SECTION 7B

MANUAL TRANSMISSION

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location View in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

NOTICE: Always use the correct fastener in the correct location. Use the correct fastener part number to replace a fastener. If the correct fastener part number is not available, a fastener of equal size and strength may be used. Do not use a fastener that is stronger when the correct fastener part number is not available in the following applications:

- ***Some bolts are designed to permanently stretch, and if a stronger fastener is used, the part will not be tightened correctly. These permanently stretching bolts will be called out. The correct part number fasteners must be used to replace this type of fastener because there is no available equivalent.***
- ***Other bolts are designed to break if over tightened to prevent part damage. If a stronger fastener is used part damage may occur.***

Fasteners that need to be replaced when removed will be called out. Fasteners that require thread lockers or thread sealant will be called out. The correct tightening specification and sequence must be used when installing fasteners. Part or system damage may occur if the above instructions are not followed.

CONTENTS

GENERAL DESCRIPTION

NEW VENTURE GEAR 4500

The New Venture Gear 4500 five-speed manual transmission provides synchronized shifting in all forward gears and constant mesh helical gearing for reduced noise.

Other features include an overspeed inhibitor from low to first gears, dual cone low, and first gear synchronizer.

NEW VENTURE GEAR 3500

The five-speed 85 mm overdrive transmission has a diecast aluminum case. The transmission gears are in constant mesh and all forward speeds are fully synchronized.

Gear shifting is done with a shift tower mounted shift lever.

DIAGNOSIS

Before repairing the transmission, check the clutch and shifting linkages to be sure the problem is in the transmission.

TRANSMISSION MOUNT

1. Raise the vehicle and try to move the extension housing up and down.
2. If the plate is loose on the crossmember, tighten the bolts.
3. If the rubber is split or spongy, replace the mount.

CLUTCH SPINDOWN TIME

1. Run the engine at a normal idle with the transmission in neutral and the clutch engaged.
2. Disengage the clutch, wait 9 seconds, and shift the transmission into reverse.
3. If a grinding noise is heard, check the clutch for the problem. Refer to SECTION 7C.

DIAGNOSIS OF MANUAL TRANSMISSION

PROBLEM	POSSIBLE CAUSE	CORRECTION
Transmission Shifts Hard	1. Shift rail binding.	1. Check for mispositioned selector arm roll pin, loose cover bolts, worn shift rail bores, worn shift rail, distorted oil seal, or extension housing not aligned with the case. Repair as necessary.
	2. Internal bind in the transmission caused by shift forks or synchronizer assemblies.	2. Remove, disassemble, and inspect the transmission. Replace worn or damaged components as necessary.
	3. Incorrect lubricant.	3. Drain and refill the transmission.
Gear Clash When Shifting From One Gear To Another	1. Lubricant level low or incorrect lubricant.	1. Drain and refill the transmission and check for lubricant leaks if the level was low. Repair as necessary.
	2. Gearshift components, or synchronizer assemblies worn or damaged.	2. Remove, disassemble, and inspect the transmission. Replace worn or damaged components as necessary.
	3. Clutch not fully disengaging.	3. Refer to Section 7C.
Transmission Noisy	1. Lubricant level low or incorrect lubricant.	1. Drain and refill the transmission. If lubricant level was low, check for leaks and repair as necessary.
	2. Clutch housing-to-engine, or transmission-to-clutch housing bolts loose.	2. Check and correct bolt torque as necessary.
	3. Gearshift mechanism, transmission gears, or bearing components worn or damaged.	3. Remove, disassemble, and inspect transmission. Replace worn or damaged components as necessary.
	4. Worn pilot bearing.	4. Refer to Section 7C.
Jumps Out Of Gear	1. Gearshift mechanism, shift forks, shift rail, springs, or shift cover worn or damaged.	1. Remove and inspect the transmission cover assembly. Replace worn or damaged cover assembly.
	2. Gear teeth worn or tapered, synchronizer assemblies worn or damaged, excessive end play caused by worn thrust washers or output shaft gears.	2. Remove, disassemble, and inspect the transmission. Replace worn or damaged components as necessary.
Will Not Shift Into One Gear	1. Gearshift lever or shift mechanism in the cover worn, damaged, or incorrectly assembled.	1. Remove and inspect the transmission cover assembly. Replace worn or damaged cover assembly.
	2. Synchronizer sleeves or hubs damaged or worn.	2. Remove, disassemble, and inspect the transmission. Replace worn or damaged components.

DIAGNOSIS OF MANUAL TRANSMISSION (cont'd)

PROBLEM	POSSIBLE CAUSE	CORRECTION
Locked In One Gear--Cannot Be Shifted Out	1. Shift rail(s) worn or broken, shifter fork bent or worn. 2. Gearshift lever worn, shift mechanism in the cover incorrectly assembled or broken, worn or damaged gear train components.	1. Inspect and replace worn or damaged parts. 2. Disassemble the transmission. Replace damaged parts or assemble correctly.
		D0312

ON-VEHICLE SERVICE

DRAIN AND FILL

Remove or Disconnect

- Raise the vehicle.

1. Filler plug.
2. Drain plug or the lower PTO cover bolt (4500 models).
3. Transmission oil.
   - Catch the oil in a suitable container.

Install or Connect

NOTICE: For steps 1 and 3, refer to "Notice" on page 7B-1.

1. Drain plug or lower PTO cover bolt (4500 models).

Tighten

- PTO cover bolt to 41 N·m (30 lbs. ft.) (New Venture Gear 4500 models).
- Drain plug to 60 N·m (46 lbs. ft.) (New Venture Gear 3500 models).

2. New transmission oil.
   - Fill to the level of the fill plug hole. Refer to "Specifications."
3. Filler plug.

Tighten

- Filler plug to 41 N·m (30 lbs. ft.) (New Venture Gear 4500 models).
- Filler plug to 60 N·m (46 lbs. ft.) (New Venture Gear 3500 models.

- Lower the vehicle.

SHIFT CONTROL LEVER REPLACEMENT

Remove or Disconnect (Figures 1 and 2)

1. Shift boot retainer screws and the retainer.
2. Shift boot screws.
3. Transmission shift control lever boot.

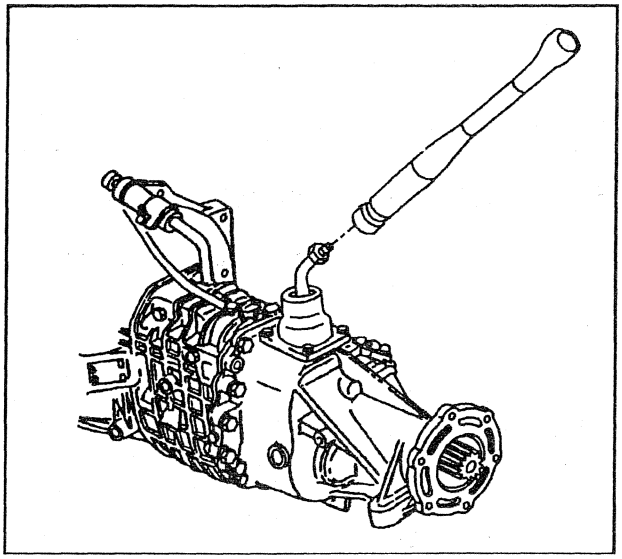


Figure 1—Shift Lever (New Venture Gear 3500 Transmission)

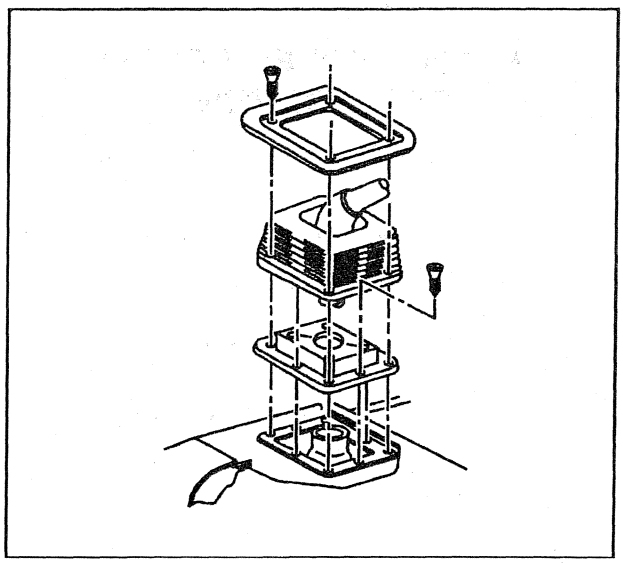


Figure 2—Shift Lever Boot (New Venture Gear 3500 and 4500 Transmissions)

