

SERVICE REPAIR

MANUAL

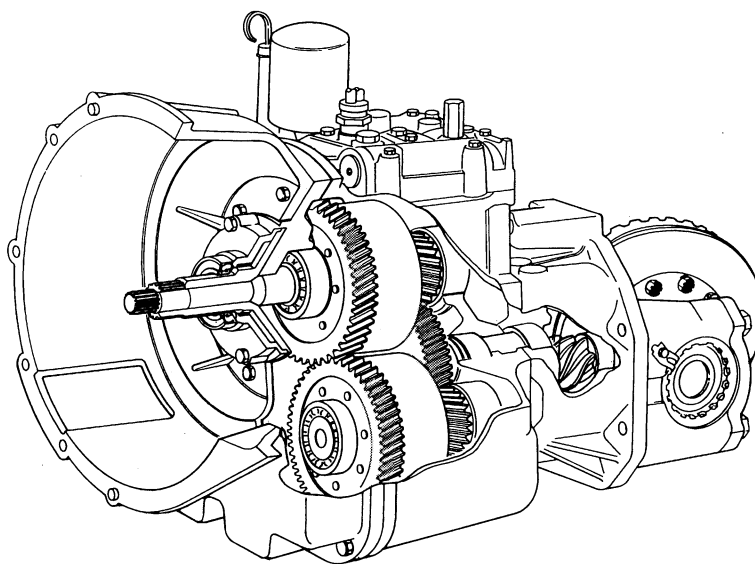
Hyster A187 (S40XL, S50XL, S60XL) Forklift

HYSTER

SINGLE-SPEED POWERSHIFT TRANSMISSION

**(HYSTER T41, T42, T43)
REPAIRS**

S/H1.25–3.00XL (S/H25–60XL)



HYSTER

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure that all slings, chains or cables are correctly fastened and that the load being lifted is balanced. Make sure that the crane, cables and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand. Use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See “How To Put The Lift Truck On Blocks” in the **OPERATING MANUAL** or the **PERIODIC MAINTENANCE** section.
- Keep the unit and working area clean and in order.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure that all nuts, bolts, snap rings and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE sign to the controls of the unit when making repairs or if the unit needs repairs.
- Make sure you follow the **DANGER, WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), and Diesel are flammable fuels. Make sure that you follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area has ventilation.

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This section is for the following models:

<u>Model</u>	<u>Serial Code</u>
S1.25–1.75XL (S25–35XL)	B10, Later Production
H1.25–1.75XL (H25–35XL)	C1, Later Production
S2.00–3.00XL (S40–60XL)	A187, B187, C187, All
H2.00–3.00XL (H40–60XL)	A177, Later Production
H2.00–3.00XL (H40–60XL)	B177, C177, All

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manual**

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**"THE
QUALITY
KEEPERS"**

**HYSTER
APPROVED
PARTS**

INTRODUCTION

GENERAL

This transmission design is used in the following lift trucks:

T41: S/H1.25–1.75XL (S/H25–35XL)

T42: S2.00–3.00XL (S40–60XL)

T43: H2.00–3.00XL (H40–60XL)

The operation and internal parts of the three transmissions are the same. The differentials for the three transmissions are different, but the repair procedures are similar.

Some lift trucks, S/H1.25–1.75XL (S/H25–35XL) and H2.00–3.00XL (H40–60XL), manufactured before 1985 have a different powershift transmission. This powershift transmission is easily identified because it has an oil filter on the left side of the transmission case.

See the section, **SINGLE-SPEED POWERSHIFT TRANSMISSION, 1300 SRM 75** for information on this earlier production transmission. The T41–43 series of powershift transmissions have an oil filter on top of the transmission control valve as shown in **FIGURE 1**.

This section has the repair procedures for the following parts of the transmission: the oil pump, clutch assemblies, control valve and the differential. The torque converter cannot be repaired.

The engine and transmission are normally removed as a unit for repairs. The engine can be removed separately for repairs. See the section, **THE FRAME, 100 SRM 254** for the procedures to remove and install the engine and transmission. See the section, **SINGLE-SPEED POWERSHIFT TRANSMISSION (DESCRIPTION AND OPERATION), 1300 SRM 255** for additional information on the operation of this transmission.

