

2000 Saturn LS

2000 AUTOMATIC TRANSMISSIONS Hydra-Matic 4T40-E & 4T45-E Overhaul

2000 AUTOMATIC TRANSMISSIONS

Hydra-Matic 4T40-E & 4T45-E Overhaul

APPLICATION

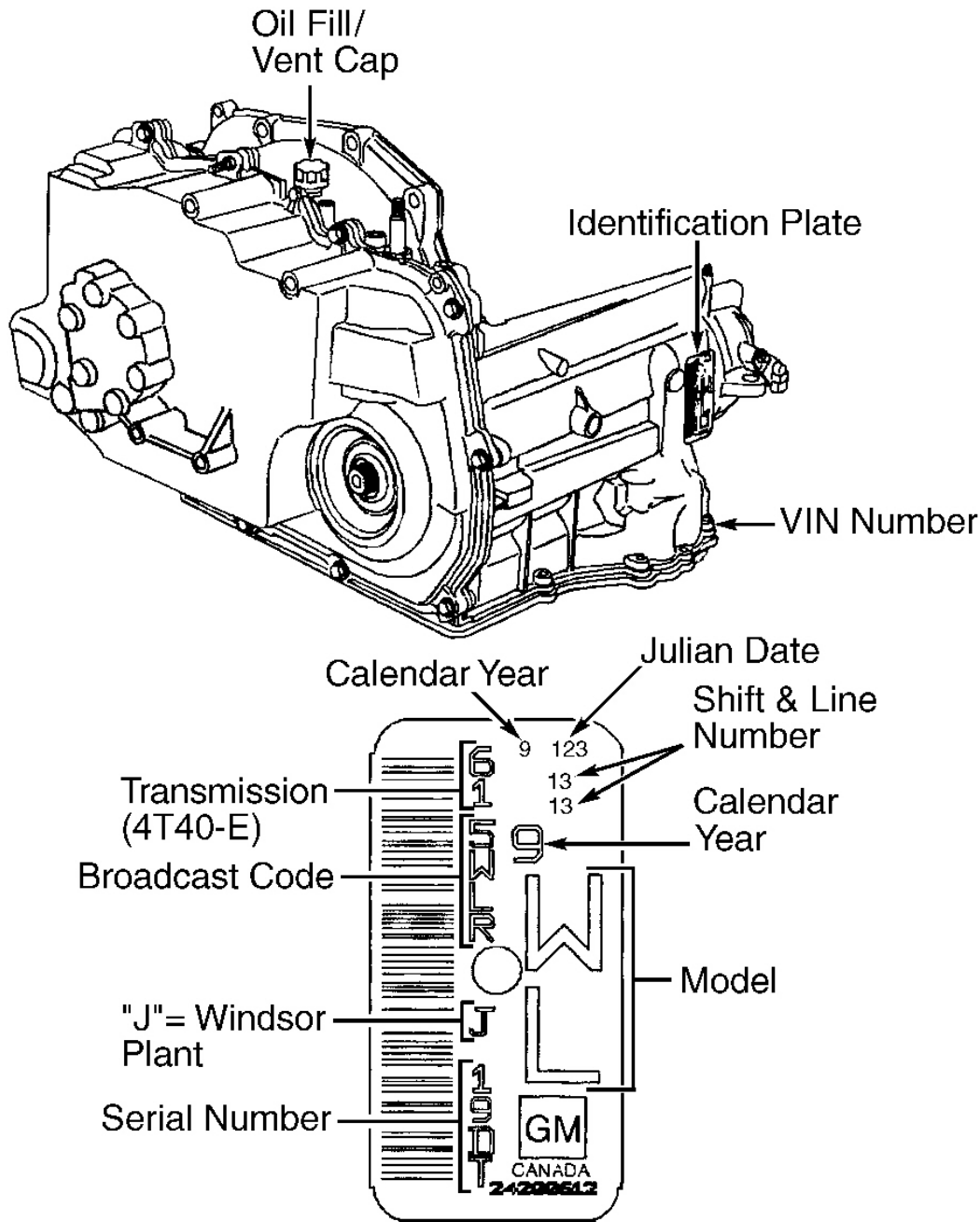
NOTE: This article also applies to 1999 Daewoo.

AUTOMATIC TRANSAXLE APPLICATIONS

Application	Transaxle Model (RPO Code)
Chevrolet	
Cavalier 2.2L & 2.4L	4T40-E (MN4)
Malibu 3.1L	4T40-E (MN4)
Daewoo	
Lanos 1.6L (1999-2000)	4T40-E (MN4)
Nubira 2.0L (1999-2000)	4T40-E (MN4)
Oldsmobile	
Alero 2.4L	4T40-E (MN4)
Alero 3.4L	4T45-E (MN5)
Pontiac	
Grand Am 2.4L	4T40-E (MN4)
Grand Am 3.4L	4T45-E (MN5)
Sunfire 2.2L & 2.4L	4T40-E (MN4)
Saturn	
LS, LS1, LS2, LW1 & LW2	4T40-E (MN4)

IDENTIFICATION

Transaxle has a metal identification plate attached to rear face of transaxle case. See **Fig. 1** . Transaxle RPO code is MN4 for 4T40-E and MN5 for 4T45-E.



G99J54964

Fig. 1: Locating Transaxle Identification Information (Typical)
 Courtesy of GENERAL MOTORS CORP.

GEAR RATIOS

TRANSAXLE GEAR RATIOS

2000 Saturn LS

2000 AUTOMATIC TRANSMISSIONS Hydra-Matic 4T40-E & 4T45-E Overhaul

Gear Range	Gear Ratio
1st	2.960:1
2nd	1.626:1
3rd	1.000:1
4th	0.681:1
Reverse	2.143:1

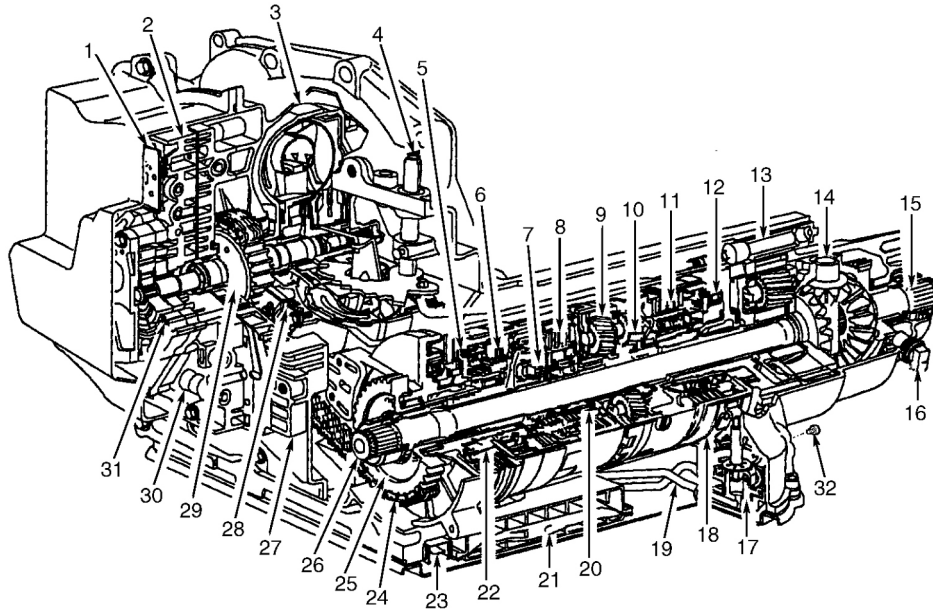
DESCRIPTION & OPERATION

Hydra-Matic 4T40-E and 4T45-E are fully automatic 4-speed transaxles consisting primarily of a 3-element hydraulic torque converter and converter clutch. Transaxle uses a variable capacity vane-type oil pump to supply all hydraulic pressure needed for operation.

Multiplied torque from torque converter is transferred to transaxle by a sprocket and drive link assembly. Other internal components consist of 5 multiple-disc clutches, 2 roller clutches, a sprag clutch, 2 bands and 2 planetary (carrier) gear sets. Differential and final drive assemblies are an integral part of transaxle. See **Fig. 2**.

The Hydra-Matic 4T40-E and 4T45-E transaxles are equipped with 2 electronic shift solenoids, a pressure control solenoid and Torque Converter Clutch (TCC) Pulse Width Modulated (PWM) solenoid. The Powertrain Control Module (PCM) utilizes these solenoids to control shifting, hydraulic pressures, and TCC apply and release.

NOTE: For diagnosis of transaxle electronic control system on Daewoo models, see appropriate **ELECTRONIC CONTROLS** article in 2000 MITCHELL(R) TRANSMISSION SERVICE & REPAIR for IMPORTED VEHICLES.



- | | | |
|--|---|---------------------------------|
| 1. Transaxle Fluid Pressure/
Manual Valve Position Switch | 11. Forward Clutch | 22. 2nd Roller Clutch |
| 2. Control Valve Body Assembly | 12. Low Roller Clutch | 23. Oil Level Control Valve |
| 3. Torque Converter | 13. Parking Lock Actuator | 24. Drive Link Assembly |
| 4. Manual Shaft & Detent Lever | 14. Differential & Final Drive Assembly | 25. Driven Sprocket |
| 5. 2nd Clutch | 15. Output Stub Shaft | 26. Output Shaft |
| 6. Reverse Clutch | 16. Output Speed Sensor | 27. Channel Plate Assembly |
| 7. Coast Clutch | 17. Low-Reverse Servo | 28. Input Speed Sensor |
| 8. Direct Clutch | 18. Low-Reverse Band | 29. Drive Sprocket |
| 9. Reaction Planetary Gear | 19. Oil Feed Tube Assembly | 30. Control Valve Body Assembly |
| 10. Input Planetary Gear Set | 20. Input Sprag Clutch Assembly | 31. Oil Pump Assembly |
| | 21. Oil Filter | 32. Transaxle Level Plug |

G00027744

Fig. 2: Identifying Hydra-Matic 4T40-E & 4T45-E Transaxle Component Locations
 Courtesy of GENERAL MOTORS CORP.

LUBRICATION

NOTE: The Hydra-Matic 4T40-E and 4T45-E transaxles are not equipped with a dipstick. For additional servicing information, see appropriate **AUTOMATIC TRANSMISSION SERVICING** article in **TRANSMISSION SERVICING**. For servicing information on Daewoo models, see **TRANSMISSION SERVICING** in **2000 MITCHELL(R) TRANSMISSION SERVICE & REPAIR** for **IMPORTED VEHICLES**.

RECOMMENDED FLUID

Use only Dexron(R) III Automatic Transmission Fluid (ATF).

FLUID CAPACITIES

TRANSAXLE FLUID CAPACITIES ⁽¹⁾

Application	Drain & Refill - Qts. (L) ⁽²⁾	Overhaul - Qts. (L)	Dry Fill - Qts. (L)
4T40-E & 4T45-E ⁽³⁾	7.0 (6.6)	9.5 (9.0)	12.9 (12.2)
(1) Fluid capacities listed are approximate.			
(2) Drain and refill capacity does not include torque converter.			
(3) Transaxle does not have a dipstick. Fill to bottom of fill plug.			

ON-VEHICLE SERVICE

The following components can be serviced without removing transaxle from vehicle:

- Accumulator Assemblies
- Case Side Cover
- Control & Shift Solenoids
- Control Valve Assembly
- Cooler Lines & Seals
- Drive Axles & Seals
- Intermediate-4th Servo
- Low/Reverse Servo
- Oil Feed Pipes
- Oil Pump & Shaft
- Park/Neutral Position (PNP) Switch
- Pressure Switch Assembly
- Shift Control Cable
- Transaxle Filter
- Transaxle Oil Pan
- Vehicle Speed Sensor
- Wiring Harness

NOTE: For removal and installation of listed components, see **REMOVAL & INSTALLATION** .

OIL COOLER FLUSHING

1. If available, fill Line Flusher (J-35944) with solution, and install line flusher to transaxle end of cooler line that feeds bottom fitting of transaxle cooler. Connect discharge hose to top cooler line and attach drain hose to oil drain container. Follow equipment manufacturer's instructions to flush oil cooler and cooler lines.
2. If line flusher is not available, flush cooler and cooler lines with a mixture of clean solvent and water. Flush cooler in both directions until all old fluid and debris are removed. If necessary, replace plugged or

damaged cooler and/or lines.

TROUBLE SHOOTING

NOTE: For electrical component testing and diagnosis of transaxle electronic control system, see appropriate **ELECTRONIC CONTROLS** article.

PRELIMINARY INSPECTION

1. Check transaxle fluid level and condition. Check PCM memory for stored Diagnostic Trouble Codes (DTC). Diagnose and repair as necessary. See appropriate **ELECTRONIC CONTROLS** article. If no DTCs are stored, go to next step.
2. Perform road test. See **ROAD TEST** under PERFORMANCE TESTS. During road test, record shift points. If shift point timing or shifting is incorrect, diagnose transaxle electronic control system. See appropriate **ELECTRONIC CONTROLS** article.
3. If shift(s) is too harsh or too soft, check hydraulic pressures. See **HYDRAULIC PRESSURE TESTS** under PERFORMANCE TESTS. For specific complaints, see appropriate condition(s) listed under **SYMPTOM DIAGNOSIS**.

SYMPTOM DIAGNOSIS

Drives In Neutral

Forward clutch not releasing. Reverse clutch and low/reverse servo do not release. Manual valve and linkage misaligned.

Engine Stall

TCC stuck on or dragging. TCC solenoid stuck on or solenoid exhaust plugged. TCC regulated apply valve stuck in apply position.

High Or Low Line Pressure

Incorrect oil level. Stuck pressure regulator valve, torque signal regulator valve, boost valve or springs. Damaged pressure control solenoid, oil pump or oil pump drive shaft. Pressure relief valve spring damaged or ball missing. Stuck pressure regulator valve. Stuck pressure regulator boost valve. Isolator and/or pressure regulator valve spring stuck. Stuck torque signal regulator valve. Clogged, restricted or leaking cooler lines. Leaking oil filter seal or pressure control solenoid "O" ring. Electrical malfunction in throttle position sensor or transaxle wiring. Case porosity, leaks or uneven surface finish in transaxle case, control valve body or channel plate.

Inaccurate/Inconsistent Shift Points

Electrical malfunction in throttle position sensor, shift solenoids, input speed sensor or vehicle speed sensor circuits. Damaged or disconnected sensor. High line pressure. Missing check balls, binding accumulator springs or pistons or stuck accumulator valve. Reverse or direct clutch housing exhaust check balls plugged.

Loss Of Drive

Low fluid level. Worn, loose or failed axle shafts. Planetary (carrier) gear or differential/final drive malfunction. Damaged torque converter and/or bolts. Shift linkage disconnected. Oil filter plugged or seal missing. Oil pump seized or broken gears. Oil pump shaft broken or stripped splines. Drive or driven sprockets and drive chain broken. Channel plate and gasket, valve body, gaskets and spacer plate damaged, leaking or misaligned. Input sprag damaged or does not hold. Stripped splines on turbine shaft. Forward clutch or low roller clutch damaged or does not hold.

Loss Of Power

Low fluid level. 1-2 shift solenoid stuck off. 2-3 shift solenoid stuck on. TCC stuck on or dragging. Damaged torque converter.

No Engine Braking In All Manual Ranges

Low line pressure. 3-4 shift valve stuck in 4th gear position. Manual valve and linkage misaligned. Misaligned, loose or restricted valve body, gaskets and spacer plate, channel plate and gasket, and driven sprocket support. Driven sprocket support seals leaking or input shaft seals leaking. Input shaft bushing damaged or misaligned. Coast clutch piston binding, cracked or leaking.

Clutch friction plates worn or splines broken. Coast clutch release spring binding. Direct and coast clutch housing damaged, cracked or fluid feed holes restricted. Direct and coast clutch housing exhaust check ball missing or out of position. Fluid leak or restriction in coast clutch fluid routing.

No Engine Braking In Manual 2nd

Incorrect vehicle speed sensor reading (reads zero MPH). Pressure switch assembly leaking or inoperative. Coast clutch does not apply. Intermediate-4th band does not apply.

No Engine Braking In Manual 1st

Low/reverse servo does not apply. Pressure switch assembly leaking or inoperative. Coast clutch does not apply. Pressure switch assembly leaking or inoperative. No. 1 check ball missing.

No Gear Selection

Shift linkage or manual valve to link clip disconnected or misaligned. Manual valve stuck. Manual valve-to-detent lever link broken or missing. Restricted or blocked fluid channels in valve body, channel plate and transaxle case.

No Park

Parking lock actuator assembly bent or damaged rod, binding or broken spring or rod is not attached to detent lever. Detent roller and spring bent, damaged or bolt not torqued. Detent lever damaged, loose or manual shift pin missing. Manual valve misaligned or link to detent lever is bent. Parking lock pawl damaged or broken tooth. Damaged parking lock gear teeth or splines. Park pawl spring broken or missing. Shift linkage misadjusted.

No Reverse Or Slips In Reverse

Low fluid level. Low fluid pressure. Reverse clutch piston leaking, binding or cracked. Reverse clutch spring and retainer assembly binding. Plugged reverse clutch center retainer and seal. Clutch friction plates worn or splines broken. Reverse clutch snap ring out of position. Reverse clutch housing cracked, feed holes plugged or tangs broken. Reverse clutch housing exhaust check ball missing or out of position. Driven sprocket support seal rings leaking. Driven sprocket support assembly porosity, cracked or misaligned. Channel plate and gasket misaligned, damaged or fluid restriction. Fluid leak across channels.

Low/reverse band binding, broken, worn or out of position. Low/reverse servo piston broken or binding, servo piston seals leaking, servo pin and springs binding. Low/reverse servo cover broken, loose or leaking. Low/reverse band anchor pin broken. Oil feed tubes broken, bent, plugged or leaking. Transaxle case porosity. Fluid leak or restriction in reverse clutch fluid routing. Shift linkage, manual valve and linkage disconnected or misaligned. No. 1 check ball missing.

Intermittent Loss Of TCC

Faulty TCC release switch (integral with pressure switch assembly). Open or short in TCC release switch circuit between pressure switch assembly and PCM.

No TCC Release

TCC solenoid internal failure, plugged exhaust or external ground. Torque converter internal failure. TCC regulated apply valve and TCC control valve stuck in TCC apply position.

No 1st Gear Or Slips In 1st Gear

Low line pressure. Oil feed tubes broken, bent, plugged or leaking. Pressure switch assembly "O" ring leaking. 1-2 shift solenoid failed off or leaking. 1-2 shift valve stuck in upshift position. 2-3 shift solenoid failed on or exhaust is plugged. Channel plate and gasket misaligned, damaged or fluid restriction. Fluid leak across channels. Manual valve or shift linkage is misaligned. Forward clutch piston assembly cracked, leaking or binding. Forward clutch inner seal and sleeve plugged. Forward clutch housing cracked or feed holes plugged.

Clutch friction plates worn or splines broken. Snap ring out of position. Forward clutch housing exhaust check ball missing or out of position. Forward clutch return spring binding. Input sprag or low roller clutch damaged or not holding. Fluid leak or restriction in forward clutch fluid passages. Forward clutch support seal rings leaking, damaged or feed holes plugged. Torque converter stator roller clutch does not hold.

No 2nd Gear Or Slips In 2nd Gear

Low fluid level. Low line pressure. Pressure switch assembly malfunction. 1-2 shift solenoid stuck on or plugged. 1-2 accumulator piston seal leaking. 1-2 accumulator valve stuck. 2-3 shift valve stuck in upshift position. Misaligned, loose or restricted valve body, gaskets and spacer plate, channel plate and gasket, and driven sprocket support. Channel plate or transaxle case porosity near 1-2 accumulator. 2nd clutch piston assembly cracked, leaking or binding. Clutch friction plates worn or splines broken. 2nd clutch plate spring retaining ring out of position. 2nd clutch spring binding. Driven sprocket support damaged, leaking or porous. Fluid leak or restriction in 2nd clutch fluid routing. 2nd roller clutch damaged or does not hold.

No 3rd Gear Or Slips In 3rd Gear

Low line pressure. Pressure switch assembly malfunction. 2-3 shift solenoid stuck off or leaking. 2-3 accumulator piston seal leaking. 2-3 accumulator valve stuck. 3-4 shift valve stuck in upshift position. Channel plate or transaxle case porosity near 2-3 accumulator. Misaligned, loose or restricted valve body, gaskets and spacer plate, channel plate and gasket, and driven sprocket support. Driven sprocket support seals leaking or input shaft seals leaking. Damaged or misaligned sleeve on input shaft.

Direct clutch piston assembly cracked, leaking or binding. Clutch friction plates worn or splines broken. Direct clutch spring retainer ring out of position. Direct clutch spring and retainer binding. Direct and coast clutch housing damaged, cracked or plugged feed holes. Direct and coast clutch and input shaft housing exhaust check ball missing or out of position. Fluid leak or restriction in direct clutch fluid routing.

No 4th Gear Or Slips In 4th Gear

Low fluid level. Low line pressure. Pressure switch assembly malfunction. 1-2 shift solenoid stuck off or leaking. 3-4 shift valve stuck in downshift position. 3-4 accumulator valve stuck. Manual valve misaligned. Misaligned, loose or restricted valve body, gaskets and spacer plate, channel plate and gasket. Transaxle case misaligned, loose, porous or leaks fluid between channels. 3-4 accumulator piston seal leaking. Channel plate or transaxle case porosity near 3-4 accumulator valve.

Intermediate-4th band and servo does not apply or is slipping. Intermediate-4th servo piston broken or binding. Intermediate-4th servo piston or cover seals leaking. Intermediate-4th servo apply pin and return springs binding. Intermediate-4th servo cover broken, loose or leaking. Transaxle case cracked at band seat. Fluid leak in band apply fluid routing or fluid restricted.

Oil Out Of Vent Or Foaming

Transaxle overfilled. Oil contaminated with antifreeze or engine overheating. Drainback holes plugged. Case porosity, plugged vent or misalignment of oil pump-to-case gasket (if equipped).

Shift Indicator Displays Incorrect Selection

Manual detent spring and roller broken or missing. Manual detent spring and roller bolt loose. Manual valve disconnected.

TCC Apply With Cold Engine

Engine coolant temperature sensor malfunction.

1st & 2nd Gears Only

2-3 shift solenoid valve stuck off, leaking or electrical malfunction. 2-3 shift valve stuck in downshift position. Failed direct clutch.

1st & 4th Gears Only

1-2 shift solenoid valve stuck on, plugged or electrical malfunction.

2000 Saturn LS**2000 AUTOMATIC TRANSMISSIONS Hydra-Matic 4T40-E & 4T45-E Overhaul****2nd Gear Only**

1-2 shift valve stuck in downshift position.

2nd & 3rd Gears Only

1-2 shift solenoid valve stuck off, leaking or electrical malfunction.

3rd & 4th Gears Only

2-3 shift solenoid valve stuck on, plugged or electrical malfunction. 1-2 and 2-3 shift valve stuck in upshift position.

CLUTCH & BAND APPLICATIONS**CLUTCH & BAND APPLICATIONS**

Selector Lever Position	Solenoid Position (1-2/2-3)	Elements In Use
"D" (Drive) 1st Gear	ON/OFF	Forward Clutch, ⁽¹⁾ Input Sprag & ⁽¹⁾ Low Roller Clutch
"D" (Drive) 2nd Gear	OFF/OFF	Forward Clutch, ⁽¹⁾ Input Sprag, ⁽³⁾ Low Roller Clutch, 2nd Clutch & ⁽¹⁾ 2nd Roller Clutch
"D" (Drive) 3rd Gear	OFF/ON	Direct Clutch, Forward Clutch, ⁽¹⁾ Input Sprag, ⁽³⁾ Low Roller Clutch, ⁽²⁾ 2nd Clutch & ⁽³⁾ 2nd Roller Clutch
"D" (Drive) Overdrive	ON/ON	Direct Clutch, ⁽²⁾ Forward Clutch, ⁽³⁾ Input Sprag, Intermediate-4th Band, ⁽³⁾ Low Roller Clutch & ⁽²⁾ 2nd Clutch
"3" (Manual 3rd) 1st Gear	ON/OFF	Coast Clutch, Forward Clutch, ⁽¹⁾ Input Sprag & ⁽¹⁾ Low Roller Clutch
"3" (Manual 3rd) 2nd Gear	OFF/OFF	Coast Clutch, Forward Clutch, ⁽¹⁾ Input Sprag, ⁽³⁾ Low Roller Clutch, 2nd Clutch & ⁽¹⁾ 2nd Roller Clutch
"3" (Manual 3rd) 3rd Gear	OFF/ON	Coast Clutch, Direct Clutch, Forward Clutch, ⁽¹⁾ Input Sprag, ⁽³⁾ Low Roller Clutch, ⁽²⁾ 2nd Clutch & ⁽³⁾ 2nd Roller Clutch
"2" (Manual 2nd) 1st Gear	ON/OFF	Coast Clutch, Forward Clutch, ⁽¹⁾ Input Sprag & ⁽¹⁾ Low Roller Clutch
"2" (Manual 2nd) 2nd Gear	OFF/OFF	Coast Clutch, Forward Clutch, ⁽¹⁾ Input Sprag, Intermediate-4th Band, ⁽³⁾ Low Roller Clutch, 2nd Clutch & ⁽¹⁾ 2nd Roller Clutch
"2" (Manual 2nd) 3rd	OFF/ON	Coast Clutch, Direct Clutch, Forward Clutch, ⁽¹⁾

2000 Saturn LS

2000 AUTOMATIC TRANSMISSIONS Hydra-Matic 4T40-E & 4T45-E Overhaul

Gear ⁽⁴⁾		Input Sprag, ⁽³⁾ Low Roller Clutch, ⁽²⁾ 2nd Clutch & ⁽³⁾ 2nd Roller Clutch
"1" (Manual Low) 1st Gear	ON/OFF	Coast Clutch, Forward Clutch, ⁽¹⁾ Input Sprag, Low/Reverse Band & ⁽¹⁾ Low Roller Clutch
"1" (Manual Low) 2nd Gear ⁽⁵⁾	OFF/OFF	Coast Clutch, Forward Clutch, ⁽¹⁾ Input Sprag, Intermediate-4th Band ⁽³⁾ Low Roller Clutch, 2nd Clutch & ⁽¹⁾ 2nd Roller Clutch
"1" (Manual Low) 3rd Gear ⁽⁴⁾	OFF/ON	Coast Clutch, Direct Clutch, Forward Clutch, ⁽¹⁾ Input Sprag, ⁽³⁾ Low Roller Clutch, ⁽²⁾ 2nd Clutch & ⁽³⁾ 2nd Roller Clutch
"R" (Reverse)	ON/OFF	Low/Reverse Band & Reverse Clutch
"N" or "P" (Neutral or Park)	ON/OFF	⁽²⁾ Input Sprag & Low/Reverse Band

(1) Holding.

(2) Applied but not effective.

(3) Overrunning.

(4) 3rd gear is only available at vehicle speeds greater than 62 MPH.

(5) 2nd gear is only available at vehicle speeds greater than 37 MPH.

PERFORMANCE TESTS

NOTE: Adaptive parameters should be reset if one of the following repairs have been performed:

- Transaxle replacement.
- Replacement of any line pressure actuator.
- Transaxle overhaul when new clutch plates are installed.
- Replacing control valve body.

To reset adaptive parameters, connect scan tool to Data Link Connector (DLC). Follow prompts on scan tool.

ROAD TEST

NOTE: For transaxle model code, refer to metal identification plate attached to transaxle. See [Fig. 1](#) . Before road testing vehicle, engine and transaxle must be at normal operating temperature. Torque converter clutch will not engage if transaxle fluid has not reached a minimum temperature of 46°F (8°C), and engine coolant has not reached operating temperature of 122°F (50°C).

Introduction

Perform road test with scan tool connected to vehicle. PCM calculates upshift points based primarily on throttle position and vehicle speed. Ensure scan tool parameters for electronic transaxle components are within tolerance. See appropriate ELECTRONIC CONTROLS article. When PCM determines a shift should occur, the ground circuit is closed or opened to shift solenoids. Solenoids move shift valves to perform shift. A scan tool should be used during road test to monitor throttle position. Some scan tools are capable of recording shift point information. Check scan tool instruction manual to determine if this test is available.

If transmission shift speeds are not as specified during road test, check for DTCs. See appropriate ELECTRONIC CONTROLS article. If slippage occurs, determine which components are applied in each gear to aid in diagnosis. See [CLUTCH & BAND APPLICATIONS](#) under TROUBLE SHOOTING. Perform hydraulic pressure test to check transmission internal components. See [HYDRAULIC PRESSURE TESTS](#).

Gear Selector Position "D" (Overdrive)

1. With gear selector in "D" (overdrive) position, choose throttle position angle of 10, 25 or 50 percent. See [Fig. 3 -Fig. 6](#). Set scan tool to monitor throttle position angle, engine speed, commanded gear, slip speed, solenoid states and vehicle speed. Accelerate vehicle to chosen throttle position angle and hold throttle steady.
2. Note shift speed engagement points in 2nd gear, 3rd gear and overdrive. Ensure shift speeds are as specified. See [Fig. 3 -Fig. 6](#). Also note Torque Converter Clutch (TCC) engagement point while in overdrive. Repeat procedure using different throttle position angles.

