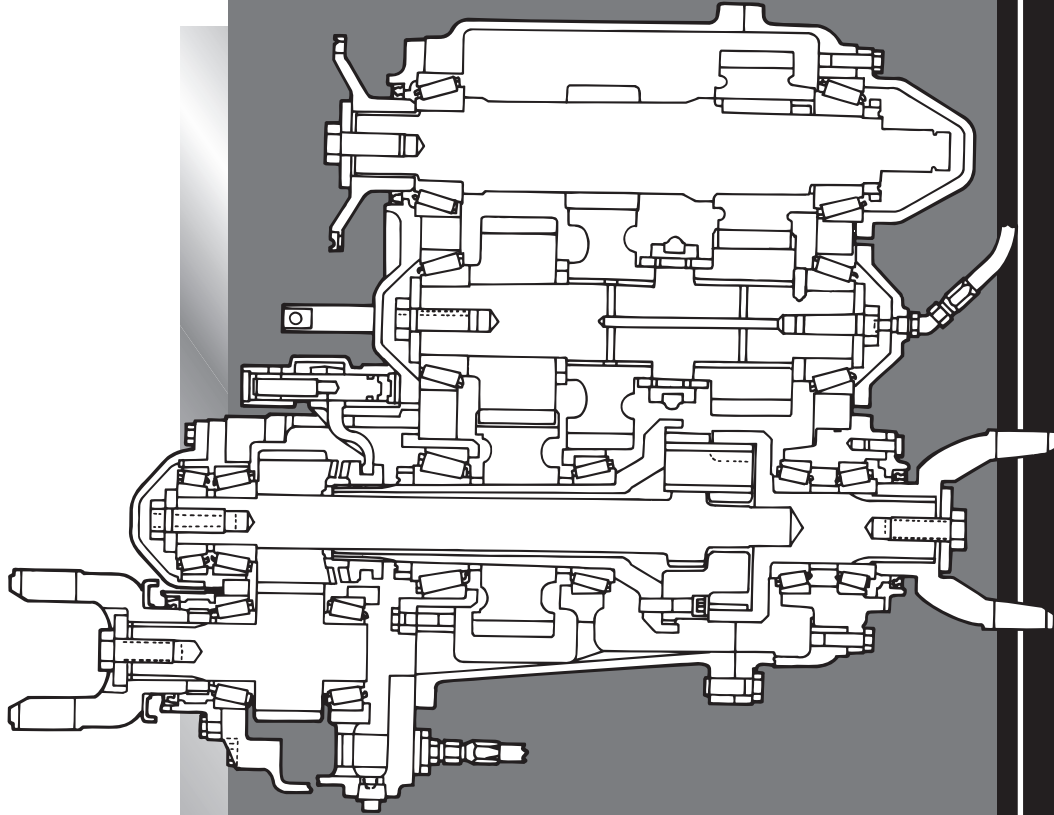
Pro Gear Mack TC15 & TC25 Series Transfer Case Service Manual to assist in identifying your Mack unit.

If you need any assistance identifying the correct transfer case unit for your truck and equipment, contact your Mack replacement part specialists at Pro Gear and Transmission.

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**TRANSFER CASE**  
**TC15 &**  
**TC25 SERIES**  
**SERVICE MANUAL**



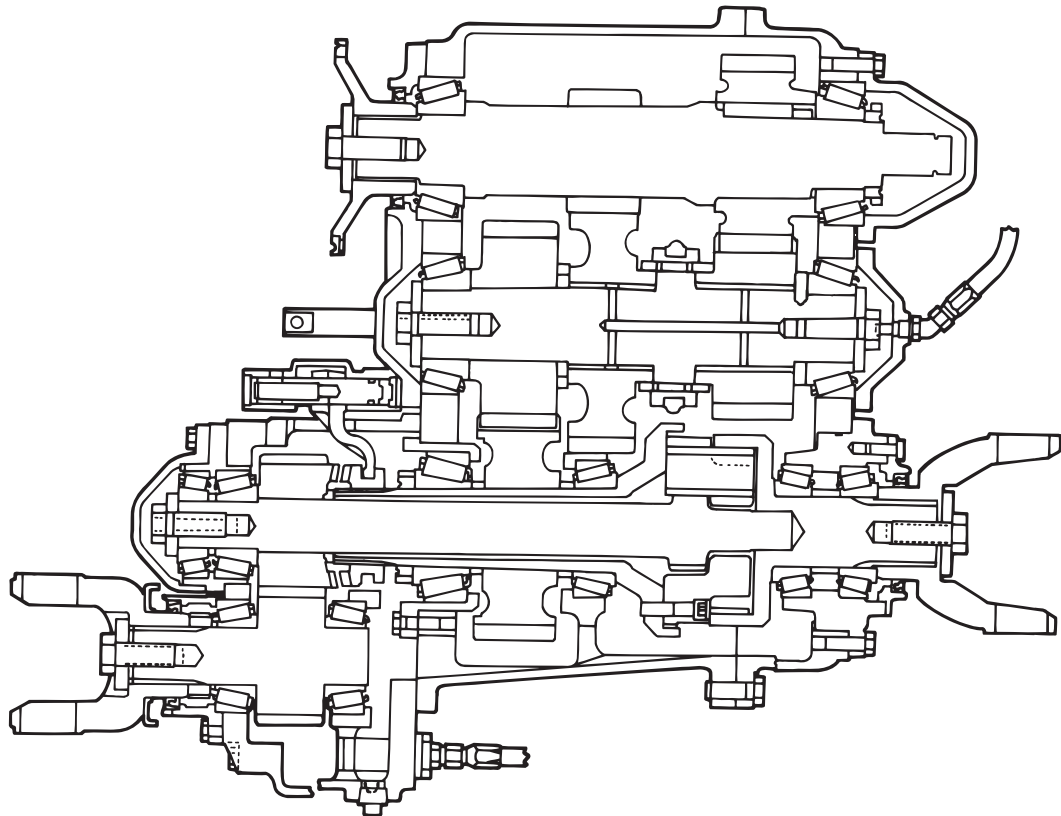
OCTOBER 1999  
(NEW ISSUE)  
10-113





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# TRANSFER CASE TC15 & TC25 SERIES SERVICE MANUAL



HEAVY-DUTY, TWO-SPEED  
TRANSFER CASE FOR FULL-TIME  
ALL-WHEEL DRIVE

OCTOBER 1999  
(NEW ISSUE)

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10-113

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## **ATTENTION**

**The information in this manual is not all inclusive and cannot take into account all unique situations. Note that some illustrations are typical and may not reflect the exact arrangement of every component installed on a specific chassis.**

**The information, specifications, and illustrations in this publication are based on information that was current at the time of publication.**

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# SAFETY INFORMATION

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## SAFETY INFORMATION



# SAFETY INFORMATION

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## Advisory Labels

Cautionary *signal words* (Danger-Warning-Caution) may appear in various locations throughout this manual. Information accented by one of these signal words must be observed to minimize the risk of personal injury to service personnel, or the possibility of improper service methods which may damage the vehicle or render it unsafe. Additional Notes and Service Hints are utilized to emphasize areas of procedural importance and provide suggestions for ease of repair. The following definitions indicate the use of these advisory labels as they appear throughout the manual:

** CAUTION**

*Directs attention to unsafe practices which could result in damage to equipment and possible subsequent personal injury or death if proper precautions are not taken.*

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** WARNING**

**Directs attention to unsafe practices which could result in personal injury or death if proper precautions are not taken.**

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** DANGER**

***Directs attention to unsafe practices and/or existing hazards which will result in personal injury or death if proper precautions are not taken.***

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**NOTE**

An operating procedure, practice, condition, etc., which is essential to emphasize.

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**SERVICE HINT**

A helpful suggestion which will make it quicker and/or easier to perform a certain procedure, while possibly reducing overhaul cost.

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# SAFETY INFORMATION

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## Service Procedures and Tool Usage

Anyone using a service procedure or tool not recommended in this manual must first satisfy himself thoroughly that neither his safety nor vehicle safety will be jeopardized by the service method he selects. Individuals deviating in any manner from the instructions provided assume all risks of consequential personal injury or damage to equipment involved.

Also note that particular service procedures may require the use of a special tool(s) designed for a specific purpose. These special tools must be used in the manner described, whenever specified in the instructions.

### **WARNING**

1. Before starting a vehicle, always be seated in the driver's seat, place the transmission in neutral, be sure that parking brakes are set, and disengage the clutch (if equipped).
  2. Before working on a vehicle, place the transmission in neutral, set the parking brakes, and block the wheels.
  3. Before towing the vehicle, place the transmission in neutral and lift the rear wheels off the ground, or disconnect the driveline to avoid damage to the transmission during towing.
- 

### **DANGER**

*Engine driven components such as Power Take-Off (PTO) units, fans and fan belts, driveshafts and other related rotating assemblies, can be very dangerous. Do not work on or service engine driven components unless the engine is shut down. Always keep body parts and loose clothing out of range of these powerful components to prevent serious personal injury. Be aware of PTO engagement or nonengagement status. Always disengage the PTO when not in use.*

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**REMEMBER,  
SAFETY . . . IS NO ACCIDENT!**





# NOTES

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# EXPLANATION OF NUMERICAL CODE

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## EXPLANATION OF NUMERICAL CODE



# EXPLANATION OF NUMERICAL CODE

## EXPLANATION OF 3-DIGIT NUMERICAL CODE

The organization of MACK service manuals has been upgraded to standardize manual content according to a reference system based on component identification. The new reference system will help to link the information contained in this publication with related information included in other MACK service-warranty publications, such as associated service bulletins, warranty manuals, and the TS477 Service Labor Time Standards Manual.

The system is based on a numerical code, the first **digit** of which identifies the general component grouping as listed here:

- GROUP 000 — GENERAL DATA
- GROUP 100 — CHASSIS
- GROUP 200 — ENGINE
- GROUP 300 — CLUTCH, TRANSMISSION, TRANSFER CASE AND PTO

GROUP 400 — STEERING, AXLES, WHEELS AND TIRES, DRIVELINE

GROUP 500 — BRAKES, AUXILIARY SYSTEMS

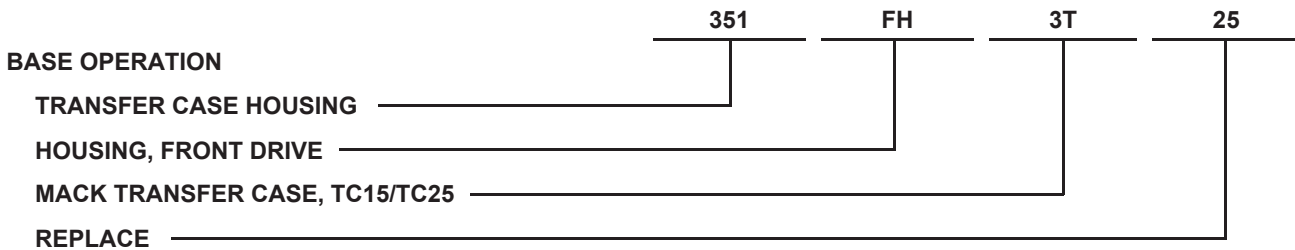
GROUP 600 — CAB, TRUCK BODY

GROUP 700 — ELECTRICAL

The second two digits of the 3-digit code are used to identify the **system, assembly** or **subassembly**, as appropriate, within each of the groupings. The codes applicable to this publication are shown at the SECTION HEADINGS as necessary, and may also appear in the TABLE OF CONTENTS, to guide you to specific component information.

Additionally, a two-character alpha code (i.e., [FH] HOUSING, FRONT DRIVE) may be shown with each operation. This alpha code, in combination with the three-digit Group number, identifies the specific assembly, subassembly or part, and directly relates to the first five positions of the operation code listed in the Service Labor Time Standards Manual, TS477.

### EXAMPLES:



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# TABLE OF CONTENTS

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# TABLE OF CONTENTS



# TABLE OF CONTENTS

---

<b>SAFETY INFORMATION</b> .....	iii
Advisory Labels .....	iv
Service Procedures and Tool Usage .....	v
<b>EXPLANATION OF NUMERICAL CODE</b> .....	vii
EXPLANATION OF 3-DIGIT NUMERICAL CODE .....	viii
<b>TRANSFER CASE IDENTIFICATION</b> .....	1
UNIT IDENTIFICATION STAMPING LOCATION .....	2
<b>DESCRIPTION AND OPERATION</b> .....	3
TC15 AND TC25 TRANSFER CASE .....	4
Description .....	4
LUBRICATION .....	4
Splash Lubrication .....	4
TC15 AND TC25 GEAR RATIOS .....	5
TC15 AND TC25 SHIFTING INSTRUCTIONS .....	6
CHASSIS DYNAMOMETER OPERATION .....	6
ALL WHEEL DRIVE RATIO MATCH .....	6
All Chassis with TC(S) 15/25 Transfer Case .....	6
<b>COMPONENT LOCATOR</b> .....	9
<b>TROUBLESHOOTING</b> .....	11
TROUBLESHOOTING CHART .....	12
<b>MAINTENANCE</b> .....	15
MAINTENANCE .....	16
Checking Oil .....	16
Changing Oil .....	16
Air Breather .....	17
<b>DISASSEMBLY</b> .....	19
[350] TRANSFER CASE DISASSEMBLY PROCEDURES .....	20
[359/360] TRANSFER CASE PTO AND OIL PUMP REMOVAL PROCEDURES .....	38
<b>BENCH PROCEDURES (DISASSEMBLY)</b> .....	43
[350] TRANSFER CASE COMPONENT DISASSEMBLY .....	44
[352] Main Shaft Disassembly .....	44
[352] Countershaft Disassembly .....	46
[352] Main-Drive Shaft Disassembly .....	51
[352] Front-Driving Shaft Disassembly .....	52
[352] Rear-Drive Shaft Disassembly .....	54
[351] Front-Drive Shaft Bearing Retainer Disassembly .....	56
[359/360/363] PTO AND PUMP COMPONENT DISASSEMBLY .....	58
[359] Oil Pump Disassembly .....	58
[360] PTO Disassembly .....	58
[363] PTO Shift Cover Disassembly .....	60
<b>INSPECTION OF PARTS</b> .....	63
[350] Inspection and Cleaning .....	64
[352] Bearings .....	64
[352] Gears .....	64
[352/353] Shifter Forks, Sliding Clutches and Shift Rails .....	64
[351] Oil Seals .....	65
General Inspection .....	66
General Reassembly Instructions .....	66
Clamp Plate Capscrews .....	66

---



# TABLE OF CONTENTS

---

<b>BENCH PROCEDURES (REASSEMBLY)</b> .....	67
[350] TRANSFER CASE COMPONENT REASSEMBLY .....	68
[351] Front-Drive Shaft Bearing Retainer Reassembly .....	68
[352] Rear-Drive Shaft Reassembly .....	71
[352] Front-Driving Shaft Reassembly .....	75
[352] Main-Drive Shaft Reassembly .....	77
[352] Countershaft Reassembly .....	78
[352] Mainshaft Reassembly .....	84
[359/360/363] PTO AND PUMP COMPONENT REASSEMBLY .....	86
[359] Oil Pump Reassembly .....	86
[360] PTO Reassembly .....	87
[363] PTO Shift Cover Reassembly .....	89
<b>REASSEMBLY</b> .....	91
[350] TRANSFER CASE REASSEMBLY PROCEDURES .....	92
Checking Main-Drive Shaft Bearing End Play .....	95
Checking Mainshaft Bearing End Play .....	103
Checking Countershaft Bearing End Play .....	104
Checking Front-Driving Shaft Bearing End Play .....	112
[359/360] TRANSFER CASE PTO AND OIL PUMP INSTALLATION PROCEDURES .....	113
<b>TRANSFER CASE DECLUTCH CONVERSION</b> .....	119
[350] TRANSFER CASE DECLUTCH CONVERSION (FRONT WHEEL DISCONNECT FEATURE) .....	120
<b>SPECIFICATIONS</b> .....	123
TC15 AND TC25 TRANSFER CASE TORQUE SPECIFICATION LOCATIONS .....	124
TC15 AND TC25 TRANSFER CASE TORQUE SPECIFICATION CHART .....	125
TC15 AND TC25 OIL PUMP AND PTO TORQUE SPECIFICATIONS .....	126
FITS AND LIMITS .....	127
All Forks and Sliding Clutches .....	127
Spring Specifications .....	127
TC15 AND TC25 TRANSFER CASE GENERAL TOLERANCES .....	128
TRANSFER CASE SPECIFICATIONS AND CAPACITIES .....	129
<b>SCHEMATIC AND ROUTING DIAGRAMS</b> .....	131
TC15 AND TC25 OIL HOSE ROUTING .....	132
<b>SPECIAL TOOLS AND EQUIPMENT</b> .....	133
SPECIAL TOOLS .....	134
<b>DISASSEMBLED VIEWS</b> .....	135
<b>INDEX</b> .....	139



# NOTES

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# TRANSFER CASE IDENTIFICATION

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## TRANSFER CASE IDENTIFICATION





# TRANSFER CASE IDENTIFICATION

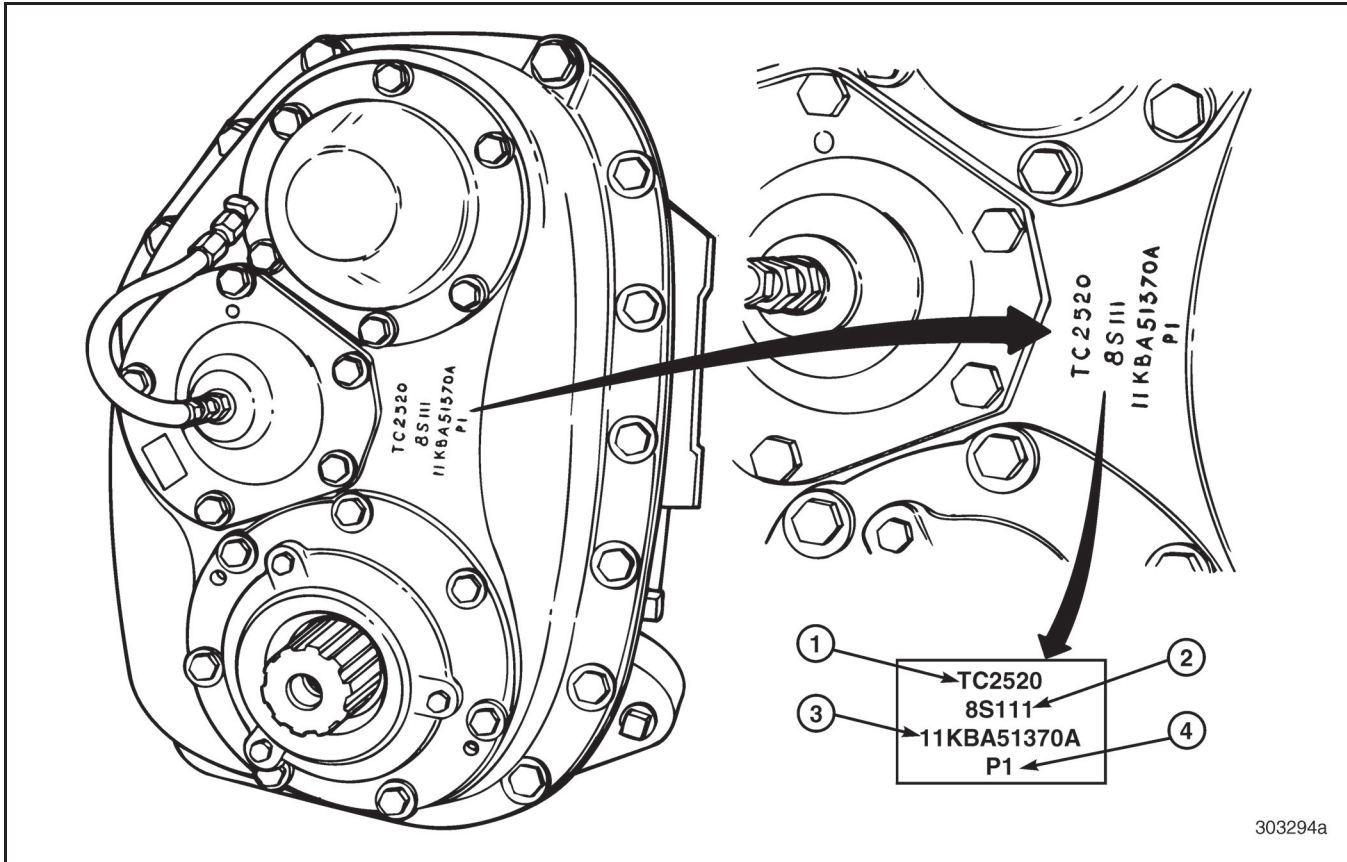


Figure 1 — Location of Identification Stamping on Rear End Plate

## UNIT IDENTIFICATION STAMPING LOCATION

The following model code information is stamped on the rear end plate of the transfer case, just to the right of the countershaft rear bearing cover. Refer to inset above.

1. Unit Symbol Identification

TC = Transfer case

25 = Family, Series

2 = Front to rear drive ratio

0 = Hi/Lo range ratios

2. Transfer Case Serial No.

3. Transfer Case Assembly (Part) No.

\* = digits may vary

4. Options (PTO, oil pump)



# DESCRIPTION AND OPERATION

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## DESCRIPTION AND OPERATION



# DESCRIPTION AND OPERATION

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## TC15 AND TC25 TRANSFER CASE

### Description

The MACK TC15 and TC25 transfer cases are heavy-duty, two-speed (Hi range/Lo range) units designed for all-wheel drive trucks. A sliding clutch is used to shift between Hi range and Lo range. A standard shift fork and rail assembly moves the sliding clutch to engage either Hi range or Lo range. A gearshift lever in the cab is used to accomplish the range shift.

Front-wheel drive output from the transfer case is accomplished by a planetary gear-type differential that comes standard with these transfer cases. This planetary gear differential provides full-time, all-wheel drive without shifting by the driver. Also, an air-actuated differential lockout is provided for use when extra traction is needed.

All gears are the helical type, which provides increased tooth contact and quieter operation. The gears are in constant mesh. Shifting between the gears is accomplished by sliding clutches. All shafts are supported by heavy-duty tapered roller bearings.

An optional power take-off (PTO) is available. The PTO is mounted on the rear of the transfer case and is driven by the mainshaft, which is transmission output driven and provides a heavy-duty drive through all transmission speeds. The PTO is engaged and disengaged by an air shifter activated by the driver.

## LUBRICATION

### Splash Lubrication

All parts inside the transfer case are lubricated by a splash-and-gravity system. Only the lower shafts and gears dip into the lubrication oil to minimize churning. As the gears and shafts spin, a constant spray of oil is directed to all internal parts of the transfer case. The oil cools as it circulates over the case. Troughs and passages, cast into the inside of the case, capture and direct oil to the bearings.

An oil line from the main shaft rear bearing cover provides additional lubrication to the countershaft Hi-range gear and Lo-range gear needle bearings and sliding clutch. The oil then flows through a drilled passage in the countershaft to the needle bearings and sliding clutch.

<b>NOTE</b>
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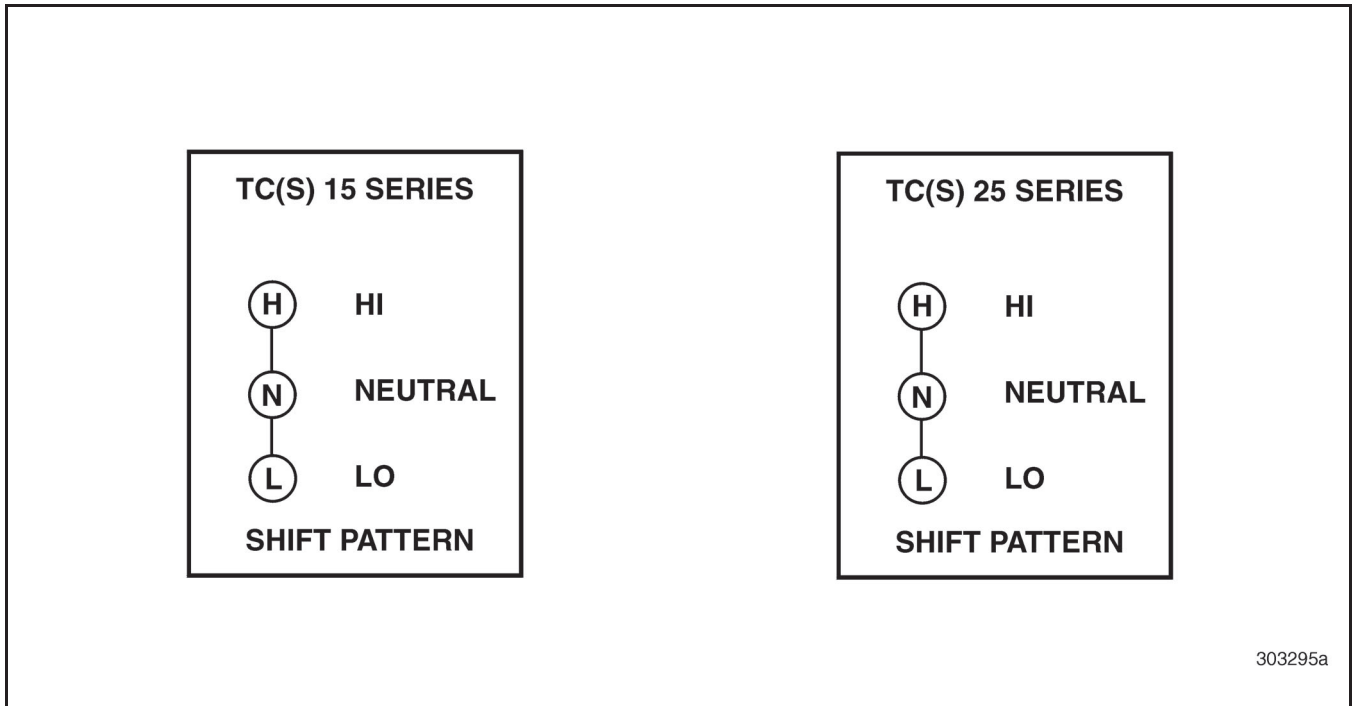
Transfer cases equipped with the optional PTO, are also equipped with a gerotor-type oil pump located on the rear of the mainshaft. This pump is connected by an oil line to the countershaft drilled passage (through the rear bearing cover), to feed additional oil to the needle bearings and sliding clutch.

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# DESCRIPTION AND OPERATION

## TC15 AND TC25 GEAR RATIOS



Model	Hi-Range Ratios	Lo-Range Ratios	Front Drive Ratios
TC15	0.999	2.593	0.965
TC150	0.768	1.992	0.965
TC151	0.999	2.593	0.838
TC1510	0.768	1.992	0.838
TC152	0.999	2.593	1.000
TC1520	0.768	1.992	1.000
TC25	1.360	2.593	0.965
TC250	1.045	1.992	0.965
TC251	1.360	2.593	0.838
TC2510	1.045	1.992	0.838
TC252	1.360	2.593	1.000
TC2520	1.045	1.992	1.000

Figure 2 — TC15 and TC25 Shift Pattern and Gear Ratios



# DESCRIPTION AND OPERATION

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## TC15 AND TC25 SHIFTING INSTRUCTIONS

Shifting between Hi range and Lo range is accomplished using a sliding clutch. A standard shift fork and rail assembly moves the sliding clutch to engage either Hi range or Lo range. A gear shift lever in the cab is used to accomplish the range shift.

Front-wheel drive output from the transfer case is accomplished by a planetary gear-type differential that comes standard with these transfer cases. This planetary gear differential provides full-time, all-wheel drive without shifting by the driver. Also, an air-actuated differential lockout is provided for use when extra traction is needed.

An optional power take-off (PTO) is available. The PTO is engaged and disengaged by an air shifter activated by the driver.

### **WARNING**

**Shifting between Hi (H) and Lo (L) range or engaging the differential lockout while the vehicle is in motion, must NOT be attempted. Drive component damage can occur.**

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### **NOTE**

A transfer case NEUTRAL (N) position is required when a transfer case power take-off (PTO) unit is incorporated. Hi (H) to Lo (L) range air shift PTO is installed.

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## CHASSIS DYNAMOMETER OPERATION

When dynamometer testing any chassis equipped with a TC15/TC25 series transfer case, always disconnect the front axle propeller (drive) shaft at the transfer case. Also, the clutch must be engaged.

These procedures are necessary because vehicles with transfer cases are not designed for continuous operation with the rear wheels turning and the front wheels standing still. Failure to observe these precautions may cause excessive speed of internal parts, such as the planetary gear differential assembly.

## ALL WHEEL DRIVE RATIO MATCH

### All Chassis with TC(S) 15/25 Transfer Case

All wheel drive vehicles using the MACK TC(S) 15/25 Series Transfer Case are built with "fast front" (smaller numerical front) ratios. This provides a positive method of assuring differential lock release, in spite of any driveline windup torque that has accumulated during lock-up.

### **CAUTION**

*Front axle gear life will be shortened if the overall front axle ratio (including tire size) is too slow or too fast with respect to the overall rear axle ratio (including tire size).*

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# DESCRIPTION AND OPERATION

There are five factors that affect ratio match, and their values must be obtained in order to make the match calculations:

- Front tire revolutions per mile.
- Rear tire revolutions per mile.  
(Above numbers change with tire size, make, ply type, and tread.)
- Transfer case front drive ratio.

Transfer Case Models	Front Drive Ratios
TC15, TC150, TC25, TC250	.966
TC151, TC1510, TC251, TC2510	.838
TC152, TC1520, TC252, TC2520	1.000

- Front axle ratio.
- Rear axle ratio.

### Formula for Calculating % Ratio Match

$$\% \text{ Ratio Match} = \frac{(R - F) \times 100}{F}$$

- Where F = (Front Tire Revolutions/Mile) x (Transfer Case Front Drive Ratio) x (Front Axle Ratio)
- Where R = (Rear Tire Revolutions/Mile) x (Rear Axle Ratio)

Note: "F" must be *smaller* than "R" to have the desirable "fast front" ratio match.

### TC15 TRANSFER CASE SERIES RATIO MATCH TOLERANCE RANGE

Minimum: + .5%

Maximum: + 3.5%

Any match within the above limits is approved.

#### EXAMPLE:

- Front tire revolutions/mile = 458
  - Rear tire revolutions/mile = 484
  - TC15 front drive ratio = .965
  - Front axle ratio = 6.17
  - Rear axle ratio = 5.73
- $$F = 458 \times .965 \times 6.17 = 2,726.9$$
- $$R = 484 \times 5.73 = 2,773.3$$
- $$(R - F) = (2,773.3 - 2,726.9) = 46.4$$

$$\% \text{ Ratio Match} = \frac{(R - F) \times 100}{F} = \frac{46.4 \times 100}{2,726.9}$$

$$= 1.7\% \text{ Fast Front}$$

$$\underline{\hspace{10em}}$$

(Approved Match)

### NOTE

When front and rear tires are *identical*, their revolutions/mile figures may be omitted from the calculation. Additionally, *identical* changes can be made to all tires in size or tread without affecting the ratio match.



# DESCRIPTION AND OPERATION

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## **! WARNING**

When the original front and rear tires are *different* in size or tread, and a tire replacement is contemplated that is not identical to the original tire in revolutions per mile, it is very important that the match ratio be rechecked per the calculation noted above. Revolutions per mile can vary greatly even though the tire size may be the same.

When the original front and rear tires are *identical*, and a tire replacement in size or tread is contemplated on either the front or the rear axles separately, it is again very important that the match ratio be rechecked per the above calculation.

---

## TCS15 TRANSFER CASE

This transfer case is the same as the TC15, except for the added feature of an overrunning clutch system which automatically prevents front axle spinout, and eliminates the need for manual lock-up operation. The “% ratio match” calculation method is identical to the TC15, however, the recommended “match tolerance range” is .5% greater on the plus side to ensure that the tire variations *never* provide a “slow front” match. The latter would void free differential action by locking the overrunning clutch, and causing tire scuffing on highway.

### TCS15 Transfer Case Series Ratio Match Tolerance Range

Minimum: +1.0%

Maximum: +4.0%

Any match within the above limits is approved.



# COMPONENT LOCATOR

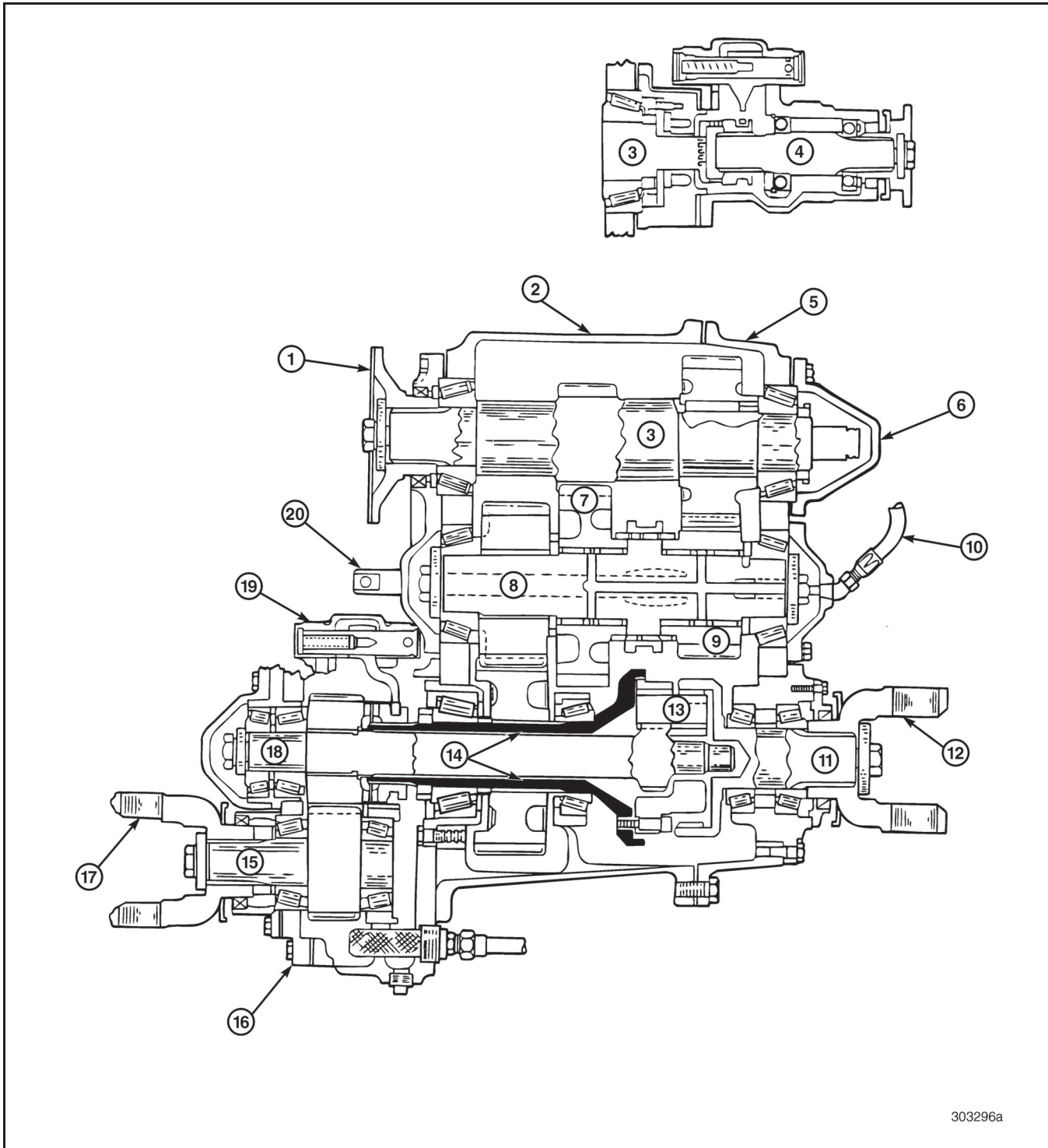
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## COMPONENT LOCATOR





# COMPONENT LOCATOR



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1. Input Yoke (from Transmission)	8. Countershaft	15. Front-Driving Shaft
2. Main Case	9. Countershaft Hi-Range Gear	16. Front-Drive Housing Cover Plate
3. Main Shaft	10. Oil Line	17. Front Axle Output Yoke
4. PTO Shaft	11. Rear-Drive Shaft	18. Front-Drive Shaft
5. Rear End Plate	12. Rear Axle Output Yoke	19. Air Shifted Differential Lockout Assembly
6. Main Shaft Rear Bearing Cover (w/o PTO)	13. Planetary Cage and Gear Assembly	20. Hi/Lo Range Shift Rail
7. Countershaft Lo-Range Gear	14. Main-Drive Shaft	

Figure 3 — Major Component Locations for TC15 and TC25 Transfer Case



# TROUBLESHOOTING

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# TROUBLESHOOTING



# TROUBLESHOOTING

## TROUBLESHOOTING CHART

Symptom	Probable Cause	Remedy
<b>NOISE</b>	<ul style="list-style-type: none"> <li>a. Low oil level</li> <li>b. Wrong oil used</li> <li>c. PTO installed incorrectly</li> <li>d. Gears worn, chipped, rough, cracked</li> <li>e. Bearings worn, cracked, corroded, galled, etc.</li> <li>f. Resonating (ringing) driveshaft</li> </ul>	<ul style="list-style-type: none"> <li>a. Fill to correct level.</li> <li>b. Drain and refill with correct oil.</li> <li>c. Reinstall PTO correctly.</li> <li>d. Replace gears.</li> <li>e. Replace bearings.</li> <li>f. Install suitable dampening material, high-speed balance driveshaft.</li> </ul>
<b>HARD SHIFTING</b>	<ul style="list-style-type: none"> <li>a. Incorrect driving practices</li> <li>b. Low oil level</li> <li>c. Improperly adjusted clutch, clutch linkage, clutch brake or shift linkage</li> <li>d. Wrong oil used</li> <li>e. Shift linkage not lubricated</li> <li>f. Shift lever binding or has interference</li> <li>g. Poppet ball binding in hole</li> <li>h. Loose setscrews in shifters or shift forks</li> <li>i. Worn or damaged bearing</li> <li>j. Clutch brake ears broken</li> </ul>	<ul style="list-style-type: none"> <li>a. Educate driver.</li> <li>b. Fill to correct level.</li> <li>c. Adjust properly.</li> <li>d. Drain and refill with correct oil.</li> <li>e. Clean and lubricate.</li> <li>f. Relieve binding or interference.</li> <li>g. Clean hole and ball.</li> <li>h. Tighten to correct torque.</li> <li>i. Replace bearing.</li> <li>j. Replace clutch brake.</li> </ul>
<b>GEAR DISENGAGEMENT (JUMPING OUT OF GEAR)</b>	<ul style="list-style-type: none"> <li>a. Shift lever interference</li> <li>b. Improperly adjusted linkage</li> <li>c. Worn or loose mounting insulators</li> <li>d. Loose, broken or missing capscrews</li> <li>e. Weak or broken shift rail poppet spring</li> <li>f. Bent or worn shift fork (range)</li> <li>g. Shift rail bent or poppet notch worn</li> <li>h. Worn taper or chipped teeth on sliding clutch teeth</li> <li>i. Worn or damaged bearings</li> </ul>	<ul style="list-style-type: none"> <li>a. Remove interference.</li> <li>b. Adjust properly.</li> <li>c. Replace insulators.</li> <li>d. Replace capscrews, check threads in case.</li> <li>e. Replace spring.</li> <li>f. Replace fork.</li> <li>g. Replace shift rail.</li> <li>h. Replace sliding clutch and mating gear if clutch teeth are damaged.</li> <li>i. Replace bearings.</li> </ul>
<b>OIL LEAKS</b>	<ul style="list-style-type: none"> <li>a. Oil level too high</li> <li>b. Drain plug or fill plug loose</li> <li>c. Loose or missing capscrews</li> <li>d. Clogged breather</li> <li>e. Gaskets leaking</li> <li>f. Worn oil seals</li> <li>g. O-rings in air shifters leak air into case</li> </ul>	<ul style="list-style-type: none"> <li>a. Drain to correct level.</li> <li>b. Tighten plug.</li> <li>c. Tighten or replace.</li> <li>d. Clean or replace.</li> <li>e. Replace gaskets.</li> <li>f. Replace seals.</li> <li>g. Replace O-rings.</li> </ul>

Continued on next page.



# TROUBLESHOOTING

Symptom	Probable Cause	Remedy
<b>BEARING FAILURE</b>	<ul style="list-style-type: none"><li>a. Dirt in system</li><li>b. Wrong grade or contaminated oil</li><li>c. Excessive vibrations</li><li>d. Binding or seized propeller shaft slip yoke</li><li>e. Improper bearing clamping</li><li>f. Improper bearing installation (end play, etc.)</li></ul>	<ul style="list-style-type: none"><li>a. Clean system, replace bearings as needed, flush and refill with clean oil.</li><li>b. Clean system, replace bearings as needed, flush and refill with clean oil.</li><li>c. Eliminate vibrations, replace bearings.</li><li>d. Clean and replace as needed.</li><li>e. Replace bearings and reclamp, using correct procedures.</li><li>f. Replace bearings, using correct procedures.</li></ul>



# NOTES

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# MAINTENANCE

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# MAINTENANCE



# MAINTENANCE

## MAINTENANCE

### Checking Oil

#### **WARNING**

**Be careful not to burn your finger in hot gear oil when checking oil level in transmission.**

To check the transfer case oil, remove the filler plug on the right-hand side of the case. The oil should be level with the bottom of the filler plug hole.

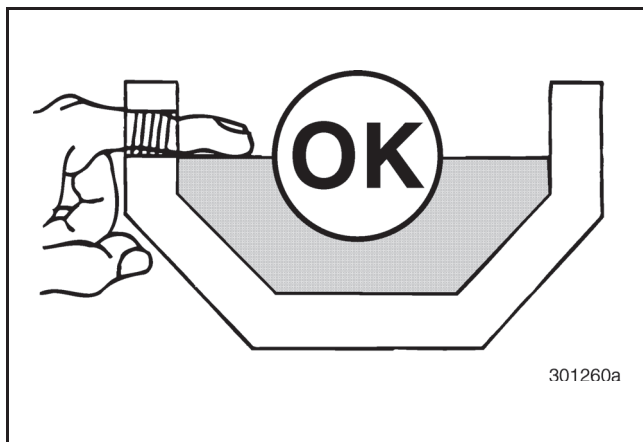


Figure 4 — Correct Oil Level

If oil can only be felt by reaching your finger down into the unit, the oil level is too low.

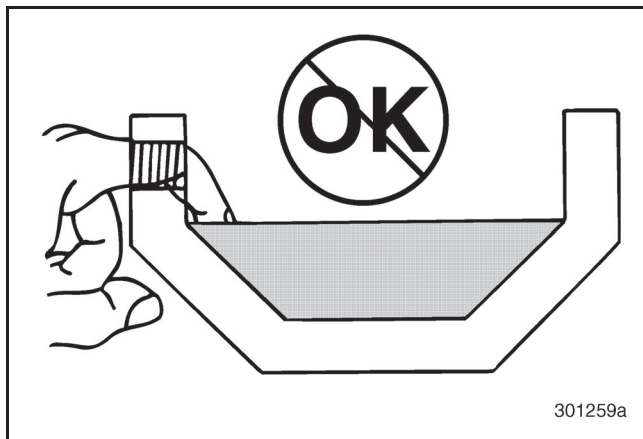


Figure 5 — Incorrect Oil Level

#### NOTE

Check the oil when it is at normal operating temperature. The vehicle should be in a level position, both front-to-rear and side-to-side.

Check the level of the oil at the intervals specified in the Maintenance and Lubrication Manual (TS494). If needed, add oil until it begins to run out of the filler plug hole. Use oil of the proper specification (refer to T15 and T25 Transfer Case Specifications and Capacities in the SPECIFICATIONS section).

### Changing Oil

When changing the oil in the transfer case, the oil should be at normal operating temperature. Remove the magnetic drain plug from the bottom of the transfer case and drain the hot oil from the unit into an industry-approved recovery container. Clean and reinstall the magnetic drain plug. Then tighten plug to 25–30 lb-ft (34–41 N•m) torque.

Remove the filler plug and fill the transfer case with oil of the proper specification to the level of the filler plug hole. (For proper oil specification, refer to T15 and T25 Transfer Case Specifications and Capacities in the SPECIFICATIONS section.)

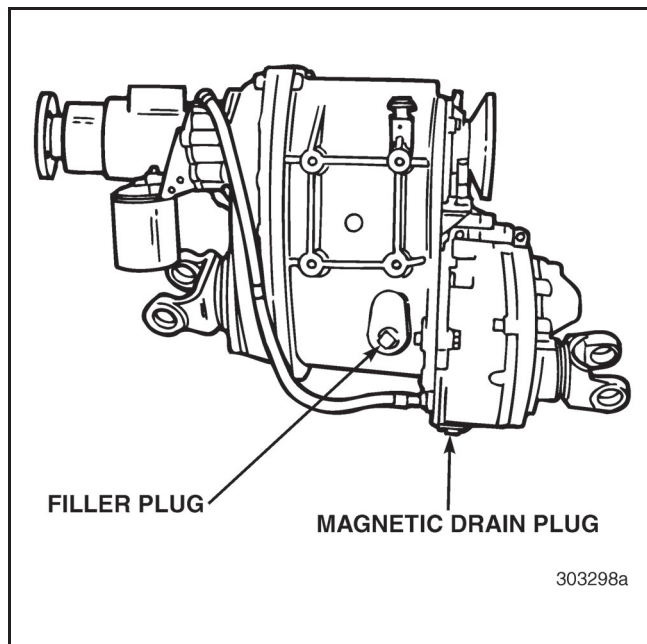


Figure 6 — Plug Locations



# MAINTENANCE

Reinstall and snug the filler plug by hand. Then wrench tighten the plug an additional 3/4 to one turn, not exceeding 55 lb-ft (75 N•m) of torque. Change the oil at the intervals specified in the Maintenance and Lubrication Manual (TS494).

## Air Breather

The TC15 and TC25 transfer cases have one air breather located on the main case. The air breather should be removed and cleaned with a suitable solvent, every time the oil is changed. Also check to be sure that airflow through the breather is unobstructed. Reinstall breather into the main case and tighten until snug.

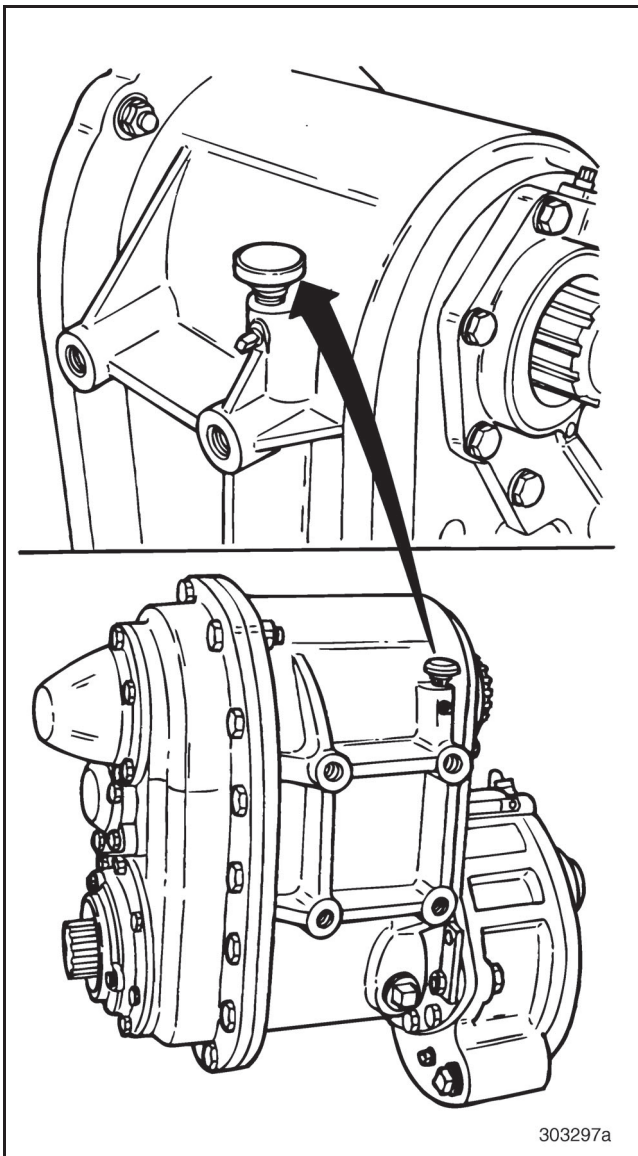


Figure 7 — Transfer Case Air Breather





# NOTES

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# DISASSEMBLY

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# DISASSEMBLY



# DISASSEMBLY

## [350] TRANSFER CASE DISASSEMBLY PROCEDURES

### NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to faulty parts. Do not disturb parts with a heavy press fit (interference fit) unless replacement is necessary. When replacement is necessary, use proper press setups and pullers so that usable parts are not damaged.

### NOTE

External inspection of the unit before cleaning and disassembly often reveals information about existing operating conditions. This may help when diagnosing problems.

### NOTE

The planetary gear differential can be inspected and serviced without removing the transfer case from the vehicle. To do this, remove the rear-drive shaft, bearing retainer and rear output yoke as an assembly.

### SERVICE HINT

During disassembly, remember the sequence in which components and individual parts are removed from the transfer case. It is good practice to keep related parts together in groups when removed. Small parts such as shims and spacers can be wired to the larger pieces they go with. Groups of parts can be kept together in boxes. Keep parts such as shim packs, bearing cones, bearing retainers (covers), bearing cups and gears with the original shaft from which they are removed. Mark each shaft and bearing cover before removal.

1. Drain the lubricant from the transfer case and plug any air line openings to prevent dirt from entering. Remove the transfer case from the vehicle and clean it externally. Mount it in a suitable overhaul stand.

### NOTE

Lift and move the transfer case using a hoist and chain. Lifting brackets are provided.

### SERVICE HINT

Mount the transfer case using the left-hand mounting pad. This provides access to the Hi-/Lo-range shift rail poppet ball, spring and capscrew.

2. Remove the front-driving shaft output yoke (flange) clamp plate and capscrew.

### SERVICE HINT

The front-driving shaft output yoke clamp plate capscrew is right-hand threaded. Loosen the capscrew in a counterclockwise direction.

### SERVICE HINT

To prevent the shaft from rotating when loosening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

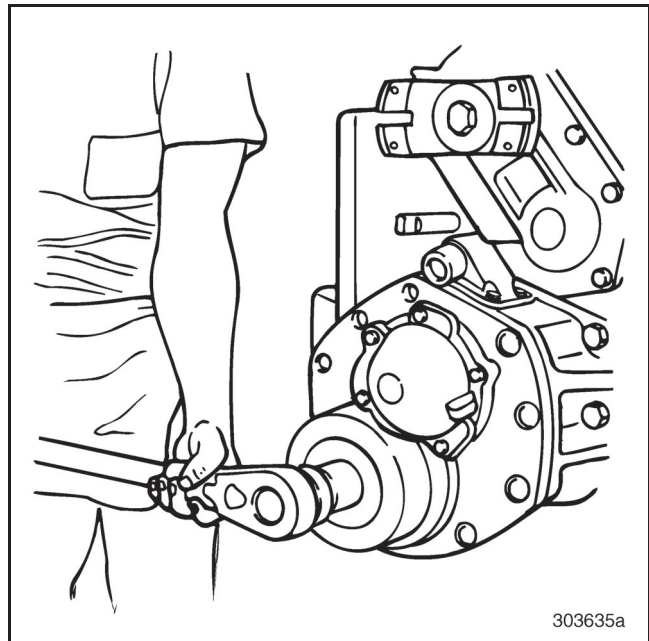


Figure 8 — Removing Front-Driving Shaft Yoke Clamp Plate Capscrew



# DISASSEMBLY

3. Remove the front-driving shaft output yoke (flange) and the speedometer tone wheel from the front-driving shaft.

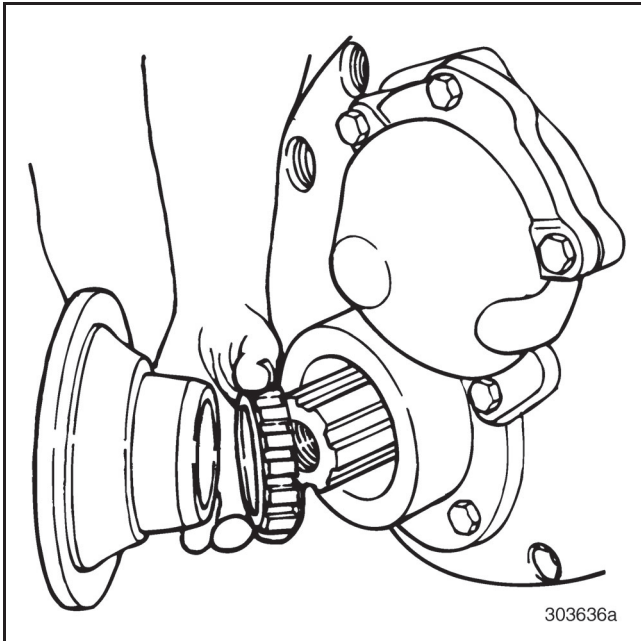


Figure 9 — Removing Output Yoke and Speedometer Tone Wheel

5. Remove the front-drive shaft bearing cover and gasket.

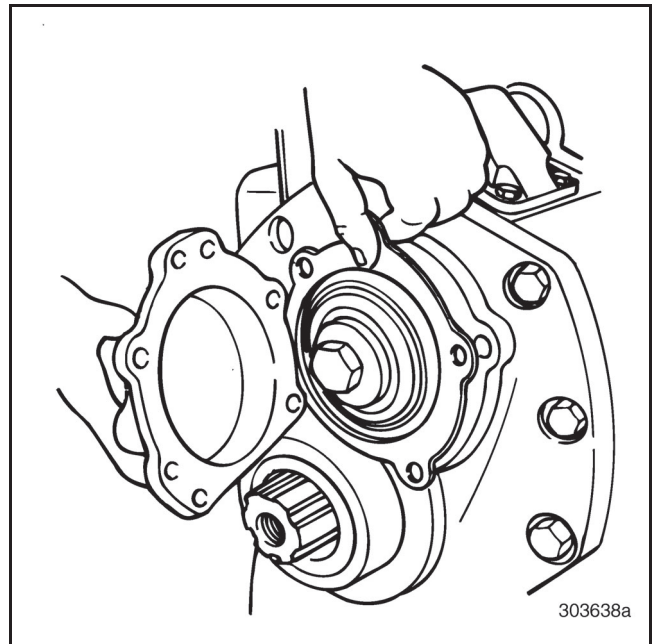


Figure 11 — Removing Front-Drive Shaft Bearing Cover and Gasket

4. Remove the front-drive shaft bearing cover capscrews.

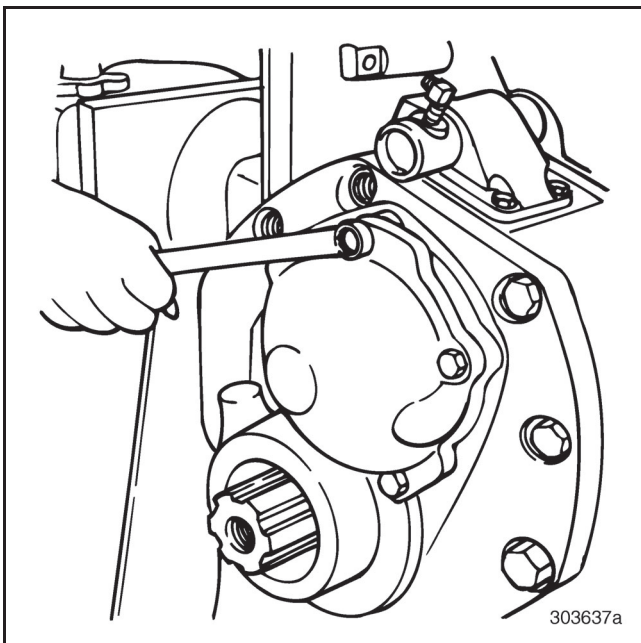


Figure 10 — Removing Front-Drive Shaft Bearing Cover Capscrews



# DISASSEMBLY

6. Remove the front-drive shaft bearing clamp plate capscrew, clamp plate and shims. Wire the shims together for use during reassembly.

## SERVICE HINT

The front-drive shaft bearing clamp plate capscrew is left-hand threaded. Loosen the capscrew in a clockwise direction.

## SERVICE HINT

To prevent the shaft from rotating when loosening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

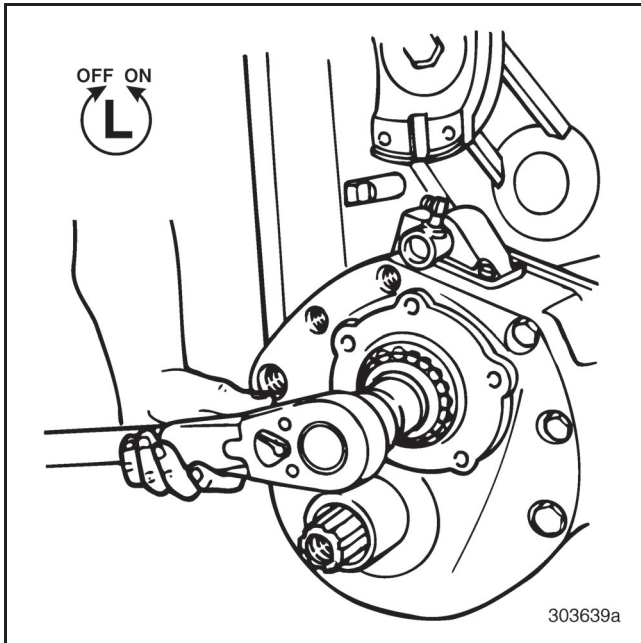


Figure 12 — Removing Front-Drive Shaft Bearing Clamp Plate Capscrew

7. Remove the front-drive shaft outer bearing cone and bearing retainer.

## SERVICE HINT

Jackscrew holes in the bearing retainer are provided to assist in removing the retainer from the unit.

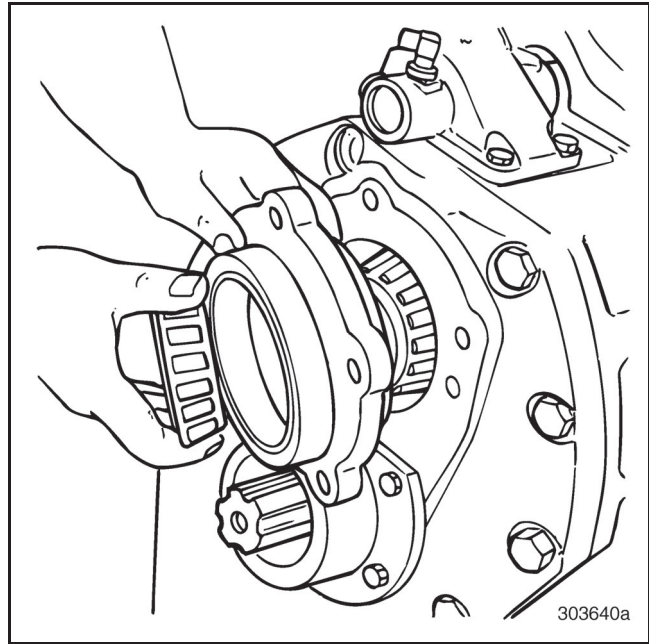


Figure 13 — Removing Front-Drive Shaft Outer Bearing Cone and Bearing Retainer

8. Remove the selective bearing spacer from the front-drive shaft.

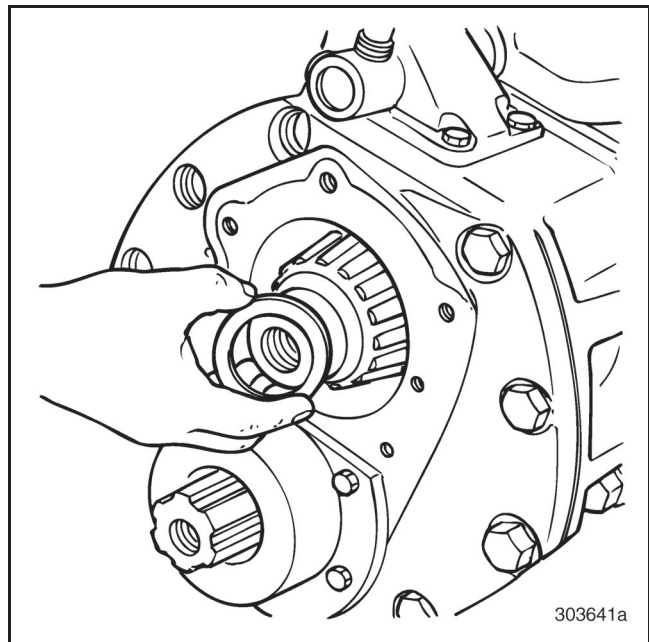


Figure 14 — Removing Selective Spacer from Front-Drive Shaft

- Remove the front-driving shaft seal housing capscrews.

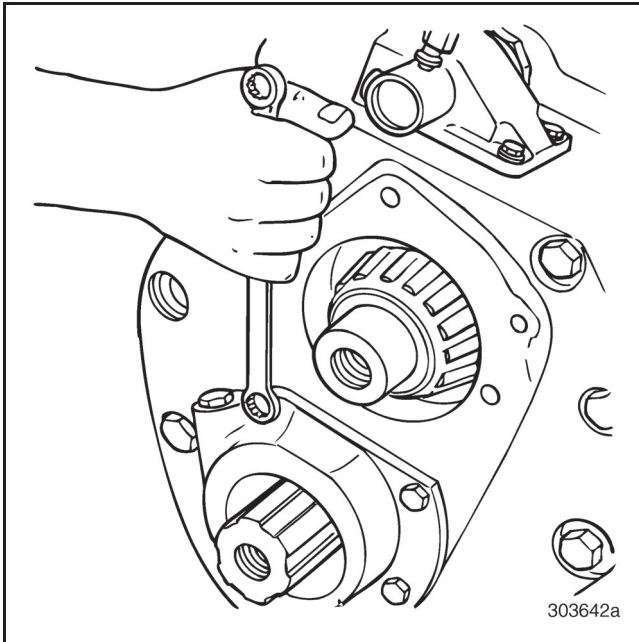


Figure 15 — Removing Front-Driving Shaft Seal Housing Capscrews

- Remove the front-driving shaft seal housing and adjusting shims. Wire the shims together for use during reassembly.

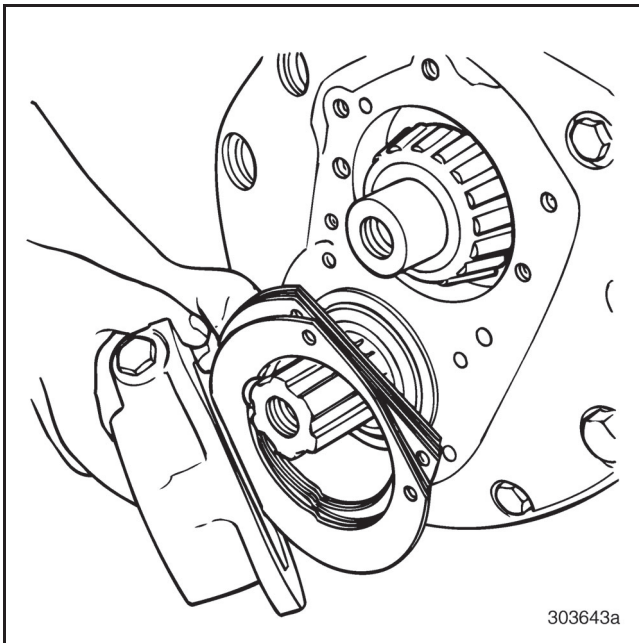


Figure 16 — Removing Front-Driving Shaft Seal Housing and Adjusting Shims

- Remove the front-drive housing cover plate capscrews and dowel bolts.

