1993-94 AUTOMATIC TRANSMISSIONS

Hydra-Matic 4L60/4L60-E

APPLICATION & LABOR TIMES

THM 4L60 APPLICATION & LABOR TIMES (1993)

Vehicle Application	Labor Times R & I (1) (3)	Labor Times Overhaul (2)	Engine Size
Buick			
Roadmaster	3.7	7.0	5.0L & 5.7L
Cadillac			
Brougham	3.9	7.0	5.0L & 5.7L
Chevrolet			
S10 4-Cylinder 2WD	4.6	6.7	2.5L
Camaro	5.0	7.0	3.4L & 5.7L
Caprice, Impala SS	3.7	7.0	5.0L & 5.7L
Corvette (4)	6.0	7.0	5.7L
GMC			
Sonoma 4-Cylinder 2WD	4.6	6.7	2.5L
Jimmy 4WD V6 (4.3L)	7.3	7.0	4.3L
Pontiac			
Firebird	5.0	7.0	3.4L & 5.7L

(1) Removal and installation of transmission from vehicle chassis.

(2) Bench overhaul time for transmission. DOES NOT include removal and installation.

(3) If equipped with ABS, add .3 Hr.

(4) If vehicle has a convertible top add .9 Hr.

THM 4L60-E APPLICATION & LABOR TIMES (1993-94)

Vehicle Application	Labor Times R & I (1) (3)	Labor Times Overhaul (2)	Engine Size
Buick			
Roadmaster	3.7	6.7	5.7L
Cadillac			
Brougham	3.9	6.7	5.7L
Chevrolet			
Astro			
2WD	3.8	6.7	4.3L
4WD	5.0	6.7	4.3L
S/T Blazer V6			

2WD	5.2	6.7	4.3L
4WD	7.8	6.7	4.3L
Blazer C/K			
4WD	5.7	6.7	All
S/T Pickup 4-Cylinder			
2WD	4.6	6.7	2.5L
4WD	7.8	6.7	2.5L
S/T Pickup V6			
2WD	5.2	6.7	4.3L
4WD	7.8	6.7	4.3L
GMC			
Jimmy			
2WD	5.2	6.7	All
4WD	7.8	6.7	All
Cutaway Van	3.7	6.7	5.7L
Hi-Cube Van	3.7	6.7	5.7L & 6.2L
Passenger Vans	3.7	6.7	All
Sports Vans	3.7	6.7	All
Suburban & Pickup			
2WD	4.9	6.7	5.7L
4WD	5.7	6.7	5.7L
Safari			
2WD	3.8	6.7	4.3L
4WD	5.0	6.7	4.3L
School Bus	N/A	6.7	4.3L & 5.7L
Sonoma 4-Cylinder			
2WD	4.6	6.7	2.5L
4WD	7.8	6.7	2.5L
Sonoma V6			
2WD	5.2	6.7	4.3L
4WD	7.8	6.7	4.3L
Vandura	3.7	6.7	All
Yukon	5.7	6.7	5.7L
Oldsmobile			
Bravada	7.8	6.7	4.3L
Custom Cruiser	N/A	N/A	5.7L
Pontiac			
Firebird	5.0	6.7	4.3L & 5.7L

(1) Removal and installation of transmission from vehicle chassis.

(2) Bench overhaul time for transmission. DOES NOT include removal and installation.

(3) If equipped with ABS, add .3 Hr.

IDENTIFICATION

Turbo Hydra-Matic (THM) 4L60 transmission can be identified by a letter code contained in identification number. Identification number is stamped on transmission case above oil pan rail on right rear side. See **Fig. 1**. Identification number contains information which must be used when ordering replacement parts.

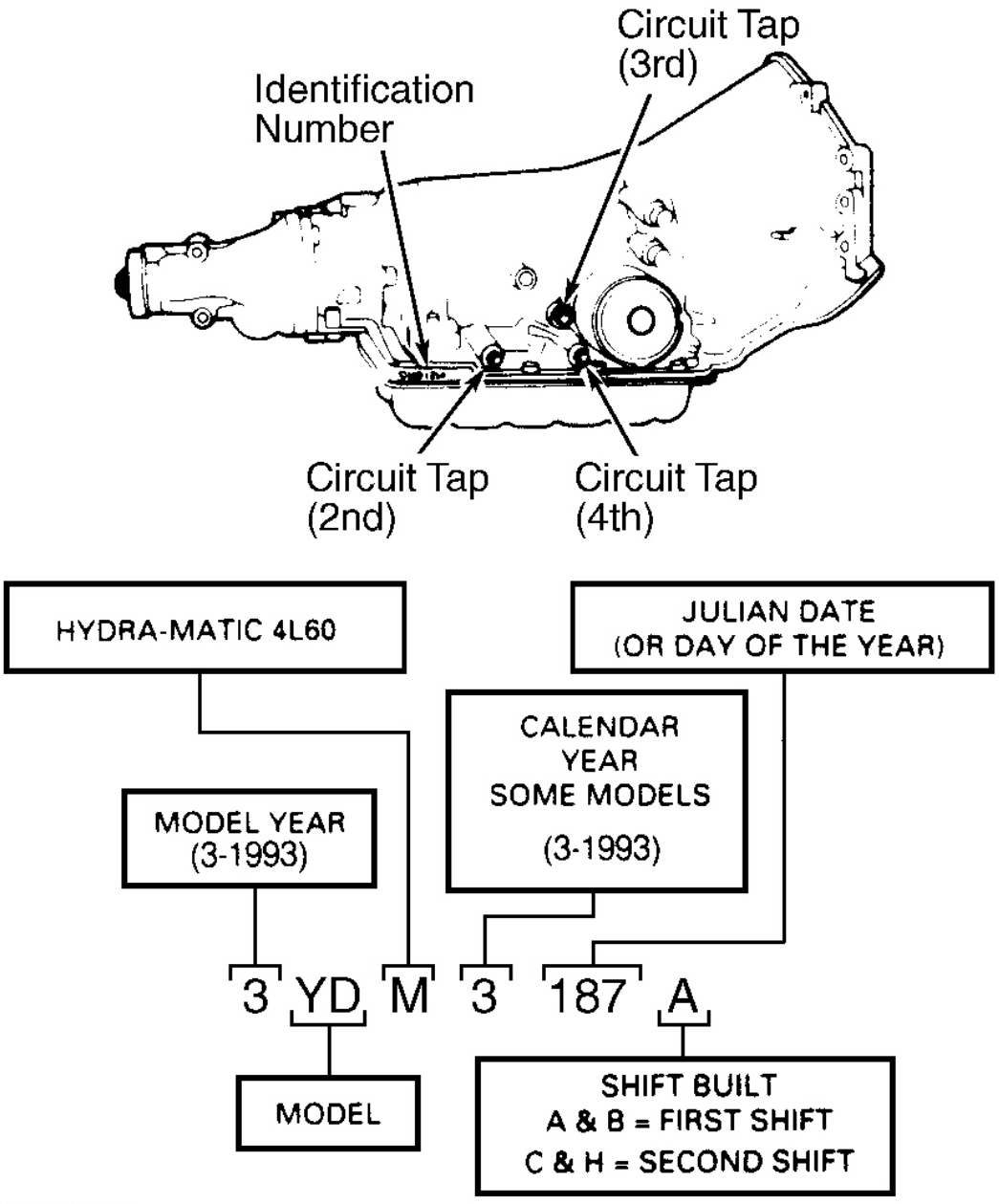

Fig. 1: Identifying Transmission & Locating Circuit Taps
Courtesy of GENERAL MOTORS CORP.

DESCRIPTION

Turbo Hydra-Matic (THM) 4L60 is a fully automatic trans-mission consisting of a 3-element hydraulic torque

converter with a Torque Converter Clutch (TCC). Two planetary gear sets, 5 multiple-disc clutches, one sprag clutch, one roller clutch and a band provide friction elements necessary to produce 4 forward speeds, last of which is Overdrive. See **Fig. 2**.

A hydraulic system, pressurized by a variable capacity vane type pump, provides pressure required to operate friction elements and automatic controls. Transmission contains an auxiliary valve body for smoother Drive and Reverse engagement. Temperature switch may be used to apply TCC to prevent transmission overheating. Temperature switch reduces fluid temperature in Overdrive when TCC is not applied.

Temperature switch mounts on valve body and sits in trans-mission pan fluid. See **Fig. 19**. At normal operating temperature or less, switch is open. As fluid in pan heats to 270-286°F (134-140°C), switch closes to allow TCC to apply until fluid in pan cools to 250-268°F (121-131°C). Heat is reduced when TCC is applied and torque multiplication function of converter is by-passed.

The 4L60-E transmission, uses clutch and band elements which are very similar to the 4L60 transmission. The 4L60-E, also contains electronic solenoids to control hydraulic operations. The 4L60-E does not use a governor valve or throttle valve assemblies. A Powertrain Control Module (PCM) receives signals from Vehicle Speed Sensor (VSS), Throttle Position Sensor (TPS), fluid pressure switch assembly, and temperature switch. These signals help PCM determine when to switch the 2 shift solenoids, 3-2 downshift solenoid, and/or TCC solenoid on or off. The PCM can also control line pressure via pressure control solenoid (force motor).

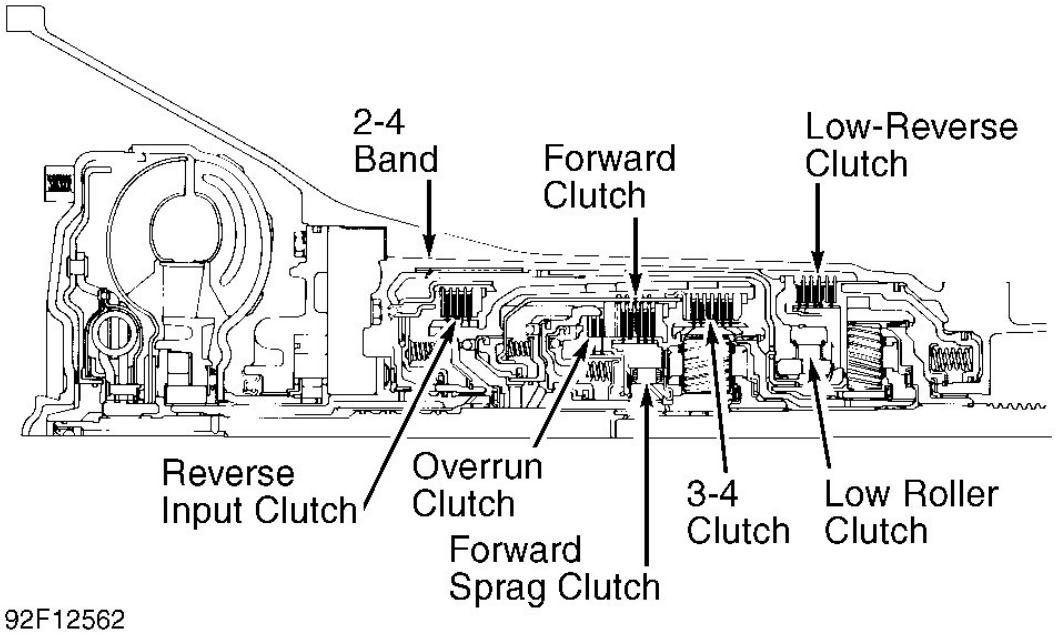

Fig. 2: 4L60 Transmission (4L60-E Transmission is Similar)
Courtesy of GENERAL MOTORS CORP.

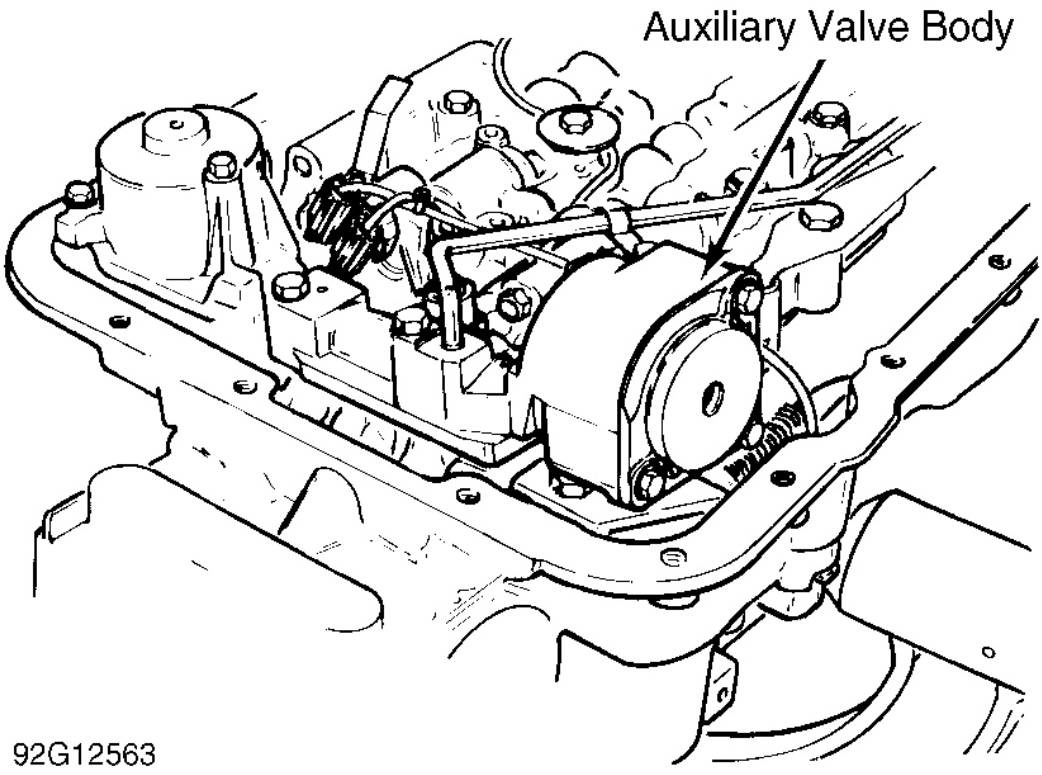

Fig. 3: Locating Auxiliary Valve Body (4L60)
Courtesy of GENERAL MOTORS CORP.