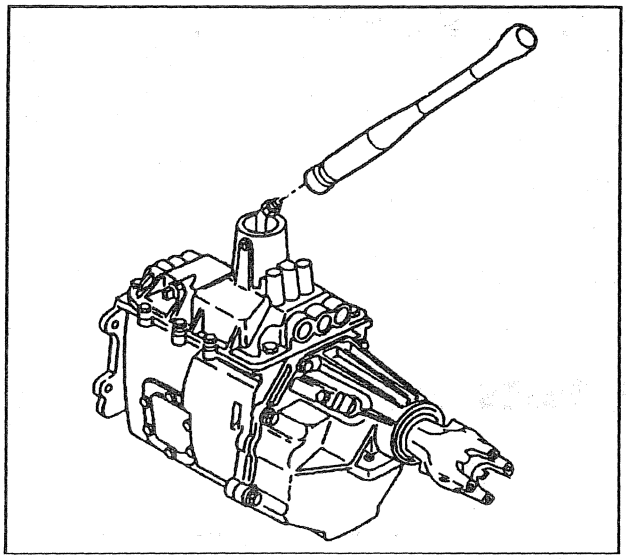


Figure 3—Shift Lever (New venture Gear 4500 Transmission)

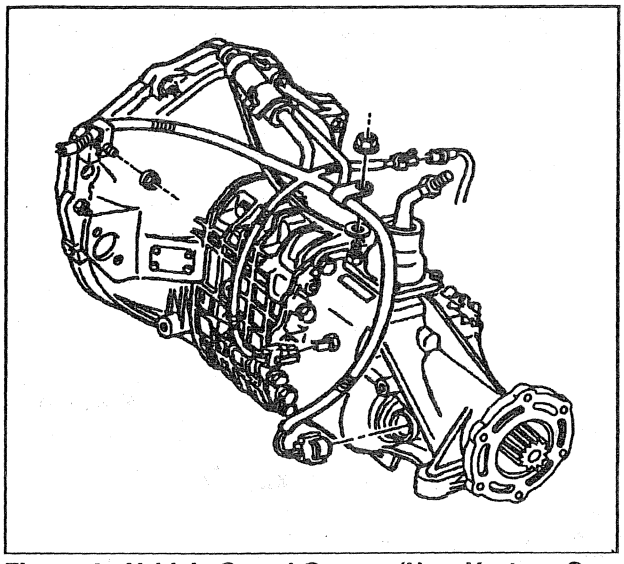


Figure 4—Vehicle Speed Sensor (New Venture Gear 3500 Transmission)

4. Insulator.
5. Control lever.

Install or Connect (Figures 1, 2 and 3)

NOTICE: For steps 4 and 5, refer to "Notice" on page 7B-1.

1. Control lever.
2. Insulator.
3. Transmission shift control lever boot.
4. Shift boot screws.

Tighten

- Screws to 1.9 N·m (17 lbs. in.).

5. Shift boot retainer and screws.

Tighten

- Screws to 1.9 N·m (17 lbs. in.).

VEHICLE SPEED SENSOR REPLACEMENT

Remove or Disconnect (Figures 4 and 5)

- Raise the vehicle.

1. Harness connector from the vehicle speed sensor.
2. Bolt, if used.
   - Place drain pan under transmission to catch fluid.
3. Speed sensor from the transmission.
4. O-ring seal.

Install or Connect (Figures 4 and 5)

1. New O-ring seal.
   - Coat the seal with a thin film of transmission oil.
2. Speed sensor.
3. Bolt, if used.
4. Harness connector to the vehicle speed sensor.

- Lower the vehicle.

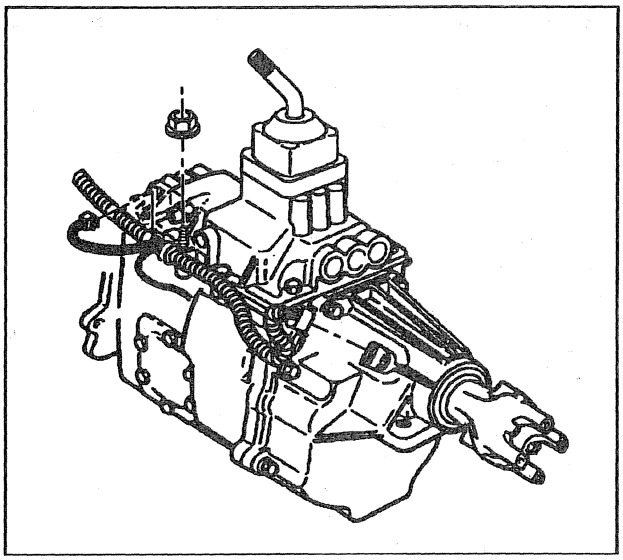


Figure 5—Vehicle Speed Sensor (New Venture Gear 4500 Transmission)

BACKUP LAMP SWITCH REPLACEMENT

Remove or Disconnect (Figures 4 and 5)

- Raise the vehicle.

1. Harness connector from the backup lamp switch.
2. Backup lamp switch.
3. O-ring seal.

Install or Connect (Figures 4 and 5)

1. New O-ring seal.
   - Coat new seal with thin film of transmission fluid.

NOTICE: Refer to "Notice" on page 7B-1.

2. Backup lamp switch.

Tighten

- Backup lamp switch to 28 N·m (21 lbs. ft.).

3. Harness connector to the backup lamp switch.
- Lower the vehicle.

EXTENSION OIL SEAL REPLACEMENT

NEW VENTURE GEAR 3500 TRANSMISSION

Two-Wheel Drive Models

Remove or Disconnect (Figure 6)

Tools Required:
J 23907 Universal Slide Hammer
J 26941 Output Shaft Seal Remover

- Raise the vehicle.

1. Transmission oil. Refer to "Drain and Fill."
2. Propeller shaft. Refer to SECTION 4A.
3. Seal, using J 23907 and J 26941 (figure 6).

Install or Connect (Figure 7)

Tool Required:
J 36503 Extension Housing Seal Installer

1. New seal, using J 36503 (figure 7).
   - Fill between the seal lips with chassis grease.
2. Propeller shaft. Refer to SECTION 4A.
3. New transmission oil. Refer to "Drain and Fill."
- Lower the vehicle.

Four-Wheel Drive Models

Remove or Disconnect (Figure 8)

Tools Required:
J 23907 Universal Slide Hammer
J 36825 Output Shaft Seal Remover

- Raise the vehicle.

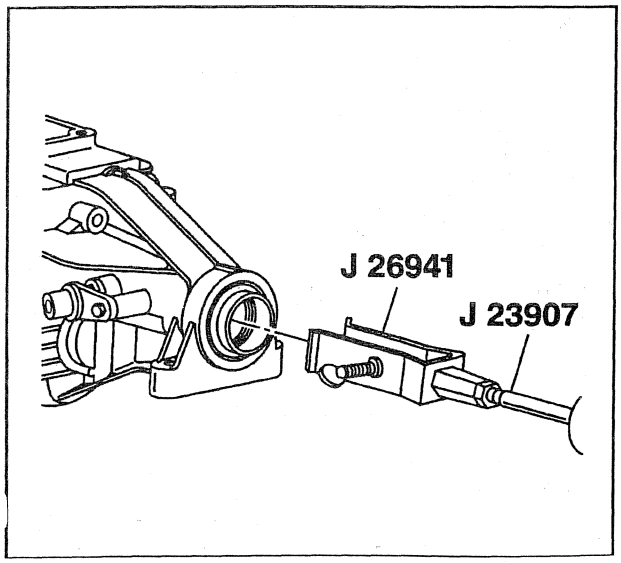


Figure 6—Extension Housing Seal Removal (2WD Models)

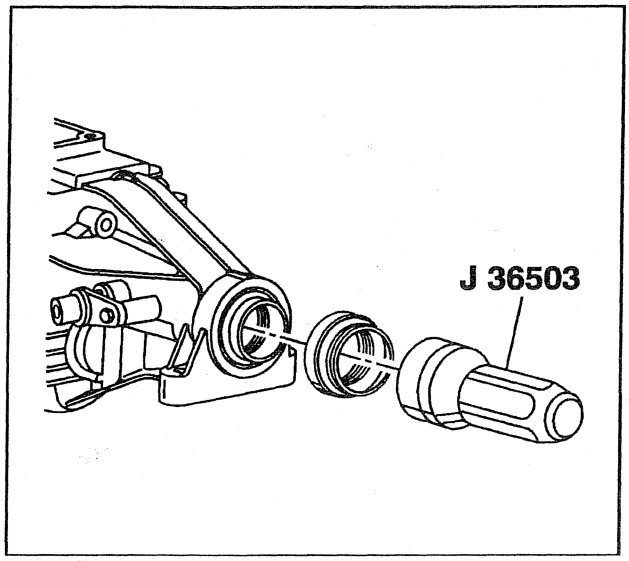


Figure 7—Extension Housing Seal Installation (2WD Models)

1. Transmission oil. Refer to "Drain and Fill."
2. Propeller shaft. Refer to SECTION 4A.
3. Seal, using J 23907 and J 36825 (figure 8).

Install or Connect (Figure 9)

Tool Required:
J 36502-A Extension Housing Seal Installer

- Install seal protector J 36502-2A onto output shaft.