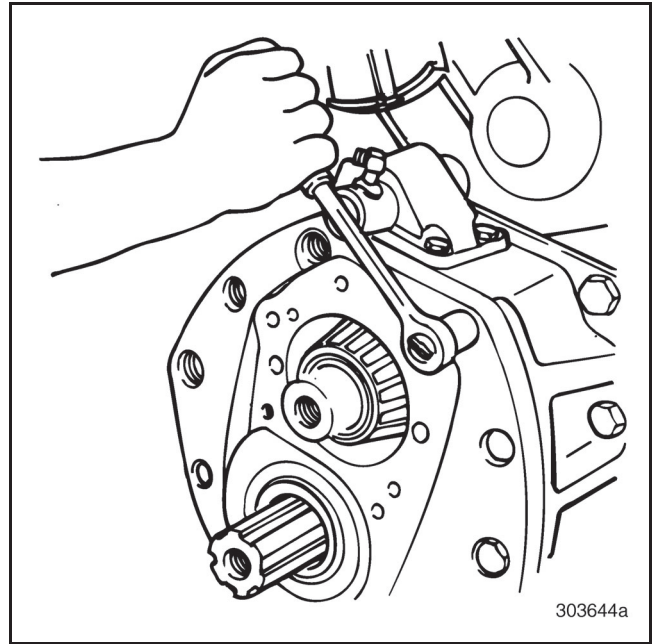


Figure 17 — Removing Front-Drive Housing Cover Plate Capscrews and Dowel Bolts

- Remove the front-drive housing cover plate.

## CAUTION

*The front-driving shaft assembly is loose in the front-drive housing and can fall out when the housing cover is removed. Place the transfer case in a position to prevent personal injury or component damage.*

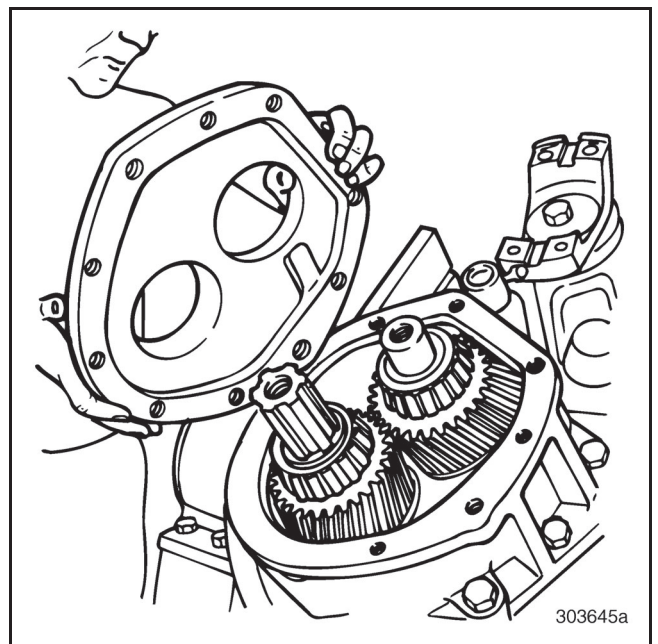


Figure 18 — Removing Front-Drive Housing Cover Plate



# DISASSEMBLY

13. Remove the front-driving shaft assembly from the case.

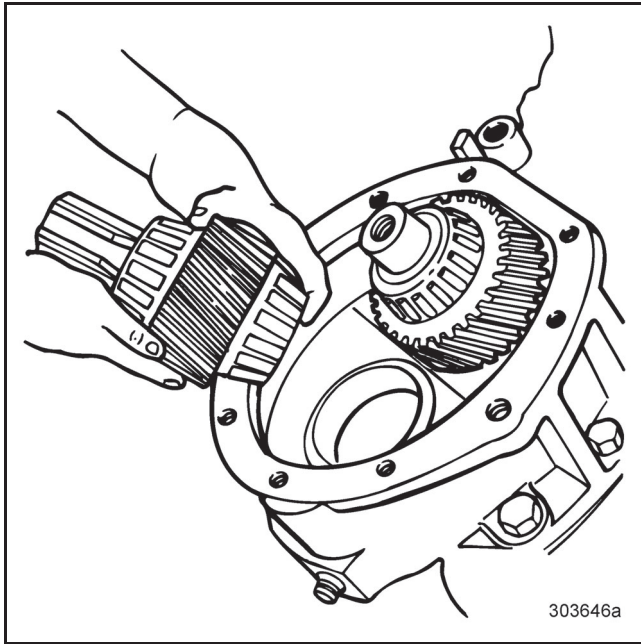


Figure 19 — Removing Front-Driving Shaft Assembly

15. Remove the splined helical gear from the end of the front-drive shaft.

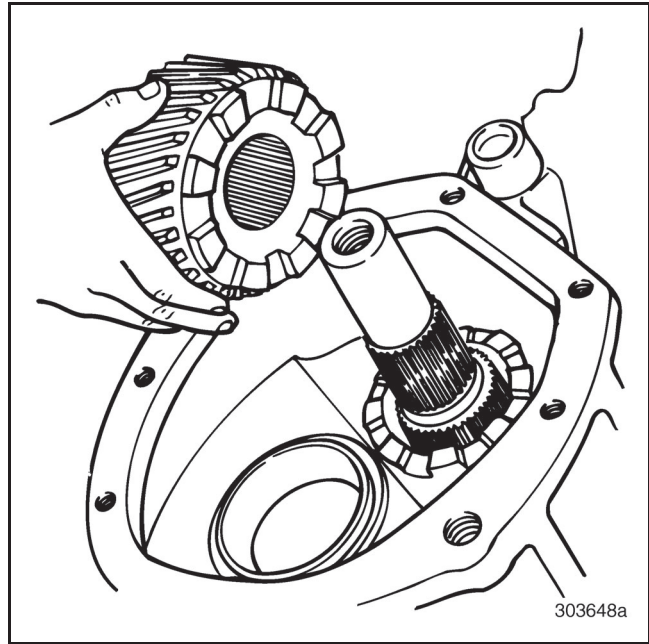


Figure 21 — Removing Helical Gear from Front-Drive Shaft

14. Remove the front-drive shaft inner bearing cone from the front end of the shaft.

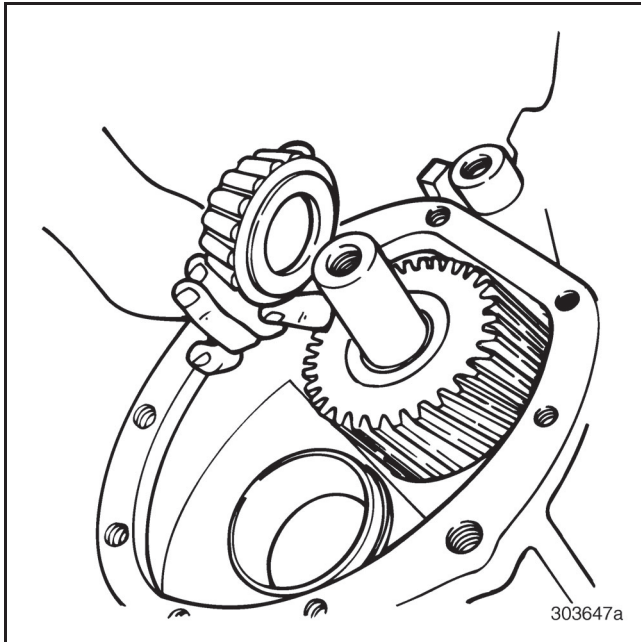


Figure 20 — Removing Front-Drive Inner Bearing Cone

16. Remove the differential lockout clutch air shifter housing capscrews.

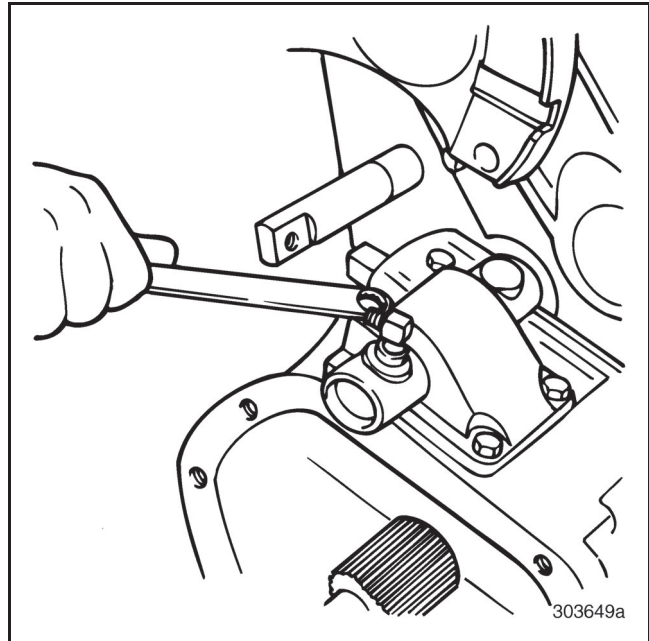


Figure 22 — Removing Shifter Housing Capscrews

17. Remove the differential lockout clutch air shifter housing and shift fork assembly.

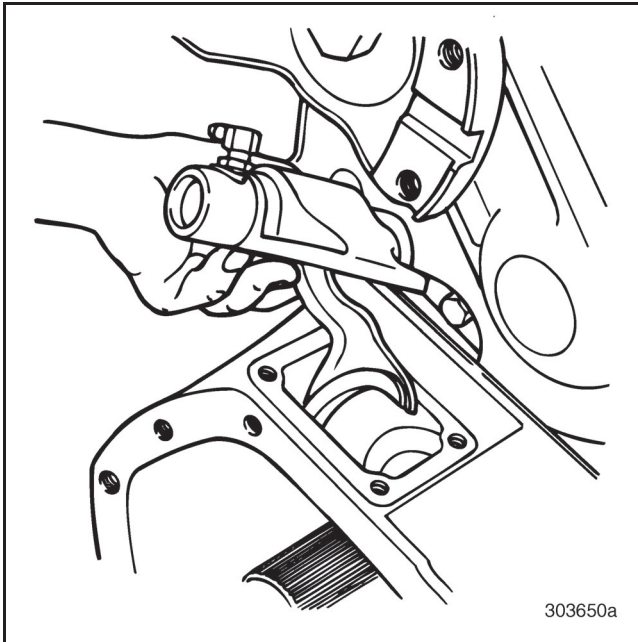


Figure 23 — Removing Air Shifter Housing and Shift Fork Assembly

18. Remove the sliding clutch from the front end of the main-drive shaft.

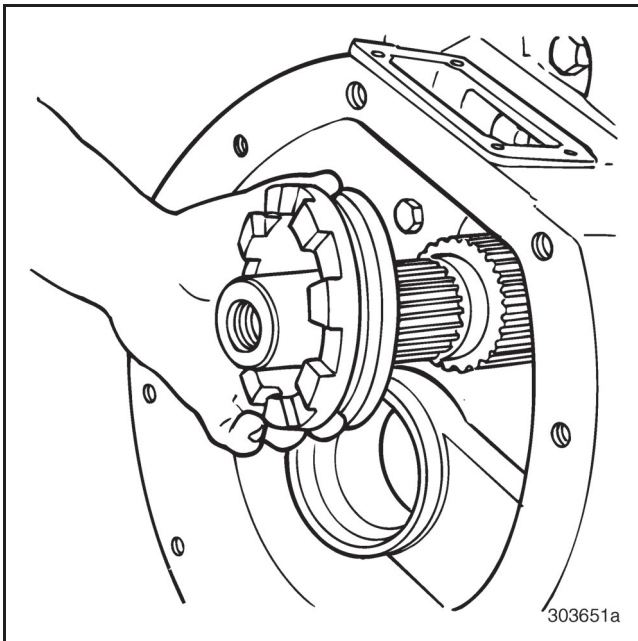


Figure 24 — Removing Sliding Clutch

19. Remove the capscrews and dowel bolts that retain the front-drive housing to the main case.

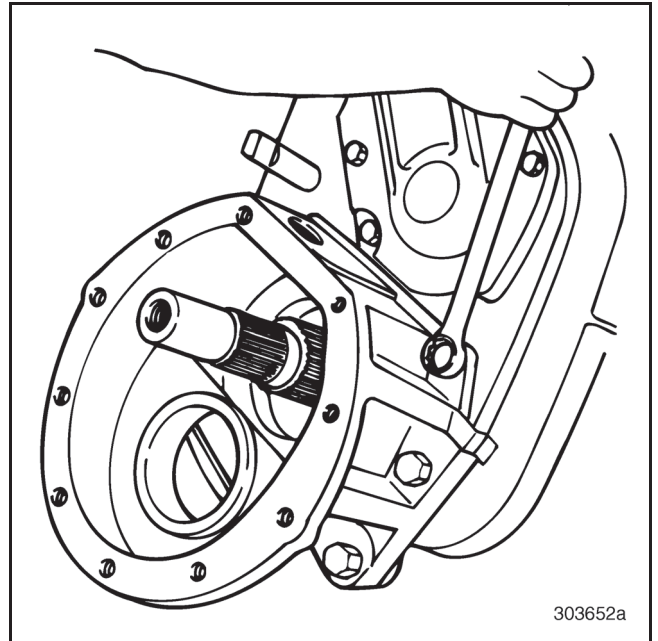


Figure 25 — Removing Front-Drive Housing Capscrews and Dowel Bolts

20. Remove the front-drive housing from the main case.

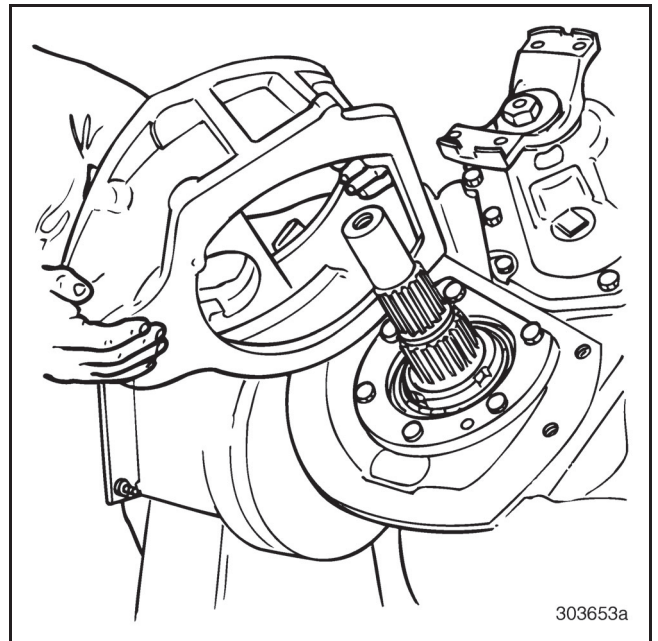


Figure 26 — Removing Front-Drive Housing





# DISASSEMBLY

21. Remove the mainshaft input yoke (flange) clamp plate capscrew and clamp plate.

## SERVICE HINT

The mainshaft input yoke clamp plate capscrew is left-hand threaded. Loosen the capscrew in a clockwise direction.

## SERVICE HINT

To prevent the shaft from rotating when loosening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

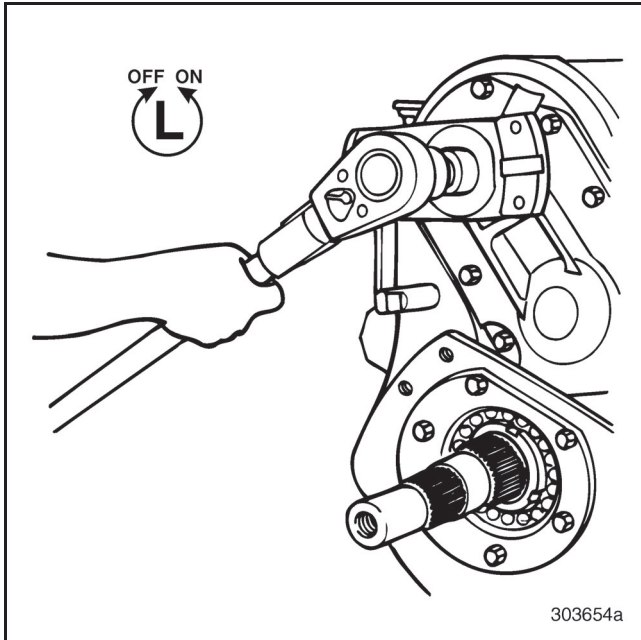


Figure 27 — Removing Mainshaft Input Yoke Clamp Plate Capscrew

22. Remove the mainshaft input yoke (flange).

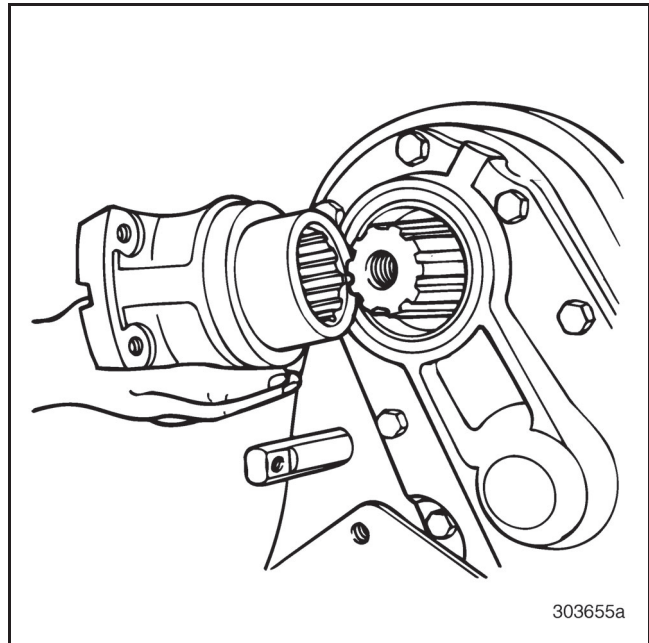


Figure 28 — Removing Mainshaft Input Yoke



# DISASSEMBLY

23. Remove the rear-drive shaft output yoke (flange) clamp plate capscrew and clamp plate.

**SERVICE HINT**

The rear-drive shaft output yoke clamp plate capscrew is right-hand threaded. Loosen the capscrew in a counterclockwise direction.

**SERVICE HINT**

To prevent the shaft from rotating when loosening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

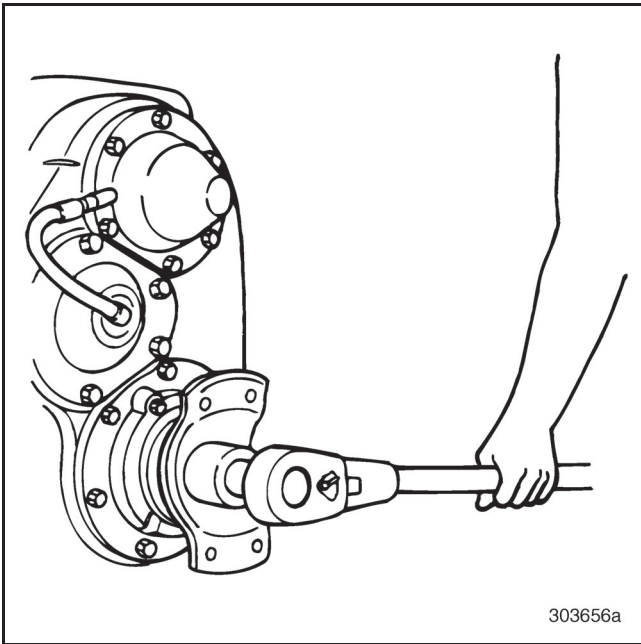


Figure 29 — Removing Rear-Drive Shaft Clamp Plate Capscrew

24. Remove the rear-drive shaft output yoke (flange).

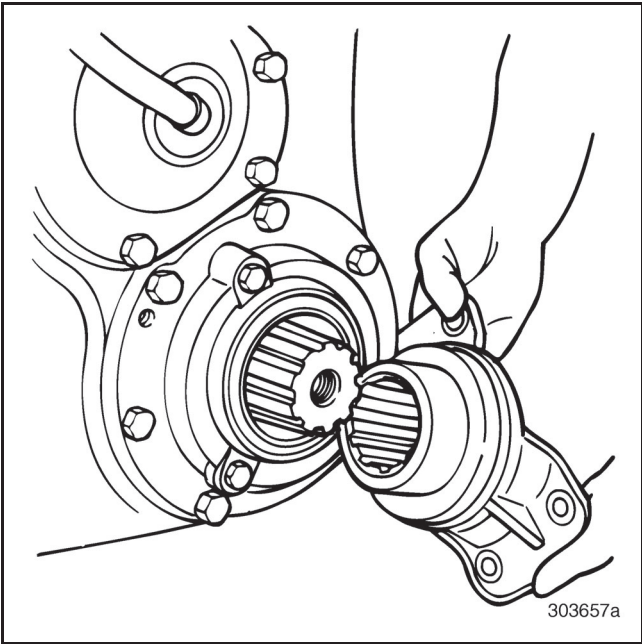


Figure 30 — Removing Rear-Drive Shaft Output Yoke

25. Remove the rear-drive shaft assembly retaining capscrews.

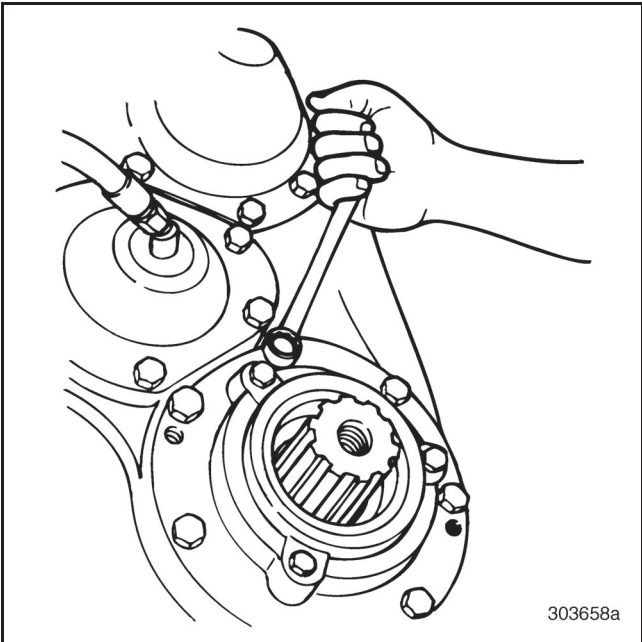


Figure 31 — Removing Rear-Drive Shaft Assembly Capscrews



# DISASSEMBLY

26. Remove the rear-drive shaft assembly from the main case.

### SERVICE HINT

Jackscrew holes are provided to assist in removing the assembly from the unit.

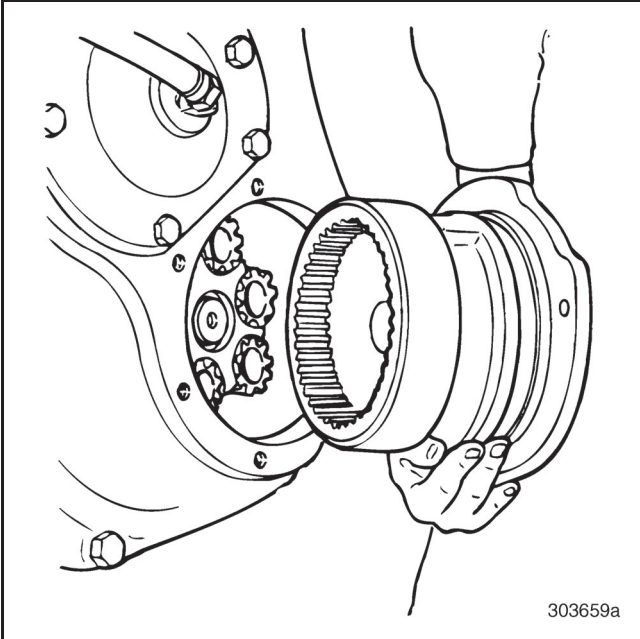


Figure 32 — Removing Rear-Drive Shaft Assembly

27. Remove the oil line from the countershaft rear bearing cover.

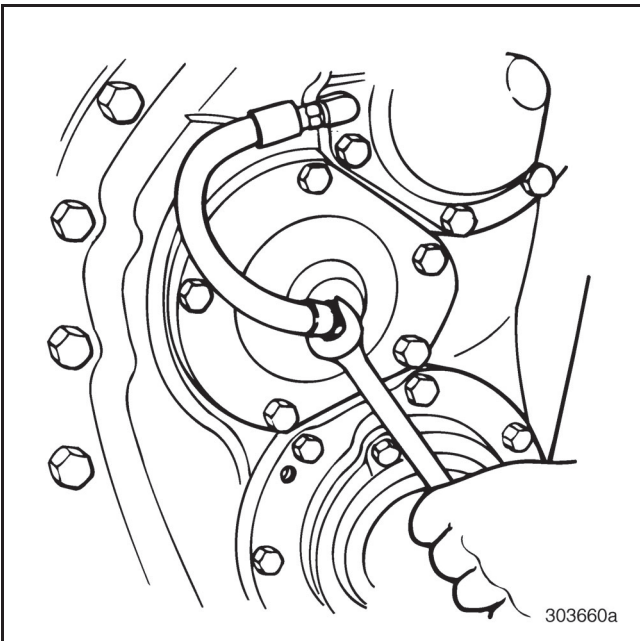


Figure 33 — Removing Oil Line from Countershaft Rear Bearing Cover

28. Remove the countershaft rear bearing cover capscrews; also remove the remaining end of the oil line from the fitting on the mainshaft rear bearing cover.

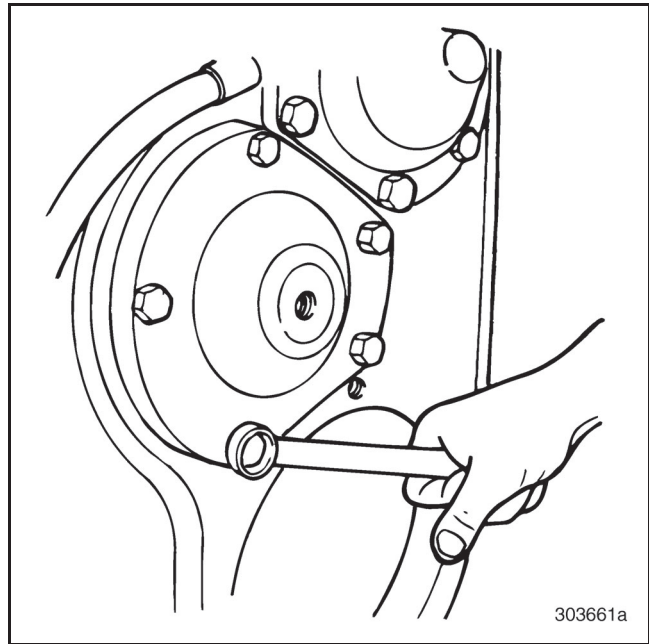
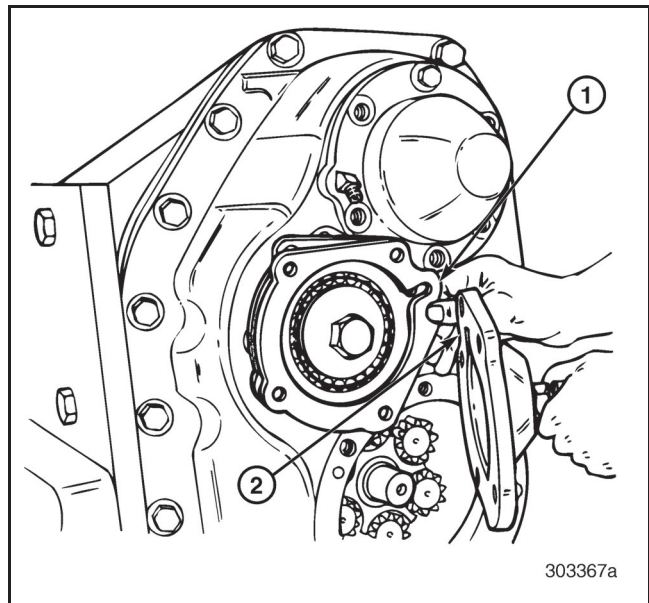


Figure 34 — Removing Countershaft Rear Bearing Cover Capscrews

29. Remove the countershaft rear bearing cover and adjusting shims. Wire the shims together for use during reassembly.



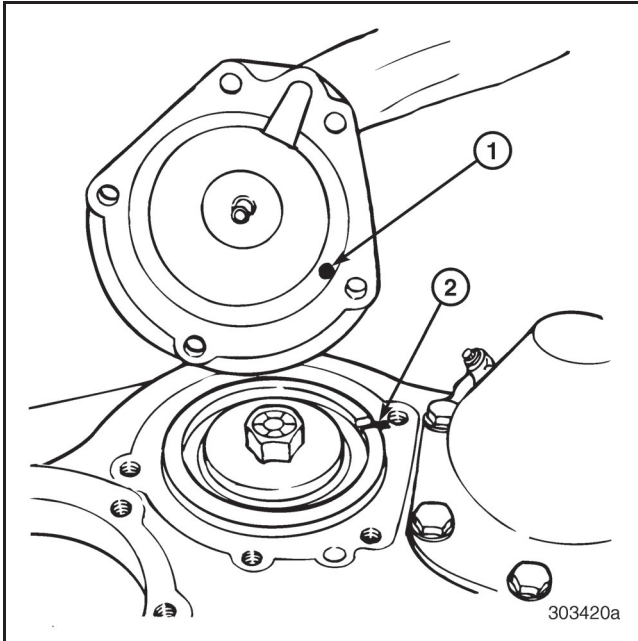
1. Countershaft Shim Oil Hole Location	2. Countershaft Rear Bearing Cover Oil Hole Location
--	--

Figure 35 — Removing Countershaft Rear Bearing Cover and Shims



# DISASSEMBLY

30. Tip the countershaft rear bearing cover on its side and note the bearing cup pin for the countershaft rear bearing cup. Mark the corresponding rear end plate area next to the bearing cup notch. This will aid in reassembly.

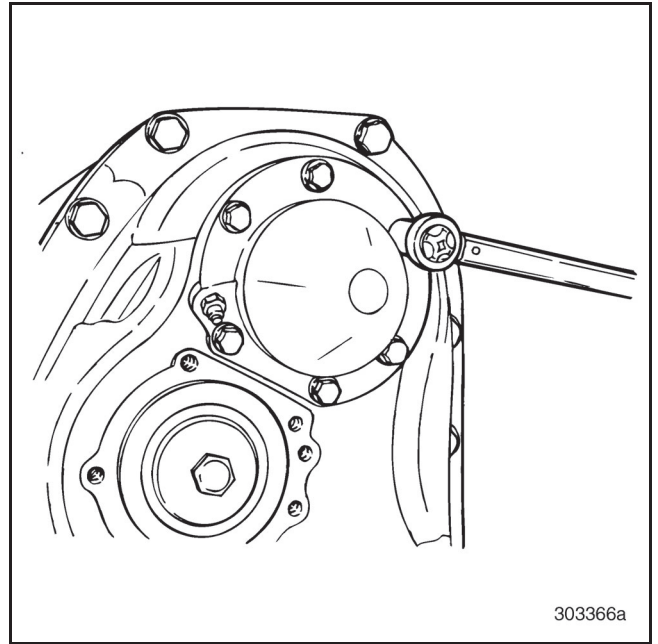


1. Rear Countershaft  
Bearing Cover Pin

2. Countershaft Bearing  
Cup Notch Marking

**Figure 36 — Marking Rear End Plate at Bearing Cup Notch**

31. Remove the capscrews retaining the mainshaft rear bearing cover.



**Figure 37 — Removing Mainshaft Rear Bearing Cover Capscrews**

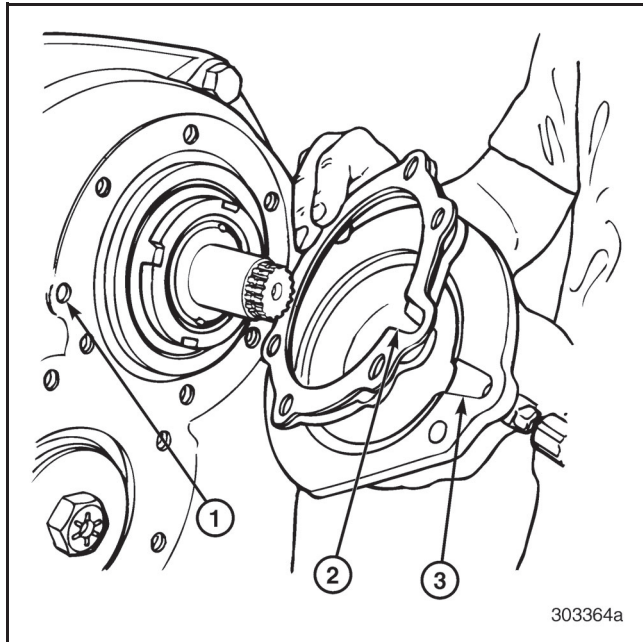


# DISASSEMBLY

32. Remove the mainshaft rear bearing cover and adjusting shims. Wire the shims together for use during reassembly.

## NOTE

If the unit is equipped with an optional PTO and oil pump assembly, refer to PTO and Oil Pump Removal and Disassembly at the end of this section.

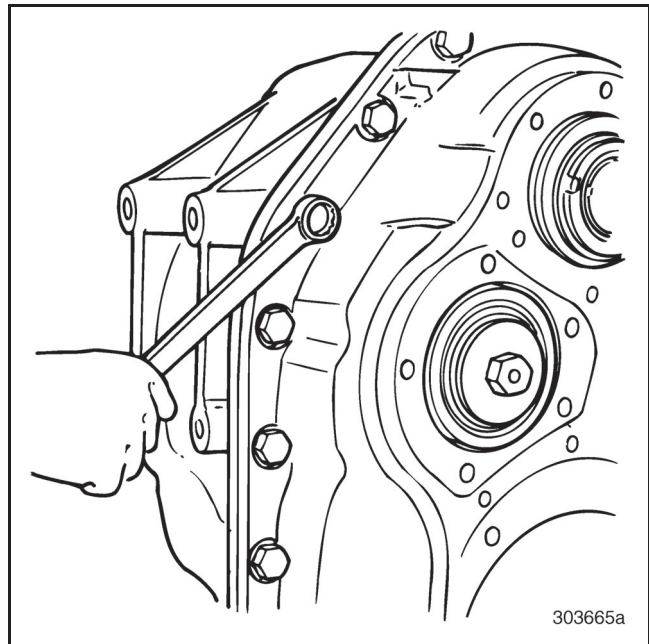


1. Transfer Case Housing Oil Passage  
2. Main Shaft Shim Oil Hole Location

3. Main Shaft Rear Bearing Cover Oil Hole Location

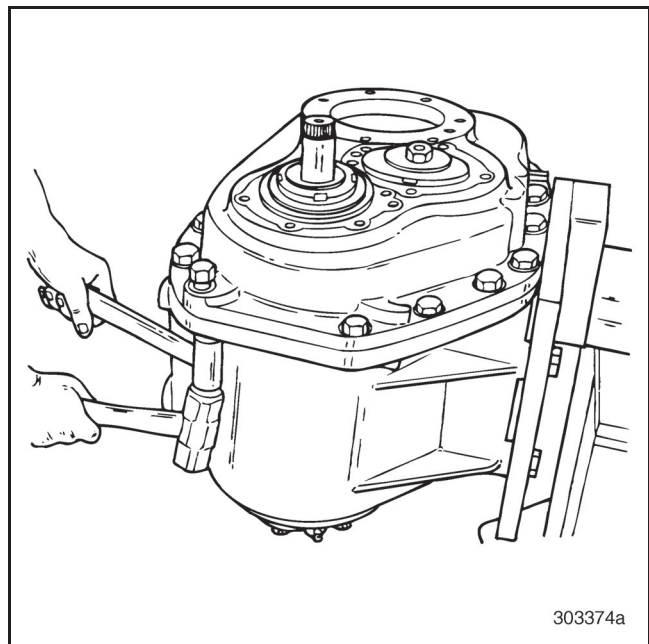
**Figure 38 — Removing Mainshaft Rear Bearing Cover and Adjusting Shims**

33. Remove the capscrews holding the rear end plate to the main case.



**Figure 39 — Removing Rear End Plate Capscrews**

34. Remove the dowel bolts securing the rear end plate to the main case. Remove bolts by placing a brass hammer against the tip of the bolt and tapping brass hammer with weighted hammer.



**Figure 40 — Removing Rear End Plate Dowel Bolts**

35. Remove the rear end plate from the main case, using a suitable hoist arrangement.

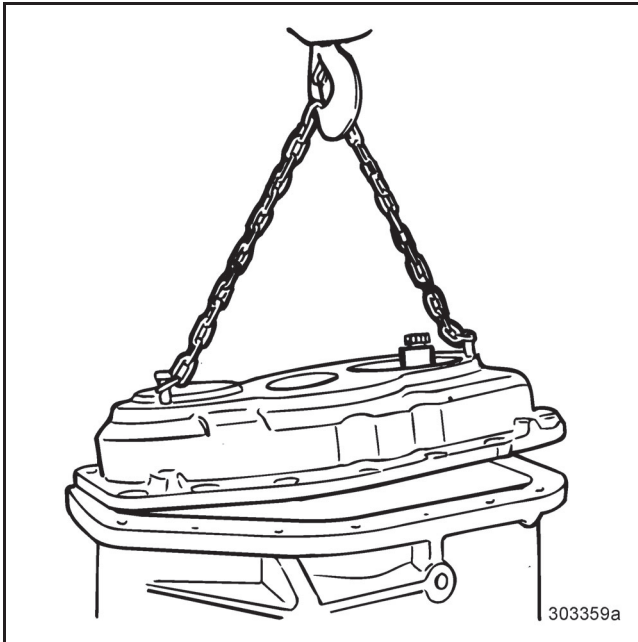


Figure 41 — Removing Rear End Plate

36. Remove the planet pinion gears from the planet pinion gear cage.

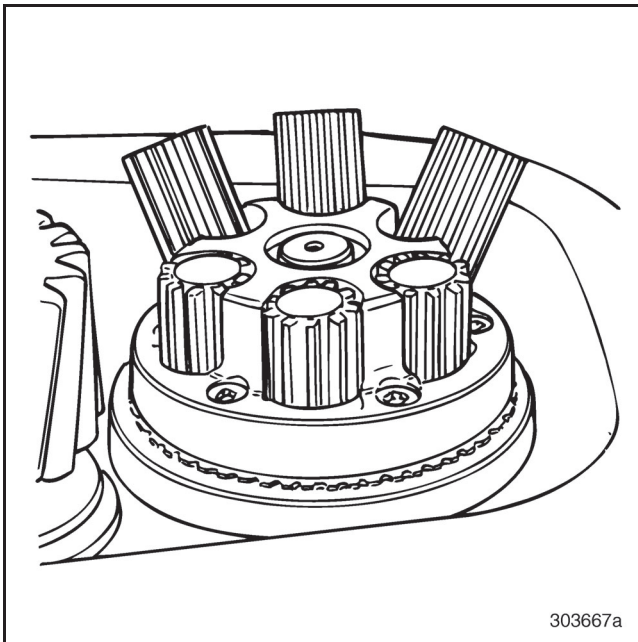


Figure 42 — Removing Planet Pinion Gears

37. Remove the Allen-head capscrews retaining the planet pinion gear cage to the main-drive shaft.

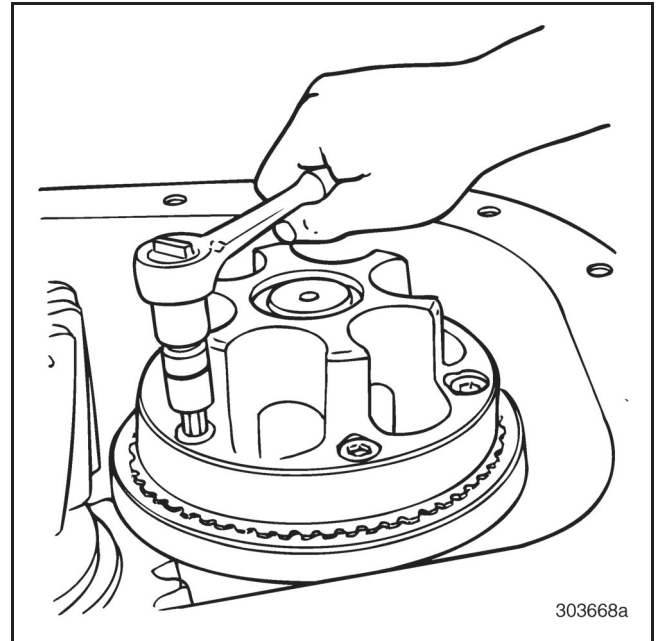


Figure 43 — Removing Planet Pinion Gear Cage Allen-Head Capscrews

38. Remove the planet pinion gear cage from the flange of the main-drive shaft.

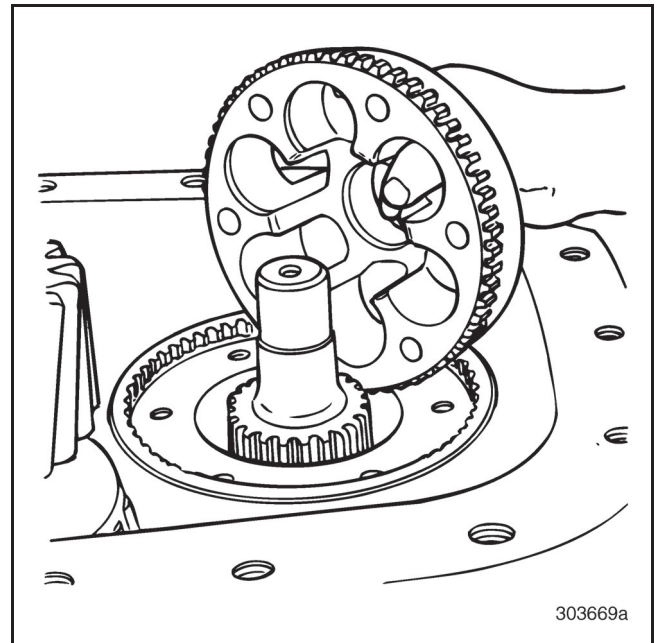


Figure 44 — Removing Planet Pinion Gear Cage



# DISASSEMBLY

39. Remove the front-drive shaft from inside the main-drive shaft.

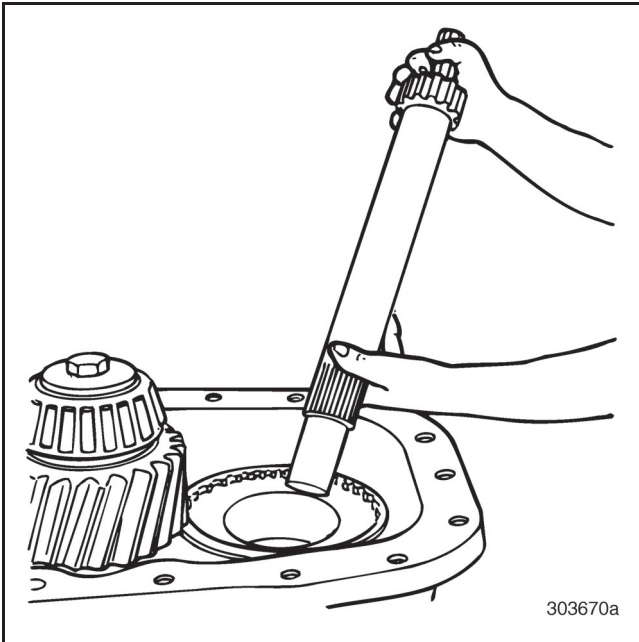


Figure 45 — Removing Front-Drive Shaft

40. Remove the mainshaft from the case.

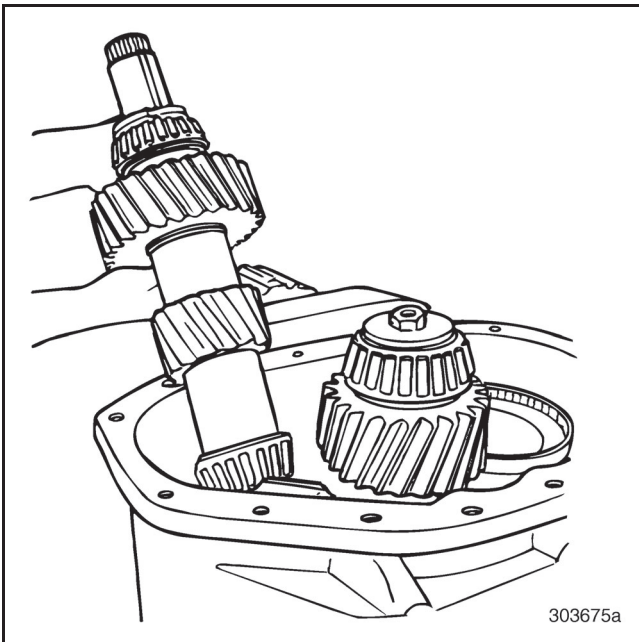


Figure 46 — Removing Mainshaft

41. Working at the front of the transfer case, remove the main-drive shaft bearing locknut, using tool J 24560, or equivalent.

## SERVICE HINT

The main-drive shaft bearing locknut is left-hand threaded. Loosen the locknut in a clockwise direction.

## SERVICE HINT

To prevent the shaft from rotating when loosening the locknut, place a soft iron wedge between the teeth of two adjoining gears.

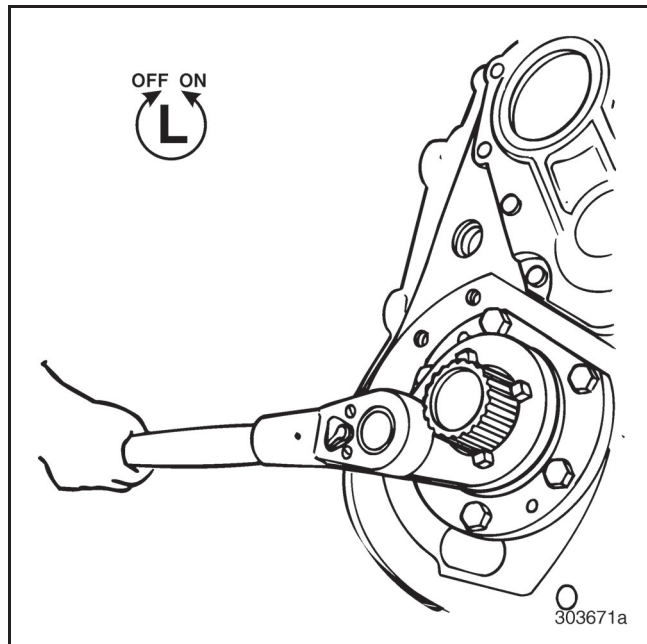


Figure 47 — Removing Main-Drive Shaft Bearing Locknut



# DISASSEMBLY

42. Remove the main-drive shaft bearing retainer capscrews.

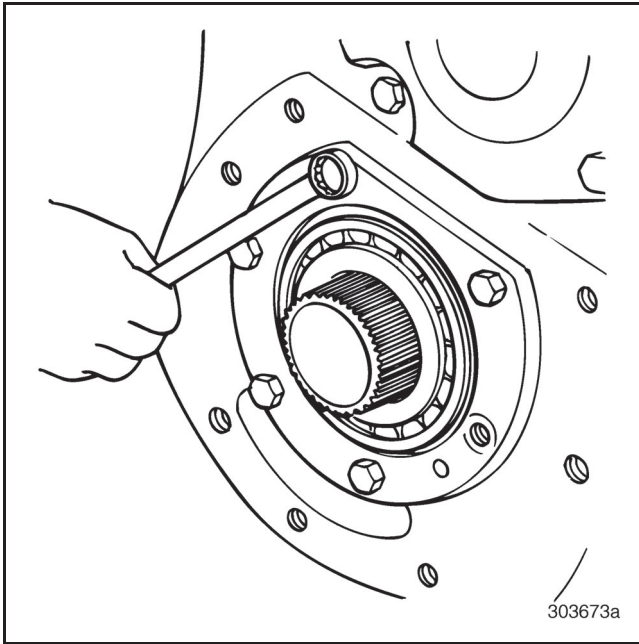


Figure 48 — Removing Main-Drive Shaft Bearing Retainer Capscrews

44. Remove the main-drive shaft bearing retainer, bearing and selective spacer.

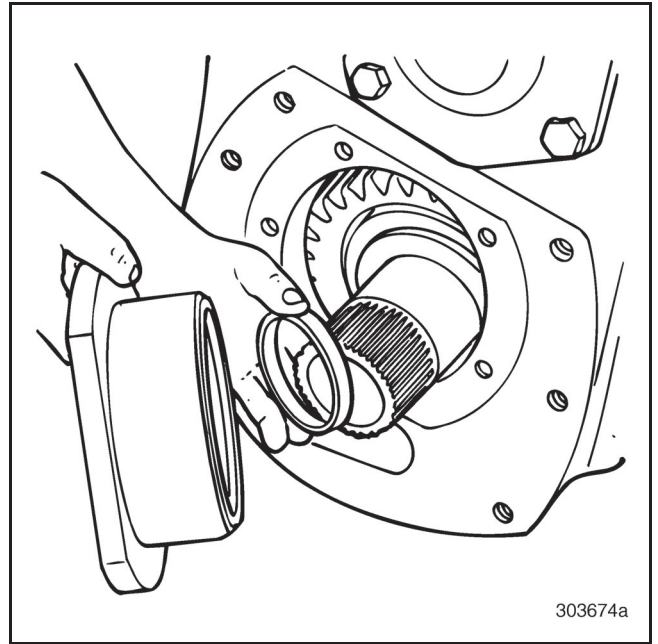
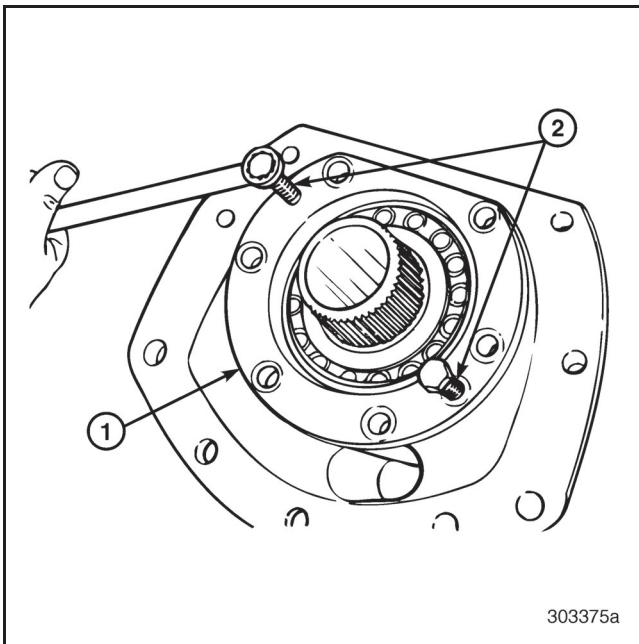


Figure 50 — Removing Main-Drive Shaft Bearing Retainer, Bearing and Selective Spacer

43. Separate the main-drive shaft bearing retainer from the transfer case housing, using jackscrews in the jackscrew holes provided.



1. Bearing Retainer

2. Jackscrews

Figure 49 — Loosening Bearing Retainer Using Jackscrews

45. Working at the rear of the transfer case, remove the two setscrews from the Hi-/Lo-range shift fork.

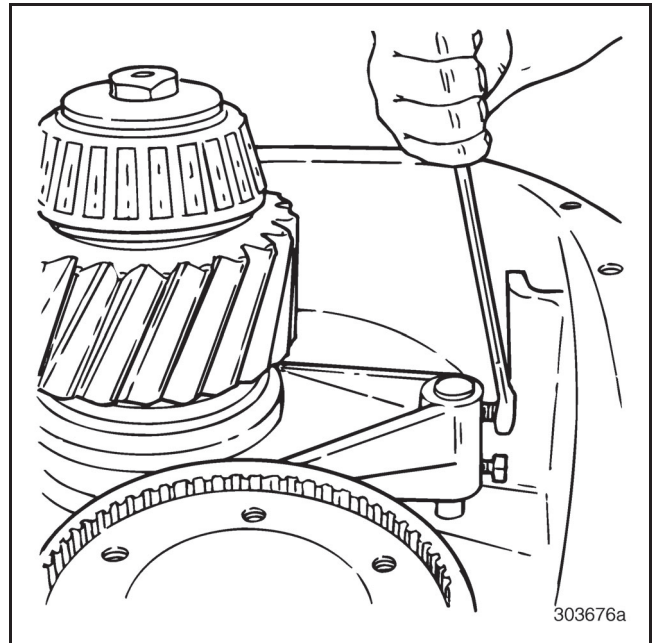


Figure 51 — Removing Shift Fork Setscrews





# DISASSEMBLY

46. Separate the Hi-/Lo-range shift fork from the shift rail. Then remove the shift fork.

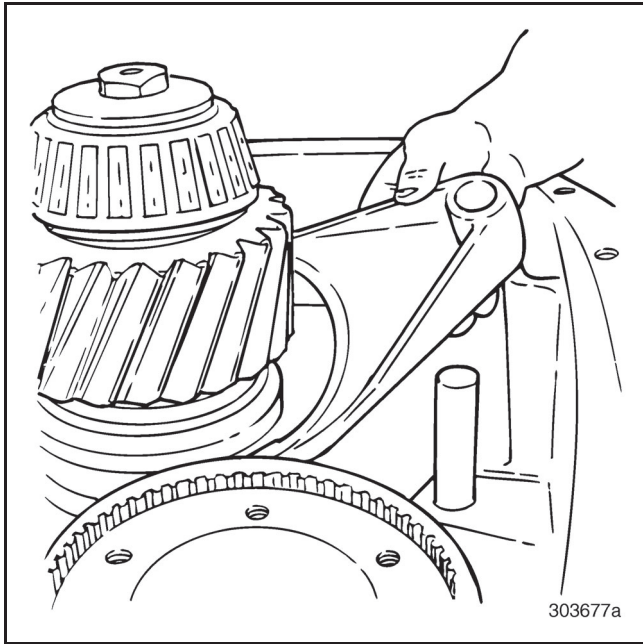


Figure 52 — Removing Shift Fork

47. Remove the shift rail poppet ball, spring and capscrew. Then slide the shift rail out of the case.

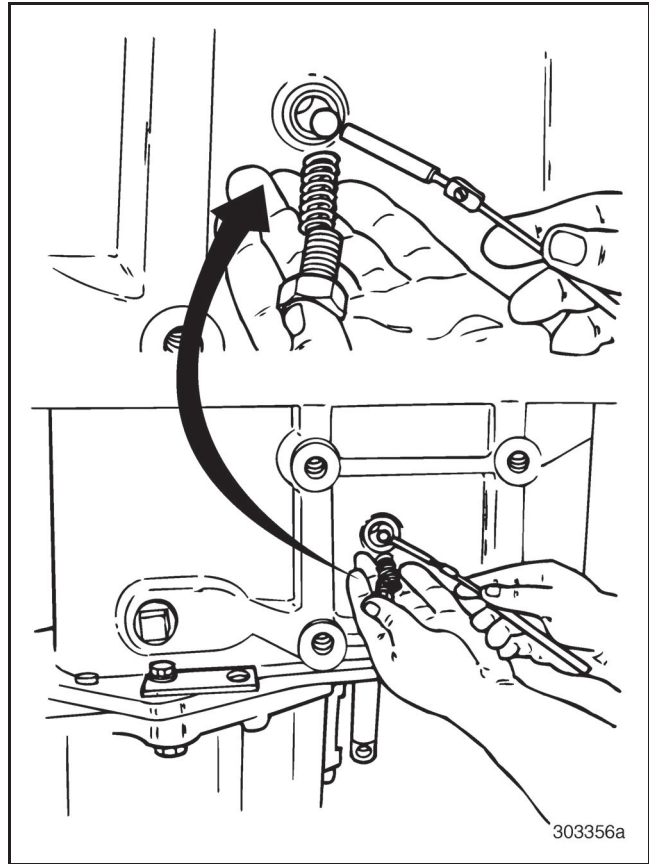


Figure 53 — Poppet Ball, Spring and Capscrew Removed

## **⚠ WARNING**

**Poppet balls are spring loaded and may cause injury when released.**

## **SERVICE HINT**

A magnet is helpful in removing the poppet ball and spring.



# DISASSEMBLY

48. Loosen the countershaft rear bearing clamp plate capscrew.

### SERVICE HINT

The countershaft rear bearing clamp plate capscrew is left-hand threaded. Loosen the capscrew in a clockwise direction.

### SERVICE HINT

To prevent the shaft from rotating when loosening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

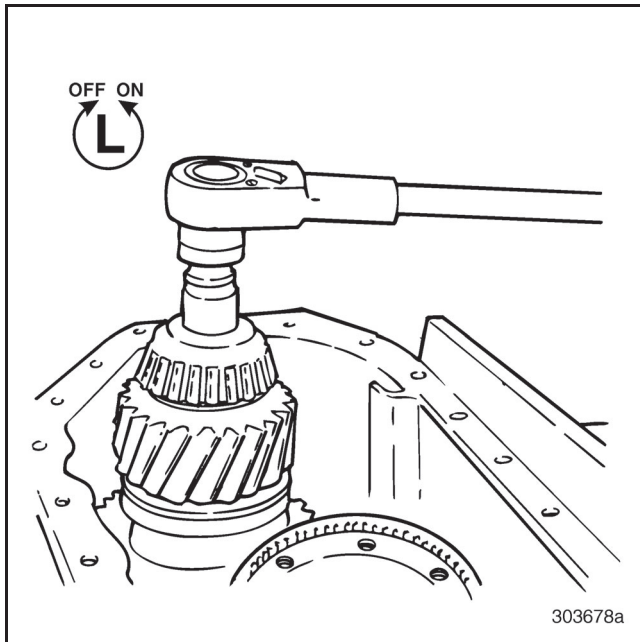


Figure 54 — Loosening Countershaft Clamp Plate Capscrew

49. Remove the countershaft rear bearing clamp plate, capscrew and shims. Wire the shims together for use during reassembly.

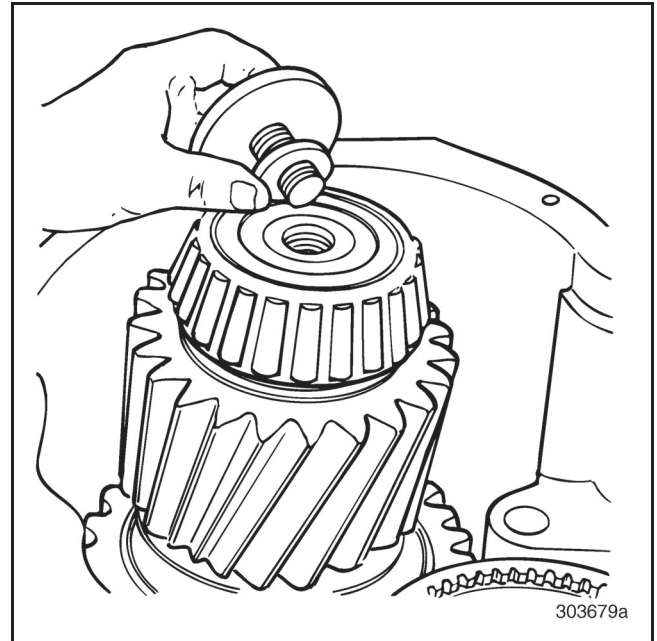


Figure 55 — Removing Clamp Plate, Capscrew and Shims

50. Insert a left-hand threaded eyebolt into the rear end of the countershaft. Then remove the countershaft using a suitable hoist.

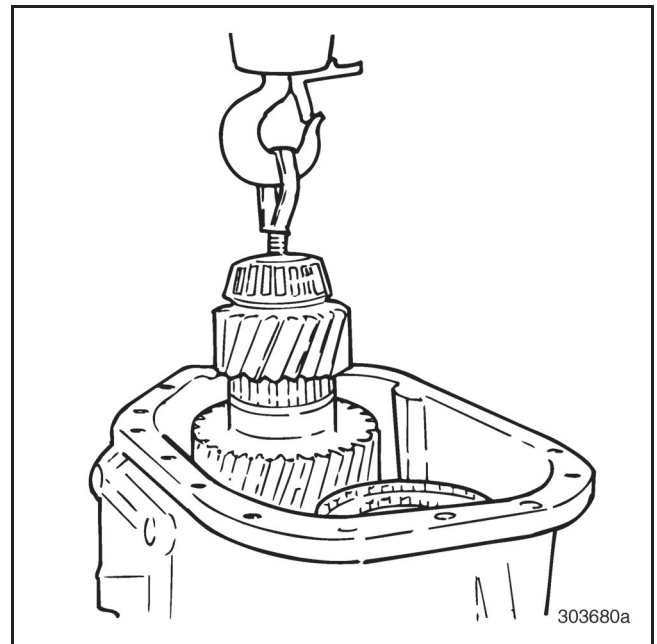
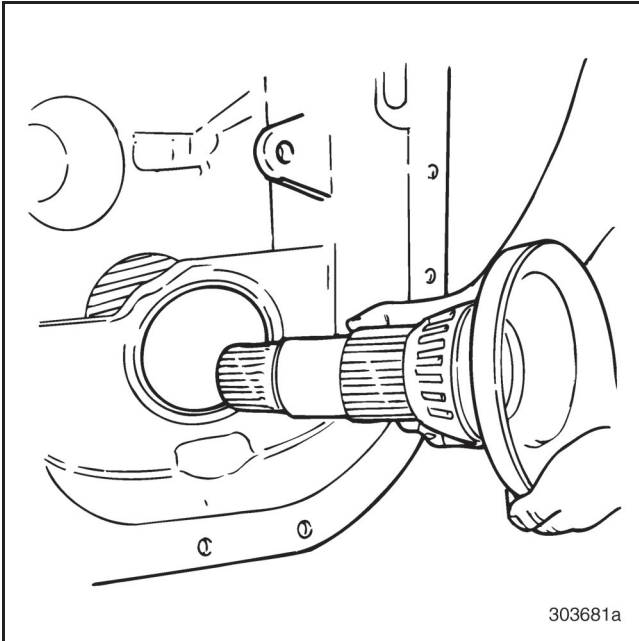


Figure 56 — Removing Countershaft Assembly



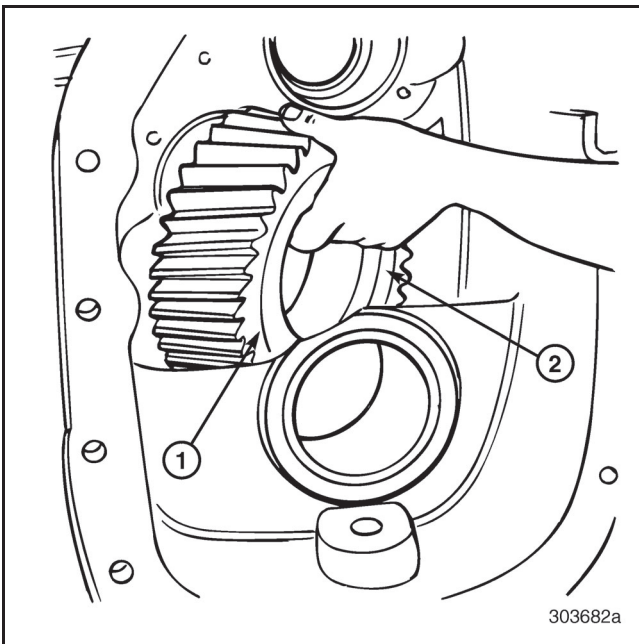
# DISASSEMBLY

51. Remove the main-drive shaft from the case.



**Figure 57 — Removing Main-Drive Shaft**

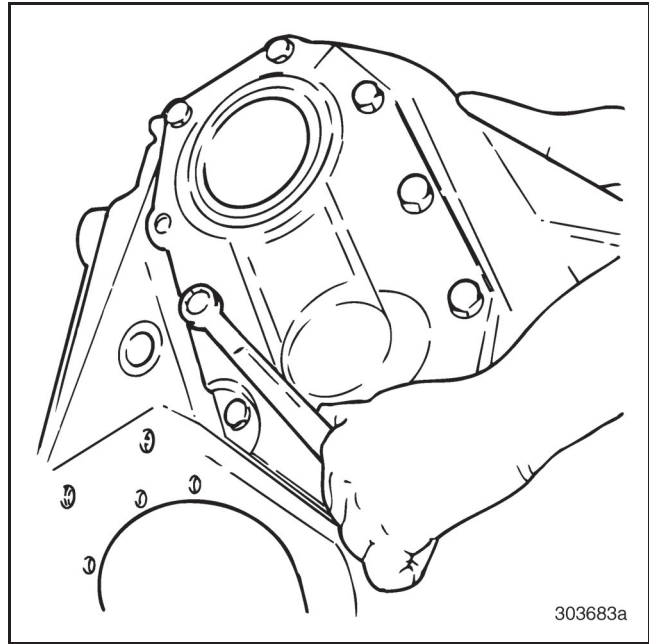
52. Remove the main-drive shaft helical gear from inside the case.