LUBRICATION & ADJUSTMENTS

See appropriate AUTO TRANS SERVICING article in the AUTOMATIC TRANS SERVICE section. See menu below.

- For Astro, see **TRANSMISSION SERVICING - A/T**
- For 1993 Blazer C/K 4WD, see **TRANSMISSION SERVICING - A/T**
- For Blazer S/T, see **TRANSMISSION SERVICING - A/T**
- For 1993 Camaro, see **TRANSMISSION SERVICING - A/T**
- For 1994 Camaro, see **TRANSMISSION SERVICING - A/T**
- For 1993 Caprice, see **TRANSMISSION SERVICING - A/T**
- For 1994 Caprice, see **TRANSMISSION SERVICING - A/T**
- For 1993 Corvette, see **TRANSMISSION SERVICING - A/T**
- For 1994 Corvette, see **TRANSMISSION SERVICING - A/T**
- For 1993 Firebird, see **TRANSMISSION SERVICING - A/T**

- For 1994 Firebird, see **TRANSMISSION SERVICING - A/T**
- For 1993 Fleetwood Brougham, see **TRANSMISSION SERVICING - A/T**
- For 1994 Fleetwood Brougham, see **TRANSMISSION SERVICING - A/T**
- For GMC Vans, see **TRANSMISSION SERVICING - A/T**
- For GMC Suburban, see **TRANSMISSION SERVICING - A/T**
- For GMC Pickup, see **TRANSMISSION SERVICING - A/T**
- For 1993 Impala SS, see **TRANSMISSION SERVICING - A/T**
- For Jimmy, see **TRANSMISSION SERVICING - A/T**
- For 1993 Roadmaster, see **TRANSMISSION SERVICING - A/T**
- For 1994 Roadmaster, see **TRANSMISSION SERVICING - A/T**
- For Safari, see **TRANSMISSION SERVICING - A/T**
- For Yukon, see **TRANSMISSION SERVICING - A/T**

ON-VEHICLE SERVICE

THROTTLE VALVE CABLE (4L60 ONLY)

Removal

Remove air cleaner. Disconnect throttle valve cable from throttle linkage. Compress locking tabs. Remove cable from mounting bracket. Raise and support vehicle. Remove cable retaining bolt from transmission. Disconnect cable from transmission. Remove seal.

Installation

To install, reverse removal procedure. Install NEW seal. Once cable is fully installed, pull upper end of cable. Slight resistance should be felt due to return spring. Ensure cable fully returns. Adjust cable. See appropriate AUTO TRANS SERVICING article in the AUTOMATIC TRANS SERVICE section. See menu below.

- For Astro, see **TRANSMISSION SERVICING - A/T**
- For 1993 Blazer C/K 4WD, see **TRANSMISSION SERVICING - A/T**
- For Blazer S/T, see **TRANSMISSION SERVICING - A/T**
- For 1993 Camaro, see **TRANSMISSION SERVICING - A/T**
- For 1994 Camaro, see **TRANSMISSION SERVICING - A/T**
- For 1993 Caprice, see **TRANSMISSION SERVICING - A/T**
- For 1994 Caprice, see **TRANSMISSION SERVICING - A/T**
- For 1993 Corvette, see **TRANSMISSION SERVICING - A/T**
- For 1994 Corvette, see **TRANSMISSION SERVICING - A/T**
- For 1993 Firebird, see **TRANSMISSION SERVICING - A/T**
- For 1994 Firebird, see **TRANSMISSION SERVICING - A/T**
- For 1993 Fleetwood Brougham, see **TRANSMISSION SERVICING - A/T**

- For 1994 Fleetwood Brougham, see **TRANSMISSION SERVICING - A/T**
- For GMC Vans, see **TRANSMISSION SERVICING - A/T**
- For GMC Suburban, see **TRANSMISSION SERVICING - A/T**
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- For Jimmy, see **TRANSMISSION SERVICING - A/T**
- For 1993 Roadmaster, see **TRANSMISSION SERVICING - A/T**
- For 1994 Roadmaster, see **TRANSMISSION SERVICING - A/T**
- For Safari, see **TRANSMISSION SERVICING - A/T**
- For Yukon, see **TRANSMISSION SERVICING - A/T**

GOVERNOR ASSEMBLY (4L60 ONLY)

Removal

Remove governor cover and "O" ring. Remove governor assembly.

Inspection

Inspect governor valve and sleeve for binding and scoring. See **Fig. 4**. Ensure weights operate freely. Inspect governor drive gear for damage and loose fit on shaft. Replace governor if necessary.

Installation

To install, reverse removal procedure. Install NEW cover seal or gasket. Apply thin coat of Loctite sealant on cover before installation. Ensure fluid level is correct.

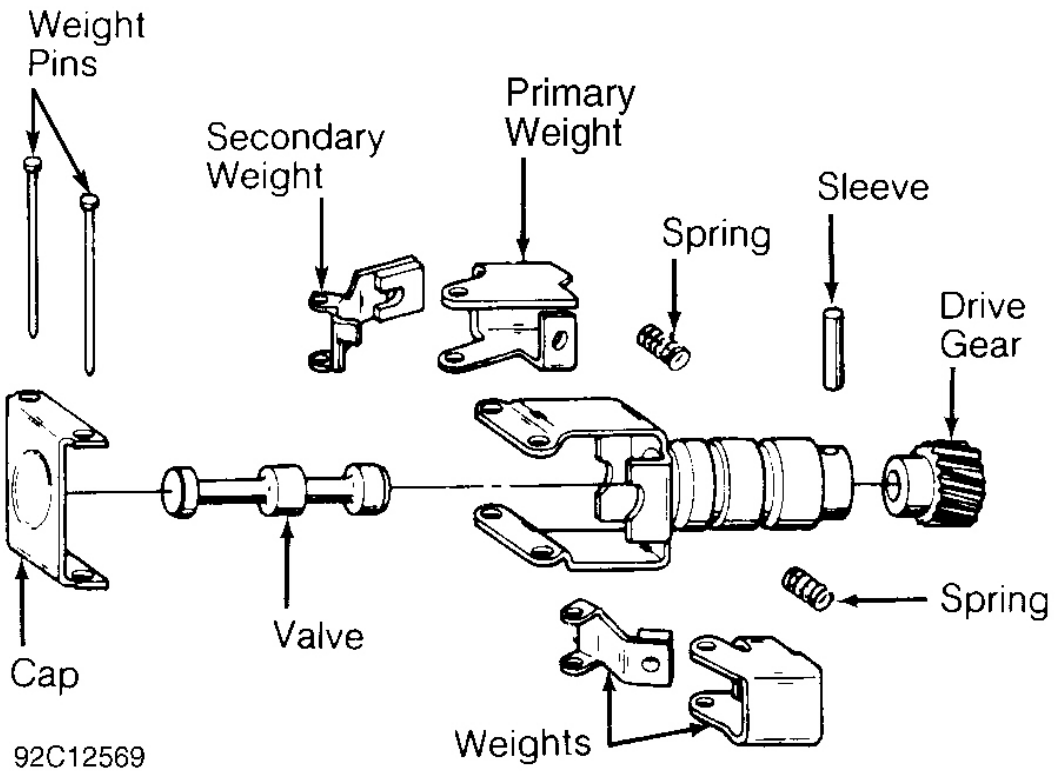


Fig. 4: Exploded View Of Governor Assembly (4L60 Only)
Courtesy of GENERAL MOTORS CORP.

2-4 SERVO ASSEMBLY

Removal & Installation

Install Piston Compressor (J-29714) on oil pan. Compress servo cover, and remove retaining ring. See **Fig. 15**. Remove servo cover and "O" ring. Remove 2-4 servo assembly. To install, reverse removal procedure. For servo pin length check, see 2-4 SERVO ASSEMBLY under **TRANSMISSION DISASSEMBLY**.

REAR OIL SEAL

Removal & Installation

Remove drive shaft. Pry oil seal from extension housing. Coat outside edge of oil seal with non-hardening sealer. Using Seal Installer (J-21426), install oil seal. To complete installation, install drive shaft. Check fluid level.

AUXILIARY VALVE BODY (4L60 ONLY)

Removal

Remove transmission oil pan. Remove oil filter and "O" ring. Ensure "O" ring is removed from transmission case. Remove clamp and pressure tube. Remove auxiliary valve body retaining bolts. Remove auxiliary valve body and check ball. See **Fig. 5**. Note location of check ball.

Installation

Coat check ball with petroleum jelly before installation. Install check ball in auxiliary valve body. To complete installation, reverse removal procedure. Lubricate "O" ring with petroleum jelly. Install new filter and "O" ring. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** table at end of article. Fill transmission with fluid.

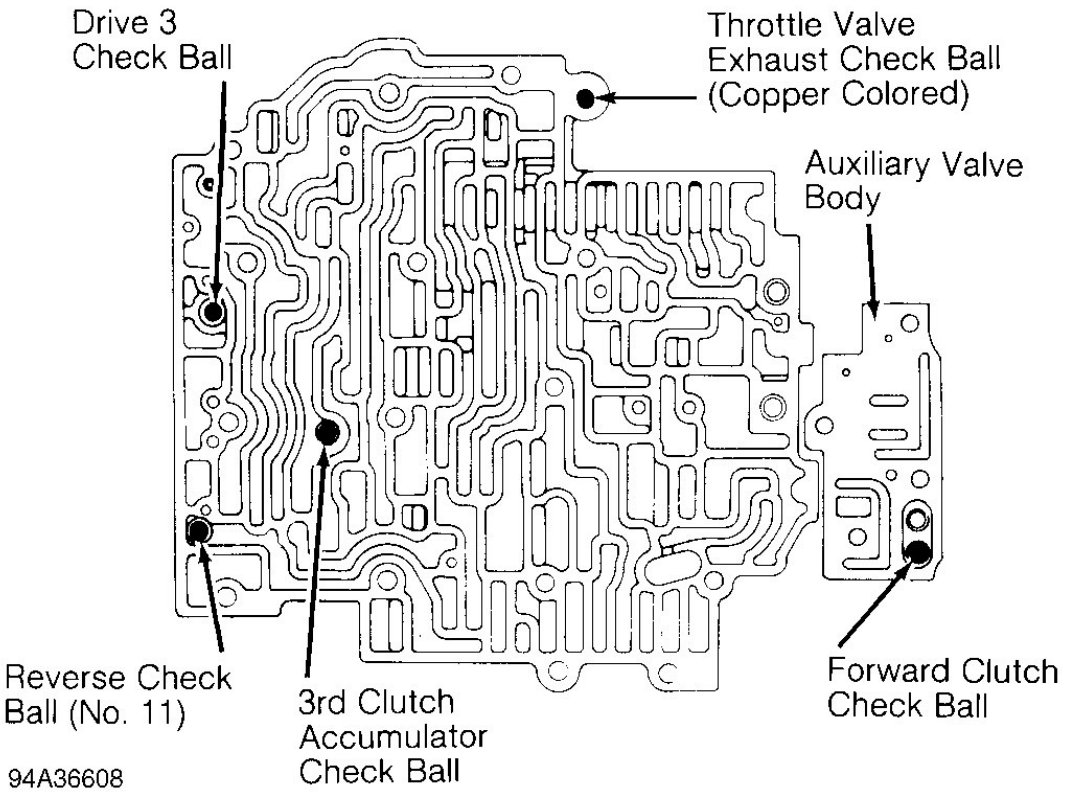


Fig. 5: Locating Valve Body Check Balls (4L60)
Courtesy of GENERAL MOTORS CORP.

VALVE BODY

CAUTION: Note valve body bolt length and location during removal procedure. Transmission case damage may occur if bolts are incorrectly installed.

Removal (4L60)

1. Disconnect throttle valve cable from throttle lever. Raise and support vehicle, and remove transmission oil pan. Remove oil filter and "O" ring. Ensure "O" ring is removed from transmission case.
2. Remove electrical connectors from switches, and tag. Remove auxiliary valve tube to access valve body. Remove valve body bolts. Note length and location of bolts for installation.
3. Note direction of manual valve link. Remove manual valve link from manual valve at valve body. See **Fig. 6**. Note direction of throttle valve link. See **Fig. 7**. Remove throttle valve bracket and throttle valve link. Remove valve body. Note location of check balls. **DO NOT** lose balls. See **Fig. 5**.