NOTE: Shift speed charts for Daewoo models are not available.

NOTE: Shift speeds may vary due to slight hydraulic delays responding to electronic controls. A change from original equipment tire size also affects shift speeds. Ensure TCC engages in 3rd gear and overdrive. TCC should not apply unless transaxle has reached a minimum operating temperature of 46°F (8°C) and engine coolant temperature is 122°F (50°C) or greater.

3. At vehicle speeds of 40-55 MPH in overdrive, quickly increase throttle angle to more than 50 percent. Verify TCC releases, transaxle immediately downshifts to 3rd gear, 1-2 shift solenoid turns off and 2-3 shift solenoid remains on.
4. At vehicle speeds of 40-55 MPH in overdrive, quickly depress accelerator to wide open position (full throttle detent downshift). Verify TCC releases, transaxle immediately downshifts to 2nd gear and both solenoids are off.
5. At vehicle speeds of 40-55 MPH in overdrive, release accelerator pedal while moving gear selector to "3" position. Verify TCC releases, transaxle immediately downshifts into 3rd gear, and engine braking slows vehicle.
6. At vehicle speeds of 40-45 MPH in overdrive, release accelerator pedal while moving gear selector to "2" position. Verify TCC releases, transaxle immediately downshifts into 2nd gear, and engine braking slows vehicle.
7. At vehicle speeds of 40 MPH in overdrive, release accelerator pedal while moving gear selector to "1" position. Verify TCC releases, transaxle immediately downshifts into 2nd gear, and engine braking slows

2000 Saturn LS

2000 AUTOMATIC TRANSMISSIONS Hydra-Matic 4T40-E & 4T45-E Overhaul

vehicle. As vehicle slows to 30-40 MPH, transaxle downshifts to 1st gear.

- With gear selector in "D" (overdrive) position, accelerate vehicle to obtain overdrive with TCC applied. Release accelerator pedal, and lightly apply brakes. Verify TCC releases and downshifts occur at specified speeds. See [Fig. 3](#) -[Fig. 6](#).

NOTE: Upshifts in manual gear ranges are controlled by shift solenoids. Perform the following steps by accelerating vehicle with 10-15 percent throttle angle.

Gear Selector Position "3" (3rd Gear)

With vehicle stopped, move gear selector to "3" position and steadily increase throttle pressure to accelerate vehicle. Note speeds at which vehicle shifts into 2nd and 3rd gears. See [Fig. 3](#) -[Fig. 6](#).

Gear Selector Position "2" (2nd Gear)

With vehicle stopped, move gear selector to "2" position. Accelerate vehicle and note speed at which vehicle shifts from 1st gear to 2nd gear. Accelerate vehicle to 35 MPH. Verify transaxle does not shift into 3rd gear, and TCC does not apply.

Gear Selector Position "1" (1st Gear)

With vehicle stopped, move gear selector to "1" position. Accelerate vehicle to 20 MPH. Verify transaxle does not upshift, and TCC does not apply.

Gear Selector Position "R" (Reverse)

With vehicle stopped, move gear selector to "R" position. Verify 1-2 shift solenoid is on, and 2-3 shift solenoid is off.

NOTE: Shift speed charts for Daewoo models are not available.

		1 - 2 Shift @ +/- 3 mph			2 - 3 Shift @ +/- 4 mph			3 - 4 Shift @ +/- 5 mph			Downshifts @ +/- 4 mph			TCC Apply 3rd Gear
% of TPS		10	25	50	10	25	50	10	25	50	4 - 3 Coast	3 - 2 Coast	2 - 1 Coast	10%
Model	Engine RPO													
WXJ	LA1	12	19	30	20	37	56	39	53	90	36	14	9	26
MXJ (GT)	LA1	11	18	28	19	34	52	39	49	97	36	13	8	24
WHR	LD9	10	19	31	23	35	57	40	56	95	35	17	8	27

G00027747

Fig. 3: Hydra-Matic 4T40-E & 4T45-E Shift Speed Chart (Alero & Grand Am)
Courtesy of GENERAL MOTORS CORP.

2000 Saturn LS

2000 AUTOMATIC TRANSMISSIONS Hydra-Matic 4T40-E & 4T45-E Overhaul

		1-2 Shift @ +/- 3 mph			2-3 Shift @ +/- 4 mph			3-4 Shift @ +/- 5 mph			Downshifts @ +/- 4 mph			TCC Apply 3rd Gear
% of TPS		10	25	50	10	25	50	10	25	50	4-3 Coast	3-2 Coast	2-1 Coast	10%
Model	Engine RPO													
WKR	LN2	9	14.5	21	18	25	39.5	39	45	67	30	11.5	6	26
WBR	LD9	9	15	28	17	29	51	34	51	79	30	11	8	22

G00027745

Fig. 4: Hydra-Matic 4T40-E & 4T45-E Shift Speed Chart (Cavalier & Sunfire)
Courtesy of GENERAL MOTORS CORP.

		1-2 Shift @ +/- 3 mph			2-3 Shift @ +/- 4 mph			3-4 Shift @ +/- 5 mph			Downshifts @ +/- 4 mph			TCC Apply 3rd Gear
% of TPS		10	25	50	10	25	50	10	25	50	4-3 Coast	3-2 Coast	2-1 Coast	10%
Model	Engine RPO													
WCR	LG8	12	16	35	18	30	58	40	54	84	36	14	8	27

G00027746

Fig. 5: Hydra-Matic 4T40-E & 4T45-E Shift Speed Chart (Malibu)
Courtesy of GENERAL MOTORS CORP.

		1-2 Shift @ +/- 3 mph			2-3 Shift @ +/- 4 mph			3-4 Shift @ +/- 5 mph			Downshifts @ +/- 4 mph			TCC Apply 3rd Gear
% of TPS		10	25	50	10	25	50	10	25	50	4-3 Coast	3-2 Coast	2-1 Coast	10
Model														
2.2L		10	14.5	29	18	25	51	39	44	67	30	11.5	6	26
3.0L		9	13	26	17	25	48	36	43	78	35	13.5	8	23

G00027748

Fig. 6: Hydra-Matic 4T40-E & 4T45-E Shift Speed Chart (Saturn)
Courtesy of GENERAL MOTORS CORP.

TORQUE CONVERTER DIAGNOSIS

Inspection

Torque converter must be replaced under the following conditions:

- Damage To Pump Assembly

- Metal Particles Present In Oil
- Leaks In Hub Weld Area
- Hub Scored Or Damaged
- Stator Failure
- Torque Converter Imbalance
- Engine Coolant Contamination
- Excessive End Play

Stall Test

1. Torque converter whine is usually noticed when vehicle is stopped and transaxle is in Reverse or Drive. Whine will increase when engine RPM is increased and will stop when vehicle is moving or when torque converter clutch is applied. Stall test is to ensure whine is coming from torque converter.
2. Start engine, and allow it to reach normal operating temperature. Apply parking and service brakes. Put transaxle in Drive. Depress accelerator to about 1200 RPM for less than 6 seconds. DO NOT depress accelerator for more than 6 seconds or transaxle damage may occur. Torque converter noise will increase under this load.

NOTE: **Torque converter whine should not be confused with pump whine, which is usually noticeable in Park, Neutral and all other gear ranges. Pump whine will vary with pressure ranges.**

Stator Check

1. Torque converter stator roller clutch may either remain locked up at all times or free-wheel in both directions. If stator is free-wheeling at all times, vehicle tends to have poor acceleration from a stop. Vehicle may act normal at speeds greater than 30-35 MPH.
2. If poor acceleration is noted, ensure exhaust system is not blocked, engine timing is correct and transaxle is in 1st gear when starting from a stop. If stator is locked up at all times, performance from a stop appears normal. Engine RPM and acceleration is limited at high speeds. Engine may overheat from this condition.
3. A visual inspection of torque converter may reveal converter is Blue from overheating. If torque converter has been removed from vehicle, stator roller clutch can be checked by inserting a finger into splined inner race of roller clutch and trying to turn race in both directions. Inner race should turn freely clockwise but should not turn or should be difficult to turn counterclockwise.

HYDRAULIC PRESSURE TESTS

CAUTION: Parking and service brakes must be applied throughout hydraulic pressure test. Total time for testing with vehicle in any driving gear should not exceed 2 minutes. Transaxle damage may occur.

1. Before performing hydraulic pressure test, check fluid level and condition. Check manual control linkages for correct adjustment, and ensure engine is properly tuned.

2. Connect scan tool to Data Link Connector (DLC). Apply parking brake and start engine. Check for stored DTCs. If DTCs are present, diagnose as necessary. See appropriate ELECTRONIC CONTROLS article. Turn engine off. Connect oil pressure gauge to line pressure test port. See **Fig. 7** . Start engine and warm to normal operating temperature with transaxle in Park.
3. Shift Access Pressure Control Solenoid (PCS) test on scan tool. Increase DESIRED PCS in 0.1 amp increments and read corresponding line pressure on oil pressure gauge. Allow pressure to stabilize for 5 seconds after each current change. Ensure line pressure is as specified. See **LINE PRESSURE SPECIFICATIONS** table. If pressure readings are not as specified, and no DTCs are present, internal malfunction exists. See **TROUBLE SHOOTING** .

NOTE: Scan tool is only able to control pressure control solenoid in Park and Neutral with vehicle stopped. This protects clutches from extremely high or low pressures in Reverse and Drive.

LINE PRESSURE SPECIFICATIONS

PCS Current (Amp)	Line Pressure - psi (kPa)
.00	152-160 (1048-1103)
.10	149-151 (1027-1041)
.30	141-143 (972-986)
.50	124-127 (855-876)
.60	111-115 (765-793)
.70	97-101 (669-696)
.80	81-84 (558-579)
.90	64-67 (441-462)
.95	56-58 (386-400)
1.00	50-51 (345-352)
1.05	50 (345)
1.10	50 (345)

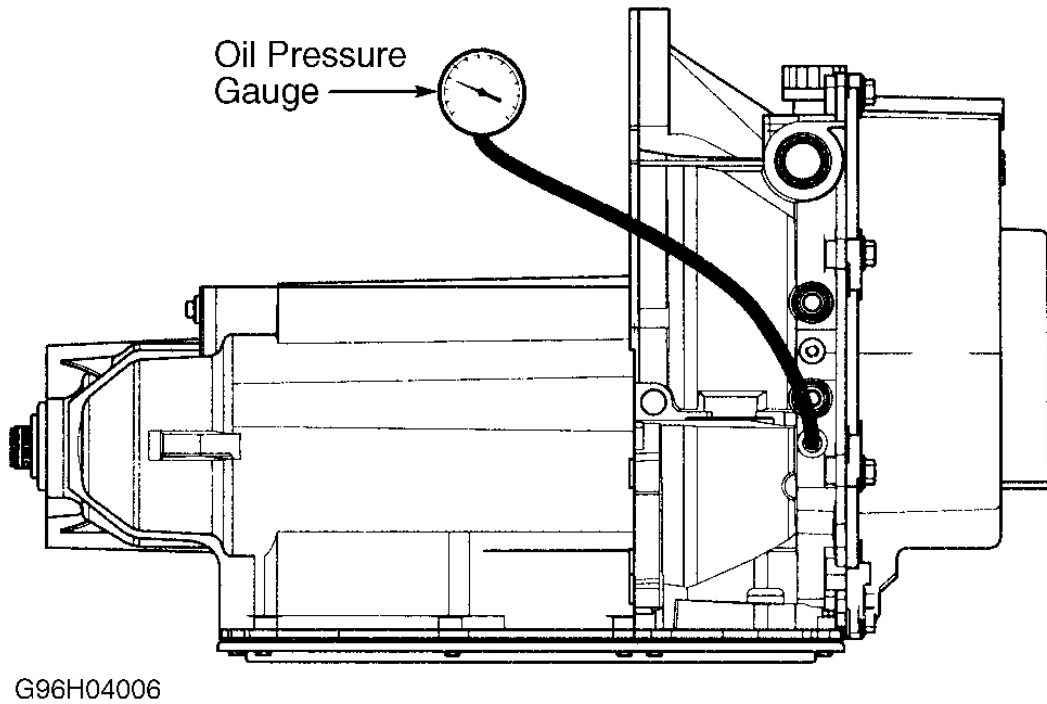


Fig. 7: Installing Oil Pressure Gauge
Courtesy of GENERAL MOTORS CORP.

REMOVAL & INSTALLATION

NOTE: Removal and installation of components not listed here are covered throughout transaxle disassembly and reassembly procedures.

INTERMEDIATE-4TH SERVO ASSEMBLY

Removal & Installation

Raise and support vehicle. Drain transaxle fluid into suitable container. Remove oil pan and filter. Remove retaining bolts for oil feed pipes. Remove oil feed pipes. Remove intermediate-4th servo cover retaining bolts. Remove intermediate-4th servo and spring. To install, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Fill transaxle with recommended fluid to proper level. See **LUBRICATION** .

LOW/REVERSE SERVO ASSEMBLY

Removal & Installation

Raise and support vehicle. Drain transaxle fluid into suitable container. Remove oil pan and filter. Remove

retaining bolts for oil feed pipes. Remove oil feed pipes. Remove low/reverse servo cover retaining bolts. Remove low/reverse servo and spring. To install, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Fill transaxle with recommended fluid to proper level. See **LUBRICATION** .

OUTPUT SPEED SENSOR

Removal & Installation

Disconnect negative battery cable. Raise and support vehicle. Disconnect output speed sensor electrical connector. Remove output speed sensor retaining stud. Remove output speed sensor. To install, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Fill transaxle with recommended fluid to proper level. See **LUBRICATION** .

PARK/NEUTRAL POSITION SWITCH

Removal

Disconnect negative battery cable. Disconnect shift linkage at transaxle. Disconnect park/neutral position switch electrical connectors. Remove park/neutral position switch mounting bolt and nut. Remove shift selector lever-to-transaxle nut and shift selector lever. Remove park/neutral position switch.

Installation

Place transaxle shift shaft in Neutral. Install park/neutral position switch while aligning flats of shift shaft with flats in switch. Install park/neutral position switch mounting bolt and nut and tighten to specification. See **TORQUE SPECIFICATIONS** . Install shift selector lever. Install shift selector lever-to-transaxle nut and tighten to specification. Connect shift linkage. Connect park/neutral position switch electrical connectors. Connect negative battery cable and tighten to specification. Ensure engine only starts with transaxle in Park or Neutral.

RIGHT STUB AXLE SHAFT & OIL SEAL

See appropriate article in DRIVE AXLES.

TRANSAXLE

See appropriate AUTOMATIC TRANSAXLE REMOVAL article in TRANSMISSION SERVICING.

TRANSAXLE DISASSEMBLY

REAR SECTION

1. Thoroughly clean transaxle exterior. Drain fluid, and remove torque converter. Remove input shaft "O" ring from input shaft. Place transaxle in holding fixture. Remove and discard snap ring from end of axle stub shaft. Attach slide hammer to shaft removal tool.
2. Install shaft removal tool into snap ring groove on stub shaft. Secure removal tool to stub shaft. Pull on

stub shaft and rotate until stub shaft snap ring at differential seats in taper on differential side gear. Pull stub shaft out using slide hammer.

LOWER SECTION

1. Remove output speed sensor stud, output speed sensor and "O" ring. See **Fig. 8** . Rotate transaxle so case side cover is facing upward to drain most transaxle fluid through stub shaft end of transaxle. Rotate transaxle with oil pan facing upward.
2. Remove bottom oil pan and gasket. Remove oil level control valve. Remove oil filter and filter seal from transaxle case. Remove 4 oil feed tube bolts and oil feed tube assembly. Feed tube seal rings are glued in place and should remain with feed tube assembly. Seal rings are reusable.



Fig. 8: Exploded View Of Transaxle Components
Courtesy of GENERAL MOTORS CORP.

SERVO ASSEMBLIES

Remove 3 bolts from intermediate-4th and low/reverse servo covers. Remove servos and servo return springs. See **Fig. 8**.

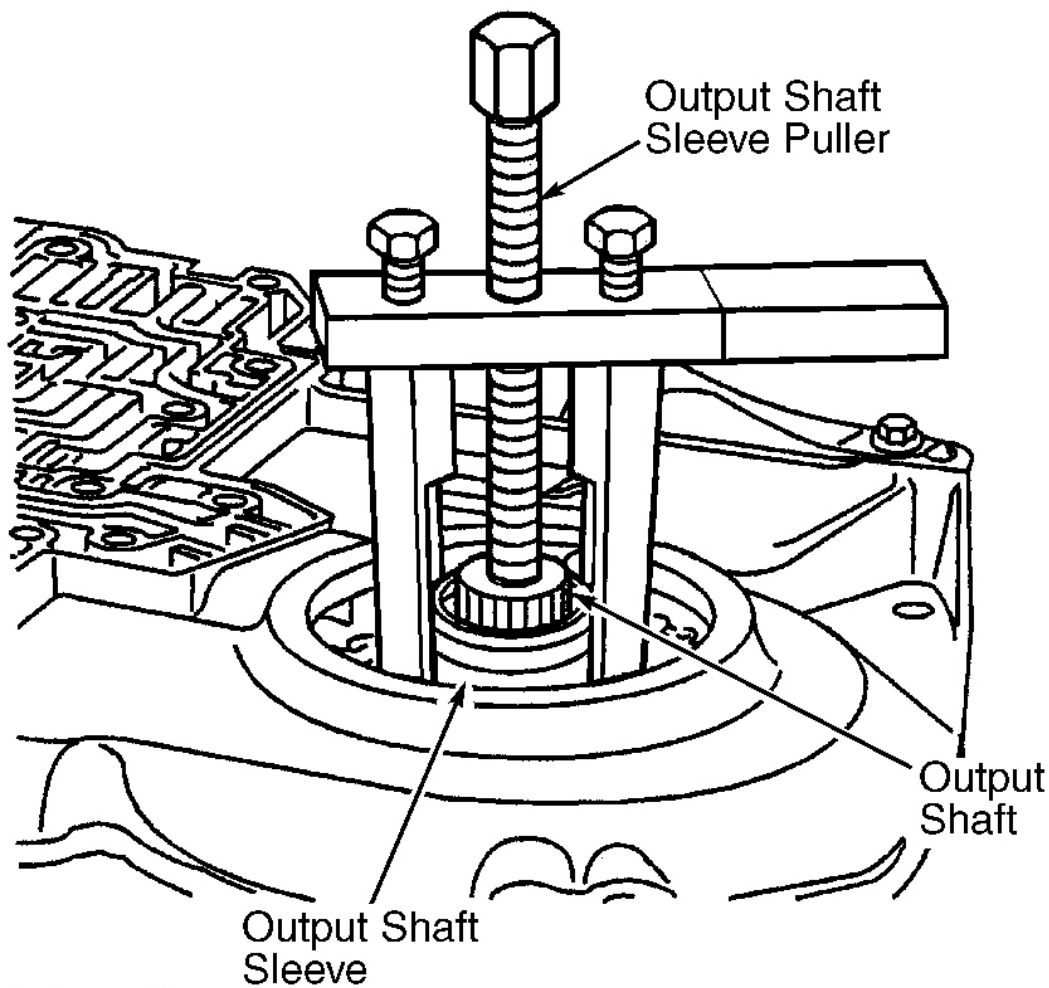
CASE SIDE COVER

Rotate transaxle so case side cover is facing upward. Remove side cover bolts and/or studs. Remove transaxle side cover. Remove 2 side cover gaskets and side cover-to-driven sprocket support thrust washer, if not removed with side cover. See **Fig. 8**.

OUTPUT SHAFT SLEEVE

CAUTION: Transaxle component damage will occur if an attempt is made to remove the output shaft at this time. Transaxle must be completely disassembled to remove output shaft.

Remove snap ring from output shaft. Install legs of Output Shaft Sleeve Puller (J-41227) under output shaft sleeve. See **Fig. 9**. Tighten center bolt of output shaft sleeve puller to remove output shaft sleeve. Discard output shaft sleeve.



G00027749

Fig. 9: Removing Output Shaft Sleeve
Courtesy of GENERAL MOTORS CORP.

OIL PUMP & CONTROL VALVE ASSEMBLY

NOTE: For oil pump, control valve assembly and channel plate bolt identification and length, see **BOLT IDENTIFICATION** table.

1. Remove 8 bolts from oil pump. See **Fig. 10** . Remove oil pump assembly and oil pump shaft. Disconnect wiring harness connectors from Pressure Switch Assembly (PSA), Pressure Control Solenoid (PCS), TCC solenoid and shift solenoids.
2. Remove 6 bolts from Transmission Fluid Pressure (TFP) switch assembly. Remove TFP switch assembly from control valve assembly. Pressure switch "O" rings are reusable and should remain with pressure switch assembly. Remove 12 remaining control valve assembly bolts. Remove control valve assembly

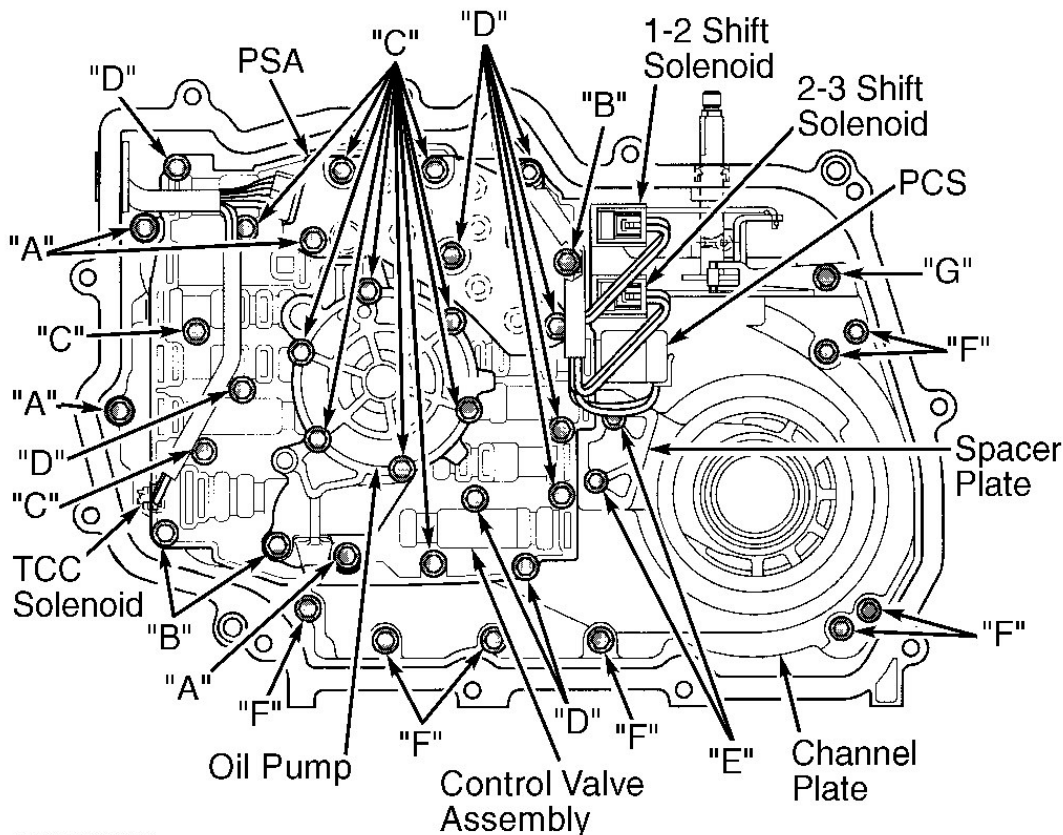
and valve body-to-spacer plate gasket. Discard gasket. See **Fig. 8** .

3. Remove 2 spacer plate support bolts and spacer plate support. Remove spacer plate with spacer plate filter attached. Remove and discard spacer plate-to-channel plate gasket. Remove 7 check balls in channel plate. See **Fig. 11** . DO NOT use a magnet to remove check balls. Magnet may cause check balls to become magnetized and attract metallic particles.

BOLT IDENTIFICATION ⁽¹⁾

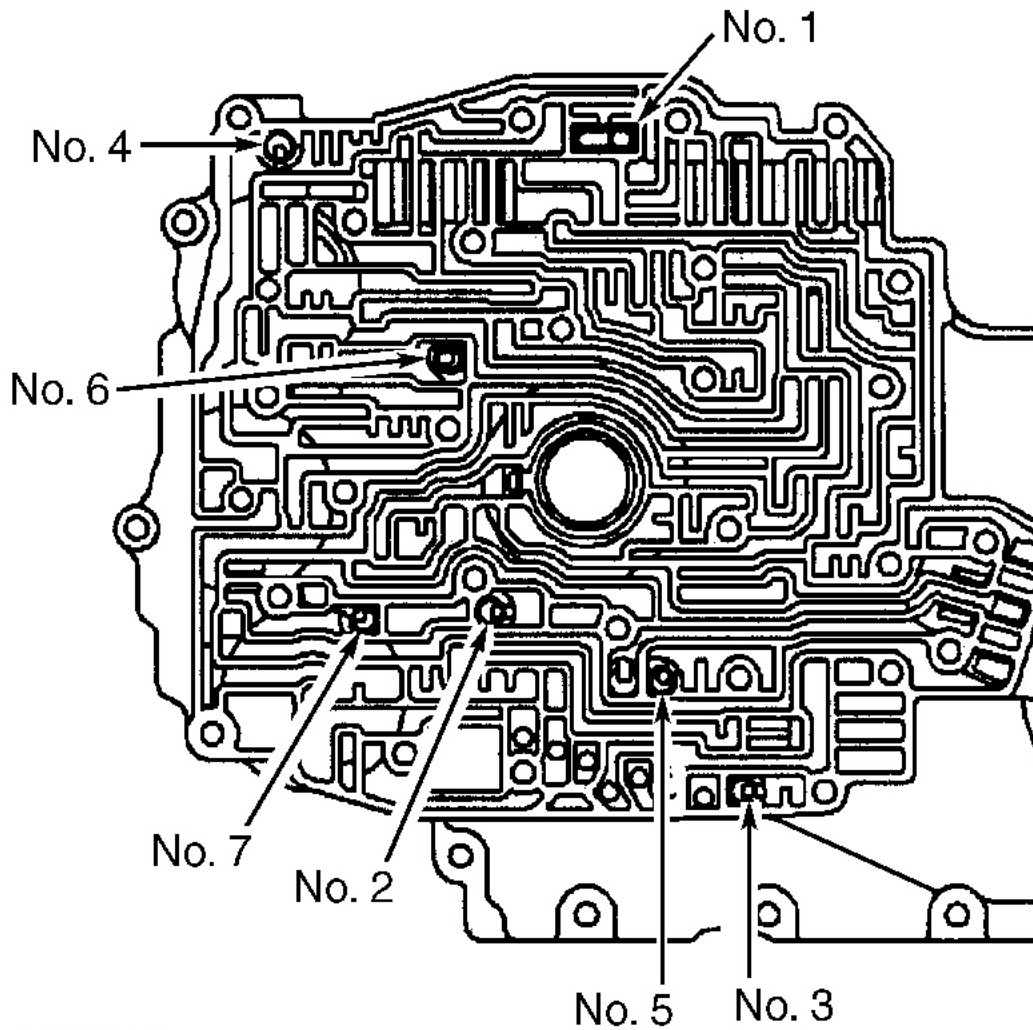
Bolt Identification	Length - In. (mm)
A	2.48 (63.0)
B	4.06 (103.0)
C	3.54 (90.0)
D	2.01 (51.0)
E	2.68 (68.0)
F	1.10 (28.0)
G	0.75 (19.0)

(1) For bolt locations, refer to illustration. See **Fig. 10** .



G96B04008

Fig. 10: Removing Oil Pump, Control Valve Assembly & Channel Plate Bolts
 Courtesy of GENERAL MOTORS CORP.



G98C01901

Fig. 11: Locating Check Balls
 Courtesy of GENERAL MOTORS CORP.

CHANNEL PLATE, GASKET & ACCUMULATORS

Disconnect manual valve clip and link from manual valve. See **Fig. 12** .

Remove 10 channel plate bolts. See **Fig. 10** . Remove channel plate assembly with drive sprocket-to-channel plate thrust washer, accumulator pistons and pins, manual valve and detent lever spring and bolt. Remove and discard channel plate-to-case gasket. Remove 3 accumulator springs from case. See **Fig. 13** .