- |                          |                               |
|--------------------------|-------------------------------|
| 1. Main-Drive Shaft Gear | 2. Protruding Hub Toward Rear |
|--------------------------|-------------------------------|

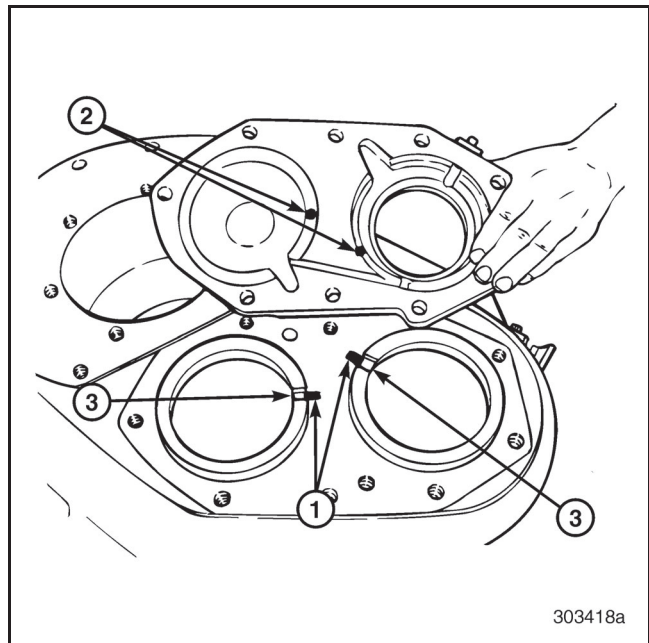
**Figure 58 — Removing Main-Drive Shaft Helical Gear**

53. Remove the mainshaft and countershaft front bearing cover capscrews. Then remove the cover.



**Figure 59 — Removing Bearing Cover Capscrews**

54. Turn the previously removed front bearing cover over and note the position of the bearing cup pins for both the mainshaft and the countershaft. Mark the corresponding main case area next to the bearing cup notches. This will aid in reassembly.



- |  |   |
|--|---|
| 1. Bearing Cup Notch Markings on Main Case | 3. Mainshaft and Countershaft Bearing Cup Notches |
| 2. Front Bearing Cover Bearing Cup Pins    |   |

**Figure 60 — Marking Main Case at Bearing Cup Notches**

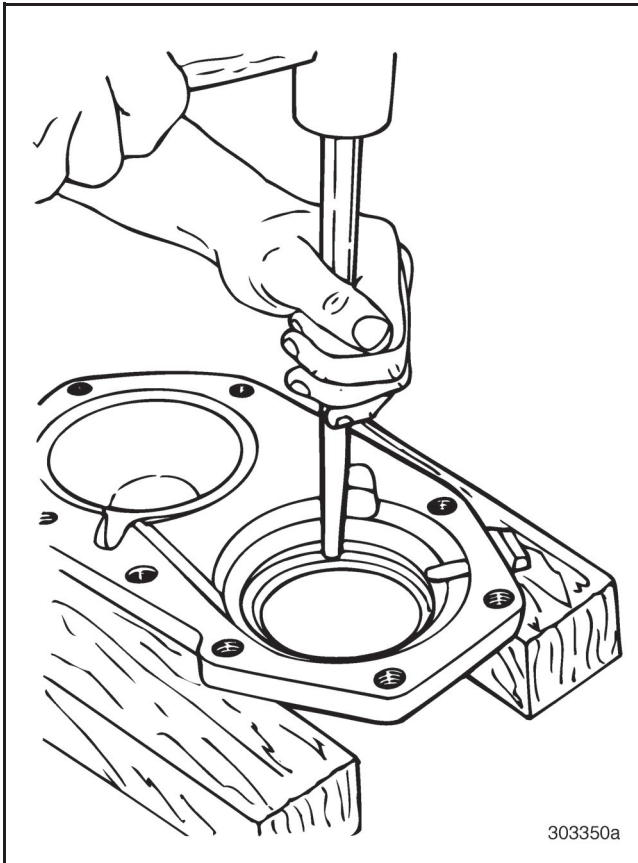


## DISASSEMBLY

55. Remove the oil seals from the front-driving shaft seal housing, mainshaft/countershaft front bearing cover (input yoke seal) and rear-drive shaft assembly seal retainer housing. Use support blocks, a blunt punch and hammer to drive seals out of covers.

### NOTE

This action destroys the seals. Make sure replacement seals are available.



**Figure 61 — Removing Input Yoke Seal from Cover  
(Mainshaft/Countershaft Bearing Cover Shown)**

56. Thoroughly clean and inspect the main case, rear end plate and front-drive housing. Set aside for later reassembly.



# DISASSEMBLY

## [359/360] TRANSFER CASE PTO AND OIL PUMP REMOVAL PROCEDURES

### NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to faulty parts. Do not disturb press fit parts, unless replacement is necessary. When replacement is necessary, use proper press setups and pullers so that usable parts are not damaged.

### NOTE

External inspection of the unit before cleaning and disassembly often reveals information about existing operating conditions. This may help when diagnosing problems.

### SERVICE HINT

During disassembly, remember the sequence in which components and individual parts are removed from the pump or PTO. It is good practice to keep related parts together in groups when removed. Small parts such as shims, spacers or snap rings can be wired to the larger pieces they go with. Keep parts such as shim packs and ball bearings with the original shaft from which they are removed.

1. Disconnect the air lines to the PTO air shifter housing. Mark the air line locations for reassembly.
2. Disconnect the oil hoses located between the transfer case sump and the oil pump. Also disconnect the oil hoses connected between the oil pump and oil filter adapter. Mark all hose locations for reassembly.

3. Remove the oil suction hose sump adapter with screen from the lower position on the front-drive housing of the transfer case.

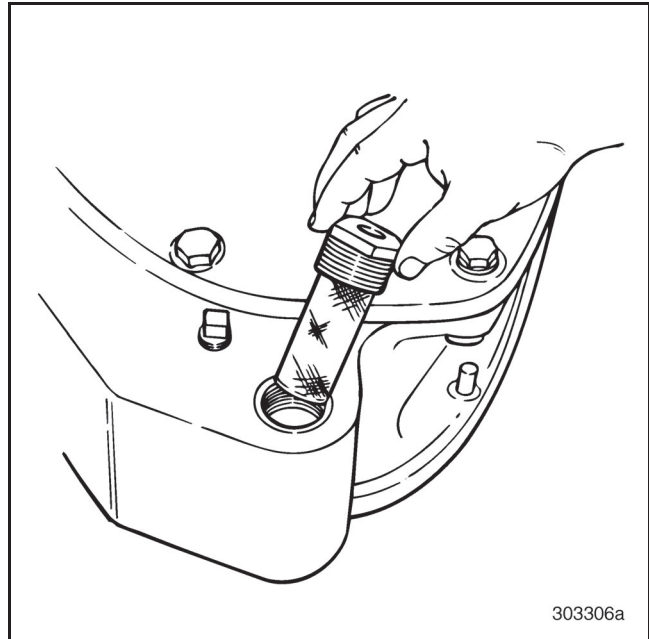


Figure 62 — Removing Sump Adapter with Screen

4. Remove the filter cartridge from the filter adapter. Use tool J 29927 or equivalent, to loosen the filter cartridge.

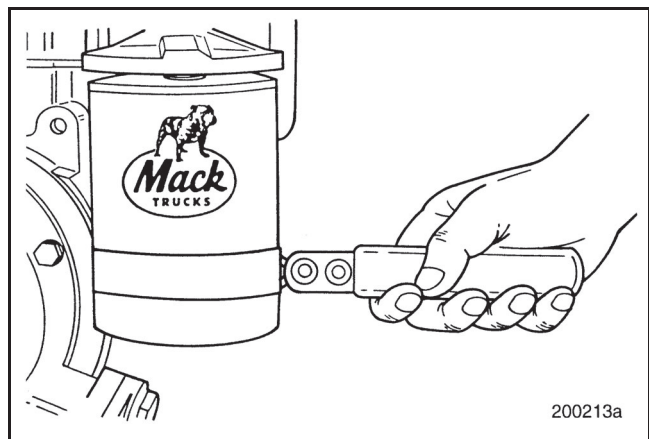


Figure 63 — Removing Filter Cartridge



# DISASSEMBLY

5. Remove the filter adapter capscrews and adapter from the mounting bracket.

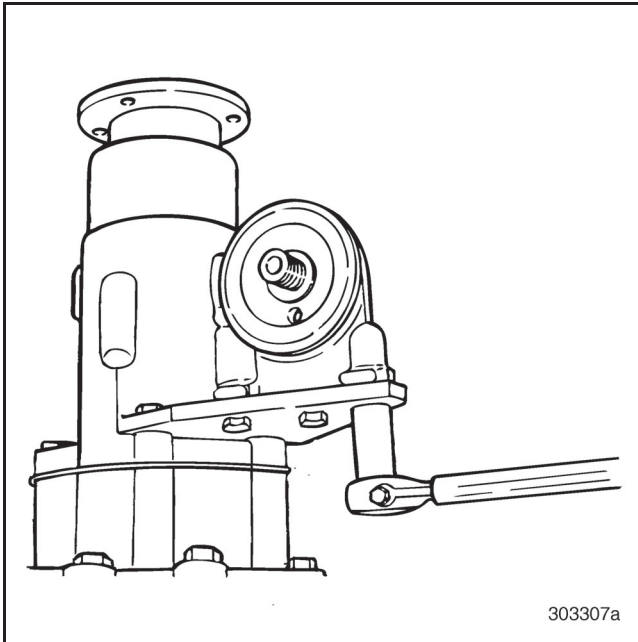


Figure 64 — Removing Filter Adapter

6. Remove the filter adapter base bracket mounting capscrews and bracket from the PTO mounting. Note the two spacer washers between the bracket and mount at each bolt location. For reassembly purposes, note the position of the bracket in relation to the PTO assembly.

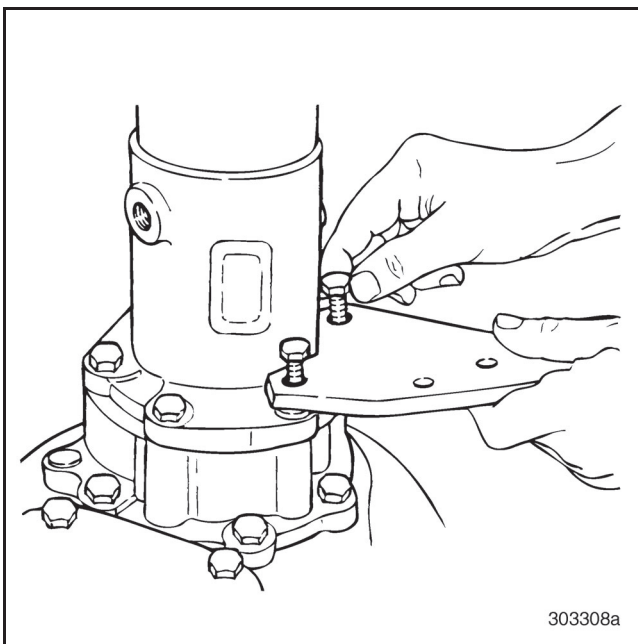


Figure 65 — Removing Filter Adapter Bracket

7. Remove the PTO air shifter capscrews, air shifter and gasket from the PTO opening.

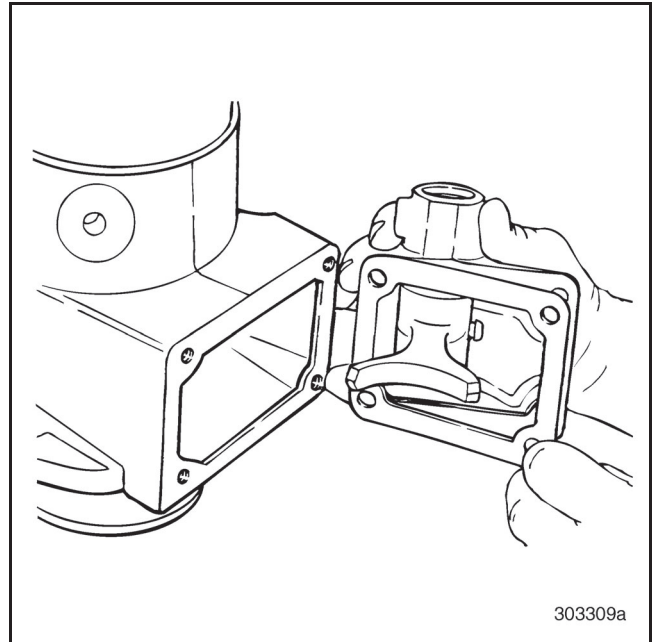


Figure 66 — Removing Air Shifter Cover

8. Shift the sliding clutch to engage the PTO shaft with the main shaft of the transfer case.



# DISASSEMBLY

9. Loosen the PTO shaft output flange clamp plate capscrew.

## SERVICE HINT

The PTO shaft output flange clamp plate capscrew is right-hand threaded. Loosen the capscrew in a counterclockwise direction.

## SERVICE HINT

To prevent the PTO shaft from rotating when loosening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

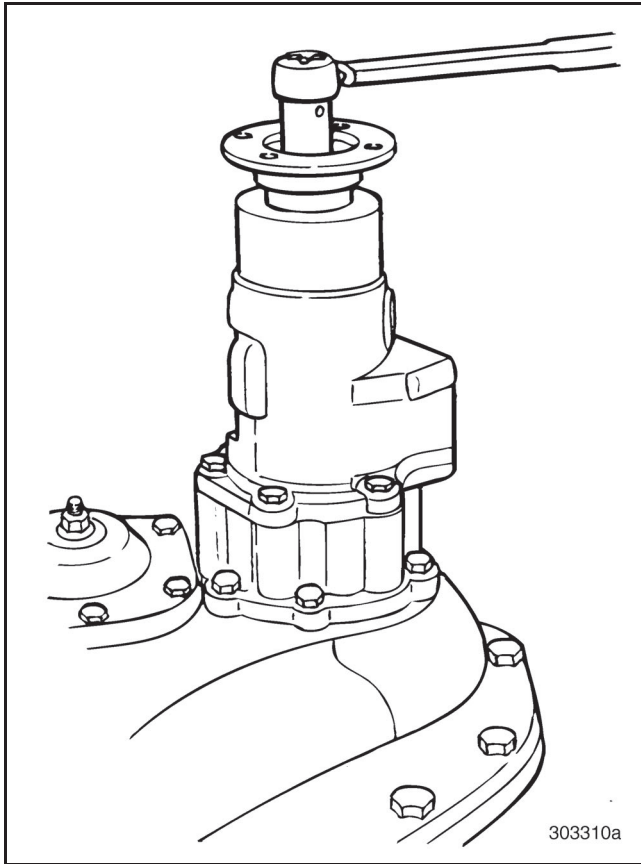


Figure 67 — Loosening Output Flange Capscrew

10. Remove the PTO shaft output flange, clamp plate and capscrew.

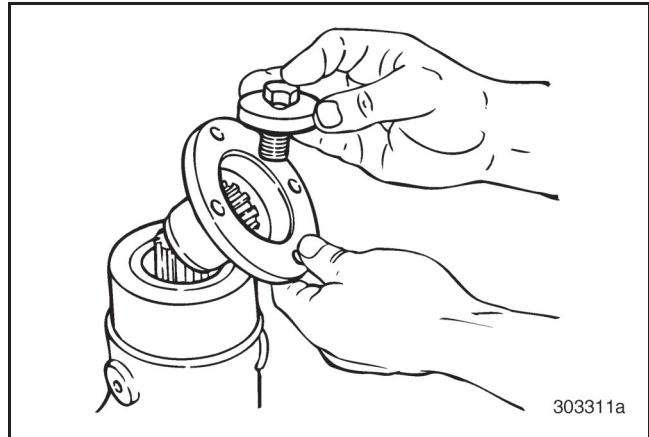


Figure 68 — Removing Output Flange, Clamp Plate and Capscrew

11. Remove the PTO-to-pump mounting capscrew, located inside the sliding clutch area of the PTO housing.

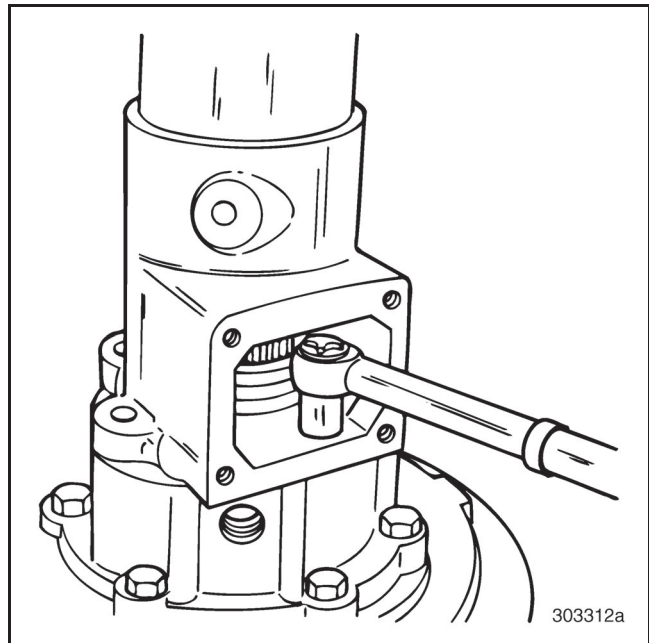
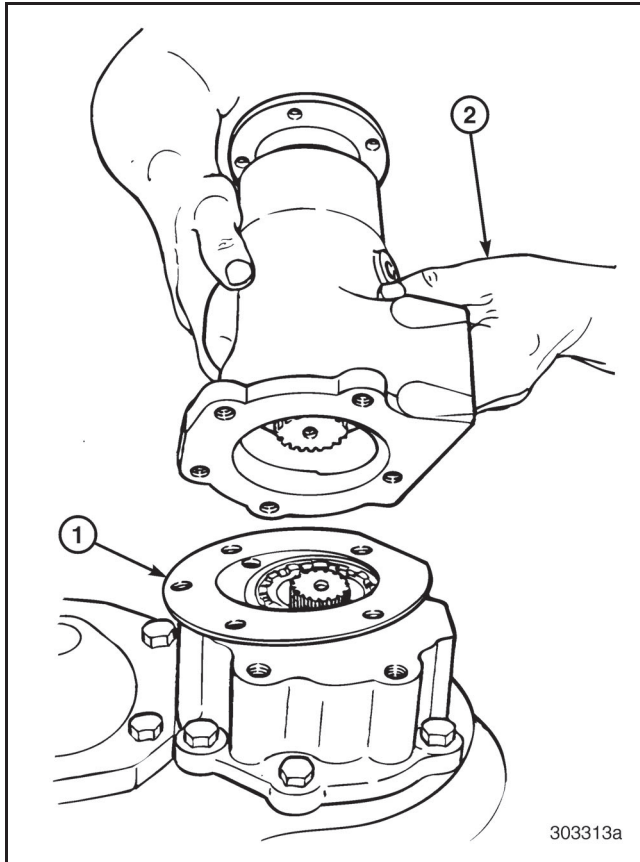


Figure 69 — Removing PTO-to-Pump Mounting Capscrew

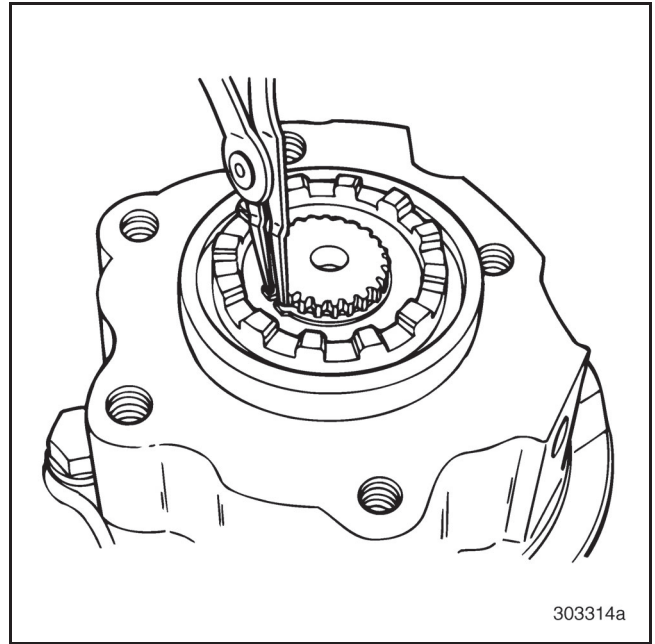
12. Remove the remaining PTO-to-oil pump mounting capscrews.
13. While holding the sliding clutch with one hand through the shifter opening, remove the PTO and sliding clutch from the oil pump as an assembly. Also remove the PTO shim from the rear of the oil pump. Tag the shim for reassembly.



1. PTO Assembly Shim	2. Support Sliding Clutch
----------------------	---------------------------

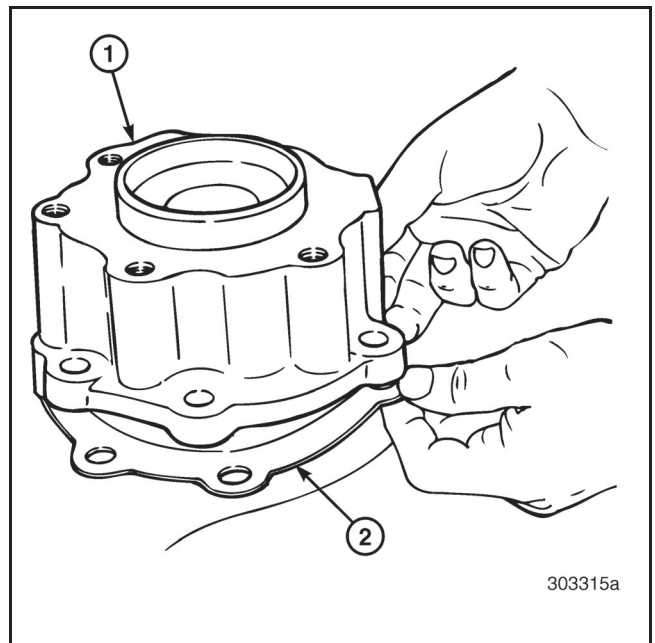
**Figure 70 — Removing PTO Assembly**

14. Remove the sliding clutch from the PTO shaft.
15. Using set J 3469 or suitable snap ring plier, remove the snap ring on the end of the mainshaft that secures the PTO clutch drive gear.



**Figure 71 — Removing Clutch Drive Gear Snap Ring**

16. Remove the PTO clutch drive gear from the end of the mainshaft.
17. Remove the oil pump housing-to-transfer case capscrews.
18. Remove the oil pump assembly from the rear of the transfer case by lifting the pump straight off the mainshaft. Also remove the oil pump shim from the rear of the transfer case and tag it for reassembly.



1. Oil Pump Assembly	2. Oil Pump Shim
----------------------	------------------

**Figure 72 — Removing Oil Pump Assembly**

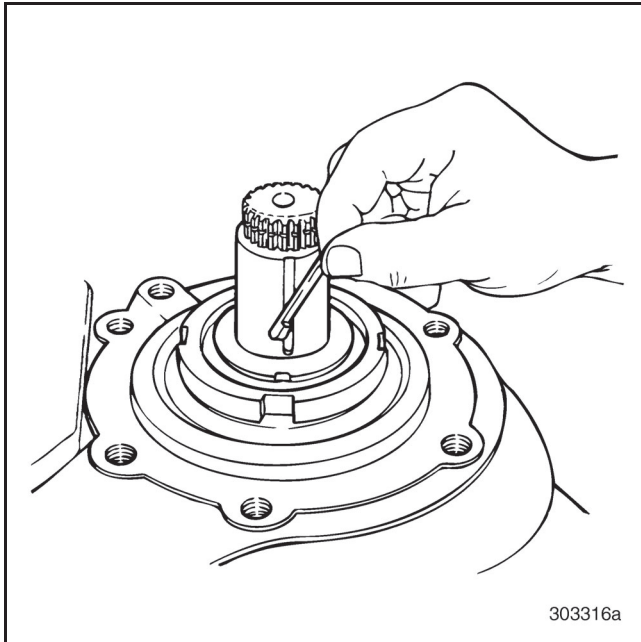




# DISASSEMBLY

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19. Remove the oil pump key on the mainshaft, from the shaft keyway.



**Figure 73 — Removing Oil Pump Key**



# BENCH PROCEDURES

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## BENCH PROCEDURES (DISASSEMBLY)



# BENCH PROCEDURES

## [350] TRANSFER CASE COMPONENT DISASSEMBLY

### NOTE

Unless a complete overhaul is necessary, remove only the parts that are required to repair the assembly. Do not disturb parts that have a heavy press fit (interference fit) unless replacement of the part is necessary. When replacement is necessary, use proper pullers and press setups to prevent damage to usable parts.

## [352] Mainshaft Disassembly

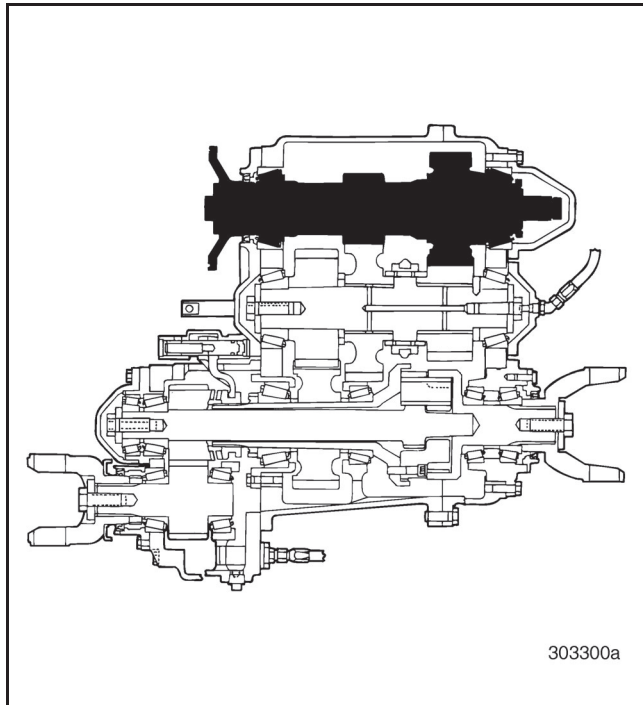
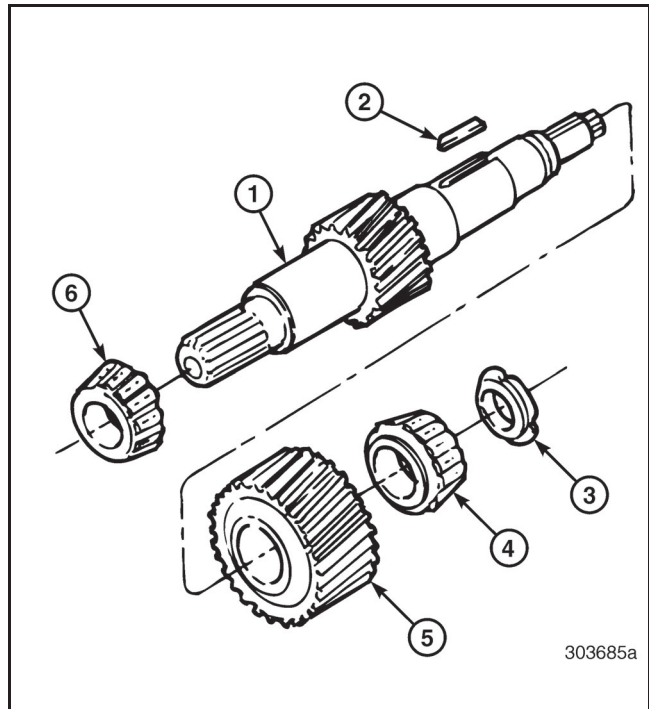


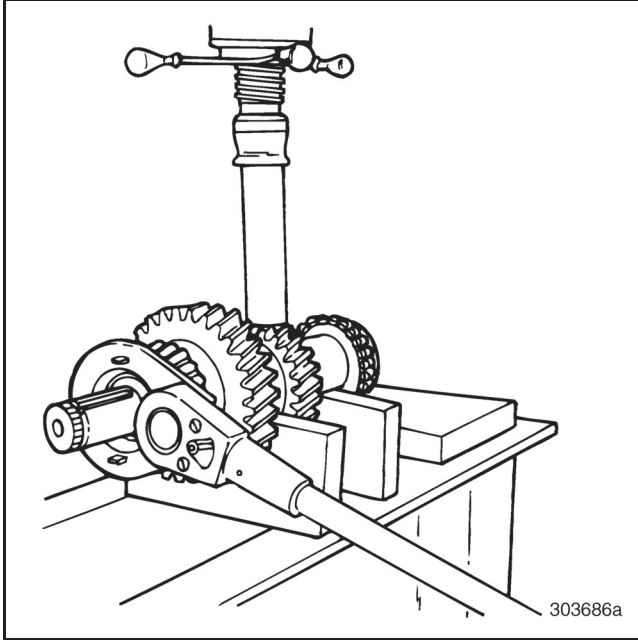
Figure 74 — Mainshaft Locator



- |  |                  |
|--|------------------|
| 1. Mainshaft (Lo-Range Gear Part of Shaft) | 4. Bearing Cone  |
| 2. Key                                     | 5. Hi-Range Gear |
| 3. Bearing Locknut                         | 6. Bearing Cone  |

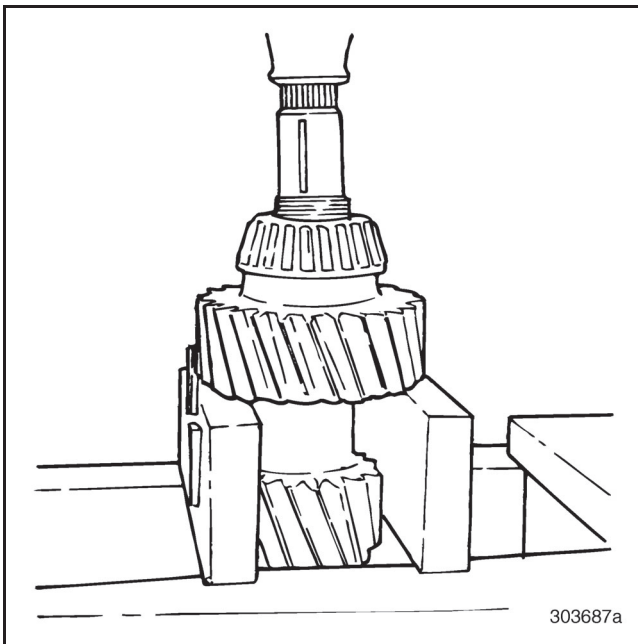
Figure 75 — Exploded View of Mainshaft

1. Mount the mainshaft securely in a press to prevent it from rotating (use V-blocks for support). Remove the rear bearing locknut from the end of the shaft, using tool J 24560, or equivalent.



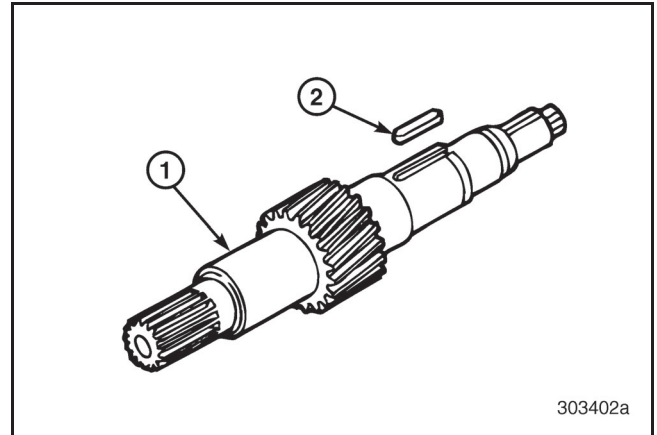
**Figure 76 — Removing Rear Bearing Locknut**

2. Place the mainshaft in the press, rear end up, supported by the Hi-range gear. Press the Hi-range gear and rear bearing cone off the shaft.



**Figure 77 — Pressing Off Hi-Range Gear and Rear Bearing Cone**

3. Remove the key from the keyway of the mainshaft.

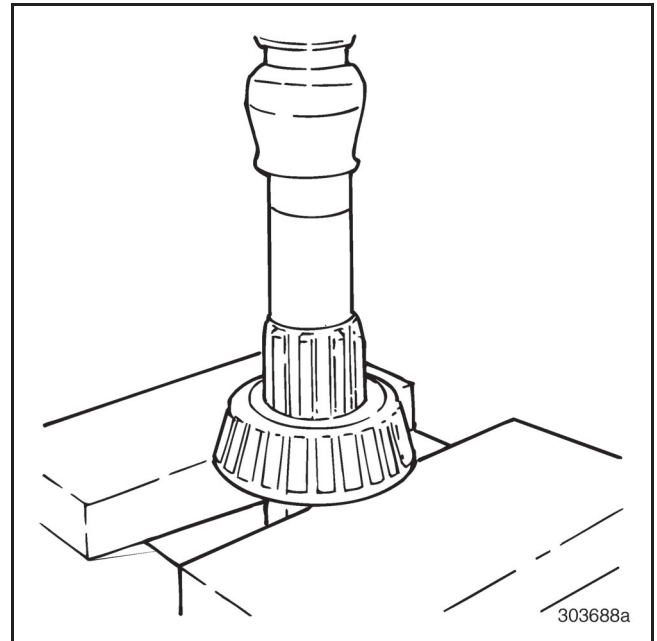


1. Mainshaft

2. High Range Gear Key

**Figure 78 — Exploded View of Main-Drive Shaft**

4. With the mainshaft in the press, remove the front bearing cone.



**Figure 79 — Removing Mainshaft Front Bearing Cone**



# BENCH PROCEDURES

## [352] Countershaft Disassembly

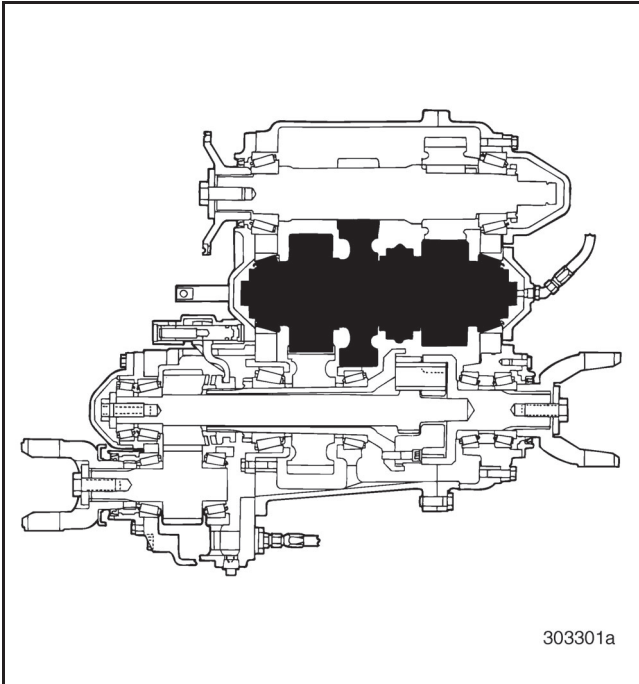


Figure 80 — Countershaft Locator

1. Mount the countershaft securely in a press to prevent it from rotating (use V-blocks for support). Loosen the front bearing cone clamp plate capscrew.

### SERVICE HINT

Clamp the Hi-range gear in the press and then engage the sliding clutch. This prevents the shaft from rotating.

### SERVICE HINT

The countershaft front bearing cone clamp plate capscrew is right-hand threaded. Loosen the capscrew in a counterclockwise direction.

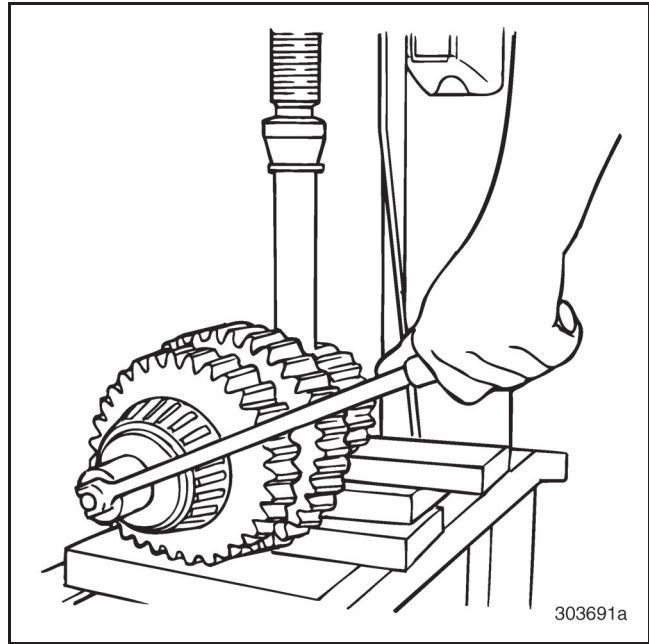


Figure 81 — Loosening Clamp Plate Capscrew

### CAUTION

*To prevent injury or component damage during the disassembly procedure, use a combination of V-blocks and press plates to clamp the countershaft in the press. This prevents heavy components from falling and helps hold the countershaft while removing various components.*





# BENCH PROCEDURES

2. Remove the front bearing cone clamp plate, capscrew and shims. Wire the shims together for use during reassembly.

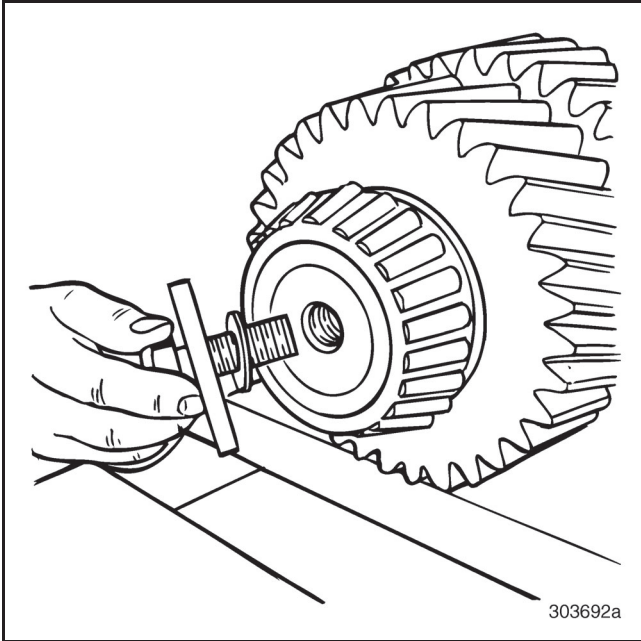


Figure 83 — Removing Clamp Plate, Capscrew and Shims

3. Remove the countershaft front bearing cone, using bearing puller J 39477-1 and bearing separator J 8176 or suitable puller.

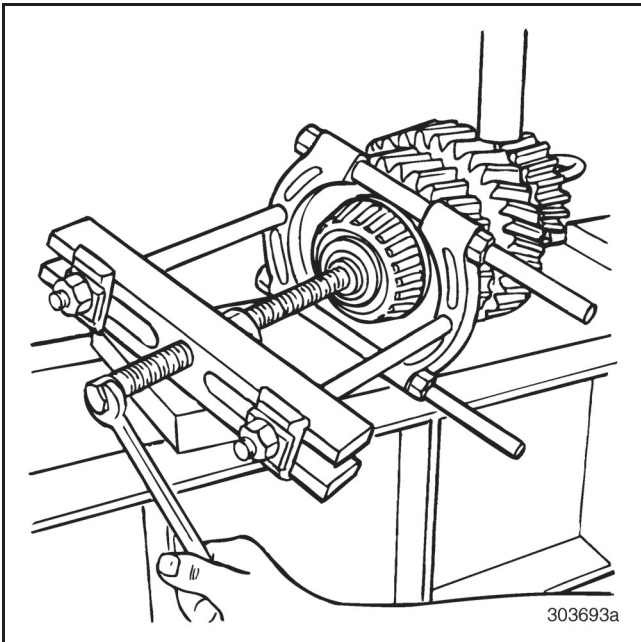


Figure 84 — Removing Front Bearing Cone

4. Remove the main-drive gear from the countershaft (slide straight off splines).

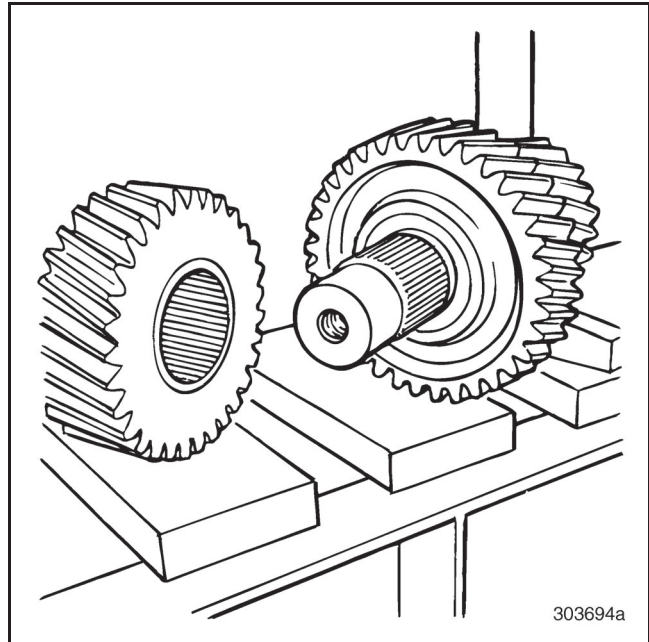


Figure 85 — Removing Main-Drive Gear

5. Remove the split thrust washer retaining ring.

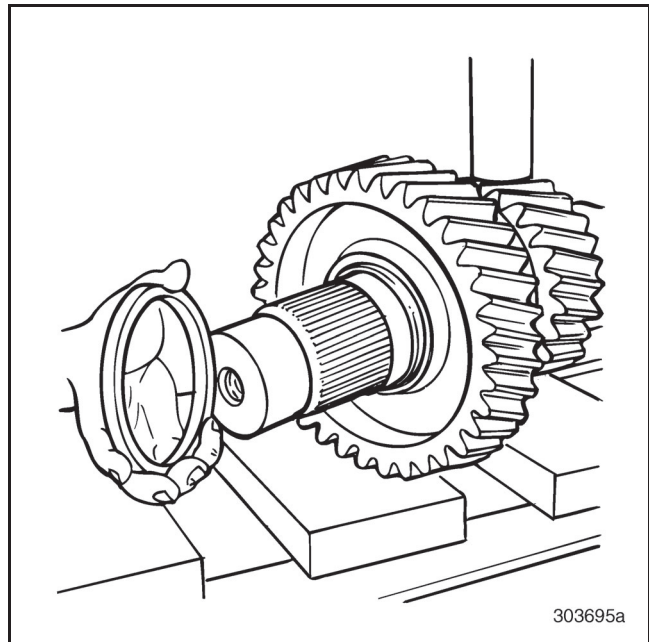


Figure 86 — Removing Split Thrust Washer Retaining Ring

6. Remove the split thrust washers from the countershaft.

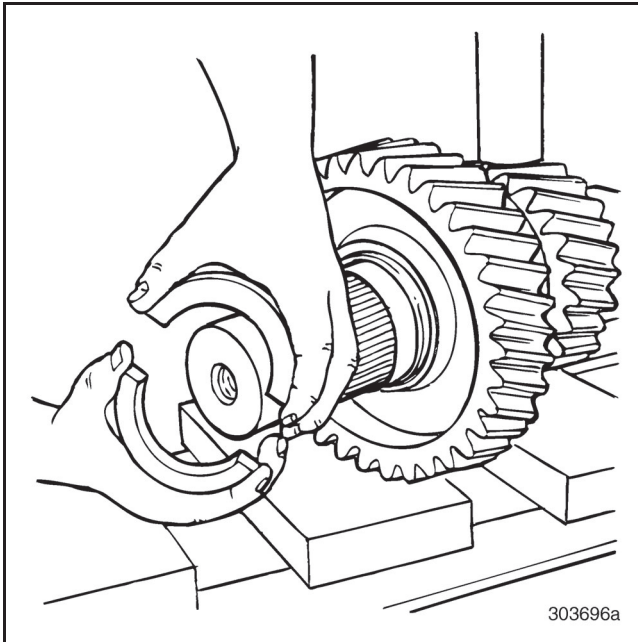


Figure 87 — Removing Split Thrust Washers

8. Remove the Lo-range gear needle bearings and spacer from the countershaft.

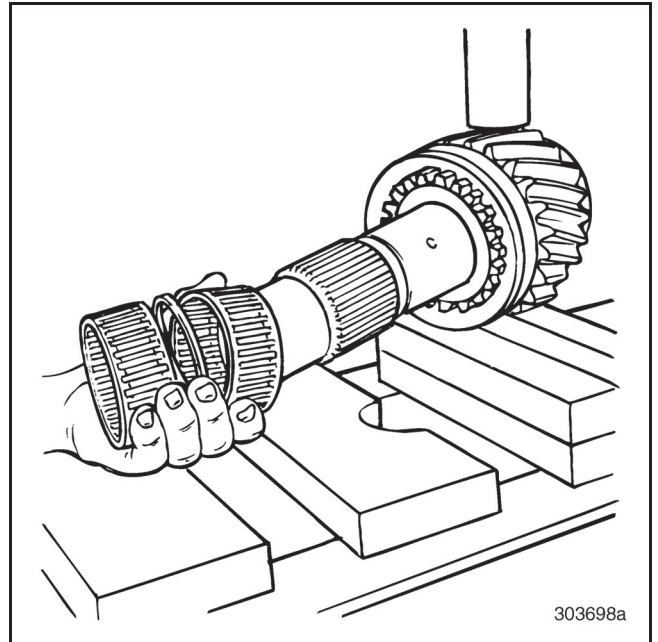


Figure 89 — Removing Needle Bearings and Spacer

7. Remove the Lo-range gear from the countershaft.

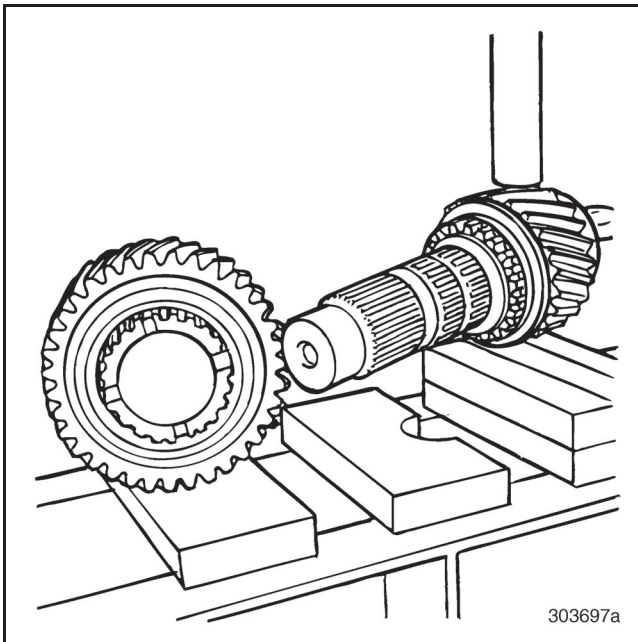


Figure 88 — Removing Lo-Range Gear

9. Remove the sliding clutch from the countershaft.

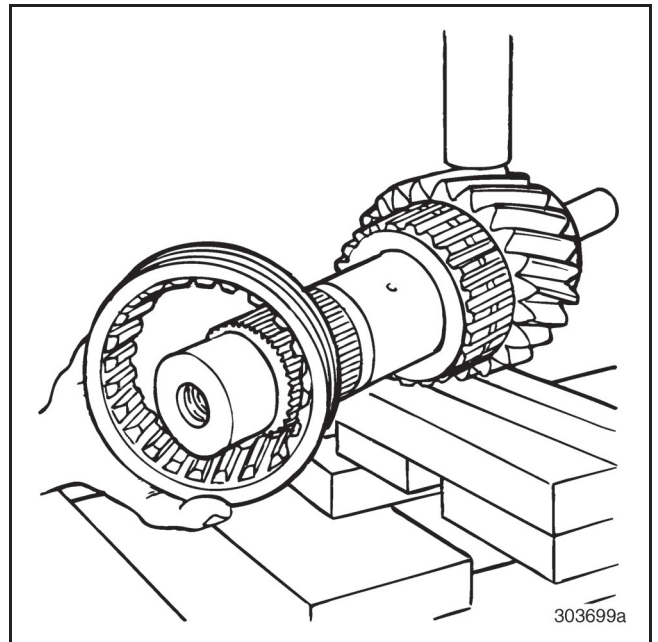


Figure 90 — Removing Sliding Clutch



10. Remove the countershaft rear bearing cone, using a suitable puller.

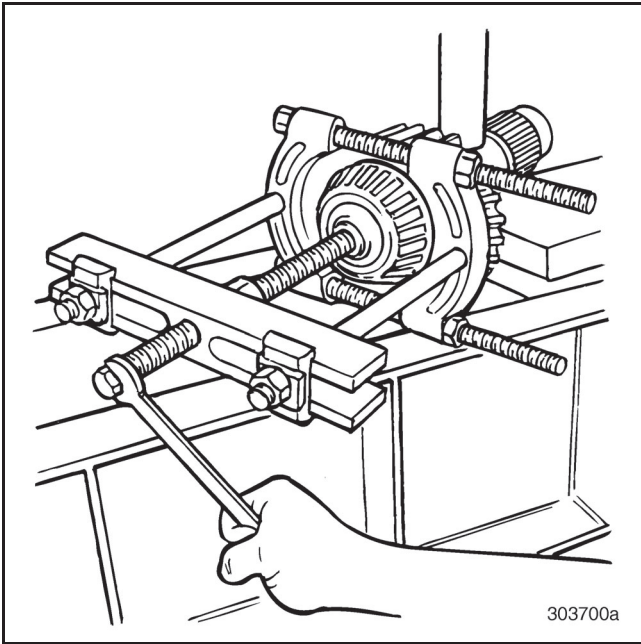


Figure 91 — Removing Countershaft Rear Bearing Cone

12. Remove the Hi-range gear from the countershaft.

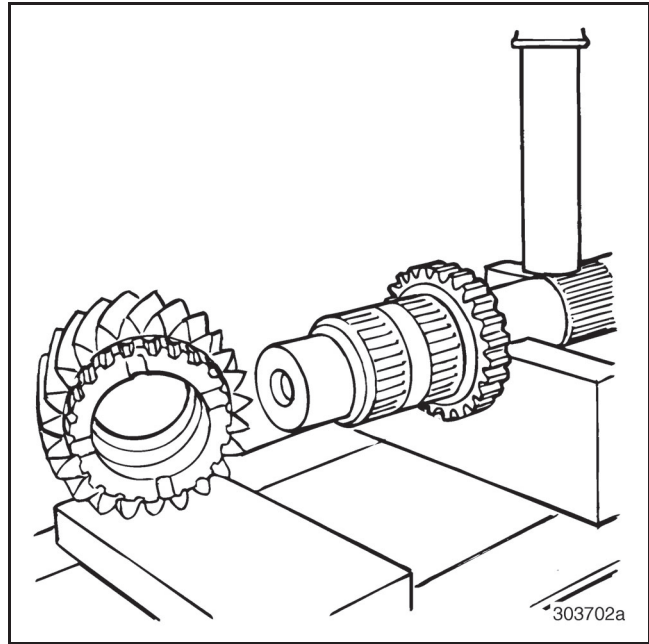


Figure 93 — Removing Hi-Range Gear

11. Remove the single thrust washer and thrust washer lockpin from the countershaft.

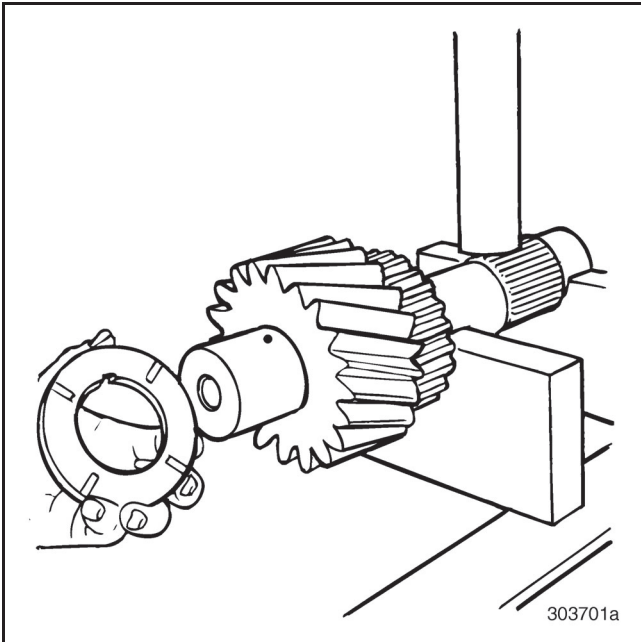


Figure 92 — Removing Thrust Washer and Lockpin from Countershaft

13. Remove the Hi-range gear needle bearings and spacer from the countershaft.

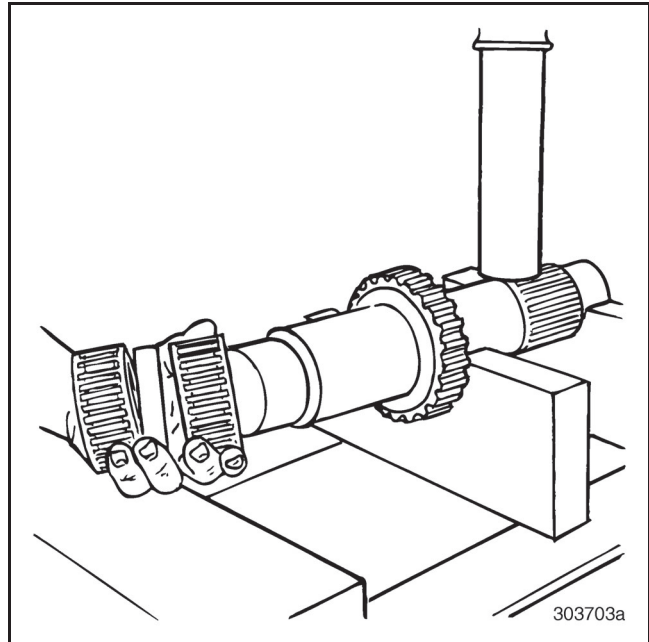


Figure 94 — Removing Needle Bearings and Spacer



# BENCH PROCEDURES

## [352] Main-Drive Shaft Disassembly

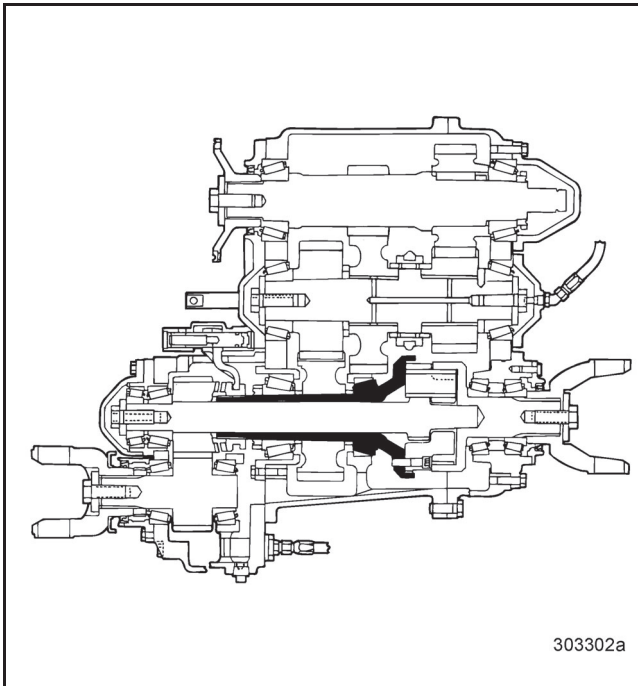
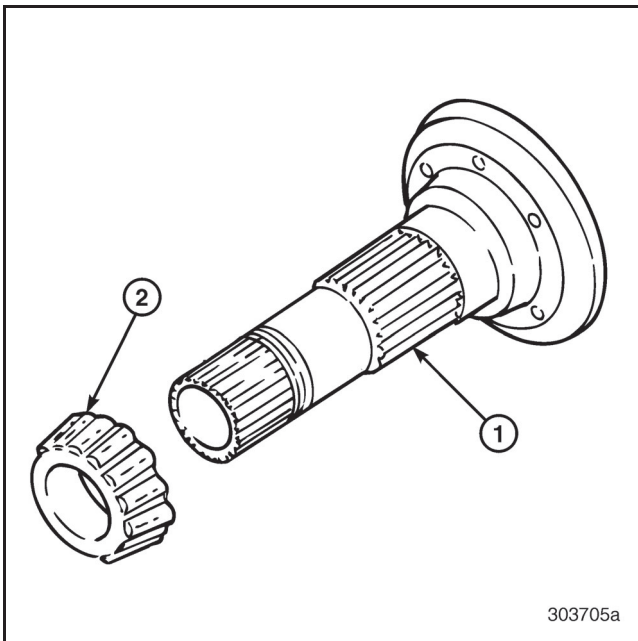


Figure 95 — Main-Drive Shaft Locator



1. Main-Drive Shaft

2. Bearing Cone

Figure 96 — Exploded View of Main-Drive Shaft

1. Remove the rear bearing from the main-drive shaft, using bearing puller J 39477-1 and bearing separator J 8176 or suitable puller.

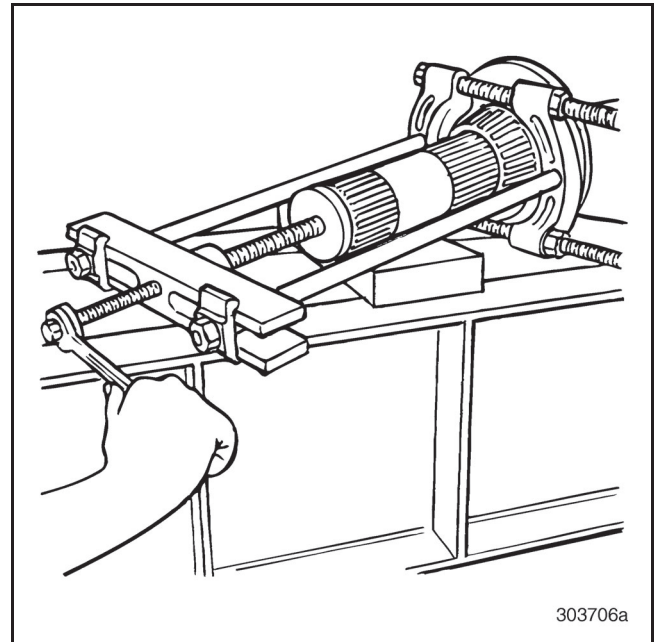


Figure 97 — Removing Rear Bearing Cone from Main-Drive Shaft

2. Clean and inspect the main-drive shaft and set aside for later reassembly.



# BENCH PROCEDURES

## [352] Front-Driving Shaft Disassembly

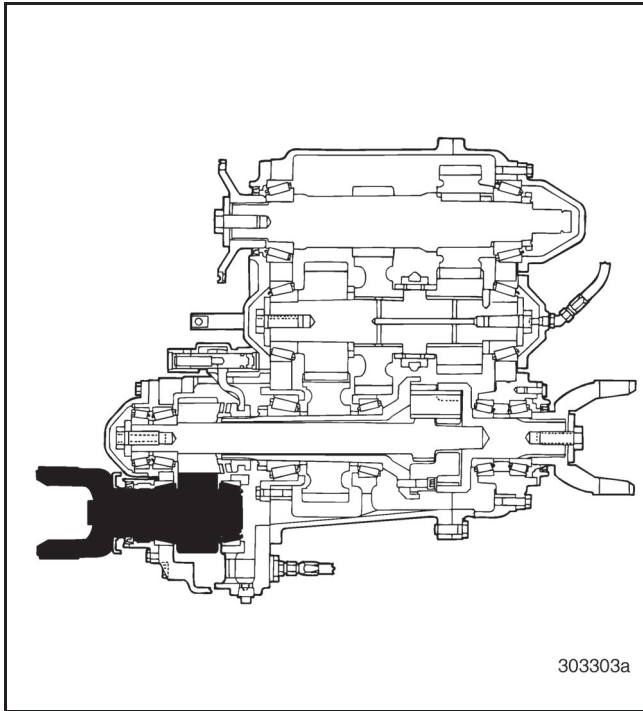
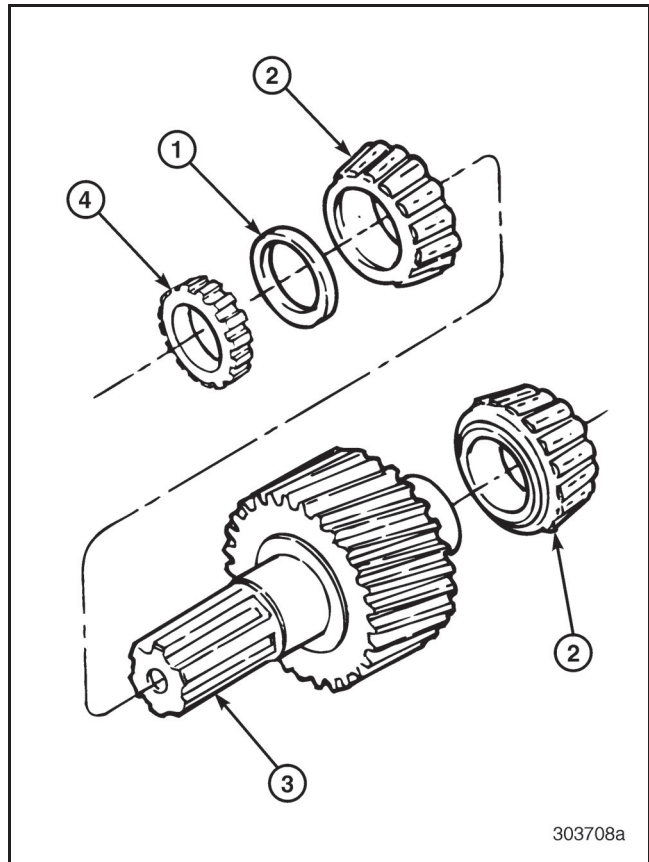


Figure 98 — Front-Driving Shaft Locator



- 1. Spacer
- 2. Bearing Cone
- 3. Front-Driving Shaft

- 4. Speedometer Tone Wheel

Figure 99 — Exploded View of Front-Driving Shaft



# BENCH PROCEDURES

1. Remove the front and rear bearing cones from the front-driving shaft, using bearing puller J 39477-1 and bearing separator J 8176 or suitable bearing puller.