1. New seal, using J 36502-1 (figure 9).
   - Fill between the seal lips with chassis grease.
   - Remove seal protector J 36502-2A.
2. Propeller shaft. Refer to SECTION 4A.
3. New transmission oil. Refer to "Drain and Fill."

- Lower the vehicle.

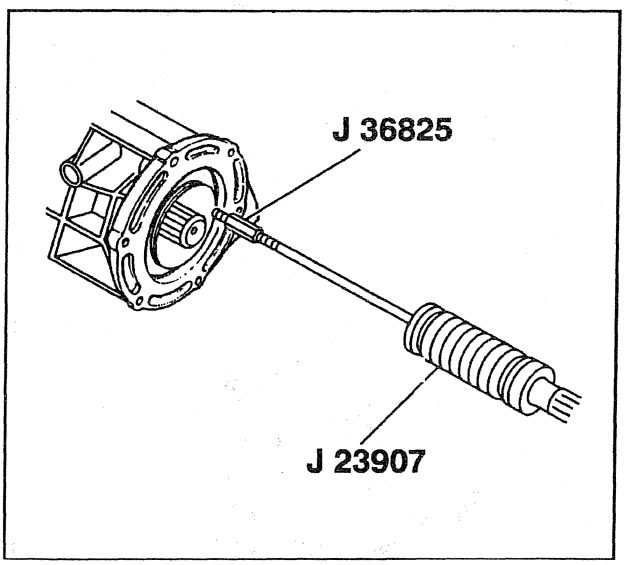


Figure 8—Extension Housing Seal Removal (4WD Models)

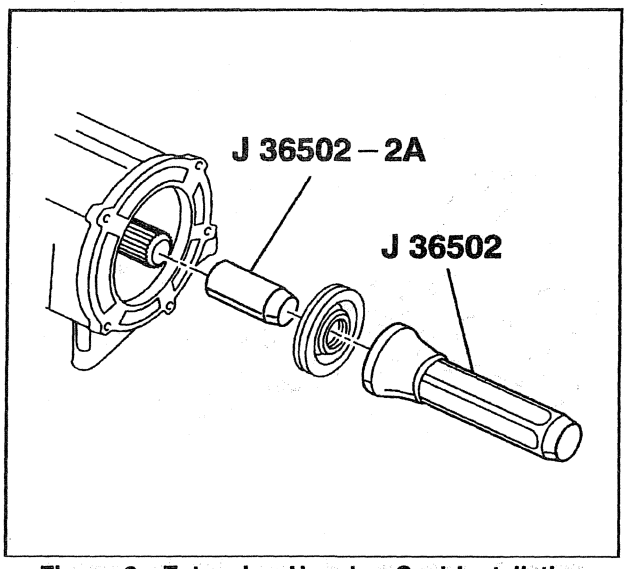


Figure 9—Extension Housing Seal Installation (4WD Models)

NEW VENTURE GEAR 4500 TRANSMISSION

Remove or Disconnect (Figure 10)

- Raise the vehicle.

1. Transmission oil. Refer to "Drain and Fill."
2. Propeller shaft. Refer to SECTION 4A.
3. Parking brake, if used. Refer to SECTION 5F.
4. Yoke nut and washers.
5. Yoke.
6. Seal.

Install or Connect (Figure 10)

Tool Required:
J 22834 Extension Housing Seal Installer

1. New seal, using J 22834.
2. Yoke.

NOTICE: Refer to "Notice" on page 7B-1.

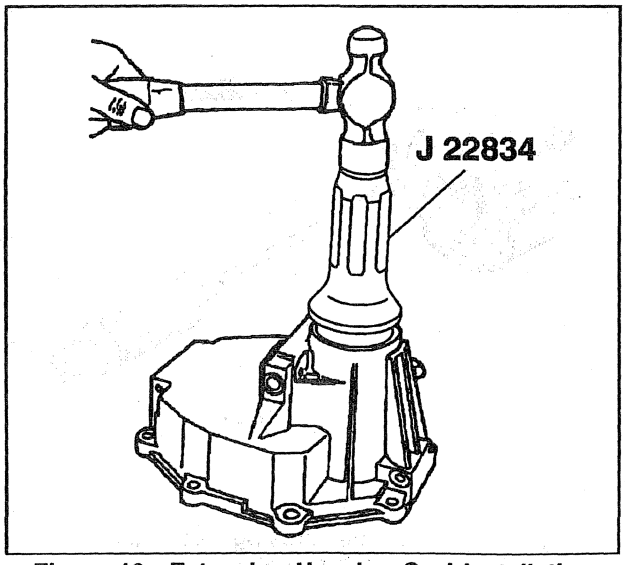


Figure 10—Extension Housing Seal Installation

3. Washers and yoke nut.

Tighten

- Yoke nut to 441 N.m (325 lbs. ft.).

4. Parking brake, if used. Refer to SECTION 5F.
5. Propeller shaft. Refer to SECTION 4A.
6. Transmission oil. Refer to "Drain and Fill."

- Lower the vehicle.

TRANSMISSION REPLACEMENT

Remove or Disconnect (Figures 11 and 12)

1. Shift control lever, as used. Refer to "Shift Control Lever Replacement."
   - Raise the vehicle.
2. Transmission oil. Refer to "Drain and Fill."
3. Propeller shaft. Refer to SECTION 4A.
4. Transfer case, if used. Refer to SECTION 7D.
5. Parking brake and controls, if used. Refer to SECTION 5F.
6. Exhaust pipes, if necessary. Refer to SECTION 6F.
7. Electrical harnesses, as necessary.
8. Clutch slave cylinder and lay it aside. Refer to SECTION 7C.
9. Bolts and the inspection cover (3500 transmission).
10. Transmission vent hose (4500 transmission).

Important

- Note the positions of any lines or wires before removing them.
- Support the transmission with a jack.

11. Shift lever ball socket (figure 12) (4500 transmission).
12. Crossmember to transmission mount.
13. Crossmember.
14. Transmission to the clutch housing bolts and washers, as used.
15. Transmission.

Important

- Do not let the transmission hang from the clutch.
- Pull the transmission straight back on the clutch hub splines.

Install or Connect (Figures 11, 12, 13 and 14)

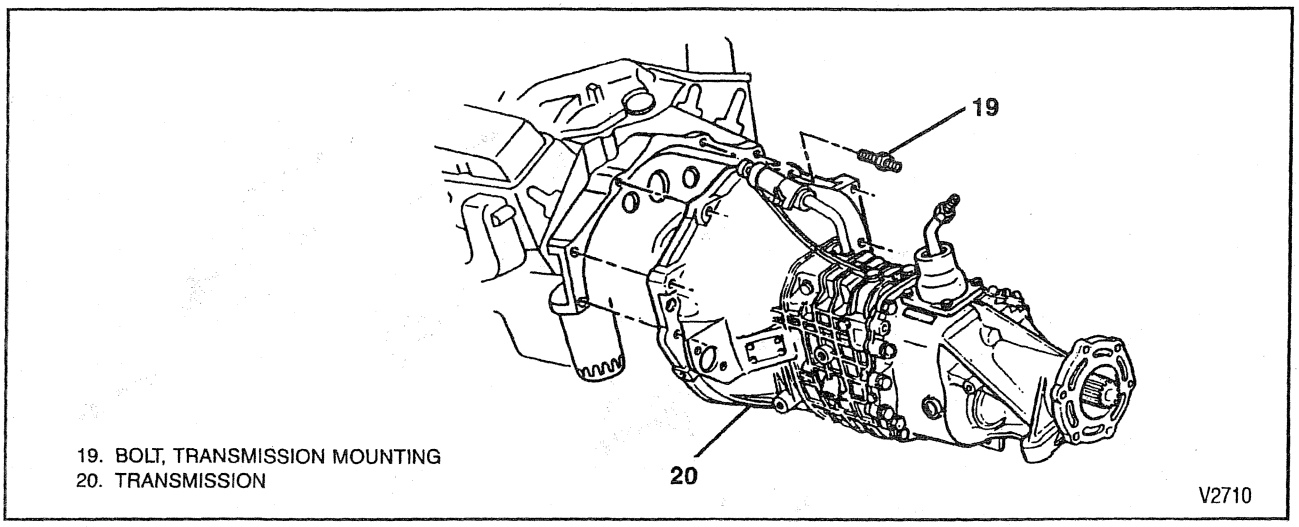
NOTICE: For steps 2 and 4, refer to "Notice" on page 7B-1.

- Shift the transmission into "Neutral" before installing.

1. Transmission.

Important

- Do not force the transmission into the clutch.
- Do not let the transmission hang from the clutch. Leave the jack under the transmission to support it.