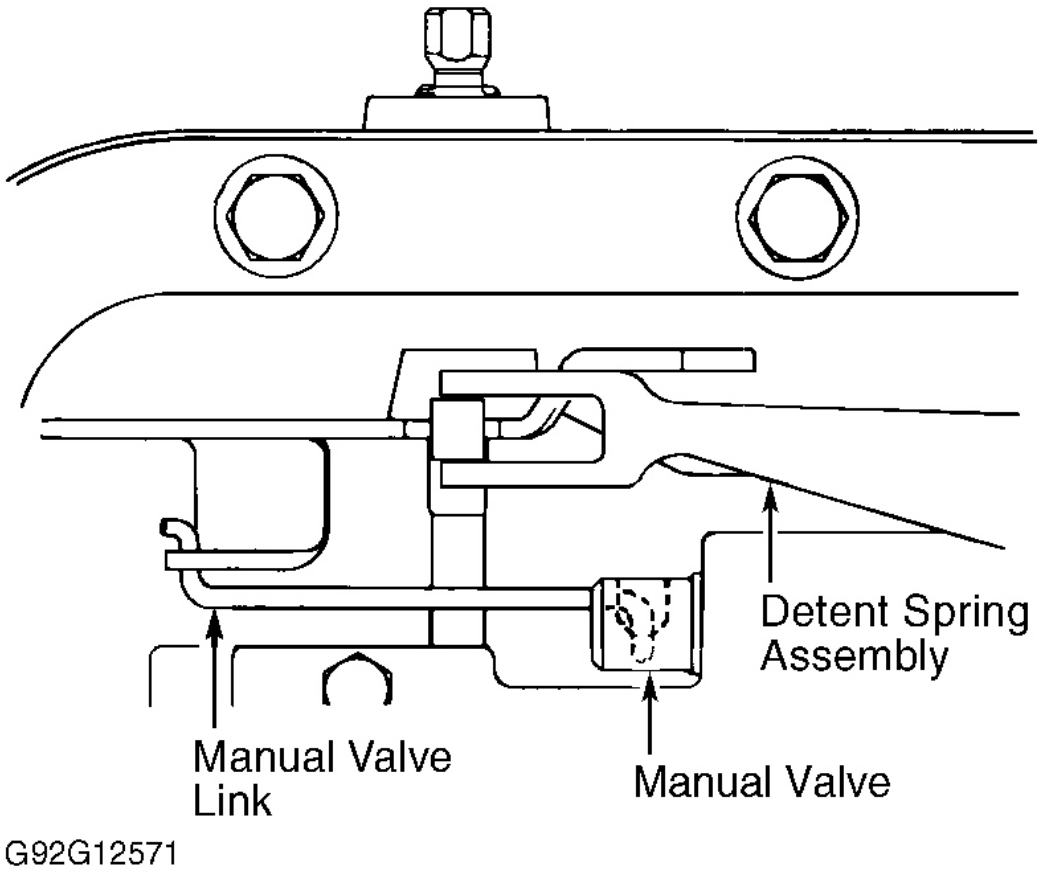


Fig. 6: Installing Manual Valve Link
Courtesy of GENERAL MOTORS CORP.

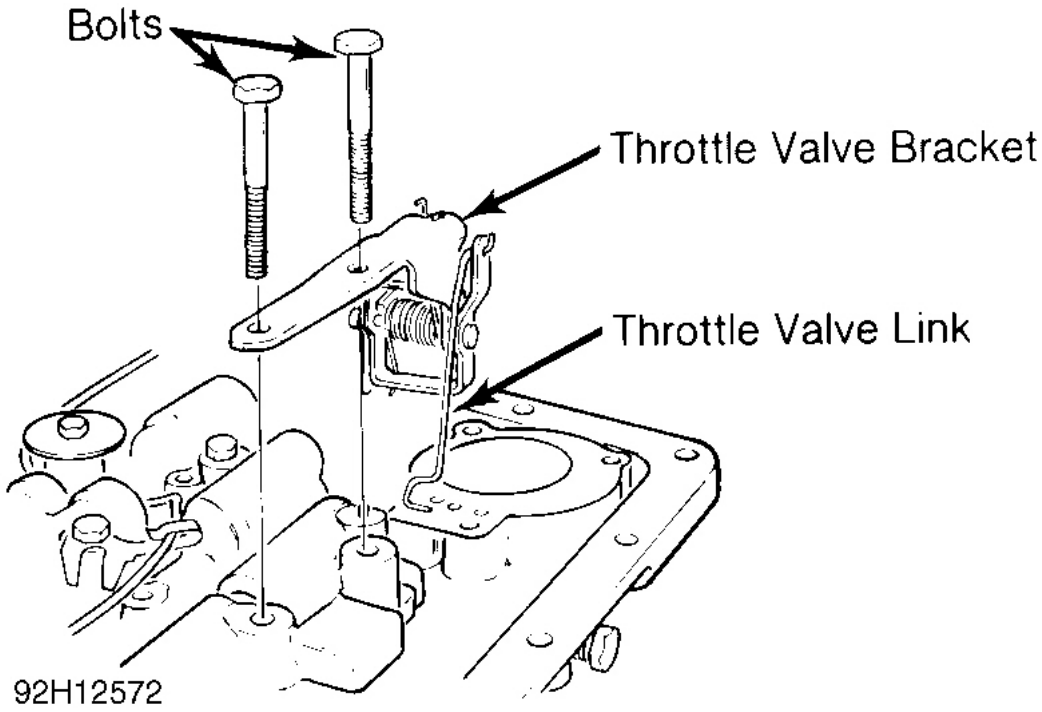


Fig. 7: Installing Throttle Valve Link
Courtesy of GENERAL MOTORS CORP.

Installation

1. Coat check balls with petroleum jelly. Install check balls in proper locations on separator plate. See **Fig. 5**. Install manual valve link. Ensure manual valve link is properly seated in manual valve. See **Fig. 6**. Improper positioning may prevent vehicle operation in "D" range.

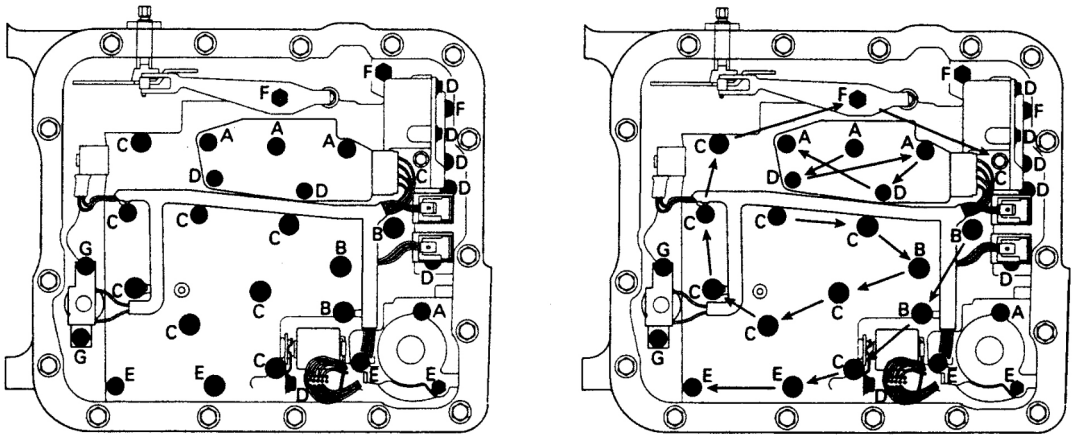
   NOTE: Improper positioning of throttle valve link will result in erratic shift points or high main line oil pressure.

2. Install throttle link. Ensure link is properly positioned with lower hook facing outside of transmission case. See **Fig. 7**. Install valve body and retaining bolts. Tighten bolts to specification. To complete installation, reverse removal procedure.
3. Lubricate oil filter "O" ring with ATF before installation. Tighten all bolts to specification. See TORQUE SPECIFICATIONS table. Fill transmission with fluid.

Removal (4L60-E)

1. Remove transmission oil pan. Remove oil filter and "O" ring. Ensure "O" ring is removed from transmission case.

2. Remove electrical connectors from switches and solenoids, and tag. Remove pressure switch assembly. Remove accumulator cover. Remove valve body bolts. Note length and location of bolts for installation. See **Fig. 8**



A M6 X 1.0 X 65.0
B M6 X 1.0 X 54.4
C M6 X 1.0 X 47.5
D M6 X 1.0 X 18.0
E M6 X 1.0 X 35.0
F M8 X 1.25 X 20.0
G M6 X 1.0 X 12.0

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Fig. 8: Valve Body Bolt Locations (4L60-E)
Courtesy of GENERAL MOTORS CORP.

3. Note direction of manual valve link. Remove manual valve link from manual valve at valve body. See **Fig. 6**. Remove valve body. Note location of check balls. **DO NOT** lose balls. See **Fig. 9** and **Fig. 10**.

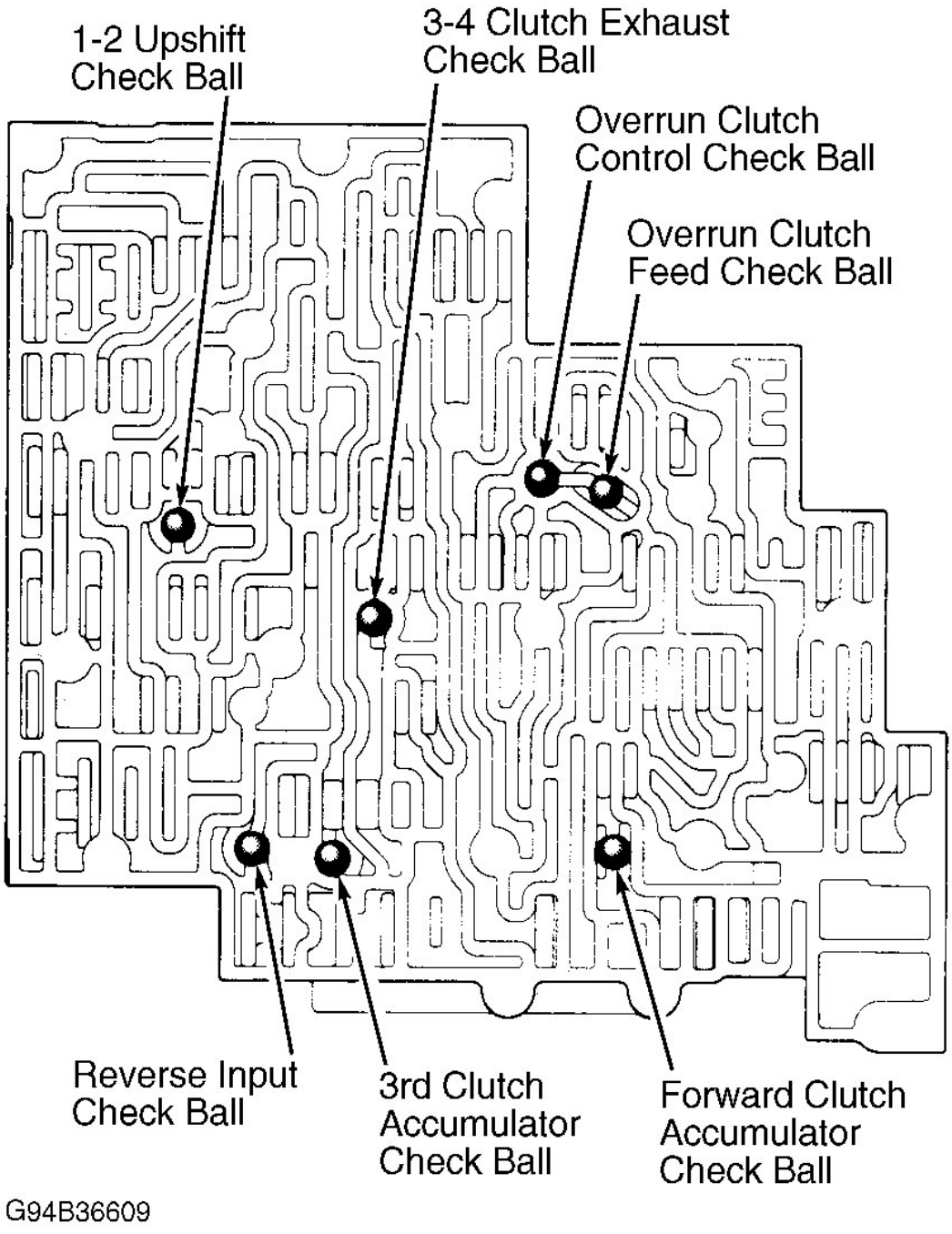

Fig. 9: Locating Valve Body Check Balls (4L60-E)
Courtesy of GENERAL MOTORS CORP.