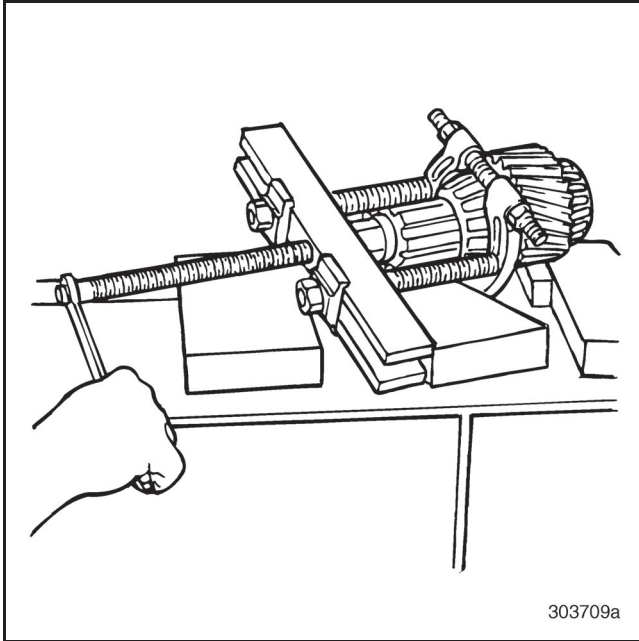


Figure 100 — Removing Front-Driving Shaft Front Bearing Cone

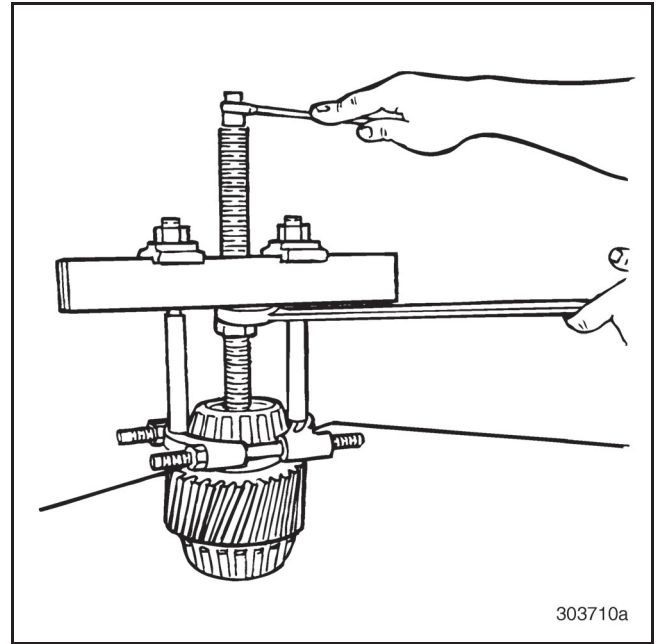


Figure 101 — Removing Front-Driving Shaft Rear Bearing Cone

2. Clean and inspect the front-driving shaft and set aside for later reassembly.



# BENCH PROCEDURES

## [352] Rear-Drive Shaft Disassembly

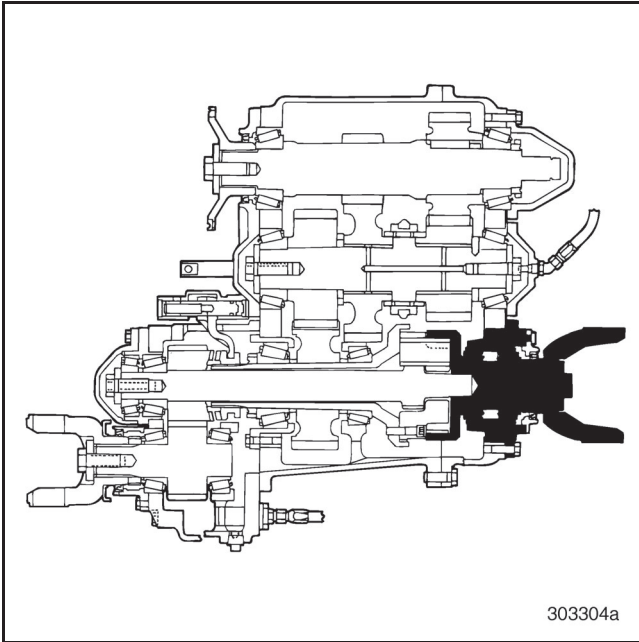
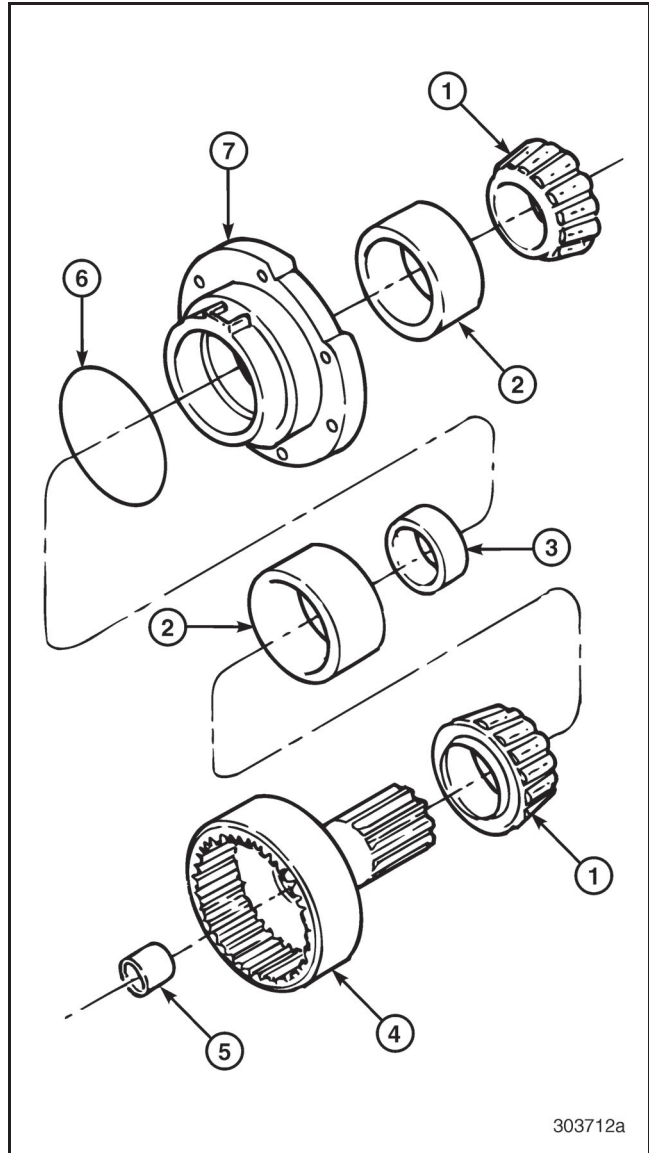


Figure 102 — Rear-Drive Shaft Locator



- 1. Bearing Cone
- 2. Bearing Cup
- 3. Selective Spacer
- 4. Rear-Drive Shaft

- 5. Bushing
- 6. O-Ring
- 7. Bearing Retainer

Figure 103 — Exploded View of Rear-Drive Shaft



# BENCH PROCEDURES

1. Remove the capscrews from the bearing retainer seal housing.

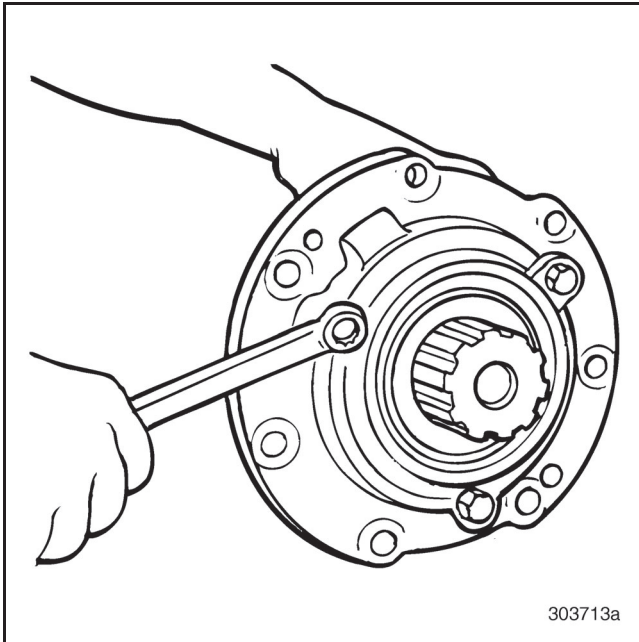


Figure 104 — Removing Bearing Retainer Seal Housing Capscrews

2. Remove the seal housing from the rear-drive shaft bearing retainer.

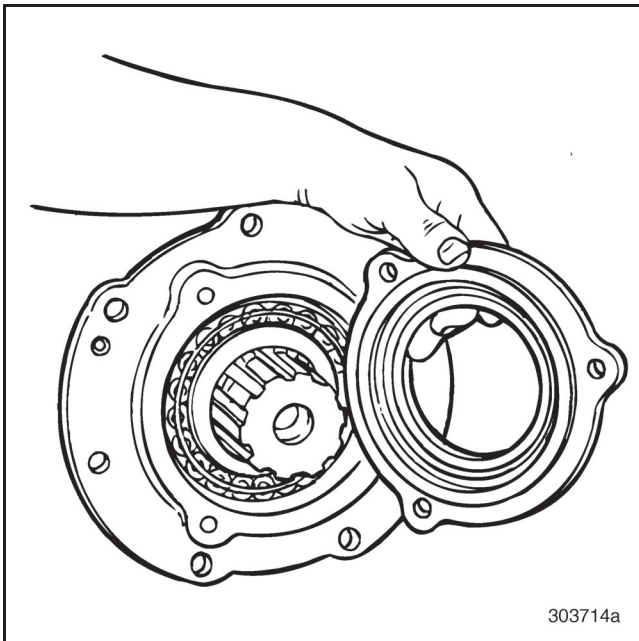


Figure 105 — Removing Seal Housing from Bearing Retainer

3. Place the rear-drive shaft assembly in a press and press the rear-drive shaft out of the bearing retainer. Also, remove the rear bearing cone and selective spacer.

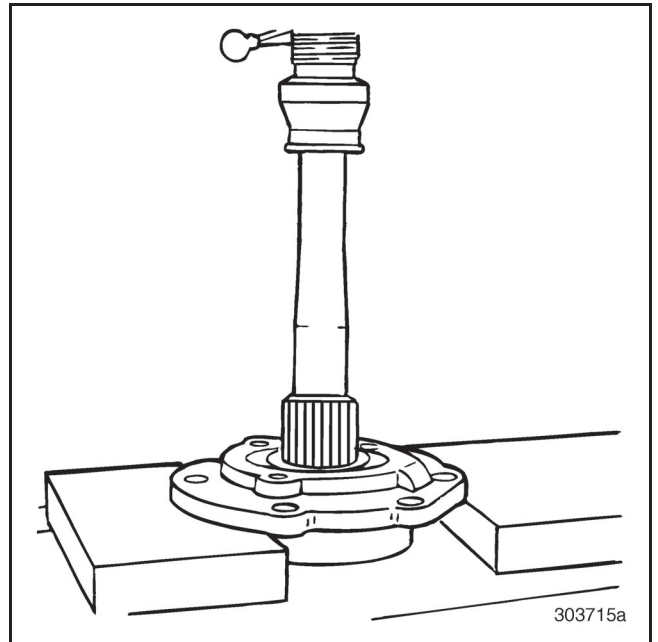


Figure 106 — Pressing Out Rear-Drive Shaft

4. Remove the front bearing cone from the rear-drive shaft, using bearing puller J 39477-1 and bearing separator J 8176 or suitable puller.

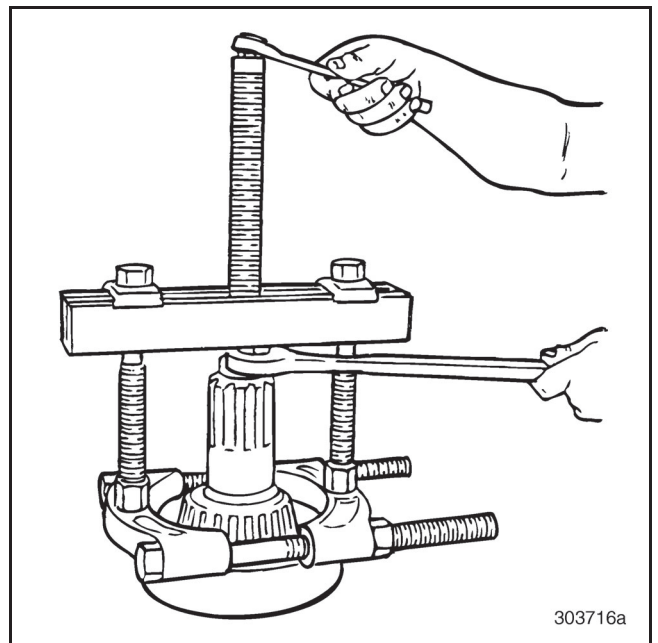
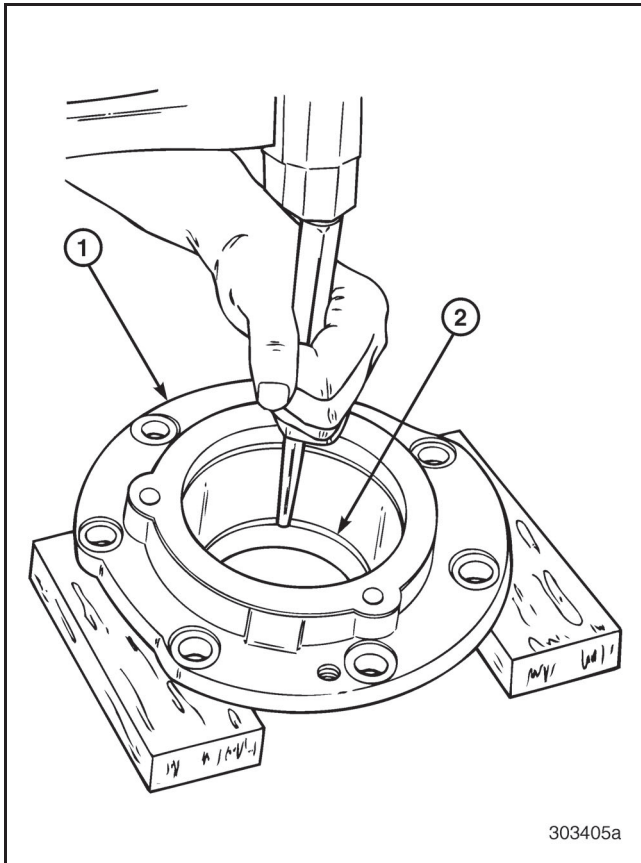


Figure 107 — Removing Front Bearing Cone



# BENCH PROCEDURES

5. Remove the front and rear bearing cups from the rear-drive shaft bearing retainer. Drive from the opposite side, using a punch and hammer or suitable puller.

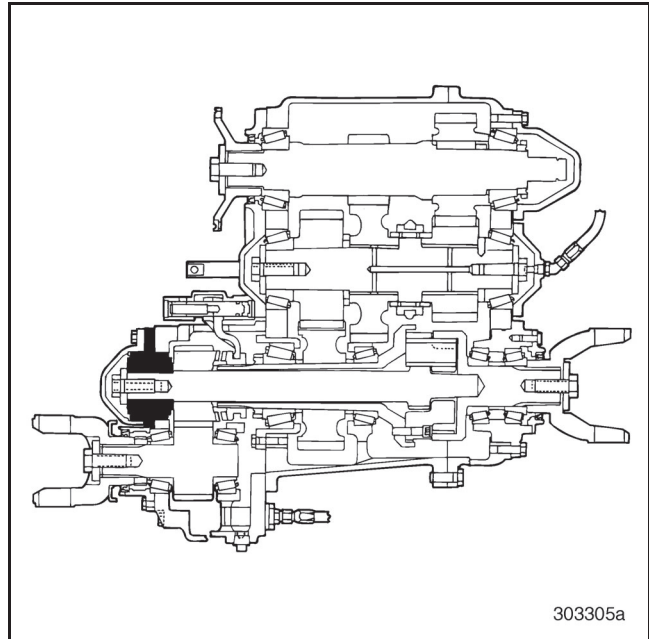


1. Rear-Drive Shaft Bearing Retainer Housing	2. Rear-Drive Shaft Bearing Cup
--	---------------------------------

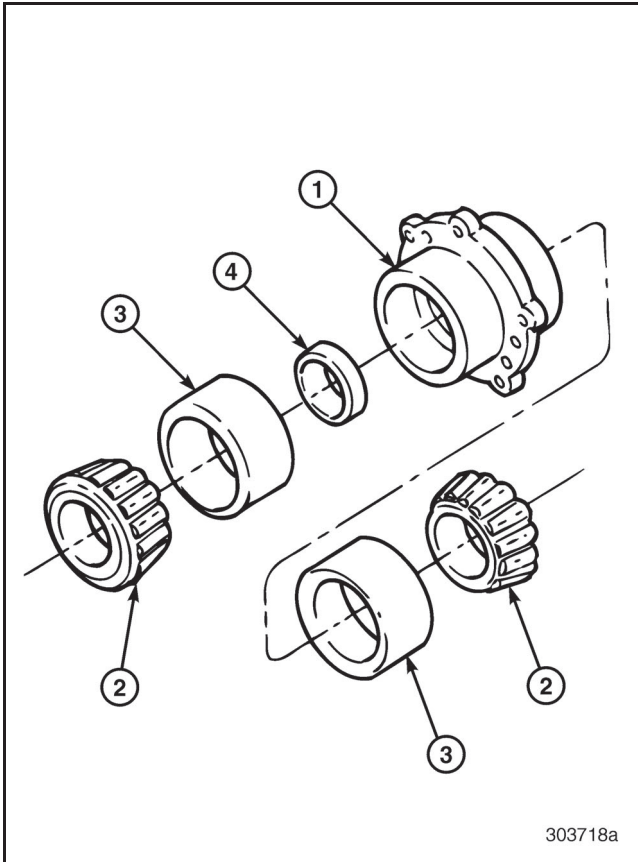
**Figure 108 — Removing Bearing Cups from Retainer Housing**

6. Remove the bushing from the front end of the rear-drive shaft, using a suitable puller. Refer to No. 5 of the rear-drive shaft exploded view at the beginning of this procedure.

## [351] Front-Drive Shaft Bearing Retainer Disassembly



**Figure 109 — Front-Drive Shaft Bearing Retainer Locator**



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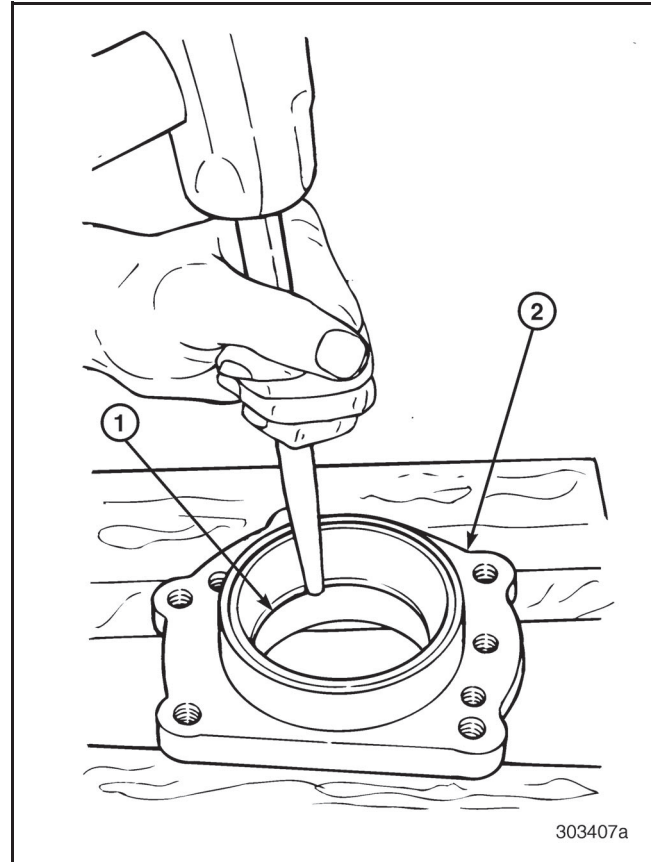
1. Bearing Retainer	3. Bearing Cup
2. Bearing Cone	4. Selective Spacer

**Figure 110 — Exploded View of Front-Drive Shaft Bearing Retainer**

1. Remove the front and rear bearing cups from the front-drive shaft bearing retainer, using a punch and hammer, or suitable puller.

### SERVICE HINT

It is easier if the rear bearing cup with the smaller inside diameter is removed first.



303407a

1. Front-Drive Shaft Bearing Cup	2. Front-Drive Shaft Bearing Retainer
----------------------------------	---------------------------------------

**Figure 111 — Removing Bearing Cups from Retainer**

2. Clean and inspect the bearing retainer and set aside for later reassembly.





# BENCH PROCEDURES

## [359/360/363] PTO AND PUMP COMPONENT DISASSEMBLY

### NOTE

Unless a complete overhaul is necessary, remove only the parts that are required to repair the assembly. Do not disturb press fit parts, unless replacement of the part is necessary. When replacement is necessary, use proper pullers and press setups to prevent damage to usable parts.

### [359] Oil Pump Disassembly

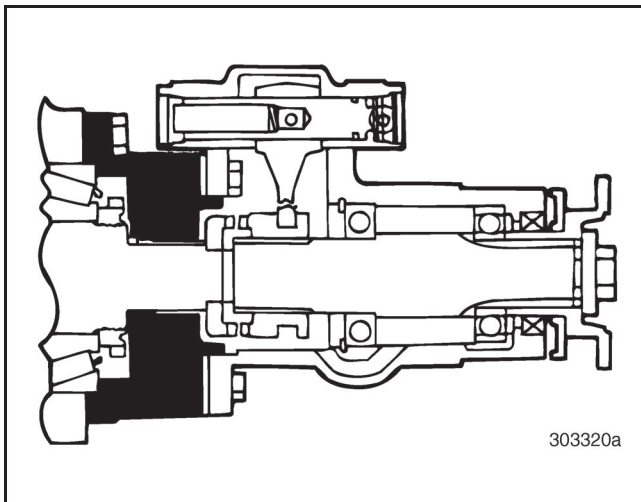


Figure 112 — Oil Pump Locator

1. Remove four Phillips screws from the oil pump cover and remove the cover.

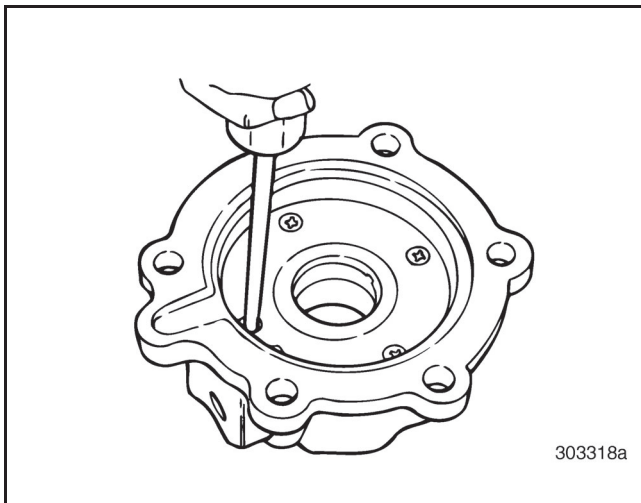


Figure 113 — Remove Oil Pump Cover

2. Remove the oil pump inner and outer gerotors from the pump housing.

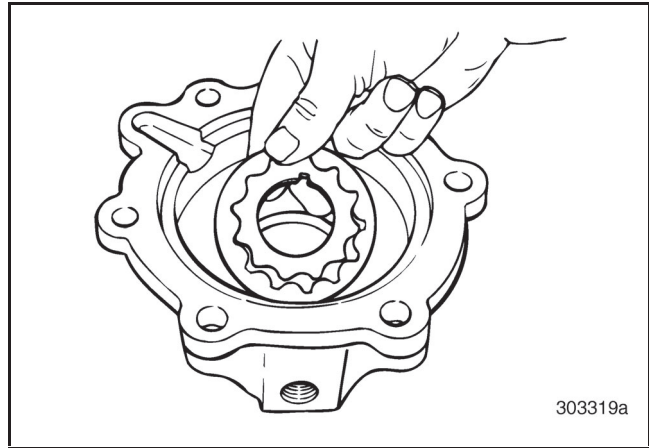


Figure 114 — Removing Oil Pump Gerotors

3. Inspect the pump housing for any signs of debris damage or deep scratches. Discard pump if any damage exists.

### [360] PTO Disassembly

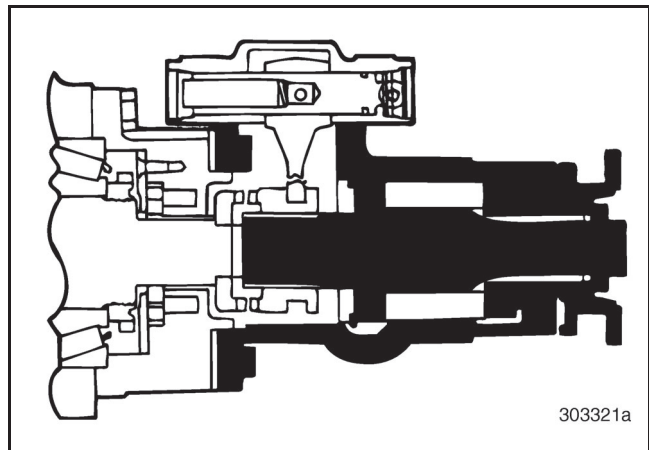


Figure 115 — PTO Locator

1. Remove the front bearing snap ring from inside the PTO housing using plier set J 34626 or suitable pliers.

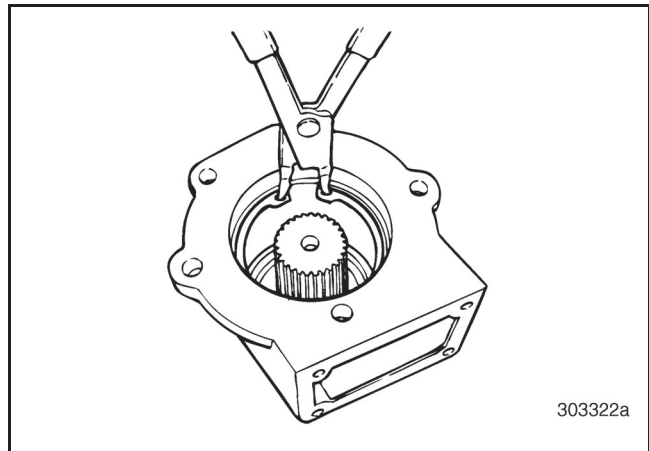
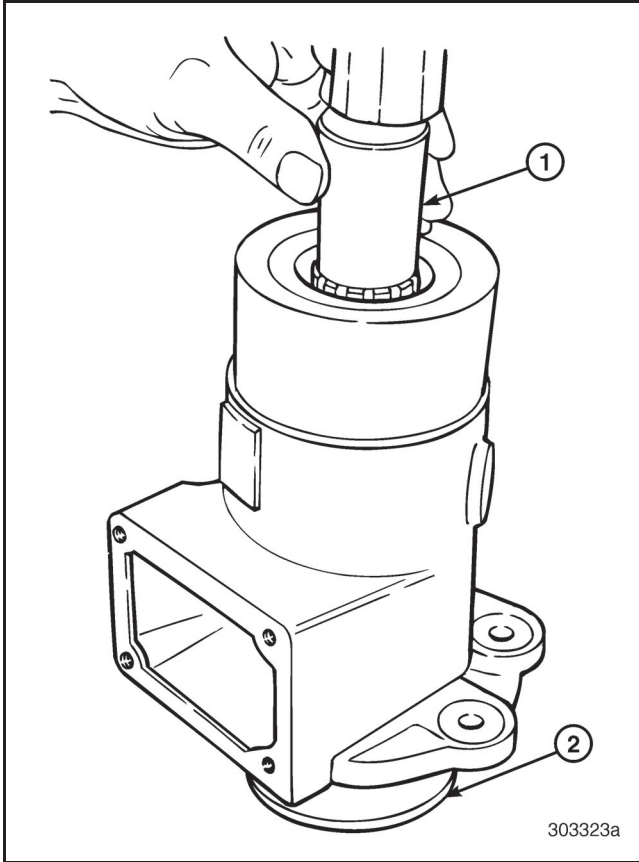


Figure 116 — Removing Front Bearing Snap Ring



# BENCH PROCEDURES

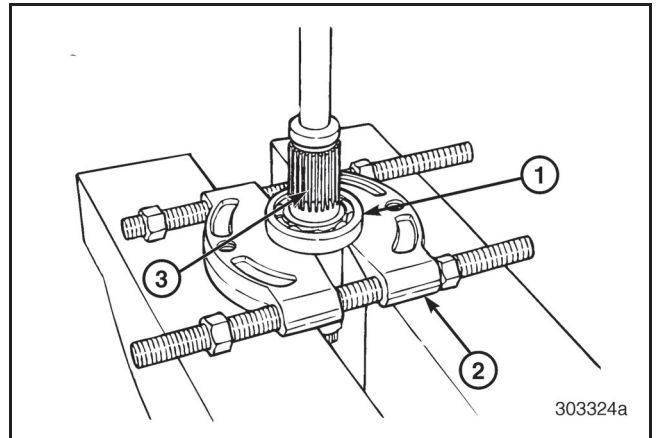
- Separate the PTO shaft from the PTO housing by tapping the end of the shaft, using a hammer and a brass bar. Place the PTO housing on a suitable support to allow the shaft to release from the housing.



1. Brass Bar	2. PTO Housing Support
--------------	------------------------

**Figure 117 — Separating PTO Shaft from Housing**

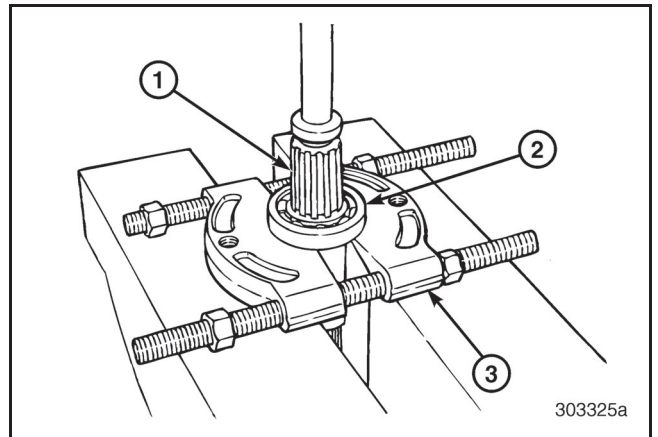
- Remove the larger forward ball bearing from the PTO shaft, using a suitable press arrangement. Apply force to the inner race of the ball bearing only.



1. Shaft Bearing 2. Bearing Separator J 8176	3. Forward Shaft Area
--	-----------------------

**Figure 118 — Removing Forward Ball Bearing from Shaft**

- Remove the smaller rearward ball bearing from the PTO shaft, using a suitable press arrangement. Apply force to the inner race of the ball bearing only.



1. Rear of PTO Shaft 2. Shaft Bearing	3. Bearing Separator J 8176
--	--------------------------------

**Figure 119 — Removing Rearward Ball Bearing from Shaft**



# BENCH PROCEDURES

5. Remove the housing oil seal, using a hammer and long drift. Place the drift inside the housing from the front and tap the seal out of the rear of the housing.

## NOTE

This action destroys the oil seal. Make sure a replacement oil seal is readily available.

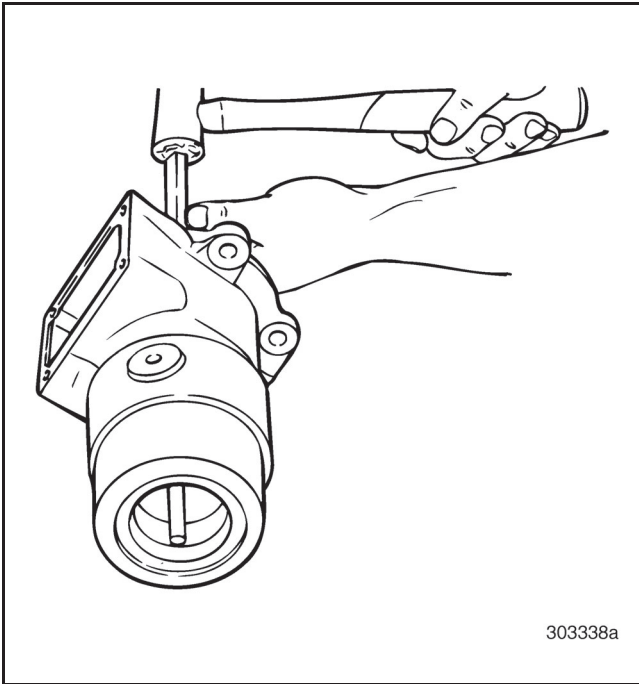


Figure 120 — Removing PTO Housing Seal

## [363] PTO Shift Cover Disassembly

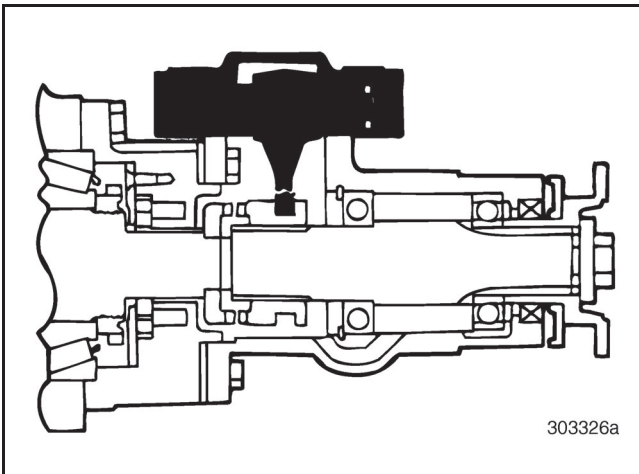


Figure 121 — PTO Shift Cover Locator

1. Secure the shift cover in a soft-jawed vise with the forward end of the cover facing up. Remove the spring-loaded front end plug from the shift cover bore, using suitable snap ring pliers. Also remove the shift rail spring.

## WARNING

The forward end plug is spring loaded and may cause injury if not released carefully.

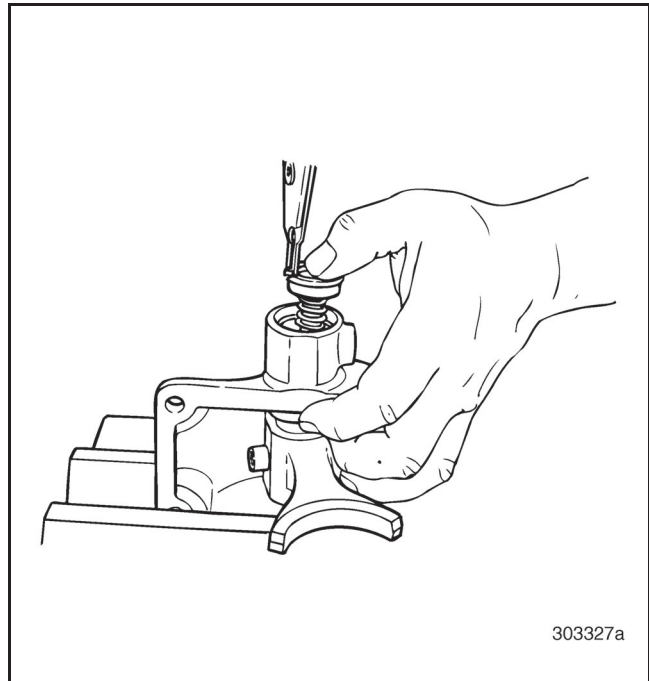


Figure 122 — Removing Shift Cover Bore End Plug

2. Remove the end plug-to-housing bore O-ring, using a suitable probe tool.

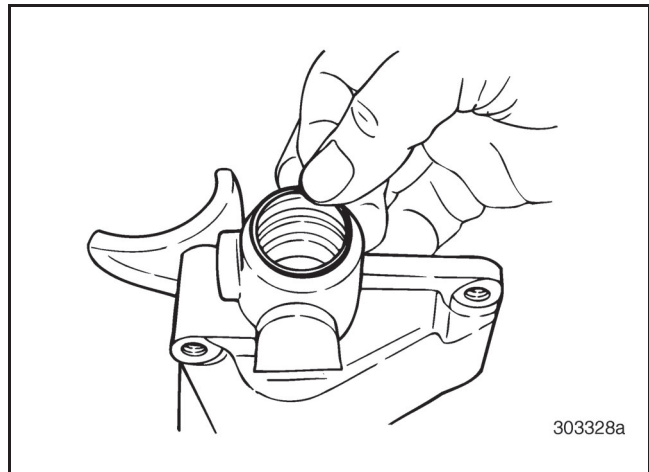


Figure 123 — Removing End Plug-to-Housing Bore O-Ring



# BENCH PROCEDURES

3. Secure the shift cover in a soft-jawed vise with the shift fork facing up. Remove the shift fork-to-shift rail setscrew, using an Allen-head wrench.

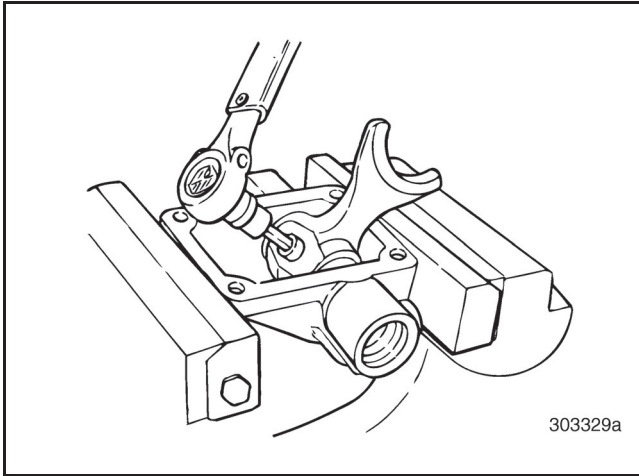


Figure 124 — Removing Shift Fork Setscrew

4. Remove the snap ring and end plug from the remaining (air pressure) end of the shift cover.
5. Remove the O-ring from the air pressure end of the shift cover.
6. Slide the shift rail forward toward the air pressure end of the cover to allow access to the air pressure O-ring.

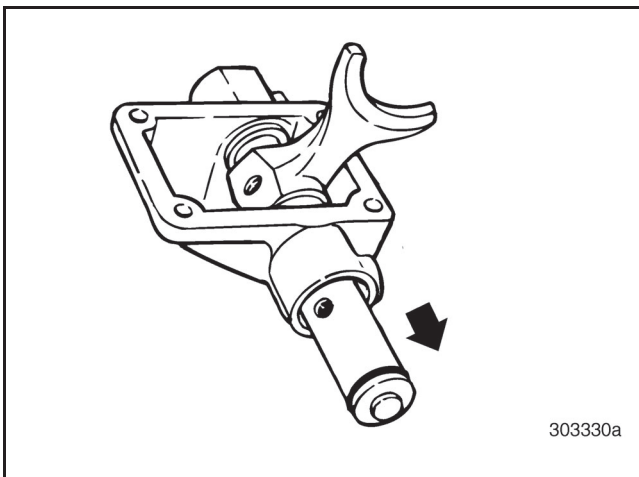


Figure 125 — Positioning Shift Rail

7. Remove the O-ring from the air pressure end of the shift rail.

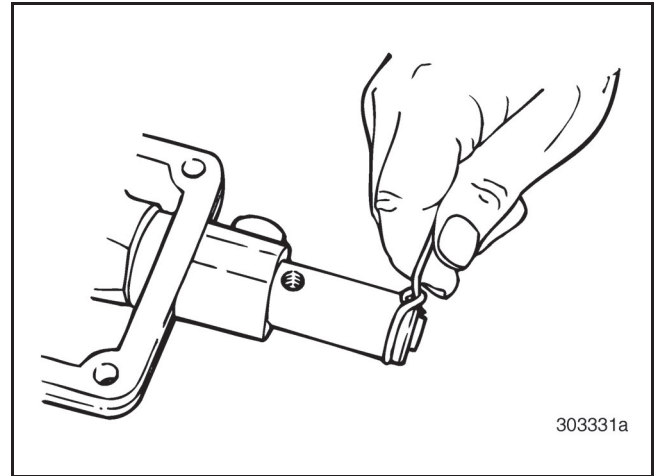


Figure 126 — Removing O-Ring from Shift Rail

8. Separate the shift rail from the shift fork and shift cover by sliding the shift rail toward the air pressure side of the cover.



# NOTES

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# INSPECTION OF PARTS

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# INSPECTION OF PARTS



# INSPECTION OF PARTS

## [350] Inspection and Cleaning

Thoroughly clean the cases, covers and all other parts of the transfer case. Remove all grease, oil and foreign matter, using a suitable safety solvent. Dry the parts with moisture-free compressed air.

## [352] Bearings

Soak bearings in fresh clean solvent to loosen all hardened grease and foreign matter, until the bearings are clean. Blow them dry with filtered, moisture-free compressed air.

### **CAUTION**

*Do not spin the bearings with compressed air. Doing so can damage the bearings.*

Inspect each bearing for flaking, cracks, fractures, cavities, indentations, measurable wear, brinelling, fretting, corrosion, nicking, cage wear or deformation and other damage. If any of these conditions are present, the bearing should be replaced.

Apply a light coat of fresh, clean, specified gear oil to the bearings. (Refer to Recommended SAE Grade Gear Oil in Transfer Case Specifications and Capacities.) Turn the races and bearings slowly by hand to be sure they move freely and are smooth. If there is resistance to movement, or if the bearing cones or cups feel rough, replace the bearings.

### **CAUTION**

*If a bearing cone or cup needs replacement, a complete **new** assembly, including cup and mating cone, is required.*

*Do not remove a **new** bearing from its packing before time of installation. Never clean protective grease from **new** bearings.*

*Do not handle bearings with dirty hands. Rags must be clean and lint free.*

Clean bearings that are satisfactory for installation. Wrap the bearings in clean, lint-free cloth and store for assembly.

## [352] Gears

Replace all gears having teeth that show signs of abrasive wear, scratching (except normal manufacturing tool marks), ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in or cracking. Always inspect gears using magnaflux (or a similar system) for cracks that would not otherwise be detected.

## [352/353] Shifter Forks, Sliding Clutches and Shift Rails

Replace forks and/or sliding clutches when the side clearance (A) between the fork (2) and sliding clutch (1) groove exceeds the specified limit (refer to TC15 and TC25 SPECIFICATIONS section of this manual).

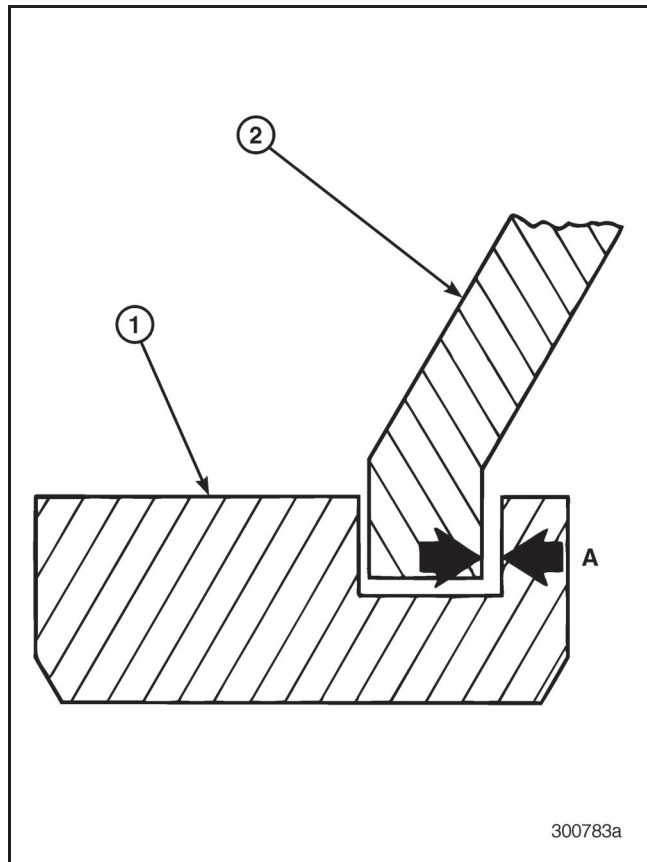


Figure 127 — Fork and Clutch Detail



# INSPECTION OF PARTS

Replace shift rails if they are cracked in either the poppet or setscrew holes. If the clearance between the shift rail and case bore exceeds 0.010-inch (0.254 mm) maximum, determine which part is worn before replacing. Shaft wear can be checked by measuring the shaft at an unworn location. Then measure the shaft at the worn area and compare measurements. When measuring a shift rail, the reading should be an average of diameter measurements taken at four locations. Compare one side of the shaft to the other, AB–CD as shown in the following figure.

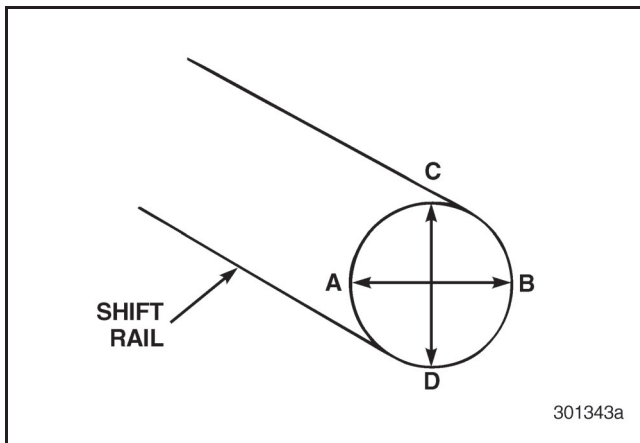


Figure 128 — Measuring Shift Rail

## [351] Oil Seals

When an overhaul is required, replace all oil seals. Be careful to ensure that the sealing surface of any seal is not damaged, turned back or cut. A nick on a shaft sealing surface can cut the seal. Remove sharp edges that can damage the seal (chamfer edges if possible). Press seals into housings, using smooth even pressure to prevent cocking the seal.

### CAUTION

*Be careful when using any abrasive polishing methods, such as emery or crocus cloth, on a sealing surface. It is possible to leave micro-grooves on the sealing surface. This can cause oil to leak past the sealing lip(s) of the oil seal. With this condition, a new seal will not stop the oil leak.*

Be careful when installing a shaft through a **new** seal (or seal over shaft). Lubricate the shaft before inserting it through the seal. Splines, keyways and holes in a shaft can damage seals unless care is taken. Lubricate the seal to prevent damage during the initial start-up period, before normal lubrication begins. Keep anti-seize and sealing compounds away from oil seals.

If an oil seal does not have a preapplied sealant on its outer diameter, apply an appropriate sealer around the outside diameter to prevent leaks.

Lip-type oil seals are precision elements requiring close attention and care during installation. It must be emphasized that the quality of the installation method and tools used have a direct influence on the life of the seal. Do not use a block of wood or discarded bearing as a substitute for the proper seal driver.

For the seal to function properly, install it squarely with respect to the shaft center line. The seal should be kept square within 0.010-inch (0.254 mm) Total Indicated Runout (TIR). Squareness of the seal to the shaft is controlled by using the proper seal installation tools.





# INSPECTION OF PARTS

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## General Inspection

Any cracked transfer case should be replaced. Check all components for wear or damage. Replace all parts as required. Replace all gaskets, O-rings, and any part that shows mutilation or damage. Repair all stripped threads, using a thread repair insert that is compatible with patch-lock type capscrews.

## General Reassembly Instructions

Refer to the Torque and Tolerance Specification tables for fits and limits.

All working metal parts, especially the bearings, should be coated with fresh, clean, specified gear oil while the transfer case is being reassembled. This ensures immediate lubrication and helps prevent parts seizure during start-up. (Refer to Recommended SAE Grade Gear Oil in Transfer Case Specifications and Capacities.)

When installing bearings, use proper bearing drivers. When pressing a bearing onto a shaft, apply force to the inner race of the bearing. When pressing a bearing into a housing (bearing cover), apply force only to the outer race. Do not apply force that is transmitted through the bearing rollers, balls or cage. Damage and premature bearing failure can result. Always apply even pressure to the bearing to prevent it from cocking or distorting during installation.

As moving parts are installed, check the parts frequently to see that they are moving freely.

## Clamp Plate Capscrews

Clamp plates and clamp plate capscrews are used to retain the bearings on both ends of the countershaft and on the front of the front-drive shaft. To make sure that these critical fasteners do not loosen:

- Clean the internal and external threads with a proper cleaning solution.
- Insert shims of the appropriate thickness between the end of the shaft and the clamp plate. Shims are to be 0.005–0.015 inch (0.127–0.381 mm) below the surface of the bearing.
- Apply 8–10 drops of Loctite 242 “Lock n’ Seal” (MACK part No. 5166-2400) to the threads of the clamp plate capscrew.
- Install and tighten the capscrews to specification.

Shims are available in thicknesses of 0.005, 0.010, 0.020, 0.031 and 0.062 inch (0.127, 0.254, 0.508, 0.787 and 1.575 mm).



# BENCH PROCEDURES

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## BENCH PROCEDURES (REASSEMBLY)



# BENCH PROCEDURES

## [350] TRANSFER CASE COMPONENT REASSEMBLY

### [351] Front-Drive Shaft Bearing Retainer Reassembly

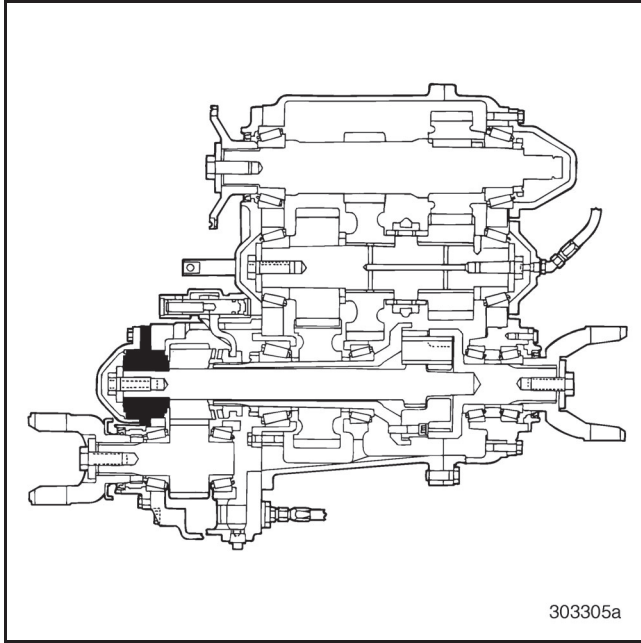
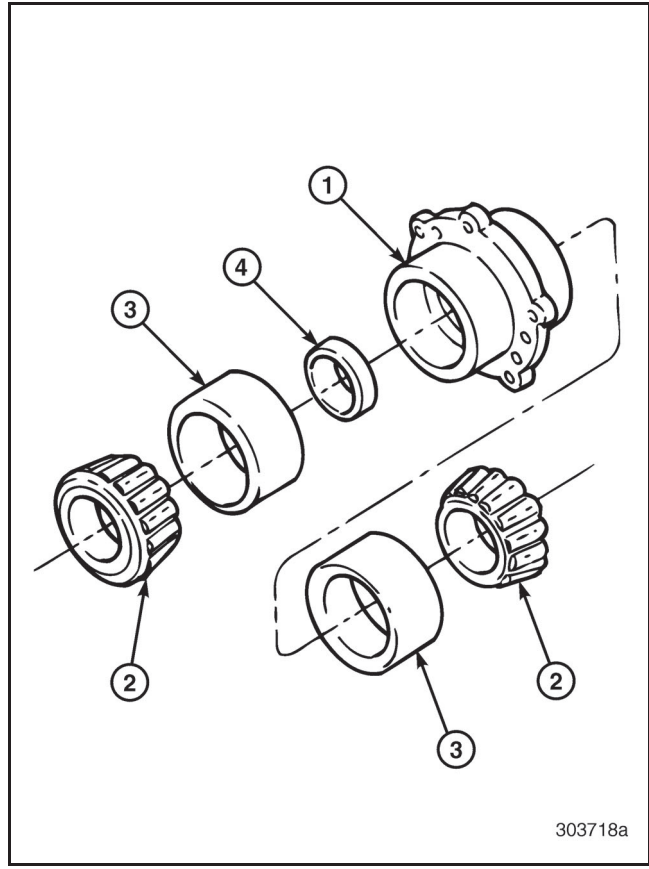


Figure 129 — Front-Drive Shaft Bearing Retainer Locator



1. Bearing Retainer	3. Bearing Cup
2. Bearing Cone	4. Selective Spacer

Figure 130 — Exploded View of Front-Drive Shaft Bearing Retainer

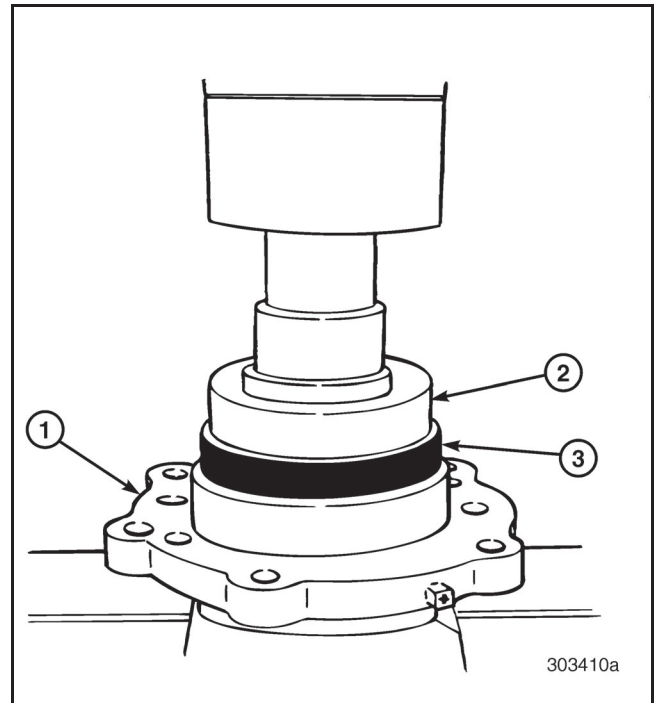


# BENCH PROCEDURES



Apply the recommended oil to shaft, gear and bearing surfaces before assembling parts.

1. Press the front and rear bearing cups into the bearing retainer. Apply even pressure to prevent cocking the cups. Press each bearing cup in until seated against the retainer shoulder.



1. Bearing Retainer  
2. Press Plate

3. Bearing Cup

**Figure 131 — Installing Bearing Cups into Retainer**



# BENCH PROCEDURES

## ADJUSTING FRONT-DRIVE SHAFT BEARING END PLAY

2. To establish bearing end play for the front-drive shaft, install the front and rear bearing cones, along with bearing spacer into the bearing retainer. Place the assembly in a press. Use a suitable driver to apply a force of 5,000 pounds to only the inner race of the bearing cone.

Assemble magnetic base dial indicator set J 7872 or equivalent, with dial indicator pin against the gasket surface of the bearing retainer.

3. Lift the bearing retainer up and down while watching the dial indicator. The bearing end play reading should be 0.001–0.005 inch (0.025–0.127 mm).

4. To adjust bearing end play, remove the assembly from the press. Remove the bearing cones and spacer. Select a different spacer that provides the required bearing end play.

### NOTE

If the end play measurement is out of specification, place a thinner selective bearing spacer between bearing cones to decrease end play or place a thicker selective bearing spacer between bearing cones to increase end play.

Selective spacer thicknesses are available in 0.001-inch (0.025-mm) increments from 0.198–0.259 inch (5.029–6.579 mm).

### NOTE

Rotate the retainer back and forth while the bearings are under pressure, to properly seat them, before measuring end play.

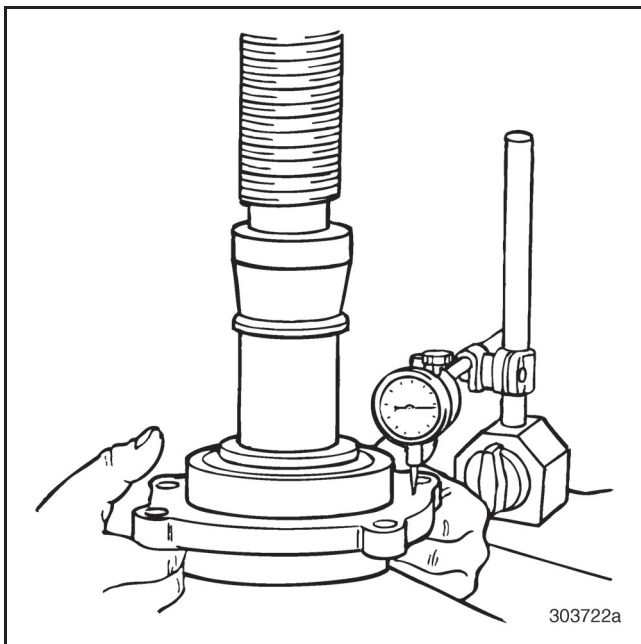


Figure 132 — Measuring End Play with Bearing Cones and Spacer Assembled in Retainer



# BENCH PROCEDURES

## [352] Rear-Drive Shaft Reassembly

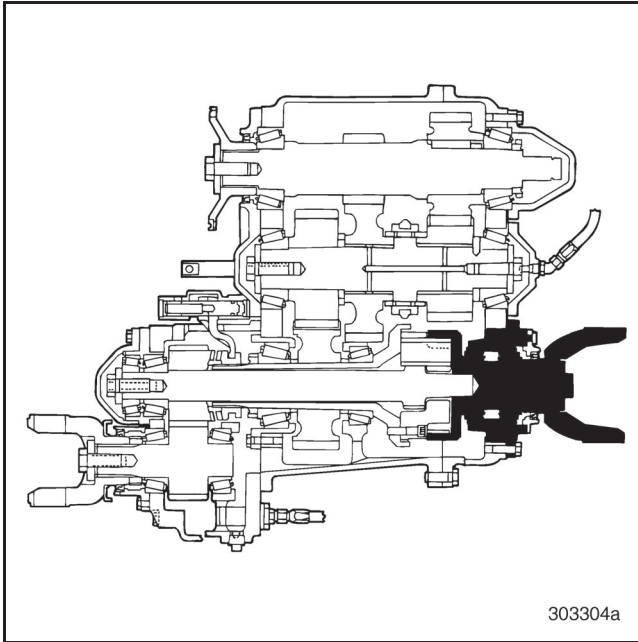
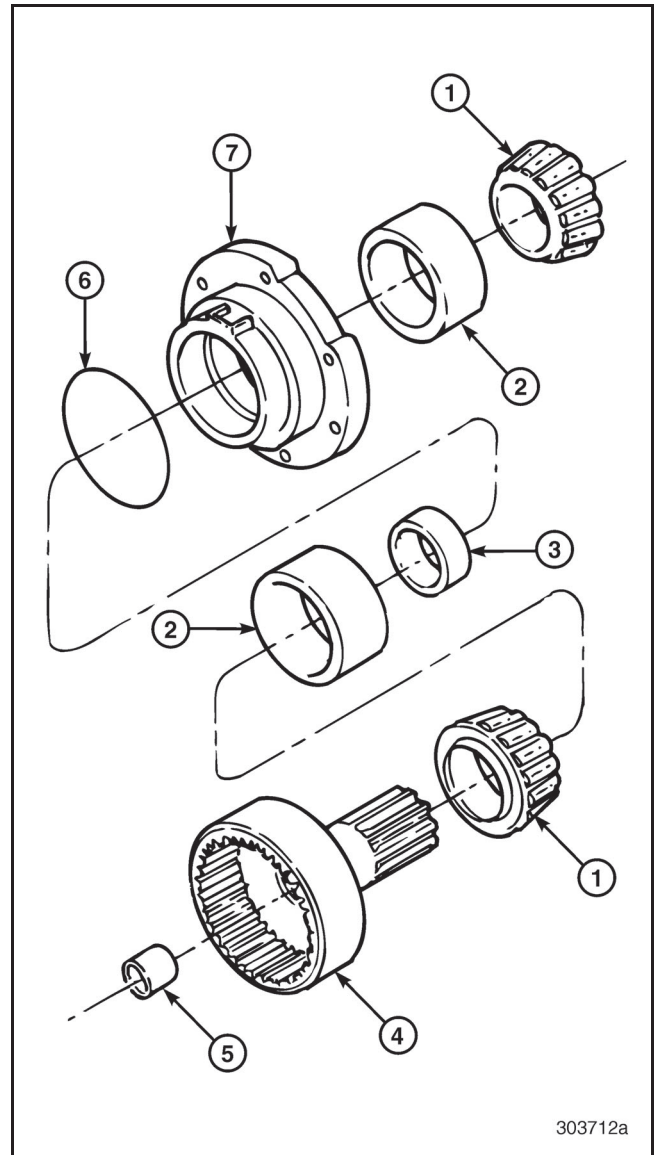


Figure 133 — Rear-Drive Shaft Locator



- |                     |                     |
|---------------------|---------------------|
| 1. Bearing Cone     | 5. Bushing          |
| 2. Bearing Cup      | 6. O-Ring           |
| 3. Selective Spacer | 7. Bearing Retainer |
| 4. Rear-Drive Shaft |                     |

Figure 134 — Exploded View of Rear-Drive Shaft

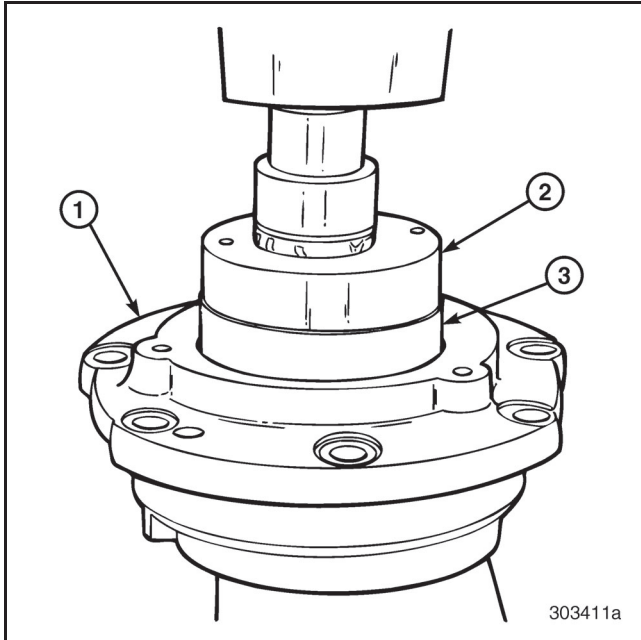


# BENCH PROCEDURES

## TE

Apply the recommended oil to shaft, gear and bearing surfaces before assembling parts.

1. Press the bearing cups into the bearing retainer until each seats against the shoulder in the retainer. Use a suitable driver and apply even pressure on the cups to prevent cocking them.



1. Bearing Retainer	3. Bearing Cup
2. Press Plate	

Figure 135 — Pressing Bearing Cups into Bearing Retainer

2. Press the bushing into the front of the rear-drive shaft, using a suitable driver. Refer to No. 5 in the exploded view found at the beginning of this procedure.

3. Press the front bearing cone onto the rear-drive shaft until seated against the shoulder on the shaft. Use a suitable driver to apply force to only the inner race of the bearing cone.

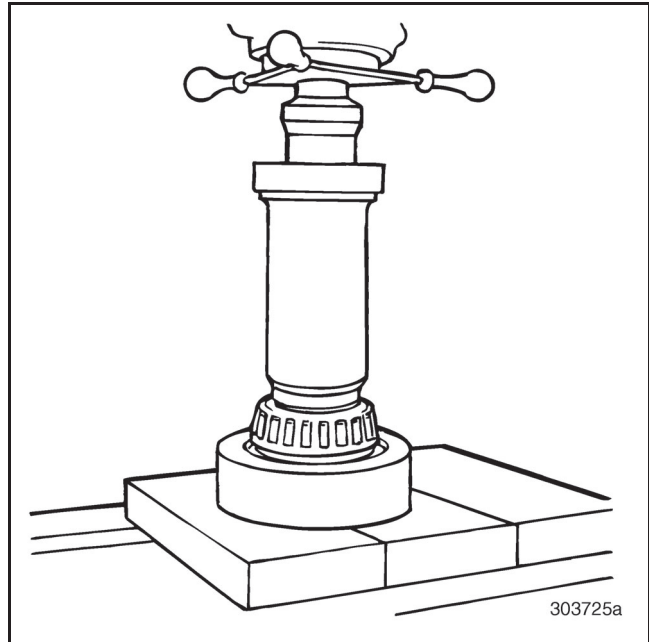


Figure 136 — Pressing Bearing Cone onto Rear-Drive Shaft

### ADJUSTING REAR-DRIVE SHAFT ASSEMBLY BEARING END PLAY

4. Slide the selective spacer onto the shaft. Then install the bearing retainer over the shaft and onto the bearing cone.