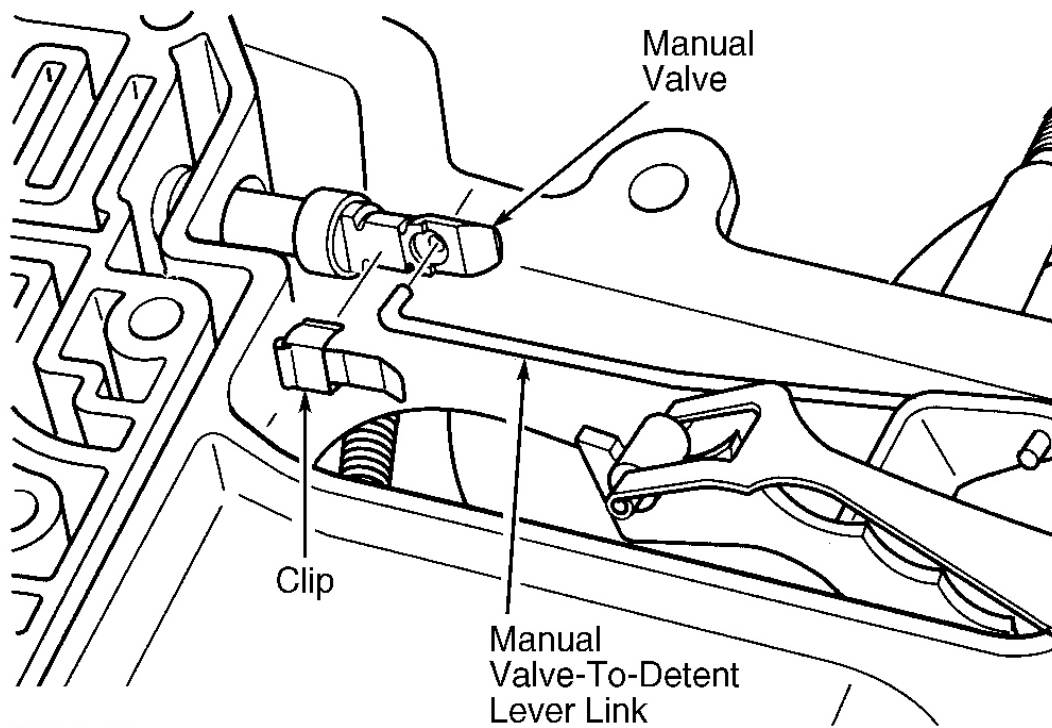


Fig. 12: Removing Manual Valve Clip, Link & Manual Valve
Courtesy of GENERAL MOTORS CORP.

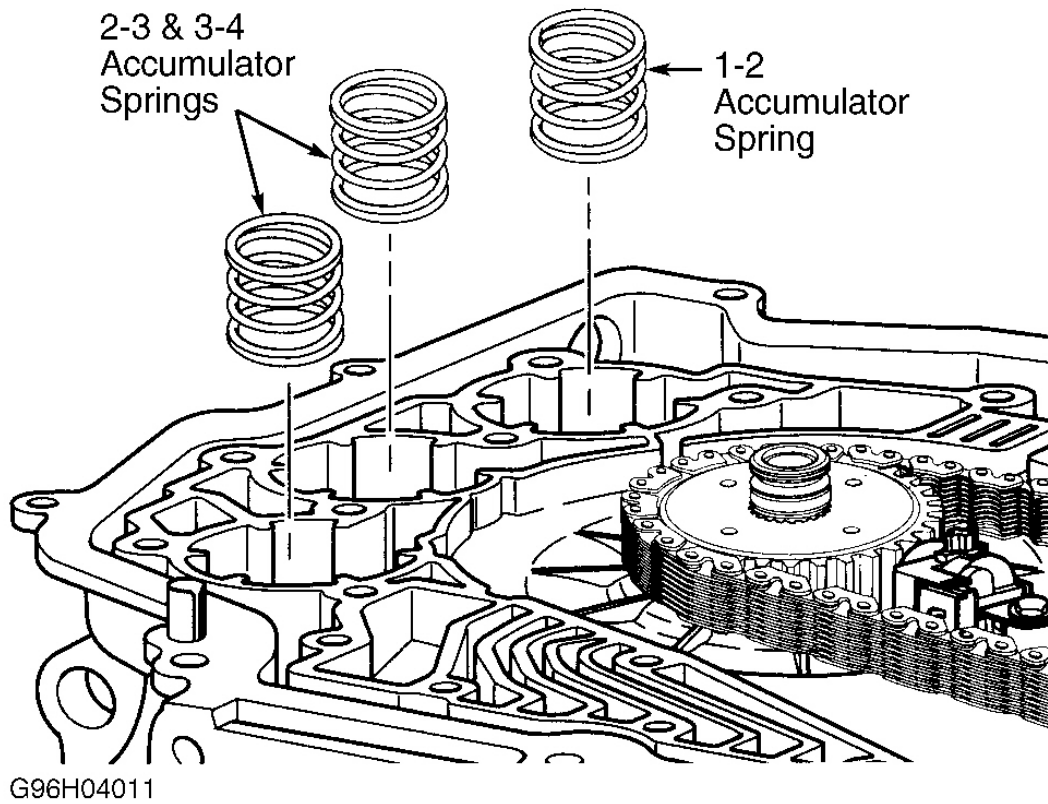
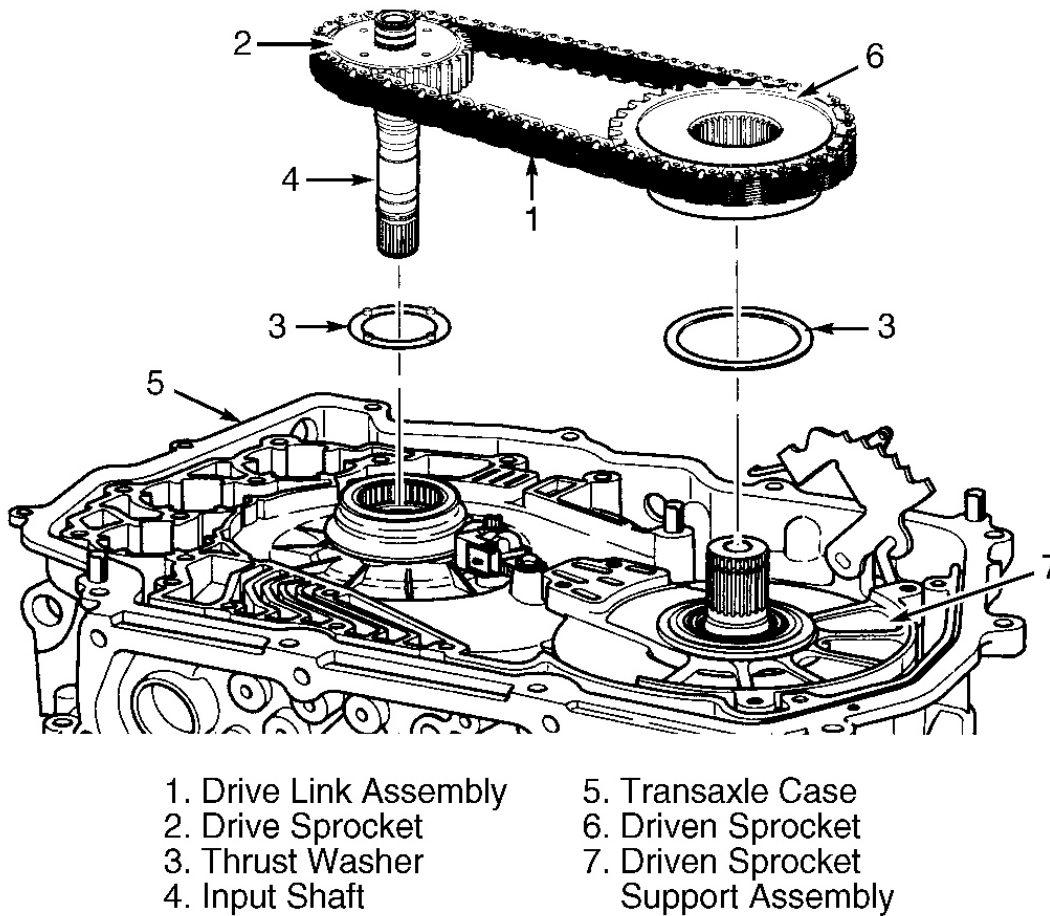


Fig. 13: Identifying Accumulator Springs
Courtesy of GENERAL MOTORS CORP.

DRIVE & DRIVEN SPROCKETS, & DRIVE LINK ASSEMBLY

Lift and remove drive sprocket, driven sprocket and drive link assembly as a complete unit. See **Fig. 14** . Note direction chain is facing when removed. Chain should be installed in same direction during assembly to prevent excessive noise. Remove drive sprocket-to-drive sprocket support thrust washer. Driven sprocket-to-driven sprocket support thrust washer should remain with driven sprocket support assembly.

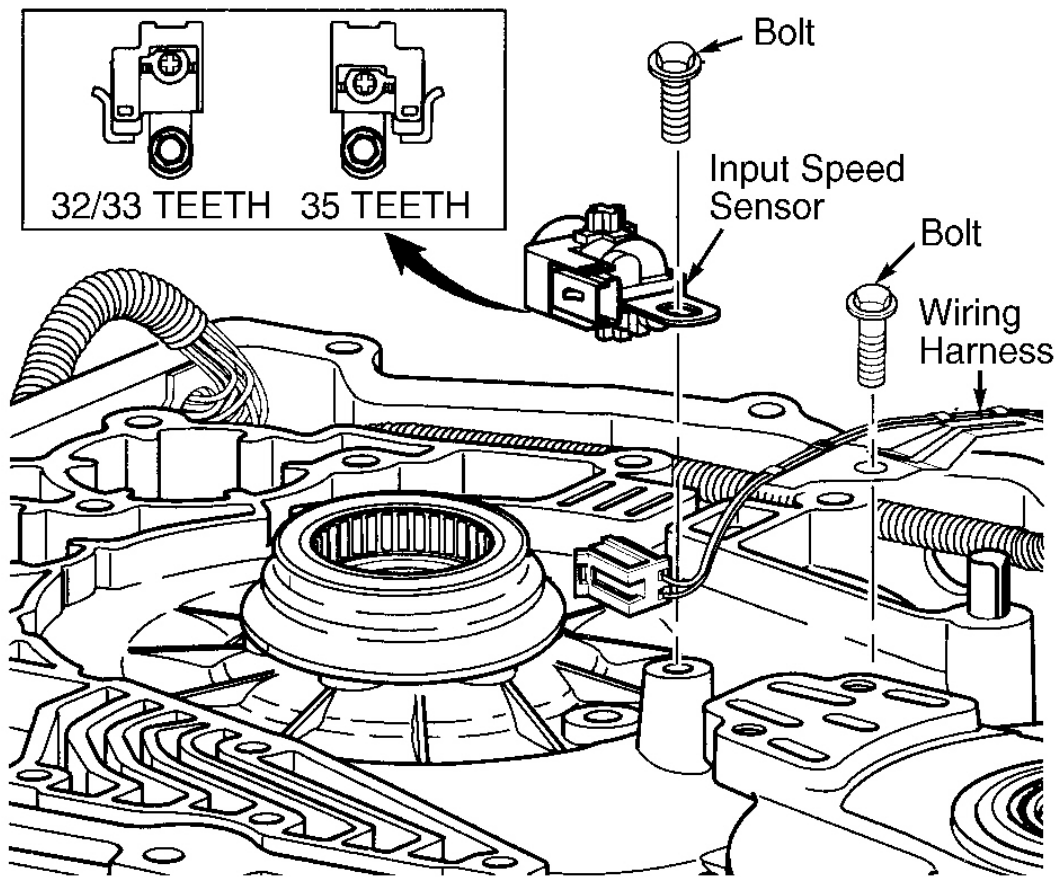


G96B04013

Fig. 14: Removing Drive & Driven Sprockets & Drive Link Assembly
 Courtesy of GENERAL MOTORS CORP.

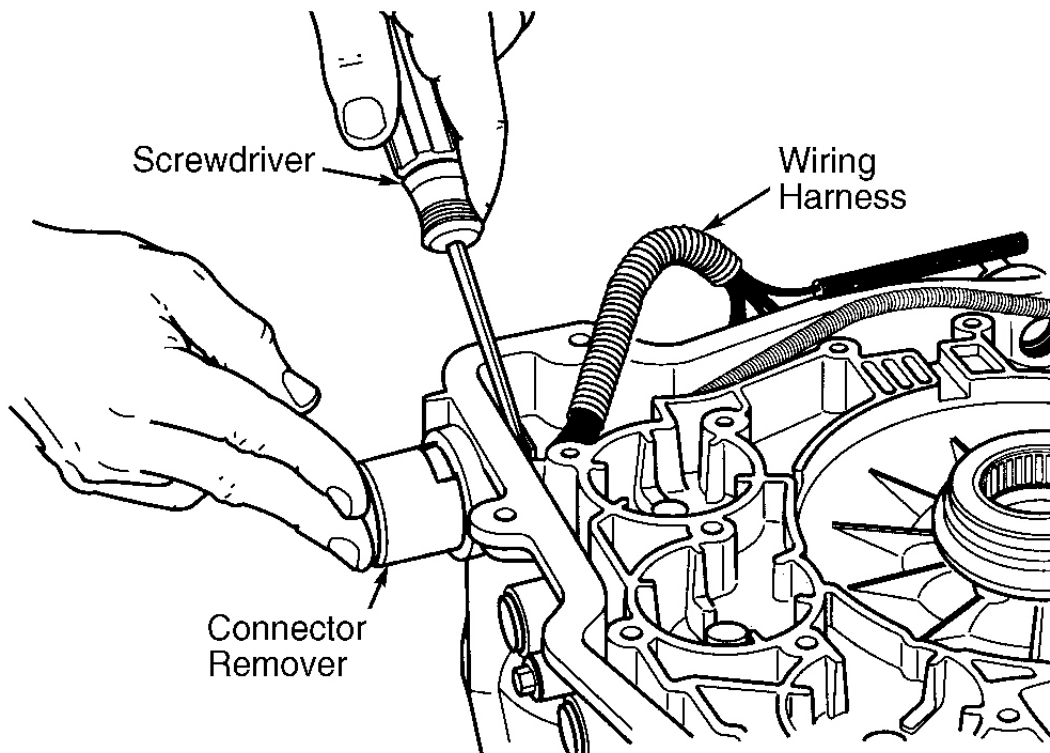
INPUT SPEED SENSOR & WIRING HARNESS

Disconnect wiring harness connector at input speed sensor. Remove input speed sensor bolt and sensor. Remove wire retainer clip bolt and retainer clip. See **Fig. 15** . Remove pass-through connector. Push tool onto pass-through connector from outside of transaxle case to compress pass-through connector retaining tabs. With retaining tabs compressed, use a screwdriver to remove pass-through connector through inside of transaxle case. Remove wiring harness. See **Fig. 16** .



G96D04014

Fig. 15: Locating & Identifying Input Speed Sensor
Courtesy of GENERAL MOTORS CORP.



G96G04015

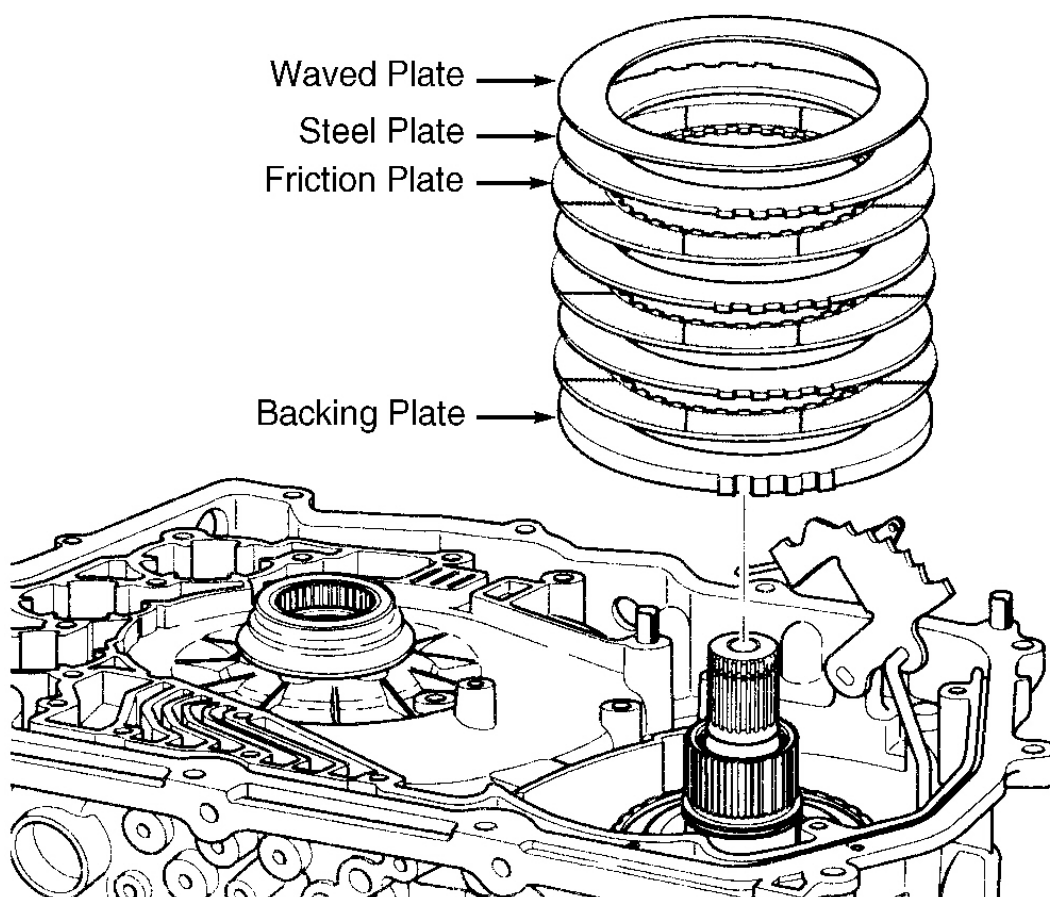
Fig. 16: Removing Pass-Through Connector From Transaxle
 Courtesy of GENERAL MOTORS CORP.

TRANSAXLE CASE COMPONENTS

1. Remove driven sprocket-to-driven sprocket support thrust washer (if necessary). Remove driven sprocket support assembly. See **Fig. 14**. Remove 2nd clutch plates. Plates consist of one waved plate, 3 steel plates, 3 friction plates and one backing plate. See **Fig. 17**. Remove driven sprocket support-to-reverse input clutch housing thrust washer. Remove reverse input clutch housing and 2nd roller clutch assembly.
2. Remove intermediate-4th band. See **Fig. 8**. Remove coast and direct clutch and reaction carrier assembly. Keep bearing assembly and selective thrust washer located on top of assembly. Remove input carrier and reaction internal gear assembly. Bearing assembly is permanently located in input carrier. Remove input carrier-to-forward clutch hub thrust bearing. Thrust bearing may have remained with input carrier.
3. Remove input flange and forward clutch hub assembly. Remove forward clutch hub-to-race thrust washer. Thrust washer may be attached to forward clutch hub. Remove forward clutch assembly and low/reverse band. Using a screwdriver, remove forward clutch support snap ring from transaxle case.
4. Remove forward clutch support and low roller clutch assembly. Keep forward clutch housing-to-forward clutch support thrust bearing with forward clutch support assembly. Parking pawl may need to be depressed to allow forward clutch support to be removed.
5. Remove output shaft, final drive assembly and final drive sun gear as an assembly. Remove differential carrier-to-case thrust bearing. Thrust bearing may be removed with final drive assembly. Remove final

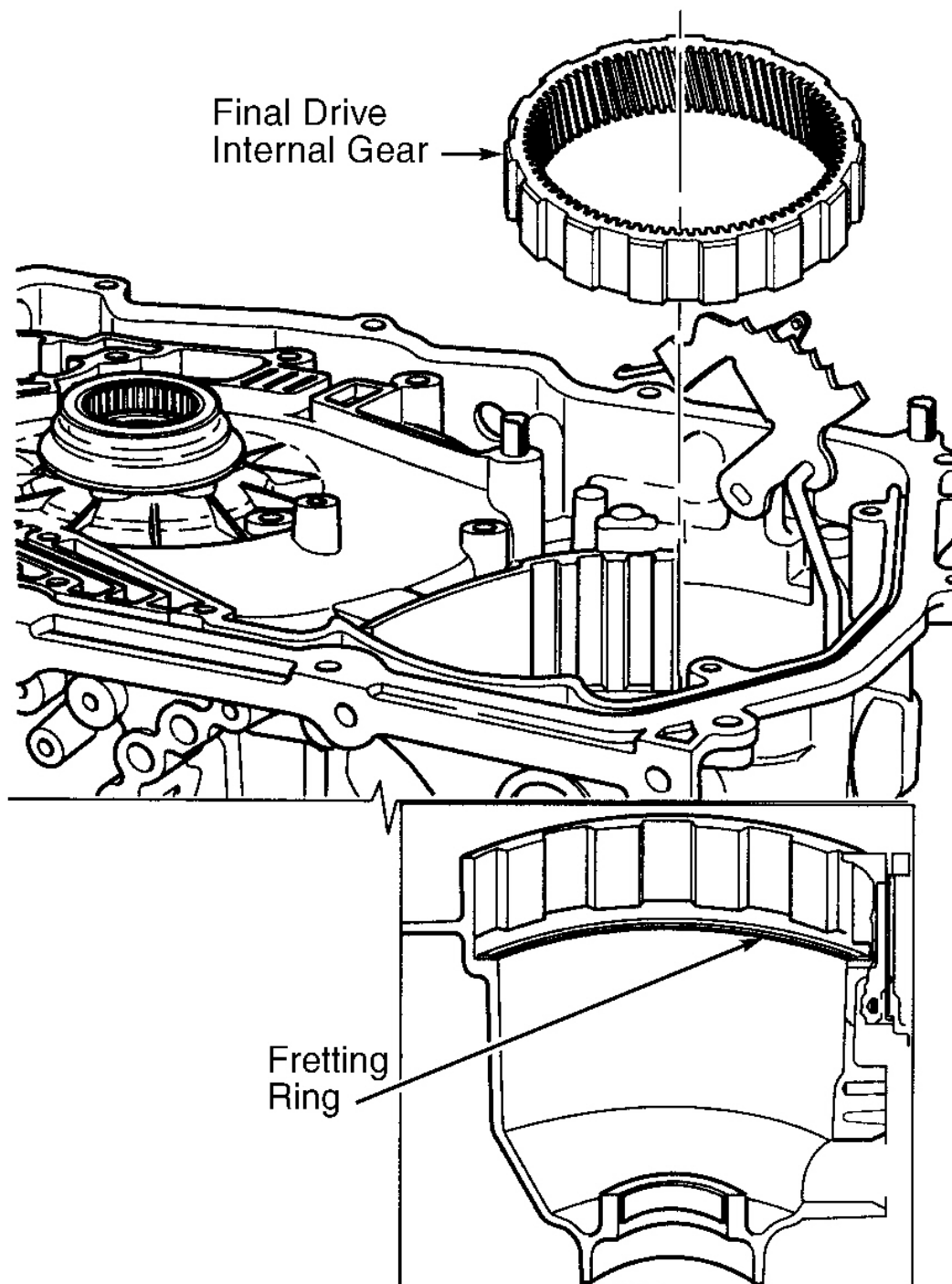
drive internal gear.

NOTE: Fretting ring is located in case ring groove. See [Fig. 18](#) . Fretting ring does not need to be removed unless damaged.



G96I04016

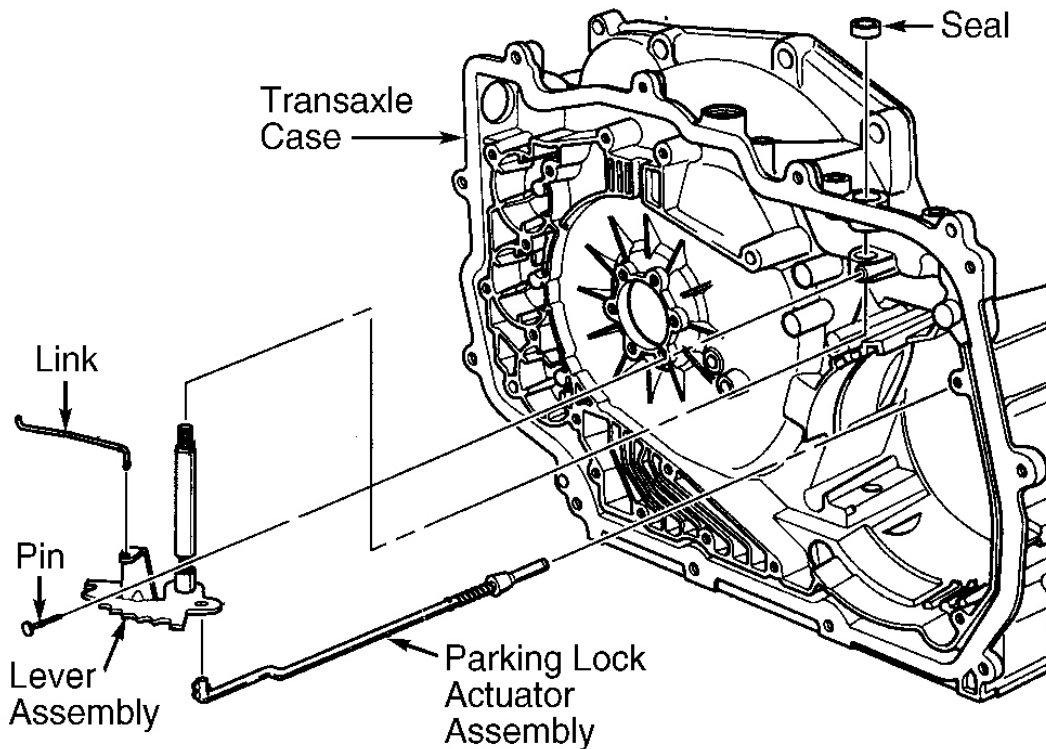
Fig. 17: Identifying 2nd Clutch Plates
Courtesy of GENERAL MOTORS CORP.



G96A04017

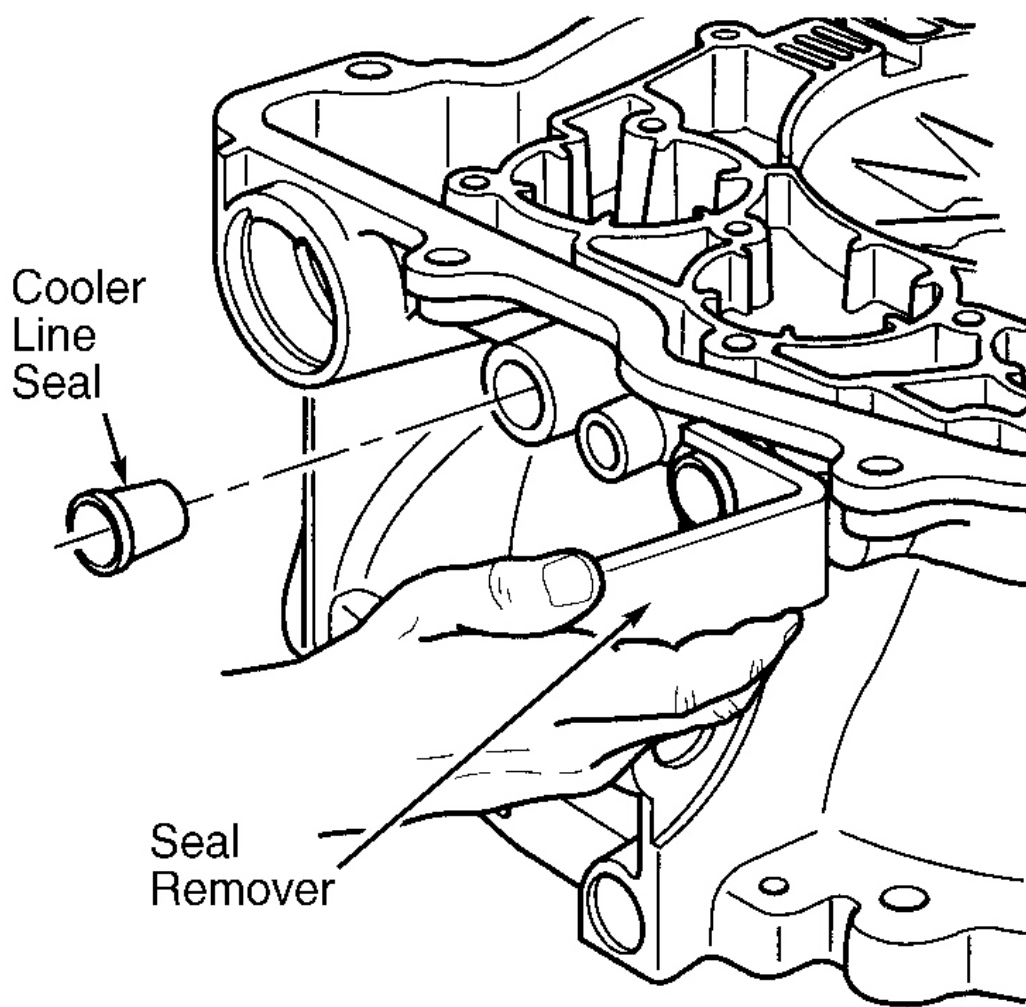
Fig. 18: Identifying Final Drive Internal Gear & Fretting Ring
Courtesy of GENERAL MOTORS CORP.

6. Remove manual shaft-to-transaxle case pin. Remove manual shaft and detent lever assembly by pushing manual shaft into case. Parking lock actuator assembly will remain attached to detent lever until assembly is removed. Remove manual shaft seal from case. See **Fig. 19** . Be careful not to damage case bore during removal.
7. Install Seal Remover (J-41239-10) between cooler line seal and transaxle case. Pivot seal remover back and forth against transaxle case as necessary to remove seals. See **Fig. 20** .
8. Insert 3 Puller Legs (J-41103-1) under torque converter seal. See **Fig. 21** . Insert Support Body (J-41103-3) over stator shaft. Insert Puller Bridge (J-41103-2) over support body and connect puller legs into slots on puller bridge. Tighten forcing screw on puller bridge until puller legs remove torque converter seal. Discard torque converter seal after removal.
9. Remove 6 bolts from drive sprocket support. Remove drive sprocket support from case. See **Fig. 8** . Using screwdriver, remove right side axle oil seal from transaxle case. DO NOT damage case bore.