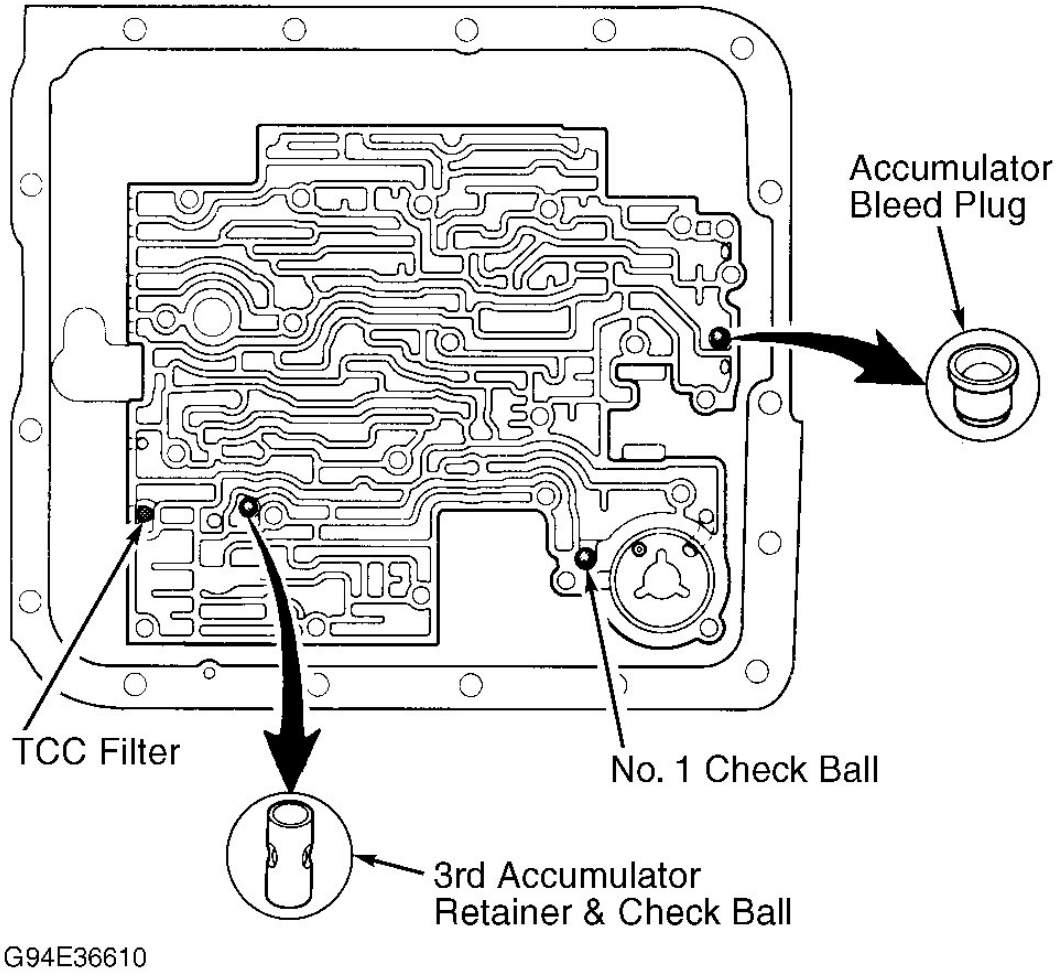

Fig. 10: Locating Check Balls in Case (4L60-E)
Courtesy of GENERAL MOTORS CORP.

Installation

1. Coat check balls with petroleum jelly. Install check balls in proper locations on separator plate. See **Fig. 9** and **Fig. 10**. Install manual valve link. Ensure manual valve link is properly seated in manual valve. See **Fig. 6**. Improper positioning may prevent vehicle operation in "D" range.

   NOTE: Improper positioning of throttle valve link will result in erratic shift points or high main line oil pressure.

2. Install valve body and retaining bolts. See **Fig. 8**. Tighten bolts to specification. To complete installation, reverse removal procedure.
3. Lubricate oil filter "O" ring with ATF before installation. Tighten all bolts to specification. See TORQUE SPECIFICATIONS table. Fill transmission with fluid.

TROUBLE SHOOTING

NOTE: Models with 4L60-E use Powertrain Control Module (PCM) computer, which controls TCC, pressure control solenoid and shifting solenoids 1-2 and 2-3. Models with 4L60, use PCM to control TCC only.

NOTE: See appropriate AUTO TRANS DIAGNOSIS - 4L60/4L80 article in AUTOMATIC TRANSMISSIONS section for electrical trouble shooting.

NOTE: For clutch and band application, see the appropriate CLUTCH & BAND APPLICATION CHART under CLUTCH & BAND APPLICATION.

SYMPTOM DIAGNOSIS

1st Gear Only, No Upshift

On 4L60 only, check governor assembly. Governor valve sticking. Driven gear loose or damaged. Drive gear retaining pin missing. Nicks or burrs on output shaft, governor sleeve or case bore. Improper support pin length. Governor weights or springs missing, damaged or binding.

On 4L60/4L60-E, check 1-2 shift valve sticking in valve body. Spacer plate or gaskets damaged or not positioned properly. Case-to-valve body face damaged or not flat. Governor screen restricted or damaged. 2-4 servo assembly restricted or blocked case passages. Nicks or burrs on servo pin or case pin bore. Missing or damaged piston or pin seals. 4th servo piston installed backward. 2-4 band worn or damaged or band anchor pin not engaged. On 4L60-E only, check shift solenoids.

1st Gear Start In 2nd Gear Start Mode (Camaro & Firebird Only)

On 4L60-E only, check second gear start switch. Check technical service bulletins.

Slips in 1st

Defective forward clutch assembly. Clutch plates worn. Piston porous or damaged. Piston seals missing or damaged. Input housing-to-forward clutch housing "O" ring seal missing or damaged. Damaged housing. Housing retainer and ball assembly damaged or not seating. Input housing and shaft assembly turbine shaft seals missing or damaged. Accumulator valve stuck in valve body.

Valve body face not flat, damaged lands, or interconnected passages. Spacer plate or gaskets incorrect, damaged or not positioned properly. Binding or broken T.V. cable (4L60). On 4L60/4L60-E, check for defective 1-2 accumulator piston assembly. Porosity in piston or cover and pin assembly. Damaged piston ring grooves. Piston seal missing or damaged. Cover gasket missing or damaged. Broken accumulator spring.

Improper oil pressure. Torque converter stator roller clutch not holding or 4th servo piston in backward. Damage to low roller clutch lugs or inner ramps. Rollers not free moving, inadequate spring tension or damage to inner splines. Oil passage plugged. Forward clutch accumulator piston seal missing or damaged. Piston out of its bore. Porosity in piston or auxiliary valve body. Abuse valve stuck in auxiliary valve body (4L60).

High Or Low 1-2 Shift Speeds

On 4L60 only, check T.V. cable binding, broken or improperly adjusted. Governor assembly valve sticking. Driven gear loose or damaged. Drive gear retaining pin missing. Nicks or burrs on output shaft, governor sleeve or case bore. Improper support pin length. Governor weights or springs missing, damaged or binding.

Throttle lever and bracket assembly damaged, binding or not installed properly. T.V. link missing, binding or damaged. Valve body face not flat, T.V. exhaust check ball stuck or T.V. plunger sticking. Oil pump assembly or case face not flat.

Slipping Or Rough 1-2 Shift

On 4L60 only, check throttle lever and bracket assembly damaged, not installed properly or T.V. cable broken or binding. Valve body assembly throttle valve sticking. T.V. bushing turned in bore. On 4L60/4L60-E, check defective valve body assembly. 1-2 shift valve train, line bias valve, accumulator valve or T.V. limit valve stuck. Gaskets or spacer plate incorrect, damaged or not installed properly. Body face not flat.

Defective 2-4 servo assembly. Apply pin incorrect length. Servo seals or "O" ring seals missing or damaged. Restricted or missing oil passages. Case servo bore damaged. Defective 2nd accumulator. Porosity in 1-2 accumulator housing or piston. Piston seal or groove damaged. Nicks or burrs in 1-2 accumulator housing. Missing or restricted oil passages or 2-4 band worn or not positioned properly. Oil pump assembly or case faces not flat.

Slipping, Rough Or No 2-3 Shift

Internal converter damage. On 4L60 only, governor valve sticking. Drive gear retaining pin missing or loose. Governor weights binding. Governor drive gear damaged. Support pin in case incorrect length. On 4L60/4L60-E, oil pump stator shaft sleeve scored or not located properly. Valve body 2-3 valve train or accumulator valve stuck. Spacer plate or gaskets incorrect, damaged or not positioned properly. Throttle valve or T.V. limit valve stuck. Input housing assembly forward or 3-4 clutch plates worn. Excessive clutch plate travel.

Forward or 3-4 piston seals damaged. Porosity in 3-4 clutch housing or piston, or 3-4 piston check ball stuck, damaged or not sealing. Restricted apply passages. Forward clutch piston or 3rd accumulator retainer and ball assembly not seating. Sealing balls loose or missing. 2-4 servo assembly or 2nd apply piston seals missing or damaged.

1st & 4th Or 2nd & 3rd Gear Only

On 4L60-E only, check shift solenoids for dirt, damaged seals or electrical connections.

3rd Gear Only

On 4L60-E only, check 2-3 shift solenoid and 3-2 control solenoid circuits, damaged seals or electrical connections.

3-2 Flare Or Tie Up

On 4L60-E only, check 3-2 control solenoid for dirt, damaged seals or electrical connections.

Slipping, Rough or No 3-4 Shift

On 4L60 only, check governor weights for binding. Governor valve sticking. Drive gear damaged or retaining pin missing or loose. Support pin in case incorrect length. On 4L60/4L60-E, check oil pump assembly faces not flat or pump cover retainer and ball assembly omitted or damaged. Valve body assembly 2-3 valve train, accumulator valve, throttle valve, T.V. limit valve (4L60 only), 1-2 shift valve or 3-2 control valve stuck. Manual valve link bent or damaged. Spacer plate or gaskets incorrect, damaged or not positioned properly. Defective 2-4 servo assembly.

Incorrect band apply pin. Servo seals missing or damaged. Porosity in pistons, cover or case. Plugged or missing orifice cup plug. Case 3rd accumulator retainer and ball assembly leaking. Porosity in 3-4 accumulator piston or bore. 3-4 accumulator piston seal or seal grooves damaged. Restricted oil passage. Defective input housing assembly. Forward or 3-4 clutch plates worn, or excessive plate travel.

Forward or 3-4 piston seals damaged. Porosity in 3-4 clutch housing or piston. 3-4 piston check ball stuck, damaged or not sealing. Restricted apply passages. Forward clutch piston retainer and ball assembly not seating. 2-4 band worn or not positioned properly. Sealing balls loose or missing.

No "R" Or Slips In "R"

Defective input housing assembly. 3-4 apply ring stuck in applied position. Forward clutch not releasing. Turbine shaft seals missing or damaged. Manual valve link disconnected. Defective oil pump assembly. Retainer and ball assembly missing or damaged. Stator shaft seal rings or ring grooves damaged. Stator shaft sleeve scored or damaged. Reverse boost valve stuck, damaged or not assembled properly. Cup plug missing.

Restricted oil passage. Faces not flat. Converter clutch apply valve stuck. Defective valve body assembly. 2-3 shift valve stuck. Manual linkage out of adjustment. Spacer plate and gaskets incorrect, damaged or not positioned properly. Defective reverse input clutch assembly. Clutch plate worn. Housing and drum assembly cracked at weld. Clutch plate or return spring assembly retaining ring out of groove. Piston deformed or dished.

Seals damaged or missing. Retainer and ball assembly not sealing. Restricted apply passage. Defective low-reverse clutch. Clutch plates worn or retaining ring not positioned properly. Porosity in piston. Seals damaged. Return spring assembly retaining ring not positioned properly. Case porosity. Case cover plate not tightened properly or gasket missing or damaged. On 4L60 only, auxiliary valve body low overrun valve stuck. Cup plug restricted, missing or damaged.

No Part-Throttle Or Delayed Downshifts

On 4L60 only, T.V. cable loose or not adjusted properly. T.V. bracket assembly bent. On 4L60/4L60-E, check for defective 2-4 servo assembly. Servo cover retaining ring missing or not assembled properly. 4th apply piston damaged or not assembled properly. Inner housing damaged or not assembled properly. Governor weights binding or governor valve stuck (4L60 only). Defective valve body assembly. Throttle valve, 3-2 control valve stuck. On 4L60 only, T.V. modulated downshift valve stuck. T.V. sleeve turned in bore. On 4L60/4L60-E, 4-3 sequence valve body channel blocked. No. 5 check ball missing.

Harsh Garage Shifts

On 4L60-E only, check valve body for missing check ball, or orifice cup plug.

No Overrun Braking in Manual 3-2-1

T.V. cable loose or not adjusted properly (4L60 only). Defective valve body assembly. 4-3 sequence valve or throttle valve stuck. No. 3 check ball not positioned properly. Spacer plate and gaskets incorrect, damaged or not positioned properly. Defective input clutch assembly. Turbine shaft oil passages plugged or not drilled. Turbine shaft seal rings damaged. Turbine shaft sealing balls loose or missing. Porosity in forward or overrun clutch piston. Overrun piston seals damaged or cut. Overrun piston check ball not sealing.