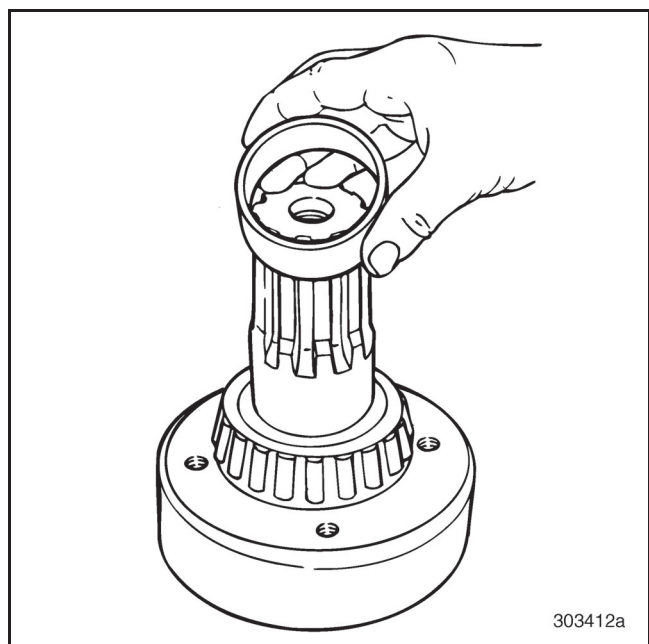


Figure 137 — Installing Bearing Spacer



## BENCH PROCEDURES

5. Place the rear bearing cone into position on the rear-drive shaft. Press the bearing cone on until seated against the spacer. Use a suitable driver that applies force to only the inner race of the bearing cone.

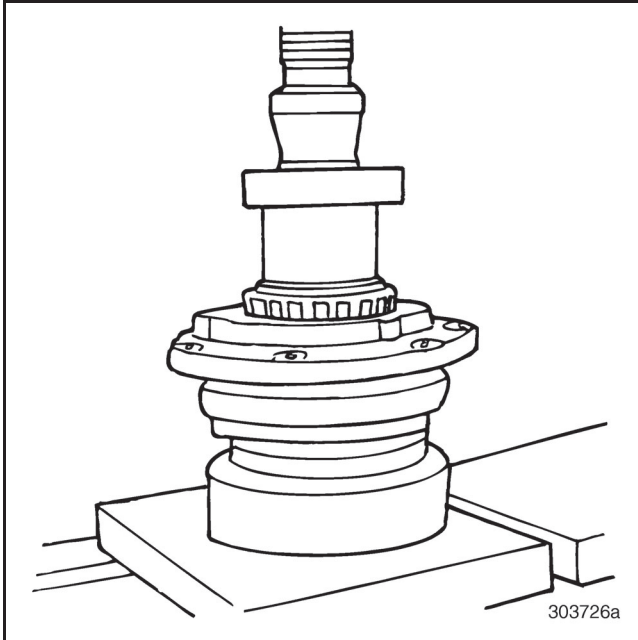


Figure 138 — Pressing on Bearing Cone

6. Keep the assembly in the press setup and apply a force of 5,000 pounds to only the rear bearing cone inner race. Assemble magnetic base dial indicator set J 7872 or equivalent, with dial indicator pin against the rear-drive shaft housing. Measure the end play, using magnetic based dial indicator set J 7872 or equivalent. End play should be 0.001–0.005 inch (0.025–0.127 mm).

### NOTE

Before measuring end play, rotate the retainer back and forth while the bearings are under pressure, to properly seat them.

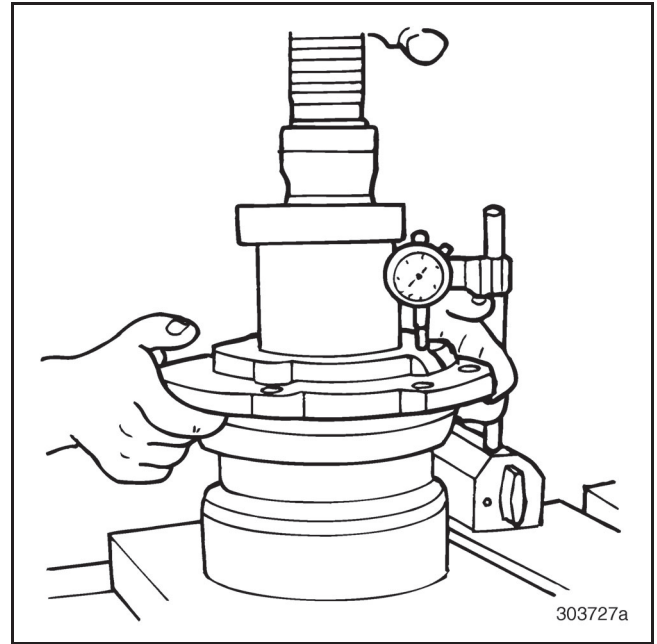


Figure 139 — Measuring End Play with Bearing Cones, Spacer and Shaft Assembled in Retainer

7. To adjust bearing end play, remove the assembly from the press. Remove the shaft, bearing cones and spacer. Select a different spacer that provides the required bearing end play.

### NOTE

If the end play measurement is out of specification, place a thinner selective bearing spacer between bearing cones to decrease end play, or place a thicker selective bearing spacer between bearing cones to increase end play.

Selective spacer thicknesses are available in 0.001-inch (0.025-mm) increments from 1.022–1.084 inch (25.96–27.53 mm).





# BENCH PROCEDURES

8. Install the rear-drive shaft seal housing onto the bearing retainer.

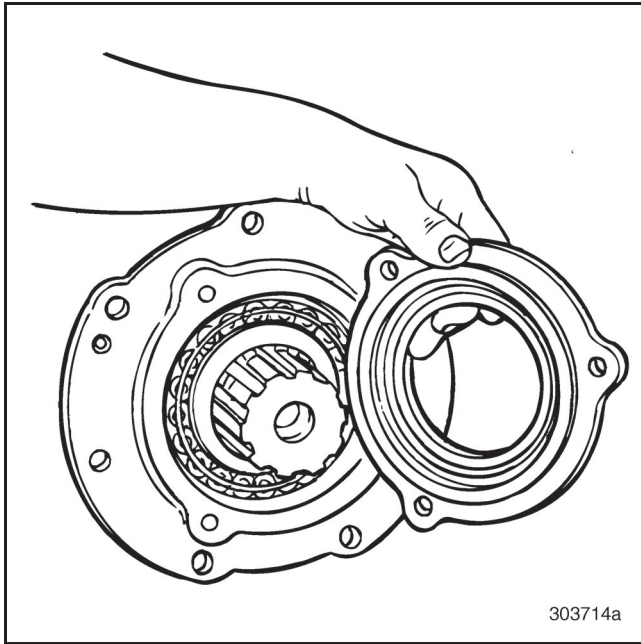


Figure 140 — Installing Rear-Drive Shaft Seal Housing

9. Install the seal housing capscrews and tighten them to specification.

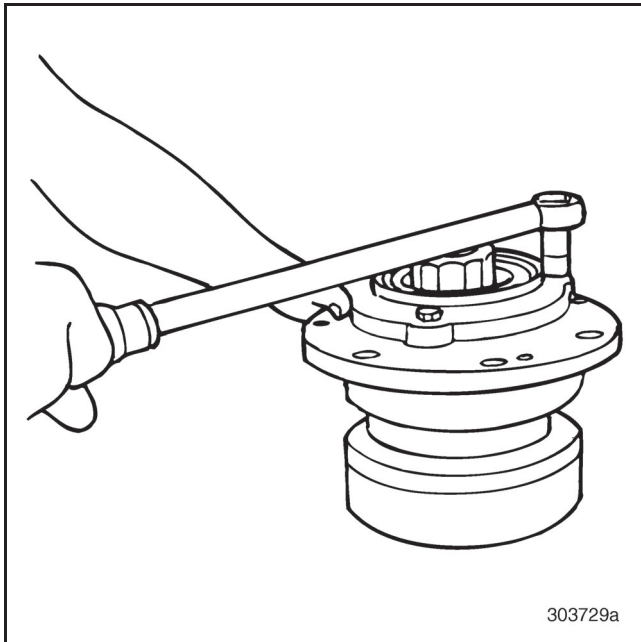
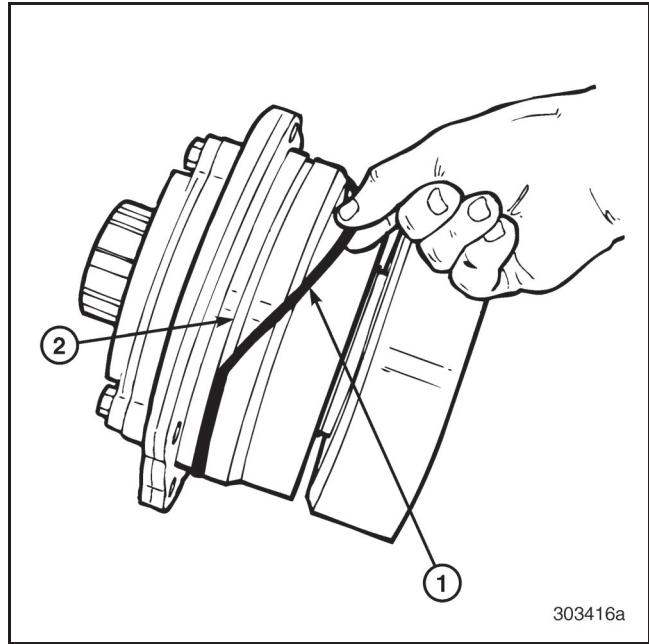


Figure 141 — Tightening Seal Housing Capscrews

10. Install a **new** O-ring into the hub groove of the rear-drive shaft bearing retainer.



1. Rear-Drive Shaft Bearing Retainer O-Ring	2. Bearing Retainer O-Ring Groove
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Figure 142 — Installing O-Ring into Bearing Retainer



# BENCH PROCEDURES

## [352] Front-Driving Shaft Reassembly

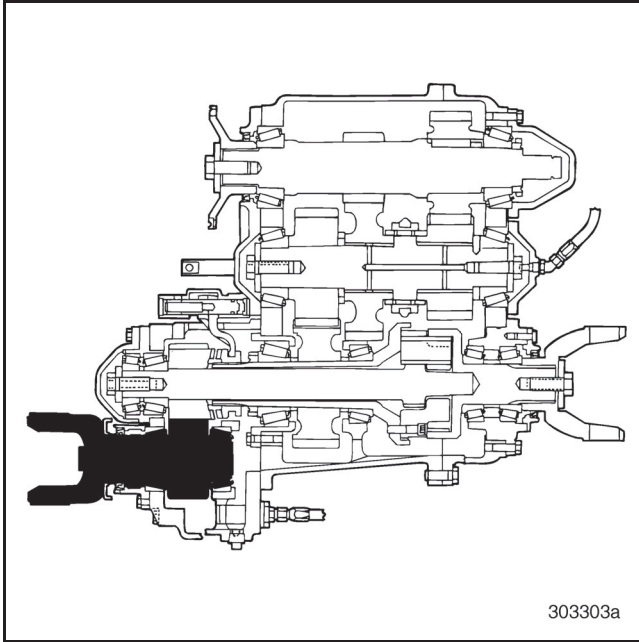
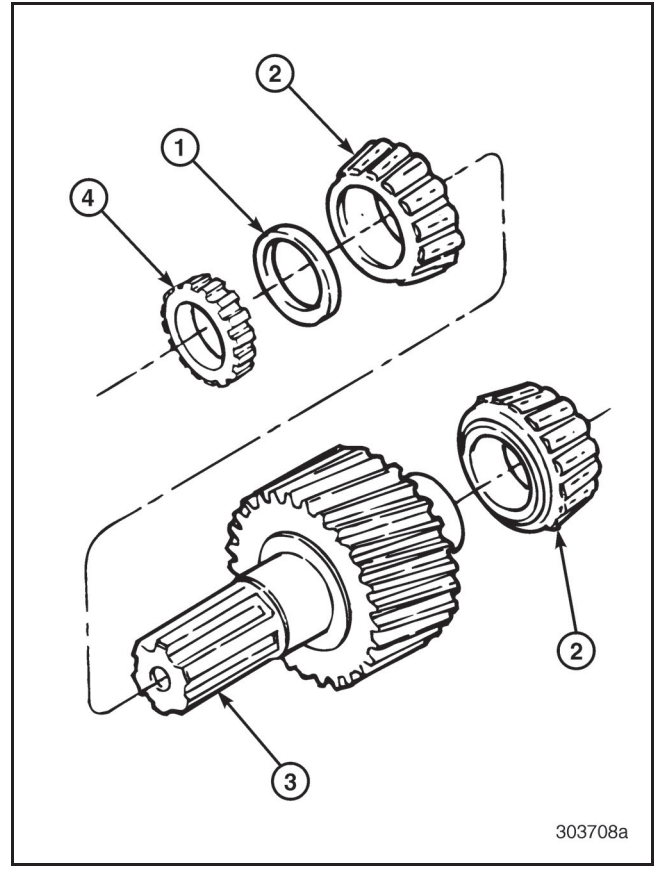


Figure 143 — Front-Driving Shaft Locator



- |                        |                           |
|------------------------|---------------------------|
| 1. Spacer              | 4. Speedometer Tone Wheel |
| 2. Bearing Cone        |                           |
| 3. Front-Driving Shaft |                           |

Figure 144 — Exploded View of Front-Driving Shaft

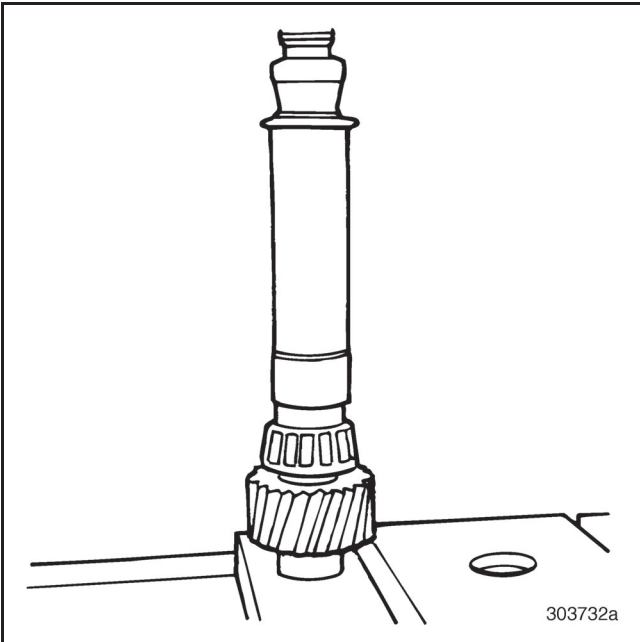


# BENCH PROCEDURES

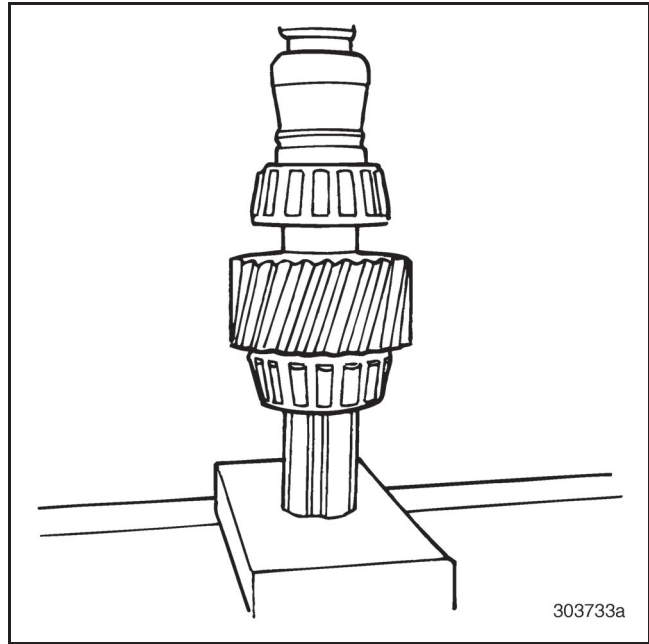


Apply the recommended oil to shaft, gear and bearing surfaces before assembling parts.

1. Press the front and rear bearing cones onto the front-driving shaft, using a suitable driver that applies pressure to only the inner race of the bearing cone.



**Figure 145 — Pressing on Front Bearing Cone**



**Figure 146 — Pressing on Rear Bearing Cone**

2. Install the spacer and tone wheel onto the front of the shaft. Refer to (1) and (2) in the exploded view found at the beginning of this procedure.



# BENCH PROCEDURES

## [352] Main-Drive Shaft Reassembly

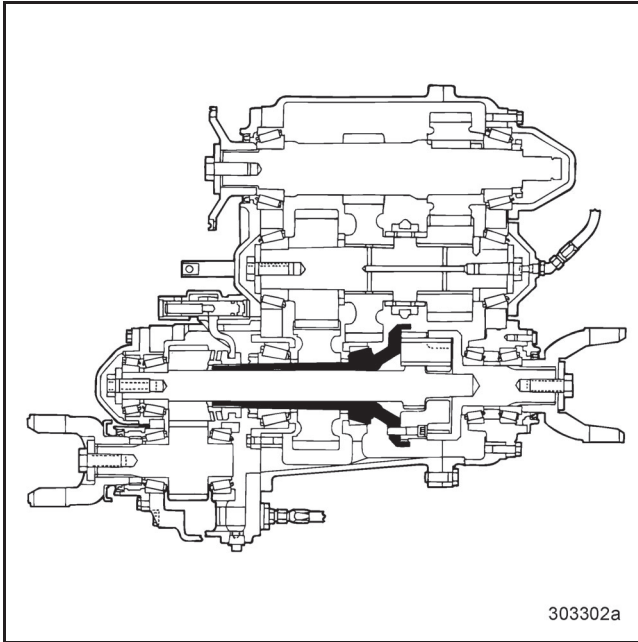
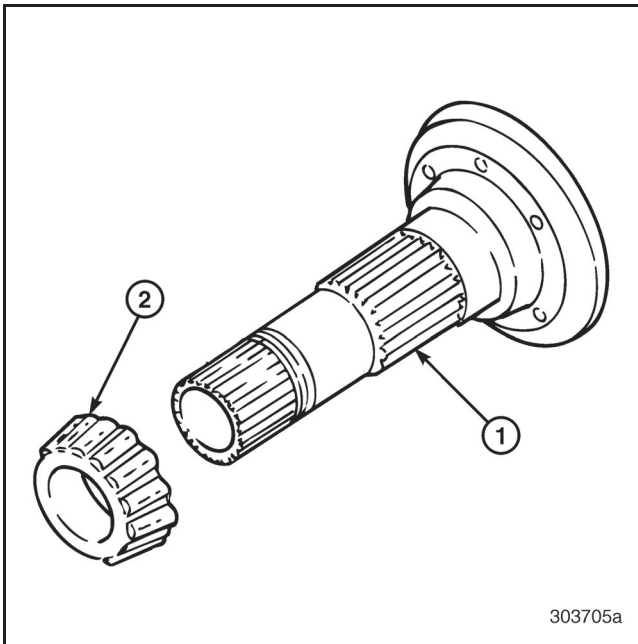


Figure 147 — Main-Drive Shaft Locator



1. Main-Drive Shaft

2. Bearing Cone

Figure 148 — Exploded View of Main-Drive Shaft

### NOTE

Apply the recommended oil to shaft, gear and bearing surfaces before assembling parts.

1. Press the rear bearing cone onto the main-drive shaft, using a suitable driver that applies pressure to only the inner race of the bearing cone.

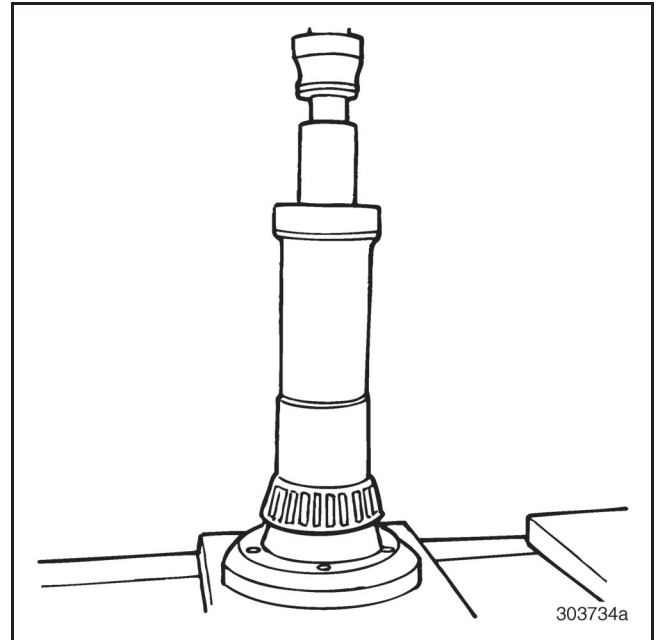


Figure 149 — Pressing Bearing Cone onto Main-Drive Shaft

2. Set the main-drive shaft aside for later installation into the transfer case.



# BENCH PROCEDURES

## [352] Countershaft Reassembly

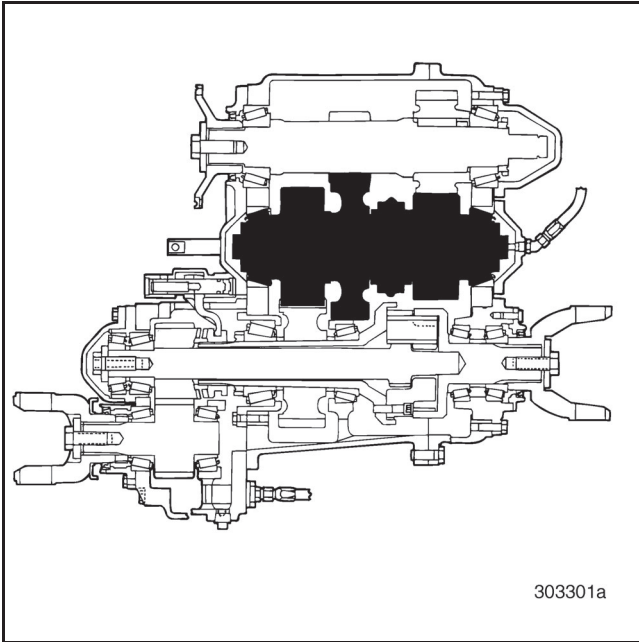


Figure 150 — Countershaft Locator

### NOTE

Apply the recommended oil to shaft, gear and bearing surfaces before assembling parts.

1. Mount the countershaft securely in a press to prevent it from rotating (use V-blocks for support). Install the Hi-range gear bearings and spacer.

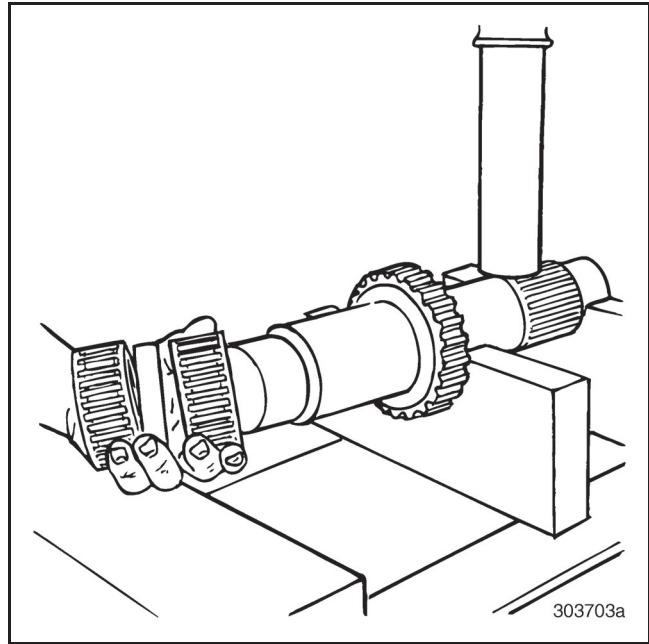


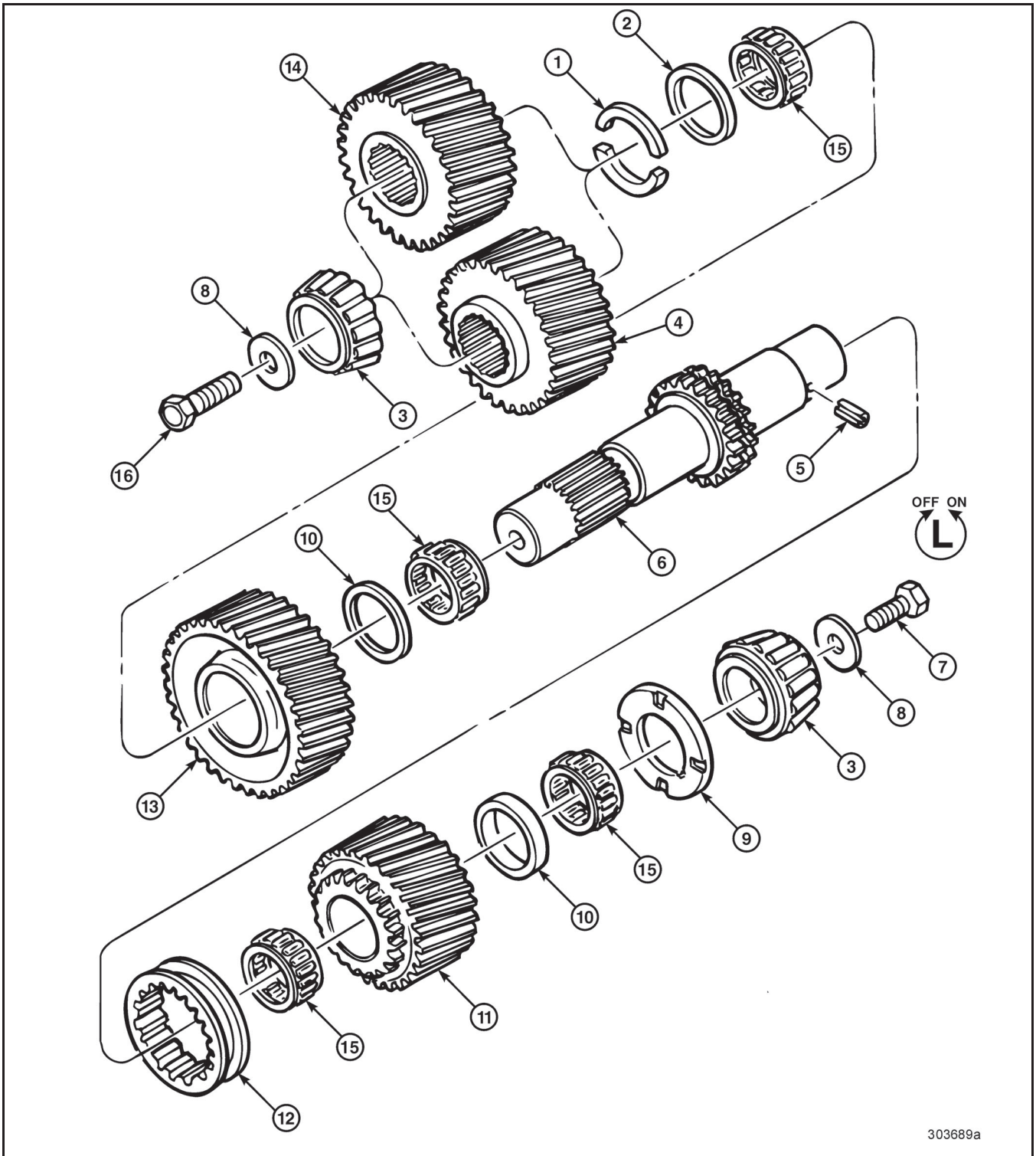
Figure 151 — Installing Hi-Range Gear Bearings and Spacer

### CAUTION

*To prevent injury or component damage, use a combination of V-blocks and press plates to clamp the countershaft in the press, during the reassembly procedure. This prevents heavy components from falling and helps hold the countershaft while installing various components.*



# BENCH PROCEDURES



303689a

1. Split Thrust Washer	7. Clamp Plate Capscrew (Left-Hand Thread)	12. Sliding Clutch
2. Thrust Washer Ring	8. Clamp Plate	13. Lo-Range Gear
3. Bearing Cone	9. Thrust Washer	14. Main-Drive Gear (Direct)
4. Main-Drive Gear (Overdrive)	10. Spacer	15. Roller Bearings
5. Thrust Washer Lockpin	11. Hi-Range Gear	16. Clamp Plate Capscrew
6. Countershaft		

Figure 152 — Exploded View of Countershaft



# BENCH PROCEDURES

2. Install the Hi-range gear over the bearings and spacer. The clutch teeth on the gear face the front of the shaft.

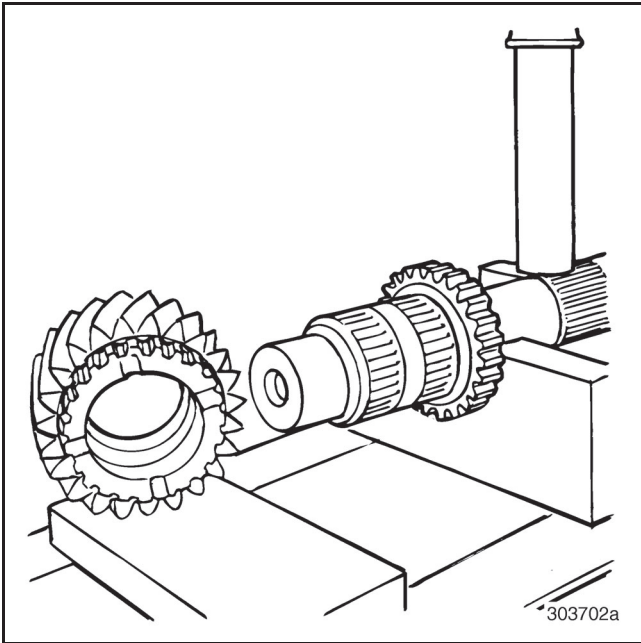


Figure 153 — Installing Hi-Range Gear

3. Install the thrust washer lockpin and the thrust washer. Align the slot in the thrust washer with the lockpin to engage.

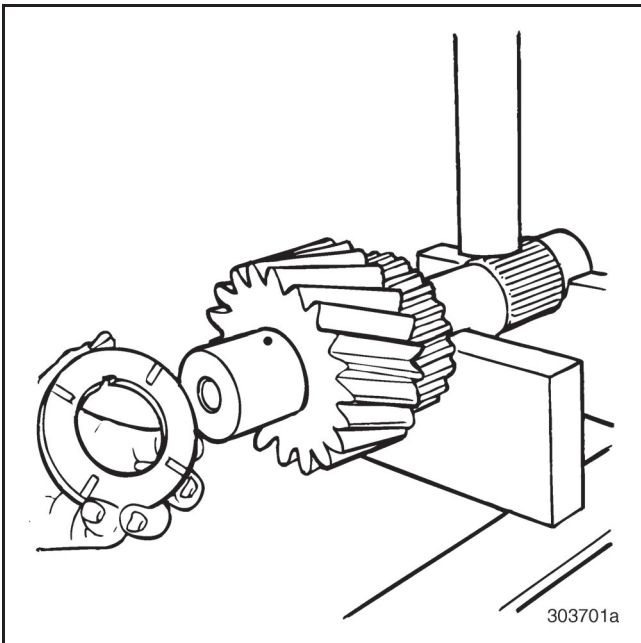


Figure 154 — Installing Thrust Washer and Lockpin

4. Place the countershaft in the press with front end down. Press the rear countershaft bearing cone onto the shaft until seated against the thrust washer. Use a suitable driver that applies force to only the inner race of the bearing cone.

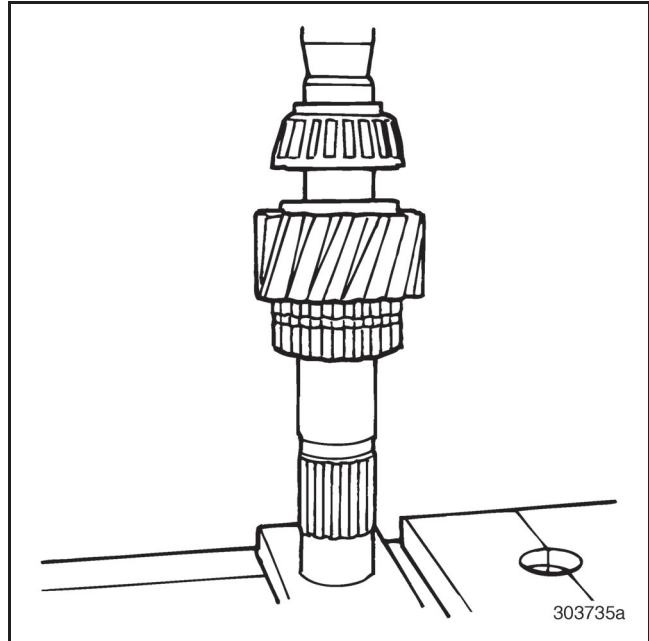


Figure 155 — Pressing Rear Bearing Cone onto Shaft

5. Place the countershaft assembly in the press and secure it using the Hi-range gear. Install the sliding clutch with the side marked "LO" toward the Lo-range gear.

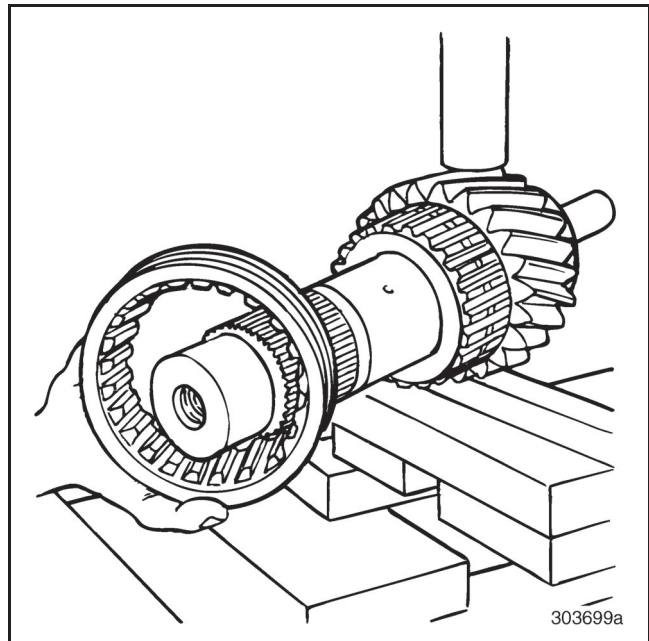


Figure 156 — Installing Sliding Clutch

- Install the Lo-range gear bearings and spacer.

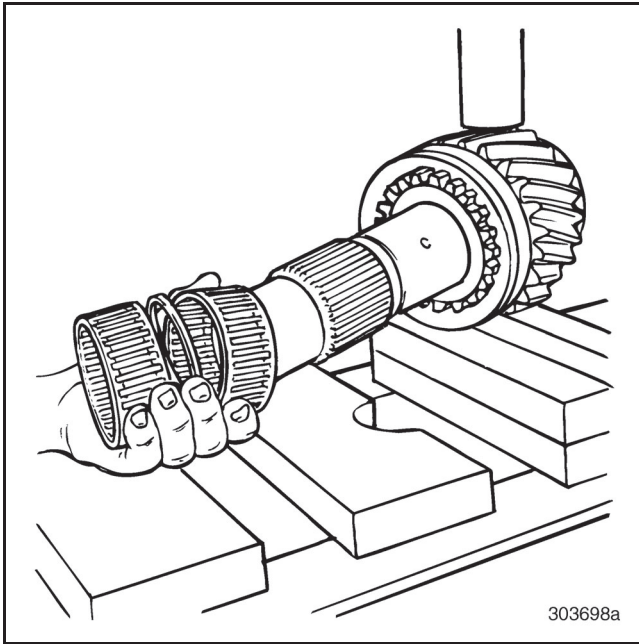


Figure 157 — Installing Lo-Range Gear Bearings and Spacer

- Install the Lo-range gear onto the countershaft over the bearings and spacer with the clutch teeth of the gear facing rearward toward the sliding clutch.

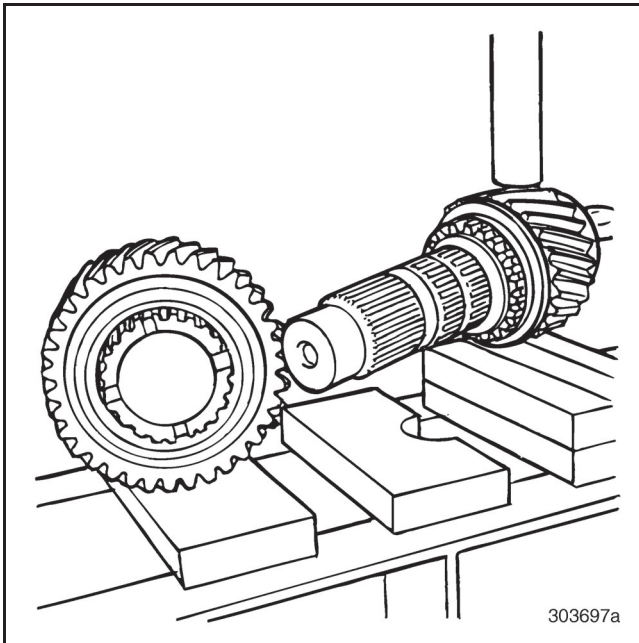


Figure 158 — Installing Lo-Range Gear

- Install the two halves of the split thrust washer into the groove located on the shaft, next to the Lo-range gear.

## NOTE

The split-type thrust washer is manufactured in one piece. If a **new** split thrust washer is required, place the **new** thrust washer in a soft-jawed vise so that the notches in the thrust washer are just barely exposed. Tap on the exposed upper side of the thrust washer, using a soft-faced mallet. This breaks the thrust washer in two, so that it can be installed onto the countershaft.

Make sure to protect the smooth machined surfaces of the thrust washer from damage.

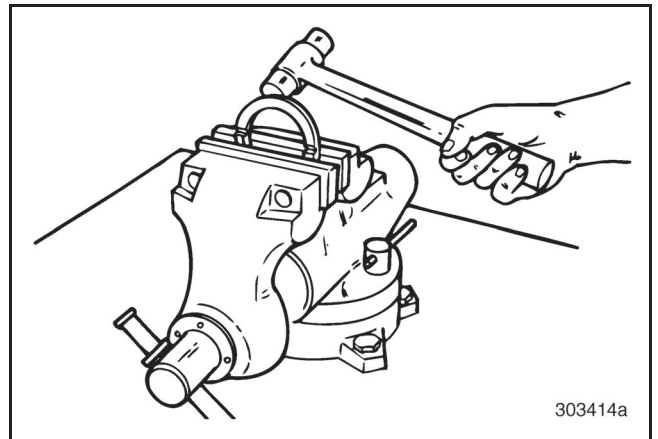


Figure 159 — Splitting Thrust Washer Halves

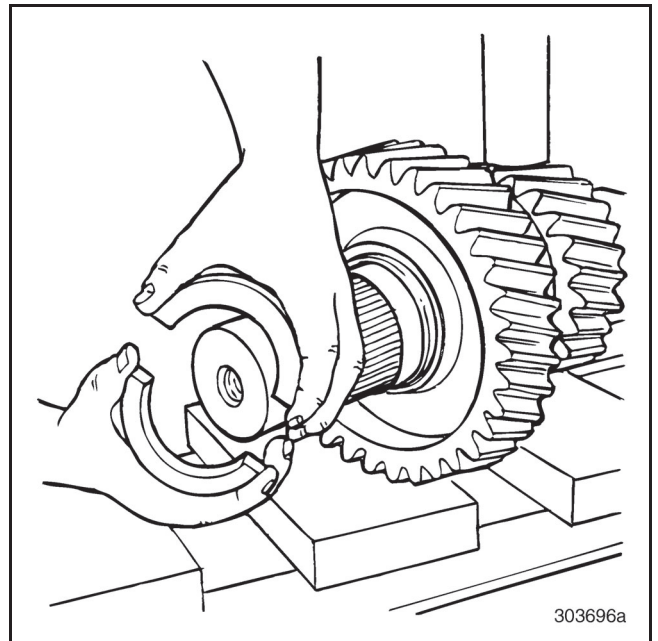


Figure 160 — Installing Split Thrust Washer Halves





# BENCH PROCEDURES

9. Install the thrust washer ring over the two halves of the split thrust washer. Tap the ring over the split washers to lock them in place.

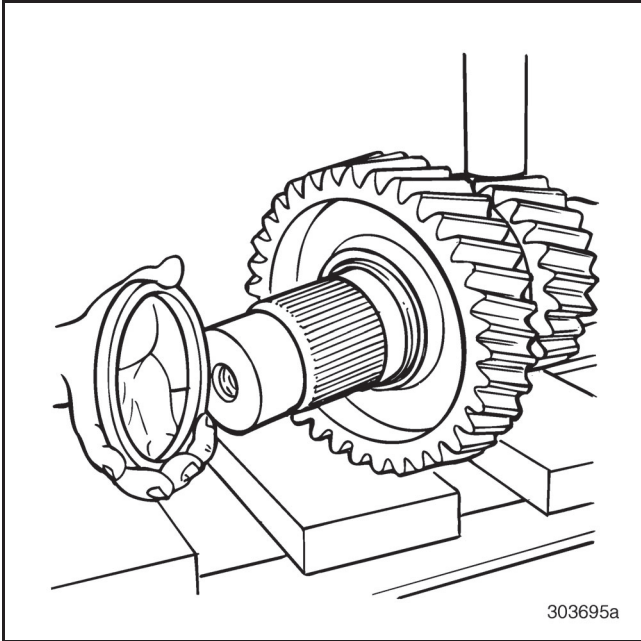


Figure 161 — Installing Thrust Washer Ring

10. Install the countershaft main-drive gear over the splines of the countershaft.

## NOTE

In direct unit transfer cases, the main-drive gear has 27 teeth and a slightly protruding hub (approximately 1/32 inch from gear face to hub face). The direct unit transfer case main-drive gear can be installed with either side facing forward.

In overdrive unit transfer cases, the main-drive gear has 31 teeth and a protruding hub on one side of the gear (approximately 13/32 inch from gear face to hub face). The overdrive unit transfer case main drive gear must be installed with the protruding hub facing forward.

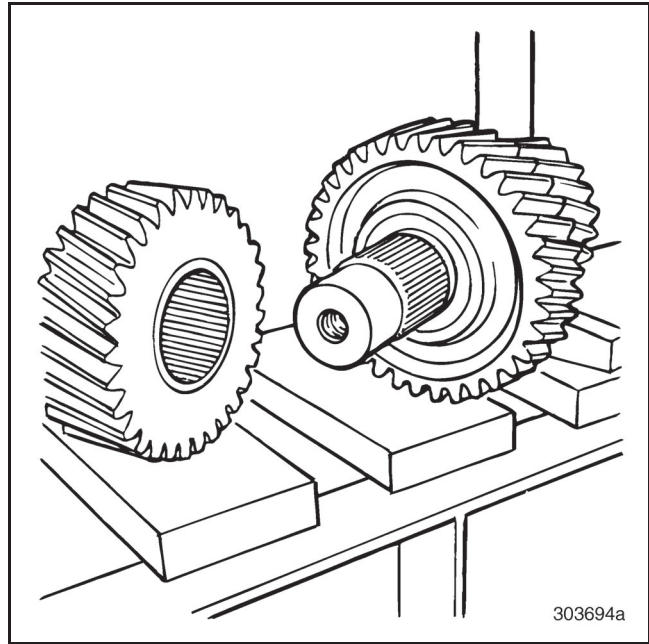


Figure 162 — Installing Main-Drive Gear

11. Place the countershaft in the press with front end up. Press the front bearing cone onto the countershaft until seated against the main drive gear. Use a suitable driver that applies force to only the inner race of the bearing cone.

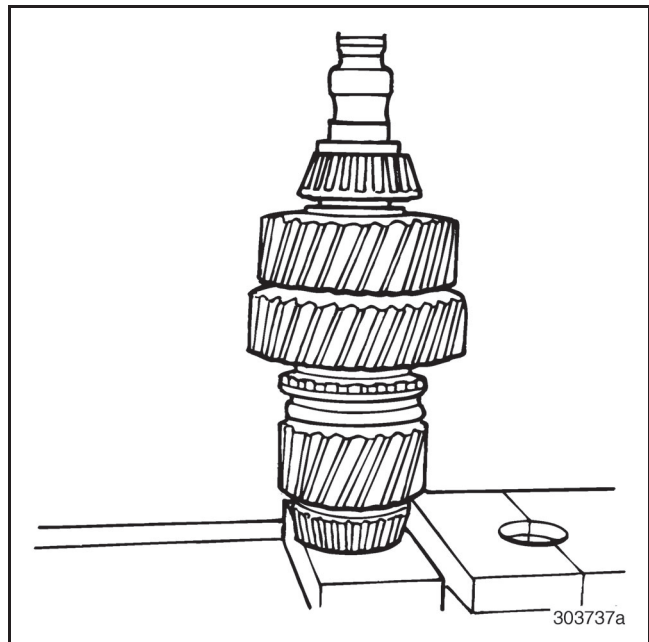


Figure 163 — Installing Front Bearing Cone onto Countershaft

12. Install the shim, clamp plate and capscrew onto the front of the countershaft.

### SERVICE HINT

The countershaft front bearing clamp plate capscrew is right-hand threaded. Install the capscrew in a clockwise direction.

### NOTE

Before installing the shim, clamp plate and capscrew, refer to INSPECTION OF PARTS, Clamp Plate Capscrews section for proper shim thickness and method of installation.

### SERVICE HINT

Clamp the Hi-range gear in the press and then, engage the sliding clutch. This prevents the shaft from rotating.

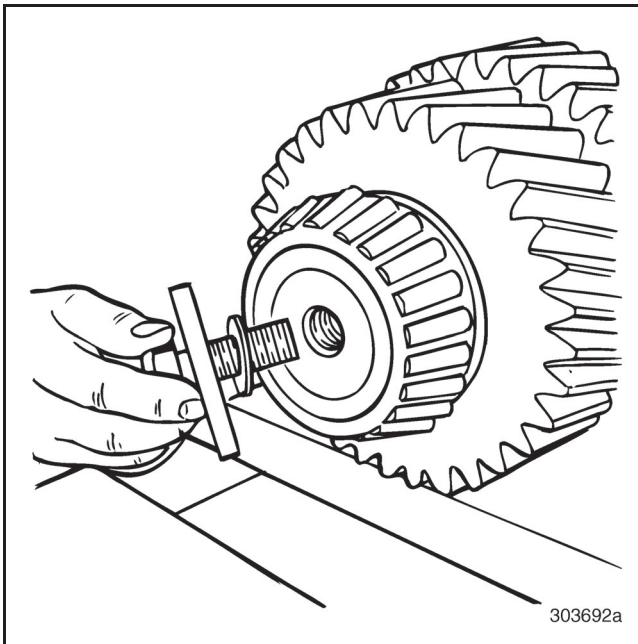


Figure 164 — Installing Front Shim, Clamp Plate and Capscrew

13. Tighten the clamp plate capscrew to specification.

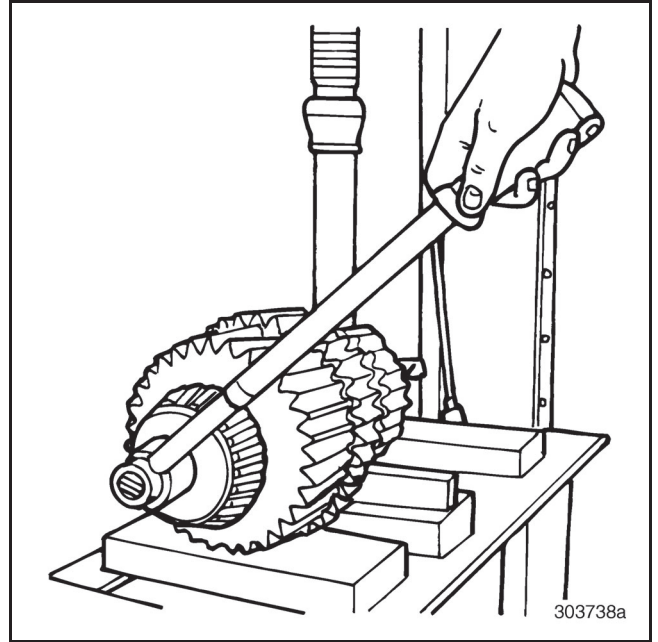


Figure 165 — Tightening Clamp Plate Capscrew

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# BENCH PROCEDURES

## [352] Mainshaft Reassembly

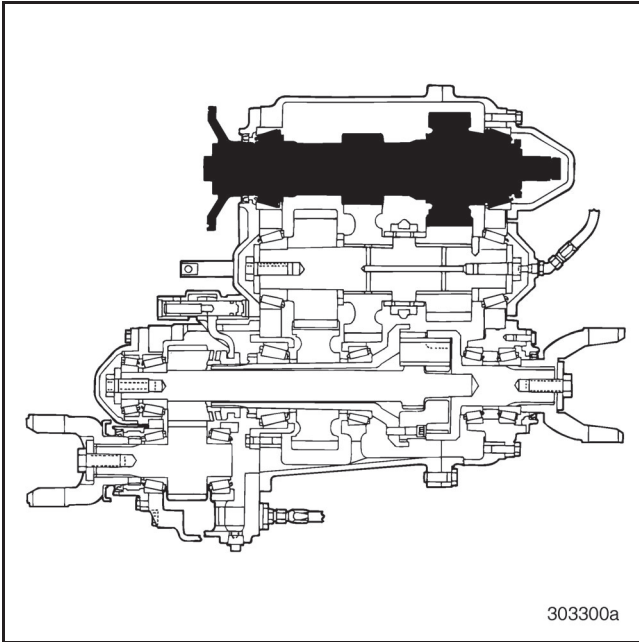


Figure 166 — Mainshaft Locator

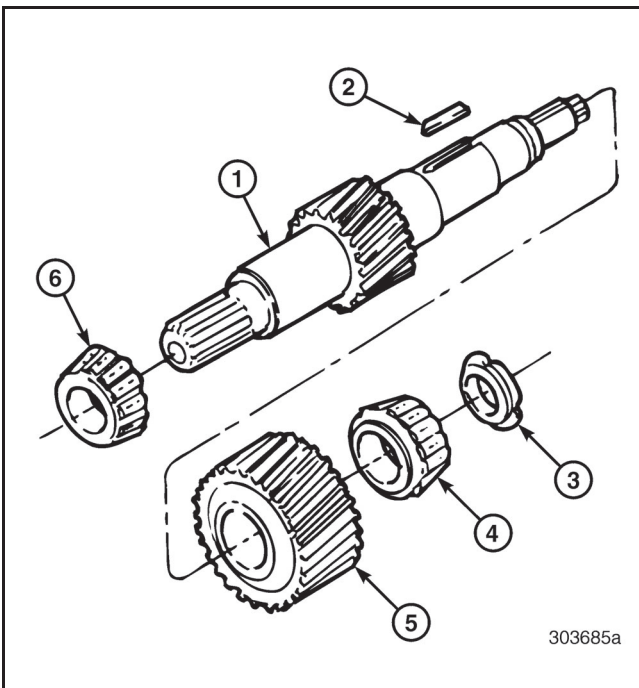
### NOTE

Apply the recommended oil to shaft, gear and bearing surfaces before assembling parts.

1. Install the key into the keyway of the mainshaft. Press the Hi-range gear onto the shaft, using a suitable driver and press setup. The protruding hub of the Hi-range gear faces the rear of the shaft when installed.

### NOTE

During all pressing operations involving a key and keyway, watch the key to make sure that no material is shaved off as the gear is being pressed on. Material can collect between the gear and mating surfaces and prevent proper seating.



- |  |                  |
|--|------------------|
| 1. Mainshaft (Lo-Range Gear Part of Shaft) | 4. Bearing Cone  |
| 2. Key                                     | 5. Hi-Range Gear |
| 3. Bearing Locknut                         | 6. Bearing Cone  |

Figure 167 — Exploded View of Mainshaft

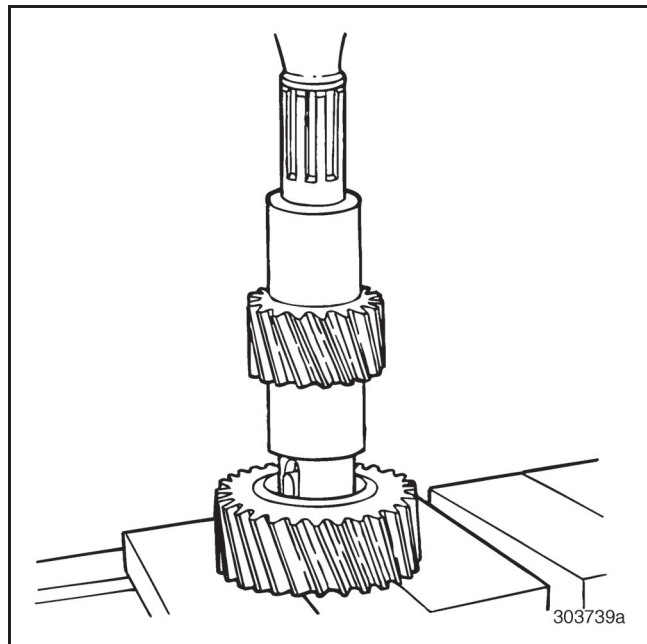


Figure 168 — Installing Hi-Range Gear onto Mainshaft

2. Place the mainshaft into the press, rear end up. Press the rear bearing cone onto the mainshaft until seated against the Hi-range gear. Use a suitable driver that applies force to only the inner race of the bearing cone.

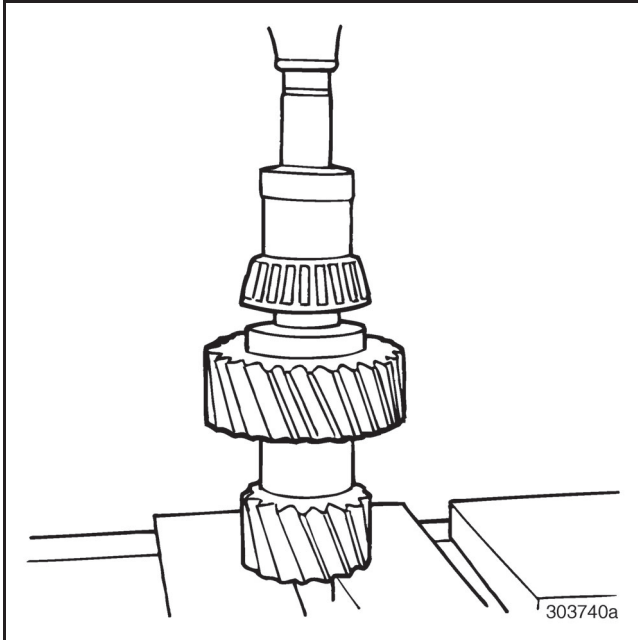


Figure 169 — Installing Rear Bearing Cone

3. Place the mainshaft into the press, front end up. Press the front bearing cone onto the mainshaft until seated against the shoulder on the shaft. Use a suitable driver that applies force to only the inner race of the bearing cone.

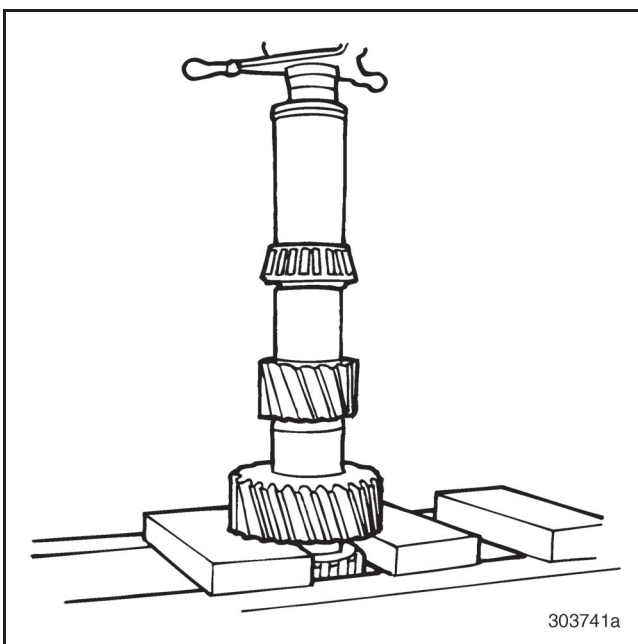


Figure 170 — Installing Front Bearing Cone onto Shaft

4. Loosely install a **new** rear bearing cone locknut onto the rear end of the mainshaft. Do not tighten at this time.

## SERVICE HINT

The mainshaft rear bearing cone locknut is right-hand threaded. Install the locknut in a clockwise direction.

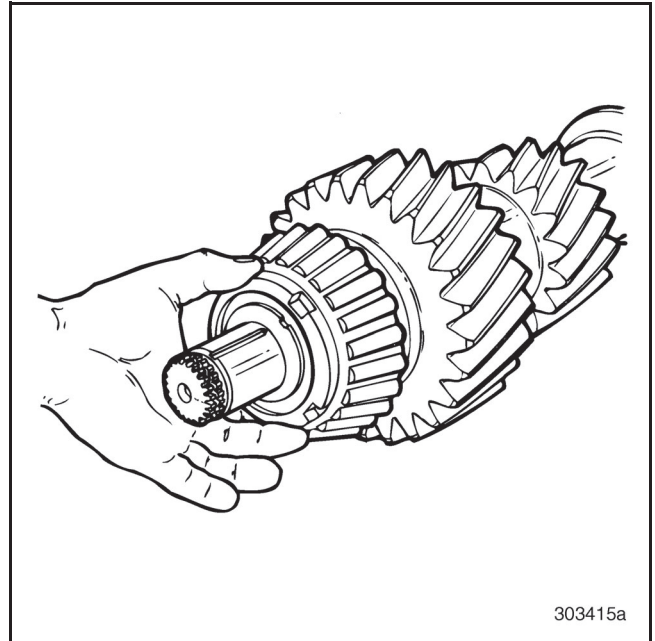


Figure 171 — Loosely Installing Rear Bearing Cone Locknut



# BENCH PROCEDURES

## [359/360/363] PTO AND PUMP COMPONENT REASSEMBLY

### [359] Oil Pump Reassembly

2. Install the oil pump cover and install four Phillips screws to secure the cover to the pump housing.

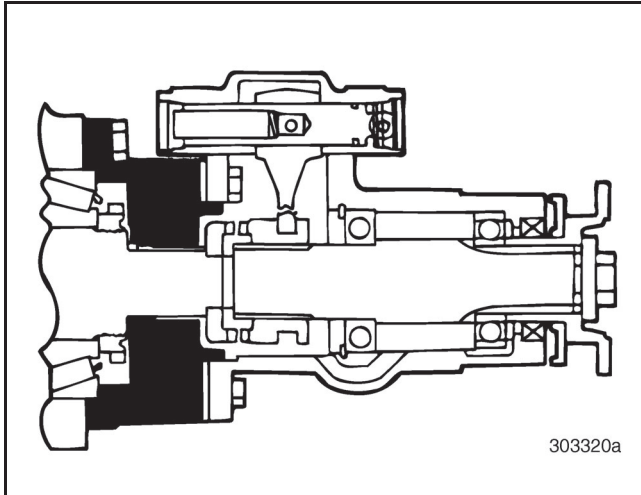


Figure 172 — Oil Pump Locator

1. Install the oil pump inner and outer gerotors into the pump housing. Lubricate the pump cavity with the recommended gear oil.

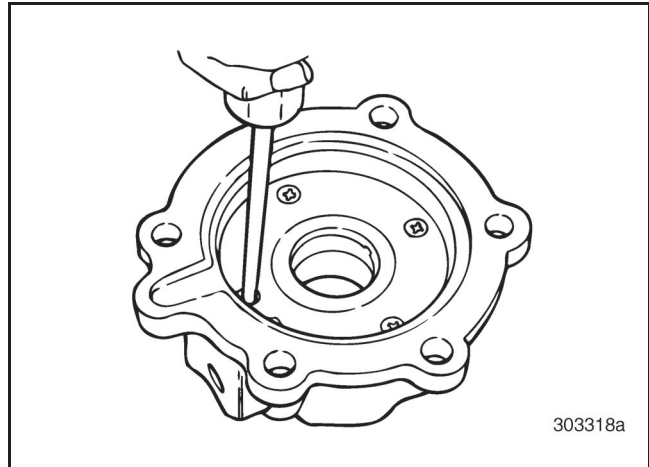


Figure 174 — Installing Pump Cover

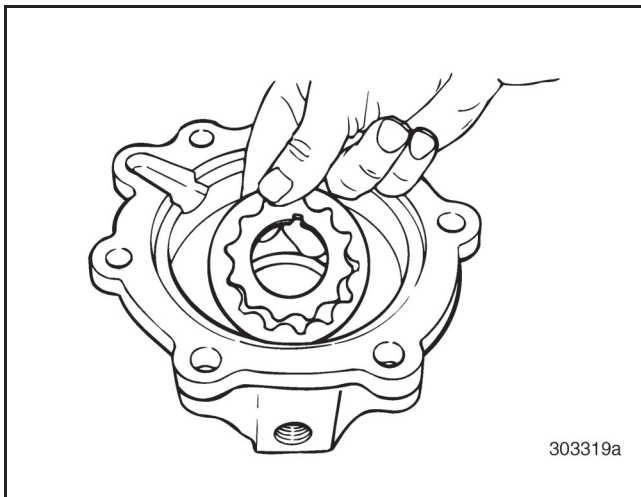


Figure 173 — Installing Pump Gerotors



# BENCH PROCEDURES

## [360] PTO Reassembly

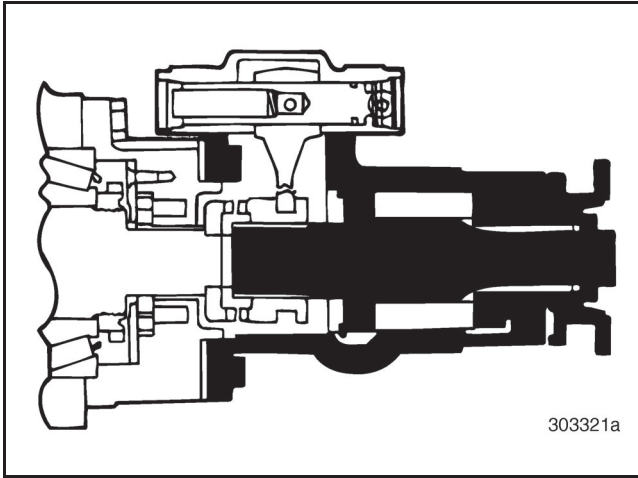


Figure 175 — PTO Locator

1. Install the PTO housing oil seal using a hammer and a seal driver. Install the seal even with housing surface.

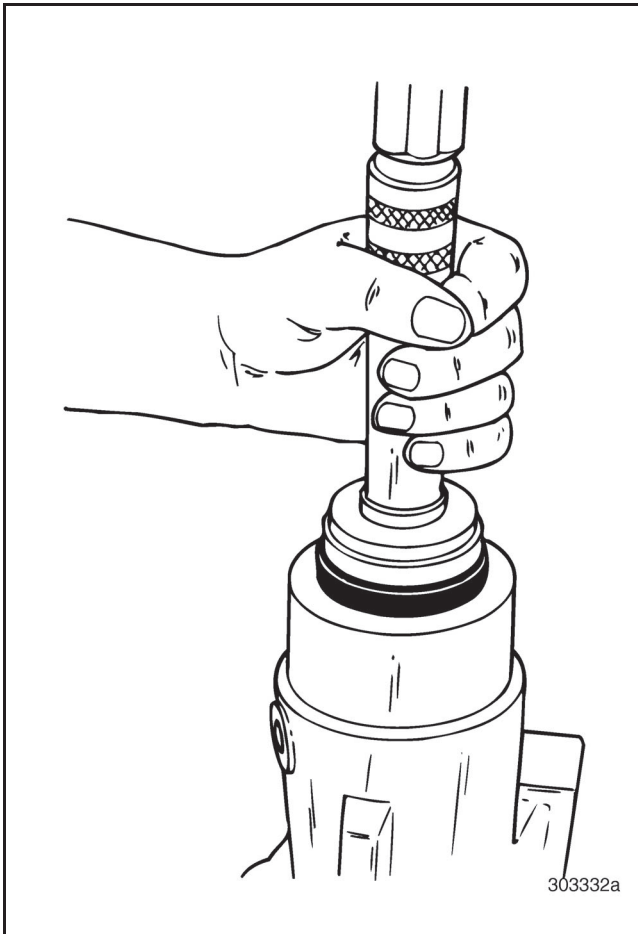


Figure 176 — Installing Housing Oil Seal

2. Position the larger bearing on the forward portion of the PTO shaft (finer spline). Using a suitable driver or press arrangement, apply force to only the inner race of the ball bearing.