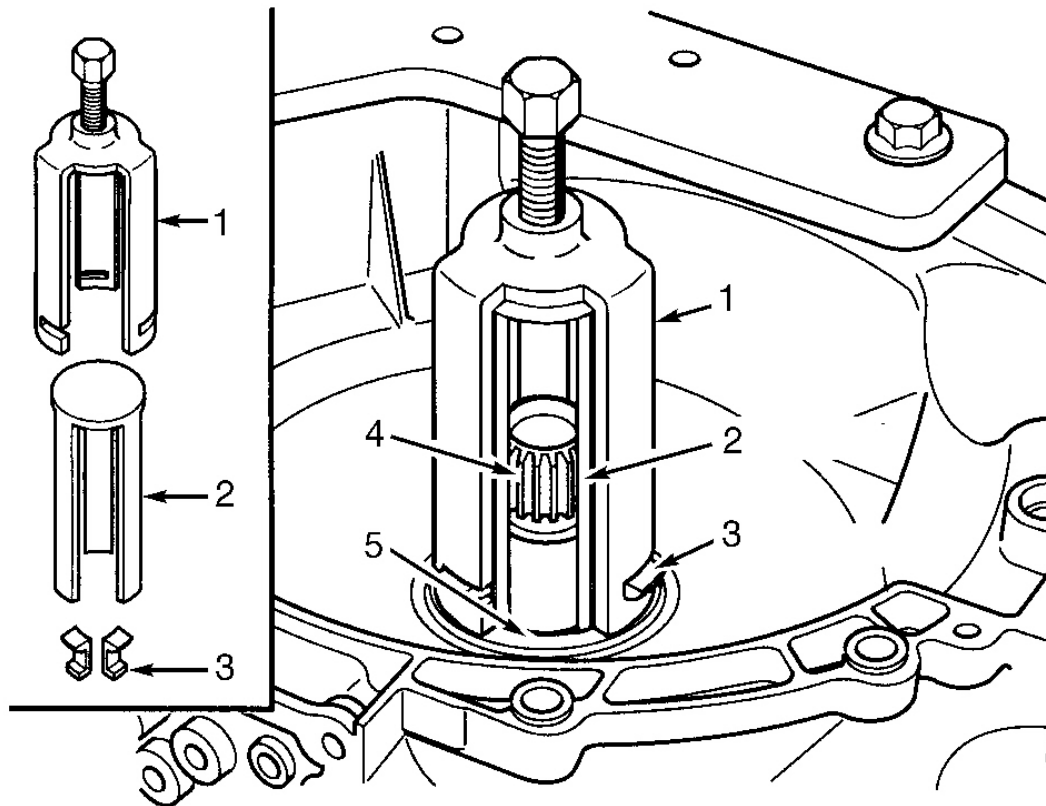
G96C04018

Fig. 19: Identifying Manual Shaft, Detent Lever & Parking Lock Actuator Assembly
Courtesy of GENERAL MOTORS CORP.



G96E04019

Fig. 20: Removing Cooler Line Seals
Courtesy of GENERAL MOTORS CORP.



- 1. Puller
- 2. Support
- 3. Feet

- 4. Drive Sprocket & Stator Shaft Support
- 5. Converter Seal

G96G04020

Fig. 21: Removing Torque Converter Seal
 Courtesy of GENERAL MOTORS CORP.

COMPONENT DISASSEMBLY, REASSEMBLY & TRANSAXLE REASSEMBLY

NOTE: The following procedures also include transaxle reassembly. Transaxle components are installed into transaxle as components are reassembled. For component seal, thrust bearing and thrust washer locations, refer to illustrations. See [Fig. 22](#) and [Fig. 23](#) .

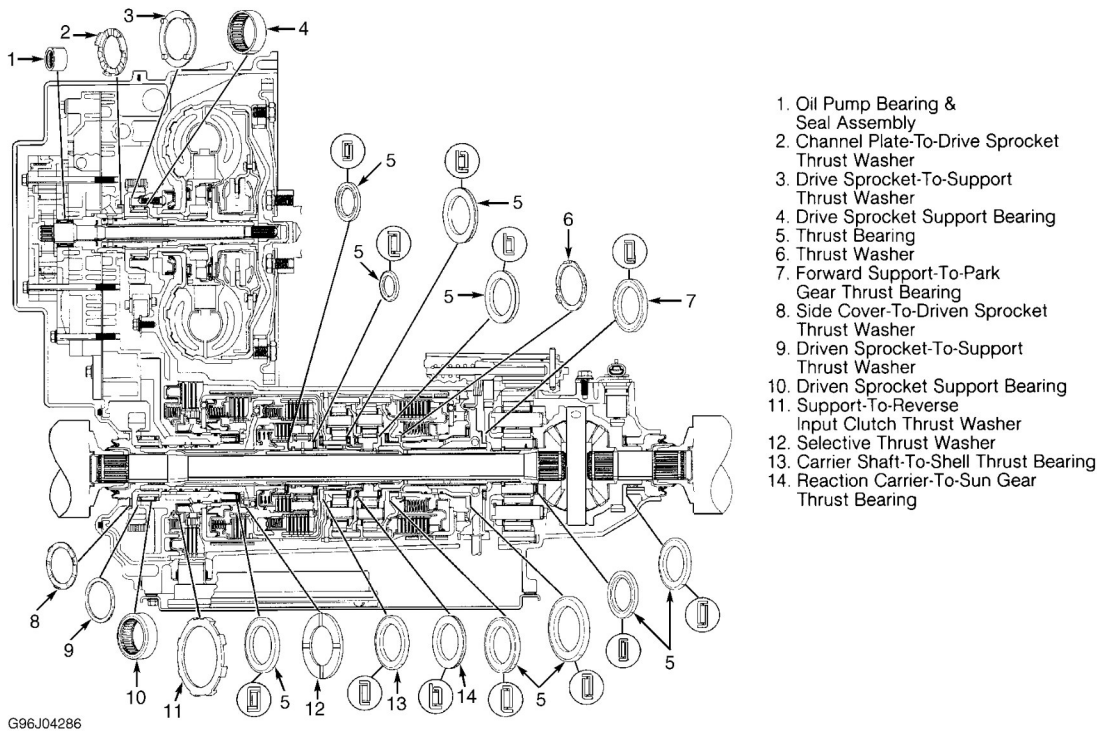


Fig. 22: Identifying Hydra-Matic 4T40-E & 4T45-E Thrust Bearing & Thrust Washer Locations
 Courtesy of GENERAL MOTORS CORP.

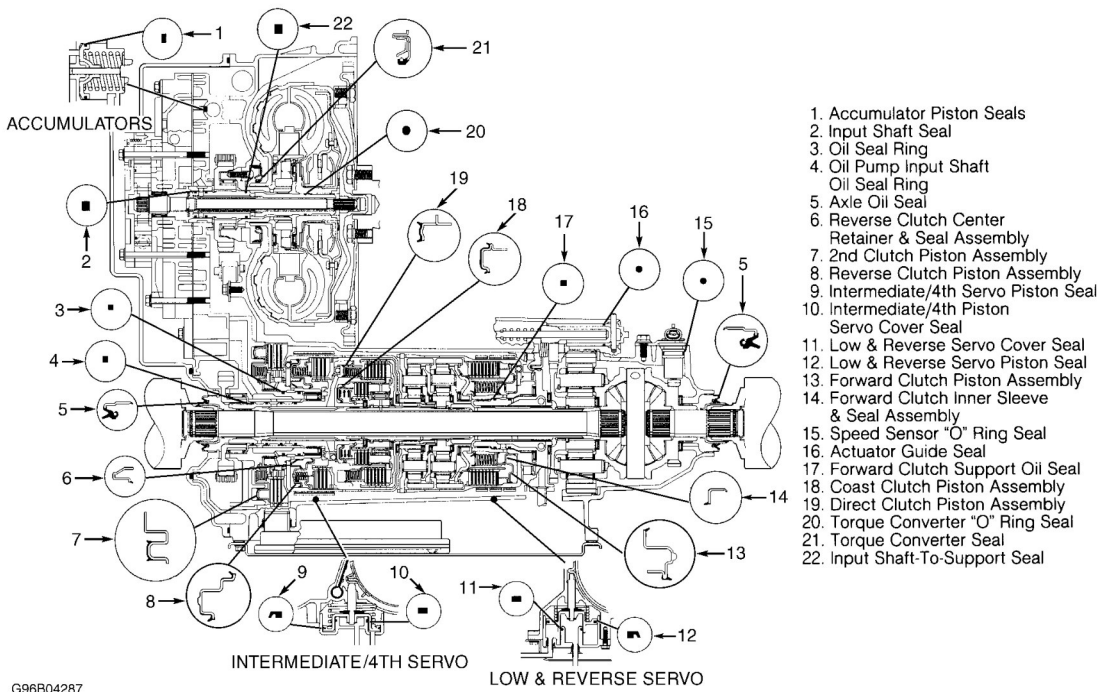
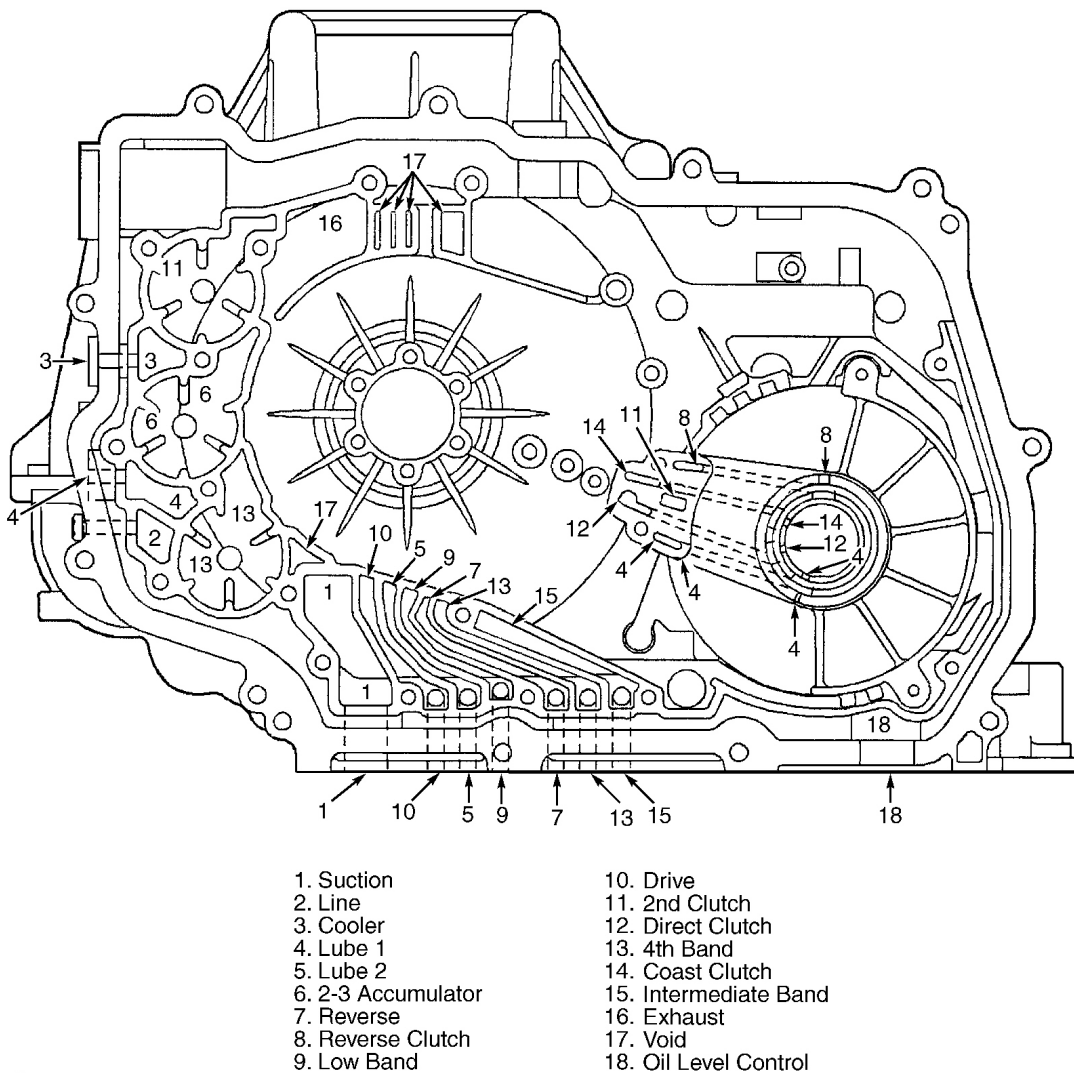


Fig. 23: Identifying Hydra-Matic 4T40-E & 4T45-E Seal Locations & Installation Direction
 Courtesy of GENERAL MOTORS CORP.

TRANSAXLE CASE

Cleaning & Inspection

Prior to transaxle reassembly, clean transaxle case thoroughly with solvent and air dry. Inspect transaxle case for damage to band lugs, snap ring grooves and bushings. Blow compressed air through all case passages. See [Fig. 24](#) . Check for interconnected or damaged oil passages and servo bores. Inspect case for stripped threads in bolt holes or casting porosity. Repair or replace case if necessary.



G99H54970

Fig. 24: Identifying Transaxle Case Fluid Passages
 Courtesy of GENERAL MOTORS CORP.

NOTE: **DO NOT** remove actuator guide unless replacement is necessary.

Actuator Guide (Disassembly & Reassembly)

1. Remove actuator guide roll pin from case. Remove actuator guide and seal from transaxle case by tapping guide into transaxle case. See **Fig. 25**.
2. Install NEW seal on actuator guide. Install actuator guide into transaxle case. Install actuator guide roll pin into transaxle case to secure actuator guide.

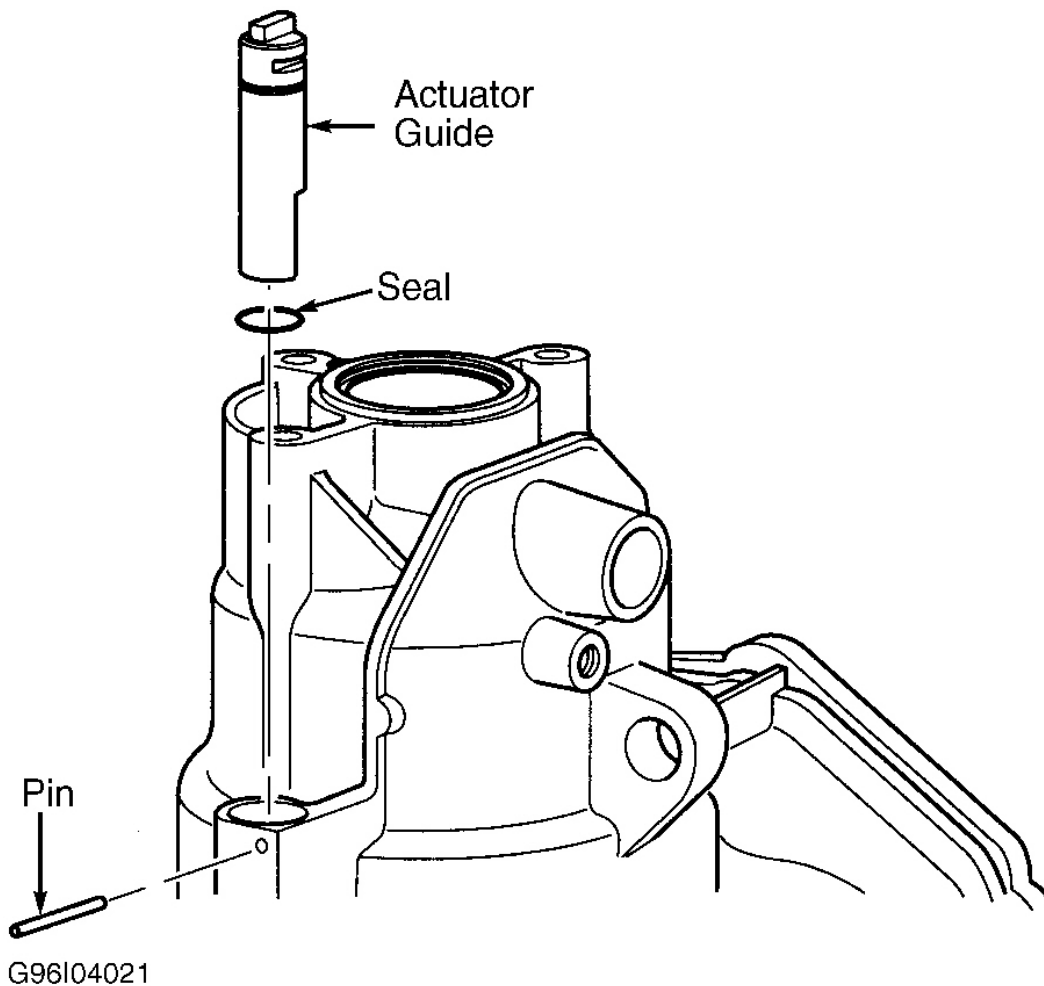


Fig. 25: Removing Actuator Guide

Courtesy of GENERAL MOTORS CORP.

Drive Sprocket Support (Disassembly & Reassembly)

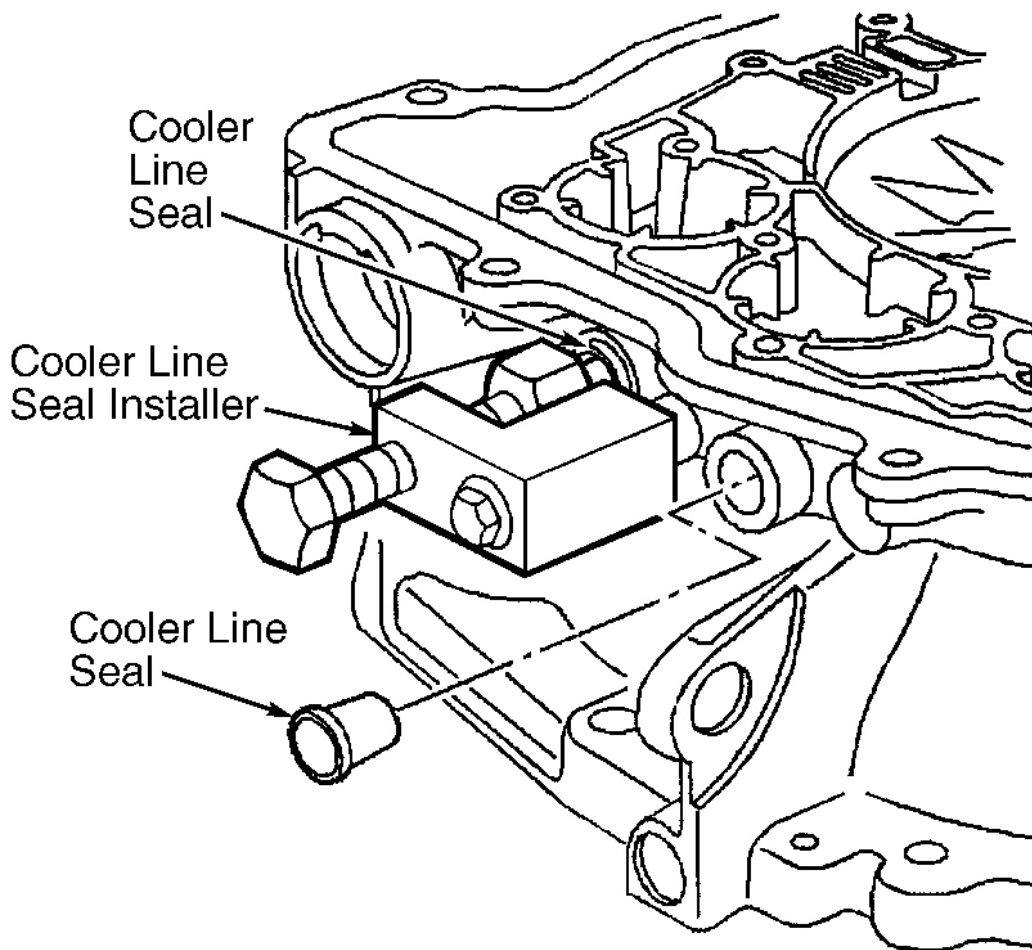
1. If removal of drive sprocket bearing from drive sprocket is necessary, use appropriate bearing puller and

slide hammer. Remove support bearing and install NEW bearing.

2. Inspect drive sprocket support for damage to stator shaft splines, journals and bushings. Also inspect converter seal drain holes for blockage. If drive sprocket support replacement is necessary, remove attaching screws and remove support. Install drive sprocket support and tighten attaching screws to specification. See **TORQUE SPECIFICATIONS** . Using Seal Installer (J-28540-A), install NEW torque converter seal.

Transaxle Cooler Line Seals (Reassembly)

Seals were removed during transaxle disassembly procedure. For reassembly, lubricate cooler line seals with transaxle fluid. Place NEW seal in transaxle case bore. Position Cooler Line Seal Installer (J-41239-1) on transaxle case at cooler line bracket bolt hole. See **Fig. 26** . Press cooler line seal into case by tightening seal pressing bolt on cooler line seal installer until seal bottoms out in case bore. Repeat procedure to install second cooler line seal.



G00027752

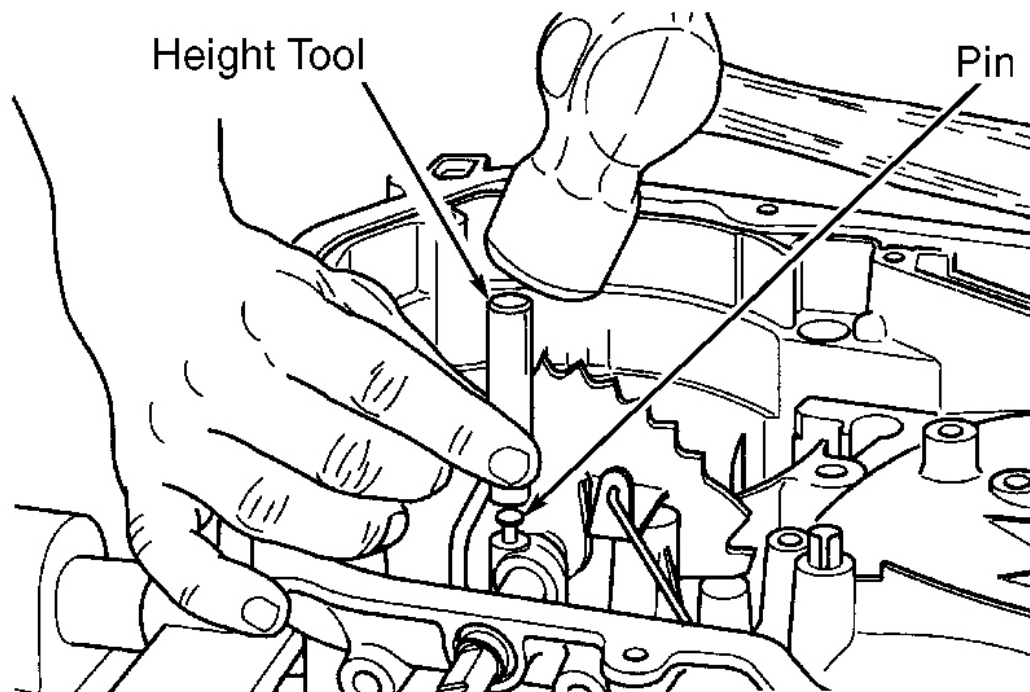
Fig. 26: Installing Cooler Line Seals

Courtesy of GENERAL MOTORS CORP.

Manual Shaft, Detent Lever & Actuator Rod (Reassembly)

CAUTION: Manual shaft-to-case pin must be installed to correct height using Height Tool (J-41229). Manual shaft-to-case pin may crack case boss if installed too deep.

Components were removed during transaxle disassembly. For component reassembly, install NEW manual shaft seal into transaxle case using 13 mm socket. Install manual shaft and detent lever assembly into transaxle case with manual valve to detent lever link and parking lock actuator assembly attached. See **Fig. 19** . Ensure parking lock actuator rod is positioned properly into actuator guide. Using Height Tool (J-41229), install manual shaft-to-case pin to correct height. See **Fig. 27** .



G96A04022

Fig. 27: Installing Manual Shaft Pin

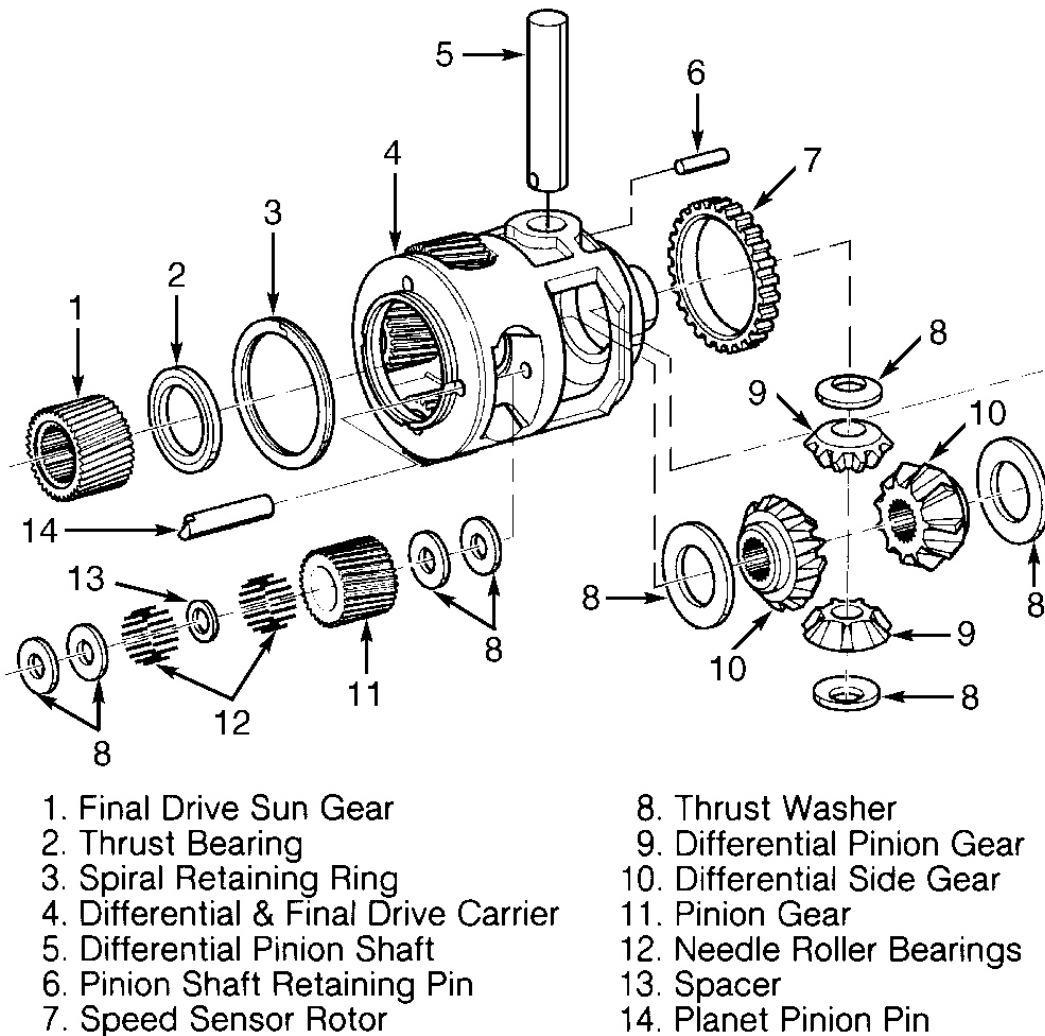
Courtesy of GENERAL MOTORS CORP.

DIFFERENTIAL & FINAL DRIVE ASSEMBLY**Disassembly & Inspection**

1. Place differential and final drive assembly in clean drain pan to prevent needle bearings from being lost if pinion gears are removed. Using a pin punch, remove differential pinion shaft retaining pin. See **Fig. 28** . Remove differential pinion shaft. Remove snap ring from end of output shaft and remove output shaft from differential carrier. Discard snap ring.

CAUTION: Note position of differential pinion gears when removing. Pinion gears should be installed in same direction as removed. Installing pinion gear upside-down may cause noise due to change in set wear pattern.

2. Remove final drive sun gear. Remove differential pinion gears and thrust washers. Remove differential side gears and thrust washers. Remove final drive carrier spiral retaining ring.
3. Remove 4 planet pinion pins, 4 pinion gears, pinion thrust washers, needle roller bearings and needle bearing spacers. Remove final drive sun gear-to-carrier thrust bearing.
4. Inspect needle bearings, thrust washers, pinion gears and planet pinion pins for excessive wear. Polishing is normal condition for pinion pins and needle bearings. Inspect pinion shaft for spalling or wear. Inspect thrust washers for wear and cracks. Clean and dry final drive carrier and final drive components.