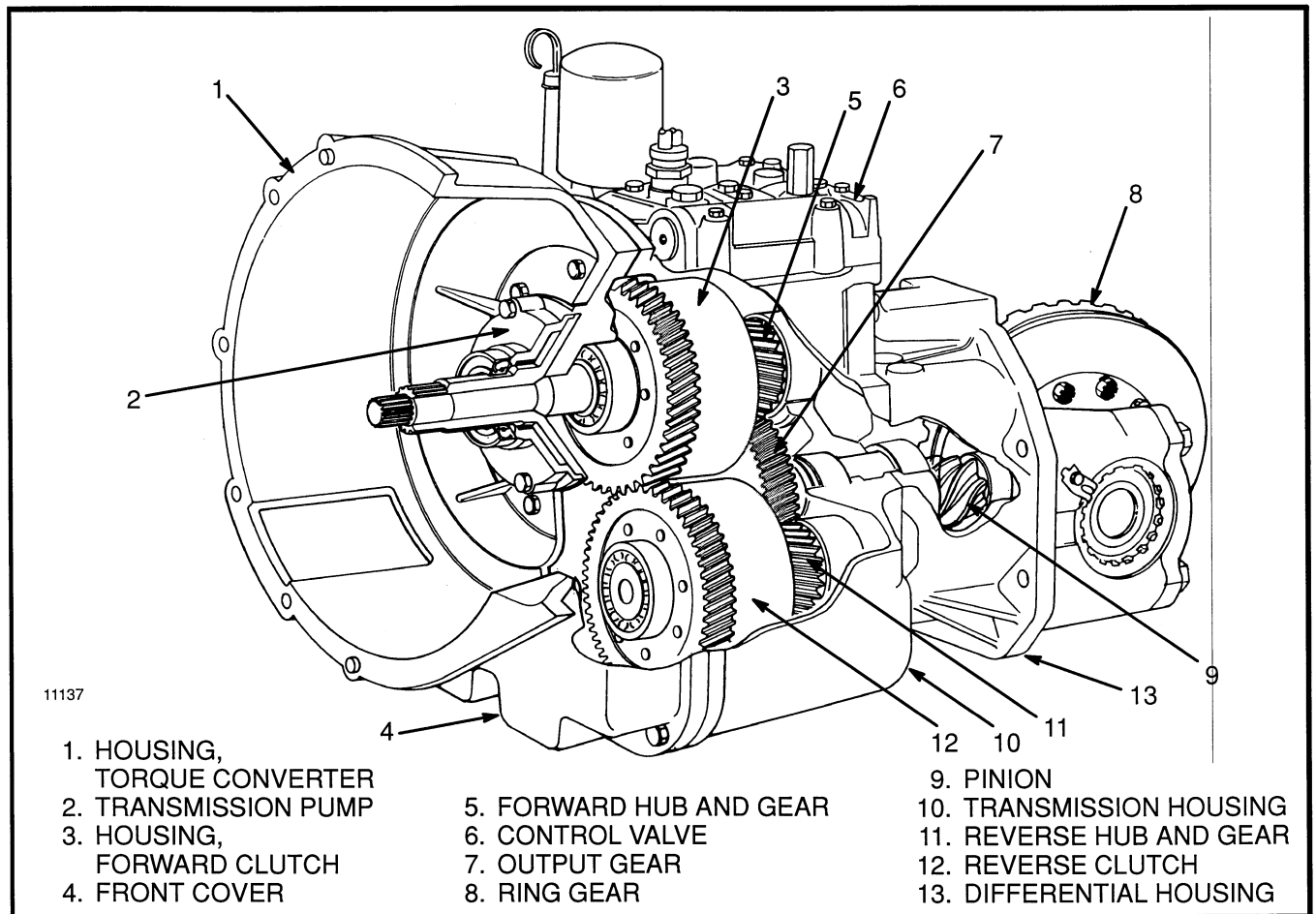


FIGURE 1. TRANSMISSION

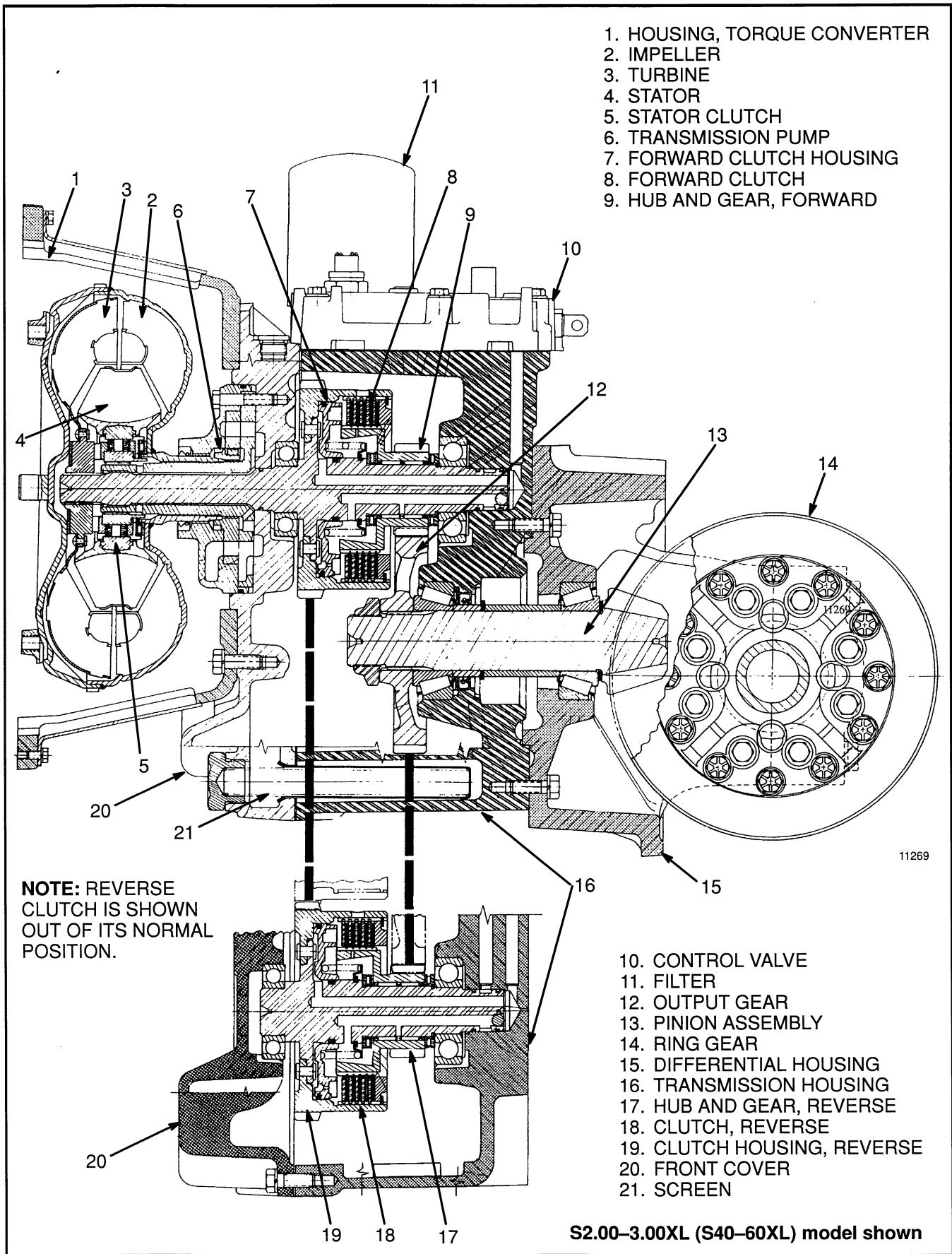


FIGURE 2. TRANSMISSION

REPAIRS

Put the engine and transmission on blocks on a work surface. Remove the capscrews that hold the torque converter housing to the engine.

WARNING

Make sure the engine and transmission are held so that they will not fall and cause an injury and damage to the equipment.

CAUTION

Be careful that you do not damage parts of the torque converter or transmission when the transmission is separated from the engine. Keep the transmission and engine in alignment until they are completely separated so that parts of the transmission are not damaged. Use a crane or lifting device to separate the transmission from the engine.

Torque Converter, Removal (See FIGURE 3.)

Remove the capscrews that hold the drive plate to the flywheel and remove the torque converter. Remove the capscrews and remove the drive plate from the torque converter.

Torque Converter, Installation

1. Lubricate the pilot hole in the flywheel and the pilot hub on the torque converter with anti-seize compound.
2. Tighten the capscrews that hold the torque converter to the drive plate to 45 N.m (33 lbf ft).
3. Install the torque converter on the transmission. Make sure the two tabs on the hub of the torque converter are correctly engaged with the oil pump.

CAUTION

The oil pump for the transmission can be damaged if the torque converter hub is not correctly engaged with the oil pump. When the flywheel housing and torque converter housing are joined, check the clearance between the drive plate for the torque converter and the flywheel before any bolts are installed. If the pilot hub on the torque converter is correctly engaged, there will be approximately 2 to 7 mm (0.08 to 0.25 in) clearance between the drive plate for the torque converter and the flywheel. If the drive plate is against the flywheel and there is still a space between the two housings, do not continue the installation until the problem is corrected.