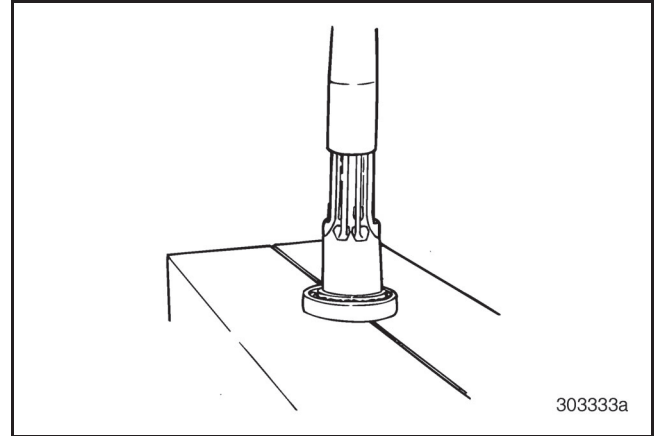


Figure 177 — Installing PTO Shaft Front Bearing

3. Position the smaller bearing on the rear portion of the PTO shaft (courser spline). Using a suitable driver or press arrangement, apply force to only the inner race of the ball bearing.

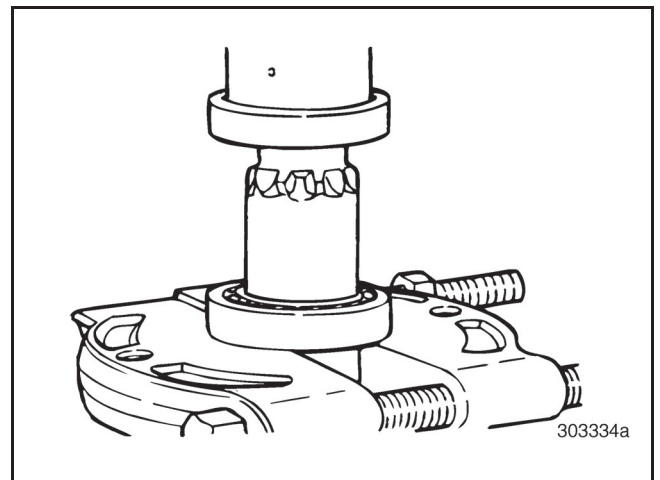


Figure 178 — Installing PTO Shaft Rear Bearing



# BENCH PROCEDURES

4. Install the PTO shaft into the forward area of the housing until bearings contact the housing surface. Support the housing to allow the shaft and bearings to move rearward. Tap the shaft rearward to seat the shaft bearings, using a brass bar.

## NOTE

Use tape or cardboard on the shaft splines to protect the shaft seal during shaft installation into the housing.

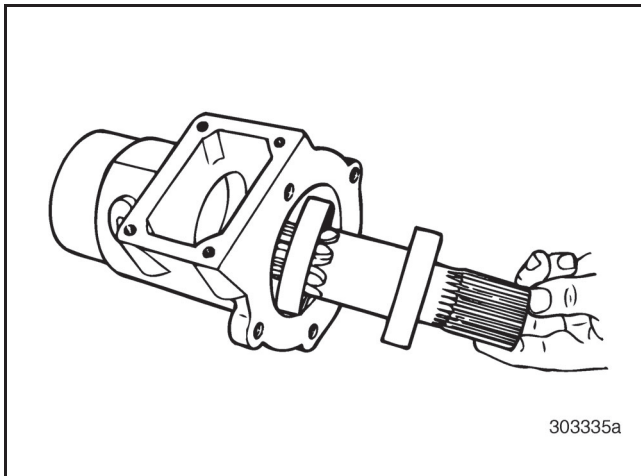


Figure 179 — Installing PTO Shaft into Housing

5. Using suitable snap ring pliers, install the snap ring that secures the front bearing and shaft assembly inside the sliding clutch area of the PTO housing.

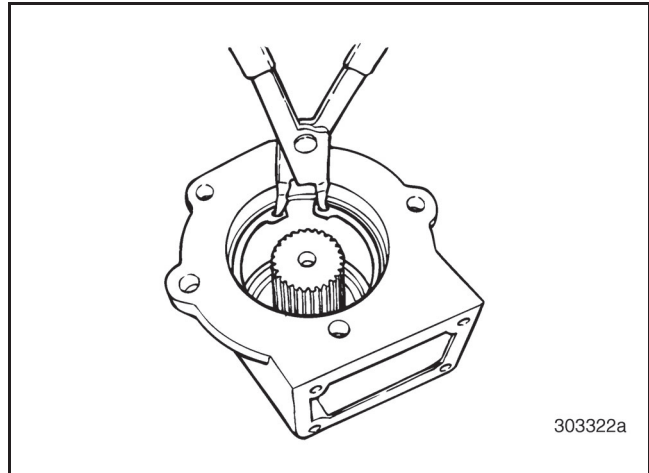


Figure 180 — Installing Front Bearing Snap Ring

6. Install the output flange, clamp plate and capscrew onto the PTO shaft. Finger-tighten the capscrew at this time.

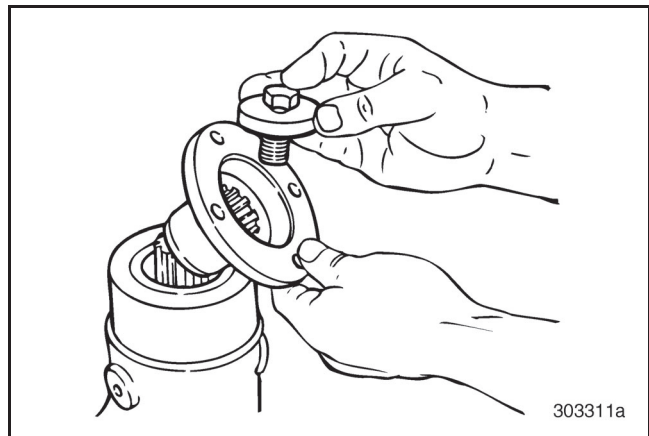


Figure 181 — Installing Output Flange

## [363] PTO Shift Cover Reassembly

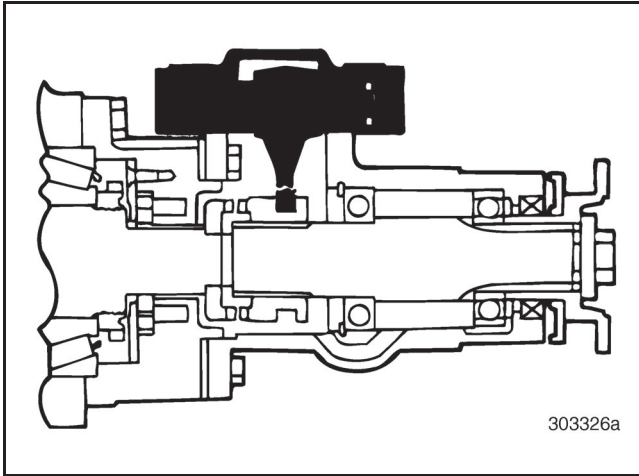
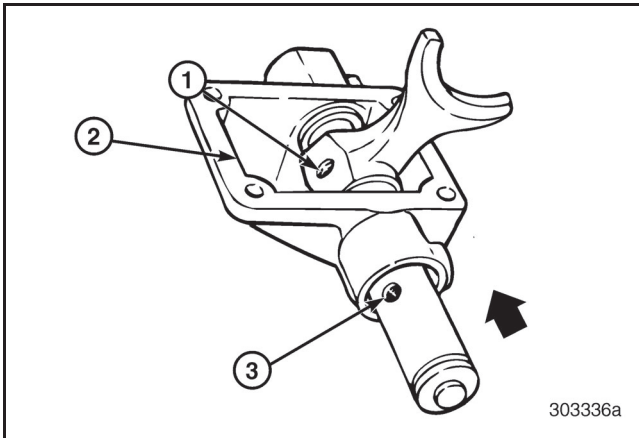


Figure 182 — PTO Shift Cover Locator

1. Partially assemble the shift fork and rail into the shift cover bore. Assemble the fork with flat side and setscrew toward the larger cavity of the shift cover. The setscrew hole in the shift rail aligns with the setscrew hole in the fork. Allow the end of the rail to remain exposed.



1. Flat Area and Setscrew Hole in Fork

2. Large Cavity Area of Cover  
3. Rail Setscrew Hole

Figure 183 — Assembling Shift Cover Components

2. Position the shift cover assembly in a soft-jawed vise. Install the fork setscrew and align it with the hole in the shift rail. Tighten to specification.

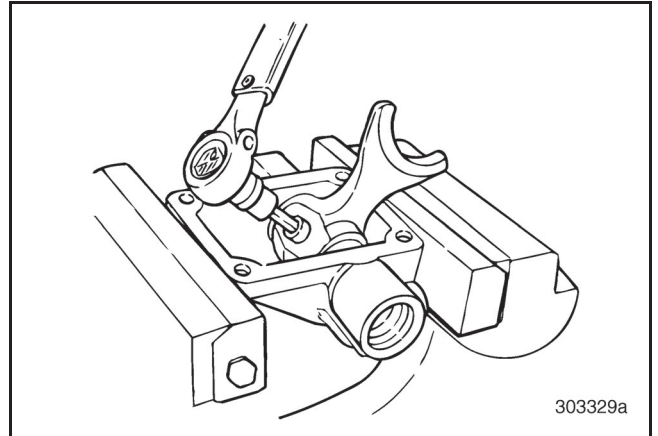


Figure 184 — Tightening Fork Setscrew

3. Install the O-ring onto the air pressure end of the shift rail.

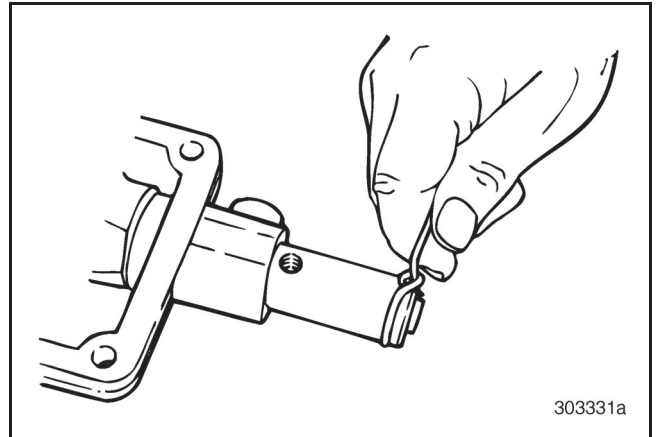


Figure 185 — Installing O-Ring onto Rail





# BENCH PROCEDURES

4. Install the O-ring onto the air pressure end of the shift cover.
5. Install the end cap and snap ring onto the air pressure side of the shift cover.

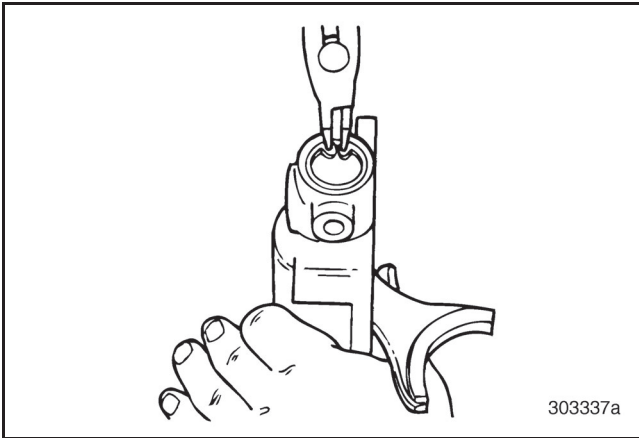


Figure 186 — Installing End Cap and Snap Ring

6. Install the O-ring onto the spring side of the shift cover.

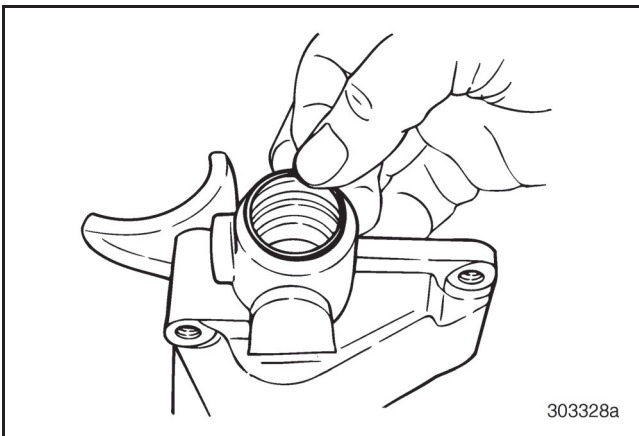


Figure 187 — Installing Shift Cover O-Ring

7. Secure the shift cover in a soft-jawed vise with the forward end of the cover facing up. Position the spring, end plug and end plug snap ring for assembly. Install the spring-loaded front end plug onto the shift cover bore, using suitable snap ring pliers and thumb pressure.

## **⚠ WARNING**

The forward end plug is spring-loaded and may cause injury if not installed carefully.

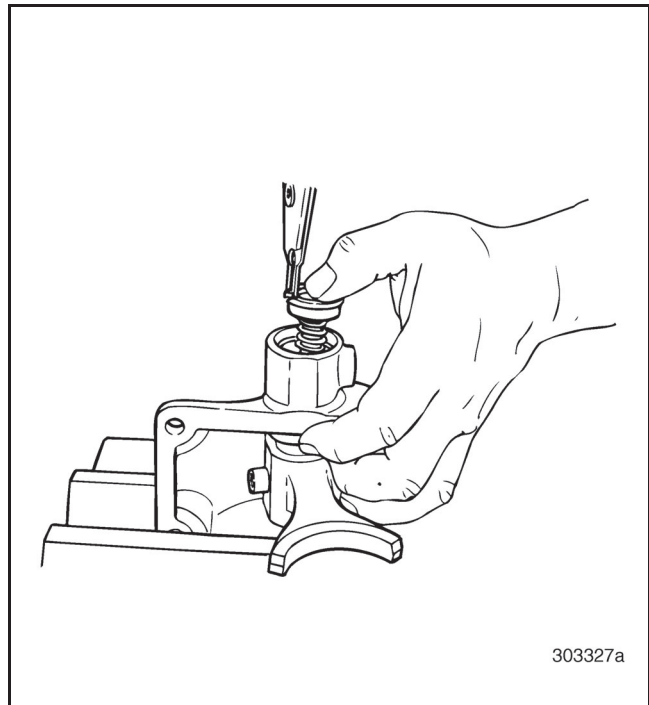


Figure 188 — Installing Shift Cover End Plug



# REASSEMBLY

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# REASSEMBLY



# REASSEMBLY

## [350] TRANSFER CASE REASSEMBLY PROCEDURES

1. Install **new** oil seals into the front-driving shaft seal housing, mainshaft/countershaft front bearing cover (input yoke seal) and rear-drive shaft assembly seal retainer housing, using suitable drivers and hammer.

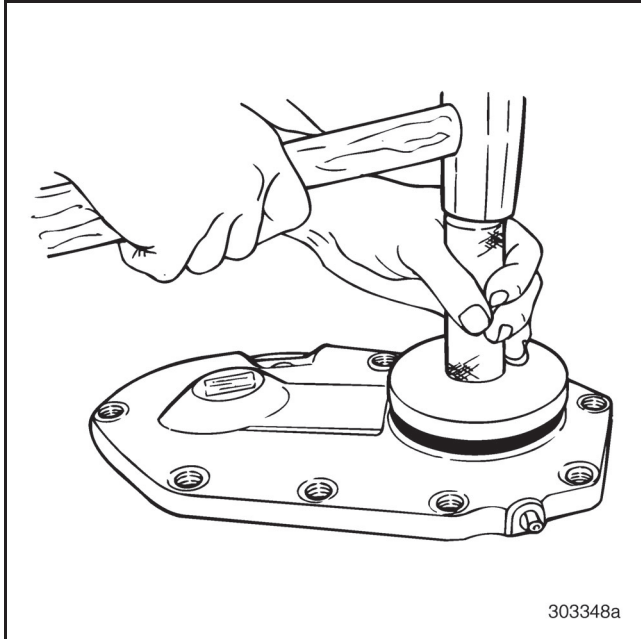
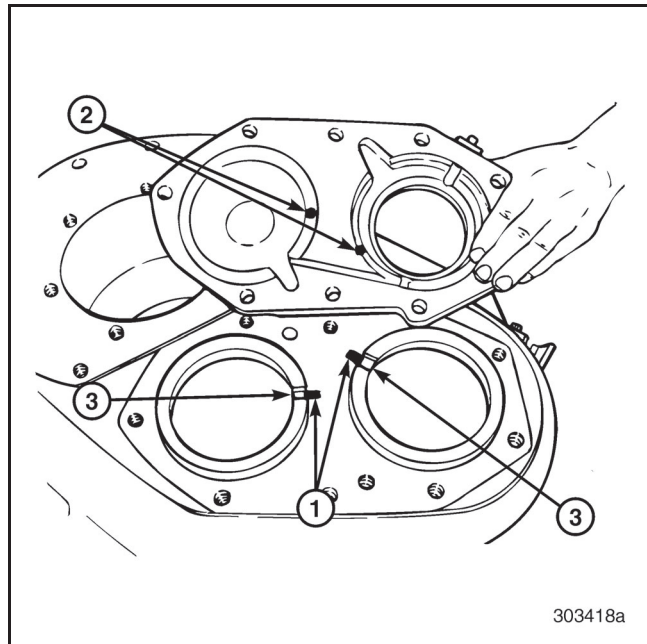


Figure 189 — Installing Oil Seal into Mainshaft/Countershaft Front Bearing Cover

2. If either of the bearing cups on the mainshaft or countershaft were removed, they should be reinstalled 1/4 inch (6.350 mm) above the surface of the main case to allow the bearing cup to be positioned by the cover when installed.
3. Both the countershaft and the mainshaft use a pinned front bearing cup arrangement. Therefore, the pins on the front bearing cover must match the notches on the bearing cups. If either front bearing cup on the mainshaft or the countershaft were removed, make sure that the replacement bearing cup notches align with the marks made at disassembly.



1. Bearing Cup Notch Markings on Main Case  
2. Front Bearing Cover Bearing Cup Pins

3. Mainshaft and Countershaft Bearing Cup Notches

Figure 190 — Marking Main Case at Bearing Cup Notches

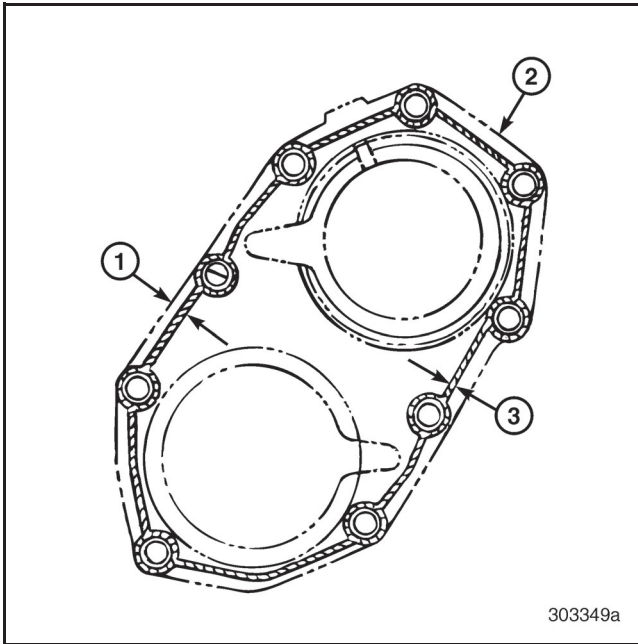


# REASSEMBLY

4. Install the mainshaft/countershaft front bearing cover and capscrews and tighten the capscrews to specification.

## NOTE

Before installing the mainshaft/countershaft front bearing cover, remove all old gasket material from the case and cover. Use a silicone-based sealer, such as MACK part No. 342SX32, as a formed-in-place gasket. This improves sealing and eliminates the need for the original gasket. When applying the sealant, use only a 0.060-inch (1.5-mm) diameter bead, to prevent excessive squeeze-out of the material and possible internal component damage. Do not allow sealer to enter oil grooves or passages.

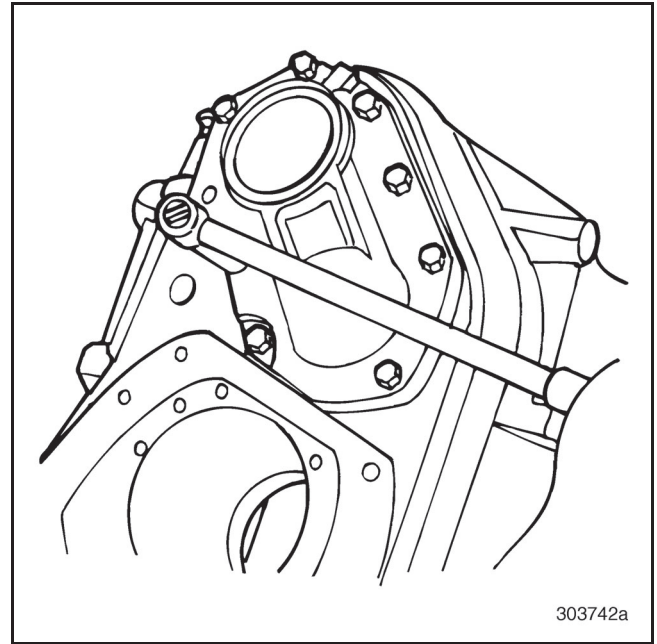


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1. 0.038 inch (0.96 mm)  
Typical Distance from  
Edge of Cover

2. Mainshaft/Countershaft  
Front Bearing Cover  
3. 0.060-inch (1.5-mm)  
Diameter Bead

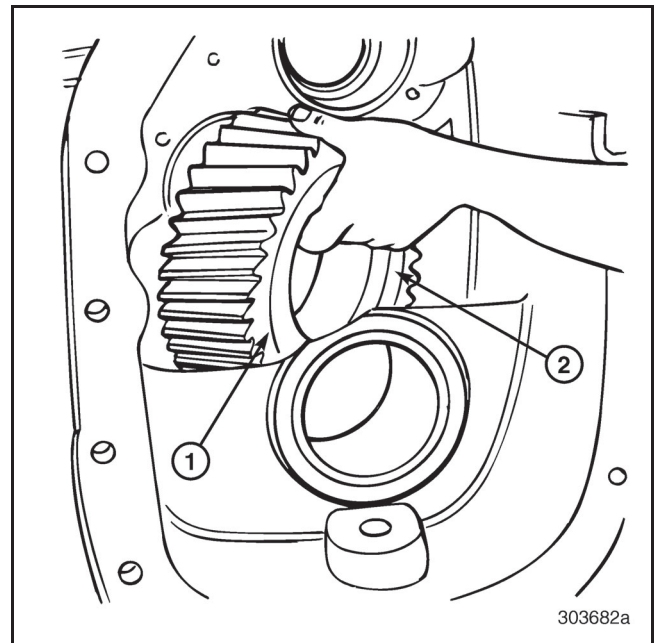
Figure 191 — Apply Formed-in-Place Gasket Material



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Figure 192 — Installing Mainshaft/Countershaft Front Bearing Cover

5. Install the main-drive shaft helical gear into the main case. The protruding hub of the gear faces the rear of the transfer case.



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1. Main-Drive Shaft Gear

2. Protruding Hub Side

Figure 193 — Installing Main-Drive Shaft Gear

6. Install the larger diameter spacer next to the rear bearing cone on the main-drive shaft, if not already done.



# REASSEMBLY

7. Install the main-drive shaft into the case through the splines of the helical gear until the bearing cone on the shaft seats in the bearing cup in the case.

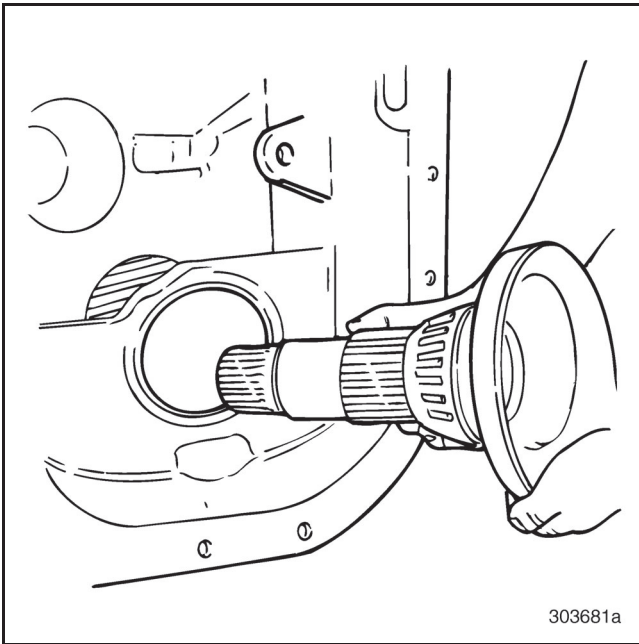


Figure 194 — Installing Main-Drive Shaft into Case

8. Working at the front of the main case, install the selective spacer, front bearing housing and front bearing cone onto the main-drive shaft.

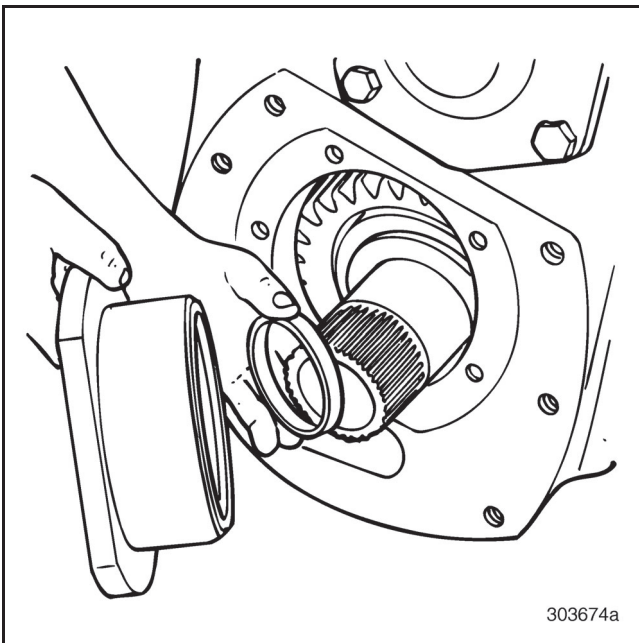


Figure 195 — Installing Spacer, Bearing Housing and Bearing Cone

9. Install the front bearing housing capscrews and tighten to specification.

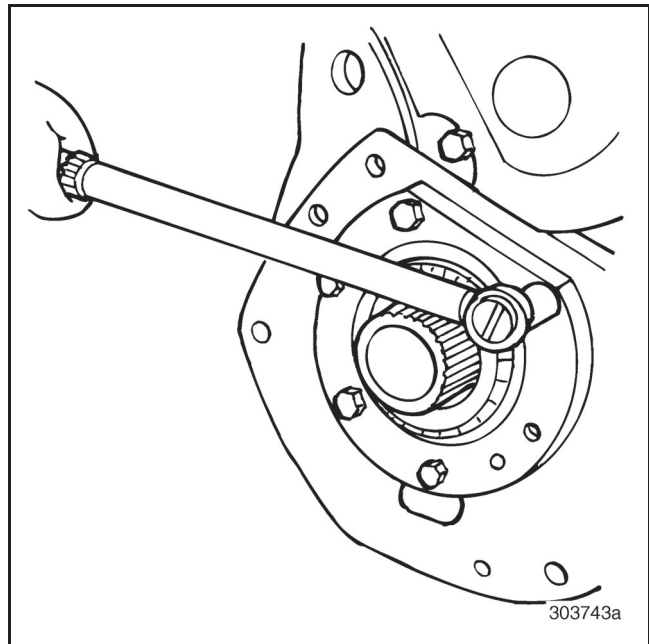


Figure 196 — Installing Front Bearing Housing Capscrews

10. Clean the threads on the front of the main-drive shaft. Apply 8 to 10 drops of Loctite 242 "Lock n' Seal" (MACK part No. 5166-2400) to the threads of the shaft and **new** locknut.



# REASSEMBLY

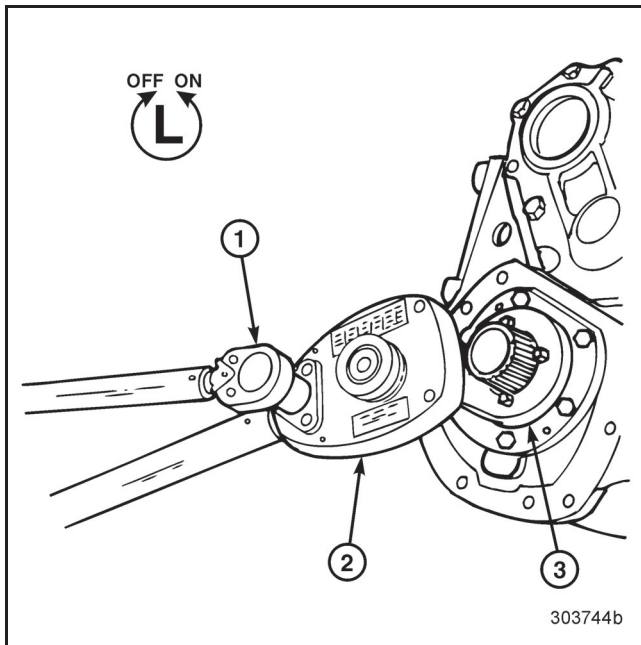
11. Install the locknut and tighten to specification, using tool J 24560, torque wrench J 23775-01 and torque multiplier OEM 6107 or equivalent tool set up.

### SERVICE HINT

To prevent the shaft from rotating when tightening the locknut, place a soft iron wedge between the teeth of the main-drive shaft gear and the case.

### SERVICE HINT

The main-drive shaft locknut is left-hand threaded. Tighten the locknut in a counter-clockwise direction.



- |                                |                                  |
|--------------------------------|----------------------------------|
| 1. Torque Wrench<br>J 23775-01 | 2. Torque Multiplier<br>OEM 6107 |
|                                | 3. Tool J 24560                  |

Figure 197 — Installing Main-Drive Shaft Locknut

## Checking Main-Drive Shaft Bearing End Play

12. Place the main-drive shaft (and case) in a vertical position, rear end up. Check bearing end play, using magnetic base dial indicator set J 7872 or equivalent.
13. Lift the main-drive shaft, while watching the dial indicator. The bearing end play reading should be 0.001–0.005 inch (0.025–0.127 mm).

### NOTE

If the end play measurement is out of specification, a thinner selective spacer decreases end play and a thicker selective spacer increases end play.

Selective spacers are available in 0.001-inch (0.025-mm) increments from thicknesses of 0.323–0.409 inch (8.204–10.388 mm).

### SERVICE HINT

Use a pry bar to move the shaft up and down while measuring end play on the dial indicator.

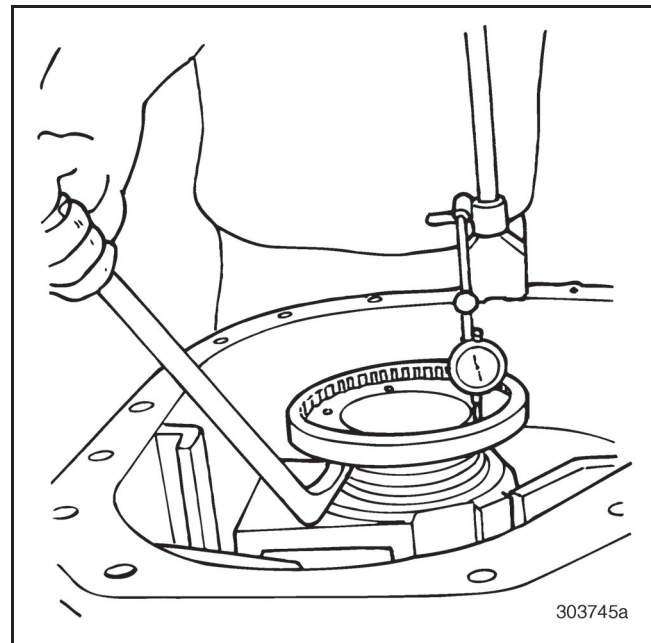


Figure 198 — Measuring Main-Drive Shaft Bearing End Play



# REASSEMBLY

14. Install an eyebolt into the threaded hole (left-hand threaded), at the rear end of the countershaft. Use a hoist to lower the countershaft into position in the case.

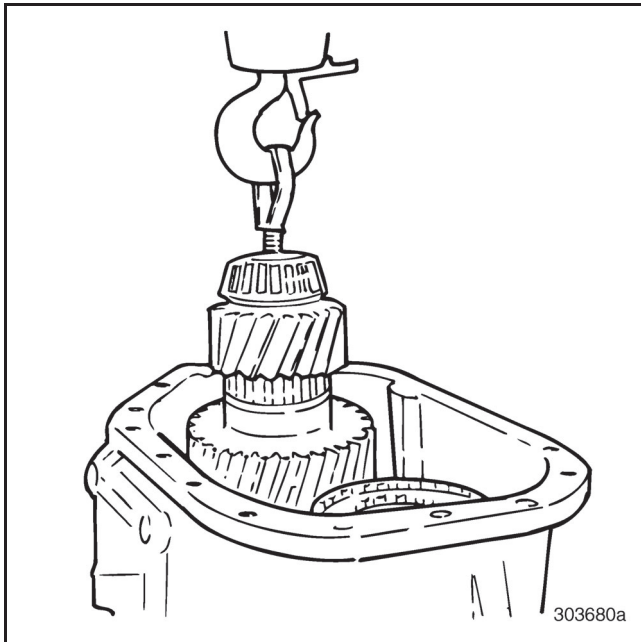


Figure 199 — Installing Countershaft

15. Install the shim(s), clamp plate and capscrew onto the rear of the countershaft. Tighten the capscrew to specification.

## NOTE

Refer to the instructions on installing clamp plates, shim(s) and capscrews in the INSPECTION OF PARTS section.

## SERVICE HINT

The countershaft clamp plate capscrew is left-hand threaded. Tighten the capscrew in a counterclockwise direction.

## SERVICE HINT

To prevent the shaft from rotating when tightening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

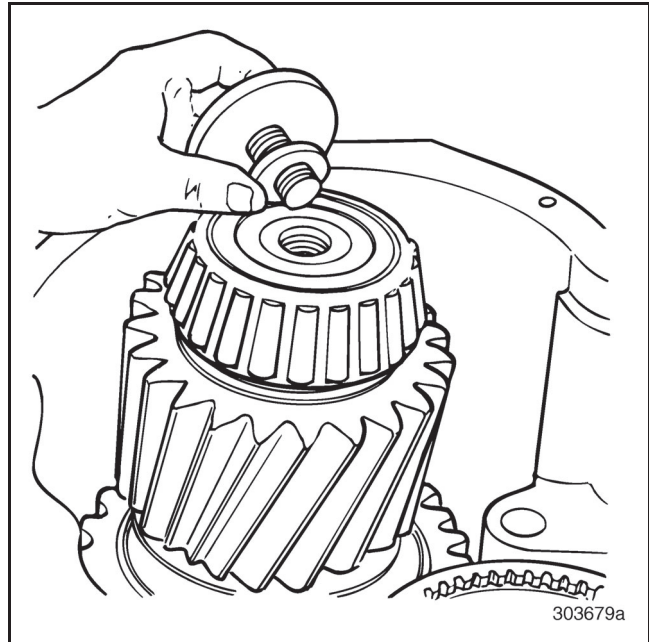


Figure 200 — Installing Clamp Plate, Capscrew and Shim(s)

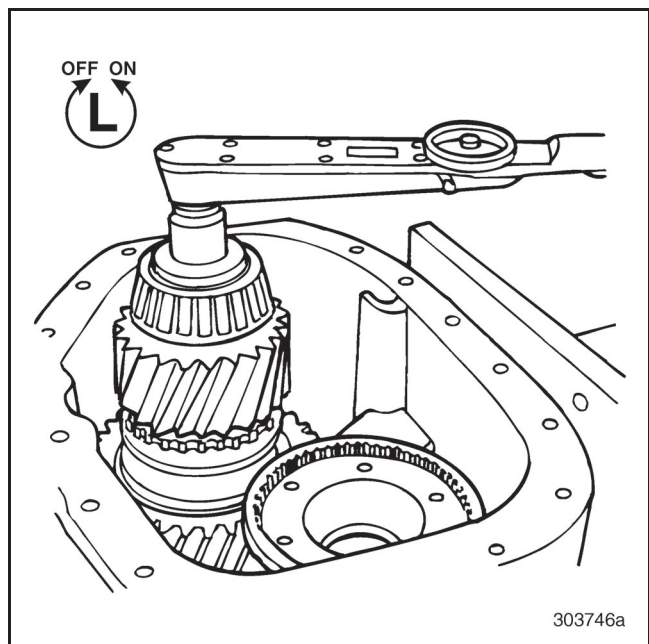


Figure 201 — Tightening Clamp Plate Capscrew



# REASSEMBLY

16. Install the shift rail into the case, and then install the Hi-/Lo-range shift fork.

## NOTE

The Hi-/Lo-range shift fork is uniform in shape and not offset and so can be installed in either direction.

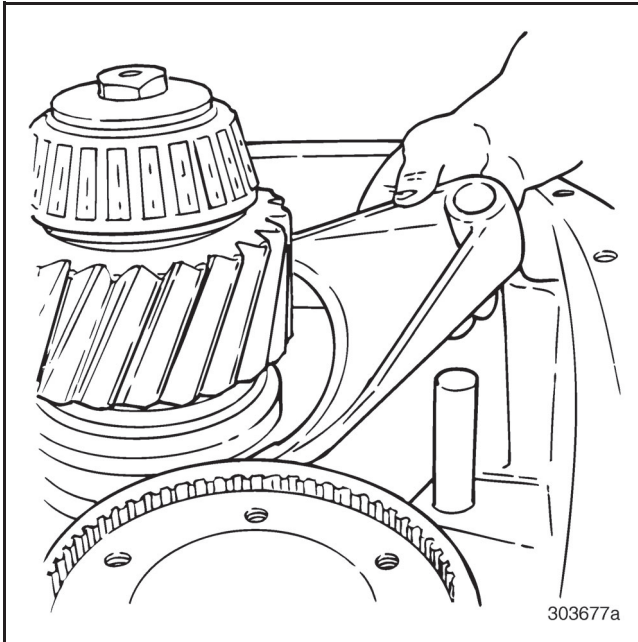


Figure 202 — Installing Hi-/Lo-Range Shift Fork

17. Align the shift fork setscrews with the notches in the shift rail. Then, using a torque wrench and crowfoot adapter, tighten the setscrews to specification.

## SERVICE HINT

To provide clearance when tightening the shift fork setscrews, install the lower setscrew first and tighten to specification. Then install the upper setscrew and tighten to specification.

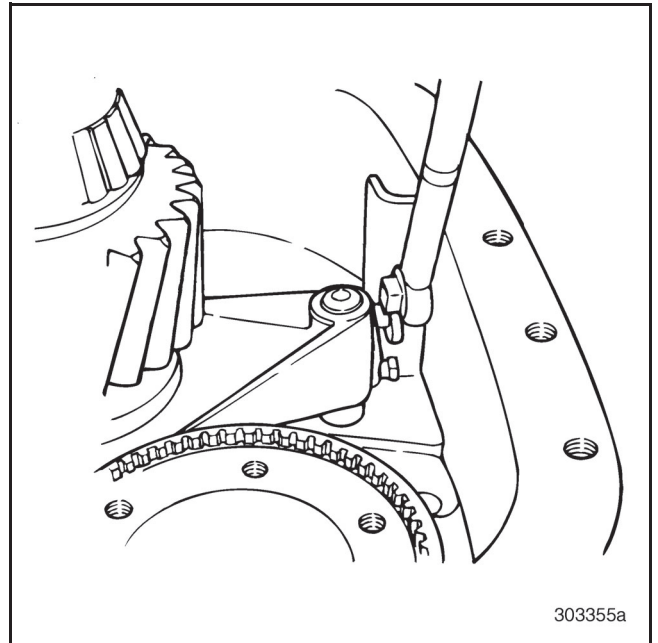


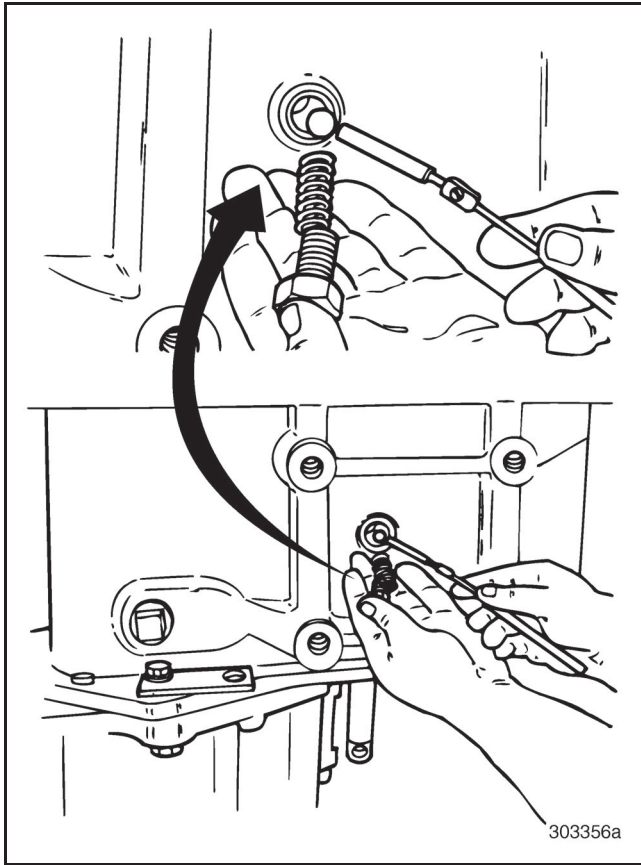
Figure 203 — Tightening Shift Fork Setscrews





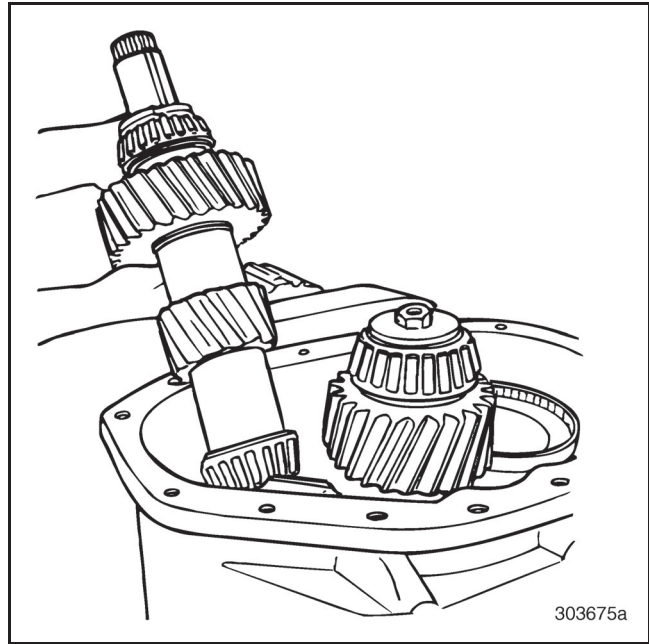
# REASSEMBLY

18. Install the shift rail poppet ball, poppet ball spring and capscrew. Then tighten the capscrew to specification.



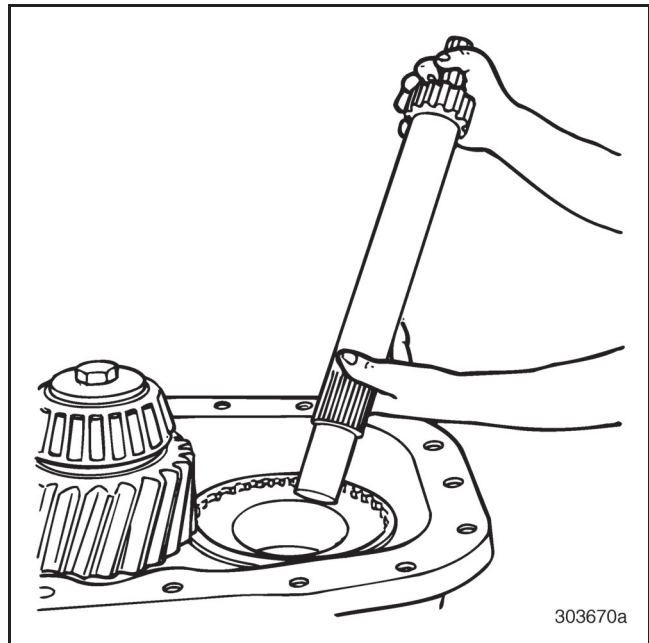
**Figure 204 — Installing Shift Fork Poppet Ball, Poppet Ball Spring and Capscrew**

19. Install the mainshaft into the case until seated in the front bearing cup and gear teeth are properly meshed.



**Figure 205 — Installing Mainshaft**

20. Install the front-drive shaft by sliding into the main-drive shaft.

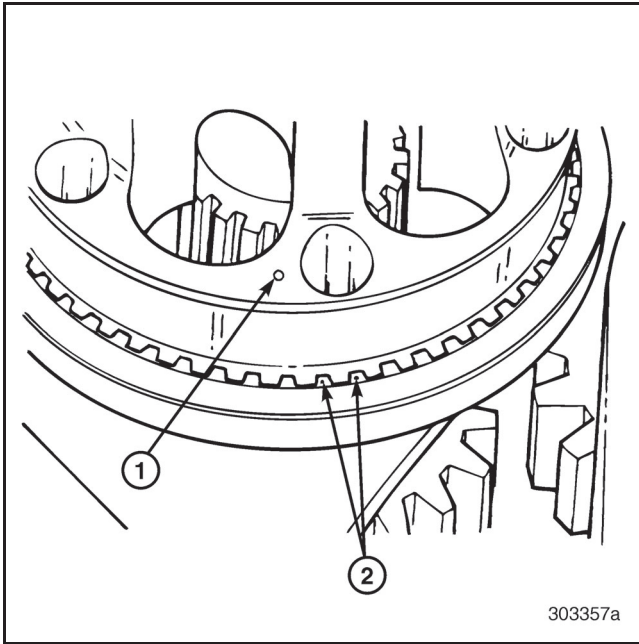


**Figure 206 — Installing Front-Drive Shaft**



# REASSEMBLY

21. Position the planet pinion gear cage onto the main-drive shaft and align the timing marks.



1. Planet Pinion Gear Cage Timing Mark	2. Main-Drive Shaft Timing Marks
--	----------------------------------

Figure 207 — Aligning Planet Pinion Gear Cage with Main-Drive Shaft

22. Install the Allen-head capscrews to secure the planet pinion gear cage, and tighten the capscrews to specification.

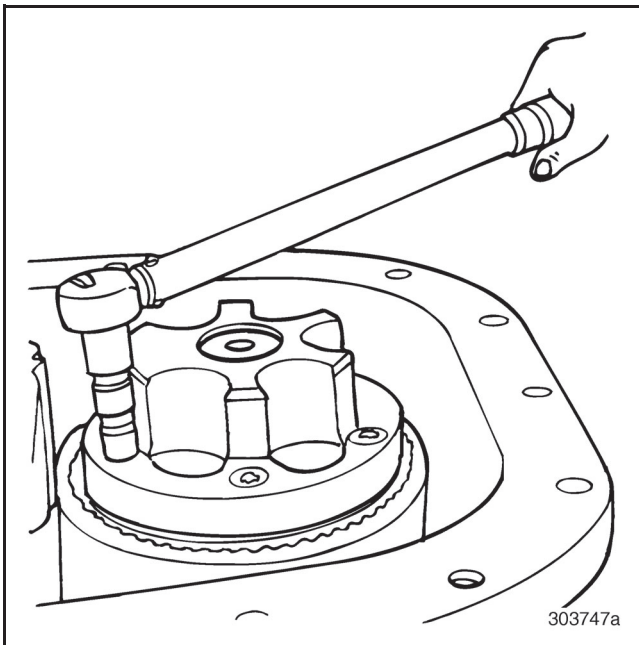


Figure 208 — Installing Planet Pinion Gear Cage Capscrews

23. Install the planet pinion gears into the planet pinion gear cage.

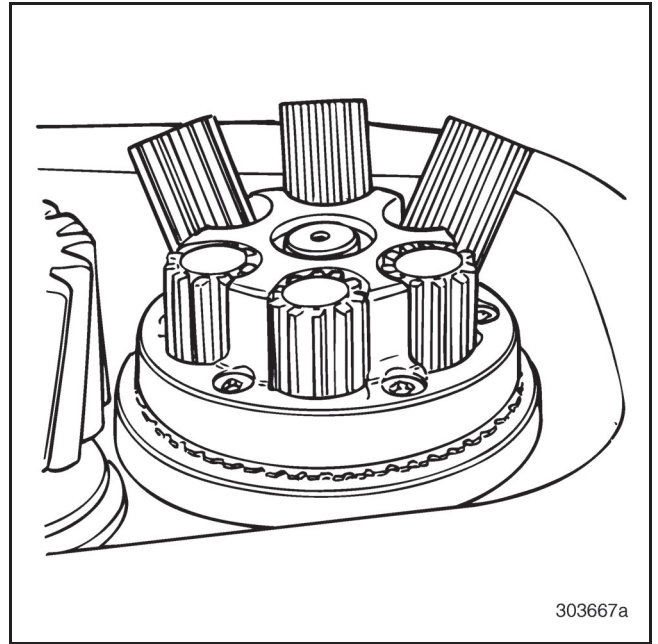


Figure 209 — Installing Planet Pinion Gears

24. Install a **new** gasket. Then install the rear end plate onto the main case, using a chain and hoist.

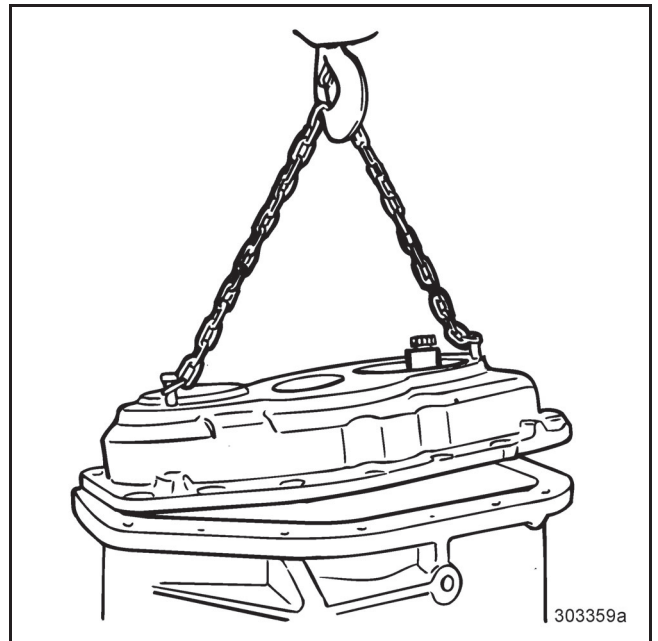
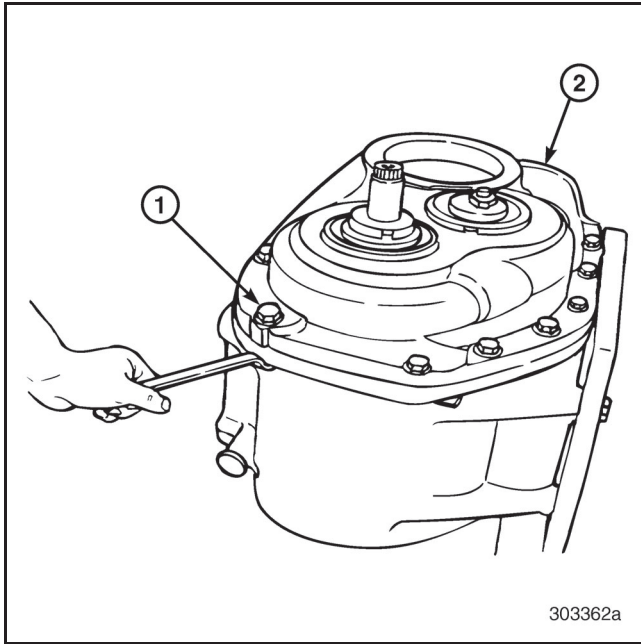


Figure 210 — Installing Rear End Plate



# REASSEMBLY

25. Install the dowel bolts and capscrews that retain the rear end plate to the main case.



1. Upper Dowel Bolt Location	2. Lower Dowel Bolt Location
------------------------------	------------------------------

Figure 211 — Rear End Plate Dowel Bolts

26. Tighten the rear end plate-to-main case fasteners to specification.

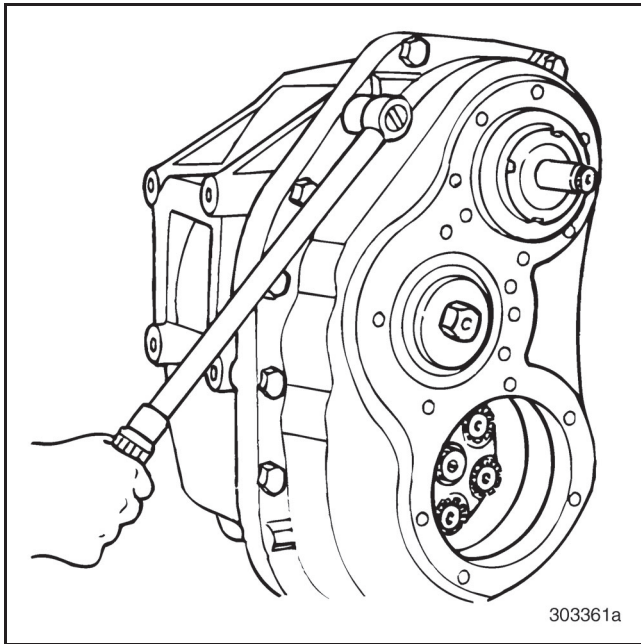


Figure 212 — Tightening Rear End Plate Dowel Bolts and Capscrews

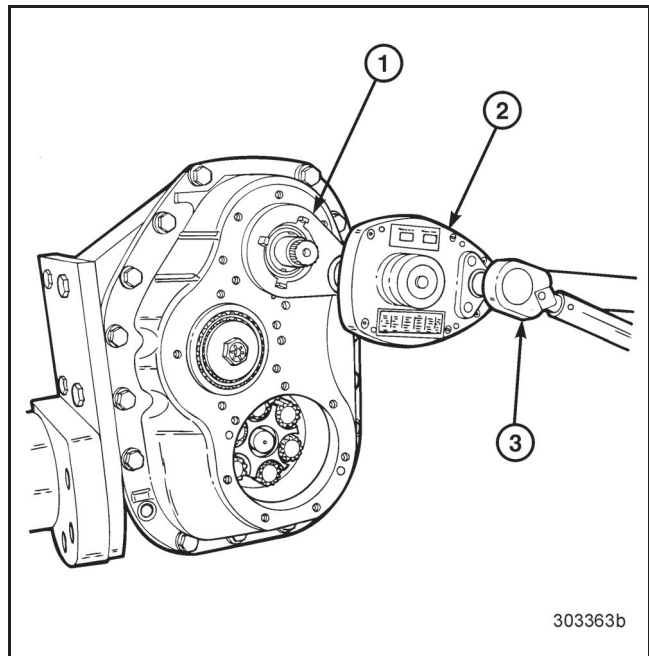
27. Clean the threads on the rear of the mainshaft. Apply 8 to 10 drops of Loctite 242 "Lock n' Seal" (MACK part No. 5166-2400) to the threads of the shaft and **new** locknut. Install the lock nut and tighten to specification, using tool J 24560, torque wrench J 23775-01 and torque multiplier OEM 6107 or equivalent tool set up.

## SERVICE HINT

The mainshaft locknut is right-hand threaded. Tighten the locknut in a clockwise direction.

## SERVICE HINT

To prevent the shaft from rotating when tightening the locknut, place a soft iron wedge between the teeth of two adjoining gears.



1. Tool J 24560	3. Torque Wrench J 23775-01
2. Torque Multiplier OEM 6107	

Figure 213 — Tightening the Main-Drive Shaft Rear Bearing Locknut

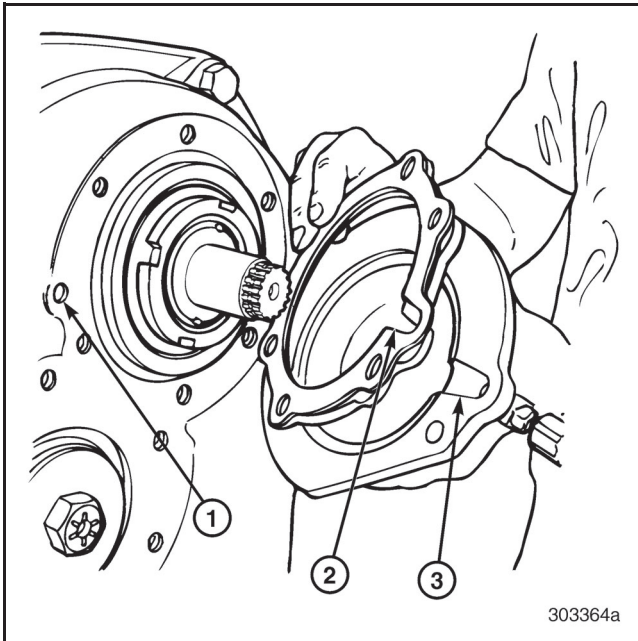


# REASSEMBLY

28. Install the mainshaft rear bearing cover and shims. Make sure that the oil hole in the cover and shims align with the oil hole in the case.

## NOTE

If the unit is equipped with the optional PTO and oil pump assemblies, install them now. Refer to PTO and Oil Pump Reassembly and Installation at the end of this section.



1. Transfer Case Housing  
Oil Passage

2. Mainshaft Shim Oil  
Hole Location

3. Mainshaft Rear  
Bearing Cover Oil Hole  
Location

Figure 214 — Installing Mainshaft Rear Bearing Cover and Shims

29. Install the mainshaft rear bearing cover capscrews and tighten them to specification.

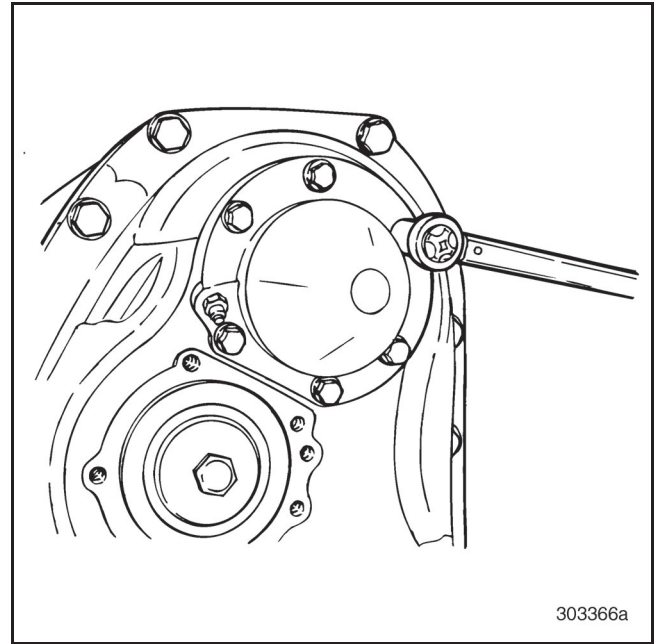


Figure 215 — Installing Rear Bearing Cover Capscrews

30. Install the mainshaft input yoke (flange) onto the front of the mainshaft.

## CAUTION

*Do not install the mainshaft input yoke using a hammer to drive the yoke on. Doing so may cause premature bearing failure.*

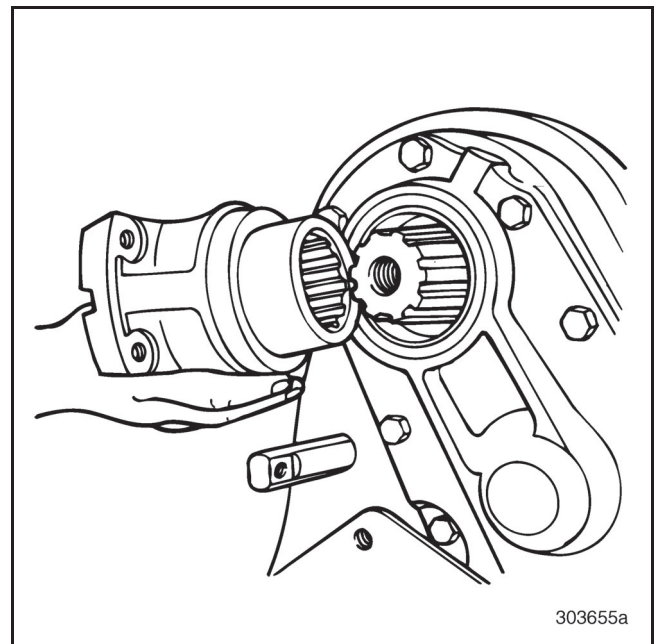


Figure 216 — Installing Mainshaft Input Yoke



# REASSEMBLY

31. Install the mainshaft input yoke (flange) clamp plate and capscrew. Tighten the capscrew to specification.

## SERVICE HINT

To prevent the shaft from rotating when tightening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

## SERVICE HINT

The mainshaft input yoke clamp plate capscrew is left-hand threaded. Tighten the capscrew in a counterclockwise direction.