G96C04023

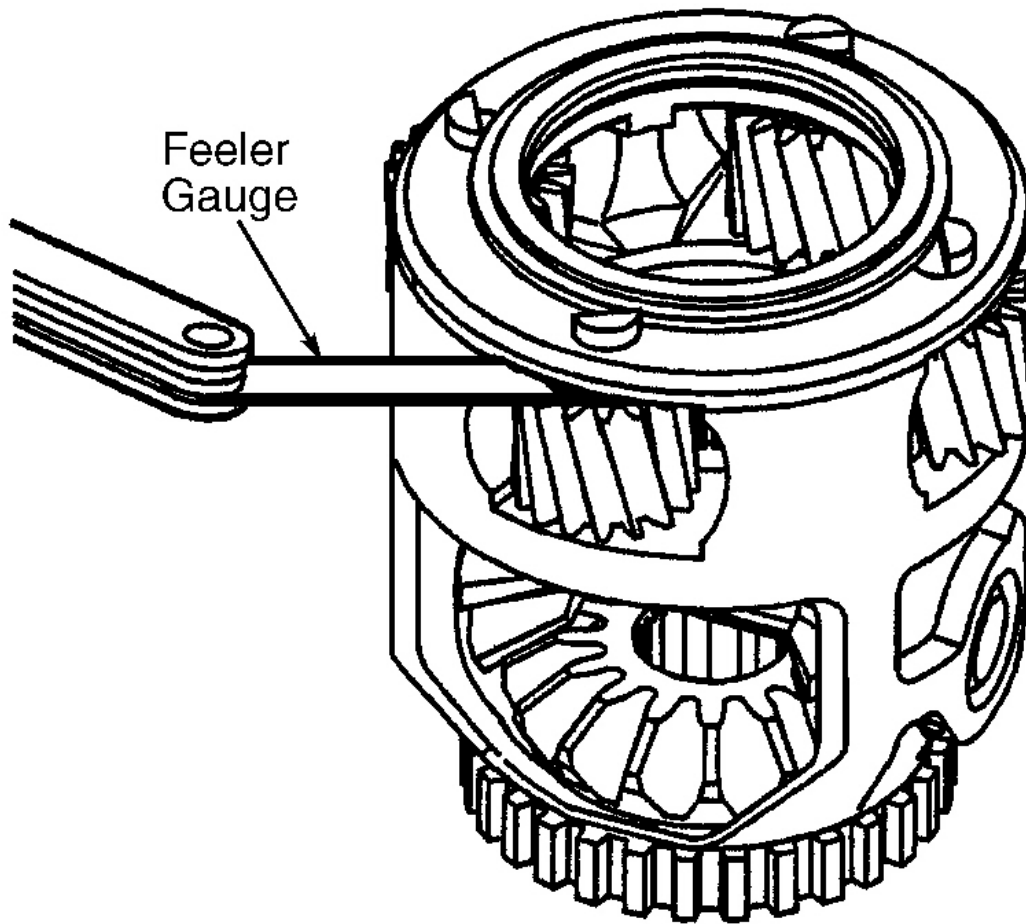
Fig. 28: Exploded View Of Differential & Final Drive Assembly
 Courtesy of GENERAL MOTORS CORP.

Reassembly

1. Install needle bearing spacer onto planet pinion gear. Needle bearing spacer must be assembled between 2 rows of needle bearings. To aid in assembly of needle bearings, place needle bearing spacer and planet pinion gear onto planet pinion pin. Place thrust washer on bottom of planet pinion gear to retain bottom row of needle bearings. Use petroleum jelly to keep needle bearings in place. Install needle bearings one at a time into planet pinion gear.
2. Install sun gear-to-final drive carrier thrust bearing onto final drive carrier. Use petroleum jelly to position thrust bearing. Assemble pinion gear thrust washers and planet pinion gears into final drive carrier. Pinion gears should be assembled in same direction as removed to prevent noise due to change in gear wear

pattern.

3. Install planet pinion pins into final drive carrier to retain planet pinion gears. Install final drive carrier spiral retaining ring to retain planet pinion pins. Install thrust washers onto differential side gears. Install differential side gears into final drive carrier. Use petroleum jelly to position thrust washers onto differential pinion gears. Install differential pinion gears and thrust washers into final drive carrier.
4. Rotate differential pinion gears into position and install differential pinion shaft through final drive carrier and differential pinion gears. Position of differential pinion shaft must allow retaining pin to be installed. Install differential retaining pin.
5. Using feeler gauge, measure end play clearance between final drive carrier and planet pinion gear thrust washers. See **Fig. 29** . End play should be .009-.024" (.23-.62 mm). If clearance is out of specification on the low side, repair or replace final drive components as necessary. If clearance is out of specification on the high side, replace final drive carrier.
6. Install fretting ring into small groove in transaxle case (if removed). Install final drive internal gear into transaxle case. See **Fig. 18** . Final drive internal gear should be assembled in same direction as removed. Install final drive carrier-to-case thrust bearing onto final drive carrier. Retain final drive carrier-to-case thrust bearing with petroleum jelly. Install final drive carrier assembly into transaxle case. Install final drive sun gear into final drive carrier. Sun gear must be installed with grooved side up (flat side down).



G00027753

Fig. 29: Measuring Final Drive Pinion End Play
Courtesy of GENERAL MOTORS CORP.

OUTPUT SHAFT

Inspection & Reassembly

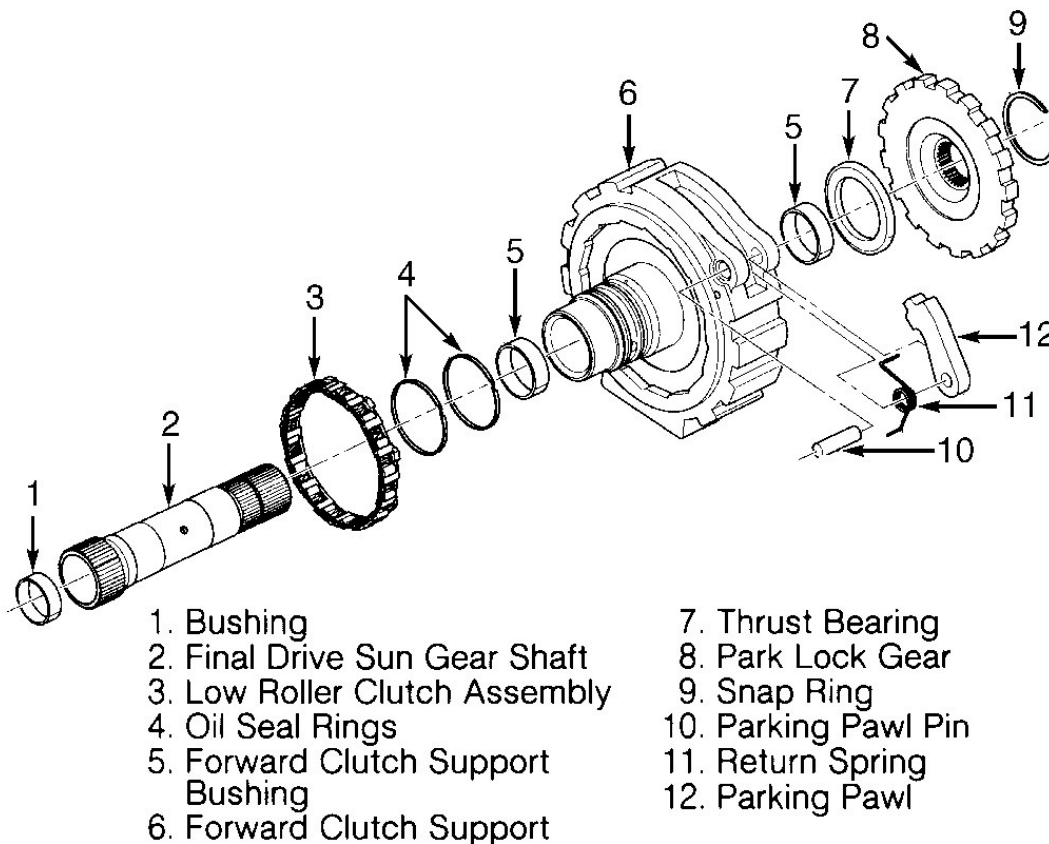
Check output shaft for damage to splines, snap ring grooves and journals. Clean output shaft and dry with compressed air. Install NEW snap ring into groove on final drive end (small machined diameter) of output shaft. Install output shaft into final drive assembly. Use a mallet to install output shaft through final drive differential gear.

FORWARD CLUTCH SUPPORT & LOW ROLLER CLUTCH ASSEMBLY

Disassembly

Turn low roller clutch assembly clockwise while gently lifting upward to remove from forward clutch support. See **Fig. 30**. Remove forward clutch support thrust bearing (front). Turn forward clutch support over. Remove final drive sun gear shaft snap ring. Remove park lock gear. Remove park lock gear thrust bearing. Remove forward clutch support from final drive sun gear shaft. Turn forward clutch support over. Remove and discard 2 "O" rings from forward clutch support.

NOTE: Parking pawl pin has a pressed fit into forward clutch support. Parking pawl pin is not serviceable and should not be removed.



G96E04024

Fig. 30: Exploded View Of Forward Clutch Support & Low Roller Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

Inspection

Inspect all components for excessive wear or damage. Inspect snap ring for over extension and "O" ring grooves for damage. Check for signs of excessive bearing or bushing wear. Check splines and park lock gear teeth for cracks or excessive wear. Ensure fluid feed holes are not plugged. Clean and dry all components.

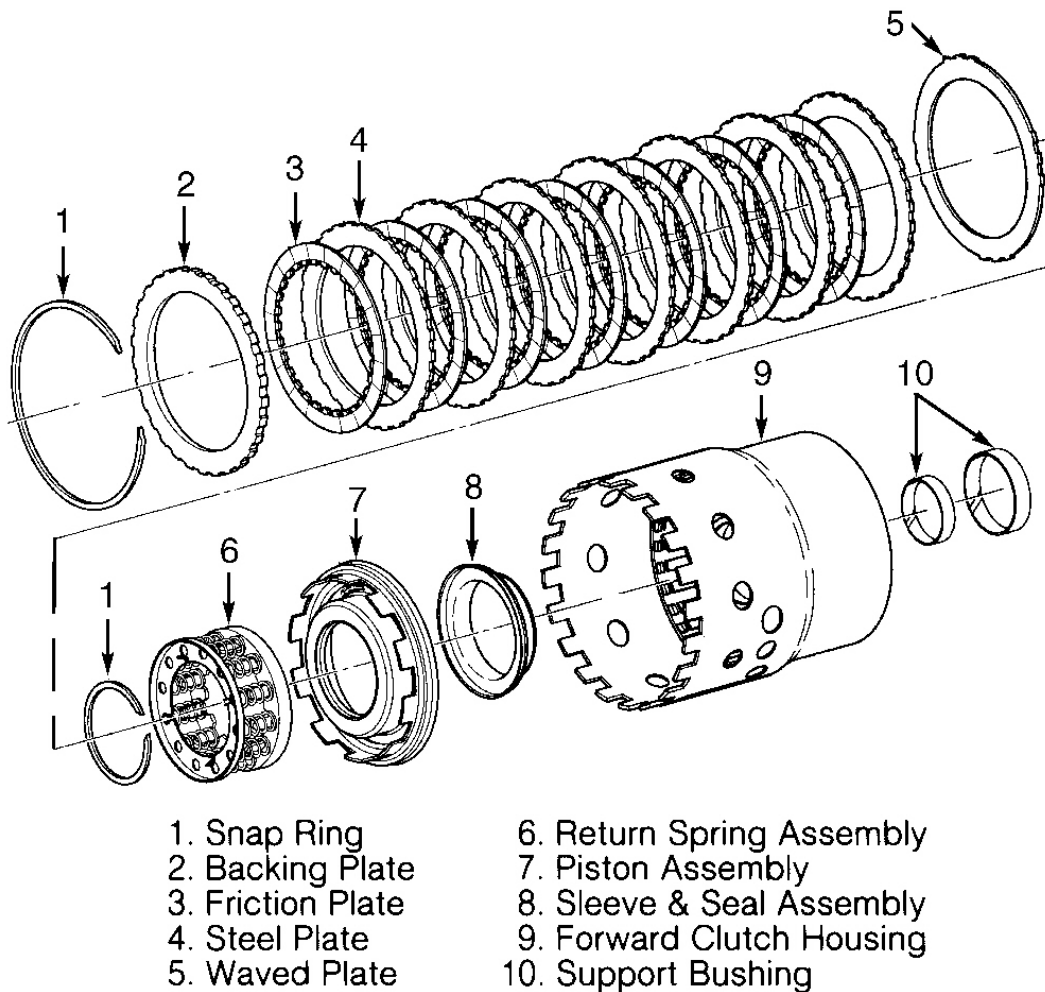
Reassembly

1. Install 2 NEW "O" rings on forward clutch support. See **Fig. 30** . Install forward clutch support onto final drive sun gear shaft. Turn forward clutch support over. Install park lock gear thrust bearing. Install park lock gear onto final drive sun gear shaft with raised inner boss facing up so parking pawl properly engages teeth on park lock gear. Install snap ring to final drive sun gear shaft to retain park lock gear. Ensure clearance between park lock gear and snap ring is .120" (3.05 mm).
2. Turn forward clutch support over. Install low roller clutch assembly onto forward clutch support. Larger tabs on cage must face down into forward clutch support. Rotate cage slightly counterclockwise to lock tabs into grooves in forward clutch support. Install forward clutch support thrust bearing (front).
3. Install forward clutch support and low roller clutch assembly into transaxle case. Compress parking pawl return spring and align parking pawl with park lock gear. Install forward clutch support snap ring into transaxle case with chamfer side up. Snap ring opening must be toward bottom of transaxle case facing bottom pan. Use a screwdriver to set snap ring into place.

FORWARD CLUTCH ASSEMBLY

CAUTION: When removing forward clutch return spring assembly, compress only enough to remove snap ring or forward clutch return spring assembly damage may occur.

1. Remove snap ring from clutch housing assembly. Remove backing plate, 7 friction plates, 7 steel plates and one waved plate. See **Fig. 31** . Using Spring Compressor (J-23327), compress forward clutch return spring assembly. Remove snap ring and spring compressor.
2. Remove forward clutch return spring assembly. Remove forward clutch piston assembly. Inspect forward clutch inner sleeve and seal assembly for damage. If inner sleeve and seal assembly is damaged, place Disc (J-41097-2) on inner hub of clutch housing. Install puller with jaws aligned with slots in inner sleeve and seal assembly. Remove inner sleeve and seal assembly.



G96H04025

Fig. 31: Exploded View Of Forward Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

Inspection

Clean all parts and dry with compressed air. Inspect all components for excessive wear or damage. Ensure fluid feed holes and retainer and ball assembly are not plugged. Inspect piston for damage. Inspect for cut seal. Repair or replace components as necessary.

Reassembly

1. Install NEW inner sleeve and seal assembly if old inner sleeve and seal assembly was removed or damaged. Using arbor press and seal installer, press inner sleeve and seal assembly onto forward clutch housing. Lubricate forward clutch piston assembly seals with transaxle fluid. Install forward clutch piston assembly into forward clutch housing.

CAUTION: When installing forward clutch return spring assembly, compress only enough to install snap ring or forward clutch return spring assembly damage may occur.

2. Install forward clutch return spring assembly into forward clutch housing with snap ring tabs facing up. Compress return spring assembly and install snap ring. Remove spring compressor. Install forward clutch waved plate. Install remaining clutch plates starting with steel plate and alternating between steel and friction plates.
3. Install forward clutch backing plate. Install snap ring to retain clutch plates. Using compressed air, check forward clutch to verify proper operation of seals and clutch assembly. Apply compressed air at specified location. See **Fig. 32** . If clutch assembly does not operate properly, check component installation.
4. Install low/reverse band into transaxle case. Align band servo pin apply surface toward bottom pan and hook band into band anchor pin in transaxle case. Install forward clutch assembly into transaxle case. Rotate forward clutch assembly counterclockwise during assembly to seat clutch assembly into low roller clutch. When assembly is seated properly, forward clutch assembly should not turn clockwise.
5. Verify proper installation of low/reverse band by inserting screwdriver through reverse servo pin hole. Screwdriver should compress band around forward clutch housing.

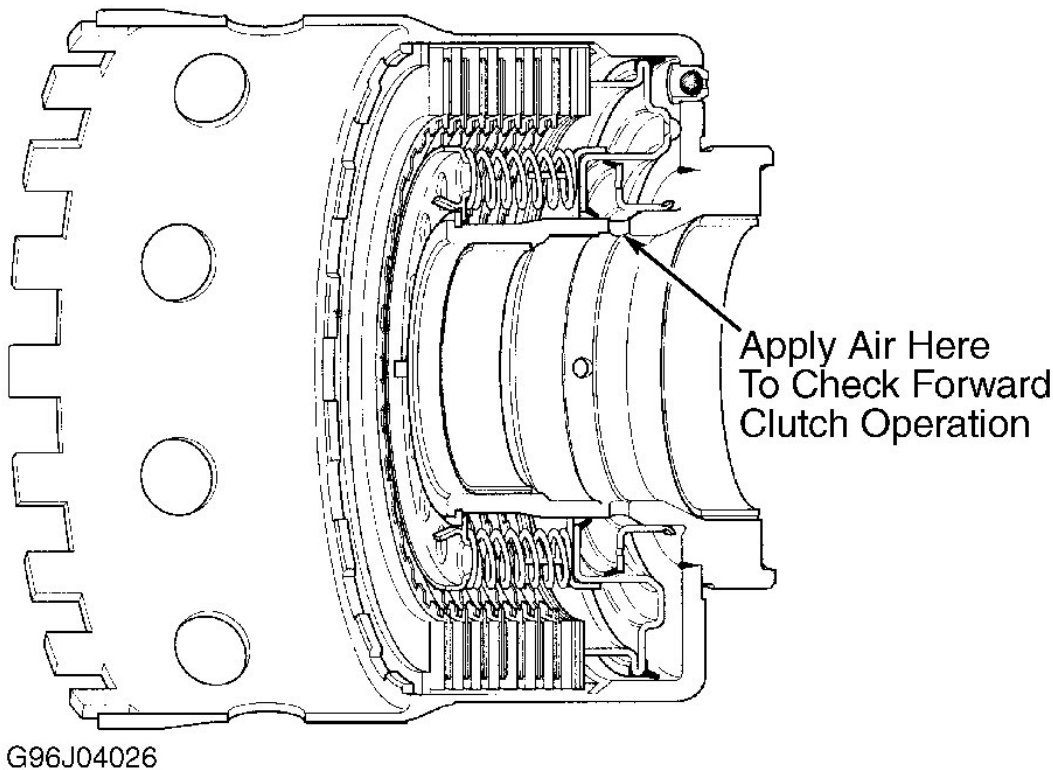


Fig. 32: Checking Forward Clutch Assembly Operation
Courtesy of GENERAL MOTORS CORP.

INPUT INTERNAL GEAR & FORWARD CLUTCH HUB ASSEMBLY**Disassembly**

CAUTION: Input internal gear is identical to reaction internal gear. However, these parts are not interchangeable after they have been installed and operated in a vehicle.

Remove thrust washer from forward clutch hub (if necessary). See **Fig. 33** . Remove input internal gear-to-forward clutch hub assembly snap ring. Remove forward clutch hub from input internal gear.

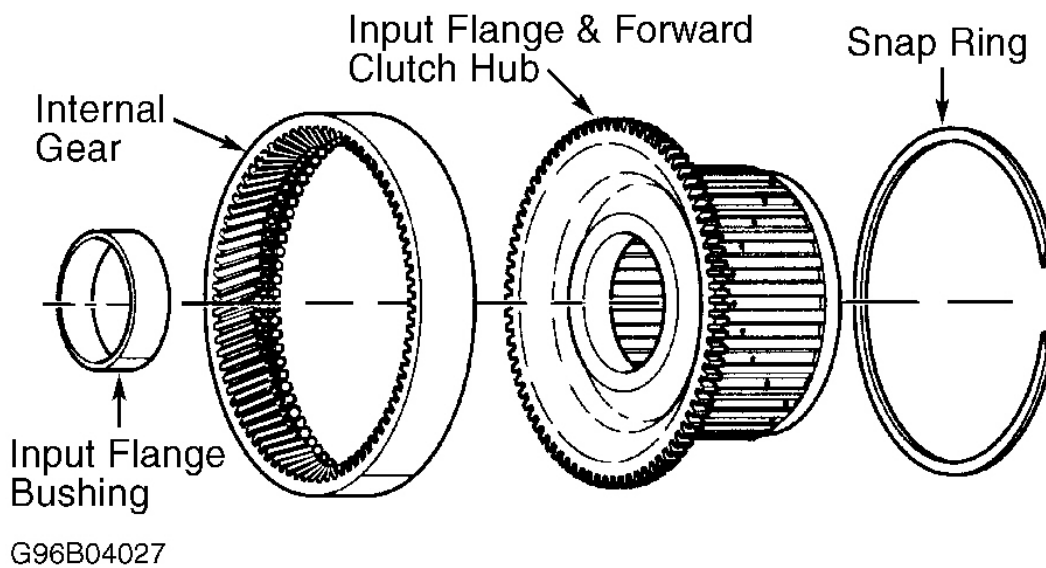


Fig. 33: Exploded View Of Input Internal Gear & Forward Clutch Hub Assembly
Courtesy of GENERAL MOTORS CORP.

Inspection

Inspect input internal gear and forward clutch hub splines, bushing and thrust washer for excessive wear or damage. Clean all parts and dry with compressed air.

Reassembly

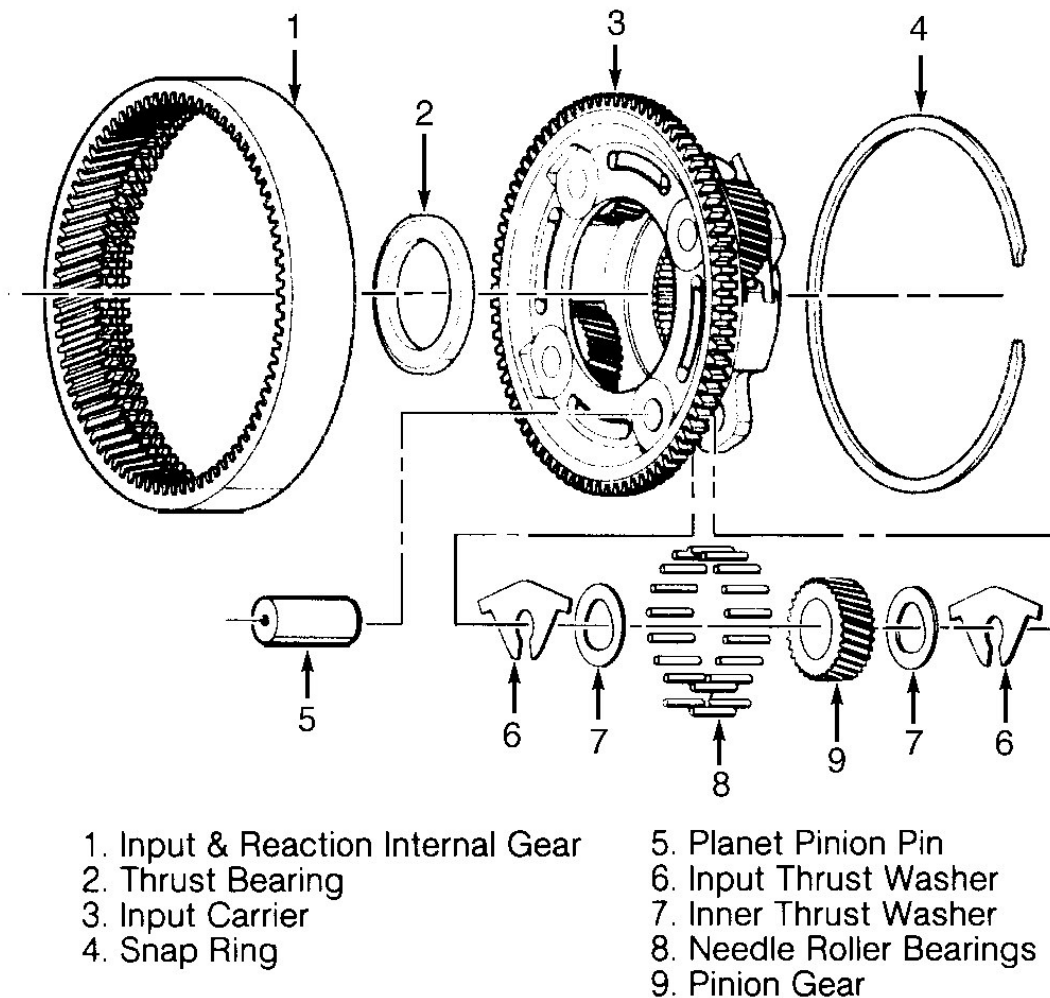
Install forward clutch hub onto input internal gear and retain hub with snap ring. Coat thrust washer with petroleum jelly. Install thrust washer onto forward clutch hub with thrust washer tabs facing forward clutch hub. Install forward clutch hub and input internal gear assembly into transaxle case. See **Fig. 8** . Rotate assembly while installing to align forward clutch hub spline with forward clutch plates.

REACTION INTERNAL GEAR & INPUT CARRIER ASSEMBLY

Disassembly

CAUTION: Reaction internal gear is identical to input internal gear for forward clutch hub. However, these parts are not interchangeable after they have been installed and operated in a vehicle.

Remove thrust bearing from reaction carrier (if necessary). Remove reaction internal gear-to-input carrier assembly snap ring. Remove input carrier assembly from reaction internal gear. See **Fig. 34**.



G96D04028

Fig. 34: Exploded View Of Reaction Internal Gear & Input Carrier Assembly
Courtesy of GENERAL MOTORS CORP.

Inspection

1. Check input carrier assembly pinion gears for excessive end play. Using a feeler gauge, measure end play clearance between carrier and pinion gear thrust washer. See **Fig. 35** . End play should be .009-.027" (.23-.69 mm). Replace carrier if pinion gear clearance is not within specification. Pinion gears are permanently assembled to carrier and are not serviceable.
2. Inspect reaction internal gear and input carrier assembly for excessive wear or damage. Inspect condition of pinion gears, washers and bearings. Clean all parts and dry with compressed air.

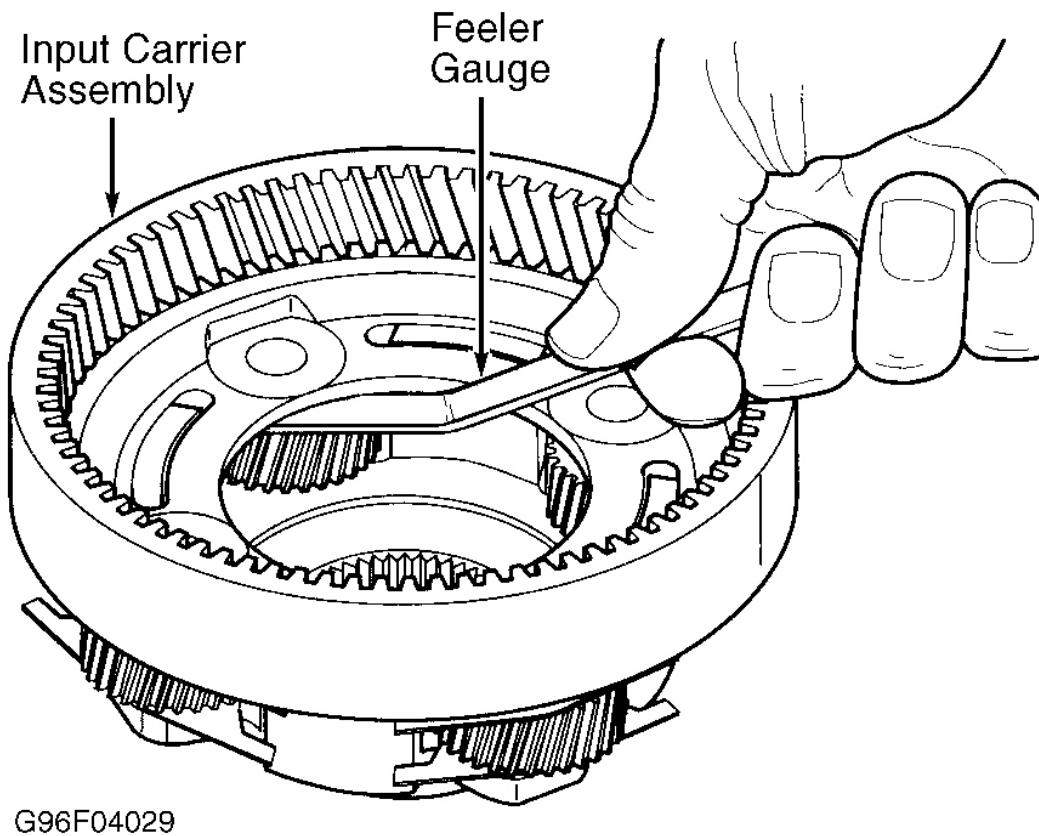


Fig. 35: Measuring Pinion Gear Clearance (Input Carrier Shown; Reaction Carrier Is Similar)
Courtesy of GENERAL MOTORS CORP.