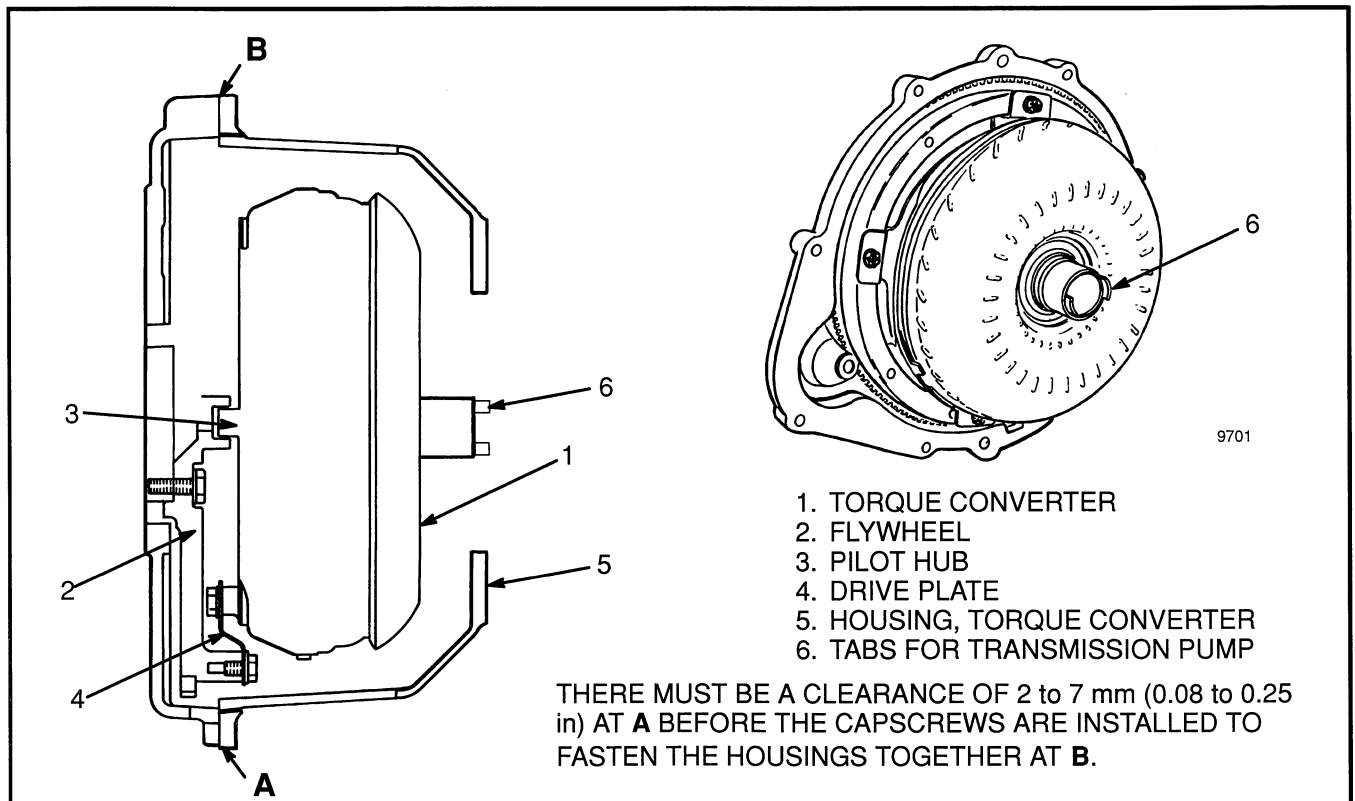


FIGURE 3. TORQUE CONVERTER, MOUNTING

4. Install the transmission on the engine. Check the clearance between the drive plate for the torque converter and the flywheel. Install the capscrews that hold the torque converter housing to the flywheel housing. Tighten the capscrews to 38 N.m (28 lbf ft).

5. Slide the torque converter to the flywheel and align the holes for the bolts. Install the capscrews that hold the drive plate to the flywheel. Tighten the capscrews to 45 N.m (33 lbf ft). Install the cover on the torque converter housing.

Front Cover And Transmission Pump, Removal and Disassembly (See FIGURE 5.)

NOTE: It is not necessary to remove the torque converter housing to remove transmission pump from the transmission. If the transmission pump is removed because the transmission must be disassembled for repairs, then remove the torque converter housing before removing the transmission pump.

1. The input shaft is part of the FORWARD clutch. The transmission pump must slide over the input shaft when it is removed. The transmission pump fits into a pilot bore. Sometimes a soft hammer or a hammer and wood drift must be used to loosen the transmission pump. Remove the transmission pump from the front cover.

2. Remove the two screws that hold the pump rotor in the pump body. Disassemble the transmission pump by removing the pump rotor and stator support from the pump body.

3. Remove the plugs and regulator valves from the front cover. Make notes so that the parts can be assembled again in the correct position.

4. The front cover is held in alignment with the transmission housing with dowel pins. Use a soft hammer to loosen the front cover from the transmission housing. Do not use a pry bar between the sealing surfaces or you

will cause oil leaks. Remove the front cover from the transmission housing.

Front Cover And Transmission Pump, Assembly and Installation

1. Install the relief valves and plugs in the front cover. Make sure the parts are installed in the correct ports. Make sure the ball bearings are installed correctly on the clutch shafts.

2. Install the front cover using a new gasket and a gasket sealant. Install the M10 x 1.5 capscrews and tighten them to 38 N.m (28 lbf ft).

3. Install the torque converter housing. Tighten the M10 x 1.5 capscrews to 38 N.m (28 lbf ft).

4. Use a sealant on the outside diameter of the seal, then install a new oil seal in the transmission pump for the stator support. Install an O-ring on the circumference of the pump body. Install the stator support and the rotor for the transmission pump.