Drives (Creeps) In Neutral

Forward clutch not releasing. Manual valve link disconnected. Converter clutch apply valve stuck in oil pump. Face of transmission case not flat or internal leakage in case.

Starts in 2nd in "D"

On 4L60-E only, governor support pin too long or missing or governor valve stuck. On 4L60/4L60-E, forward sprag clutch assembly installed backward.

No Park

Parking linkage binding, loose, missing or not positioned properly.

Oil Pressure High or Low

Perform PRELIMINARY CHECKING PROCEDURE. See CONTROL PRESSURE TEST under **TESTING**. Oil pressure regulator valve stuck or valve spring damaged. Rotor guide omitted or not assembled properly. Rotor cracked or broken. T.V. (4L60 only) or reverse boost valve or sleeve stuck, damaged or not assembled properly. Orifice valve in pressure regulator valve plugged. Sticking slide or excessive rotor clearance. Pressure relief ball not seated or damaged. Pump cover or body has porosity. Incorrect pump cover or pump face not flat. Excessive rotor clearance.

Intake pipe restricted by casting flash. Cracks in filter body or intake pipe. "O" ring seal missing, cut or damaged. Incorrect grease used during rebuild procedure. On 4L60 only, T.V. exhaust ball stuck or damaged. On 4L60/4L60-E, throttle link, lever and bracket assembly binding, damaged or not assembled properly.

Manual valve scored or damaged. Spacer plate or gaskets incorrect, damaged or not assembled properly. Face not flat. On 4L60 only, throttle valve or T.V. limit valve sticking. Modulated downshift valve, line bias valve or 2-3 shift valve stuck. On 4L60-E only, check for stuck 2-3 solenoid valve, damaged pressure control solenoid or damaged pressure switch assembly. On 4L60/4L60-E, check for missing check balls or wrong assembly. Case-to-valve body face not flat.

Harsh Shift Points

On 4L60-E only, check PCM input signals from TPS, pressure switch assembly, fluid temperature switch, VSS and engine coolant temperature sensor. Inspect pressure control solenoid for damaged pins or seals, or dirt in oil circuits.

High Or Low Shift Points

On 4L60 only, T.V. cable binding or not adjusted properly. T.V. exhaust ball stuck or damaged. Throttle lever and bracket assembly binding, damaged or not assembled properly. Pressure regulator valve or T.V. boost valve stuck. Pump slide sticking.

Throttle valve or plunger sticking. Modulated T.V. upshift or downshift valves, T.V. limit valve or line bias valve sticking. Spacer plate or gaskets damaged, incorrect or not assembled properly.

Valve body pad porous or damaged. Governor filter restricted or damaged. 2-4 accumulator has porosity. Servo piston seals damaged. Apply pin damaged or has improper length. 2-4 band burned or anchor pin not engaged.

On 4L60-E only, check for stuck pressure regulator valve or pump slide sticking. Spacer plate or gaskets damaged, incorrect or not assembled properly.

Valve body pad porous or damaged. 2-4 accumulator has porosity. Servo piston seals damaged. Apply pin damaged or has improper length. 2-4 band burned or anchor pin not engaged. Throttle Position (TP) sensor, VSS and/or 4WD low switch (if equipped) disconnected or damaged.

NOTE: Models with 4L60-E use Powertrain Control Module (PCM) computer, which controls TCC, pressure control solenoid and shifting solenoids 1-2 and 2-3. Models with 4L60, use PCM to control TCC only.

No Converter Clutch Apply

Transmission not supplied 12 volts. Outside electrical connector damaged. Inside electrical connector wiring harness or solenoid damaged. Solenoid wire pinched. Solenoid not grounded. Pressure switches incorrect or damaged. Temperature switch damaged. Engine speed sensor or pressure switch assembly (4L60-E only). Converter internal damage.

Converter clutch valve stuck or assembled backward, or retaining ring not positioned properly. Pump-to-case gasket not positioned properly. Orifice cup plug restricted or damaged. Solenoid "O" ring seal cut or damaged. Pump-to-body cover high or uneven bolt torque.Turbine shaft "O" ring seal cut or damaged. Turbine shaft retainer and ball assembly restricted or damaged. TCC shift valve or apply valve stuck. Solenoid "O" ring leaking. Solenoid screen is blocked.

Converter Shudder

Torque converter has internal damage. Converter clutch valve stuck. Restricted oil passages. Crack in filter body. Flash restricting filter neck. "O" ring seal cut or damaged. Turbine shaft "O" ring cut or damaged. Turbine shaft retainer and ball assembly restricted or damaged. Low oil pressure. Engine not tuned properly.

No Converter Clutch Release

Solenoid external ground. Converter internal damage. Converter clutch valve stuck. Converter clutch apply valve stuck in apply position. PCM external ground.

Converter Clutch Apply Cold

On 4L60-E only, check engine coolant temperature sensor and trouble codes.

Ratcheting Noise

Parking pawl return spring weak, damaged or not assembled properly.

Oil Leaking Out Vent

Chamfer in pump body rotor pocket too large. T.V. limit valve stuck (4L60 only). Fluid level overfilled. Cross leak out of pump body and cover.

Vibration in Reverse & Whining Noise in Park

Oil pump broken vane rings.

Front Oil Leak

Torque converter welded seam leaking. Damaged torque converter hub. Damaged front seal.

No Reverse, Slips in Reverse, Bad Engagement (No Braking or Weak Braking in Manual Low)

No. 5 check ball missing. Faulty low-reverse clutch. Reverse boost valve sticking. Reverse boost valve installed backward.

Pump Bushing Spins Out, "Walks" Into Seal, Or Seizes To Converter Hub

Transmission and engine center lines do not match. Excessive crankshaft runout. Bent flexplate (drive plate). Excessive converter hub runout. Pump bushing I.D. not centered in pump. Bushing too loose in pump. Not enough hub-to-bushing clearance.

Slip on 2-3 Shift, Falling Out of 3rd, Repeated 3-4 Clutch or 2-4 Band Failure

Leaking No. 7 check ball (direct clutch accumulator check valve located in case, visible through servo). Cracked input shaft. Input shaft sealing rings leaking. Leak at base of input shaft where shaft is pressed into drum. Pump cover bore (sealing ring surface) worn. Servo air bleed cup plug loose or blown out of case. Pump-to-case gasket misaligned or ripped. 3-4 air bleed ball in back of input drum leaking. 3-4 clutch piston seals leaking. Servo release side (large) sealing ring leaking in 2nd gear and dragging 3rd clutch. Band apply pin in case worn. Servo seized in case. Damaged pump. Stator sleeve turned in pump and partly blocking feed passage. Throttle valve sticking, causing delayed 3rd clutch circuit pressure rise during 2-3 shift.

Delayed or No Forward Clutch Engagement, Slips or Chatters in 1st Gear

Leak at forward clutch accumulator (auxiliary valve body; on 4L60) caused by accumulator pin "walking" out of oval hole in cover.

No 4th Gear, No 3-4 Upshift (Stays in 3rd, 2nd Usually Okay)

Leaking 4th gear piston sealing ring (inside servo cover). Excessive servo clearance allowing 4th piston to "walk" out of cover, leaking 4th apply oil out servo vent hole. Servo vent hole blocked (hole is at pan gasket surface). Leaking 4th signal switch. 3-4 relay valve installed backward. Aluminum disc missing from between

3-4 relay valve and hole pin. Servo feed tunnel cup missing from valve body. 3-4 shift valve stuck. Incorrect spring or spring too stiff at 3-4 shift valve. 3-4 accumulator air bleed cup plug blown out of case. Throttle valve sticks.

Falls Out of 4th Gear During Coasting

Low line pressure at idle (weak pressure regulator spring).

Binds Up on 3-4 Shift (Feels Like Brake Drag)

Forward pressure plate installed incorrectly. Too many plates in overrun clutch. Incorrect top steel plate installed in overrun clutch.

No Forward Or Reverse Gears (Line Pressure Reading Okay)

Mismatched converter input shaft or broken turbine hub.

Binds Up In Reverse

Stator sleeve rotated out of position. Stuck 2-3 shift valve. Servo pin jammed in case. Stuck 3-4 relay or 4-3 sequence valve.

No Reverse

Reverse input drum cracked at weld or seals damaged.

No Drive In "D" Range

Torque converter stator roller clutch not holding.

No Drive In "OD" Range

Faulty output sprag. Teeth "hammered" out of forward friction plates.

CLUTCH & BAND APPLICATION

CLUTCH & BAND APPLICATION CHARTS

CLUTCH & BAND APPLICATION CHART (4L60)

Selector Lever Position	Elements In Use
"D" (Overdrive)	
First Gear	Forward Clutch, Forward Sprag & Low Roller Clutch
Second Gear	Forward Clutch Forward Sprag & 2-4 Band
Third Gear	Forward Clutch, Forward Sprag & 3-4 Clutch

Overdrive	Forward Clutch, 2-4 Band & 3-4 Clutch
"D" (Drive)	
First Gear	Forward Clutch, Forward Sprag, Low Roller Clutch & Overrun Clutch
Second Gear	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band,
Third Gear	Forward Clutch, Forward Sprag, Overrun Clutch & 3-4 Clutch
"2" (Intermediate)	
First Gear	Forward Clutch, Forward Sprag, Low Roller Clutch & Overrun Clutch
Second Gear	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band
"1" (Low)	
First Gear	Forward Clutch, Forward Sprag, Low Reverse Clutch, Low Roller Clutch & Overrun Clutch
"R" (Reverse)	Low Reverse Clutch & Reverse Input Clutch
"N" Or "P" (Neutral Or Park)	All Clutches & Bands Released Or Ineffective

TESTING

NOTE: The following tests are for 4L60 transmission only. For testing of 4L60-E, see appropriate AUTO TRANS DIAGNOSIS - 4L60/4L80 article in AUTOMATIC TRANSMISSIONS.

ROAD TEST

1. Operate vehicle in Overdrive. Accelerate using steady throttle pressure. Note shift points for 2nd, 3rd, Overdrive and TCC application. TCC application should occur in 3rd or Overdrive.
2. Torque converter clutch will not engage until engine coolant has reached a temperature of 130°F (54°C). Compare shift points to shift speed charts. See **Fig. 11**. If TCC application is not obtained, see appropriate AUTO TRANS DIAGNOSIS - 4L60/4L80 article in AUTOMATIC TRANSMISSIONS.
3. Operate vehicle in Overdrive normally at 40-55 MPH with throttle in half-open position. Ensure TCC releases, and note 3rd gear downshift point. Repeat procedure with wide open throttle. Ensure TCC releases, and note 2nd gear downshift point.
4. Operate vehicle in Overdrive normally at 40-55 MPH. Release accelerator while manually shifting transmission to 3rd gear. Ensure TCC releases and engine braking is felt, and note 3rd gear downshift point.
5. Operate vehicle in Overdrive normally at 40-45 MPH. Release accelerator while manually shifting transmission into 2nd gear. Ensure TCC releases and engine braking is felt, and note 2nd gear downshift point.

6. With transmission in Overdrive, accelerate normally to 25 MPH, allowing vehicle to upshift normally. Release accelerator while manually shifting transmission into 1st gear. Ensure TCC releases and engine braking is felt, and note 1st gear downshift point.
7. With transmission in Overdrive, accelerate to 4th gear with TCC applied. Release accelerator. Lightly apply brakes, and ensure TCC releases and note speed at which downshifts occur. Compare shift points noted to shift speed charts. See **Fig. 11**.
8. Place transmission in 3rd gear with vehicle stopped. Accelerate, and note 1st-2nd and 2nd-3rd shift points. Repeat procedure with transmission in 2nd gear. Note 1st-2nd shift point. Accelerate to 25 MPH. Ensure 2nd-3rd gear upshift does not occur and TCC does not engage.
9. Place transmission in 1st gear with vehicle stopped. Accelerate to 15 MPH. Ensure upshifts do not occur and TCC does not engage. With vehicle stopped, place transmission in Reverse and slowly accelerate to observe reverse gear operation.
10. Compare all shift points to shift speed charts. See **Fig. 11**. If shift points are not within approximate speed listed, see **TROUBLE SHOOTING**. Control pressure can also be checked. See CONTROL PRESSURE TEST.