Reassembly

Install input carrier assembly to reaction internal gear and retain with snap ring. Coat thrust bearing with petroleum jelly. Install thrust bearing onto input carrier assembly. 2nd thrust bearing is permanently retained in input carrier assembly. Install reaction internal gear and input carrier assembly into transaxle case. See **Fig. 8** . Rotate assembly while installing to mesh input carrier pinion gears to input internal gear.

COAST & DIRECT CLUTCH, & REACTION CARRIER ASSEMBLY

Disassembly

1. Remove selective thrust bearing and thrust washer from input shaft. Remove input sun gear-to-input sun gear shaft snap ring. Remove input sun gear from input sun gear shaft. Remove thrust bearing from reaction carrier assembly. See **Fig. 36**.
2. Remove reaction carrier assembly. A thrust bearing is permanently installed in reaction carrier assembly under pinion gears. Remove reaction sun shell. Remove thrust bearing from reaction carrier shaft shell. Remove reaction carrier shaft shell. Remove thrust bearing from top of sprag race assembly.
3. Remove coast and direct clutch snap ring. Remove direct clutch plates from clutch input housing. Note number and sequence of plates during removal for reassembly reference. Number of clutch plates may vary depending on vehicle model. Direct clutch consists of a backing plate, steel plates and friction plates.
4. Remove input sun gear shaft and sprag as an assembly by lifting up on input sun gear shaft. Remove inner race-to-input housing thrust bearing from input housing, if necessary. Thrust bearing may remain with input sun gear shaft and sprag when assembly is removed. Remove coast clutch plates from input housing. Coast clutch consists of 4 steel plates and 4 friction plates.
5. Using Clutch Spring Compressor (J-23327) and Adapter (J-41232), compress direct clutch spring and retainer assembly. See **Fig. 37**. Remove direct clutch spring retainer ring. Remove clutch spring compressor and adapter. Remove direct clutch spring and retainer assembly. Remove direct clutch piston assembly.
6. Using clutch spring compressor and Adapter (J-41236), compress coast clutch release spring assembly. Remove snap ring, clutch spring compressor and adapter. Remove coast clutch spring retainer and coast clutch release spring. Remove coast clutch piston assembly. Remove and discard 4 Teflon oil seal rings from input shaft assembly.
7. Remove input sprag assembly from input sun gear shaft. Remove snap ring from sprag assembly. Remove sprag clutch assembly from sprag outer race. Remove 2 end bearings from sprag clutch assembly.

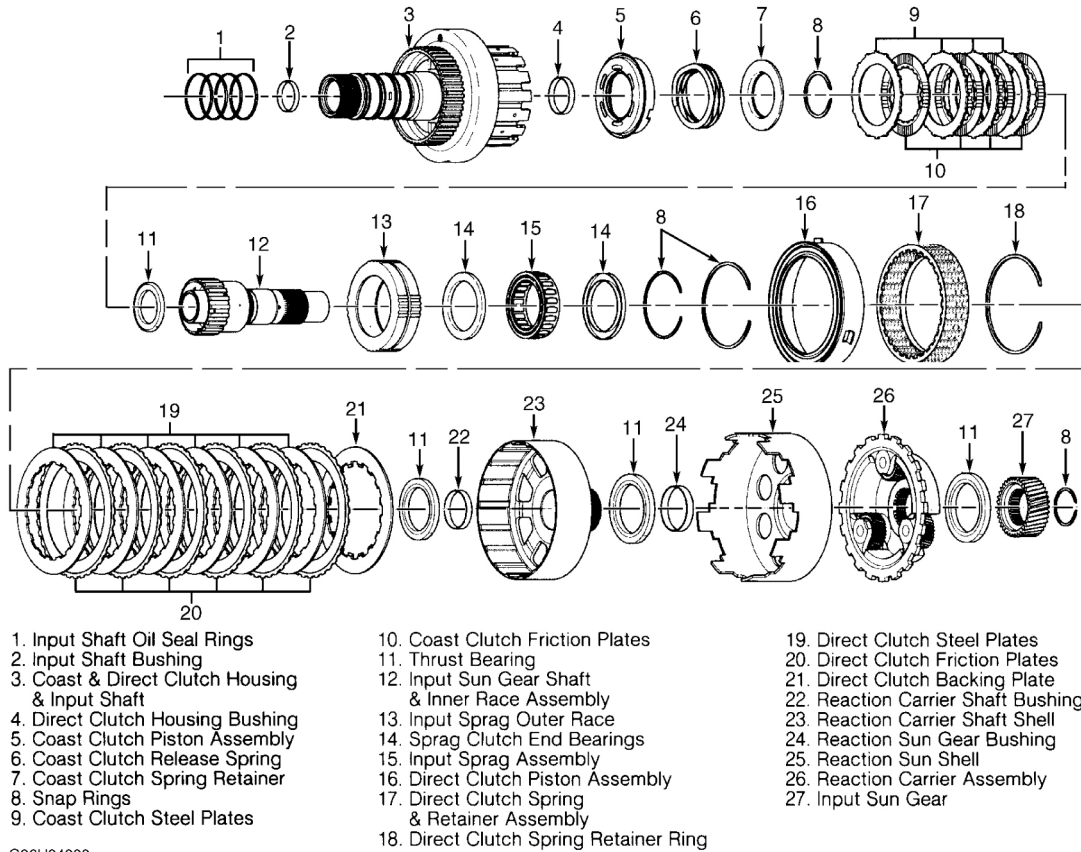
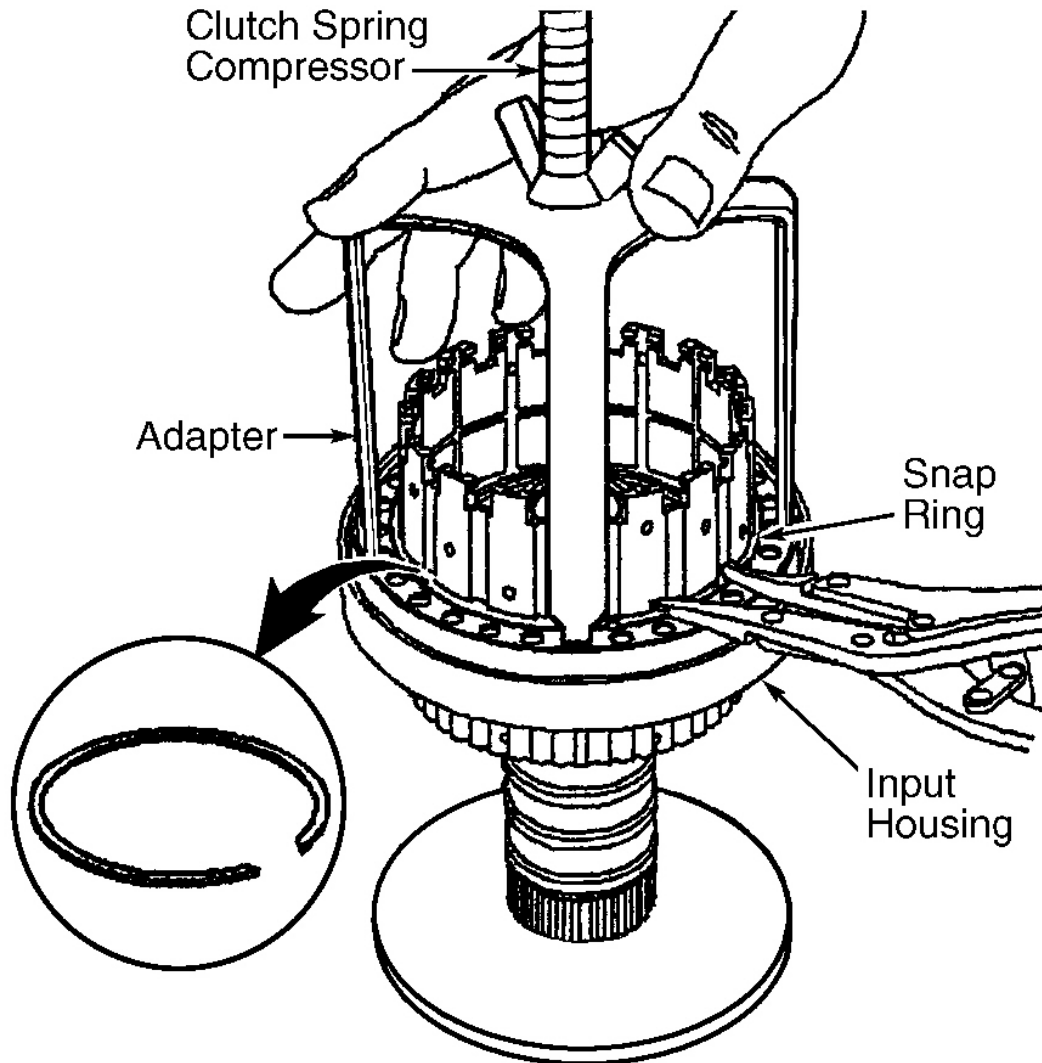


Fig. 36: Exploded View Of Coast & Direct Clutch Assemblies
Courtesy of GENERAL MOTORS CORP.



G00027756

Fig. 37: Compressing Direct Clutch Return Spring Assembly
Courtesy of GENERAL MOTORS CORP.

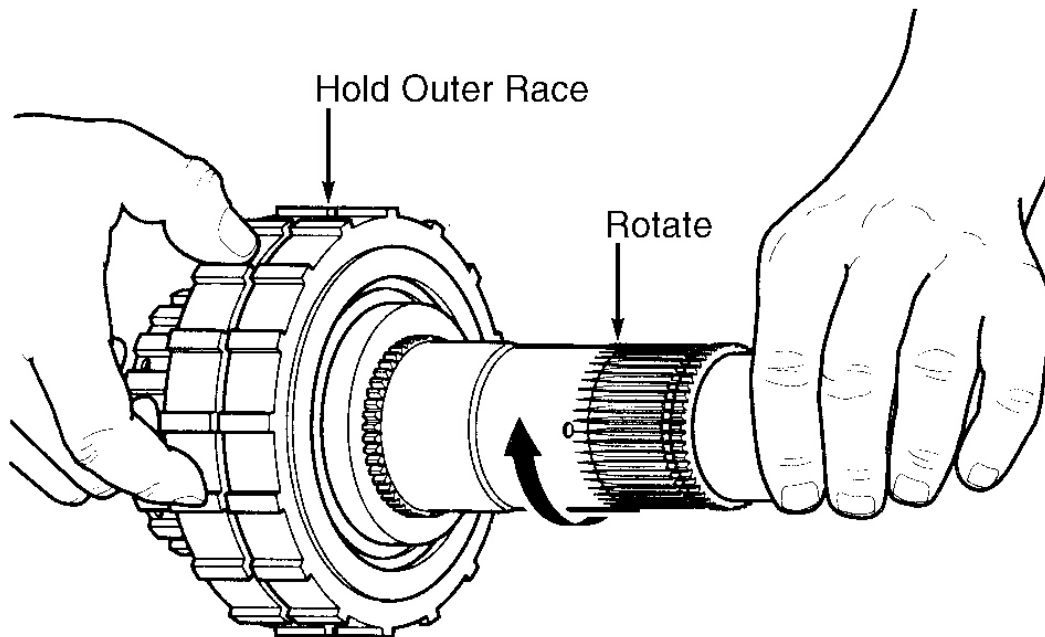
Inspection

1. Check clutch spring assemblies for distortion or missing springs. Check oil passages for blockage. Check bushings and bearings for excessive wear. Inspect seal grooves on input shaft for nicks or damage.
2. Inspect piston assemblies for cut seals or damage. If pistons or seals are damaged, assembly must be replaced. Check coast and direct clutch retainer and ball assemblies for leaks or damage. Check splines, housings and clutch plates for cracks, excessive wear or damage. Clean all parts and dry with compressed air. Replace components as necessary.
3. Measure reaction carrier pinion gears for excessive end play. Using a feeler gauge, measure end play

clearance between carrier and pinion gear thrust washer. See **Fig. 35** . End play should be .009-.027" (.23-.69 mm). Replace carrier if pinion gear clearance is not within specification. Pinion gears are permanently assembled to carrier and are not serviceable.

Reassembly

1. Lubricate coast clutch piston seal with transaxle fluid prior to installation. Install coast clutch piston assembly into input housing. Install coast clutch release spring and spring retainer into input housing. See **Fig. 36** . Spring retainer must be assembled with inner lip facing up.
2. Using Clutch Spring Compressor (J-23327) and Adapter (J-41236), compress coast clutch spring retainer and install snap ring onto input housing. Remove spring compressor and adapter. Lubricate direct clutch piston seal with transaxle fluid. Install direct clutch piston assembly into input housing.
3. Install direct clutch spring and retainer assembly into input housing with snap ring tabs facing up. Using clutch spring compressor and Adapter (J-41232), compress direct clutch spring and retainer assembly and install snap ring into input housing. See **Fig. 37** . Remove spring compressor and adapter.
4. Install coast clutch plates into input housing. Start with steel plate and alternate between 4 steel and 4 NEW friction plates. Steel plates must be assembled with splines in input housing grooves that are machined to piston.
5. Place sprag outer race on bench with flat side down and end with snap ring groove up. Place one end bearing into outer race. Install sprag clutch into sprag outer race with grooved edge up and flat side down. Rotate sprag slowly during assembly. Install other end bearing on top of sprag clutch.
6. Install snap ring into sprag outer race to retain sprag assembly and end bearings. Install sprag clutch and outer race assembly onto input sun gear shaft. Snap ring side of assembly faces up when installing sprag clutch onto input sun gear shaft. Flat side of sprag outer race functions as backing plate for coast clutch. Rotate input sun gear shaft clockwise during assembly to help seat sprags.
7. Ensure correct operation of sprag clutch by holding sprag clutch outer race and rotating input sun gear shaft. Input sun gear shaft should only rotate in clockwise direction. See **Fig. 38** .



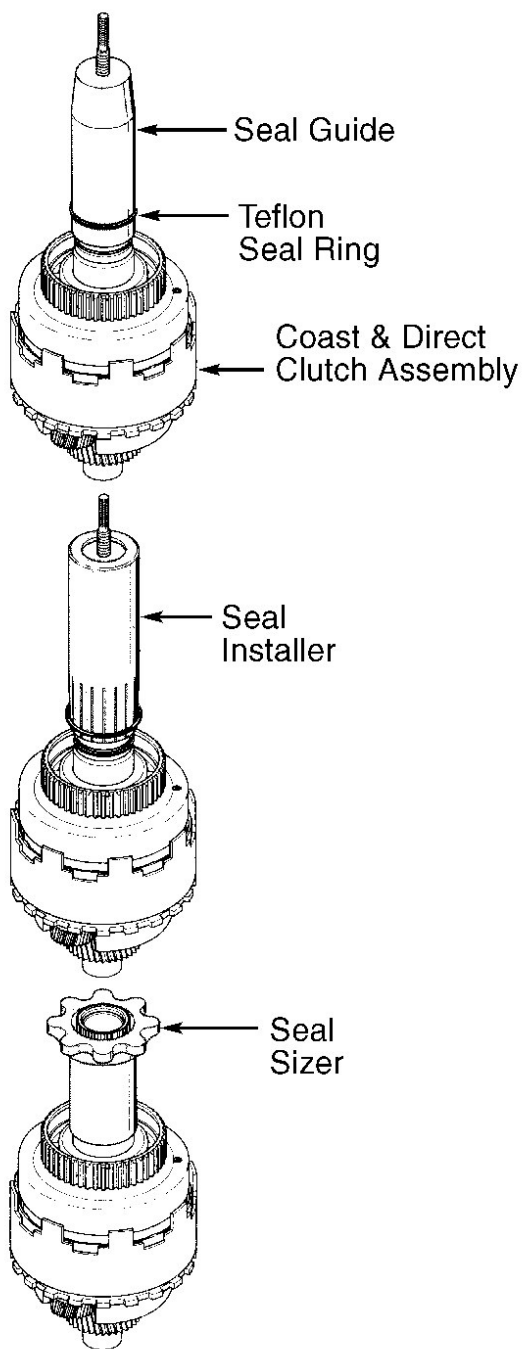
INPUT SUN GEAR SHAFT MUST
FREE WHEEL IN DIRECTION OF ARROW
& HOLD IN OPPOSITE DIRECTION

G96J04031

Fig. 38: Checking Sprag Clutch Operation
Courtesy of GENERAL MOTORS CORP.

8. Coat thrust bearing with petroleum jelly. Install thrust bearing on back side of input sun gear shaft. Install input sun gear shaft and sprag clutch assembly into input housing. Splines on input sun gear shaft engage with coast clutch friction plates.
9. Install direct clutch plates into input housing. Start with steel plate and alternate between steel plate and NEW friction plates. Ensure same number of steel and friction plates removed are reinstalled. Install direct clutch backing plate onto input housing with flat side down.
10. Install snap ring to retain input sun gear shaft, sprag clutch assembly and direct clutch plates. Coat thrust bearing with petroleum jelly. Install thrust bearing on top of sprag clutch assembly. Install reaction carrier shaft shell onto input housing. Splines on inside of reaction carrier shaft shell engage direct clutch friction plates.
11. Install thrust bearing onto top of reaction carrier shaft shell. Install reaction sun shell onto reaction carrier shaft shell. Install reaction carrier assembly onto reaction sun gear. Rotate reaction carrier assembly to mesh sun gear with pinion gears.
12. Install reaction carrier assembly-to-input sun gear thrust bearing onto reaction carrier assembly. Install input sun gear onto input sun gear shaft. Install input sun gear snap ring onto input sun gear shaft.
13. Slide Seal Guide (J-41234-1) over input shaft and position at seal groove closest to housing. See **Fig. 39**.

Coat seal guide with transaxle fluid. Guide NEW Teflon seal onto seal guide and slide seal into groove using Seal Installer (J-41234-2). Repeat procedure for 3 remaining seals, adjusting seal guide as necessary.



G96B04032

Fig. 39: Installing Input Shaft Teflon Seal Rings

Courtesy of GENERAL MOTORS CORP.

14. After all seals are installed, use Seal Sizer (J-41234-3) to size seals. Leave tool in place for at least 5 minutes. If possible, leave tool in place until assembly is ready to be installed in transaxle case.
15. Air check coast clutch and direct clutch to ensure proper operation of seals and clutch assemblies. Apply 20 psi (1.41 kg/cm²) of compressed air to specified location to check component operation. See **Fig. 40** . If clutch assemblies do not operate properly, check component installation.

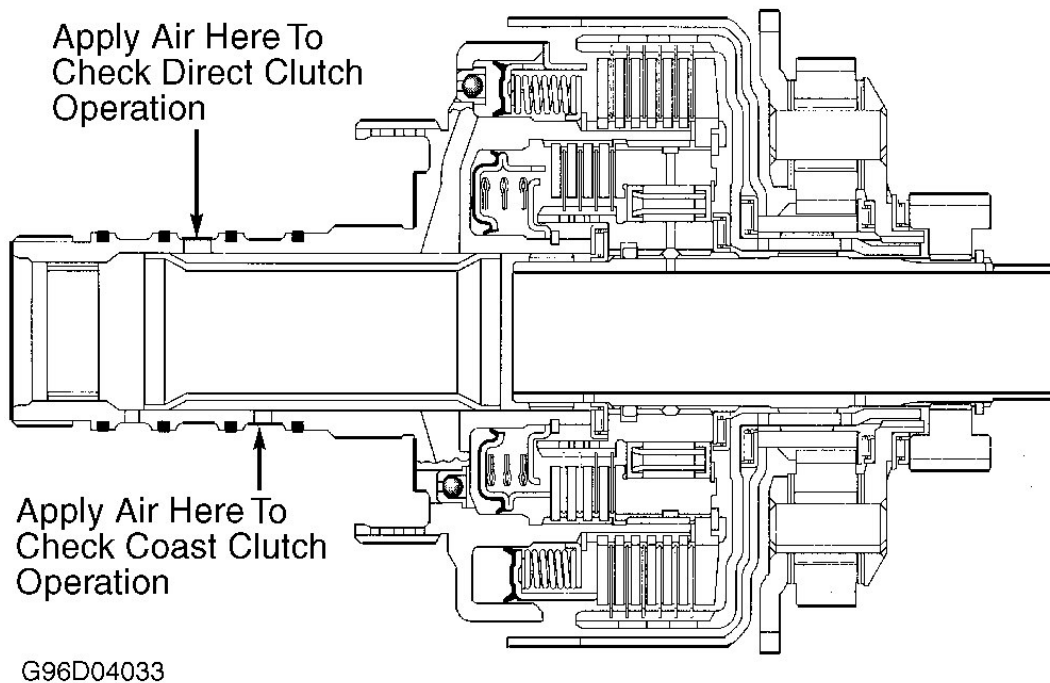


Fig. 40: Checking Coast & Direct Clutch Operation
Courtesy of GENERAL MOTORS CORP.

16. Install coast clutch, direct clutch and reaction carrier assembly into transaxle case. Measure clutch assembly end play. Place gauge block across machined surface of transaxle case. See **Fig. 41** . Measure distance between top of coast and direct clutch housing and machined surface of transaxle case (Dimension "A"). Choose correct selective thrust washer. See **SELECTIVE THRUST WASHER IDENTIFICATION** table.

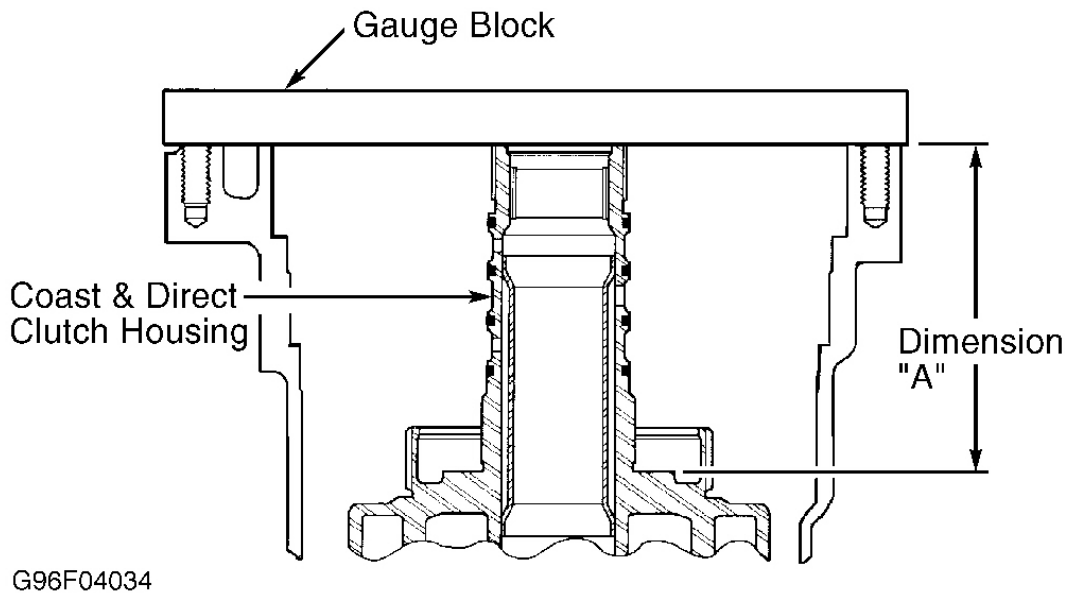


Fig. 41: Measuring Clutch Assembly End Play
 Courtesy of GENERAL MOTORS CORP.

17. Install selective thrust washer on top of input housing. Tab on thrust washer must be located in recessed area for retainer and ball assembly. Install thrust bearing over input shaft and on top of selective thrust washer.

SELECTIVE THRUST WASHER IDENTIFICATION

Dimension "A" - In. (mm)	Washer Identification	Washer Thickness - In. (mm)
3.95-3.96 (100.4-100.6)	Brown	.059-.062 (1.50-1.60)
3.96-3.98 (100.6-101.1)	Gray	.070-.075 (1.78-1.91)
3.98-3.99 (101.1-101.4)	Natural	.082-.086 (2.08-2.18)
3.99-4.00 (101.4-101.6)	Black	.094-.098 (2.39-2.49)
4.00-4.01 (101.6-101.9)	Orange	.106-.109 (2.69-2.77)
4.01-4.02 (101.9-102.1)	Violet	.117-.121 (2.97-3.07)
4.02-4.03 (102.1-102.4)	Yellow	.129-.133 (3.28-3.38)
4.03-4.05 (102.4-102.9)	Red	.141-.145 (3.58-3.68)
4.05-4.06 (102.9-103.1)	Green	.152-.156 (3.86-3.96)

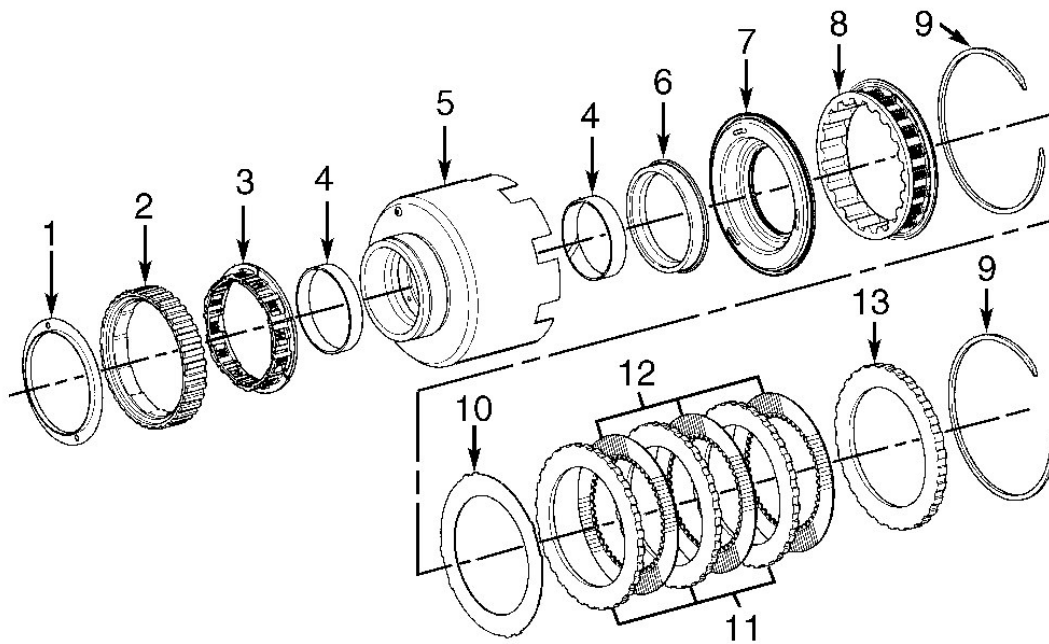
REVERSE INPUT CLUTCH & 2ND ROLLER CLUTCH ASSEMBLY

Disassembly

1. Remove reverse clutch snap ring. See **Fig. 42** . Remove reverse clutch selective backing plate, 3 steel plates, 3 friction plates and one waved plate. Using Clutch Spring Compressor (J-23327) and Adapter (J-

41232), compress reverse clutch spring and retainer assembly. See [Fig. 43](#) . Remove snap ring, spring compressor and adapter. Remove reverse clutch spring and retainer assembly. Remove reverse clutch piston assembly.

2. Inspect reverse clutch retainer and seal assembly for damage. DO NOT remove seal assembly if seal is not damaged. If seal assembly is damaged, install Seal Remover Snap Ring (J-41097-1) under outer lip of reverse clutch retainer and seal assembly. See [Fig. 44](#) . Place Seal Remover Disc (J-41097-2) on inner hub of reverse clutch housing. Using a puller, remove reverse clutch retainer and seal assembly.
3. Remove 2nd roller clutch and roller clutch retainer by prying up on roller clutch assembly with 2 screwdrivers. DO NOT score roller clutch inner race with screwdrivers. The 2nd roller clutch retainer is pressed onto reverse clutch housing and is not reusable after being removed. Rotate 2nd roller clutch assembly clockwise until indexed with roller clutch cam. Remove 2nd roller clutch assembly from inside of roller clutch cam.