5. Install the transmission pump on the front cover. Tighten the capscrews to 19 N.m (14 lbf ft).

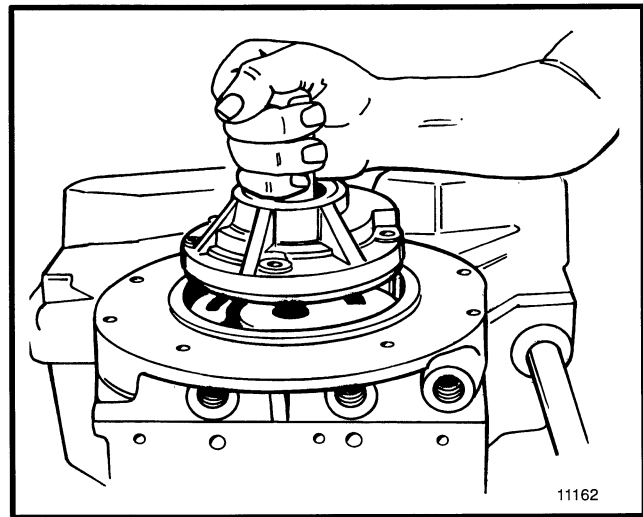


FIGURE 4. INSTALLATION OF THE TRANSMISSION PUMP

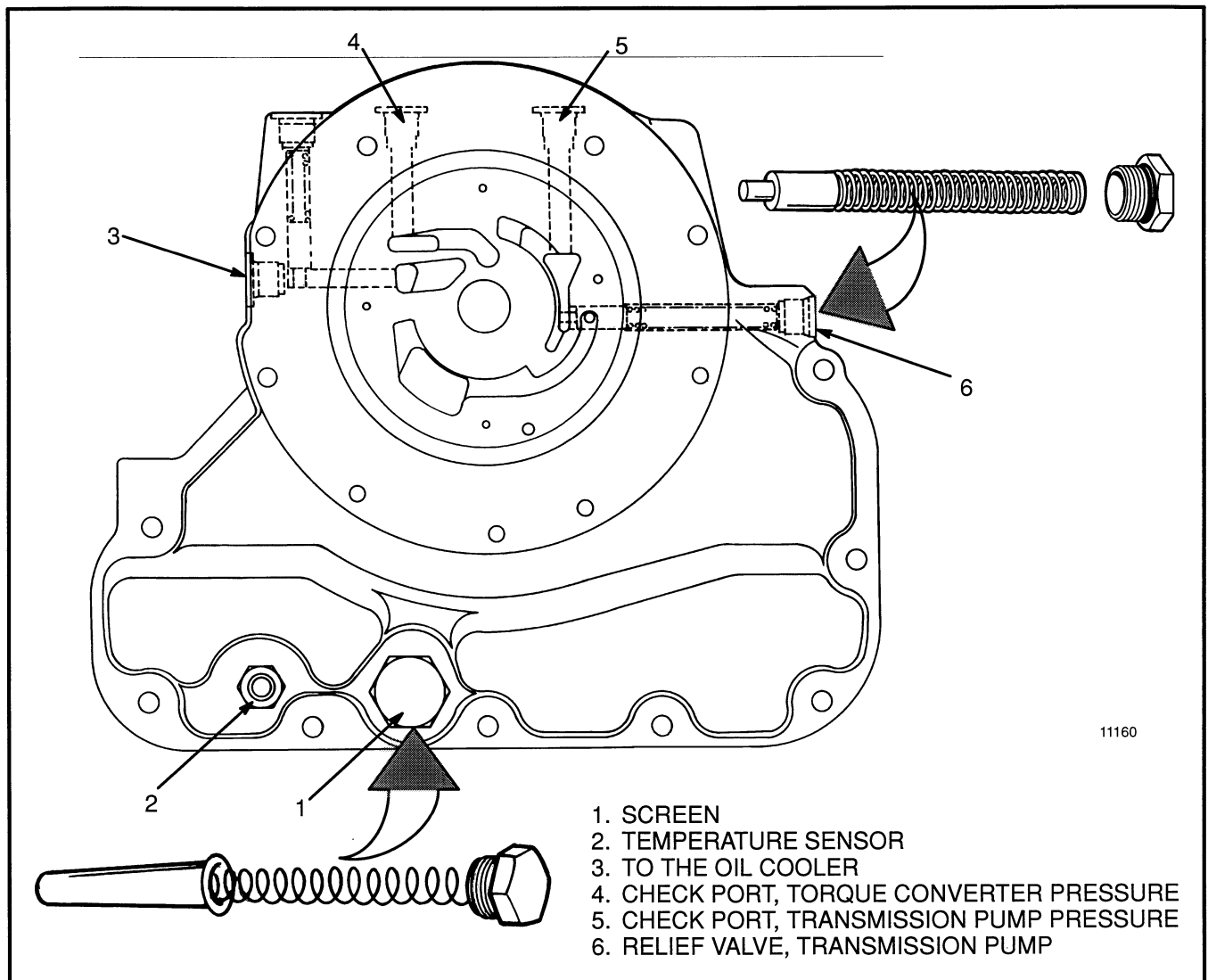


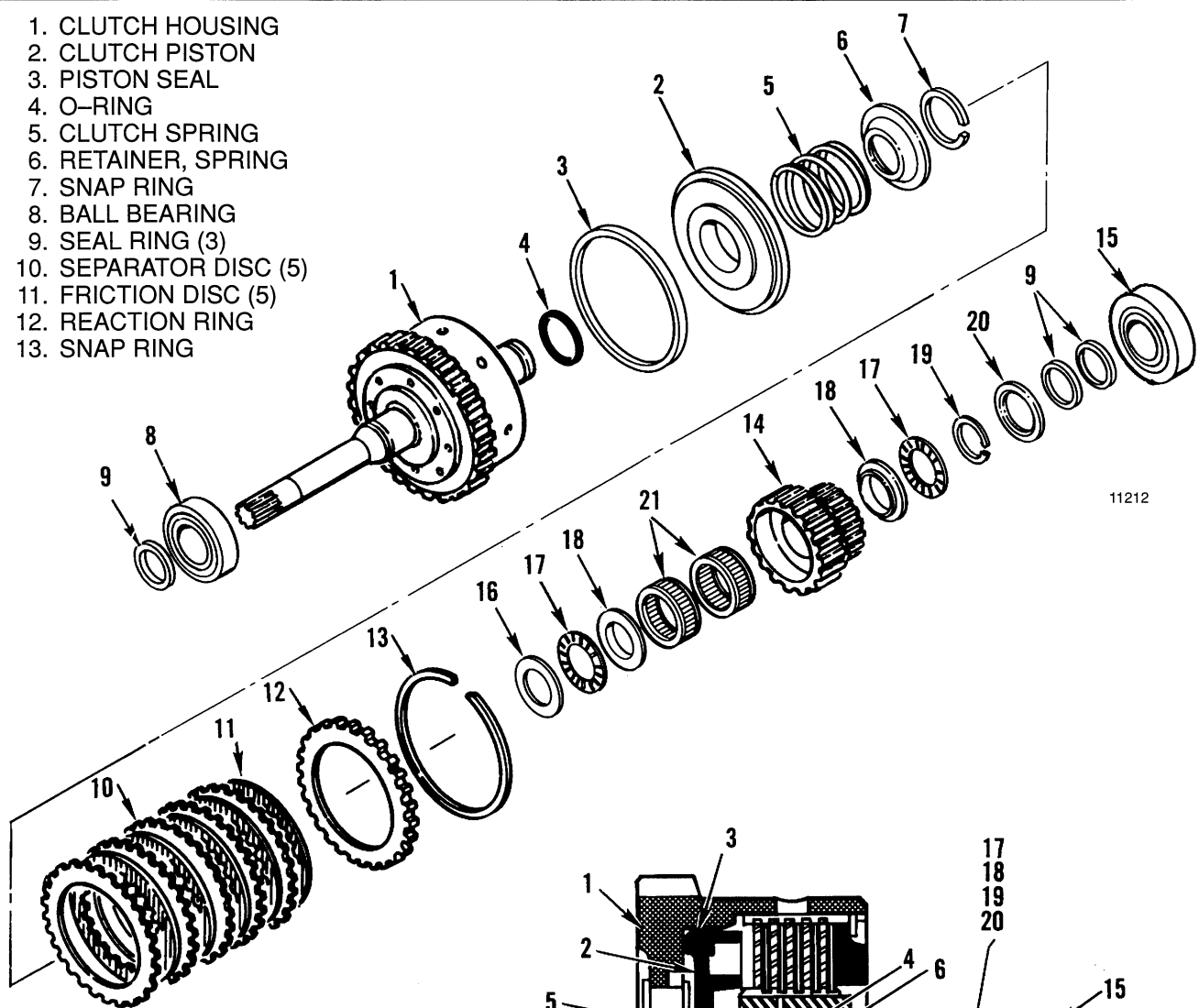
FIGURE 5. FRONT COVER OF THE TRANSMISSION

Clutch Assemblies, Removal and Disassembly (See FIGURE 7.)

NOTE: If the transmission pump does not require disassembly, the front cover and transmission pump can be removed from the transmission housing as a single unit.

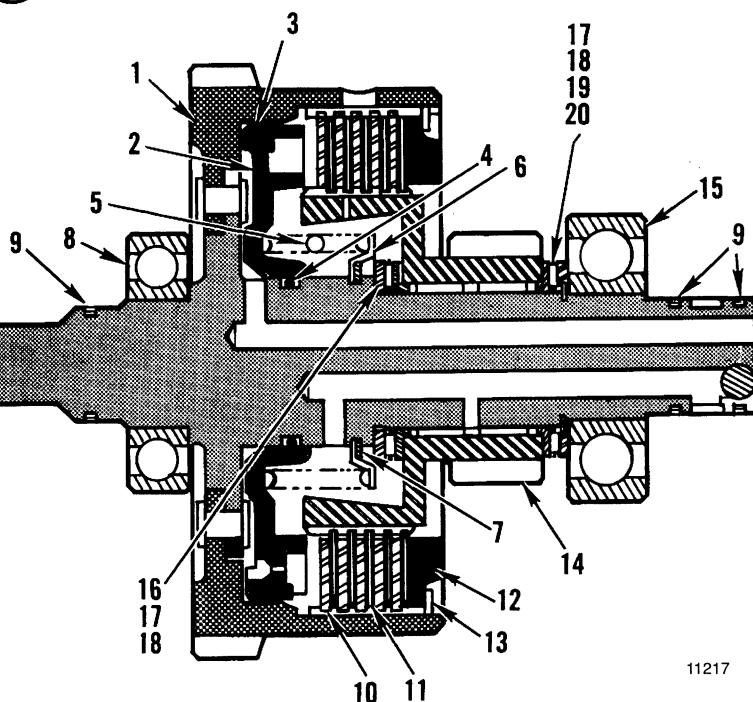
The FORWARD clutch assembly is shown in the photographs for this procedure. The procedure is similar for removal and disassembly of the REVERSE clutch assembly.