CLUTCH & BAND APPLICATION CHART (4L60-E)

Selector Lever Position	Shift Solenoid Position	Elements In Use
"D" (Overdrive)		
First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag & Low Roller Clutch
Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag & 2-4 Band
Third Gear	1-2 OFF/2-3 OFF	Forward Clutch, Forward Sprag & 3-4 Clutch
Overdrive	1-2 ON/2-3 OFF	Forward Clutch 2-4 Band & 3-4 Clutch
"D" (Drive)		
First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag, Low Roller Clutch & Overrun Clutch
Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band,
Third Gear	1-2 OFF/2-3 OFF	Forward Clutch, Forward Sprag, Overrun Clutch & 3-4 Clutch
"2" (Intermediate)		
First Gear	1-2 ON/2-3 ON	Forward Clutch,

		Forward Sprag, Low Roller Clutch & Overrun Clutch
Second Gear	1-2 OFF/2-3 ON	Forward Clutch, Forward Sprag, Overrun Clutch & 2-4 Band
"1" (Low)		
First Gear	1-2 ON/2-3 ON	Forward Clutch, Forward Sprag, Low Reverse Clutch, Low Roller Clutch & Overrun Clutch
"R" (Reverse)	1-2 ON/2-3 ON	Low Reverse Clutch & Reverse Input Clutch
"N"/"P" (Neutral or Park)	1-2 ON/2-3 ON	All Clutches & Bands Released or Ineffective

1993 HYDRA-MATIC 4L60 SHIFT SPEED CHART

MODEL	1-2 MIN THROTTLE	2-3 MIN THROTTLE	3-4 MIN THROTTLE	1-2 W.O.T.	4-3 COAST DOWN	3-2 COAST DOWN	2-1 COAST DOWN
AAM	11-14	23-26	36-46	27-30	25-29	13-20	6-8
ADM	13-15	23-26	36-45	40-44	30-38	18-26	9-12
AFM	15-18	26-31	38-52	34-39	28-33	16-24	9-12
ASM	11-13	22-28	36-47	27-30	25-29	13-20	6-8
BAM	12-15	22-28	32-41	30-36	22-26	13-21	9-11
BBM	14-18	26-33	40-52	36-43	25-29	14-24	9-11
BCM	13-18	26-28	43-53	36-42	25-29	14-24	9-11
BFM	13-16	24-28	38-52	30-40	25-29	14-21	8-11
BHM	12-15	22-28	33-43	30-36	21-25	12-20	7-9
BRM	16-19	28-31	35-48	36-50	24-31	15-23	10-13
BWM	13-18	25-31	38-51	36-42	25-29	14-24	9-11
CPM	13-20	23-29	49-53	33-39	35-46	15-22	11-13
FDM	15-19	26-33	42-51	40-47	28-35	16-24	11-13
FFM	10-13	18-21	33-46	34-42	17-20	10-16	4-7
FMM	13-21	21-23	31-43	34-42	19-24	13-20	8-10
HBM	13-16	24-28	43-51	31-41	25-34	14-22	9-12
HDM	13-16	26-29	40-48	31-38	28-34	15-24	10-12
HJM	14-18	18-31	50-55	31-41	31-47	16-27	11-13
HLM	14-17	26-34	56-63	34-43	40-51	15-25	10-13
LHM	13-14	22-25	48-53	24-27	35-47	13-21	8-10
SAM	13-15	18-25	48-50	28-35	37-47	10-18	9-12
SFM	10-13	18-23	43-51	29-35	36-45	13-19	8-10
YAM	12-14	21-26	31-46	45-52	21-26	12-21	9-11
YCM	12-14	21-26	31-40	42-52	21-26	12-21	9-11
YDM	14-16	24-28	38-51	35-44	23-29	13-22	9-11

Notes:
1. All speeds indicated are in miles per hour. Conversion to KM/H = MPH x 1.609.
2. Shift points will vary slightly due to engine loads and vehicle options.
3. Speeds listed with + exceed 65 MPH.
4. Speeds are based on TPS of 10 to 20. Use scan tool to measure correct TPS.

For transmission model identification, see Fig. 1.

94H36605

Fig. 11: Shift Speed Chart
Courtesy of GENERAL MOTORS CORP.

CONTROL PRESSURE TEST

Preliminary Checking Procedure

1. Ensure fluid level is correct and engine is in good operating condition before performing control pressure test. Ensure shift linkage is properly adjusted. See appropriate AUTO TRANS SERVICING article in the AUTOMATIC TRANS SERVICE section. See menu below.
2. Control pressure can be checked to ensure proper throttle valve cable adjustment. If control pressure is not within specification, adjust throttle valve cable before attempting any other corrections. See THROTTLE VALVE CONTROL PRESSURE CHECK.

Throttle Valve Control Pressure Check

1. Install pressure gauge on transmission line pressure tap. See **Fig. 12**. Install tachometer on engine. Apply parking brake. Ensure engine is at normal operating temperature.

2. Operate engine at 1000 RPM. With gear selector in "P" position, note oil pressure reading. Move gear selector to "D" position, and note oil pressure reading.
3. Oil pressure "D" reading must be equal to "P" reading or must not exceed it by more than 10 psi (.70 kg/cm). Operate engine at 1400 RPM. Oil pressure should increase. Adjust throttle valve cable if pressure does not increase. See appropriate AUTO TRANS SERVICING article in the AUTOMATIC TRANS SERVICE section. See menu below.
    - For Astro, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Blazer C/K 4WD, see **TRANSMISSION SERVICING - A/T**
    - For Blazer S/T, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Camaro, see **TRANSMISSION SERVICING - A/T**
    - For 1994 Camaro, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Caprice, see **TRANSMISSION SERVICING - A/T**
    - For 1994 Caprice, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Corvette, see **TRANSMISSION SERVICING - A/T**
    - For 1994 Corvette, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Firebird, see **TRANSMISSION SERVICING - A/T**
    - For 1994 Firebird, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Fleetwood Brougham, see **TRANSMISSION SERVICING - A/T**
    - For 1994 Fleetwood Brougham, see **TRANSMISSION SERVICING - A/T**
    - For GMC Vans, see **TRANSMISSION SERVICING - A/T**
    - For GMC Suburban, see **TRANSMISSION SERVICING - A/T**
    - For GMC Pickup, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Impala SS, see **TRANSMISSION SERVICING - A/T**
    - For Jimmy, see **TRANSMISSION SERVICING - A/T**
    - For 1993 Roadmaster, see **TRANSMISSION SERVICING - A/T**
    - For 1994 Roadmaster, see **TRANSMISSION SERVICING - A/T**
    - For Safari, see **TRANSMISSION SERVICING - A/T**
    - For Yukon, see **TRANSMISSION SERVICING - A/T**

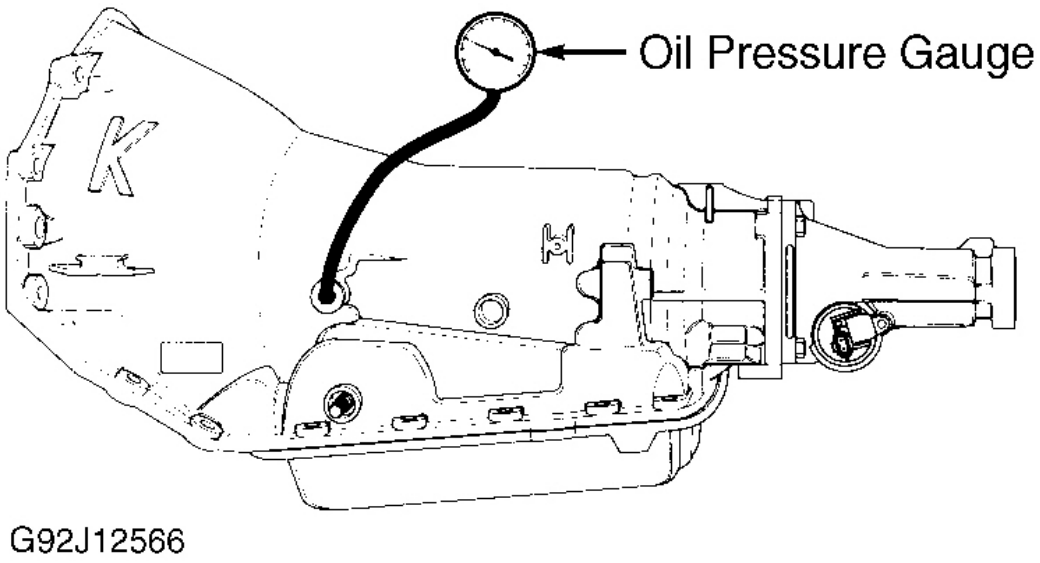

Fig. 12: Locating Line Pressure Tap
Courtesy of GENERAL MOTORS CORP.

CAUTION: DO NOT perform following pressure tests for longer than two (2) minutes or transmission damage may occur.

Minimum Throttle Valve Pressure Check

1. Ensure throttle valve cable is properly adjusted. Attach pressure gauge to line pressure tap. See **Fig. 12**. Apply parking brake and service brakes.
2. Check line pressure as specified. See **Fig. 13**. Pressure readings must be within specification. If pressure reading is not within specification, see **TROUBLE SHOOTING**.

Full Throttle Valve Pressure Check

1. Attach pressure gauge to line pressure tap. See **Fig. 12**. Apply parking brake and service brakes. Ensure throttle valve cable is secured in fully extended position.
2. Check line pressure as specified. See **Fig. 13**. Pressure readings must be within specification. If pressure reading is not within specification, see **TROUBLE SHOOTING**.

Pressure Differential Check

1. Possible leakage in clutch circuits may be determined by checking oil pressure differential between line pressure and 2nd, 3rd and 4th clutches. Attach pressure gauges to line pressure tap and appropriate clutch circuit tap on transmission.

2. Circuit tap for 2nd clutch is located on right rear side of transmission, above pan. Circuit tap for 3rd clutch is located next to 2-4 servo, above 4th clutch circuit tap. See **Fig. 1**. Drive vehicle, and note both pressure readings. Pressure differential between line pressure and clutch circuits exceeding 10 psi (0.70 kg/cm^2) indicates possible leakage in clutch circuit.

1993 HYDRA-MATIC 4L60 TRANSMISSION PRESSURES

RANGE	MODEL	NORMAL PRESSURE AT MINIMUM T.V.		NORMAL PRESSURE AT FULL T.V.	
		kPa	PSI	kPa	PSI
PARK, NEUTRAL, OVERDRIVE & MANUAL 3RD @ 1000 RPM	AAM	518-587	75-85	1016-1183	147-171
	ADM	518-587	75-85	1197-1389	174-201
	AFM, BWM	518-587	75-85	1028-1192	149-173
	ASM	518-587	75-85	952-1105	138-160
	BAM	451-518	65-75	944-1105	137-160
	BBM	518-587	75-85	965-1126	140-160
	BCM	518-587	75-85	931-1067	135-155
	BFM	518-587	75-85	1421-1689	206-245
	BHM	518-587	75-85	943-1085	137-157
	BRM	518-587	75-85	1061-1227	135-178
	CPM	451-515	65-75	1090-1273	158-184
	FDM	451-515	65-75	983-1142	142-166
	FFM, FMM	451-515	65-75	1311-1533	190-222
	LHM	518-587	75-85	1402-1669	203-242
	SAM	451-515	65-75	894-1038	130-150
	SFM	451-515	65-75	948-1104	137-160
	YAM, YCM, YDM	451-515	65-75	1354-1617	196-235
REVERSE @ 1000 RPM	AAM	738-836	107-121	1448-1685	210-244
	ADM	738-836	107-121	1706-1979	247-287
	AFM, BWM	738-836	107-121	1465-1698	212-246
	ASM	738-836	107-121	1356-1575	196-228
	BAM	742-847	108-123	1551-1816	225-263
	BBM	738-836	107-121	1375-1605	199-232
	BCM	738-836	107-121	1326-1520	192-220
	BFM	665-754	96-109	1825-2169	264-314
	BHM	738-836	107-121	1343-1545	195-224
	BRM	738-836	107-121	1511-1748	219-253
	CPM	742-847	108-123	1792-2092	260-303
	FDM	580-662	84-96	1263-1467	183-213
	FFM, FMM	580-662	84-96	1684-1969	244-286
	LHM	665-754	96-109	1801-2144	261-311
	SAM	580-662	84-96	1148-1333	166-193
	SFM	580-662	84-96	1217-1417	176-205
	YAM, YCM, YDM	580-662	84-96	1739-2077	252-301
MANUAL 2ND & MANUAL LO @ 1000 RPM	AAM, ADM, AFM, ASM, BBM, BCM, BHM, BRM, BWM	1121-1269	162-184	1121-1269	162-184
	BAM, CPM, FDM, FFM, FMM, SAM, SFM, YAM, YCM, YDM	1127-1286	163-187	1127-1286	163-187
	BFM, LHM	1293-1465	188-212	1293-1465	188-212

For transmission model identification, see Fig. 1.
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Fig. 13: Oil Pressure Specifications
Courtesy of GENERAL MOTORS CORP.

TORQUE CONVERTER

NOTE: Torque converter is a sealed unit and must be serviced as complete assembly.

STALL TEST

1. Torque converter whine is usually noticed when vehicle is stopped and transmission 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 transmission in Drive. Depress accelerator to approximately 1200 RPM for less than 6 seconds. **DO NOT** depress accelerator for more than 6 seconds or transmission 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.

STATOR CHECK

1. Torque converter stator roller clutch can either remain locked up at all times or freewheel in both directions. If stator is freewheeling at all times, vehicle tends to have poor acceleration from a stop. Vehicle may act normal at speeds above 30-35 MPH.
2. If poor acceleration is noted, ensure exhaust system is not blocked, engine timing is correct and transmission 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.

END PLAY CHECK

1. Inspect torque converter for hub scoring, cracks or weld area cracks before checking end play. Install End Play Checking Tool (J-35138) on torque converter. See **Fig. 14**.
2. Note end play of torque converter. End play must be within specification. See **TORQUE CONVERTER END PLAY SPECIFICATIONS** table. Replace torque converter if end play is not within specification or damage to hub area exists.