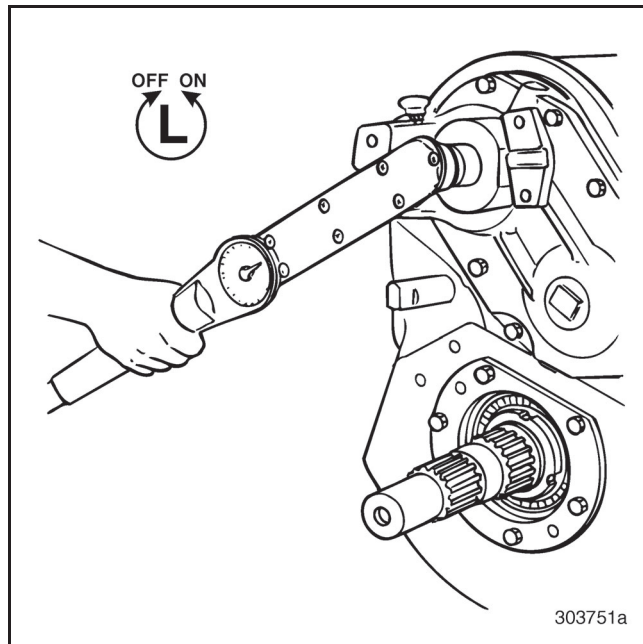
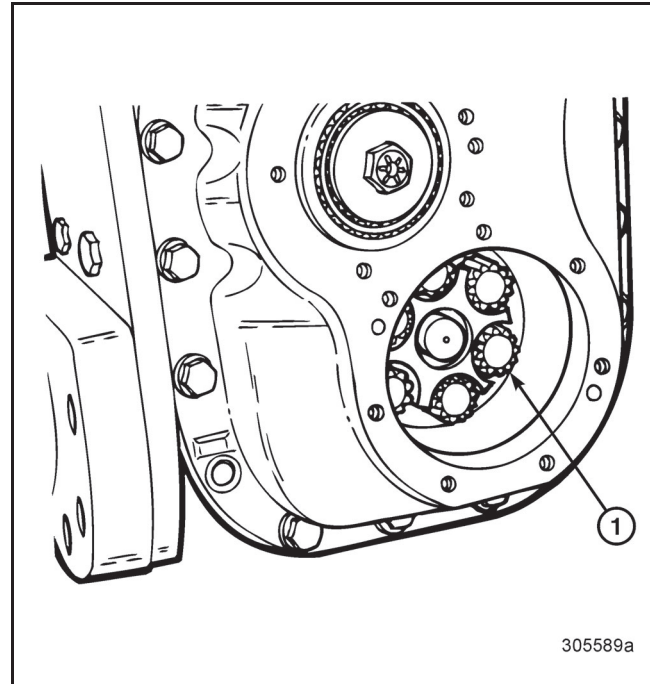


Figure 217 — Installing Input Yoke Clamp Plate and Capscrew

32. Temporarily remove the six planet gears from the planet gear cage. This will prevent the planet gears from accidentally falling out during the mainshaft bearing end play check.



1. Planet Pinion Gear

Figure 218 — Temporarily Removing Planet Gears



# REASSEMBLY

## Checking Mainshaft Bearing End Play

33. Place the mainshaft (and case) in a vertical position, front end up. Check bearing end play, using magnetic base dial indicator set J 7872 or equivalent.
34. Lift the mainshaft, while watching the dial indicator. The bearing end play reading should be 0.003–0.008 inch (0.076–0.203 mm). To adjust bearing end play, remove the mainshaft rear bearing cover and add or remove shims as necessary.

### NOTE

If the end play measurement is out of specification, remove shims to decrease end play or add shims to increase end play.

Selective shims are available in 0.005 (0.127 mm), 0.007 (0.178 mm), 0.020 (0.508 mm) and 0.031 (0.787 mm) inch thicknesses.

### SERVICE HINT

Use a pry bar to move the shaft up and down while measuring end play on the dial indicator.

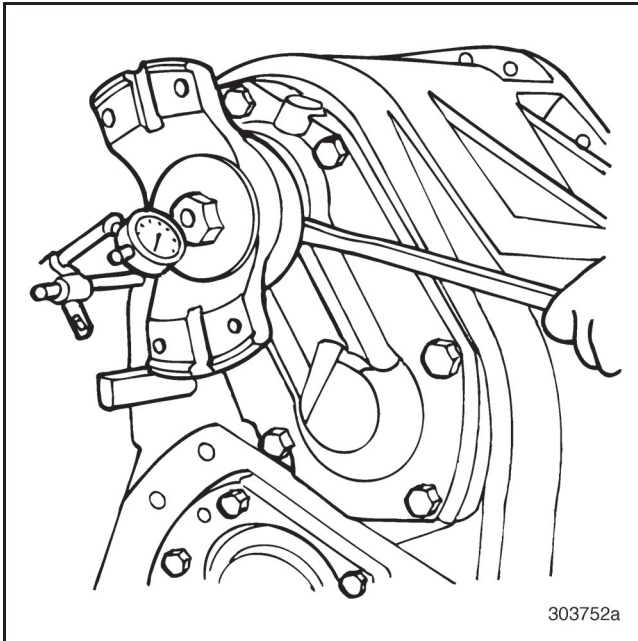
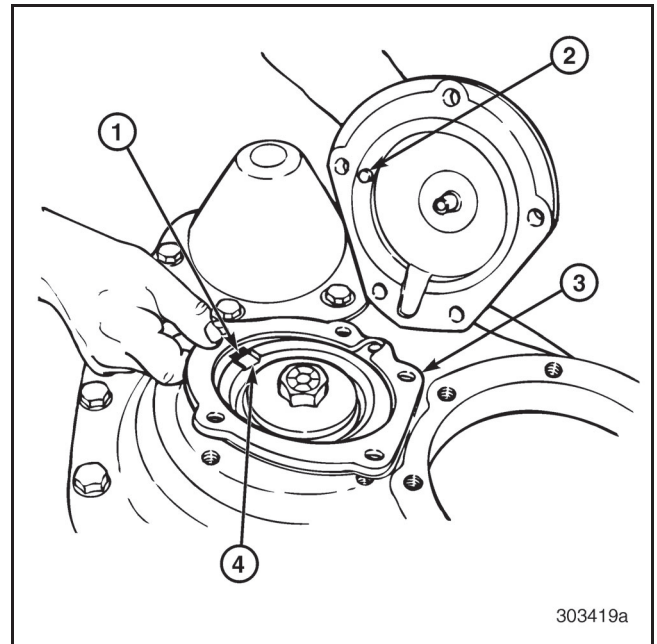


Figure 219 — Measuring Mainshaft Bearing End Play

35. Reinstall the six planet gears into the planet gear cage.
36. The countershaft uses a pinned rear bearing cup arrangement. Therefore, the pin on the rear bearing cover must match the notch on the bearing cup. If the bearing cup on the countershaft was removed, ensure that the replacement bearing cup notch aligns with the mark made at disassembly.



1. Bearing Cup Notch Markings on Rear End Plate
2. Rear Bearing Cover Bearing Cup Pin

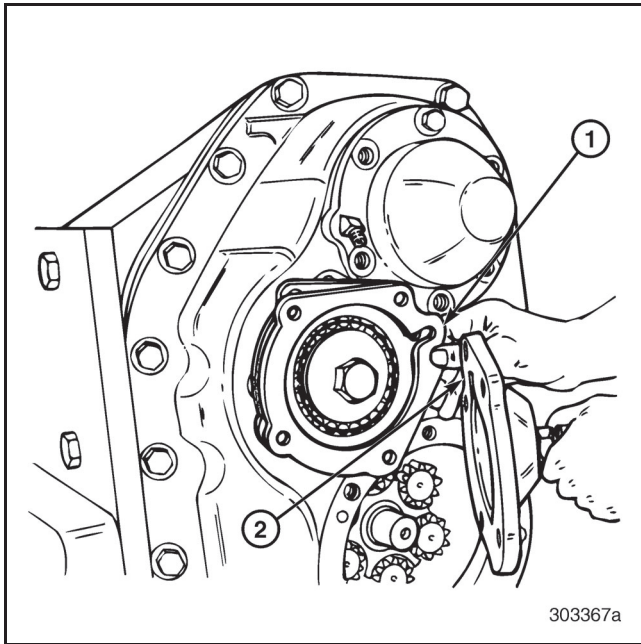
3. Countershaft Shim Pack
4. Countershaft Bearing Cup Notch

Figure 220 — Aligning Countershaft Bearing Cup Notch to Cover Pin



# REASSEMBLY

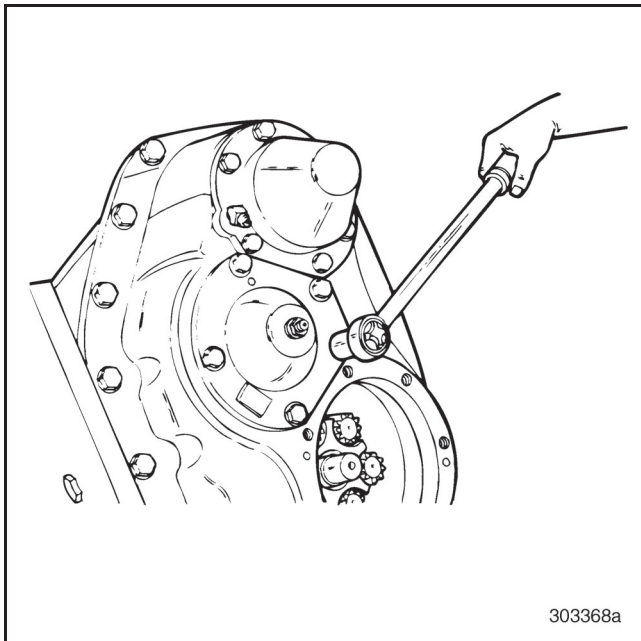
- 37. Install the countershaft rear bearing cover and shims. Make sure to align the oil hole in the cover and shims with the oil hole in the case.



1. Countershaft Shim Oil Hole Location	2. Countershaft Rear Bearing Cover Oil Hole Location
--	--

**Figure 221 — Installing Countershaft Rear Bearing Cover and Shims**

- 38. Install the countershaft rear bearing cover capscrews and tighten them to specification.



**Figure 222 — Tightening Bearing Cover Capscrews**

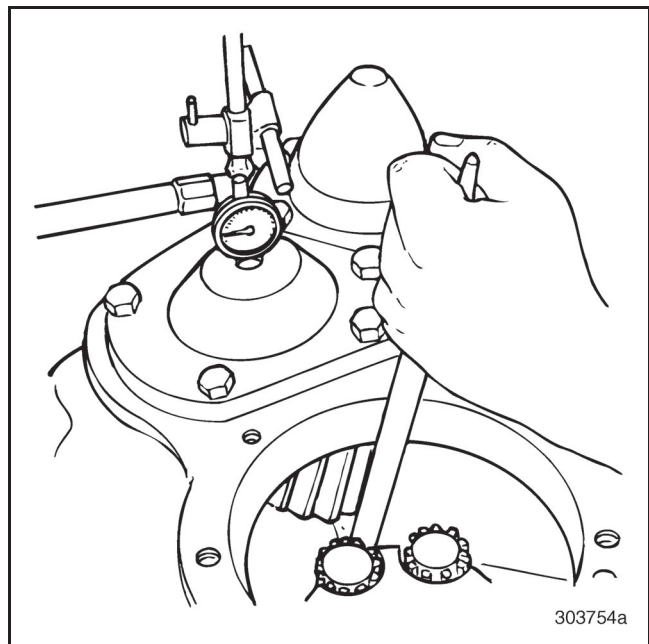
## Checking Countershaft Bearing End Play

- 39. Place the countershaft (and case) in a vertical position, rear end up. Check bearing end play, using a dial indicator.
- 40. Remove the lubrication fitting found at the center of the countershaft rear bearing cover.
- 41. Mount the dial indicator stem through the oil line hole in the countershaft rear bearing cover. Adjust the dial indicator so that the stem rests against the clamp plate capscrew at the rear end of the countershaft.
- 42. Lift the countershaft using a pry bar, while watching the dial indicator. The bearing end play reading should be 0.003–0.008 inch (0.076–0.203 mm). To adjust bearing end play, remove the countershaft rear bearing cover and add or remove shims as necessary.

### NOTE

If the end play measurement is out of specification, remove shims to decrease end play or add shims to increase end play.

Selective shims are available in 0.005 (0.127 mm), 0.007 (0.178 mm), 0.020 (0.508 mm) and 0.031 (0.787 mm) inch thicknesses.



**Figure 223 — Measuring Countershaft Bearing End Play**



# REASSEMBLY

43. Reinstall the lubrication fitting into the center of countershaft rear bearing cover. Torque to specifications.
44. Install the oil line between the countershaft rear bearing cover and the mainshaft rear bearing cover.

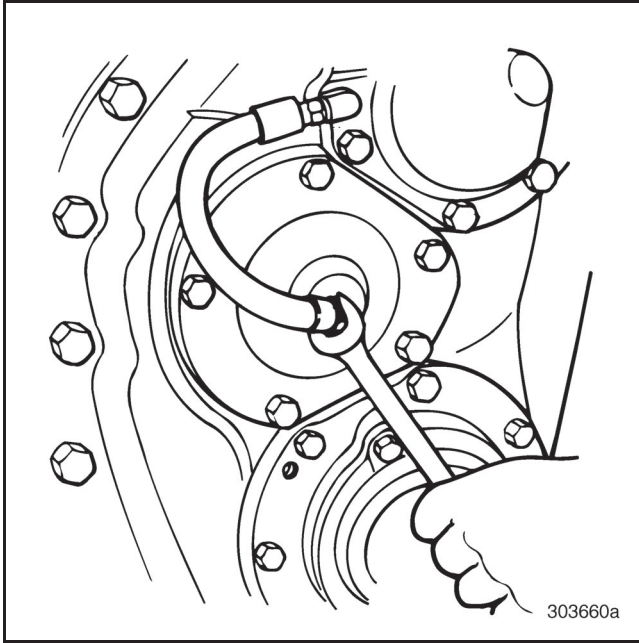


Figure 224 — Installing the Oil Line Between Covers

45. Install the rear-drive shaft assembly into the rear of the case.

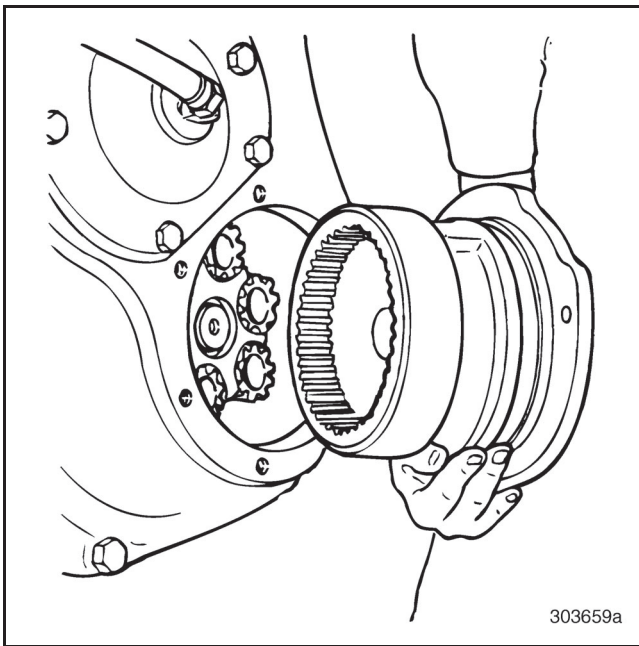


Figure 225 — Installing Rear-Drive Shaft Assembly

46. Install the rear-drive shaft assembly capscrews and tighten them to specification.

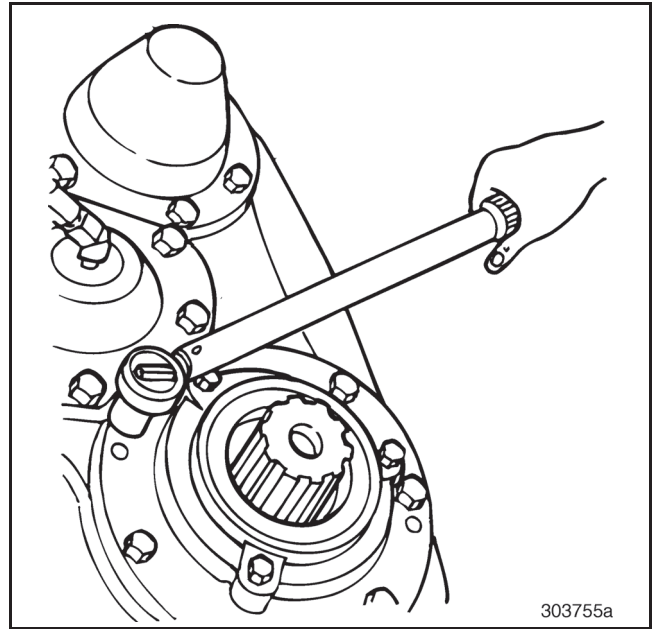


Figure 226 — Installing Rear-Drive Shaft Assembly Capscrews

47. Install the rear-drive shaft output yoke (flange) onto the rear of the rear-drive shaft.

## **CAUTION**

*Do not install the rear-drive shaft output yoke using a hammer to drive the yoke on. Doing so may cause premature bearing failure.*

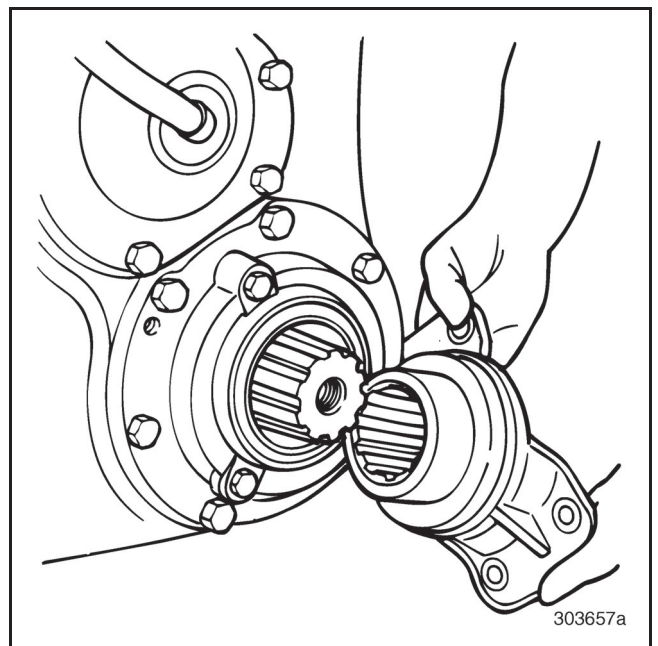


Figure 227 — Installing Output Yoke





# REASSEMBLY

48. Install the rear-drive shaft output yoke (flange) clamp plate and capscrew. Tighten the capscrew to specification.

## SERVICE HINT

To prevent the shaft from rotating when tightening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

## SERVICE HINT

The rear-drive shaft output yoke clamp plate capscrew is right-hand threaded. Tighten the capscrew in a clockwise direction.

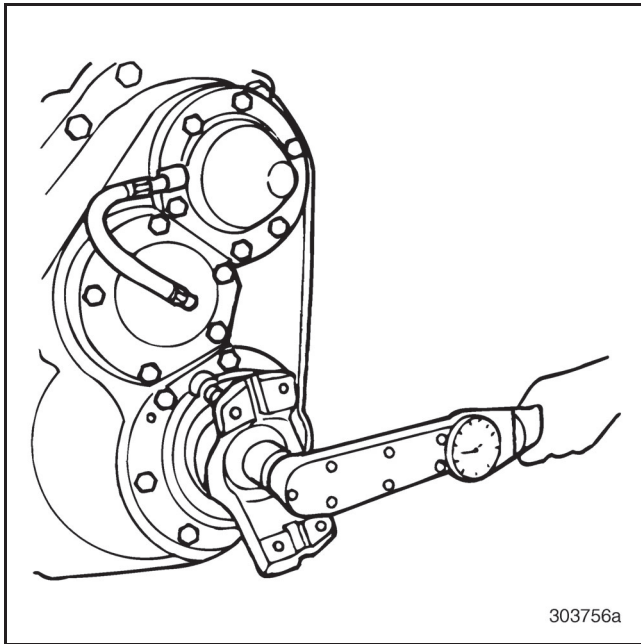


Figure 228 — Installing Output Yoke Clamp Plate and Capscrew

49. Install a **new** main case-to-front drive housing gasket on the gasket surface of the main case. Then position the housing on the main case.

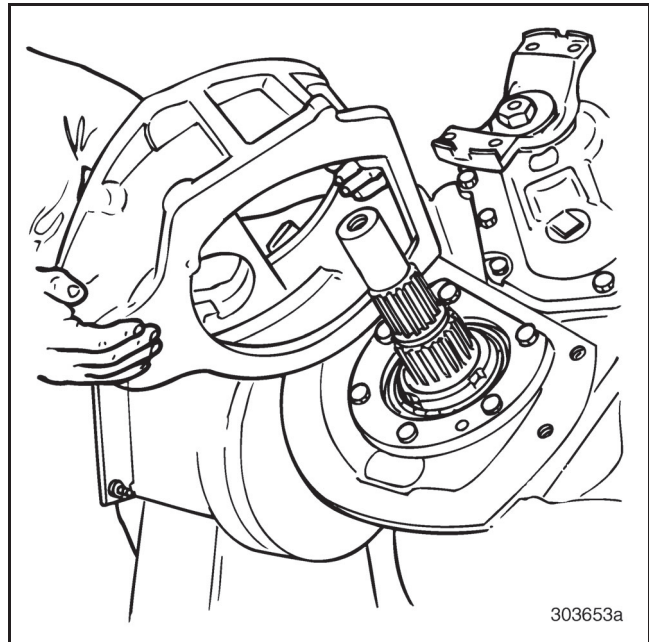


Figure 229 — Installing Front-Drive Housing

50. Install the front drive housing capscrews and dowel bolts and tighten to specification.

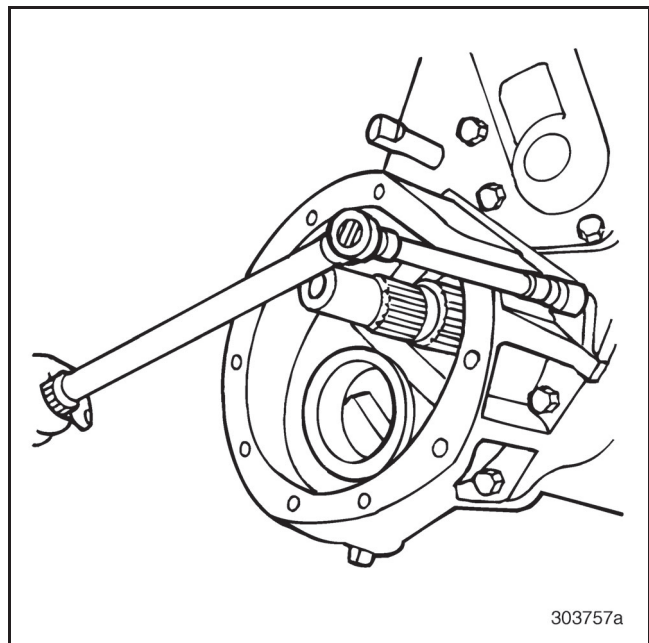


Figure 230 — Installing Front-Drive Housing Capscrews and Dowel Bolts



# REASSEMBLY

51. Install the differential lockout sliding clutch onto the splines of the main-drive shaft.

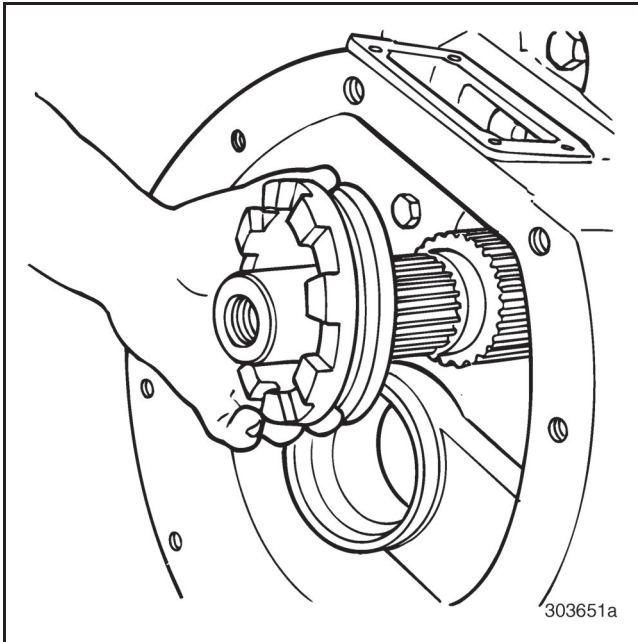


Figure 231 — Installing Sliding Clutch

52. Install the differential lockout clutch air shifter housing and shift fork assembly onto the front-drive housing. Use a **new** gasket between assembly and housing. Make sure the shift fork engages the groove in the sliding clutch.

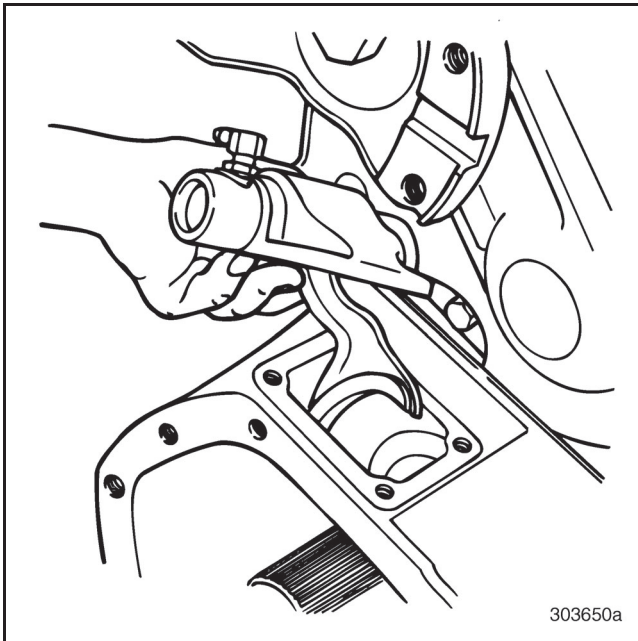


Figure 232 — Installing Differential Lockout Air Shifter Housing and Shift Fork Assembly

53. Install the differential lockout air shifter housing capscrews and tighten to specification.

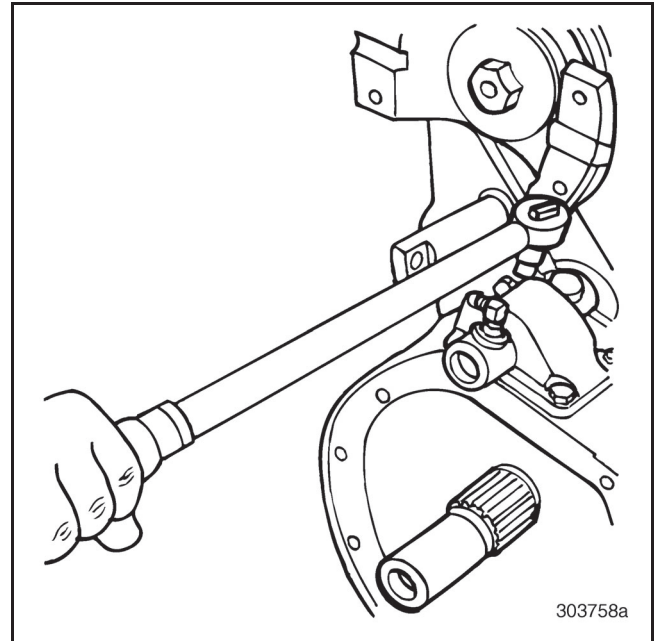


Figure 233 — Installing Differential Lockout Air Shifter Housing Capscrews

54. Install the front-drive shaft helical gear onto the front-drive shaft with clutch teeth facing rearward.

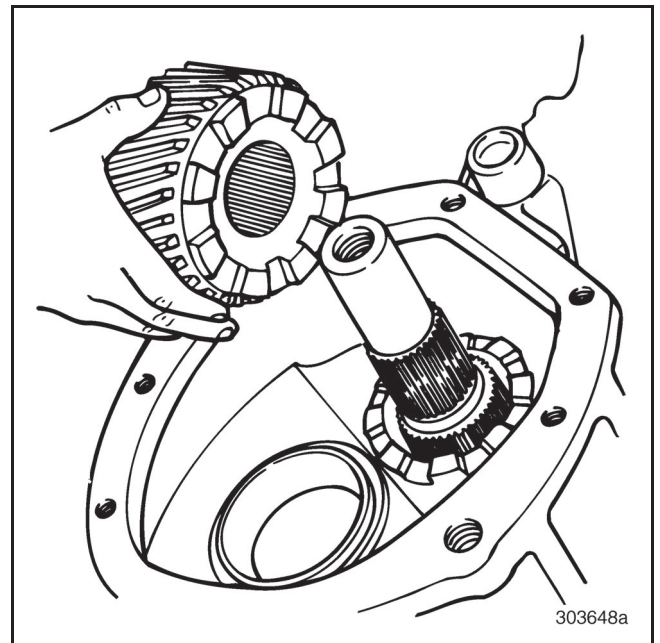


Figure 234 — Installing Helical Gear onto Front-Drive Shaft



# REASSEMBLY

55. Install the front-drive shaft rear bearing cone onto the front-drive shaft.

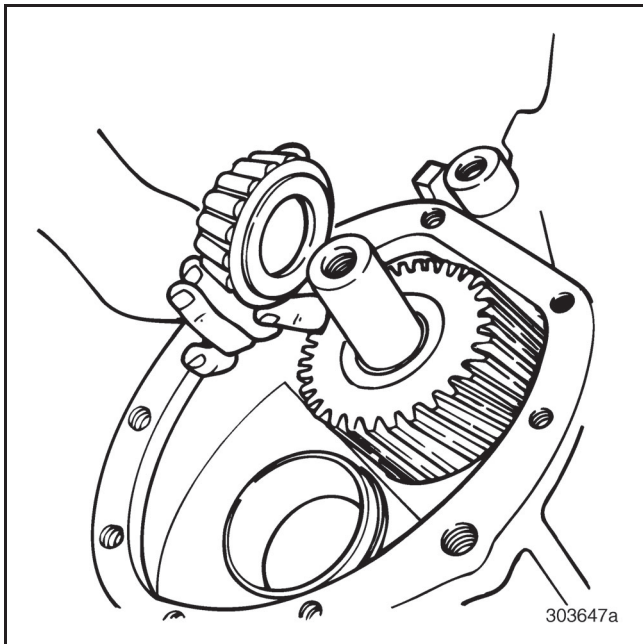


Figure 235 — Installing Rear Bearing Cone

56. Install the front-driving shaft assembly into the front-drive housing. Make sure the rear bearing cone is seated and gears are properly meshed.

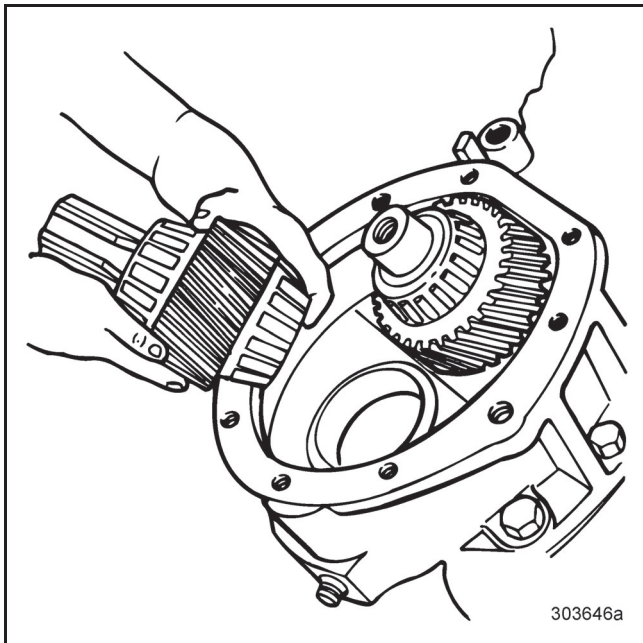


Figure 236 — Installing Front-Driving Shaft Assembly

57. Install a **new** gasket onto the front-drive housing. Then install the front-drive housing cover plate.

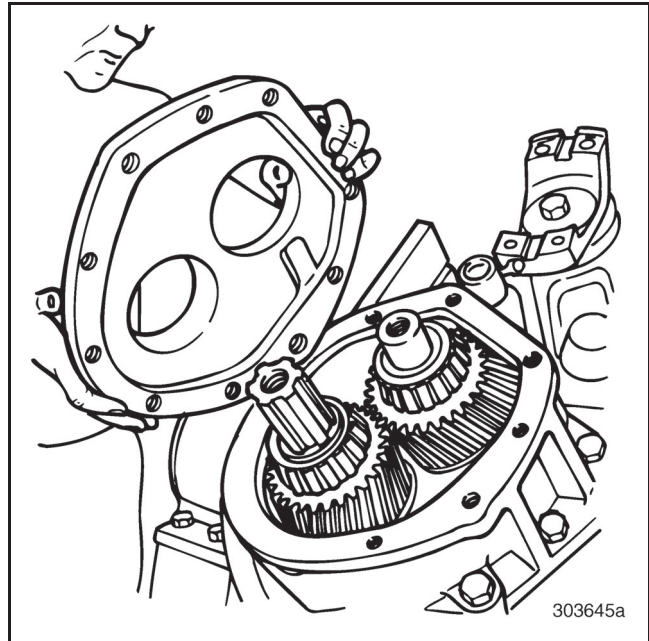


Figure 237 — Installing Cover Plate

58. Install the front-drive housing cover plate capscrews and tighten to specification.

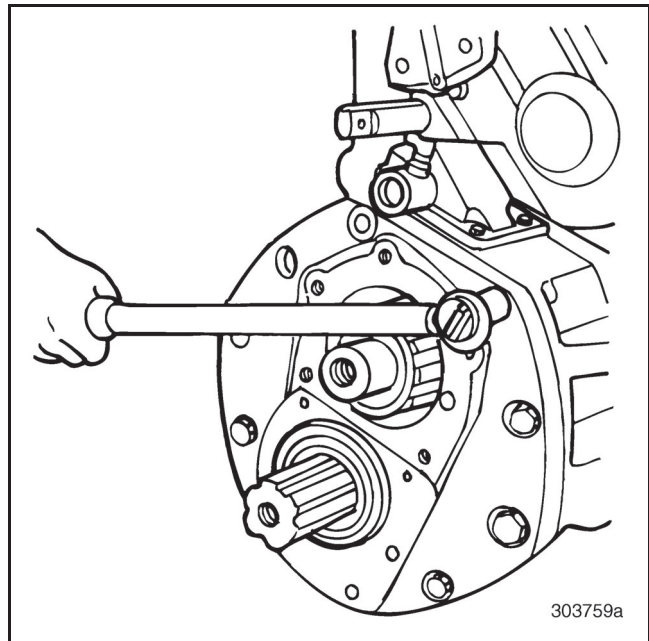


Figure 238 — Installing Cover Plate Capscrews



# REASSEMBLY

59. Install the front-driving shaft seal housing and shims.

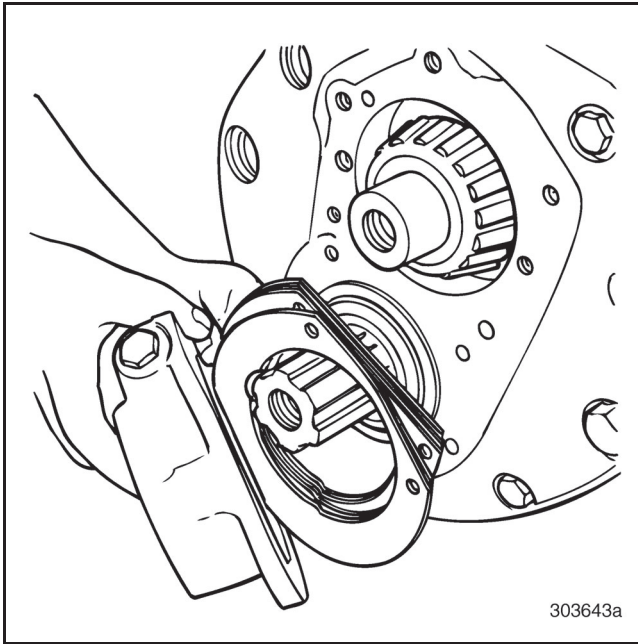


Figure 239 — Installing Seal Housing and Shims

60. Install front-driving shaft seal housing capscrews and tighten to specification.

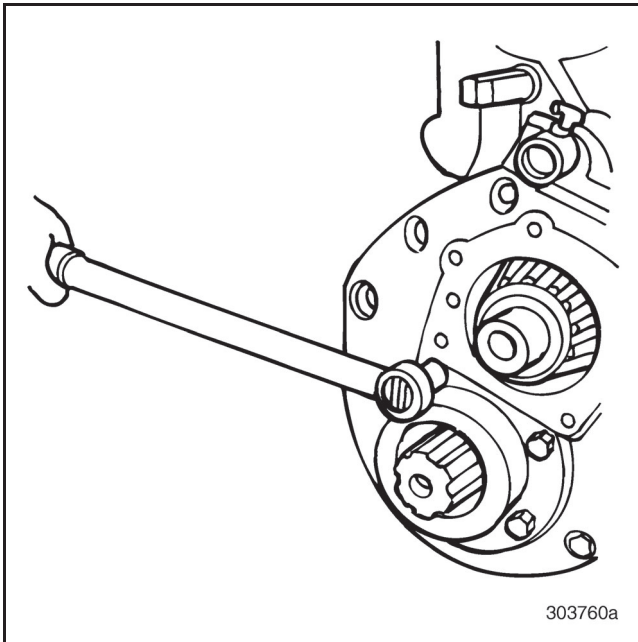


Figure 240 — Tightening Seal Housing Capscrews

61. Install the selective bearing spacer onto the front-drive shaft.

## NOTE

The selective bearing spacer thickness determines front-drive shaft bearing end play. To determine correct selective bearing spacer thickness, refer to Front-Drive Shaft Bearing Retainer Reassembly on page 68.

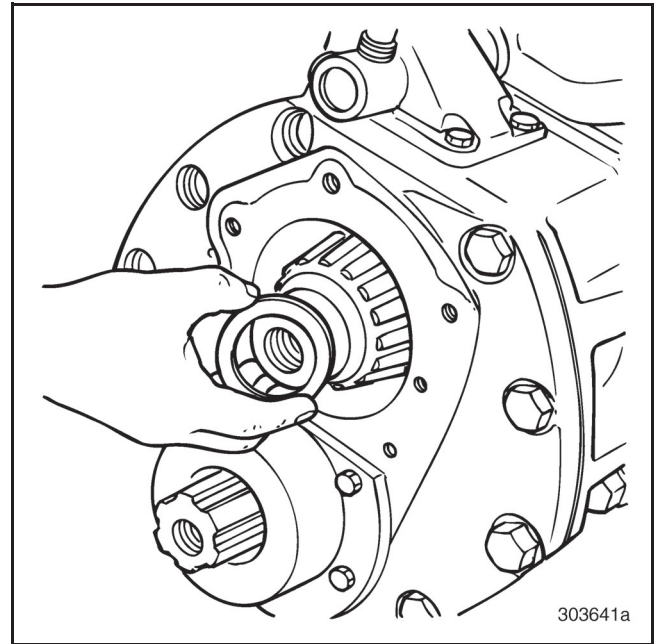


Figure 241 — Installing Selective Bearing Spacer



# REASSEMBLY

62. Install the front-drive shaft bearing retainer and front bearing cone.

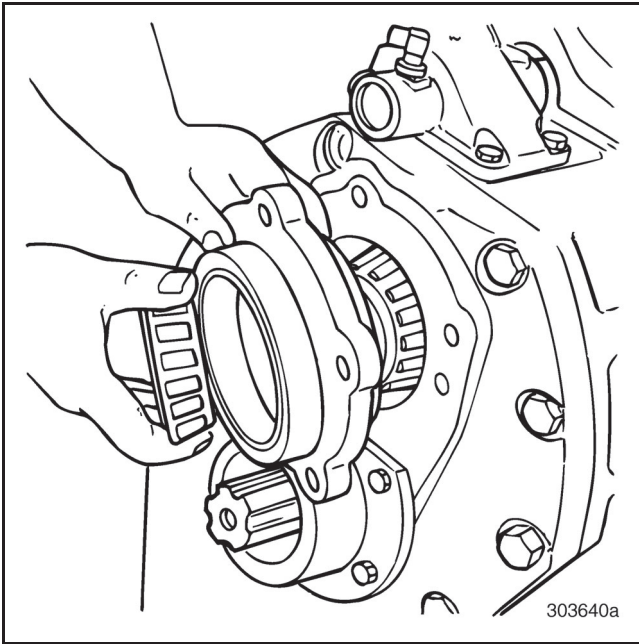


Figure 242 — Installing Bearing Retainer and Bearing Cone

63. Install the front-drive shaft shim(s), clamp plate and clamp plate capscrew onto the front of the front-drive shaft. Tighten capscrew to specification.

## NOTE

Refer to the instructions on installing clamp plates, shim(s) and capscrews in the INSPECTION OF PARTS section.

## SERVICE HINT

The front-drive shaft clamp plate capscrew is left-hand threaded. Tighten the capscrew in a counterclockwise direction.

## SERVICE HINT

To prevent the shaft from rotating when tightening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

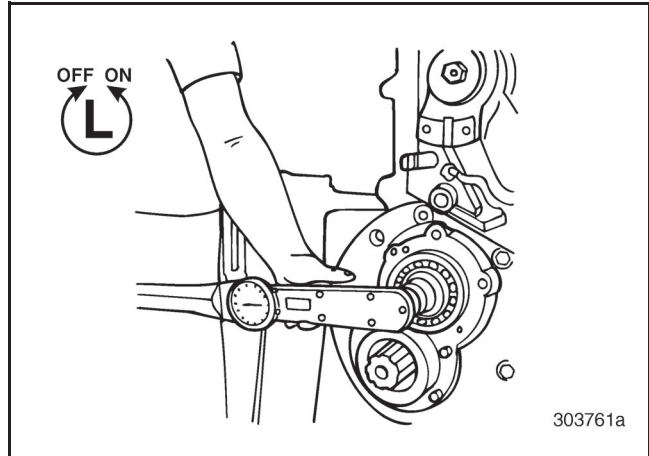


Figure 243 — Tightening Clamp Plate Capscrew

64. Position a **new** gasket over the front-drive shaft bearing retainer. Then install the front-drive shaft bearing cover.

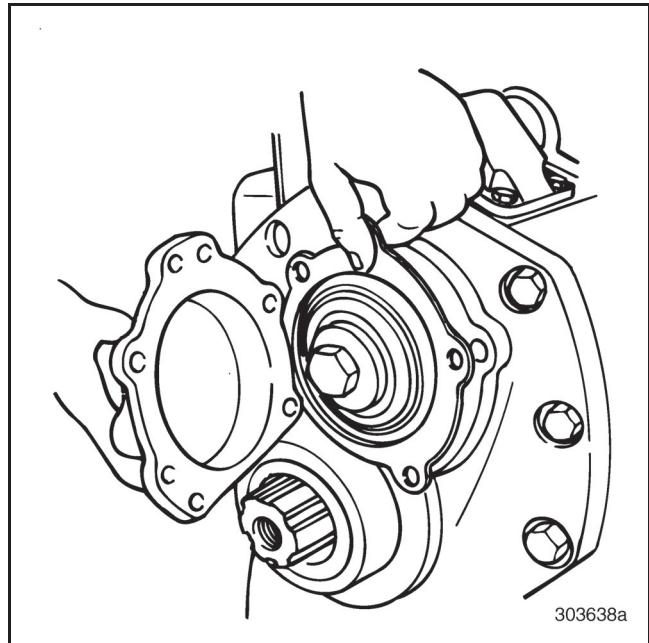


Figure 244 — Installing Bearing Cover and Gasket



# REASSEMBLY

65. Install the capscrews into the front-drive shaft bearing cover and tighten to specification.

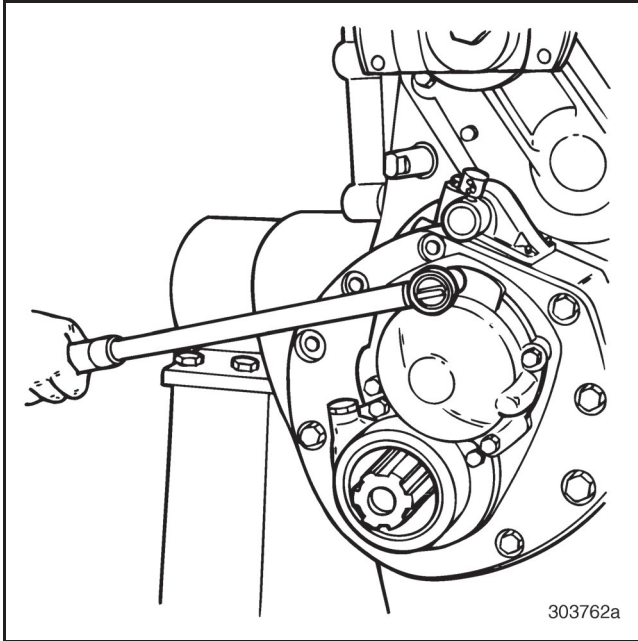


Figure 245 — Installing Bearing Cover Capscrews

66. If not already done, install the speedometer tone wheel and spacer. Then install the front-driving shaft output yoke (flange) onto the front-driving shaft.

## **CAUTION**

*Do not install the front-driving shaft output yoke using a hammer to drive the yoke on. Doing so may cause premature bearing failure.*

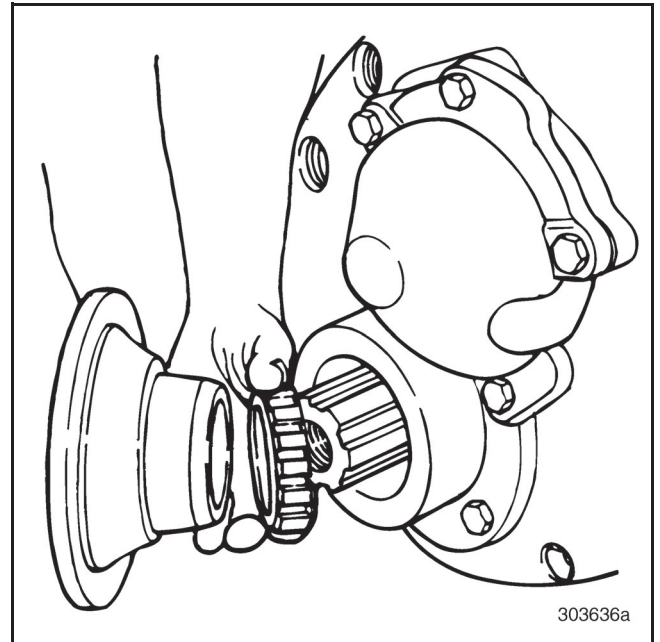


Figure 246 — Installing Output Yoke and Speedometer Tone Wheel



# REASSEMBLY

67. Install the front-driving shaft output yoke (flange) clamp plate and capscrew. Tighten the capscrew to specification.

## SERVICE HINT

To prevent the shaft from rotating when tightening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

## SERVICE HINT

The front-driving shaft output yoke clamp plate capscrew is right-hand threaded. Tighten the capscrew in a clockwise direction.

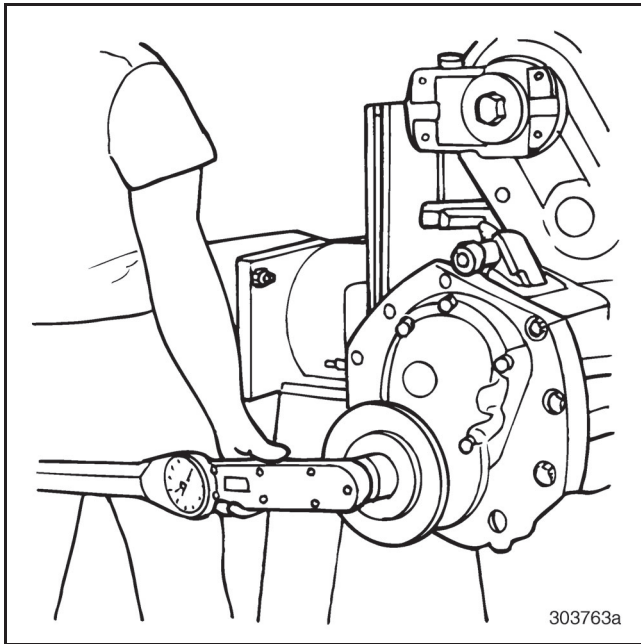


Figure 247 — Tightening Output Yoke Clamp Plate Capscrew

## Checking Front-Driving Shaft Bearing End Play

68. Place the front-driving shaft (and case) in a vertical position, front end up. Check bearing end play, using a dial indicator.
69. Lift the front-driving shaft by the output yoke, while watching the dial indicator. The bearing end play reading should be 0.001–0.005 inch (0.025–0.127 mm). To adjust bearing end play, remove the output yoke and front-driving shaft seal housing and add or remove shims as necessary.

## NOTE

If the end play measurement is out of specification, remove shims to decrease end play or add shims to increase end play.

Selective shims are available in 0.005 (0.127 mm), 0.007 (0.178 mm), 0.020 (0.508 mm) and 0.031 (0.787 mm) inch thicknesses.

## SERVICE HINT

Use a pry bar to move the shaft up and down while measuring end play on the dial indicator.

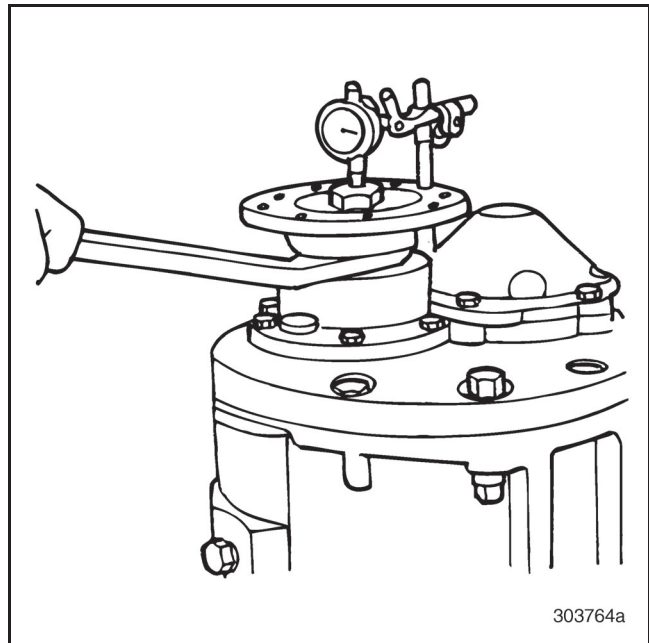


Figure 248 — Measuring Front-Driving Shaft Bearing End Play

70. Reinstall the front-driving shaft seal housing and output yoke as necessary.
71. Install the transfer case into the vehicle.
72. If not already done, install the transfer case magnetic drain plug, and tighten to specification. (See Figure 6 on page 16.)
73. Attach all air lines and shift linkage as necessary.
74. Fill the transfer case with the recommended lubricant. Refer to T15 and T25 Transfer Case Specifications and Capacities.
75. Install and tighten the filler plug to specification. (See Figure 6 on page 16.)



# REASSEMBLY

## [359/360] TRANSFER CASE PTO AND OIL PUMP INSTALLATION PROCEDURES

1. Install the oil pump key into the keyway of the mainshaft. Install the key with thicker, rounded end toward the front of the transfer case.

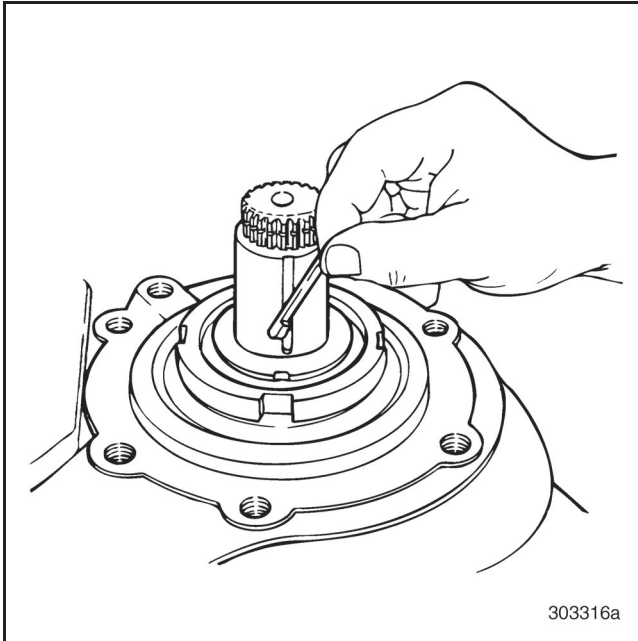


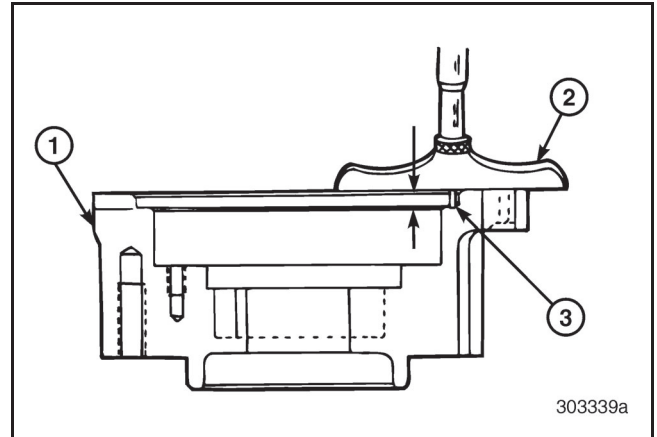
Figure 249 — Installing Key

### DETERMINE SHIM PACK THICKNESS

#### NOTE

If the original oil pump housing is being reinstalled, the original shim removed during disassembly should be reused. If, however, a new oil pump housing is required, measure for bearing depth between the original housing and the replacement housing.

2. For replacement oil pump housings, measure the depth from the pump base to the mainshaft bearing cone recess of the oil pump housing.



1. Oil Pump Mounting Base
2. Depth Micrometer

3. Measured Depth of Bearing Cone Recess

Figure 250 — Measuring Oil Pump Bearing Recess

- a. Record the measurements of the original pump housing bearing recess. Then record the measurement of the replacement pump housing recess.
- b. Compare the measurements of the original pump housing to those of the replacement pump housing.
- c. If the measurement of the replacement housing is smaller, increase the shim pack thickness equal to the difference.
- d. If the measurement of the replacement housing is larger, decrease shim pack thickness equal to the difference.

#### NOTE

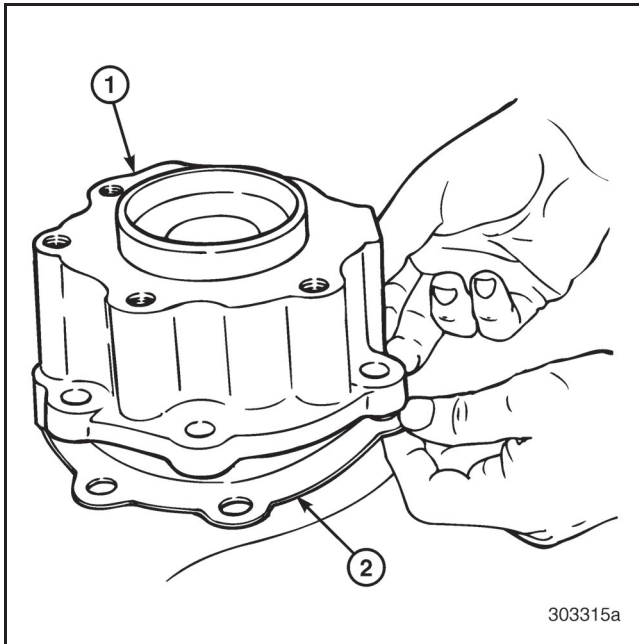
Shims are available through MACK Service Parts in thicknesses of 0.005, 0.007, 0.020 and 0.031 inch (0.127, 0.178, 0.508 and 0.787 mm).





# REASSEMBLY

- Carefully position the oil pump and pre-determined shim pack onto the mainshaft. Align the oil pump key with the slot in the oil pump inner gerotor.

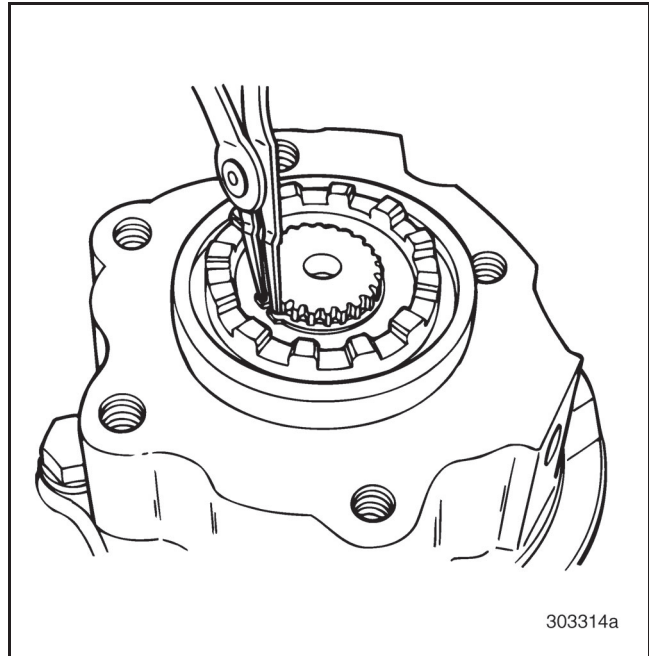


1. Oil Pump Housing	2. Determined Shim Pack
---------------------	-------------------------

**Figure 251 — Installing Oil Pump and Shim(s)**

- Install the oil pump housing-to-transfer case capscrews, and tighten to specification.
- Install the PTO clutch drive gear onto the end of the mainshaft.

- Install the snap ring onto the end of the mainshaft that secures the PTO clutch drive gear, using suitable snap ring pliers.



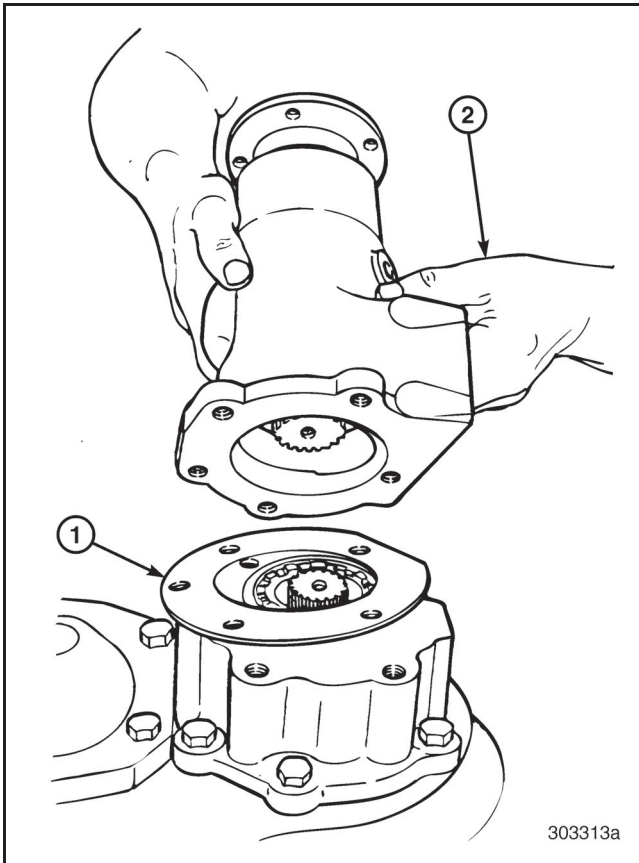
**Figure 252 — Installing Clutch Drive Gear Snap Ring**

- Install the original PTO shim(s) and **new** gasket onto the rear of the oil pump housing.
- Install the sliding clutch onto the PTO shaft with the clutching teeth facing outward.



# REASSEMBLY

9. While holding the sliding clutch with one hand through the shifter opening, install the PTO and sliding clutch onto the oil pump as an assembly.



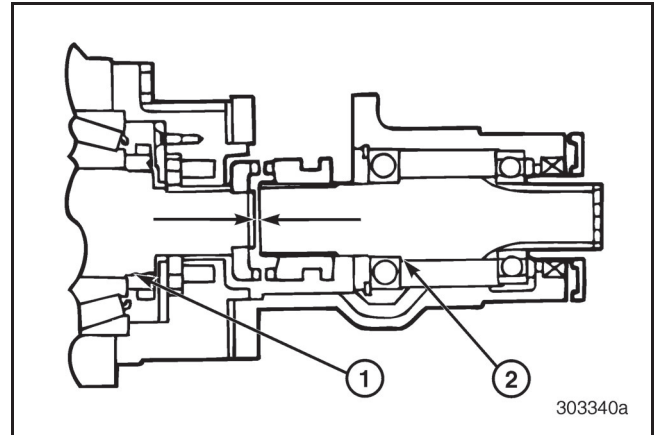
1. PTO Assembly Shim	2. Support Sliding Clutch
----------------------	---------------------------

Figure 253 — Installing PTO Assembly

10. While looking through the PTO shifter cover opening, check to make sure that the PTO shaft and the rear of the transfer case mainshaft do not touch. The PTO shaft must be allowed to spin freely, without interference or rubbing on the mainshaft.
  - If PTO shaft does not spin freely, add enough shim(s) to allow shaft to spin freely.
  - If an excessive gap exists between the transfer case mainshaft and PTO shaft, remove enough shim(s) which still allow PTO shaft to spin freely.

## NOTE

Shims are available through MACK Service Parts in thicknesses of 0.031 inch (0.787 mm) and 0.062 inch (1.58 mm).



1. Transfer Case Mainshaft	2. PTO Shaft
----------------------------	--------------

Figure 254 — Inspecting for Correct Mainshaft to PTO Shaft Gap

11. After determining the correct shim pack, install all the PTO housing-to-oil pump mounting capscrews, except the two used to secure the oil filter bracket. Note the hidden capscrew in the shift cover area, which must also be installed. Tighten all capscrews to specification.

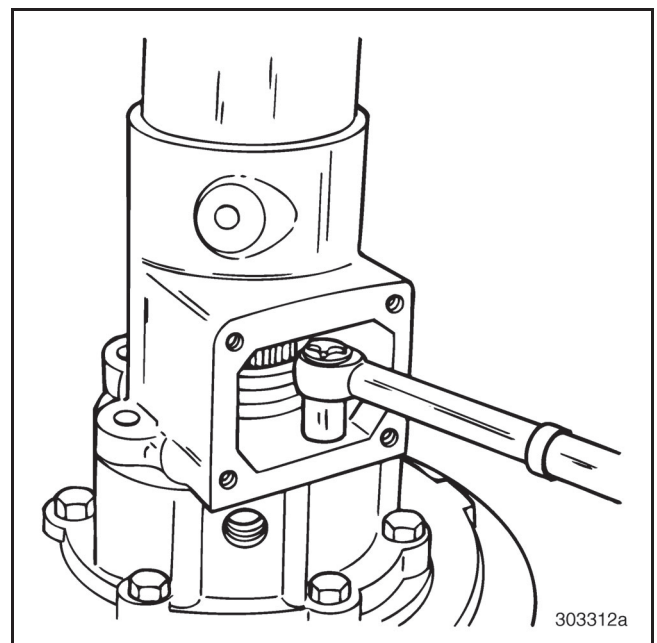


Figure 255 — Tightening PTO Housing Capscrews



# REASSEMBLY

- Shift the PTO sliding clutch to engage the clutch drive gear and connect the PTO shaft with the mainshaft of the transfer case.
- If not previously done, install the PTO shaft output flange, clamp plate and capscrew.

## SERVICE HINT

To prevent the shaft from rotating when tightening the capscrew, place a soft iron wedge between the teeth of two adjoining gears.

- Tighten the PTO shaft output flange clamp plate capscrew to specification.

## SERVICE HINT

The PTO shaft output flange clamp plate capscrew is right-hand threaded. Tighten the capscrew in a clockwise direction.