1. CLUTCH HOUSING
2. CLUTCH PISTON
3. PISTON SEAL
4. O-RING
5. CLUTCH SPRING
6. RETAINER, SPRING
7. SNAP RING
8. BALL BEARING
9. SEAL RING (3)
10. SEPARATOR DISC (5)
11. FRICTION DISC (5)
12. REACTION RING
13. SNAP RING



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14. HUB AND GEAR
15. BALL BEARING
16. THRUST WASHER
17. THRUST NEEDLE BEARING (2)
18. THRUST WASHER (2)
19. SNAP RING
20. THRUST WASHER
21. NEEDLE BEARINGS, HUB

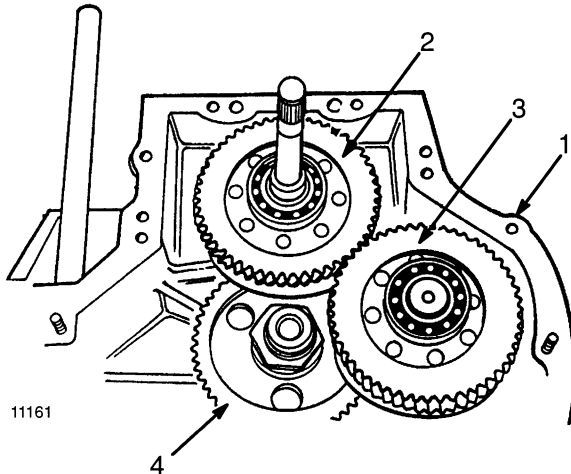


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NOTE: See Step 4 of FIGURE 8. for the needle bearing arrangement for the hub and gear.

FIGURE 6. CLUTCH ASSEMBLY

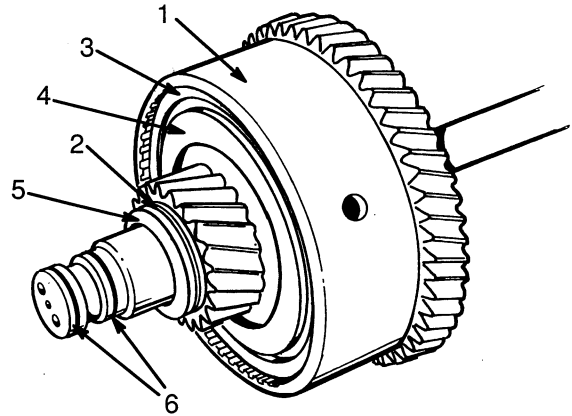
STEP 1. Remove the torque converter housing. Remove the transmission pump and front cover from the transmission housing as a unit. If the transmission pump and front cover must be disassembled, remove the oil pump from the front cover.



1. TRANSMISSION HOUSING
2. FORWARD CLUTCH ASSEMBLY
3. REVERSE CLUTCH ASSEMBLY
4. OUTPUT GEAR

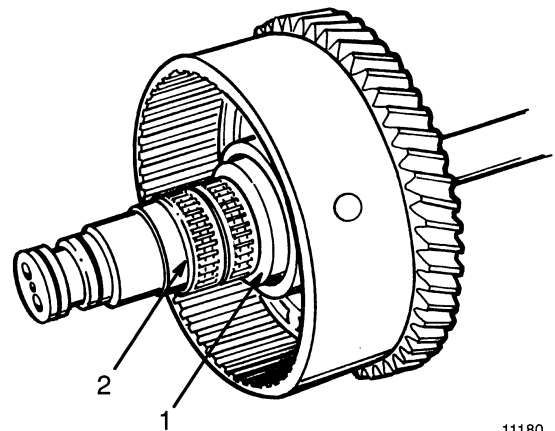
STEP 2. Pull the FORWARD clutch assembly straight from the transmission housing. Remove the REVERSE clutch assembly. Do not damage the seal rings on the end of the clutch shafts.

NOTE: Do not remove the output gear from the pinion shaft unless the differential must be repaired.



1. HUB AND GEAR
2. THRUST BEARING ASSEMBLY
3. SNAP RING
4. REACTION RING
5. SNAP RING
6. SEAL RINGS

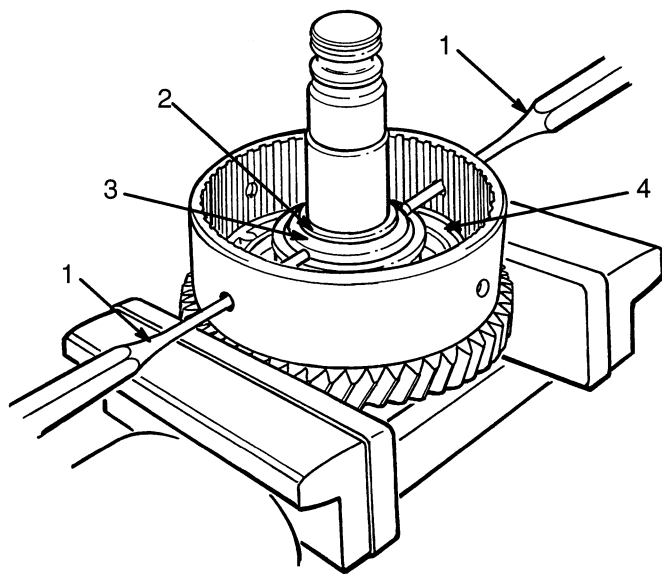
STEP 3. If the ball bearing did not stay in the transmission case, remove it from the clutch shaft. Remove the special thrust washer. Remove the snap ring, thrust washers, and thrust needle bearing. Remove the hub from the clutch assembly. Remove the large snap ring, then remove the reaction ring. Remove the friction discs and separator plates.



1. THRUST BEARING ASSEMBLY
2. NEEDLE BEARINGS

STEP 4. Remove the needle bearings from the shaft. Remove the other set of thrust washers and thrust needle bearing.

FIGURE 7. REMOVAL AND DISASSEMBLY OF CLUTCH ASSEMBLIES (1 OF 2)



1. PUNCH
2. SNAP RING
3. SPRING RETAINER
4. PISTON

11163



WARNING

The spring for the clutch is compressed. Make sure the spring and spring retainer are not suddenly released and cause injury when the snap ring is removed.

STEP 5. Remove the piston only if there is a problem with the piston or seals. Use two punches to push the spring retainer down. Remove the snap ring for the retainer. Remove the retainer, spring and piston.



CAUTION

Some service technicians make a special bracket so that the spring and retainer can be compressed in a press to remove the snap ring. The snap ring can also be removed by one person while another person compresses the spring and retainer.

STEP 6. Pull the piston from the clutch housing. Remove the seal from the circumference of the piston and the O-ring from the shaft.

NOTE: Some service technicians put the rubber tip of a low pressure air nozzle in the oil passage at the end of the clutch shaft to remove the piston. Apply air pressure to remove the piston from the clutch housing.

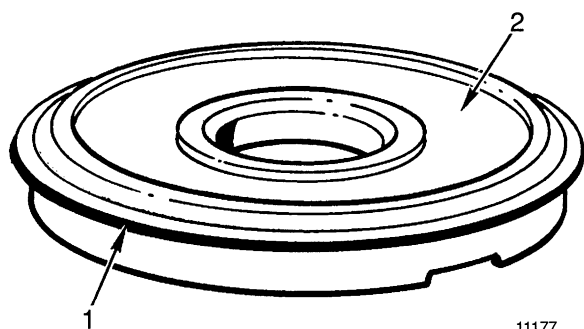
FIGURE 7. REMOVAL AND DISASSEMBLY OF CLUTCH ASSEMBLIES (2 of 2)

Clutch Assemblies, Inspection

1. Inspect the gears for the clutch assemblies and the differential gears for wear or damage.
2. Check all parts that have splines for damage to the splines. Check for notches worn in the splines.
3. Inspect the friction discs for burned lining or bent surfaces. Check for small holes in the lining. Replace the friction discs if one-half the depth of the oil grooves are worn away or the discs are damaged. Discard a friction disc that has a thickness less than 1.57 mm (0.060 in).

4. The separator plates must not be bent, have damaged surfaces, or have large blue areas from too much heat.
5. Inspect the bearings for wear or damage.
6. Inspect the piston for damage. Make sure that the sealing surfaces are good. Make sure the orifice is clean.
7. Check for grooves or other damage on the machined surfaces of the shaft. Check the seal rings for damage and wear. Check the seal ring surfaces in the housing for damage.