19. BOLT, TRANSMISSION MOUNTING
20. TRANSMISSION

Figure 11—Transmission Installation (New Venture Gear 3500) - 4WD Models

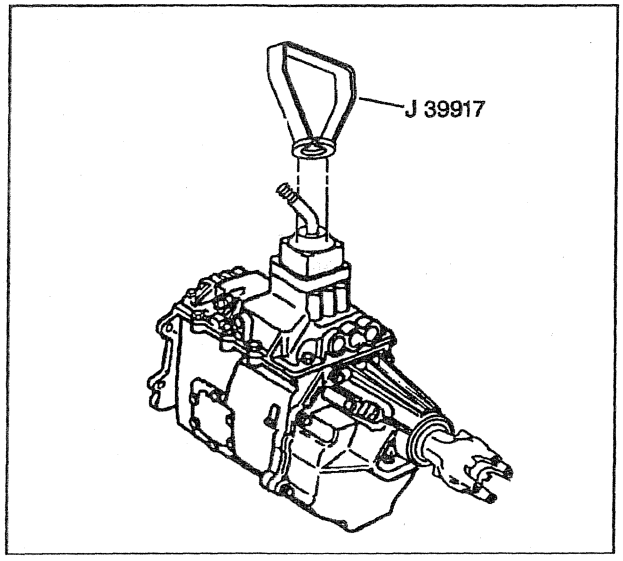


Figure 12—Removal of Shift Lever Ball Socket

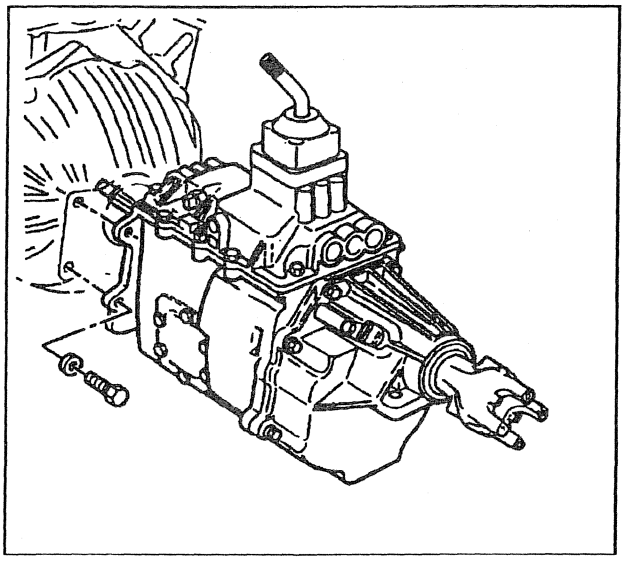


Figure 13—Transmission Installation (New Venture Gear 4500) - 2WD Models

2. Transmission to the clutch housing washers and bolts, as used.

Tighten

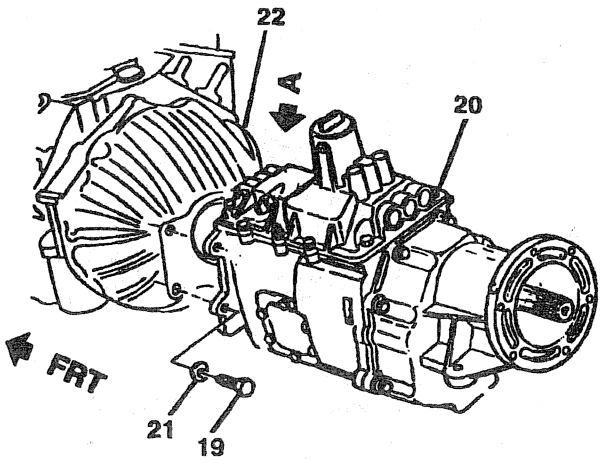
- Bolts (19). Refer to "Specifications."

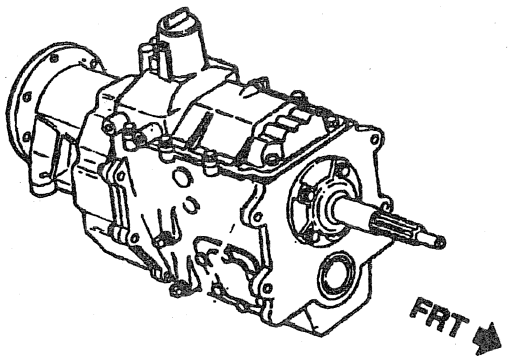
3. Crossmember.
   - Remove the jack.
4. Bolts and the inspection cover (3500 transmission).

Tighten

- Bolts to 18 N·m (13 lbs. ft.).

5. Transmission vent hose (4500 transmission).
6. Clutch slave cylinder. Refer to SECTION 7C.
7. Electrical harnesses, as necessary.
8. Exhaust pipes, if necessary. Refer to SECTION 6F.
9. Parking brake and controls, if used. Refer to SECTION 5F.
10. Transfer case, if used. Refer to SECTION 7D.
11. Propeller shaft. Refer to SECTION 4A.
    - Lower the vehicle.
12. Shift control lever, as used. Refer to "Shift Control Lever Replacement."
13. New transmission oil. Refer to "Drain and Fill."





VIEW A

19. BOLT, 100 N·m (74 LBS. FT.)
20. TRANSMISSION
21. WASHER, TRANSMISSION MOUNTING
22. HOUSING, CLUTCH

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Figure 14—Transmission Installation (New Venture Gear 4500) - 4WD Models

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Backup Lamp Switch	28 N·m (21 lbs. ft.)
Inspection Cover Mounting Bolts	18 N·m (13 lbs. ft.)
Oil Drain Plug (New Venture 3500)	60 N·m (46 lbs. ft.)
Oil Fill Plug (New Venture 4500)	41 N·m (30 lbs. ft.)
Oil Fill Plug (New Venture 3500)	60 N·m (46 lbs. ft.)
PTO Cover Bolt (New Venture 4500)	41 N·m (30 lbs. ft.)
Transmission to Clutch Housing Bolts (New Venture 4500)	100 N·m (74 lbs. ft.)
Transmission to Engine Bolts (New Venture 3500)	47 N·m (35 lbs. ft.)
Yoke Nut (New Venture 4500)	441 N·m (325 lbs. ft.)

LUBRICATION SPECIFICATIONS

New Venture Gear 4500 Manual Transmission

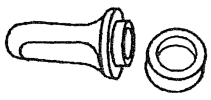
Capacity	3.78L (4.0 Qts.)
Type Recommended	Castrol Syntorq GL-4 Transmission Fluid

New Venture Gear 3500 Manual Transmission

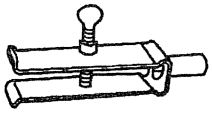
Capacity	1.98L (2.0 Qts.)
Type Recommended	Synchromesh Transmission Fluid

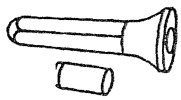
T2850

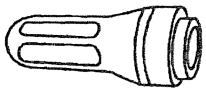
SPECIAL TOOLS

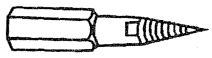
1.  J 22834

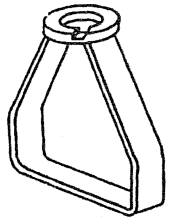
2.  J 23907

3.  J 26941

4.  J 36502–A

5.  J 36503

6.  J 36825

7.  J 39917

1. EXTENSION HOUSING SEAL INSTALLER
2. SLIDE HAMMER
3. OUTPUT SHAFT OIL SEAL REMOVER
4. EXTENSION HOUSING SEAL INSTALLER
5. EXTENSION HOUSING SEAL INSTALLER
6. OUTPUT SHAFT OIL SEAL REMOVER
7. SHIFT LEVER BALL SOCKET REMOVER AND INSTALLER

NOTES

SECTION 7C

CLUTCH

CAUTION: This vehicle is equipped with Supplemental Inflatable Restraint (SIR). Refer to CAUTIONS in Section 9J under "ON-VEHICLE SERVICE" and the SIR Component and Wiring Location View in Section 9J before performing service on or around SIR components or wiring. Failure to follow CAUTIONS could result in possible air bag deployment, personal injury, or otherwise unneeded SIR system repairs.

CAUTION: When servicing clutch parts, do not create dust by grinding or sanding clutch disc or by cleaning parts with a dry brush or compressed air. Many earlier models or aftermarket clutch parts may contain asbestos fiber which can become airborne if dust is created during servicing. A water dampened cloth or water based solution should be used to remove any dust on clutch parts. Equipment is commercially available to perform this washing function. These wet methods will prevent asbestos fibers from becoming airborne.

NOTICE: Always use the correct fastener in the correct location. Use the correct fastener part number to replace a fastener. If the correct fastener part number is not available, a fastener of equal size and strength may be used. Do not use a fastener that is stronger when the correct fastener part number is not available in the following applications:

- *Some bolts are designed to permanently stretch, and if a stronger fastener is used, the part will not be tightened correctly. These permanently stretching bolts will be called out. The correct part number fasteners must be used to replace this type of fastener because there is no available equivalent.*
- *Other bolts are designed to break if over tightened to prevent part damage. If a stronger fastener is used part damage may occur.*

Fasteners that need to be replaced when removed will be called out. Fasteners that require thread lockers or thread sealant will be called out. The correct tightening specification and sequence must be used when installing fasteners. Part or system damage may occur if the above instructions are not followed.