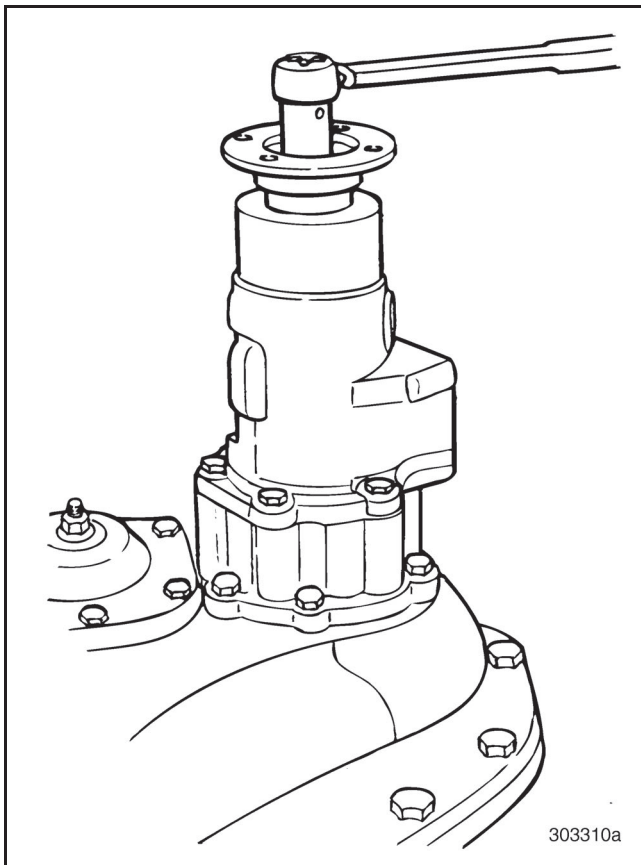


Figure 256 — Tightening PTO Shaft Output Flange Capscrew

- Apply heavy grease to the PTO air shifter cover surface to hold the cover gasket. Then position the cover gasket on the surface.

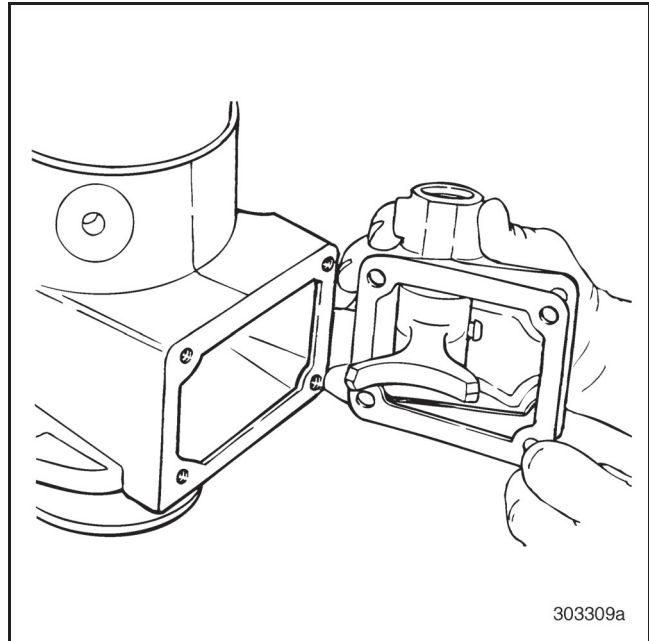
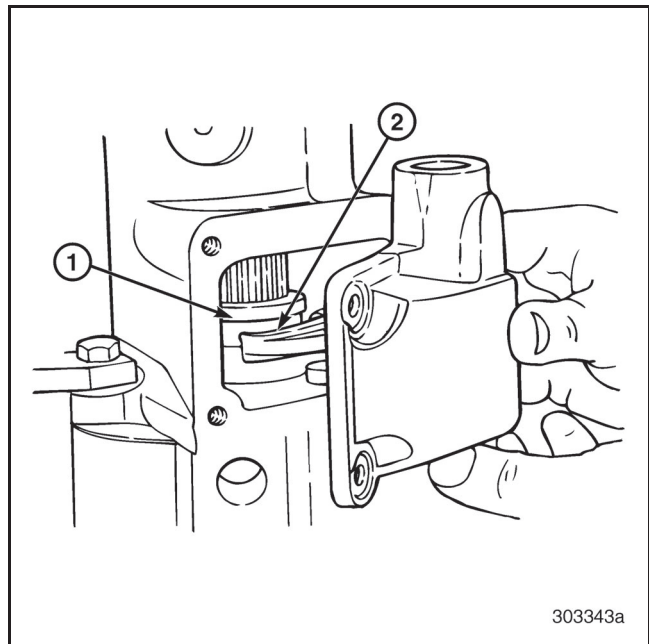


Figure 257 — Positioning Air Shifter Cover Gasket

- Install the air shifter cover onto the PTO housing. Align the shift fork with the sliding clutch groove while installing the shifter cover.



1. Sliding Clutch

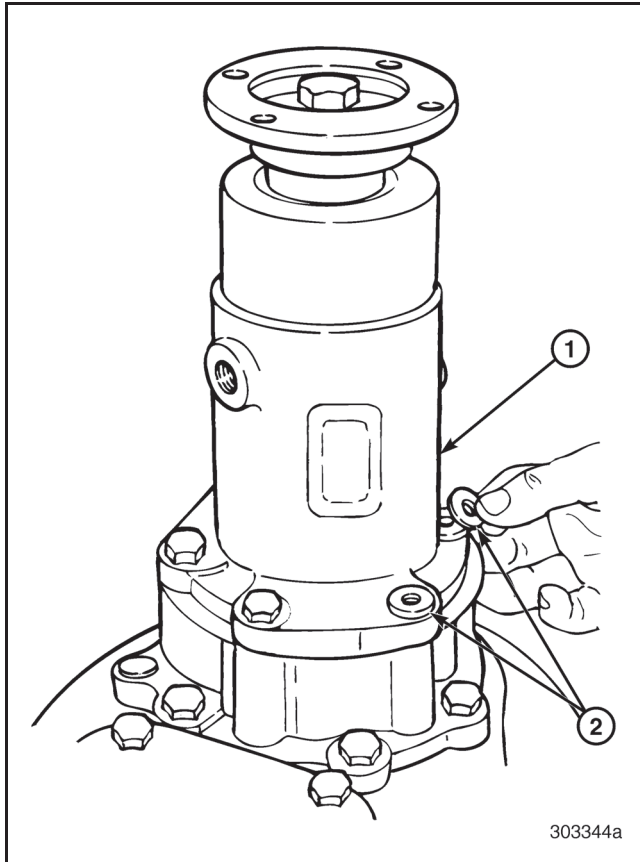
2. Shift Fork

Figure 258 — Aligning and Installing Shifter Cover



# REASSEMBLY

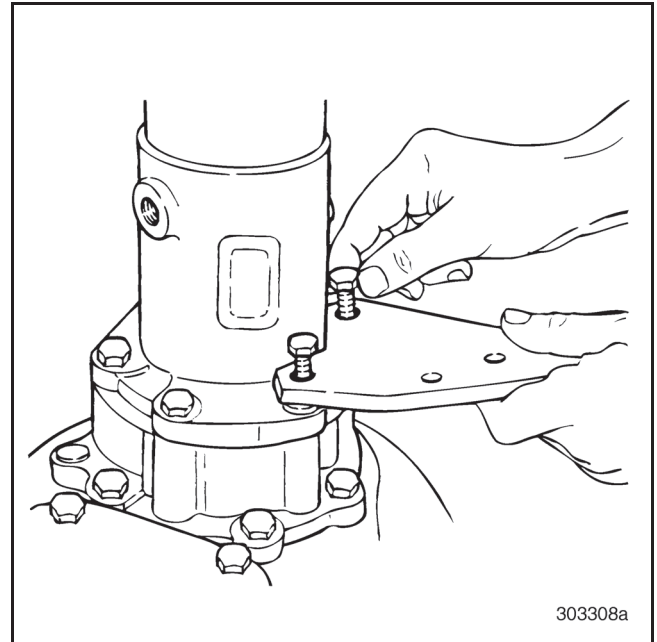
17. Install and tighten the air shifter cover capscrews to specifications.
18. Position flat washers (spacers) on the lower right-hand (viewed from the rear) PTO housing bolt location and the next location up.



- |                           |                           |
|---------------------------|---------------------------|
| 1. Forward Portion of PTO | 2. Flat Washers (Spacers) |
|---------------------------|---------------------------|

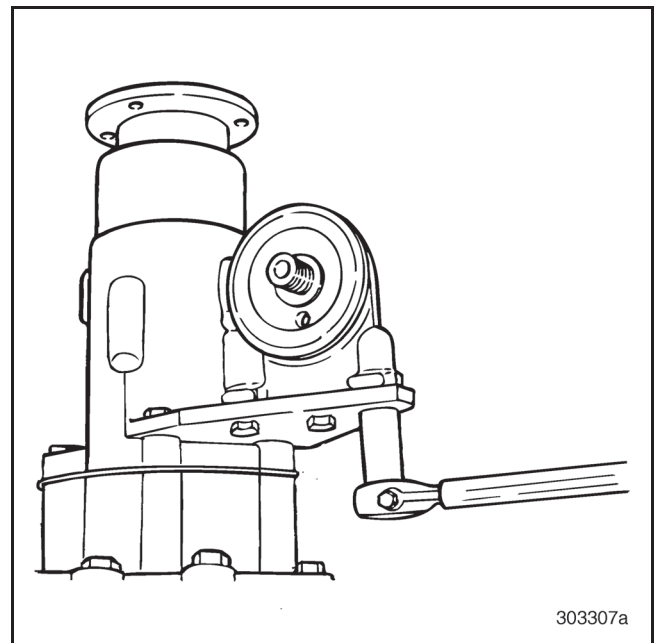
**Figure 259 — Installing Flat Washers (Spacers)**

19. Position the filter adapter base bracket on the flat washers previously installed. Install the two slightly longer PTO mounting capscrews through the bracket and PTO flange.



**Figure 260 — Installing Filter Adapter Mounting Bracket**

20. Tighten the two bracket and PTO mounting capscrews to specification.
21. Install the filter adapter onto the mounting bracket facing the lower portion of the transfer case. Tighten the capscrews to specification.



**Figure 261 — Installing Filter Adapter**



## REASSEMBLY

22. Install the filter cartridge onto the filter adapter and hand-tighten.

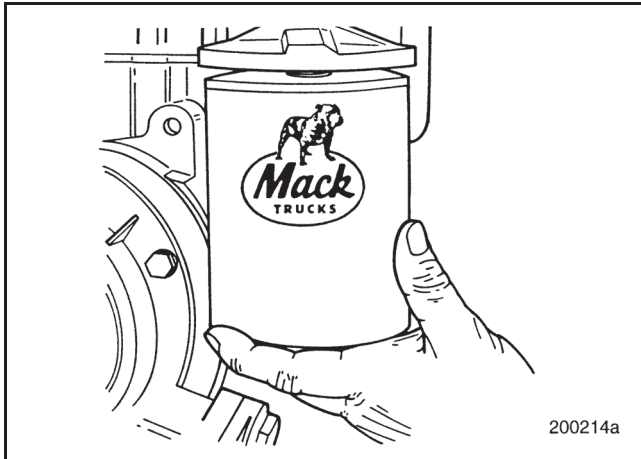


Figure 262 — Installing Filter Cartridge

23. Install the oil suction hose sump adapter with screen into the lower position on the front-drive housing of the transfer case.

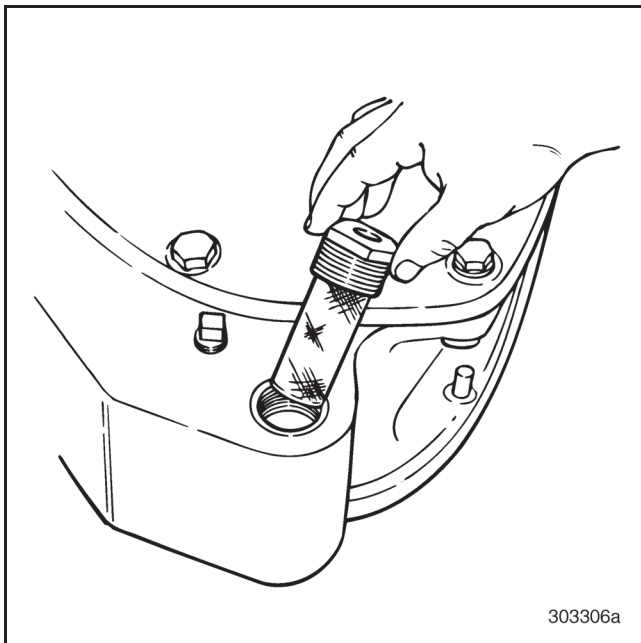


Figure 263 — Installing Sump Adapter with Screen

24. Reconnect the oil hose, located between the transfer case sump and the oil pump, as marked at disassembly. Also connect the oil hose(s) connected between the oil pump and oil filter adapter. Refer to schematics in the SCHEMATIC AND ROUTING DIAGRAMS section.
25. Reconnect the air lines to the PTO air shifter housing per markings made at disassembly.



# DECLUTCH CONVERSION

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## TRANSFER CASE DECLUTCH CONVERSION



# DECLUTCH CONVERSION

## [350] TRANSFER CASE DECLUTCH CONVERSION (FRONT WHEEL DISCONNECT FEATURE)

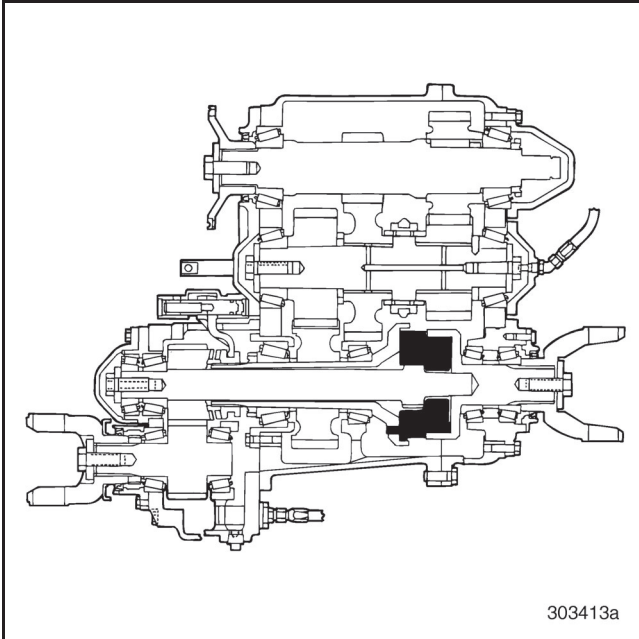


Figure 264 — Transfer Case Declutch Conversion Locator

Some vehicle operators have expressed a desire to be able to shift out of all-wheel drive under certain operating conditions.

A declutch conversion has been developed that involves the installation of a permanent locking sleeve that replaces the planetary pinion gears and eliminates all differential action. The normal differential lockout clutch then becomes a declutch unit to engage or disengage the front axle. When the clutch is disengaged, drive output is to the rear axle(s) only, as in a conventional truck. When the clutch is engaged, the drive output is to both the front and rear axles, without any differential action, as in the standard transfer case.

### NOTE

The declutch conversion feature may also be desirable when an auxiliary transmission with certain PTO options is used. However, MACK recommends installing an auxiliary transmission or split shaft PTO ahead of the standard TC15/150 transfer case with planetary gear type differential, to allow for normal operation.

### **⚠ WARNING**

**Do not attempt to shift between Hi (H) and Lo (L) range or shifting in or out of lockup while the vehicle is in motion. Drive component damage can occur. Shift only with vehicle stopped and wheels not spinning.**

### **⚠ WARNING**

**When vehicle traction is suitable and front-wheel drive is not required, operators must shift out of the lockup mode. Drive component damage can occur if operated on areas of high traction.**

### NOTE

When the transfer case has been modified with the declutch feature, the vehicle is no longer capable of full-time, all-wheel drive.

1. Drain the transfer case lubricant.
2. Disconnect the rear driveshaft (propeller shaft) at the rear output yoke (flange).
3. Remove the rear-drive shaft assembly bearing retainer capscrews.



# DECLUTCH CONVERSION

4. Remove the rear-drive shaft, bearing retainer and output yoke as an assembly.

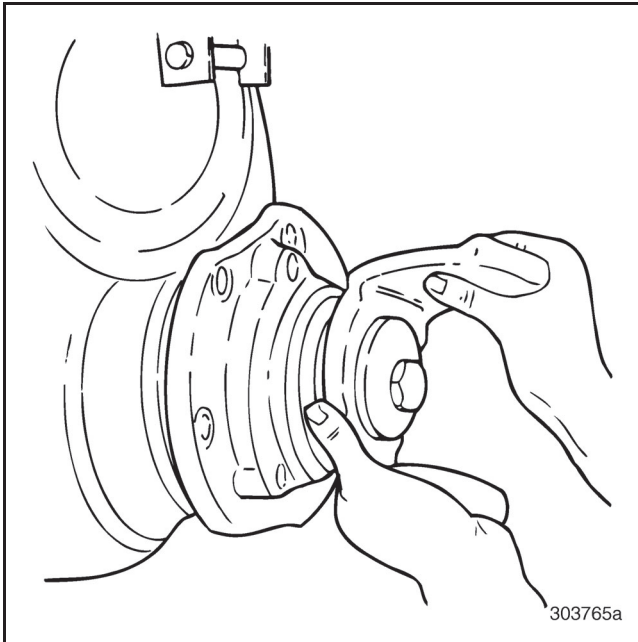


Figure 265 — Removing Rear-Drive Shaft, Bearing Retainer and Output Yoke Assembly

5. Remove the six planetary pinion gears from the planetary cage.

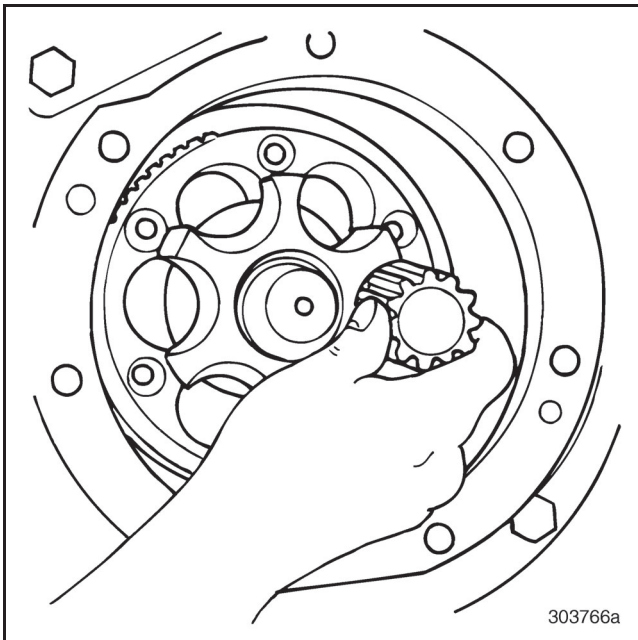


Figure 266 — Removing Planetary Pinion Gears

6. Shift the transfer case into lockup. Then remove the six planetary cage Allen-head capscrews.
7. Remove the planetary cage from the flange of the main-drive shaft.

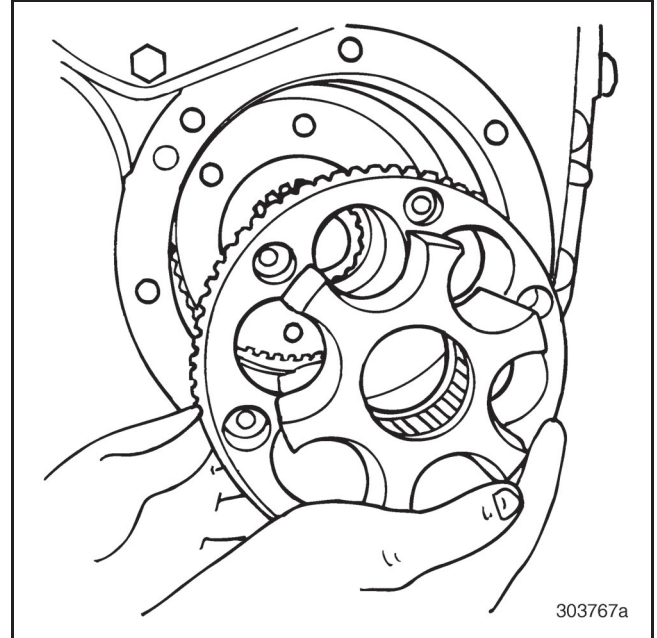


Figure 267 — Removing Planetary Cage

## NOTE

Note the double timing marks on the flange area of the main-drive shaft. Also note the timing mark "O" adjacent to one of the capscrew holes of the front wheel disconnect sleeve. When installing the sleeve, place the spline tooth that is directly in line with the capscrew hole closest to the timing mark, between the double timing marks on the flange of the main-drive shaft. It may be helpful to paint the marks for easier installation.





# DECLUTCH CONVERSION

- Align the timing mark (tooth in line with capscrew hole) on the front wheel disconnect sleeve with the timing marks on the main-drive shaft flange. Then install the sleeve.

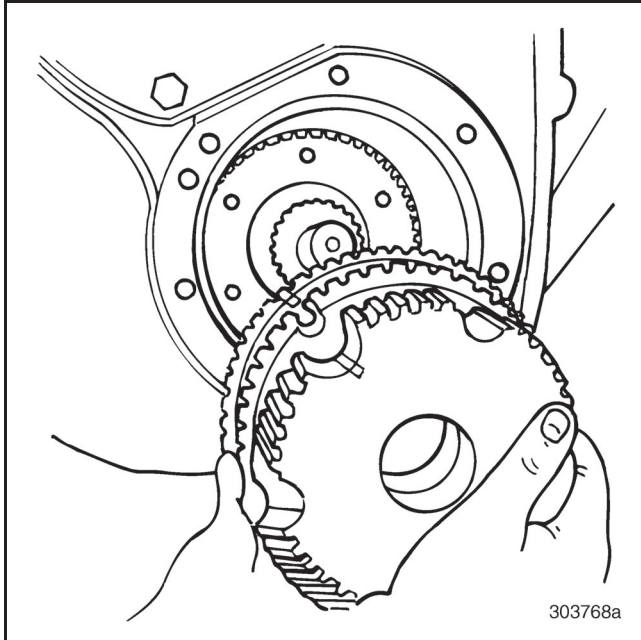


Figure 268 — Installing Front Wheel Disconnect Sleeve

- Install the six Allen-head capscrews into the front wheel disconnect sleeve, and tighten them to specification.
- Shift the transfer case out of lockup.
- Install a **new** O-ring onto the bearing retainer of the rear-drive shaft assembly.
- Install the rear-drive shaft and output yoke (flange) assembly into the rear end plate to mesh with the front wheel disconnect sleeve.

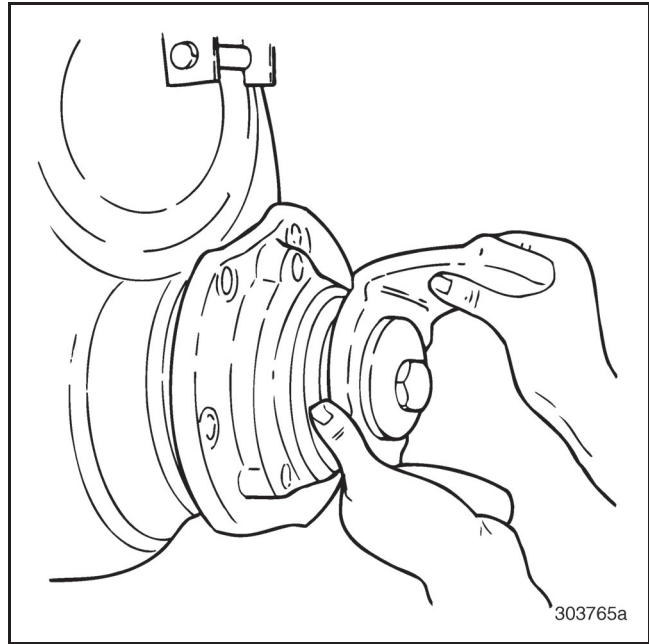


Figure 269 — Removing Rear-Drive Shaft, Bearing Retainer and Output Yoke Assembly

- Reconnect the rear driveshaft (propeller shaft) to the rear-drive shaft output yoke (flange). Tighten fasteners to specification.
- Fill the transfer case to the proper level with the recommended lubricant.
- To indicate that the transfer case has the front wheel disconnect feature, stamp the letter "D" next to the transfer case model number (located on rear end plate). Example: TC150 "D"

## Parts Required:

Qty.	Part Number	Description	Replaces
1	796KC325	Sleeve, Front Wheel Disconnect	—
1	—	Cage, Planet Gear	251KB32A
6	—	Gear, Planet	770KB11



# SPECIFICATIONS

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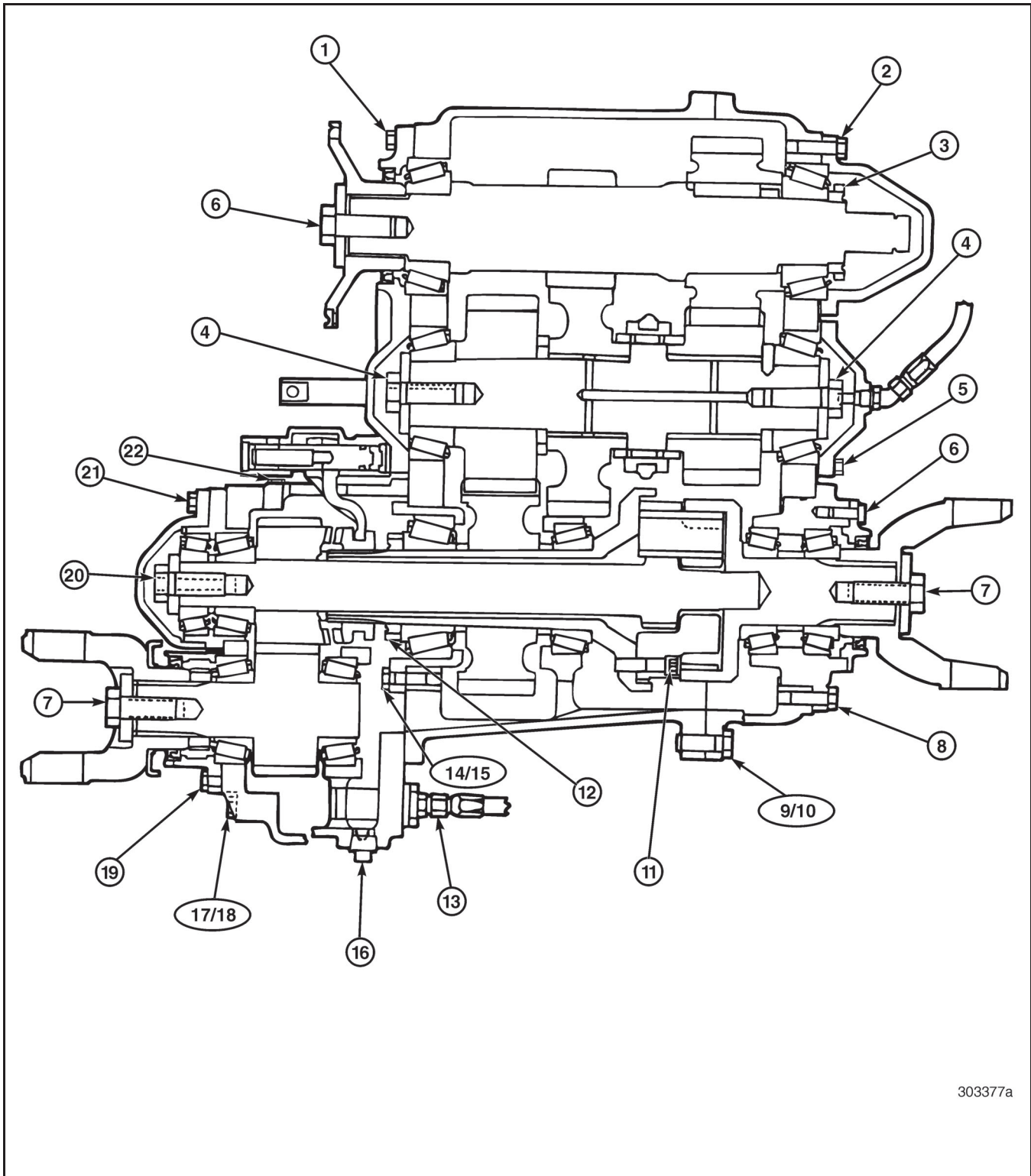
## SPECIFICATIONS



# SPECIFICATIONS

## TC15 AND TC25 TRANSFER CASE TORQUE SPECIFICATION LOCATIONS

Refer to Figure 271 on the next page for torque specifications.



303377a

Figure 270 — Torque Specification Locations



# SPECIFICATIONS

## TC15 AND TC25 TRANSFER CASE TORQUE SPECIFICATION CHART

Refer to Figure 270 on the previous page for torque specification locations.

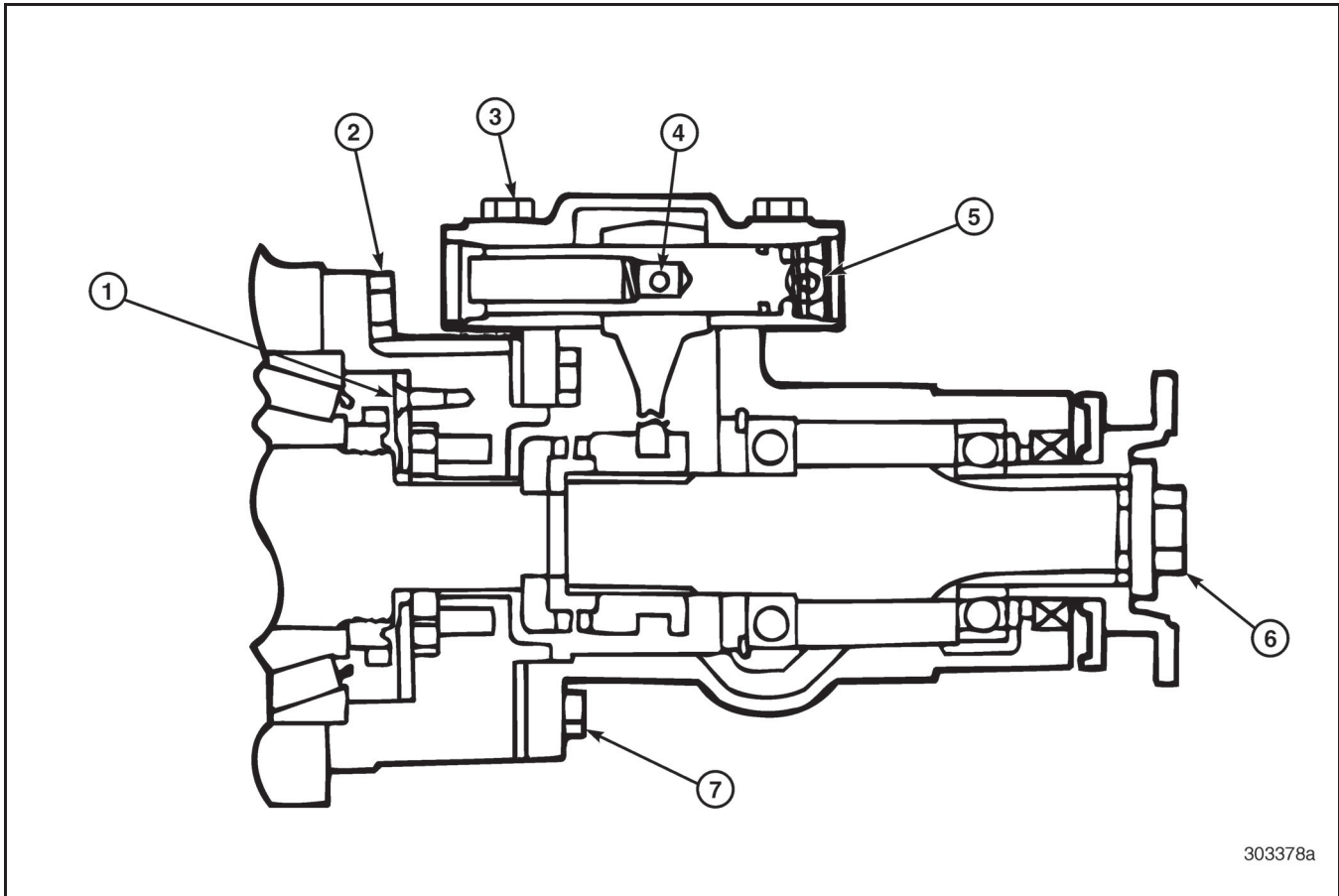
Item and Location	Torque — Lb-Ft (N•m)
1. Mainshaft/Countershaft Front Cover Capscrews	60–80 (81–109)
2. Mainshaft Rear Bearing Cover Capscrews	60–80 (81–109)
3. Mainshaft Rear Bearing Locknut	800–1200 (1085–1627)
4. Countershaft Clamp Plate Capscrews	500–600 (678–814)
5. Countershaft Rear Bearing Cover Capscrews	85–105 (115–142)
6. Rear-Drive Shaft Seal Housing Capscrews	27–33 (37–45)
7. Input and Output Yoke (Flange) Clamp Plate Capscrews	500–600 (678–814)
8. Rear-Drive Shaft Bearing Retainer Capscrews	60–80 (81–109)
9. Rear End Plate Capscrews	115–145 (156–197)
10. Rear End Plate Dowel Bolts	60–80 (81–109)
11. Planetary Pinion Gear Cage Allen-Head Screws	72–88 (98–119)
12. Main-Drive Shaft Bearing Locknut	800–1200 (1085–1627)
13. Oil Hose Fittings	Hand Check
14. Front-Drive Housing Capscrews	60–80 (81–109)
15. Front-Drive Housing Dowel Bolts	60–80 (81–109)
16. Magnetic Oil Drain Plug (3/4 NPT)	25–30 (34–41)
17. Front-Drive Housing Cover Plate Capscrews	60–80 (81–109)
18. Front-Drive Housing Cover Plate Dowel Bolts	60–80 (81–109)
19. Front-Driving Shaft Seal Housing Capscrews	27–33 (37–45)
20. Front-Drive Shaft Clamp Plate Capscrew	500–600 (678–814)
21. Front-Drive Shaft Bearing Retainer/Cover Capscrews	40–50 (54–68)
22. Differential Lockout Cover Capscrews	18–22 (24–30)
— Hi-/Lo-Range Shift Fork Setscrews	35–50 (48–68)
— Hi-/Lo-Range Shift Rail Ball and Spring Capscrew	115–145 (156–197)
— Oil Filler Plug	55 (75) Max.
— Air Breather Boss Pipe Plug (3/8 NPT)	20–25 (27–34)
— Front-Drive Shaft Bearing Retainer Pipe Plug (1/8 NPT)	5–7 (7–10)
— Mainshaft/Countershaft Front Cover Pipe Plug (1/4 NPT)	15–20 (20–27)

Figure 271 — Torque Specification Chart



# SPECIFICATIONS

## TC15 AND TC25 OIL PUMP AND PTO TORQUE SPECIFICATIONS



303378a

Item and Location	Torque — Lb-Ft (N•m)
1. Oil Pump Gerotor Cover Screws	97–117 in-lb (11–13)
2. Oil Pump Housing Capscrews	60–80 (81–109)
3. PTO Shift Cover Capscrews	18–22 (24–30)
4. PTO Shift Fork Setscrew	18–22 (24–30)
5. Oil Hose Fittings	Hand Check
6. PTO Shaft Output Flange Clamp Plate Capscrew	135–165 (183–224)
7. PTO Housing Capscrews	40–50 (54–68)

Figure 272 — Oil Pump and PTO Torque Specifications



# SPECIFICATIONS

## FITS AND LIMITS

### All Forks and Sliding Clutches

	Minimum New	Maximum New	Maximum Wear
1. Clearance between fork pad and clutch groove	0.005 inch	0.020 inch	0.050* inch

\*If unit has experienced disengagement, clearance must not exceed 0.030 inch maximum.

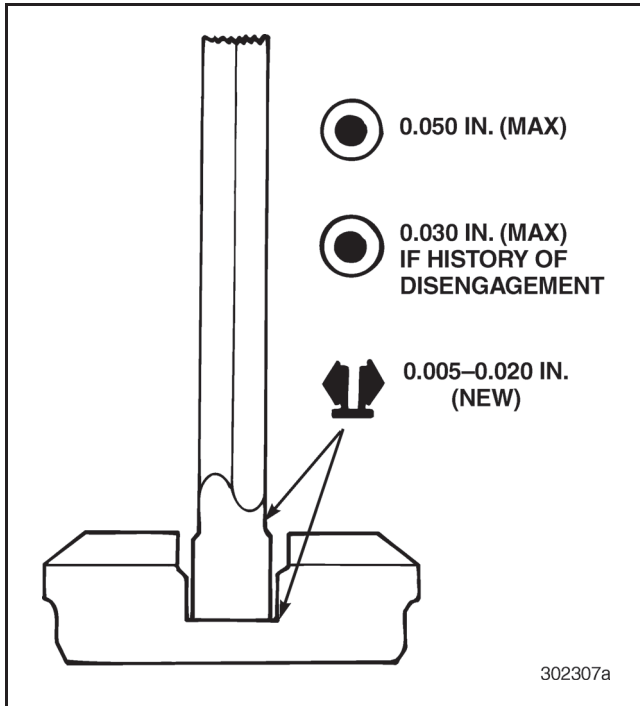


Figure 273 — Sliding Clutch Clearances

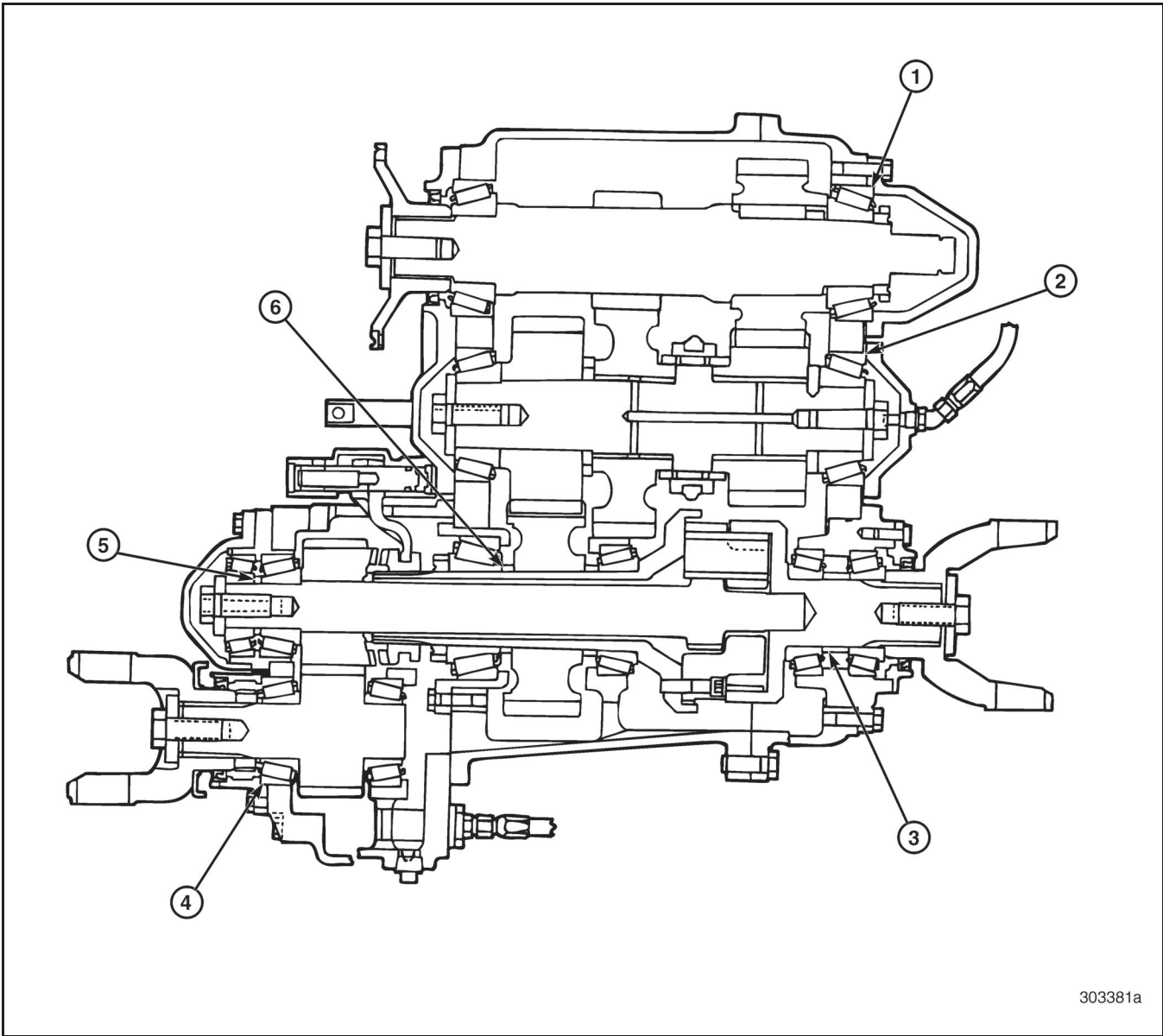
### Spring Specifications

Spring	Free Length	Load	Length Under Load
Hi-/Lo-Range Shift Rail Poppet Ball Spring	1.281 inches	38–46 lbs.	1.125 inches



# SPECIFICATIONS

## TC15 AND TC25 TRANSFER CASE GENERAL TOLERANCES



303381a

Component	Available Thickness	End Play Specification
1. Mainshaft Bearing End Play	0.005, 0.007, 0.020, 0.031 inch Shims	0.003–0.008 inch
2. Countershaft Bearing End Play	0.005, 0.007, 0.020, 0.031 inch Shims	0.003–0.008 inch
3. Rear-Drive Shaft Bearing End Play	1.022–1.084 inch Spacers*	0.001–0.005 inch
4. Front-Driving Shaft Bearing End Play	0.005, 0.007, 0.020, 0.031 inch Shims	0.001–0.005 inch
5. Front-Drive Shaft Bearing End Play	0.198–0.259 inch Spacers*	0.001–0.005 inch
6. Main-Drive Shaft Bearing End Play	0.323–0.409 inch Spacers*	0.001–0.005 inch

\*Bearing spacers are available in increments of 0.001 inch.

Figure 274 — Bearing and Shaft End Play Specifications



# SPECIFICATIONS

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## TRANSFER CASE SPECIFICATIONS AND CAPACITIES

Make . . . . .	Mack Trucks, Inc.
Type . . . . .	Heavy-Duty Transfer Case
Controls . . . . .	Selective, One Lever Manual with Air-Shifted Differential Lockout and PTO Drive (Optional)
Speeds . . . . .	Two
Cases . . . . .	Ductile Iron
Gears . . . . .	Helical Type
Shaft Splines . . . . .	Fine Pitch Rolled Involute
Lubrication . . . . .	Splash-and-Gravity Lubrication (plus gravity and pump feed to countershaft needle bearings and sliding clutch)
Drain Plug . . . . .	Magnetic
Oil Capacity — TC15/TC25 . . . . .	Approx. 20 pints (additional oil is needed when oil cooler and hoses are added)

Recommended SAE Grade Gear Oil for All Temperature Operations: TC15/TC25

MACK GO-J and GO-J Plus\* Specification

- 90, 140, 80W-90, 80W-140, 85W-140 (Mineral Base)
- 75W-90, 75W-140, 80W-140 (Synthetic Base)

\* GO-J Plus is required for MACK-gear component extended service drain intervals.





# NOTES

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# **SCHEMATIC & ROUTING DIAGRAMS**

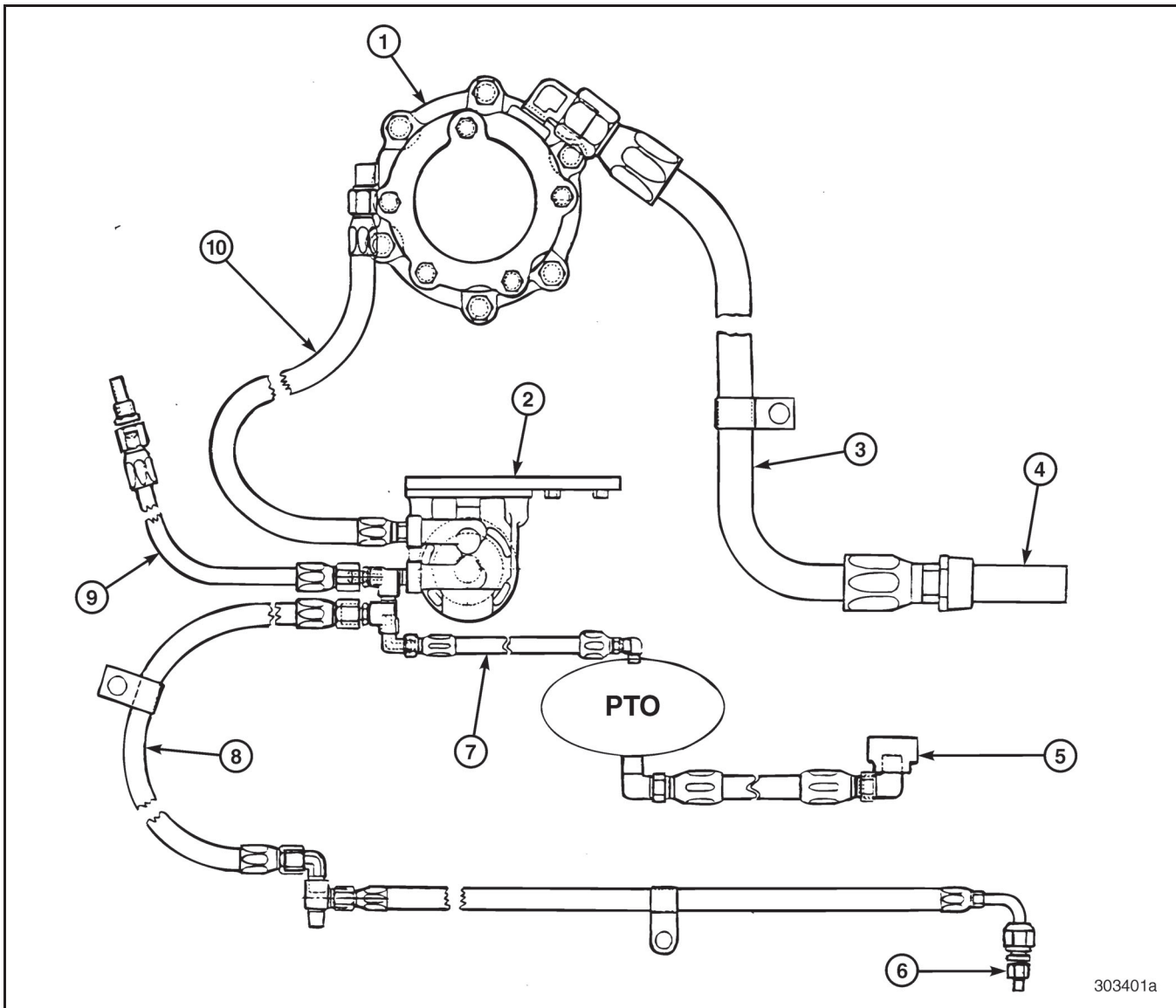
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## **SCHEMATIC & ROUTING DIAGRAMS**



# SCHEMATIC & ROUTING DIAGRAMS

## TC15 AND TC25 OIL HOSE ROUTING



303401a

- |  |   |
|--|---|
| <ol style="list-style-type: none"><li>1. Transfer Case Oil Pump</li><li>2. Oil Filter Adapter</li><li>3. Suction Hose from Sump to Pump</li><li>4. Sump Screen</li><li>5. Oil Drain Fitting (Sump)</li></ol> | <ol style="list-style-type: none"><li>6. Output to Bearing</li><li>7. Filter Adapter to PTO, Hose</li><li>8. Pressure Hose to Front Cover</li><li>9. Pressure Hose to Countershaft Cover</li><li>10. Pump to Filter, Hose (Also to Oil Cooler, if Equipped)</li></ol> |
|--|---|

Figure 275 — TC15 and TC25 Oil Hose Routing



# **SPECIAL TOOLS & EQUIPMENT**

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## **SPECIAL TOOLS & EQUIPMENT**



# SPECIAL TOOLS & EQUIPMENT

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## SPECIAL TOOLS

J 34629	Snap Ring Pliers Set
J 29369-1	Bearing Puller
J 29369-2	Bearing Puller
J 2619-O1	Slide Hammer
J 7872	Magnetic Base Dial Indicator Set
J 39477-1	Bar-Type Puller
J 8176	Bearing Separator
J 24407	30–250 lb-ft Torque Wrench
J 24560	Bearing Retainer Nut Wrench
J 23775-O1	100–600 lb-ft Torque Wrench
OEM-4052	Internal Puller
J 7804-O1	Yoke and Flange Remover
OEM 6107	Torque, Multiplier

Above tools are available from:

**KENT-MOORE**  
**O.E. TOOL AND EQUIPMENT GROUP**  
**SPX CORPORATION**  
**28635 MOUND ROAD**  
**WARREN, MICHIGAN 48092-3499**

**TEL: 1-800-328-6657**  
**FAX: 1-800-578-7375**



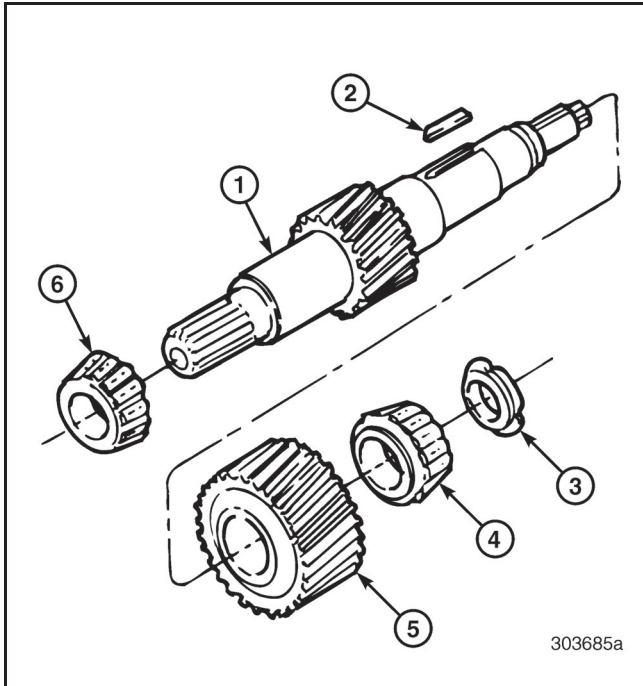
# DISASSEMBLED VIEWS

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# DISASSEMBLED VIEWS

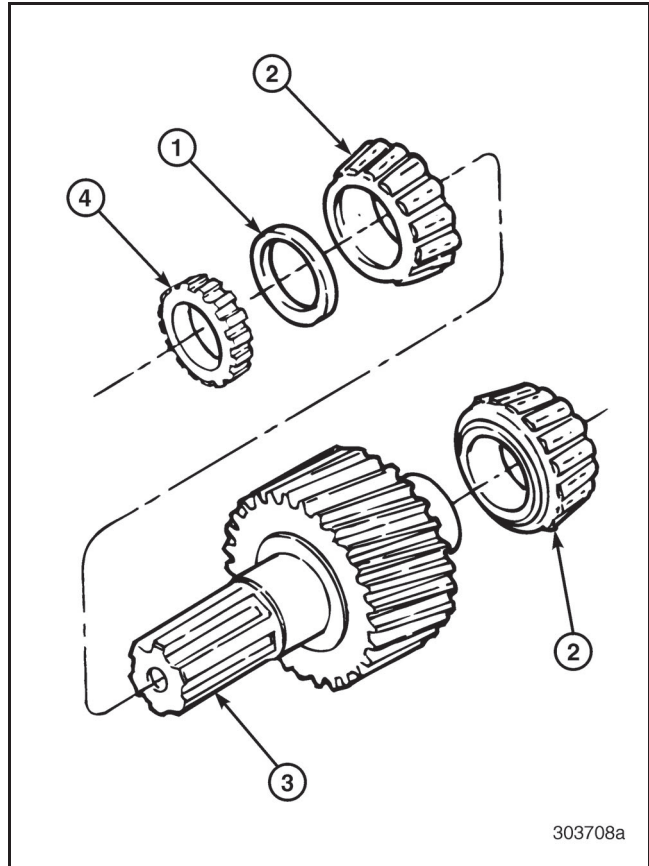


# DISASSEMBLED VIEWS



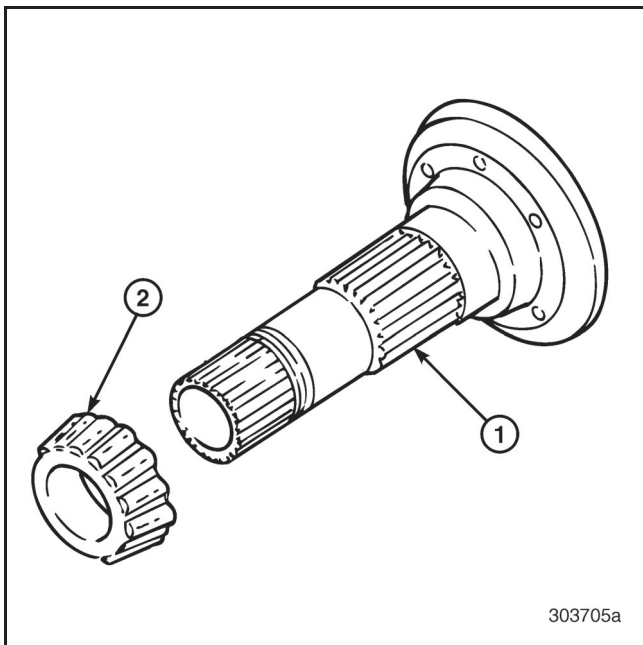
- |  |                  |
|--|------------------|
| 1. Mainshaft (Lo-Range Gear Part of Shaft) | 4. Bearing Cone  |
| 2. Key                                     | 5. Hi-Range Gear |
| 3. Bearing Locknut                         | 6. Bearing Cone  |

**Figure 276 — Exploded View of Mainshaft**



- |                        |                           |
|------------------------|---------------------------|
| 1. Spacer              | 4. Speedometer Tone Wheel |
| 2. Bearing Cone        |                           |
| 3. Front-Driving Shaft |                           |

**Figure 278 — Exploded View of Front-Driving Shaft**



- |                     |                 |
|---------------------|-----------------|
| 1. Main-Drive Shaft | 2. Bearing Cone |
|---------------------|-----------------|

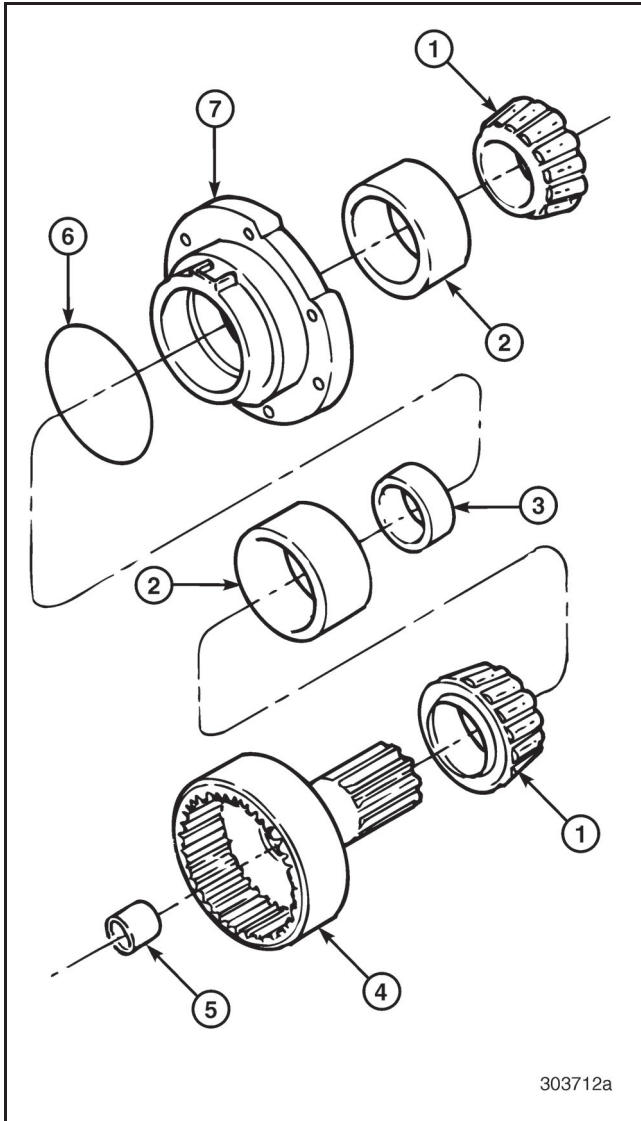
**Figure 277 — Exploded View of Main-Drive Shaft**







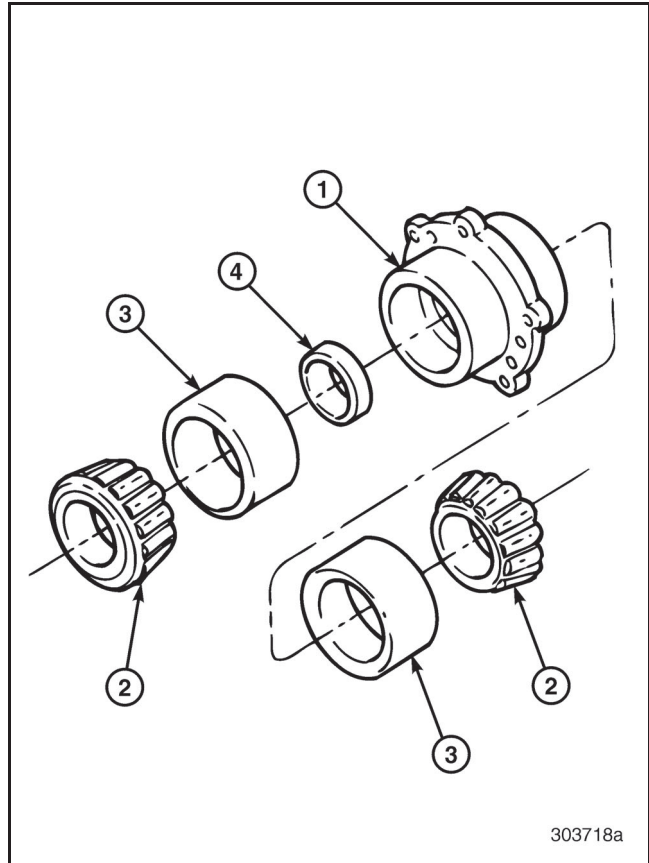
# DISASSEMBLED VIEWS



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- |                     |                     |
|---------------------|---------------------|
| 1. Bearing Cone     | 5. Bushing          |
| 2. Bearing Cup      | 6. O-Ring           |
| 3. Selective Spacer | 7. Bearing Retainer |
| 4. Rear-Drive Shaft |                     |

**Figure 280 — Exploded View of Rear-Drive Shaft**



303718a

- |                     |                     |
|---------------------|---------------------|
| 1. Bearing Retainer | 3. Bearing Cup      |
| 2. Bearing Cone     | 4. Selective Spacer |

**Figure 281 — Exploded View of Front-Drive Shaft Bearing Retainer**



# INDEX

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# INDEX



# INDEX

<b>A</b>		<b>G</b>	
AIR BREATHER .....	17	GEARS.....	64
ALL CHASSIS WITH TC(S) 15/25 TRANSFER CASE .....	6	GENERAL INSPECTION.....	66
ALL FORKS AND SLIDING CLUTCHES .....	127	GENERAL REASSEMBLY INSTRUCTIONS .....	66
ALL WHEEL DRIVE RATIO MATCH .....	6		
<b>B</b>		<b>I</b>	
BEARINGS.....	64	INSPECTION AND CLEANING.....	64
BENCH PROCEDURES (DISASSEMBLY) .....	43	INSPECTION OF PARTS .....	63
BENCH PROCEDURES (REASSEMBLY).....	67		
<b>C</b>		<b>L</b>	
CHANGING OIL .....	16	LUBRICATION.....	4
CHASSIS DYNAMOMETER OPERATION .....	6		
CHECKING COUNTERSHAFT BEARING END PLAY .....	104	<b>M</b>	
CHECKING FRONT-DRIVING SHAFT BEARING END PLAY.....	112	MAIN SHAFT DISASSEMBLY.....	44
CHECKING MAIN-DRIVE SHAFT BEARING END PLAY .....	95	MAIN-DRIVE SHAFT DISASSEMBLY.....	51
CHECKING MAINSHAFT BEARING END PLAY .....	103	MAIN-DRIVE SHAFT REASSEMBLY .....	77
CHECKING OIL .....	16	MAINSHAFT REASSEMBLY.....	84
CLAMP PLATE CAPSCREWS.....	66	MAINTENANCE.....	15, 16
COMPONENT LOCATOR .....	9		
COUNTERSHAFT DISASSEMBLY .....	46	<b>O</b>	
COUNTERSHAFT REASSEMBLY.....	78	OIL PUMP DISASSEMBLY .....	58
		OIL PUMP REASSEMBLY.....	86
<b>D</b>		OIL SEALS.....	65
DECLUTCH CONVERSION.....	119		
DESCRIPTION .....	4	<b>P</b>	
DESCRIPTION AND OPERATION .....	3	PTO AND PUMP COMPONENT DISASSEMBLY .....	58
DIAGRAMS.....	131	PTO AND PUMP COMPONENT REASSEMBLY.....	86
DISASSEMBLED VIEWS.....	135	PTO DISASSEMBLY .....	58
DISASSEMBLY .....	19	PTO REASSEMBLY.....	87
		PTO SHIFT COVER DISASSEMBLY .....	60
<b>F</b>		PTO SHIFT COVER REASSEMBLY.....	89
FITS AND LIMITS.....	127		
FRONT-DRIVE SHAFT BEARING RETAINER DISASSEMBLY .....	56	<b>R</b>	
FRONT-DRIVE SHAFT BEARING RETAINER REASSEMBLY .....	68	REAR-DRIVE SHAFT DISASSEMBLY .....	54
FRONT-DRIVING SHAFT DISASSEMBLY ..	52	REAR-DRIVE SHAFT REASSEMBLY.....	71
FRONT-DRIVING SHAFT REASSEMBLY ..	75	REASSEMBLY.....	91



# INDEX

---

## S

SCHEMATIC & ROUTING DIAGRAMS . . . . .	131
SHIFTER FORKS, SLIDING CLUTCHES AND SHIFT RAILS . . . . .	64
SPECIAL TOOLS & EQUIPMENT . . . . .	133
SPECIFICATION CHART . . . . .	125
SPECIFICATION LOCATIONS . . . . .	124
SPECIFICATIONS . . . . .	123
SPLASH LUBRICATION . . . . .	4
SPRING SPECIFICATIONS . . . . .	127

## T

TC15 AND TC25 GEAR RATIOS . . . . .	5
TC15 AND TC25 OIL HOSE ROUTING . . . . .	132
TC15 AND TC25 OIL PUMP AND PTO TORQUE SPECIFICATIONS . . . . .	126
TC15 AND TC25 SHIFTING INSTRUCTIONS . . . . .	6
TC15 AND TC25 TRANSFER CASE . . . . .	4
TC15 AND TC25 TRANSFER CASE GENERAL TOLERANCES . . . . .	128
TC15 AND TC25 TRANSFER CASE TORQUE . . . . .	124
TRANSFER CASE COMPONENT DISASSEMBLY . . . . .	44
TRANSFER CASE COMPONENT REASSEMBLY . . . . .	68
TRANSFER CASE DECLUTCH CONVERSION (FRONT WHEEL DISCONNECT FEATURE) . . . . .	120
TRANSFER CASE DISASSEMBLY PROCEDURES . . . . .	20
TRANSFER CASE IDENTIFICATION . . . . .	1
TRANSFER CASE PTO AND OIL PUMP INSTALLATION PROCEDURES . . . . .	113
TRANSFER CASE PTO AND OIL PUMP REMOVAL PROCEDURES . . . . .	38
TRANSFER CASE REASSEMBLY PROCEDURES . . . . .	92
TRANSFER CASE SPECIFICATIONS AND CAPACITIES . . . . .	129
TROUBLESHOOTING . . . . .	11

## U

UNIT IDENTIFICATION STAMPING LOCATION . . . . .	2
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# NOTES

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