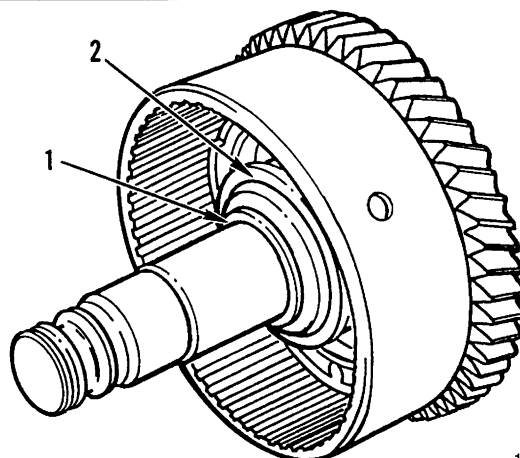
Clutch Assemblies, Assembly and Installation



11177

- 1. PISTON SEAL
- 2. PISTON

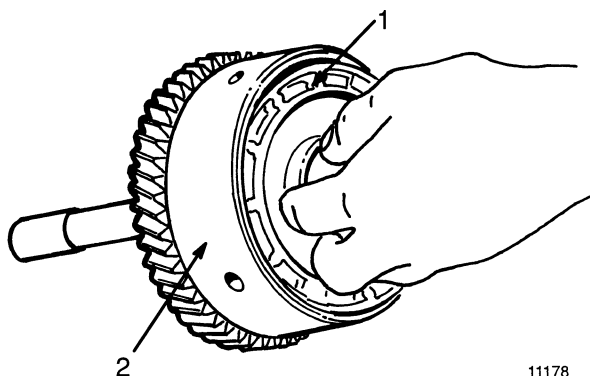
STEP 1. Lubricate all parts with transmission oil. Install the O-ring on the shaft and the seal in the piston. The lip of the seal must be towards the clutch housing.



11163

- 1. SNAP RING
- 2. SPRING RETAINER

STEP 3. Install the spring and retainer in the clutch housing. Compress the spring so that the snap ring can be installed. Install the snap ring that holds the retainer on the shaft.

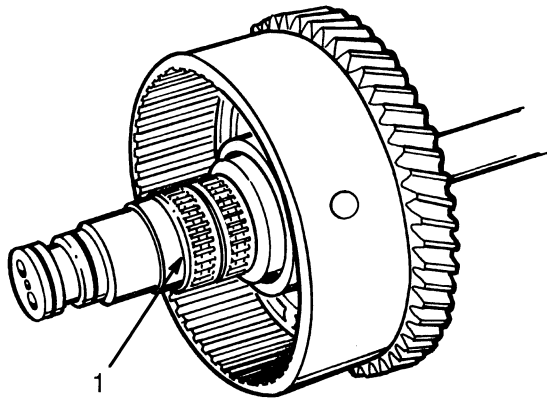


11178

- 1. PISTON
- 2. CLUTCH HOUSING

STEP 2. Put a strong rubber band on the piston seal to compress the lip of the piston seal for approximately 15 minutes. Remove the rubber band and quickly install piston in the clutch housing before the lip seal expands. Make sure the piston seal is not damaged during installation. A damaged piston seal will prevent the correct operation of the transmission and will require complete disassembly again for repairs.

FIGURE 8. ASSEMBLY AND INSTALLATION OF A CLUTCH ASSEMBLY (1 of 4)



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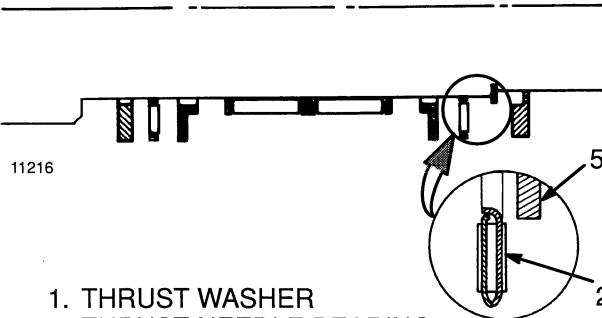
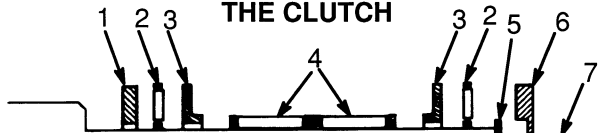
1. NEEDLE BEARINGS (HUB)*

STEP 4. Install the thrust washer assembly on the clutch shaft (see the needle bearing arrangement). Install the two sets of needle bearings for the hub on the shaft.

***NOTE:** On some transmissions, a one-piece needle bearing in a nylon cage (item 4) was used and the two thrust washers (item 3) were a special design for this bearing. If the thrust washers or the one-piece needle bearings are damaged or worn, these parts must be replaced with the following part numbers:

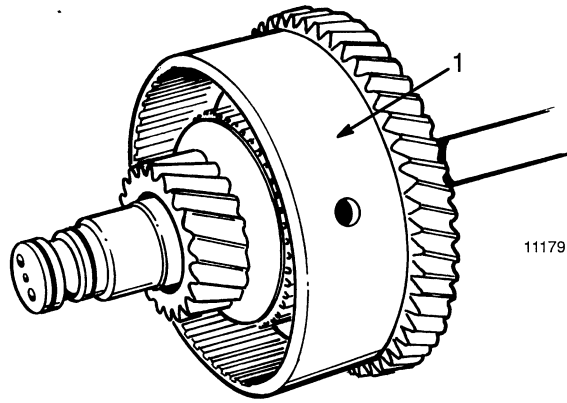
- (2) THRUST WASHER, Part No. 347767
- (2) NEEDLE BEARINGS, Part No. 334454

ARRANGEMENT OF NEEDLE BEARINGS IN THE CLUTCH



11216

- 1. THRUST WASHER
- 2. THRUST NEEDLE BEARING
- 3. THRUST WASHER*
- 4. NEEDLE BEARINGS (HUB)*
- 5. SNAP RING
- 6. THRUST WASHER
- 7. CLUTCH SHAFT

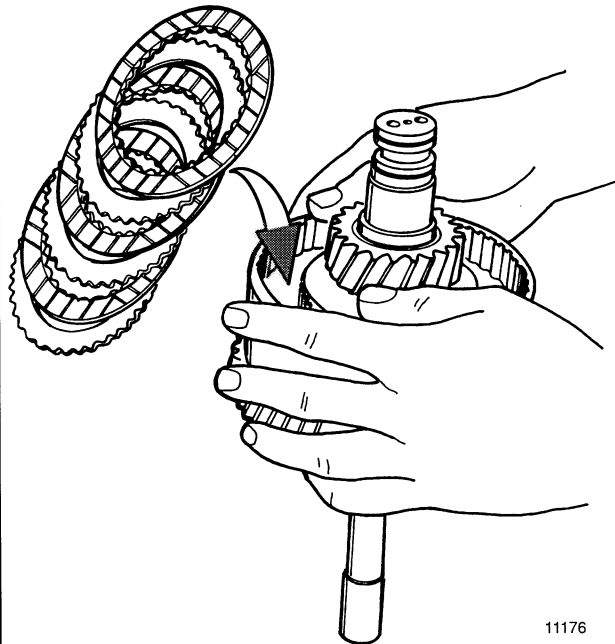


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1. HUB AND GEAR

STEP 5. Install the hub and gear on the clutch shaft. Install the second thrust washer and thrust needle bearings. Install the snap ring. See the thrust washer and thrust bearing arrangement in step 4.