CONTENTS

GENERAL DESCRIPTION

The principal parts of the clutch system are the driving members, the driven members, and the operating members.

DRIVING MEMBERS

The driving members consist of two flat surfaces machined to a smooth finish. One of these is the rear face of the engine flywheel, and the other is the front face of the clutch cover assembly.

DRIVEN MEMBERS

The driven member is the clutch disc with a splined hub which is free to slide lengthwise along the splines of the input shaft, and drives the input shaft through these same splines.

The driving and driven members are held in contact by spring pressure. This pressure is exerted by a diaphragm spring in the clutch cover assembly.

OPERATING MEMBERS

HYDRAULIC CLUTCH SYSTEM

The clutch release system consists of a clutch master cylinder with a reservoir and an actuator cylinder connected to the master cylinder by hydraulic tubing. The clutch master cylinder is mounted on the cowl panel and the actuator is mounted on the clutch housing. The clutch master cylinder is operated directly by the clutch pedal via a pushrod.

When the clutch pedal is pressed down, hydraulic fluid under pressure from the clutch master cylinder flows into the actuator cylinder. As hydraulic force is applied to the actuator cylinder, the pushrod movement rotates the clutch fork to force the release bearing into the diaphragm spring and release the clutch.

The hydraulic clutch system provides automatic clutch adjustment, so no adjustment of clutch linkage or pedal position is required.

HYDRAULIC CLUTCH SYSTEM FLUID

When adding fluid to or refilling the system after service operations use GM Delco Supreme No. II® Brake Fluid or an equivalent fluid that meets DOT 3 specifications.

NOTICE: Do not use mineral or paraffin base oil in the clutch hydraulic system. These fluids will damage the rubber parts in the cylinders.

DIAGNOSIS

PRELIMINARY TESTS

Before attempting to repair the clutch, transmission, or related components for any reason other than an obvious failure, identify the problem and probable cause. A large percentage of clutch and manual transmission problems are revealed by shifting difficulties such as high shift effort, gear clash, or grinding. When any of these problems occur, make a careful analysis of these difficulties. Use the "Diagnosis of Clutch System" and "Diagnosis of Hydraulic Clutch System" charts to assist in proper diagnosis of clutch problems.

Before removing the clutch hydraulic system, verify the malfunction by measuring the travel of the clutch actuator cylinder pushrod. When the clutch pedal is pushed fully to the floor stop, the actuator cylinder pushrod should move 25.4 mm (1.0 inch) minimum against the clutch release lever. Do not replace the hydraulic system if pushrod travel meets or exceeds this distance.

If the actuator cylinder does not meet the travel requirements, check the reservoir fluid level. The actuator cylinder must be in place when checking the fluid level. The proper level is 11 mm (0.43 in.) from the top lip of the reservoir. Fill to the specified level with GM Delco Supreme No. II® Brake Fluid; Hydraulic Clutch Fluid or equivalent that meets DOT 3 specifications. Do not overfill the system.

NOTICE: Carefully clean the top and sides of the reservoir before opening to prevent contamination of the system with dirt, water, or other foreign material. Remove the reservoir diaphragm before adding fluid. Carefully replace the diaphragm and cover after filling.

If the reservoir requires any fluid, check the hydraulic system components for leakage. Remove the rubber boots from the cylinders and check for leakage past the pistons. A slight wetting of the surfaces is acceptable. Replace the system if excessive leakage is evident.

CLUTCH SPIN DOWN TIME

1. Run the engine at a normal idle with the transmission in neutral and the clutch engaged.
2. Disengage the clutch, wait 9 seconds, and shift the transmission into reverse.
3. If a grinding noise is heard, refer to the "Diagnosis Of Hydraulic Clutch System" chart in this section.

DIAGNOSIS OF CLUTCH SYSTEM

PROBLEM	POSSIBLE CAUSE	CORRECTION
Will Not Disengage (Pedal to the floor and hard to shift into reverse).	1. Air in the hydraulic system. 2. Master or actuator hydraulic cylinder seals worn. 3. Not enough pedal travel. 4. Release bearing worn or damaged. 5. Driven plate worn or damaged. 6. Clutch fork off the ball stud. 7. Driven plate binding.	1. Bleed and check for damage. 2. Replace components as necessary. 3. Remove aftermarket floor covering from behind clutch pedal or trim pedal bumper. 4. Replace. 5. Replace. 6. Install correctly and lubricate. 7. Replace the plate.
Slipping.	1. Driven plate friction material worn or oil soaked. 2. Clutch cover or flywheel warped. 3. Diaphragm spring weak. 4. Driven plate overheated.	1. Replace. Check for leaks as needed. 2. Replace as necessary. 3. Replace the clutch cover. 4. Allow to cool and make 30-40 normal starts - DO NOT OVERHEAT.
Grabbing (Chattering).	1. Clutch cover or flywheel warped. 2. Driven plate friction material damaged. 3. Driven plate friction material contaminated. 4. Engine mounts loose or damaged.	1. Replace as necessary. 2. Replace as necessary. 3. Replace and check for leaks. 4. Tighten or replace.
Rattling (Transmission Click).	1. Diaphragm spring weak. 2. Clutch fork loose or off the ball stud. 3. Driven plate springs weak or damaged.	1. Replace the clutch cover. 2. Replace the retainer or install the fork correctly and lubricate. 3. Replace the driven plate.
Release Bearing Noisy With The Clutch Engaged.	1. Release bearing binding. 2. Clutch fork off the ball stud or loose spring tension. 3. Hydraulic return springs weak.	1. Clean or replace if damaged, and lubricate. 2. Install correctly and lubricate. 3. Replace master and actuator cylinders.
Noisy.	1. Release bearing worn or damaged. 2. Clutch fork off the ball stud. 3. Pilot bearing loose.	1. Replace. 2. Install correctly and lubricate. 3. Replace.
Pedal Stays On The Floor When Disengaged.	1. Release bearing binding. 2. Diaphragm spring weak.	1. Free up or replace, and lubricate. 2. Replace the clutch cover.
Pedal Is Hard To Push.	1. Hydraulic tube blocked or crimped. 2. Master or actuator cylinders binding. 3. Driven plate worn.	1. Replace. 2. Replace as necessary. 3. Replace driven plate and clutch cover.
		D0309

DIAGNOSIS OF HYDRAULIC CLUTCH SYSTEM

PROBLEM	POSSIBLE CAUSE	CORRECTION
Pedal Travels To Floor. No Pressure Or Very Little Resistance.	Master or actuator cylinder faulty. Tube burst or leaking. No fluid in reservoir.	Replace system.
Pedal Travels To Floor. No Pressure Or Very Little Resistance. Fluid In Master Cylinder Dust Cover.	Seal faulty in master cylinder.	Replace system.
Pedal Travels To Floor. No Pressure Or Very Little Resistance. Fluid Level In Reservoir Rises As Pedal Is Depressed.	Seal faulty in master cylinder.	Replace system.
Fluid In Area Of Master Cylinder Dust Cover And On Pedal	Seal faulty in master cylinder.	Replace system.
Fluid In Actuator Cylinder And On Cylinder Body	Actuator cylinder seal faulty.	Replace system.
Pedal Feels "Spongy" When Depressed	Air in system.	Check fluid level, bleed system, if necessary. Check and replace system if symptom recurs.
Unable To Select Gears. Pedal Effort And Travel Normal.	Clutch or transmission mechanism faulty.	Check and replace clutch or transmission components.
Clutch Slip	Clutch plate worn or contaminated.	Check and replace. Clean and service or replace assembly.
Difficulty In Selecting Gears. Pedal Effort And Travel Normal.	Clutch or transmission mechanism faulty.	Check and replace faulty or worn assembly.
Pedal Sticks or Binds During Travel.	Clutch fork ball stud worn. Release bearing or transmission bearing retainer worn. Clutch pedal bushings worn.	Check and replace worn parts.
		D0255

ON-VEHICLE SERVICE

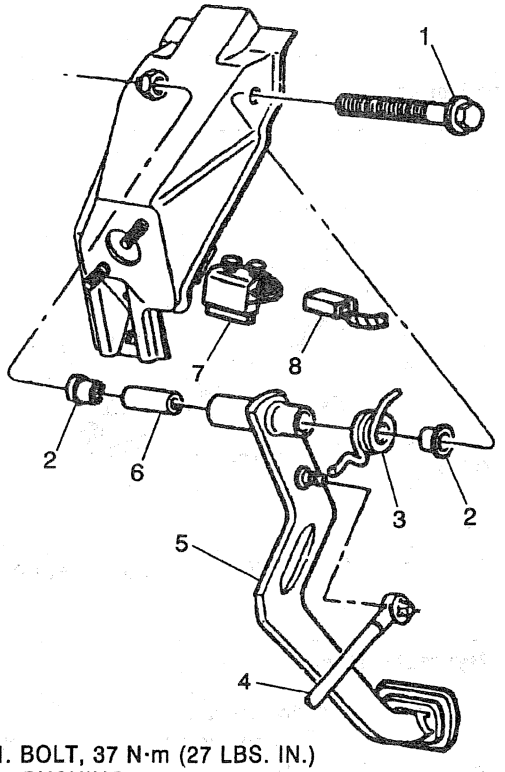
CLUTCH PEDAL REPLACEMENT

Remove or Disconnect (Figure 1)

1. Negative battery cable. Refer to SECTION 0A.
2. Lower filler panel(s). Refer to SECTION 10A4.
3. Lower left side air conditioning duct, if needed. Refer to SECTION 1B.
4. Push rod from the clutch pedal.
5. Bolt, clutch pedal, and spring.
6. Bushings and spacer.