TORQUE CONVERTER END PLAY SPECIFICATIONS

Converter Diameter In. (mm)	End Play In. (mm)
9.65 (245.0)	.000-.020 (.00-.50)
11.73 (298.0)	.000-.024 (.00-.61)

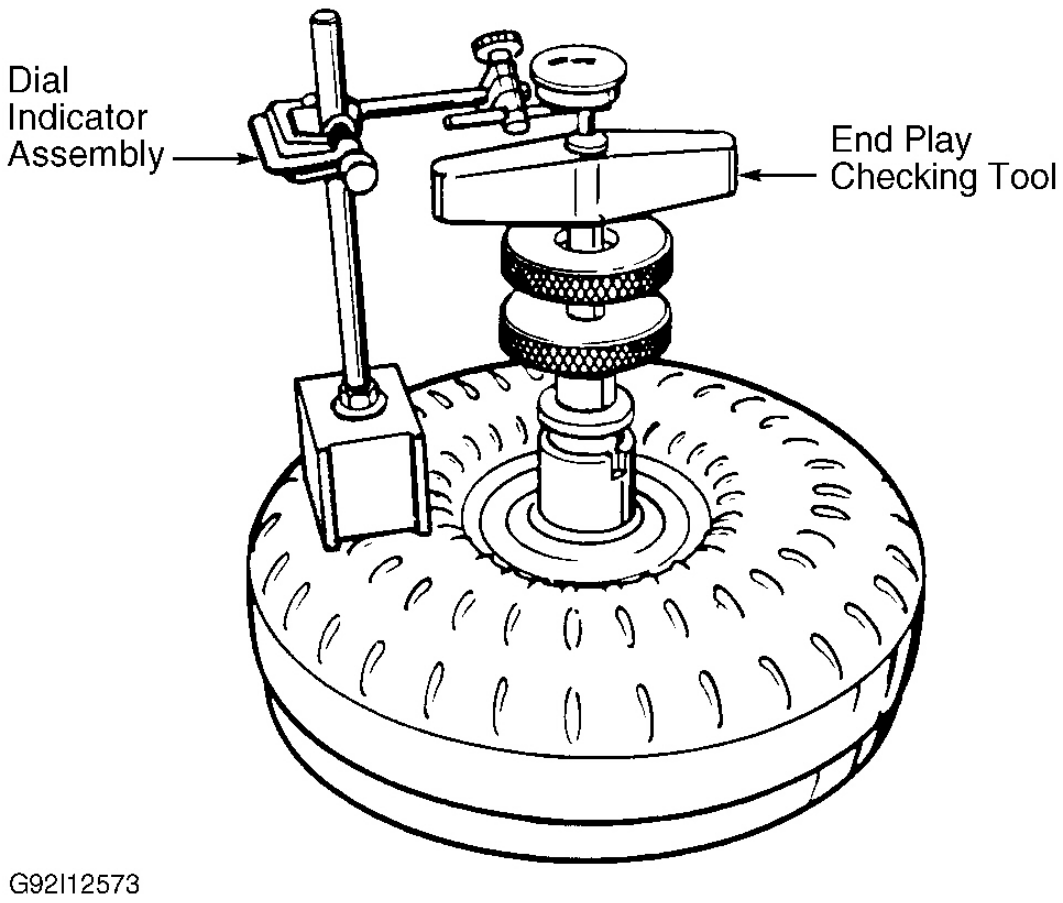


Fig. 14: Checking Torque Converter End Play
Courtesy of GENERAL MOTORS CORP.

CONVERTER FLUSHING

Torque converter flushing is not recommended. Replace torque converter if contamination is found during oil cooler flushing procedure.

NOTE: For additional information on Torque Converter Clutch (TCC), see appropriate AUTO TRANS DIAGNOSIS - 4L60-E article in AUTO TRANS DIAGNOSIS section.

REMOVAL & INSTALLATION

See appropriate AUTO TRANS REMOVAL article in the AUTOMATIC TRANS SERVICE section. See menu below.

- Astro, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**

- 1993 Blazer C/K 4WD **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- Blazer S/T, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1993 Camaro, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1994 Camaro, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1993 Caprice, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1994 Caprice, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1993 Corvette, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1994 Corvette, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1993 Firebird, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1994 Firebird, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1993 Brougham **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1994 Brougham, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- GMC Vans, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- GMC Suburban, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- GMC Pickup, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1993 Impala SS, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- Jimmy, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1993 Roadmaster, **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- 1994 Roadmaster, **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- Safari, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**
- Yukon, see **TRANSMISSION REMOVAL & INSTALLATION - A/T**

TRANSMISSION DISASSEMBLY

2-4 SERVO ASSEMBLY

1. Mount transmission on bench. Remove torque converter. Install Servo Cover Compressor (J-29714) on oil pan. See **Fig. 15**. Compress servo cover. Remove servo cover and "O" ring.
2. Remove 2-4 servo assembly. Servo pin length should be checked before disassembling assembly to determine 2-4 band and reverse input drum wear or damage.

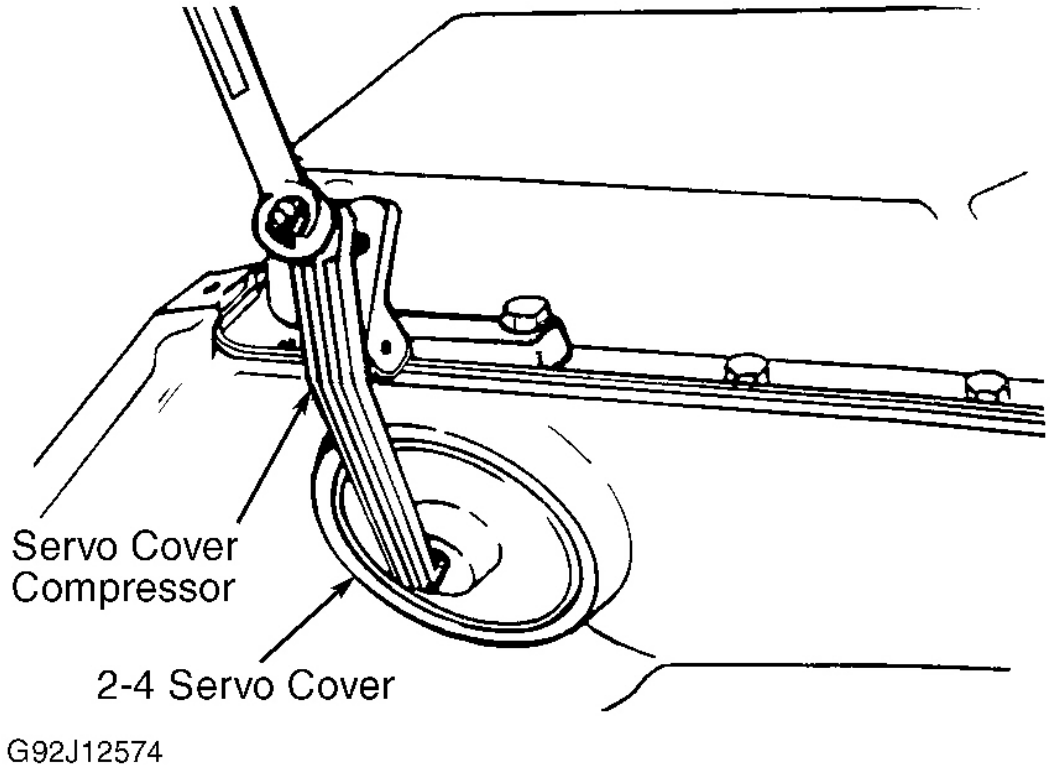


Fig. 15: Compressing Servo Cover
Courtesy of GENERAL MOTORS CORP.

CHECKING SERVO PIN LENGTH

1. Remove 4th apply piston and return spring. See **Fig. 16**. Remove retainer ring, washer, apply pin spring and 2nd apply piston pin. Install Piston Compressor (J-22269-01) on 2nd apply piston. See **Fig. 17**.
2. Remove retainer ring, cushion spring and spring retainer. Install Band Apply Pin Tool (J-33037) and apply pin. See **Fig. 18**. Apply 100 INCH lbs. (11 N.m) torque.
3. White line on band apply tool should be within gauge slot if pin length is correct. If White line is not within gauge slot, inspect 2-4 band and reverse input drum for wear and damage during disassembly.
4. Servo pin length must be checked during reassembly. Servo pin is preset and must not be readjusted. See **SERVO PIN SPECIFICATIONS** table under 2-4 BAND & SERVO ASSEMBLY under **TRANSMISSION REASSEMBLY**.

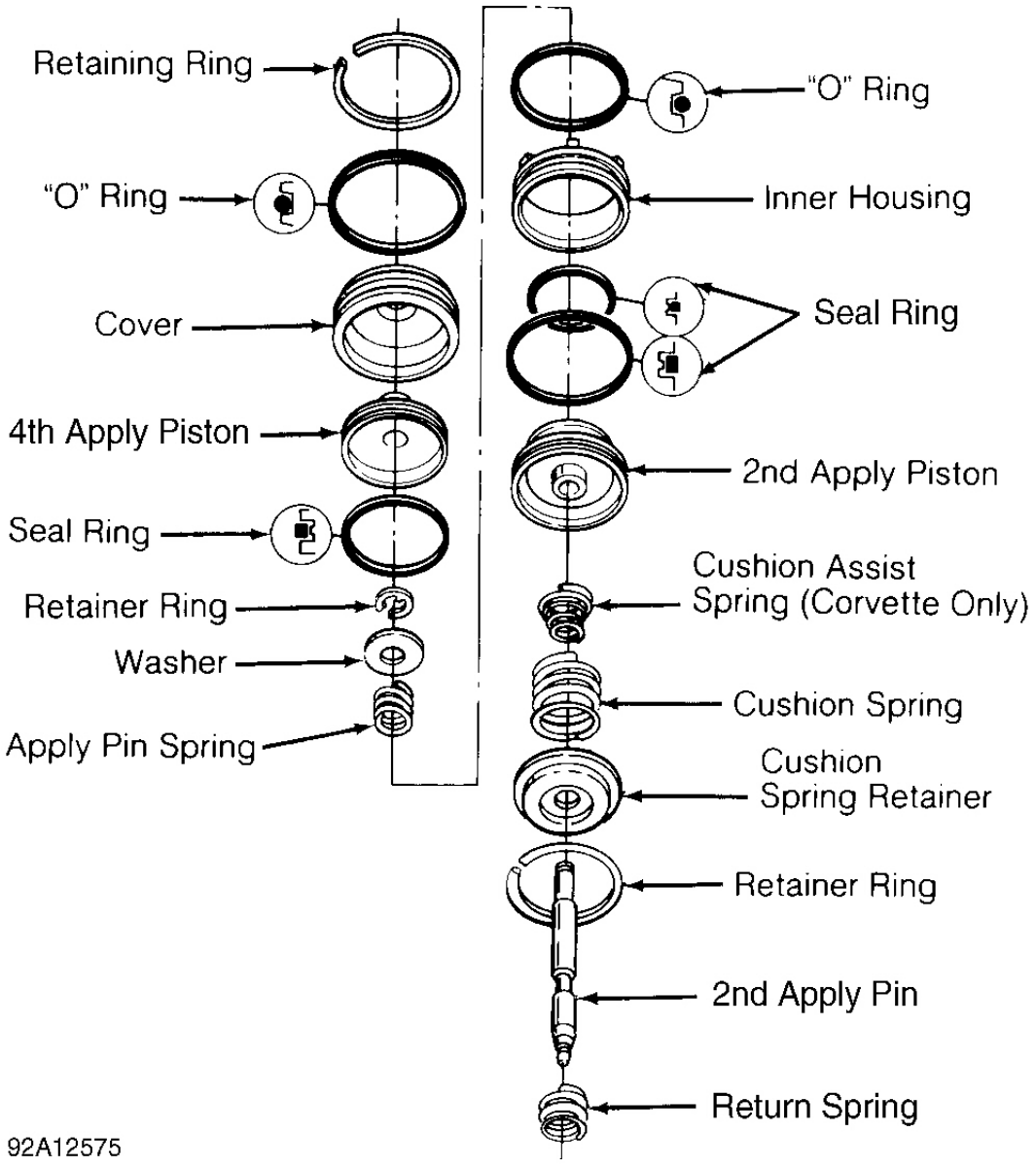


Fig. 16: Exploded View of 2-4 Servo Assembly
Courtesy of GENERAL MOTORS CORP.