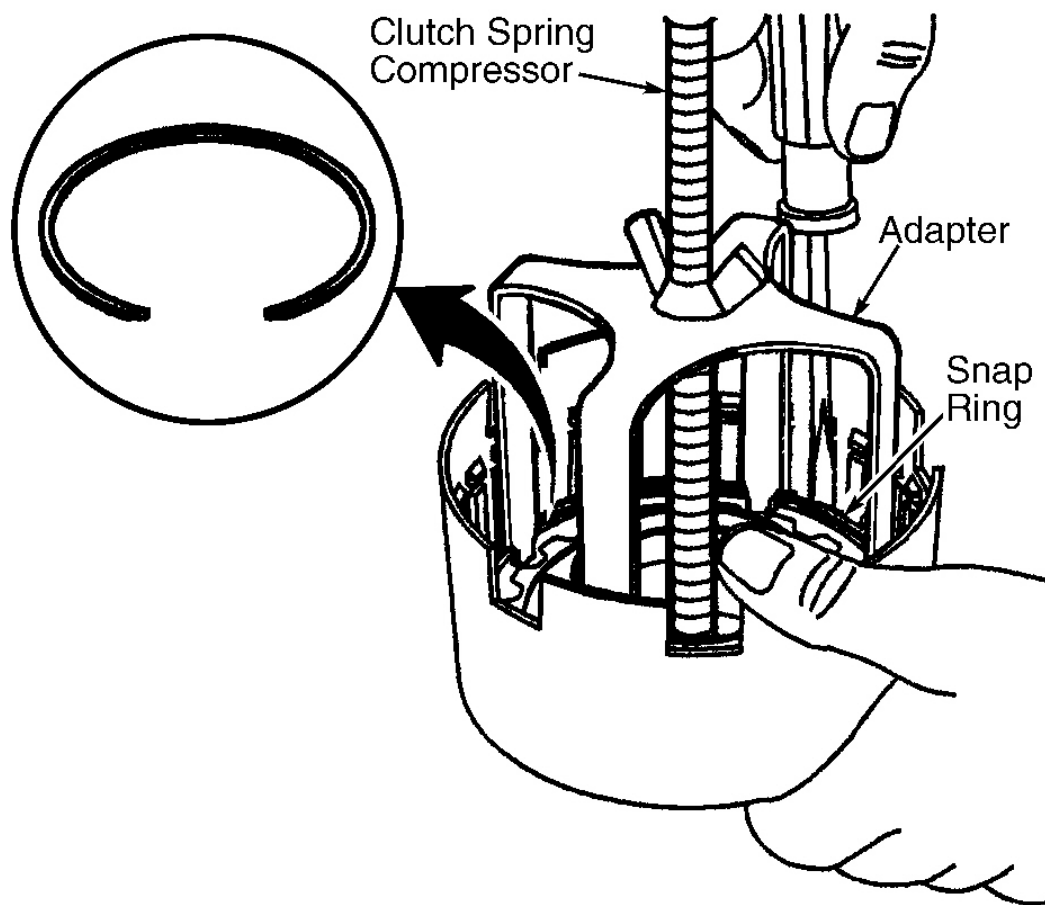


- | | |
|--|--|
| 1. 2nd Roller Clutch Retainer | 8. Reverse Clutch Spring & Retainer Assembly |
| 2. 2nd Roller Clutch Cam | 9. Snap Ring |
| 3. 2nd Roller Clutch Assembly | 10. Reverse Clutch Waved Plate |
| 4. Reverse Clutch Bushing | 11. Reverse Clutch Steel Plates |
| 5. Reverse Clutch Housing | 12. Reverse Clutch Friction Plates |
| 6. Reverse Clutch Retainer & Seal Assembly | 13. Reverse Clutch Selective Backing Plate |
| 7. Reverse Clutch Piston Assembly | |

G96I04035

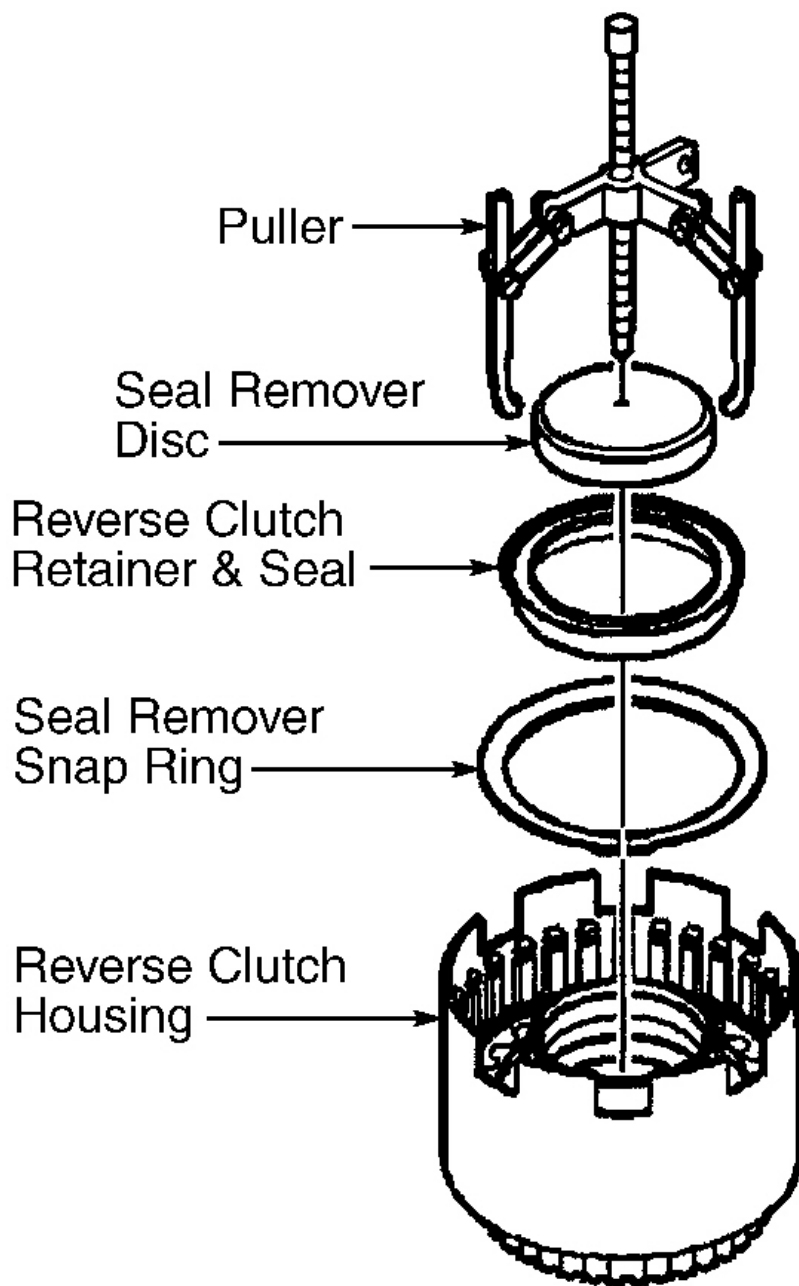
Fig. 42: Exploded View Of Reverse Input Clutch & 2nd Roller Clutch Assembly

Courtesy of GENERAL MOTORS CORP.



G00027757

Fig. 43: Compressing Reverse Clutch Spring & Retainer Assembly
Courtesy of GENERAL MOTORS CORP.



G00027758

Fig. 44: Removing Reverse Clutch Retainer & Seal Assembly
Courtesy of GENERAL MOTORS CORP.

Inspection

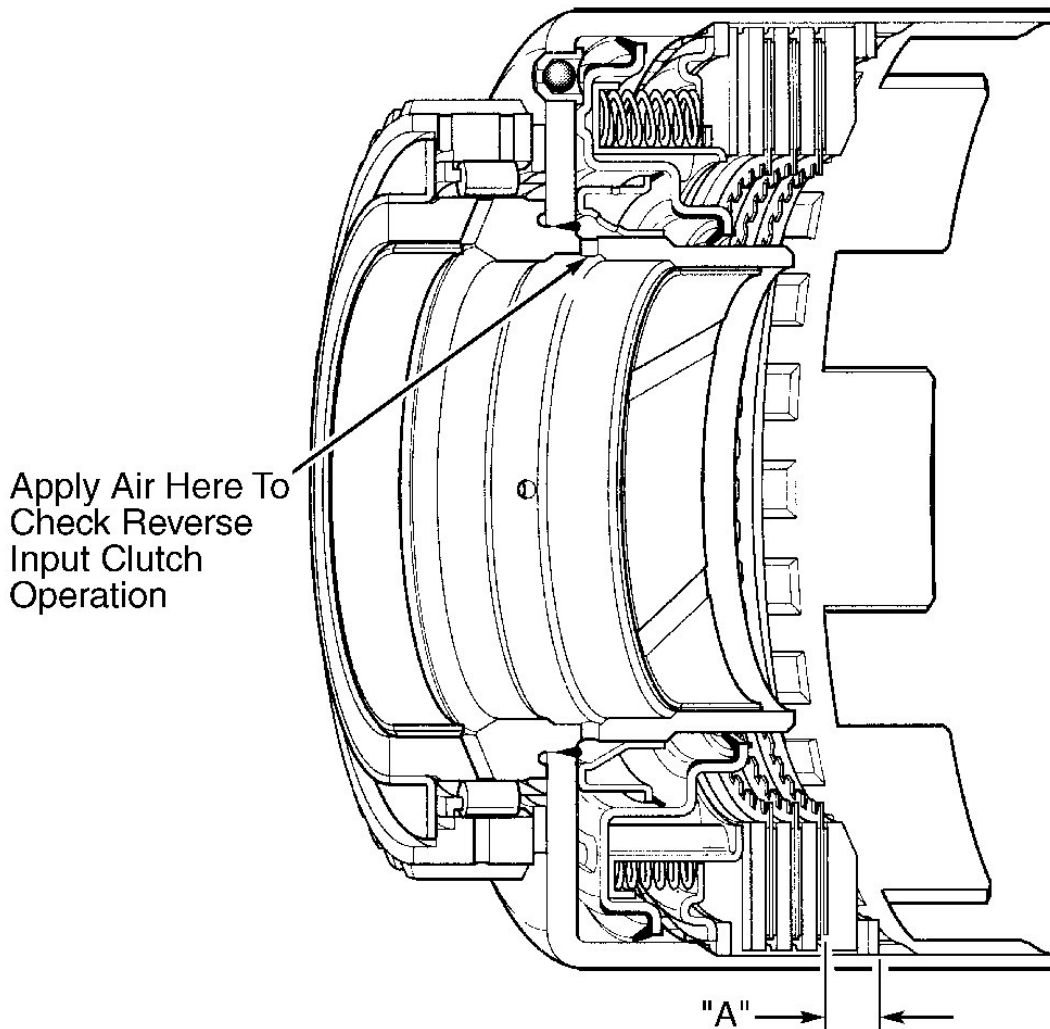
Check reverse clutch housing for excessive band wear and damaged splines. Check retainer and ball assembly for clogging or damage. Ensure fluid feed holes are not plugged. Check bushings and roller clutch for excessive wear. Check reverse clutch spring and retainer assembly for dislocated or damaged springs. Clean all parts and dry with compressed air.

Reassembly

1. Install NEW reverse clutch retainer and seal assembly using arbor press and seal installer if seal was removed or damaged. Lubricate reverse clutch piston seal with transaxle fluid. Install reverse clutch piston assembly. Install reverse clutch spring and retainer assembly with smaller outside diameter facing down.
2. Using Clutch Spring Compressor (J-23327) and Adapter (J-41232), compress reverse clutch spring and retainer assembly. See **Fig. 43** . Install snap ring. Remove spring compressor and adapter. Install reverse clutch plates into clutch housing, starting with one waved plate. Then, starting with a steel plate, alternate between steel plates and NEW friction plates.
3. Measure distance between top of snap ring groove and top friction plate (Dimension "A"). See **Fig. 45** . Select appropriate backing plate. See **BACKING PLATE IDENTIFICATION** table. Backing plate identification letter is stamped on beveled side of backing plate. Install appropriate reverse clutch backing plate with beveled side facing up. Install snap ring in reverse clutch housing to retain reverse clutch plates.

BACKING PLATE IDENTIFICATION

Backing Plate Identification	Dimension "A" - In. (mm)
A	.35-.37 (8.9-9.4)
B	.37-.39 (9.4-9.9)
C	.39-.41 (9.9-10.4)



G96A04036

Fig. 45: Measuring Selective Backing Plate Dimension & Checking Reverse Input Clutch Operation
 Courtesy of GENERAL MOTORS CORP.

4. Air check reverse clutch assembly to ensure proper operation of seals and clutch assembly. Apply 20 psi (1.41 kg/cm²) of compressed air to specified location to check component operation. See **Fig. 45**. If clutch assembly does not operate properly, check component installation.
5. Install 2nd roller clutch assembly into roller clutch cam. Install 2nd roller clutch onto reverse clutch housing with flat side of roller clutch cam facing down toward housing. Rotate roller clutch during assembly to properly engage rollers.

NOTE: When installing roller clutch assembly, Installer (J-41235) is designed to press roller clutch assembly to a specified depth. If 2nd roller clutch is installed too far down onto inner race, roller clutch may not operate

properly.

6. Ensure roller clutch operates properly. While holding reverse clutch housing, roller clutch cam should only rotate clockwise. See **Fig. 46** . Install NEW 2nd roller clutch retainer onto 2nd roller clutch assembly. Using Installer (J-41235), press retainer and roller clutch assembly into place on reverse clutch housing and roller clutch inner race.
7. Install reverse clutch and 2nd roller clutch assembly into transaxle case. See **Fig. 8** . Tangs on reverse clutch housing spline to tangs on reaction carrier sun gear and shell assembly. Rotate reverse clutch housing during installation to align clutch plates. Install reverse clutch thrust washer on top of 2nd roller clutch with tabs facing down onto housing.

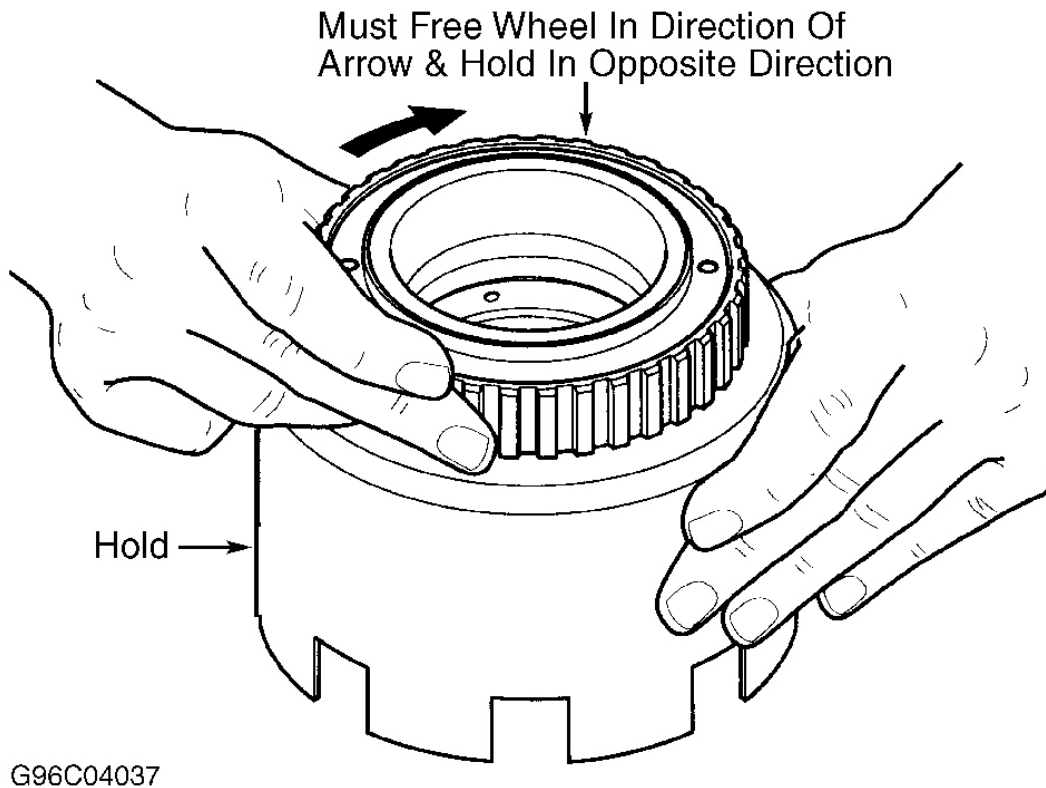


Fig. 46: Checking 2nd Roller Clutch Operation
Courtesy of GENERAL MOTORS CORP.

INTERMEDIATE-4TH BAND

Reassembly

Install NEW intermediate-4th band into transaxle case. See **Fig. 8** . Ensure band is positioned properly by inserting screwdriver through intermediate-4th servo bore. Screwdriver should press on servo pin rest and compress band around reverse clutch housing.

2ND CLUTCH PLATES

Inspection

Check clutch plates for excessive wear and replace as necessary. Clean parts and dry with compressed air.

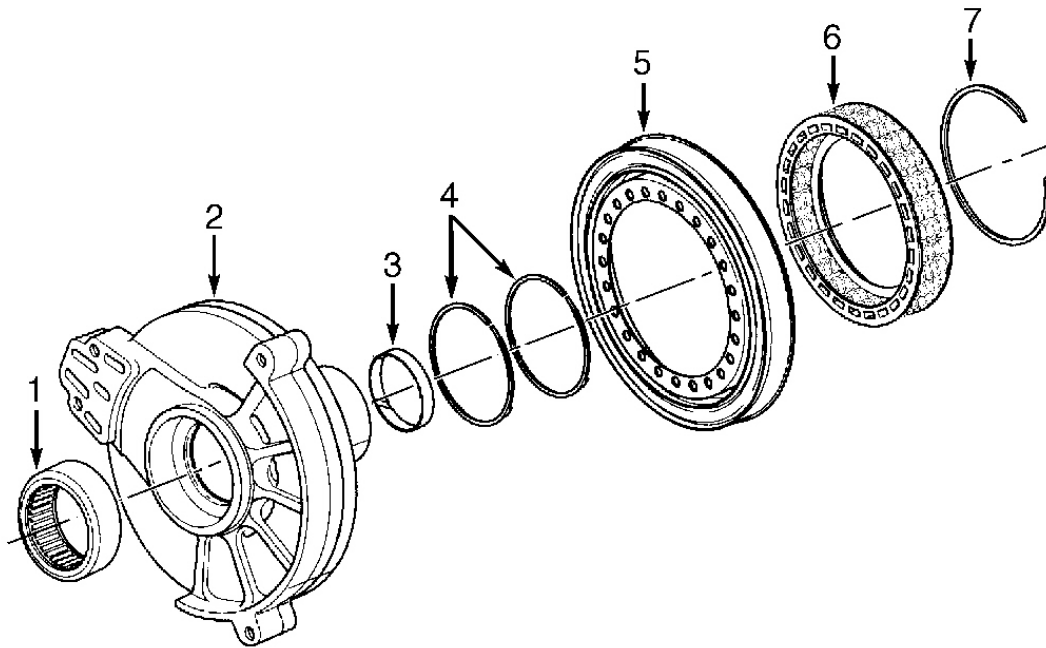
Reassembly

Install 2nd clutch backing plate with flat side facing up. Install 2nd clutch plates into transaxle case. See **Fig. 17** . Install NEW friction plate and alternate between friction plates and steel plates. Install 2nd clutch waved plate.

DRIVE SPROCKET SUPPORT ASSEMBLY

Disassembly

Remove and discard 2 oil seal rings. See **Fig. 47** . Using Clutch Spring Compressor (J-23327) and Adapter (J-41232), compress 2nd clutch spring assembly and remove spring retaining ring. Remove 2nd clutch spring assembly, spring compressor and adapter. Remove 2nd clutch piston assembly. Clutch piston and seal assembly are reusable if not damaged.



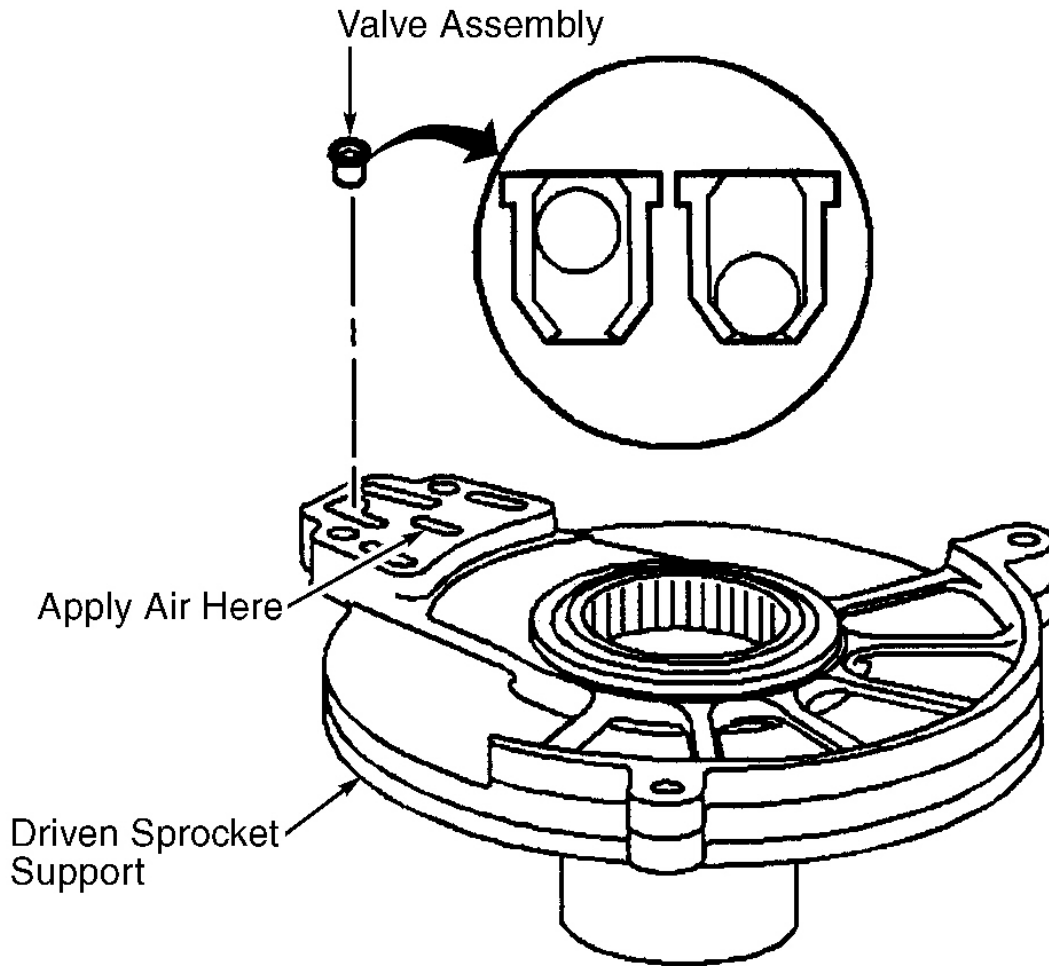
- | | |
|------------------------------------|-------------------------------|
| 1. Driven Sprocket Support Bearing | 5. 2nd Clutch Piston Assembly |
| 2. Driven Sprocket Support | 6. 2nd Clutch Spring Assembly |
| 3. Driven Sprocket Support Bushing | 7. Spring Retaining Ring |
| 4. Oil Seal Rings | |

G96E04038

Fig. 47: Exploded View Of Drive Sprocket Support & 2nd Clutch
 Courtesy of GENERAL MOTORS CORP.

Inspection

1. Check 2nd clutch piston assembly for damage. If seal is damaged, replace 2nd clutch piston assembly. Check bushing and bearing for excessive wear or damage. Check driven sprocket support for plugged feed holes, damaged seal grooves, stripped bolt holes or damaged machined surfaces. Check for dislocated or damaged springs.
2. Inspect valve assembly for free operation. Use ATF to inspect for valve leakage. Ensure valve is in fully seated position prior to checking for leaks. See **Fig. 48**. Remove valve using 1/4" drift and mallet only if inspection indicates a problem or a leak is detected. Clean all parts and dry with compressed air.



G98E01902

Fig. 48: Checking 2nd Clutch Operation
Courtesy of GENERAL MOTORS CORP.

Reassembly

1. Lubricate 2nd clutch piston seal with transaxle fluid. Install 2nd clutch piston assembly into driven sprocket support. See **Fig. 47** . Install 2nd clutch spring assembly into driven sprocket support.
2. Using Clutch Spring Compressor (J-23327) and Adapter (J-41232), compress 2nd clutch spring assembly and install spring retaining ring. Remove spring compressor and adapter. Install 2 NEW oil seal rings onto driven sprocket support. Air check 2nd clutch to ensure proper operation. Apply compressed air to 2nd clutch fluid circuit. See **Fig. 48** . If clutch assembly does not operate properly, check component installation.
3. Install driven sprocket support and 2nd clutch assembly into transaxle case. When installed properly, driven sprocket support will sit slightly below machined surface of transaxle case.

INPUT SPEED SENSOR & WIRING HARNESS

Reassembly

1. Install input speed sensor into transaxle case. Tab on sensor housing fits into recess on transaxle case boss. Position of input speed sensor depends on number of teeth on drive sprocket. Number of teeth varies depending on model. See **Fig. 15**.
2. Drive sprockets with 32 or 33 teeth have speed sensor connector (Natural) facing bottom pan. Drive sprockets with 35 teeth have speed sensor connector (Black) facing oil fill/vent cap. Install input speed sensor bolt and tighten to specification. See **TORQUE SPECIFICATIONS**.
3. Inspect wiring, "O" ring seal and pass-through connector pins for damage. Install wire harness pass-through connector into transaxle case bore from inside of transaxle case. Route input speed sensor wire harness in case channel. Install wire harness retainer and bolt. Tighten bolt to specification. Connect input speed sensor connector.

DRIVE & DRIVEN SPROCKETS & DRIVE LINK ASSEMBLY

Disassembly

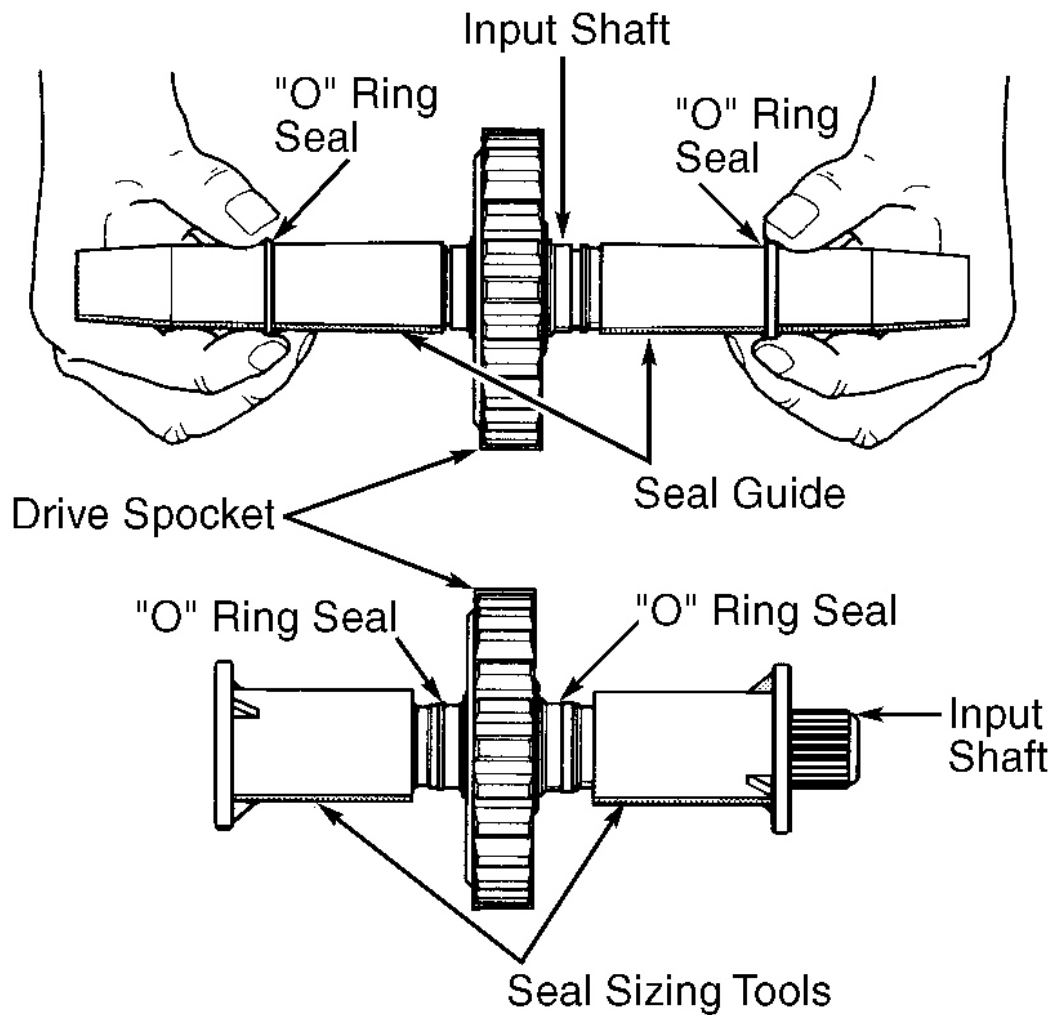
Remove input shaft-to-drive sprocket snap ring. Remove drive sprocket from input shaft. Remove 3 Teflon seals from input shaft. See **Fig. 8**. Seals are not reusable and should be discarded.

Inspection

Check drive sprocket, driven sprocket, drive link assembly, thrust washers and input shaft for excessive wear or damage. Check seal grooves for damage. Clean all parts and dry with compressed air.

Reassembly

1. Install drive sprocket onto input shaft. Retain drive sprocket to input shaft using snap ring. Slide Input Shaft Seal Guides (J-29569-1 and J-29829-1) over input shaft. See **Fig. 49**. Coat both halves of input shaft seal guides with transaxle fluid.
2. Guide NEW Teflon "O" ring seals over input shaft seal guides and into seal grooves on input shaft. Remove input shaft seal guides. Using Seal Sizing Tools (J-29829-2 and J-29569-2), size "O" ring seals to input shaft. Allow seal sizer to remain in place for 5 minutes to properly size "O" ring seals.
3. Coat drive sprocket-to-drive sprocket support thrust washer with petroleum jelly. Install drive sprocket-to-drive sprocket support thrust washer onto drive sprocket. Position tabs on thrust washer into holes on drive sprocket.
4. Install driven sprocket-to-driven sprocket support thrust washer onto driven sprocket support. See **Fig. 14**. Install drive link assembly to drive and driven sprockets. Position drive link assembly in same direction as removed. If drive link assembly is NEW, it can be installed in either direction. Install drive sprocket, driven sprocket and drive link assembly onto transaxle as a complete assembly.