Install or Connect (Figure 1)

1. New spacer and bushings.
   - Coat with grease before installing.
2. Spring, clutch pedal, and bolt.



1. BOLT, 37 N·m (27 LBS. IN.)
2. BUSHING
3. SPRING
4. ASSEMBLY, ROD
5. CLUTCH PEDAL
6. SPACER
7. SWITCH, NEUTRAL START
8. CONNECTOR

3107r5058

Figure 1—Clutch Pedal Assembly

Tighten

- Clutch pedal bolt to 37 N·m (27 lbs. ft.).

3. Push rod to the clutch pedal.
4. Lower left side air conditioning duct, if needed. Refer to SECTION 1B.
5. Lower filler panel(s). Refer to SECTION 10A4.
6. Negative battery cable.

MASTER CYLINDER, HYDRAULIC TUBE, AND ACTUATOR CYLINDER ASSEMBLY REPLACEMENT

Remove or Disconnect (Figures 2 and 3)

1. Negative battery cable. Refer to SECTION 0A.
2. Lower filler panel(s). Refer to SECTION 10A4.
3. Lower left side air conditioning duct, if needed. Refer to SECTION 1B.
4. Push rod from the clutch pedal.
5. Master cylinder to cowl panel nuts.
   - If the assembly is being replaced it may be necessary to cut the tube at the rear of engine to be able to remove assembly more easily.
   - Raise the vehicle.
6. Actuator cylinder to clutch housing nuts.
7. Hydraulic tube to engine nuts and clips (figure 3).
8. Hydraulic clutch assembly.
9. Inspection plug.
   - Lower the vehicle.

Install or Connect (Figures 2 and 3)

The system comes filled with fluid. Be sure the cap remains on during installation.

1. Install the assembly from the top.
   - Raise the vehicle.
   - The plastic retaining strap must be left on the actuator cylinder when it is installed. It will release upon the first pedal application.
2. Actuator cylinder to the clutch housing and nuts.

Tighten

- Actuator cylinder nuts to 17 N·m (13 lbs. ft.).
- Check push rod to assure the it is properly seated in the fork.

3. Clutch fork inspection plug.

Tighten

- Inspection plug to 7.5 N·m (66 lbs. in.).
- Lower the vehicle.

4. Push rod assembly to the cowl.
5. Master cylinder to cowl panel and nuts.

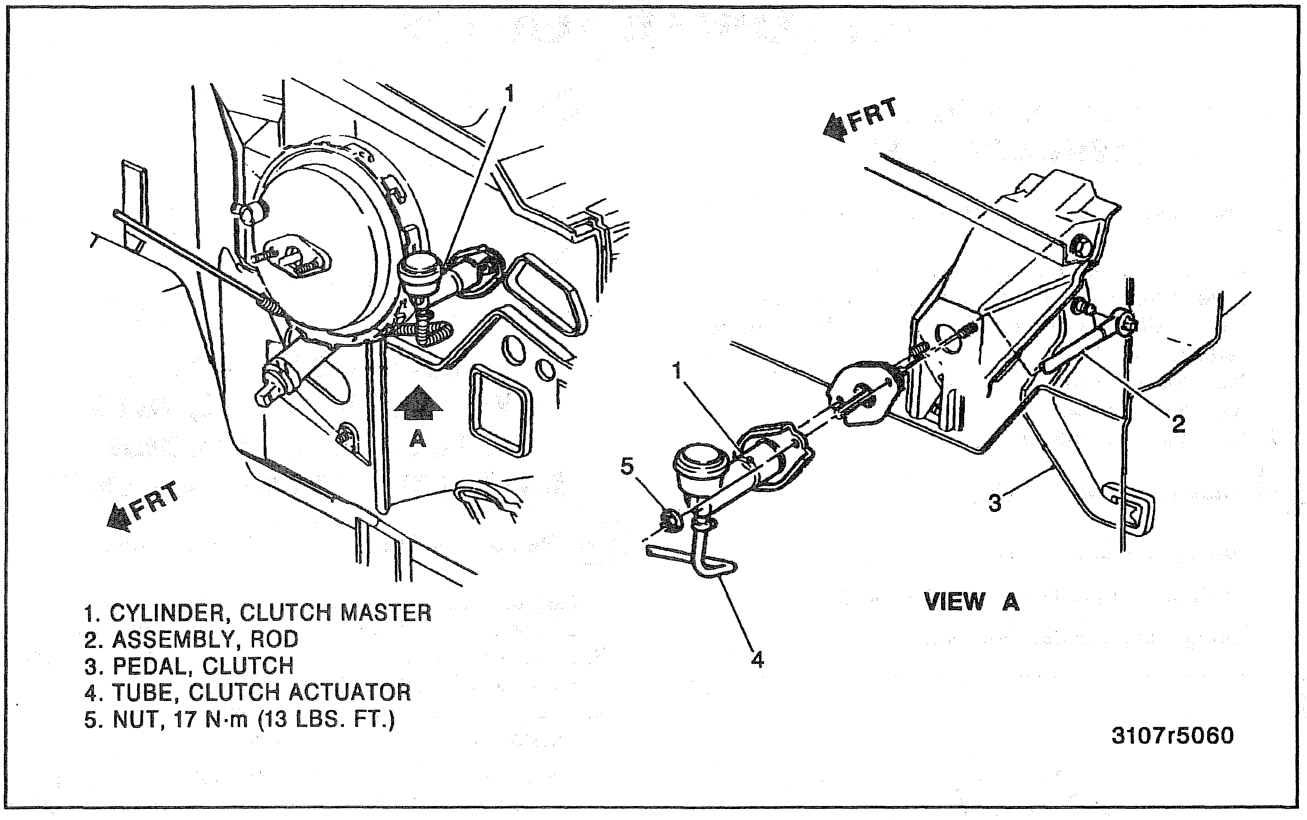


Figure 2—Master Cylinder and Reservoir

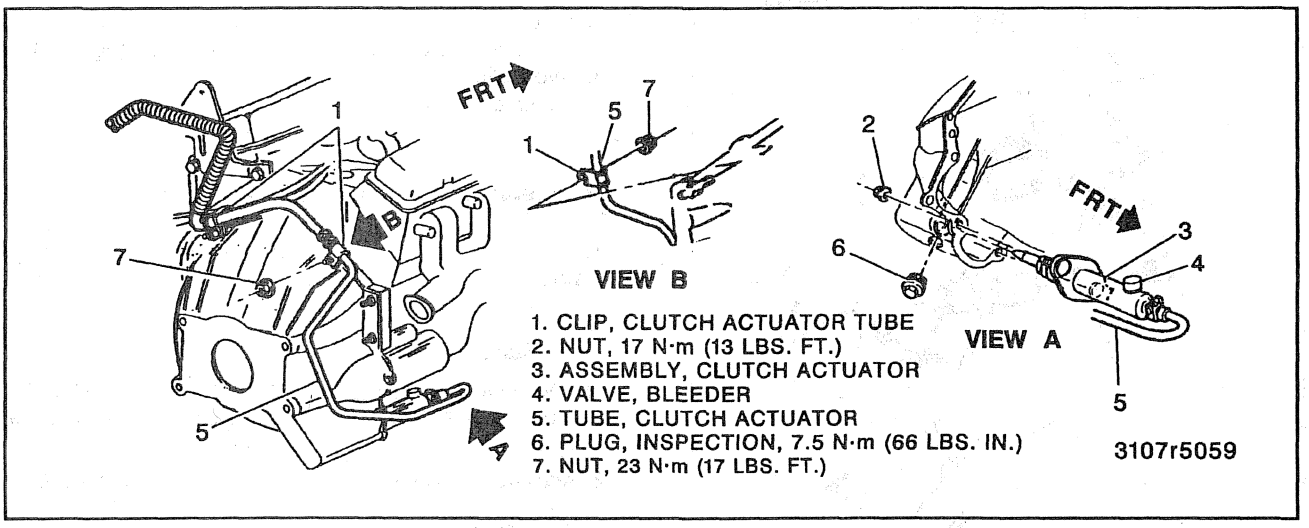


Figure 3—Actuator Cylinder and Hydraulic Hose

Tighten

- Master cylinder nuts to 17 N·m (13 lbs. ft.).
- Raise the vehicle.