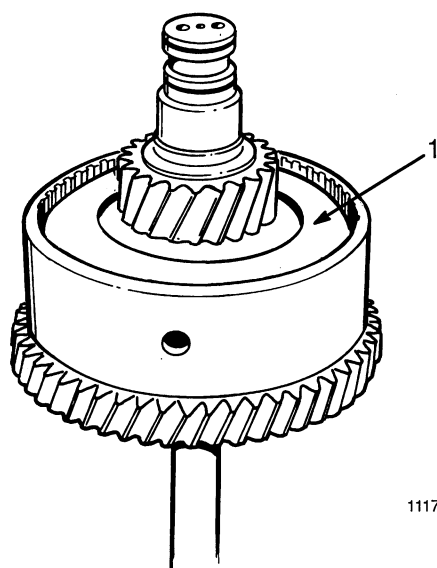
NOTE: Make sure the orientation of the cage of the thrust needle bearing and the snap ring is the same as shown in the arrangement in step 4.



11176

STEP 6. Install the separator plates (5) and friction discs (5). Begin with a separator plate against the piston and finish with a friction disk against the reaction ring.

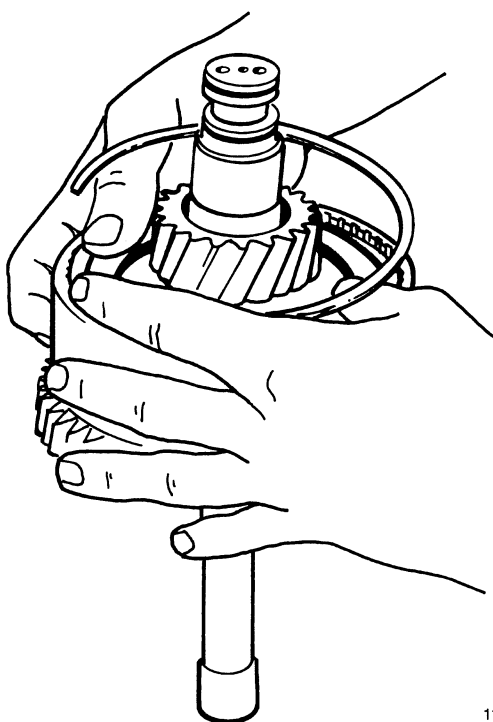
FIGURE 8. ASSEMBLY AND INSTALLATION OF A CLUTCH ASSEMBLY (2 of 4)



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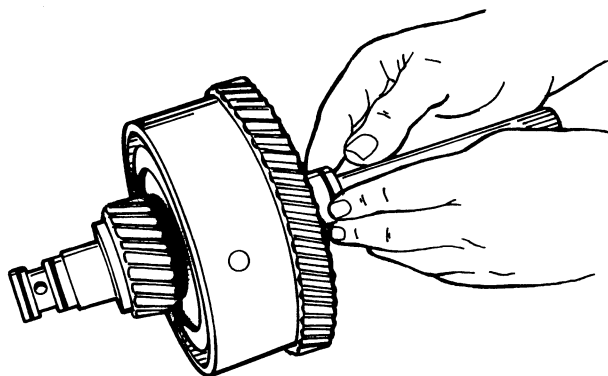
1. REACTION RING

STEP 7. Install the reaction ring.



11170

STEP 8. Install the snap ring. After assembly is complete, there must be 0.64 to 2.74 mm (0.025 to 0.108 in) clearance in the clutch assembly. Put a straight edge across the clutch housing and measure the movement of the reaction ring in the clutch housing.

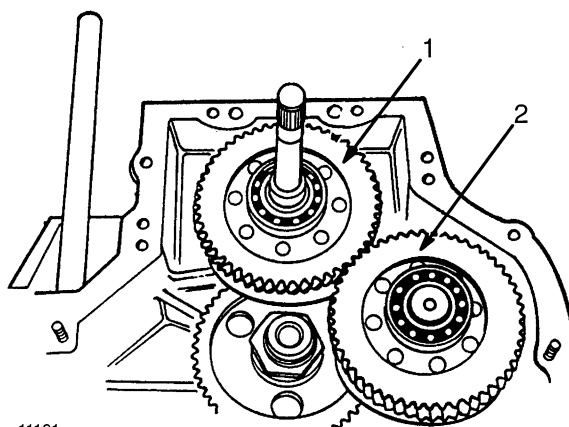


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STEP 9. Install the seal rings. The FORWARD clutch has one seal ring on the input shaft and two seal rings on the output end of the clutch shaft. The REVERSE clutch only has two seal rings on the output end of the clutch shaft.

STEP 10. Install the ball bearings on the end of the clutch shaft that goes into the front cover of the transmission. Install the seal rings on the shaft.

STEP 11. Make sure the special thrust washer is installed after the snap ring as shown in step 4. Install the ball bearing in the transmission housing.



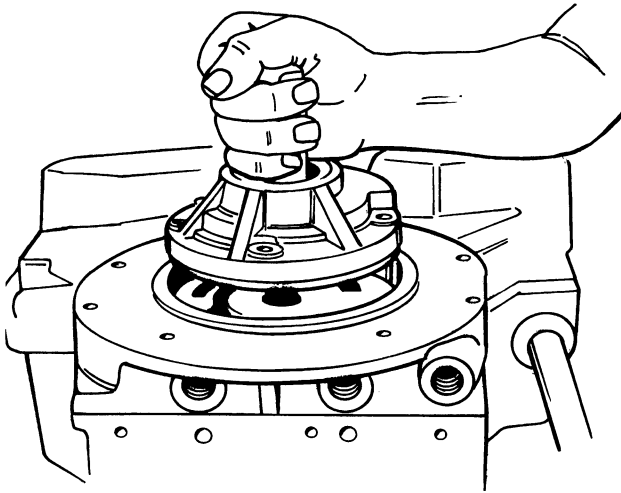
11161

1. FORWARD CLUTCH ASSEMBLY
2. REVERSE CLUTCH ASSEMBLY

STEP 12. Install the FORWARD and REVERSE clutch assemblies in the transmission housing. Make sure that the seal rings are not damaged when the clutch shafts are installed in the transmission housing.

FIGURE 8. ASSEMBLY AND INSTALLATION OF A CLUTCH ASSEMBLY (3 of 4)

STEP 13. Install the front cover. Use a new gasket and use gasket sealant on the metal surfaces. Tighten the capscrews to 38 N.m (28 lbf ft).



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STEP 14. Install the O-ring and the oil pump on the front cover. Tighten the capscrews to 19 N.m (14 lbf ft).

STEP 15. Install the torque converter housing on the transmission housing. Tighten the capscrews to 38 N.m (28 lbf ft).

STEP 16. Install the oil screen, spring and plug in the transmission housing.

FIGURE 8. ASSEMBLY AND INSTALLATION OF A CLUTCH ASSEMBLY (4 of 4)

Differential, Removal and Disassembly (See FIGURE 9.)

1. Disassemble only the parts of the differential that must be repaired. If the ring gear and pinion are not to be replaced, check the contact pattern before disassembly. The pattern and gear clearance are used as references for assembly. See the Differential, Assembly And Installation section for the procedures.

NOTE: Two types of nuts have been used on the pinion shaft. Early models have a “prevailing torque nut” while later models use a stake nut and hardened washer. Follow disassembly and assembly procedures carefully.

2. Loosen the nut for the output gear. When a stake nut is used, use a tool to remove the punch mark from the groove of the pinion shaft. The nut is tightened to 750 N.m (553 lbf ft).

NOTE: Some service technicians make a special tool from a discarded gear to hold the output gear when the nut is being installed or removed from the pinion shaft.

3. Loosen the thrust bolt for the ring gear. Remove the bearing caps, adjusting nuts and the differential assembly.

4. Use a hammer and soft driver to remove the pinion from the output gear and the transmission housing. Make a note of the shim and spacer arrangement. If the pinion will not be replaced, the shim and spacer arrangement will be approximately the same when the differential is assembled again.