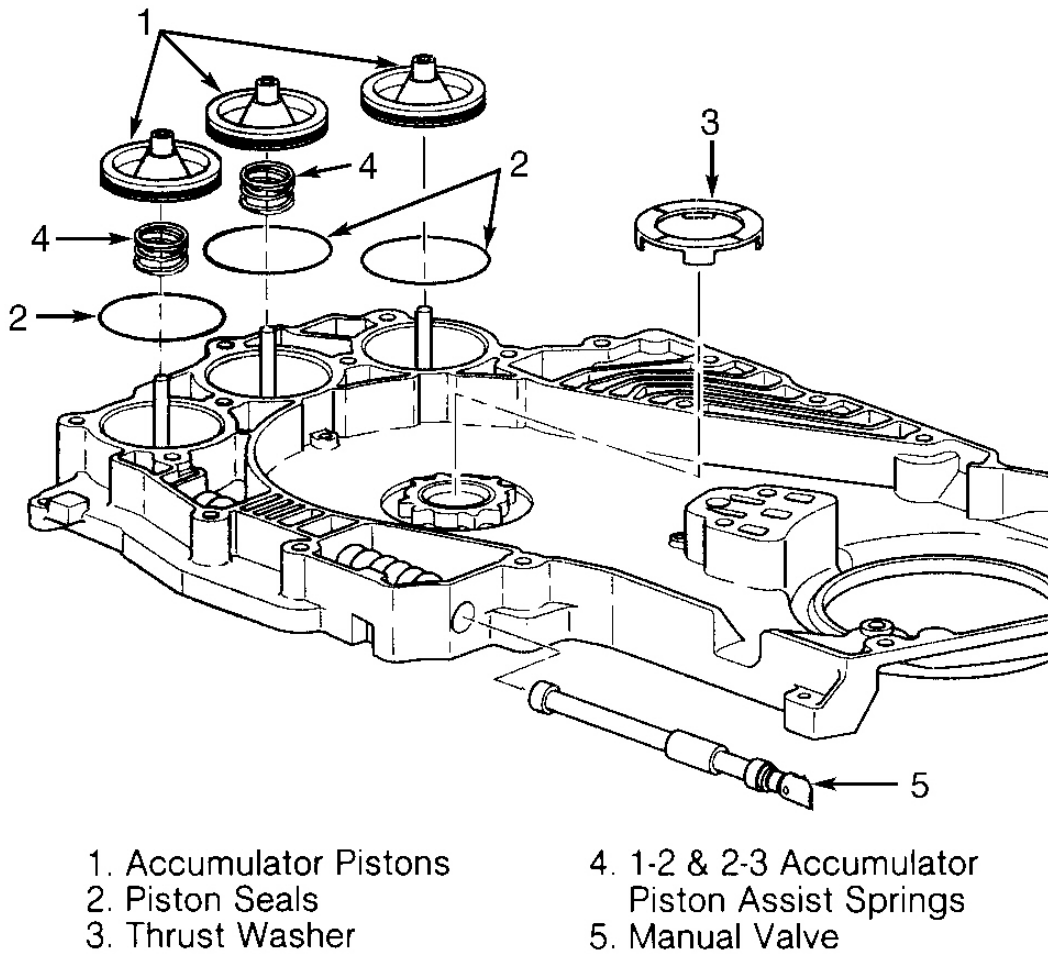
G96I04040

Fig. 49: Installing Input Shaft Teflon Seals
 Courtesy of GENERAL MOTORS CORP.

CHANNEL PLATE ASSEMBLY

Disassembly

Remove 3 accumulator pistons from channel plate. Accumulator pins are pressed into channel plate and should not be removed. Remove 1-2 and 2-3 accumulator assist springs, keeping 1-2 accumulator assist spring and retainer assembly together. Remove and discard piston seals from accumulator pistons. Remove manual valve from channel plate. See **Fig. 50**.



G96I04281

Fig. 50: Removing & Installing Accumulator Pistons
Courtesy of GENERAL MOTORS CORP.

Inspection

Check channel plate for plugged passages or damage. Check accumulator assist springs, pistons and pins for damage. Check channel plate sleeve for input shaft wear. Check channel plate bolt holes for stripped threads and debris. Check surfaces for nicks or scratches which could cause fluid leaks. Check manual valve for free movement. Inspect drive sprocket-to-channel plate thrust washer. Clean all parts and dry with compressed air.

Reassembly

1. Install 3 NEW accumulator piston seals onto accumulator pistons. Install 1-2 and 2-3 accumulator assist springs. Coat piston seals with petroleum jelly. Install accumulator pistons into channel plate over guide pins. Pistons are identical and can be assembled in any of 3 accumulator bores.

2. Install manual valve into channel plate. Install 3 accumulator springs into transaxle case accumulator bores. See **Fig. 13** . The 1-2 accumulator spring is slightly taller than other 2 springs and is installed in bore closest to electrical pass-through connector.
3. Coat channel plate-to-drive sprocket thrust washer with petroleum jelly. Install channel plate-to-drive sprocket thrust washer onto channel plate. Install NEW channel plate-to-transaxle case gasket. Install channel plate assembly onto transaxle case. Channel plate should fit tightly over guide pins located on transaxle case.
4. Install 6 channel plate-to-transaxle case bolts, and 2 channel plate-to-driven sprocket support bolts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
5. Connect manual valve link to both manual valve and detent lever. Install manual valve clip onto manual valve. See **Fig. 12** .

CHECK BALLS, SPACER PLATE & GASKETS

Inspection

Check spacer plate and spacer plate filter for damage or debris. Replace spacer plate and/or spacer plate filter if damaged. Clean all parts and dry with compressed air.

Reassembly

Install 7 check balls into correct locations on channel plate. See **Fig. 11** . Install NEW spacer plate-to-channel plate gasket onto channel plate. Install spacer plate on top of gasket and channel plate. Install spacer plate support and 2 bolts onto spacer plate. See **Fig. 10** . Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

CONTROL VALVE ASSEMBLY

NOTE: Each valve is held in control valve body by a retainer clip. Clip can be removed using screwdriver. Use care not to score valve body when removing clips and valves. Ensure each valve moves freely in valve body bore prior to disassembly.

Disassembly

Thoroughly clean valve body and dry with compressed air. Remove valve body components noting location of each component. See **Fig. 51** . Lay components on a clean surface in order removed. Remove actuator oil filter and electrical solenoids noting component location.

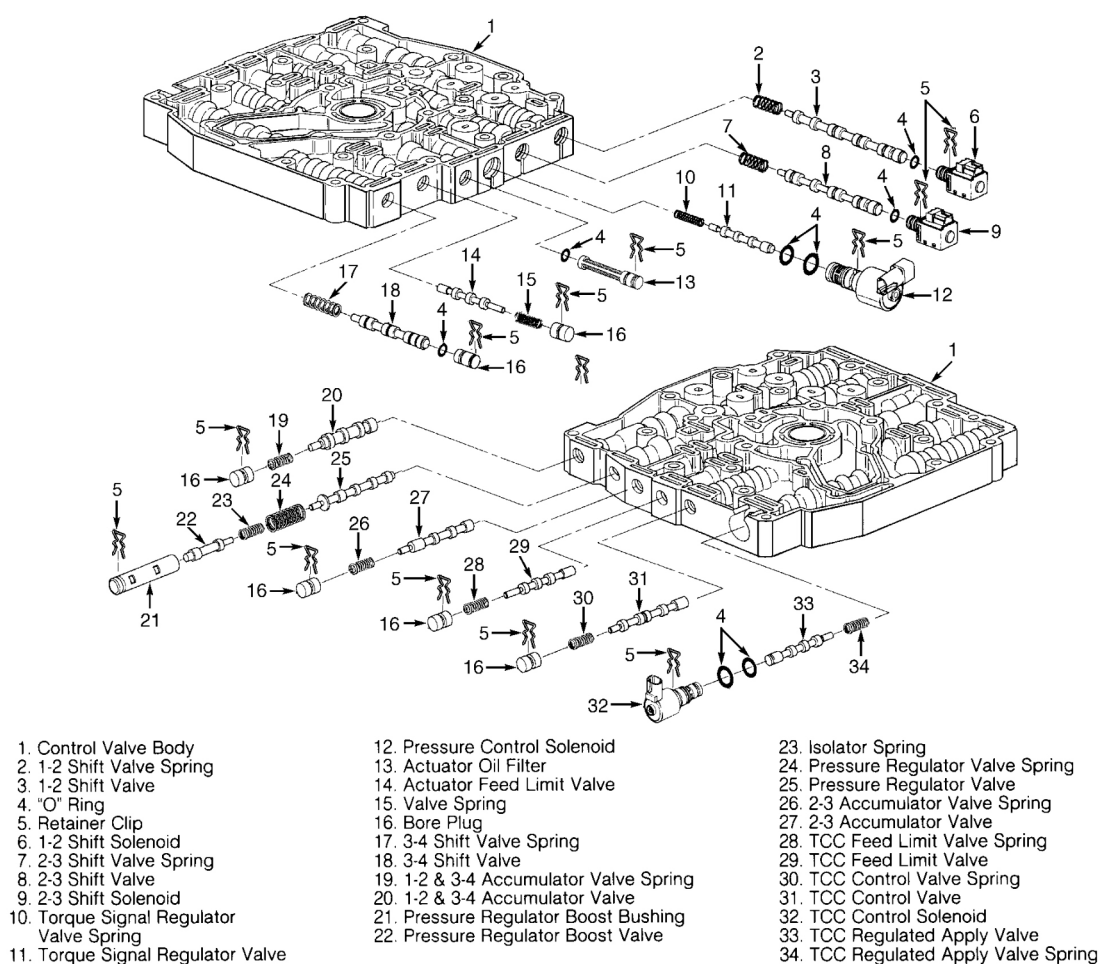


Fig. 51: Exploded View Of Control Valve Assembly
 Courtesy of GENERAL MOTORS CORP.

Inspection

Check valve body passages for debris and machined surfaces for nicks or scratches. Check valves for nicks or scratches which may result in valves sticking or fluid leaks. Check springs, bushings, "O" rings, screens and solenoids for damage. Clean all components and dry with compressed air. NEVER use shop towels to clean valve body components.

Reassembly

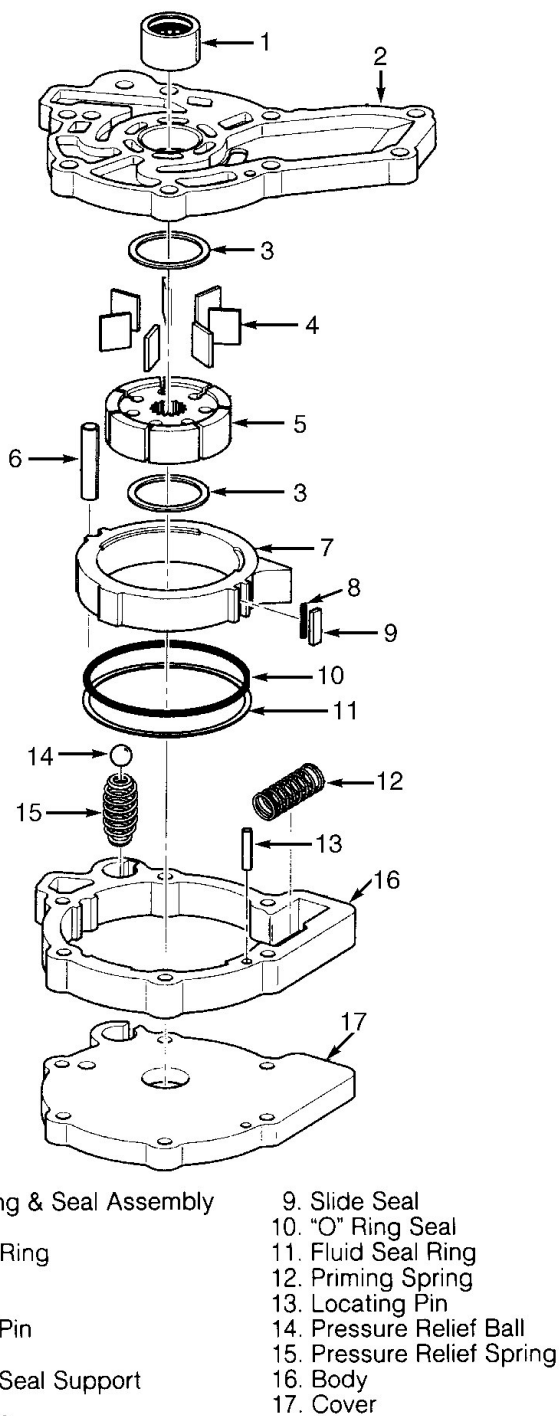
1. Reassemble control valve assembly in reverse order of disassembly. Lightly coat valves in transaxle fluid prior to installation. Install control valve assembly-to-spacer plate gasket onto spacer plate. Install control valve assembly onto transaxle case.
2. Check pressure switch assembly to ensure condition and location of "O" rings. Install pressure switch assembly onto control valve assembly. Install 18 control valve assembly bolts. See **Fig. 10** . Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

3. Connect wiring harness to pressure switch assembly, pressure control solenoid (Red connector), 1-2 shift solenoid (Red and Light Green wires) 2-3 shift solenoid (Red and Yellow wires) and TCC solenoid. See **Fig. 10** .

OIL PUMP ASSEMBLY

Disassembly

Oil pump is serviceable as a complete assembly only. Oil pump assembly should not be disassembled. Exploded view of oil pump assembly is provided for reference only. See **Fig. 52** .



G96C04283

Fig. 52: Exploded View Of Oil Pump Assembly
Courtesy of GENERAL MOTORS CORP.

Inspection

Check bearing on flange for excessive wear or damage. Check machined surfaces for scratches or nicks which may cause fluid leaks. Thoroughly flush oil pump assembly with clean transaxle fluid through pump inlet and outlet passages. While flushing pump, use oil pump drive shaft to rotate oil pump rotor. Allow excess fluid to drain from oil pump assembly.

Reassembly

Install oil pump shaft into control valve assembly. Install oil pump assembly onto oil pump shaft and control valve assembly. Rotate oil pump shaft during assembly to engage shaft splines to pump rotor splines. Install 8 oil pump bolts and tighten to specification. See **Fig. 10** . See **TORQUE SPECIFICATIONS** .

TRANSAXLE SIDE COVER & GASKETS**Disassembly**

Using hammer handle, remove side cover axle seal. DO NOT score or damage side cover bore.

Inspection

Check side cover for cracks or damage to seal grooves and mounting bosses. Check side cover gasket for damage. Gaskets are reusable if not damaged. During initial assembly, side cover gaskets are glued into place. Thoroughly clean side cover and gaskets prior to reassembly. Clean and dry gasket grooves and axle shaft bore.

Reassembly

Install side cover gaskets into grooves on side cover. Secure gaskets in place using petroleum jelly. Install side cover-to-driven sprocket thrust washer onto side cover. Secure thrust washer in place using petroleum jelly. Install side cover assembly onto transaxle case. See **Fig. 8** . Install side cover bolts and/or studs. Install stud at bolt hole to left of oil fill/vent cap. See **Fig. 1** . Tighten bolts and/or studs to specification. See **TORQUE SPECIFICATIONS** .

LEFT & RIGHT AXLE SEALS**Reassembly**

NOTE: **Seal Installer (J-41102) must be used to install axle seals. Installer sets seal depth during installation.**

Using Axle Seal Installer (J-41102), install NEW axle seal into side cover (left seal) or transaxle case (right seal). See **Fig. 53** . Lubricate splines of output shaft to prevent damage to shaft during vehicle operation.

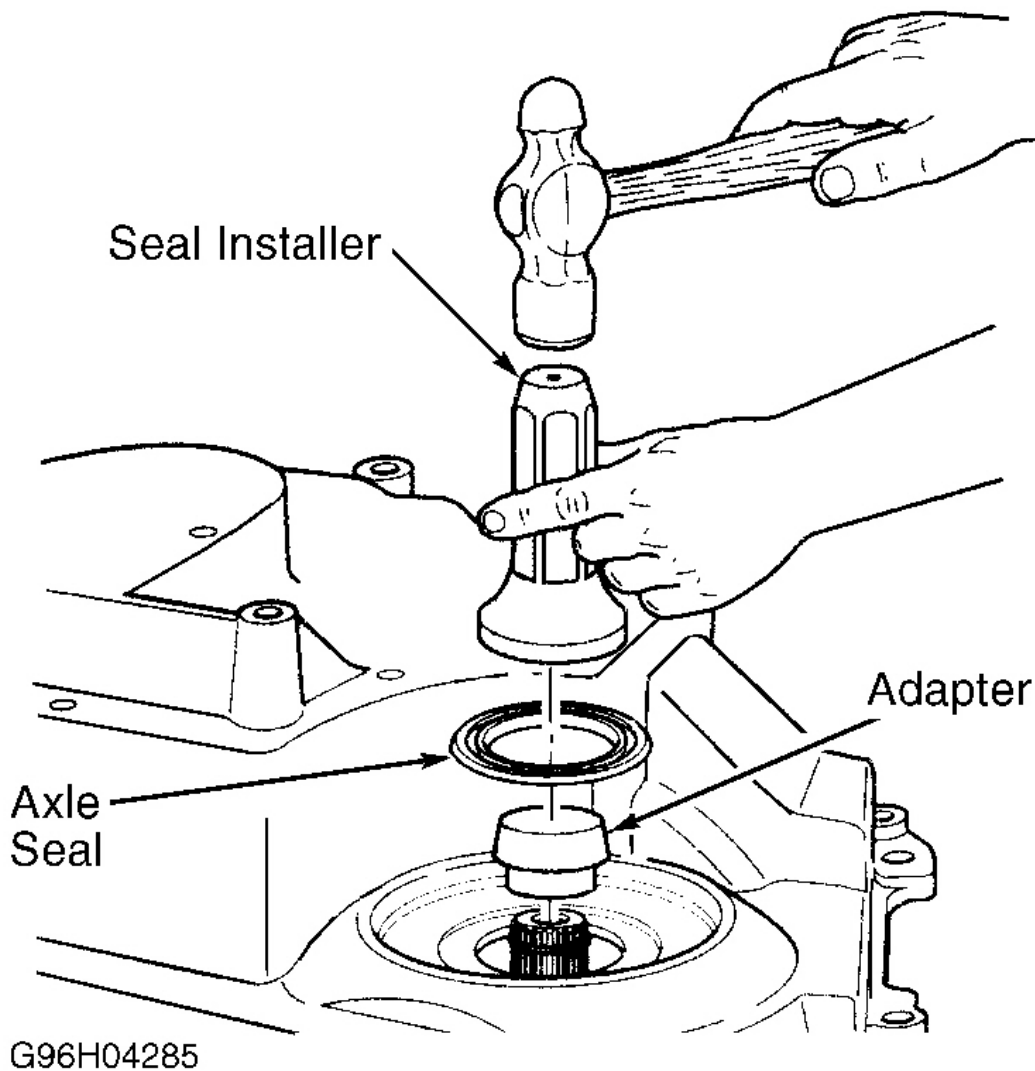


Fig. 53: Installing Axle Seal (Left Side Shown; Right Side Is Similar)
Courtesy of GENERAL MOTORS CORP.

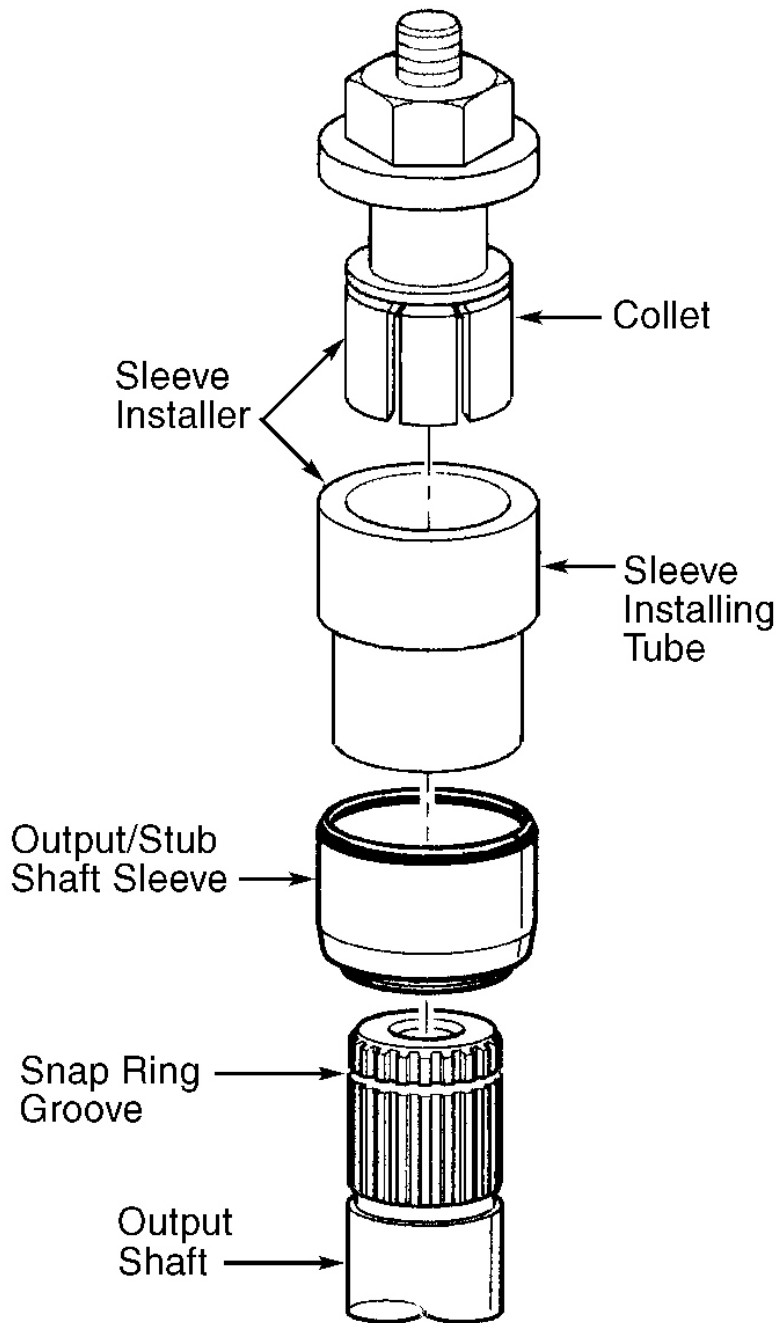
OUTPUT SHAFT SLEEVE ASSEMBLY

Reassembly

NOTE: Sleeve Installer (J-41228) must be used to install sleeve onto output shaft. Fluid leak may occur if sleeve installer is not used.

Place output/stub shaft sleeve over end of output shaft. See **Fig. 54** . Install collet into output shaft snap ring groove with collet attached to threaded collet shaft. Place sleeve installing tube over collet. Ensure small outside

diameter of sleeve installing tube fits securely into output/stub shaft sleeve. Install bearing and nut onto threaded collet shaft. Hold end of threaded collet shaft while tightening nut to press sleeve onto output shaft. Remove sleeve installer. Install NEW snap ring into output shaft snap ring groove.



G96E04284

Fig. 54: Installing Output Shaft Sleeve

Courtesy of GENERAL MOTORS CORP.

STUB SHAFT & SLEEVE ASSEMBLY

Inspection

NOTE: Sleeve Installer (J-41228) must be used to install sleeve onto stub shaft. Fluid leak may occur if sleeve installer is not used.

Check stub shaft for damage to splines, snap ring grooves and journals. Check sleeve for excessive wear, scratches or nicks which may cause a fluid leak or damage to seal. Replace stub shaft and sleeve as necessary. Clean and dry stub shaft and sleeve using compressed air.

Reassembly

1. Place output/stub shaft sleeve over end of output shaft. See **Fig. 54** . Install collet into output shaft snap ring groove with collet attached to threaded collet shaft. Place sleeve installing tube over collet. Ensure small outside diameter of sleeve installing tube fits securely into output/stub shaft sleeve.
2. Install bearing and nut onto threaded collet shaft. Hold end of threaded collet shaft while tightening nut to press sleeve onto output shaft. Remove sleeve installer. Install 2 NEW snap rings on stub shaft. Snap rings are not reusable once shaft is removed. Install stub shaft into transaxle. Use a mallet to install shaft through final drive differential gear.

VEHICLE SPEED SENSOR

Inspection & Reassembly

Check vehicle speed sensor for damage to sensor or electrical connector. Install NEW "O" ring on speed sensor. Install speed sensor into transaxle case. See **Fig. 8** . Install speed sensor stud and tighten to specification. See **TORQUE SPECIFICATIONS** .

INTERMEDIATE-4TH & LOW/REVERSE SERVOS

Disassembly

Remove piston and pin assembly from servo cover. Remove snap ring from servo pin. Remove piston and servo cushion springs from servo pin. See **Fig. 8** . Remove and discard servo piston seals (outer seal from piston and inner seal from cover).

Inspection

Check all components for damage. Ensure fluid feed holes are not plugged. Check bolt hole threads for debris and stripping. Check seal grooves for damage. Clean all parts and dry with compressed air.

Reassembly

1. Install servo cushion springs and servo piston onto servo pin. Retain spring and piston by installing snap ring onto servo pin. Install NEW seals onto servo piston and seal cover. Lubricate piston seals with

transaxle fluid. Install servo piston assembly into servo cover.

2. Install servo return spring into transaxle case. Install servo cover and piston assembly over servo return spring. Install 3 servo cover bolts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

OIL FEED TUBES

Inspection

Check oil feed tubes for plugged passages, bent tubes or cracks. Check oil feed tube seals. Verify proper location of seals. Replace seals only if they are cut, swelled or damaged. Oil feed tube seals are glued into place during initial assembly. If a seal needs replacement, thoroughly clean any residual glue from oil feed tubes. Clean tubes and dry with compressed air.

Reassembly

Install oil feed tube assembly onto transaxle. See **Fig. 8**. Install bolts and tighten to specification. See **TORQUE SPECIFICATIONS**.

OIL FILTER ASSEMBLY & SEAL, & OIL LEVEL CONTROL VALVE

Reassembly

Using socket (same size as seal), install NEW oil filter seal into transaxle case. Tap gently and evenly on seal to prevent damage to case bore and seal. Install NEW oil filter assembly into filter seal. See **Fig. 8**. It may be necessary to twist filter slightly during installation. Install oil level control valve into transaxle case. Push straight down on center of valve to prevent damage to case bore.

OIL PAN & GASKET

Inspection

Check oil pan for cracks, dents or damage to gasket sealing surface. Check gasket for cuts or damage. Bottom pan gasket may be reused if not damaged. Clean and dry oil pan, magnet and gasket using compressed air.

Reassembly

Install pan gasket and bottom oil pan onto transaxle case. See **Fig. 8**. Install 12 oil pan bolts and tighten to specification. See **TORQUE SPECIFICATIONS**.

TORQUE CONVERTER ASSEMBLY

Reassembly

Install NEW input shaft "O" ring on end of input shaft. Install torque converter onto transaxle. Install Torque Converter Holding Fixture (J-21366) to secure converter during transaxle installation.

TORQUE SPECIFICATIONS

2000 Saturn LS

2000 AUTOMATIC TRANSMISSIONS Hydra-Matic 4T40-E & 4T45-E Overhaul

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Channel Plate Bolt	10 (14)
Flexplate-To-Crankshaft Bolt	
Alero, Cavalier, Grand Am & Sunfire (2.4L)	(1)
Alero & Grand Am (3.4L)	61 (83)
Cavalier & Sunfire (2.2L)	55 (75)
Lanos	44 (60)
Malibu (3.1L)	52 (71)
Nubira	48 (65)
Saturn "L" Series	(2)
Flexplate-To-Torque Converter Bolt	
Daewoo	48 (65)
Except Daewoo	33 (45)
Park/Neutral Position Switch Mounting Bolt & Nut	18 (24)
Shift Selector Lever-To-Transaxle Nut	15 (20)
Side Cover Bolt/Stud	15 (20)
Spacer Plate Bolt	10 (14)
	INCH Lbs. (N.m)
Control Valve Body Assembly Bolt	106 (12)
Drive Sprocket Attaching Screw	106 (12)
Input Speed Sensor Bolt	106 (12)
Intermediate-4th Servo Cover Bolt	106 (12)
Low/Reverse Servo Cover Bolt	106 (12)
Oil Feed Tube Bolt	106 (12)
Oil Pan Bolt	106 (12)
Oil Pump Bolt	106 (12)
Output Speed Sensor Retaining Stud	106 (12)
(1) Tighten to 22 ft. lbs. (30 N.m), and then tighten an additional 45 degrees.	
(2) Tighten to 39 ft. lbs. (53 N.m), and then tighten an additional 25 degrees.	

TRANSAXLE SPECIFICATIONS**TRANSAXLE SPECIFICATIONS (END PLAY)**

Application	In. (mm)
Final Drive Pinion Gears	.009-.024 (.23-.62)
Input & Reaction Carrier Pinion Gears	.009-.027 (.23-.69)