6. Clips and nuts retaining clutch actuator hose to the engine (figure 3).

Tighten

- Clip nuts to 23 N·m (17 lbs. ft.).
- Lower the vehicle.

7. Push rod to the clutch pedal.
8. Lower left side air conditioning duct, if needed. Refer to SECTION 1B.
9. Lower filler panel(s). Refer to SECTION 10A4.
10. Negative battery cable.

- Check the fluid level in the reservoir and add as necessary, pump pedal several times the system should not need to be bled.
- If system needs to be bled. Refer to "Hydraulic Clutch System Bleeding."

HYDRAULIC CLUTCH SYSTEM BLEEDING

The hydraulic clutch system is prefilled with fluid. If fluid is inadvertently lost during component repair or replacement, the following bleed procedure can be used.

Bleed (Figures 2 and 3)

1. Disconnect the push rod from the clutch pedal.
2. Remove the actuator cylinder from the clutch housing.
3. Remove the reservoir cap.
4. Slowly depress the actuator cylinder push rod to the bottom of the bore.
5. While holding the actuator cylinder push rod, fill the reservoir with GM Delco Supreme No. II® Brake Fluid; Hydraulic Clutch Fluid or equivalent that meets DOT 3 specifications, if needed.
6. Slowly release the actuator cylinder push rod.
7. Hold actuator cylinder vertically with push rod facing down.
8. Depress the push rod into the actuator cylinder with short strokes of 5 mm - 10 mm (0.20 inch - 0.40 inch).
   - Hold the push rod against palm of your hand in a position which allows the actuator cylinder to be lower than the master cylinder.
   - Watch the reservoir for air bubbles.
   - Stroke the actuator until the air bubbles are no longer entering the master cylinder.
9. Install actuator cylinder to clutch housing.
   - Align push rod into fork pocket.
10. Fill reservoir with GM Delco Supreme No. II® Brake Fluid; Hydraulic Clutch Fluid or equivalent that meets DOT 3 specifications, if needed.
11. Clean reservoir cap and install on reservoir.
12. Connect push rod to the clutch pedal.

CLUTCH ASSEMBLY AND PILOT BEARING REPLACEMENT

Remove or Disconnect (Figures 4 and 5)

Tools Required:
- J 5824-01 Clutch Alignment Tool
- J 23907 Pilot Bearing Puller
- J 38149 Universal Puller

1. Negative battery cable. Refer to SECTION 0A.
2. Actuator cylinder (figure 3).
   - Hydraulic tube and clips.
3. Inspection cover to clutch housing bolts.
4. Inspection cover from the clutch housing.
5. Transmission to clutch housing bolts (NV4500 transmission).
6. Transmission from the clutch housing (NV4500 transmission). Refer to SECTION 7B.
7. Clutch housing to the engine studs.
8. Transmission from the engine (NV3500 transmission). Refer to SECTION 7B.
9. Clutch housing from the engine (NV4500 transmission).
10. Spring, seat, and clutch fork.
11. Clutch fork inspection plug.