5. Remove the bearings, oil seal, shims, and spacer from the transmission housing.

6. Remove the differential housing from the transmission housing.

7. Disassemble the differential as needed to make repairs. Remove the ring gear from the differential case. Remove the bolts from the differential halves and remove the spider gears and axle gears.

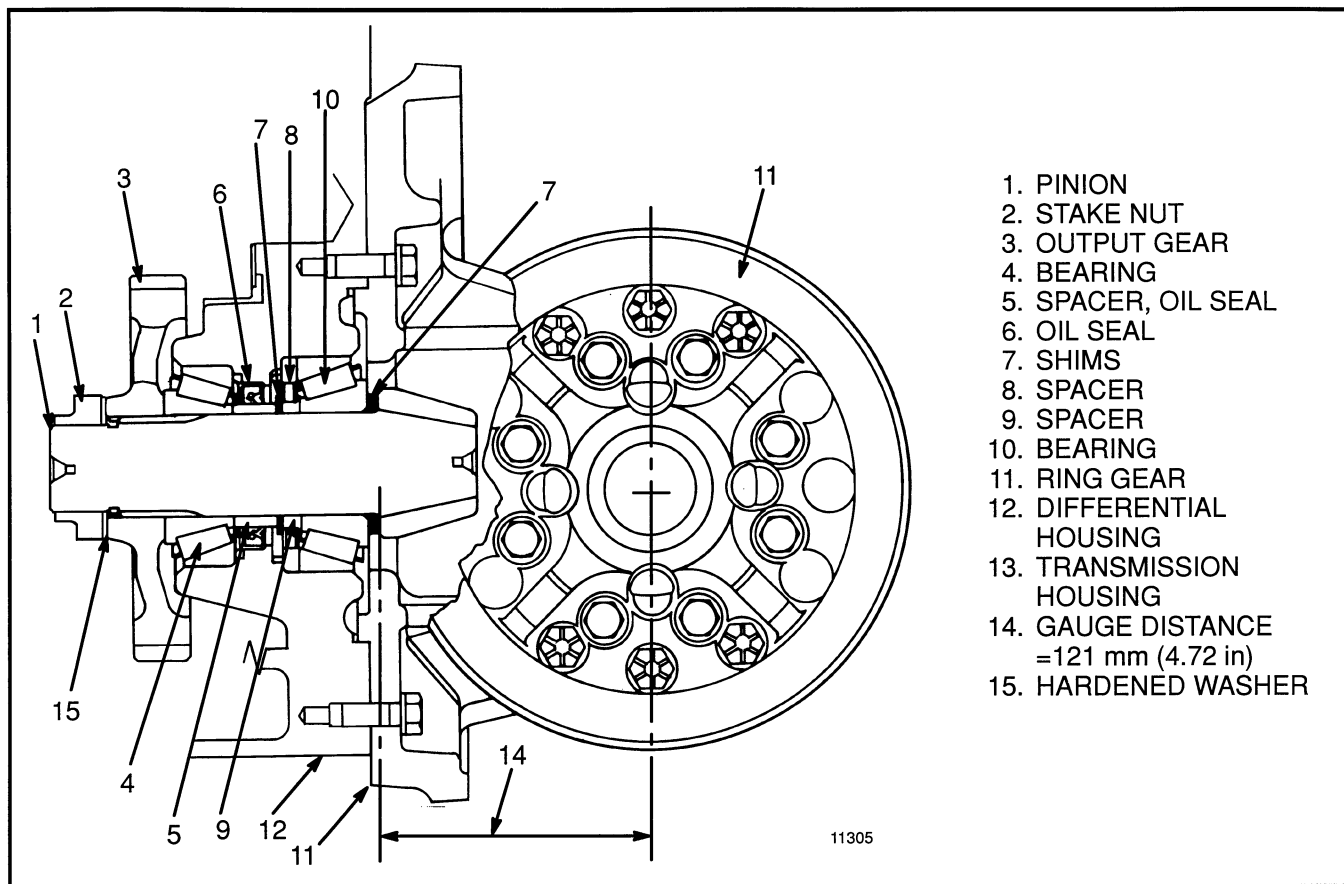


FIGURE 9. DIFFERENTIAL S/H1.25–1.75XL (S/H25–35XL)

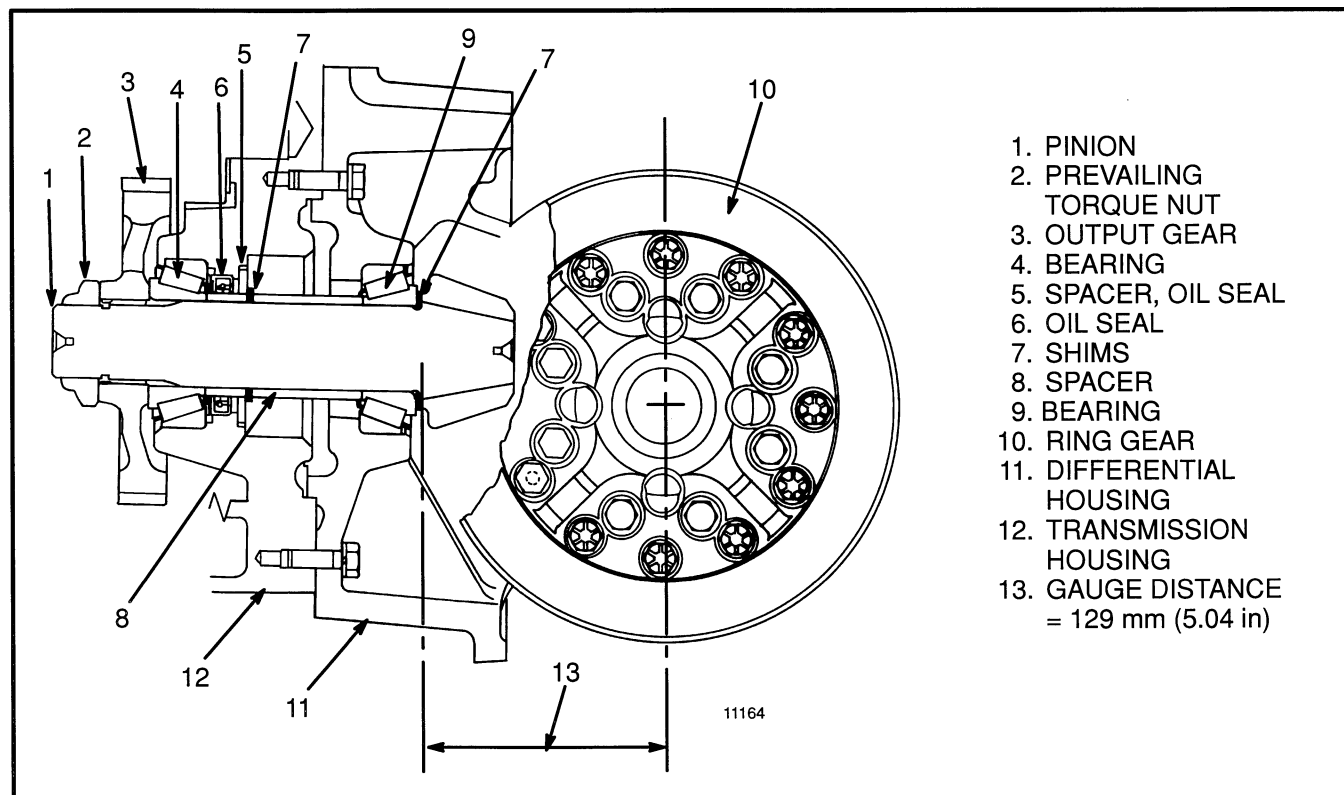


FIGURE 10. DIFFERENTIAL S2.00–3.00XL (S40–60XL)