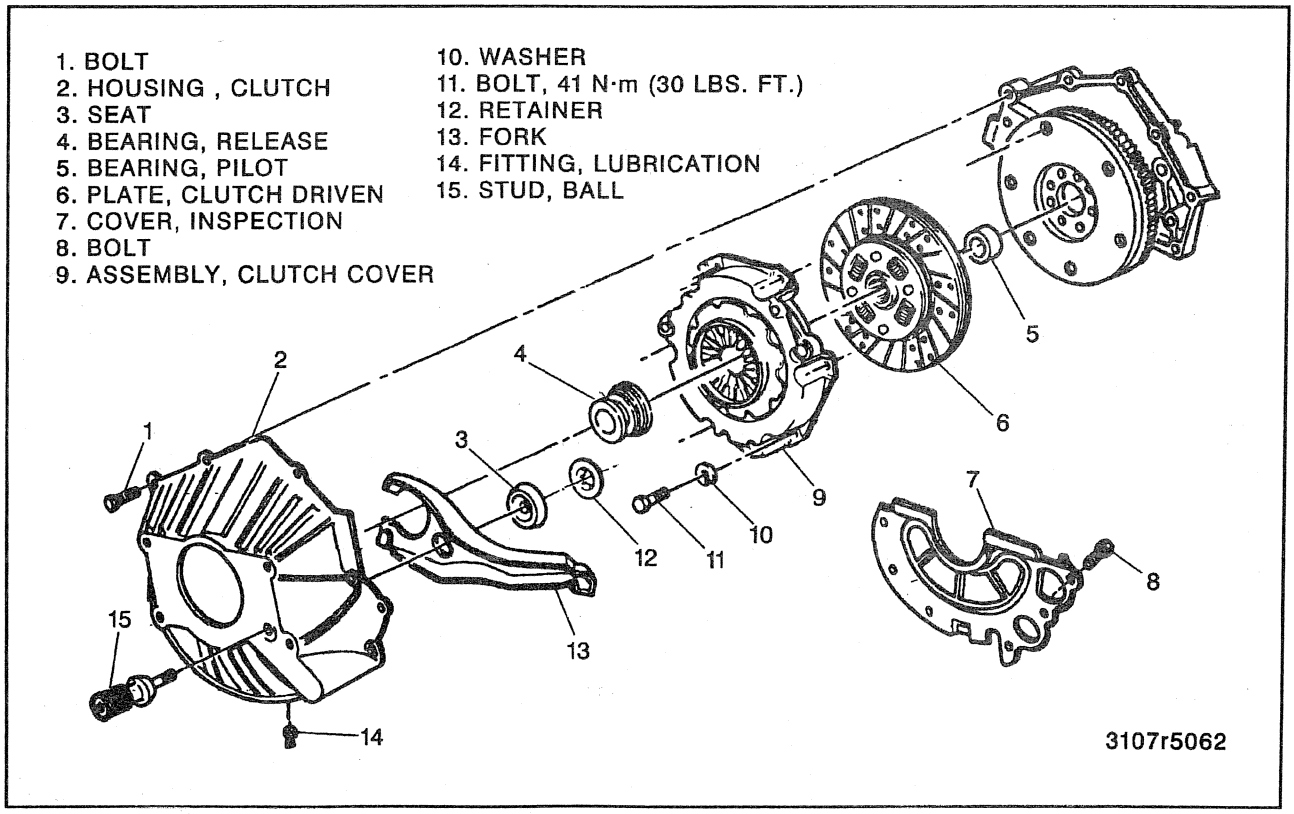


Figure 4—Clutch Assembly and Pilot Bearing

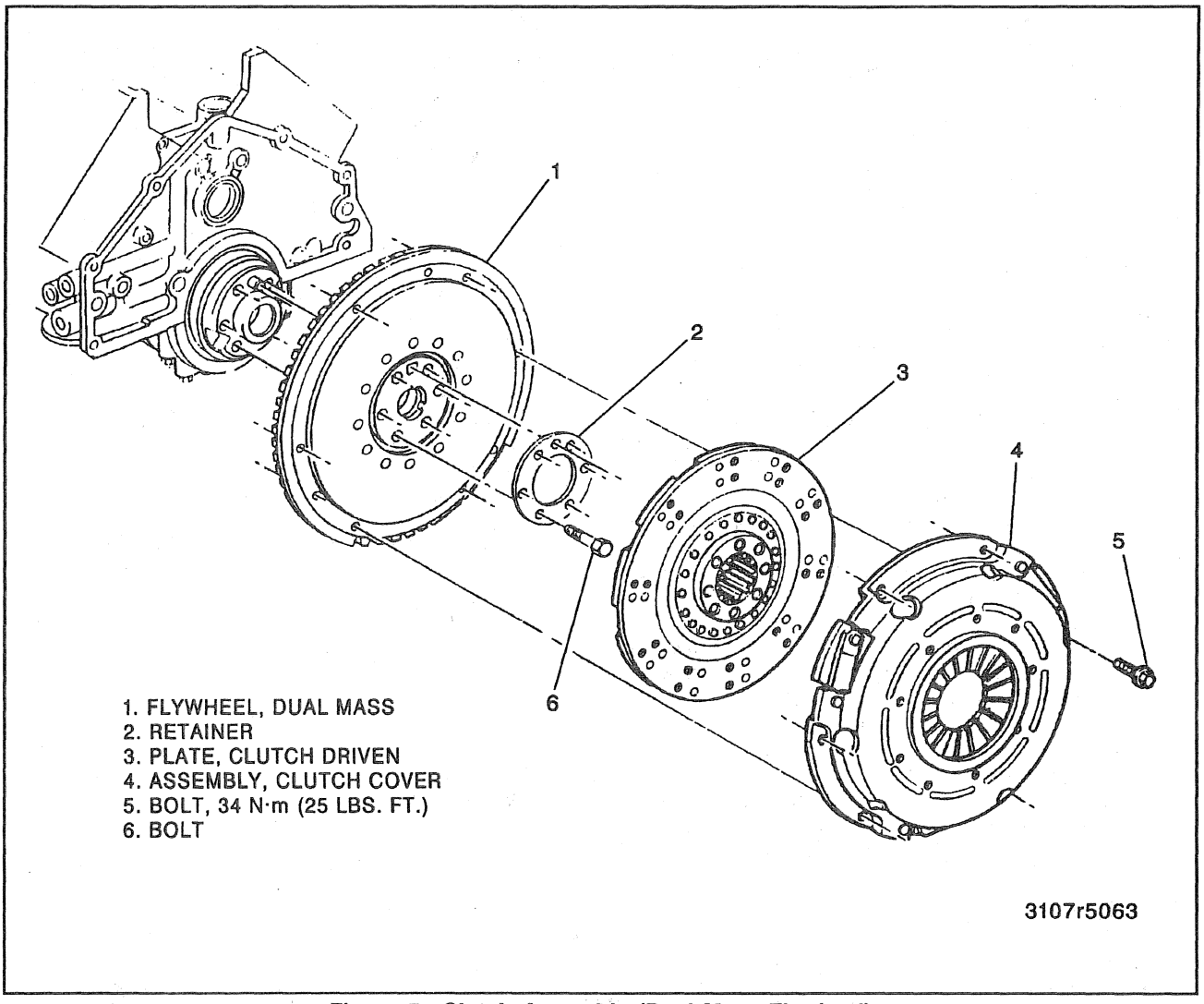


Figure 5—Clutch Assembly (Dual Mass Flywheel)

Important

- Install J 5824-01 or a used clutch drive gear to support the clutch.
- Mark the flywheel, clutch cover, and a pressure plate lug for alignment during installation.

12. Bolts and spring washers from clutch cover.

Important

- Loosen each bolt one turn at a time to avoid warping the clutch cover.

13. Cover assembly and driven plate.
    - Remove the clutch alignment tool.
14. Pilot bearing if it is worn or damaged. Use J 23907 or J 38149 as needed (figure 6).

Clean

1. All parts with a clean, water dampened cloth to remove any fibers.
2. Clutch fork, clutch housing, and ball stud with solvent. Wipe dry.

NOTICE: The release bearing is permanently packed with lubricant and should not be soaked in cleaning solvent since this will dissolve the lubricant.

Inspect

- All parts for wear and damage.
- Contact surfaces for scoring and flatness with a straight edge.
- Friction pads for scoring, gouges, and loose rivets. Check to see if they are oil soaked.
- All splines for nicks, burrs, and sliding fit.
- All springs for bending and breaks.
- Boot for tears and brittleness.

Measure

- Transmission pilot hole in the clutch housing for runout using a dial indicator. Runout should not be more than 0.380 mm (0.015 inch).

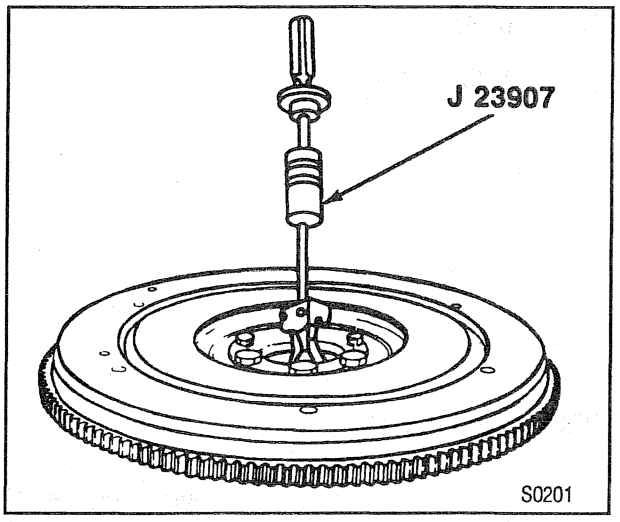


Figure 6—Pilot Bearing Removal

Install or Connect (Figures 4 and 5)

Tool Required:
J 5824-01 Clutch Alignment Tool
Brass Drift or Equivalent (Gas Engines Only)
J 34140 Pilot Bearing Driver (6.5L Diesel Only)

1. New pilot bearing if needed. Use Brass Drift or J 34140 as needed to drive the bearing in until the tool bottoms out.

— **Gas Engine**
- Lubricate the bearing with a few drops of machine oil.

— **6.5L Diesel Engine**
- The bearing is sealed and does not need any lubrication.

2. Driven plate and cover assembly.

Important
- Install J 5824-01 or a used clutch drive gear to support the clutch.
- Align the marks made during removal or, if new, align the lightest part of the clutch cover, identified by a yellow dot, to the heaviest part of the flywheel, identified by an "X".

3. New spring washers and bolts.

Important
- Tighten each bolt one turn at a time to avoid warping the clutch cover.

Tighten
- Clutch cover bolts to 41 N·m (30 lbs. ft.).
- Clutch cover bolts (dual mass flywheel) to 34 N·m (25 lbs. ft.).
- Remove the clutch alignment tool.

NOTICE: Be careful not to use too much lubricant. Excessive lubricant may get on the clutch disc and cause slippage, or damage may result to the clutch.

4. Ball stud.
- Coat the rounded end of the ball stud with high temperature grease.
- Pack the ball stud from the lubrication fitting on the clutch housing.

5. Release bearing and clutch fork.
- Pack the inside recess (A) and outside groove (B) of the release bearing with high temperature grease as shown (figure 7).
- Release bearing to the clutch fork.

Important
- Bearing retainer spring should be depressed and rest within groove (B) of the release bearing (figure 7).

6. Seat and retainer.
7. Clutch housing and studs (NV4500 transmission).

Tighten
- Clutch housing studs to 31 N·m (23 lbs. ft.).

8. Transmission to engine (NV3500 transmission). Refer to SECTION 7B.
9. Transmission to the clutch housing (NV4500 transmission). Refer to SECTION 7B.
10. Inspection cover and bolts.

Tighten
- Inspection cover bolts to 12 N·m (106 lbs. in.).

11. Actuator cylinder (figure 3).
- Hydraulic tube and clips.
- Remove clutch fork inspection plug to make sure push rod is properly seated in the fork.

12. Clutch fork inspection plug.

Tighten
- Inspection plug to 7.5 N·m (66 lbs. in.).

13. Negative battery cable.

FLYWHEEL REPLACEMENT

For flywheel replacement procedures, refer to SECTION 6.

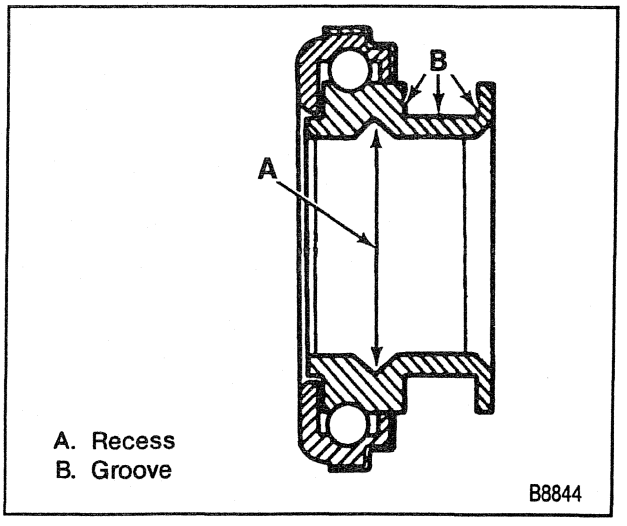


Figure 7—Release Bearing

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Actuator Cylinder-to-Clutch Housing Nut	17 N·m (13 lbs. ft.)
Clutch Housing Mounting Bolts	31 N·m (23 lbs. ft.)
Clutch Pedal Mounting Bolt	37 N·m (27 lbs. ft.)
Inspector Cover Bolts	12 N·m (106 lbs. in.)
Inspector Plug	7.5 N·m (66 lbs. in.)
Master Cylinder Mounting Nut	17 N·m (13 lbs. ft.)
Hydraulic Tube-to-Clutch Housing Mounting Nut	23 N·m (17 lbs. ft.)
Clutch Cover to Flywheel Mounting Bolts (All Except Dual Mass Flywheel)	41 N·m (30 lbs. ft.)
Clutch Cover to Flywheel Mounting Bolts (Dual Mass Flywheel Only)	34 N·m (25 lbs. ft.)

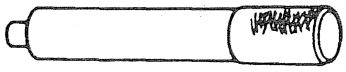
LUBRICATION SPECIFICATIONS

Capacity	11 mm (0.43 in.) Below Lip of Reservoir
Type Recommended	DOT 3 Brake Fluid or Equivalent

T2849

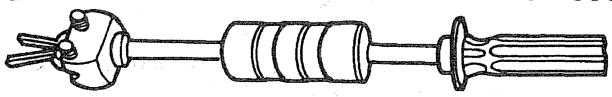
SPECIAL TOOLS

1. J 34140



3. J 5824-01

2. J 23907



1. Pilot Bearing Driver
2. Clutch Pilot Bearing Remover
3. Clutch Alignment Tool

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