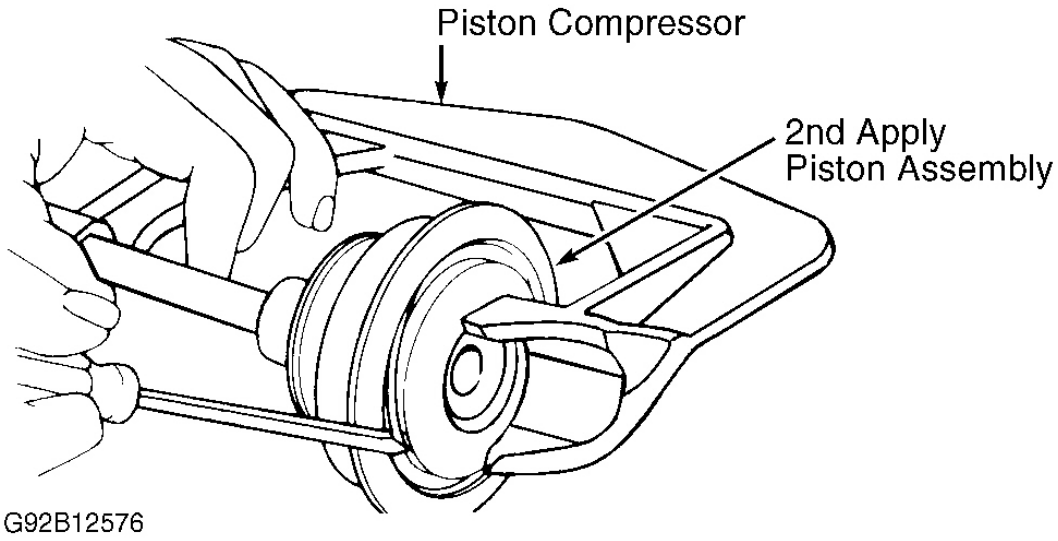


Fig. 17: Compressing 2nd Apply Piston
Courtesy of GENERAL MOTORS CORP.

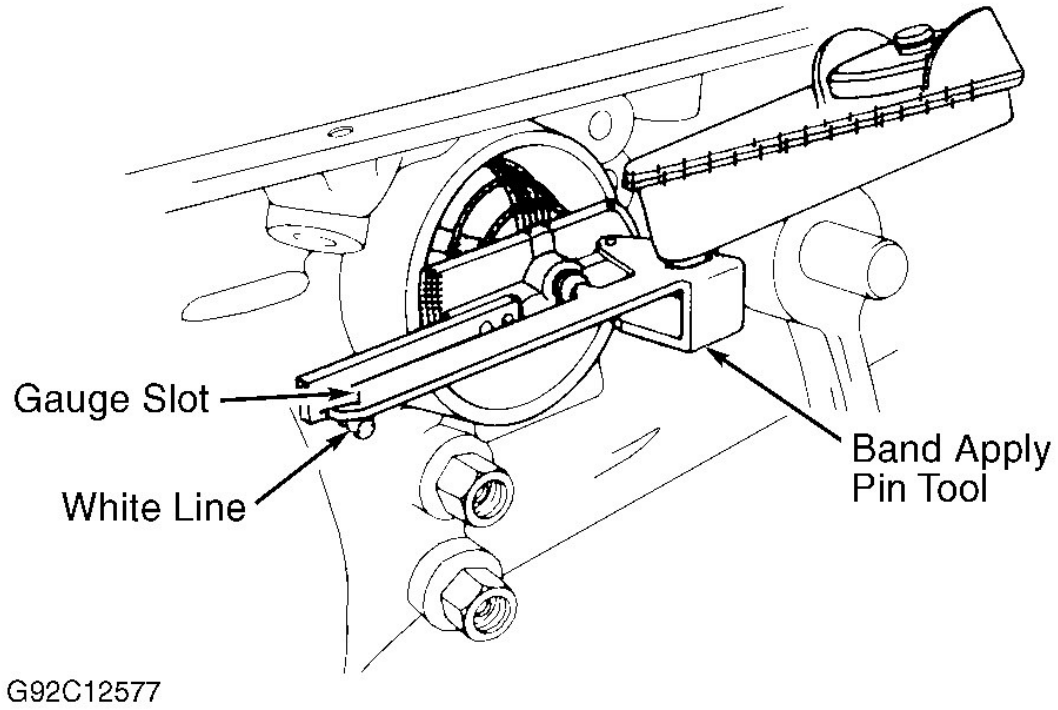


Fig. 18: Measuring Servo Pin Length

Courtesy of GENERAL MOTORS CORP.

EXTENSION HOUSING

1. On 4L60 models, remove governor assembly. On models with mechanical speedometers, remove retaining bolt, washer and retainer. Remove speedometer driven gear assembly, driven gear and "O" ring.
2. On models with internal speed sensor, remove retaining bolt and washer. Remove speed sensor assembly and "O" ring. Remove extension housing and seal. Remove output shaft sleeve and "O" ring (if equipped). Speed sensor rotor must be removed from output shaft.
3. Install Gear Puller (J-21427-01) and Adapter (J-8433) on rotor. Pull rotor from output shaft. On models with mechanical speedometers, push retaining clip tab. Remove speedometer gear from output shaft.
4. On 4L60-E models, remove speed sensor assembly. Remove extension housing and seal.

VALVE BODY & AUXILIARY VALVE BODY (4L60 ONLY)

Remove valve body and auxiliary valve body (4L60). See VALVE BODY and AUXILIARY VALVE BODY (4L60 ONLY) under **ON-VEHICLE SERVICE**. Note bolt length and location during removal. Note check ball location for reassembly reference. See **Fig. 5** and **Fig. 9**.

1-2 ACCUMULATOR & SPACER PLATES

1. Remove solenoid retaining bolts. Remove solenoid and "O" ring. Remove wiring harness, and note location for reassembly reference. Carefully remove accumulator cover retaining bolts, 1-2 accumulator cover and pin assembly.
2. Remove 1-2 accumulator piston, seal and spring. Remove spacer plate, and note check ball and filter locations. Remove spring, 3-4 accumulator piston and pin. Note spacer plate and gasket locations. See **Fig. 10** and **Fig. 19** for check ball and filter locations.

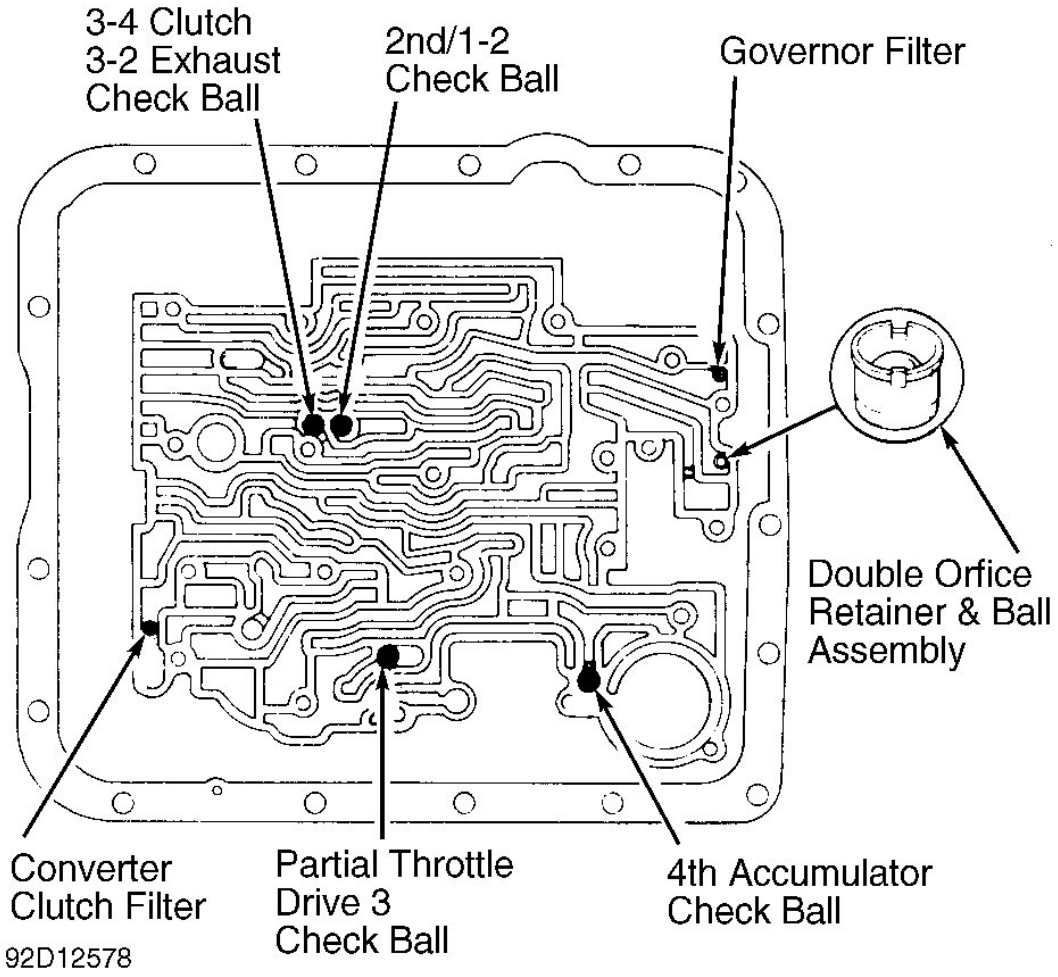


Fig. 19: Locating Check Balls & Filters in Case (4L60)
Courtesy of GENERAL MOTORS CORP.

TRANSMISSION END PLAY CHECK

NOTE: Check transmission end play before disassembly. If end play is not within specification, check for damaged parts.

1. Install Pump Remover/End Play Fixture (J-24773-A) and End Play Adapter (J-25022-A) on end of turbine shaft. See **Fig. 20**.
2. Clamp dial indicator on long bolt with indicator tip on end play fixture. Measure transmission end play. Transmission end play should be .005-.036" (.13-.91 mm).

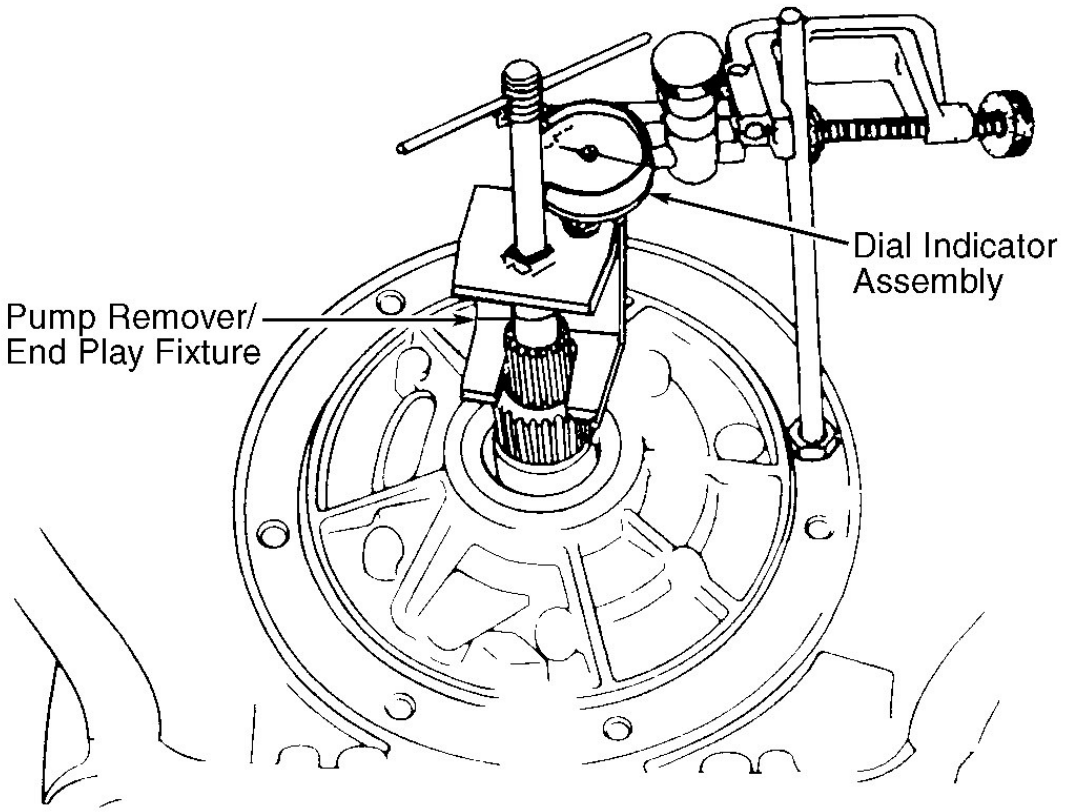


Fig. 20: Checking Transmission End Play
Courtesy of GENERAL MOTORS CORP.

OIL PUMP, INPUT CLUTCH & REVERSE CLUTCH

1. Ensure TCC solenoid assembly and oil filter are removed before oil pump removal. Remove oil pump retaining bolts. Using Oil Pump Remover (J-37789-A) and Adapter (J-39119), pull pump assembly free from case.
2. Remove oil pump seal and gasket. Remove reverse input clutch-to-pump thrust washer from pump. Lift out turbine shaft with reverse and input clutch assembly.

2-4 BAND & INPUT GEAR SET

1. Remove band anchor pin from case. See **Fig. 21**. Remove 2-4 band assembly from case. Remove input sun gear. See **Fig. 22**.

CAUTION: Output shaft must be held in place when removing input carrier retaining ring.

2. Install Output Shaft Support (J-29837) on output shaft. See **Fig. 23**. Remove input carrier to output shaft retaining ring. Remove input carrier. Remove output shaft. Remove input carrier thrust washer from reaction carrier shaft.

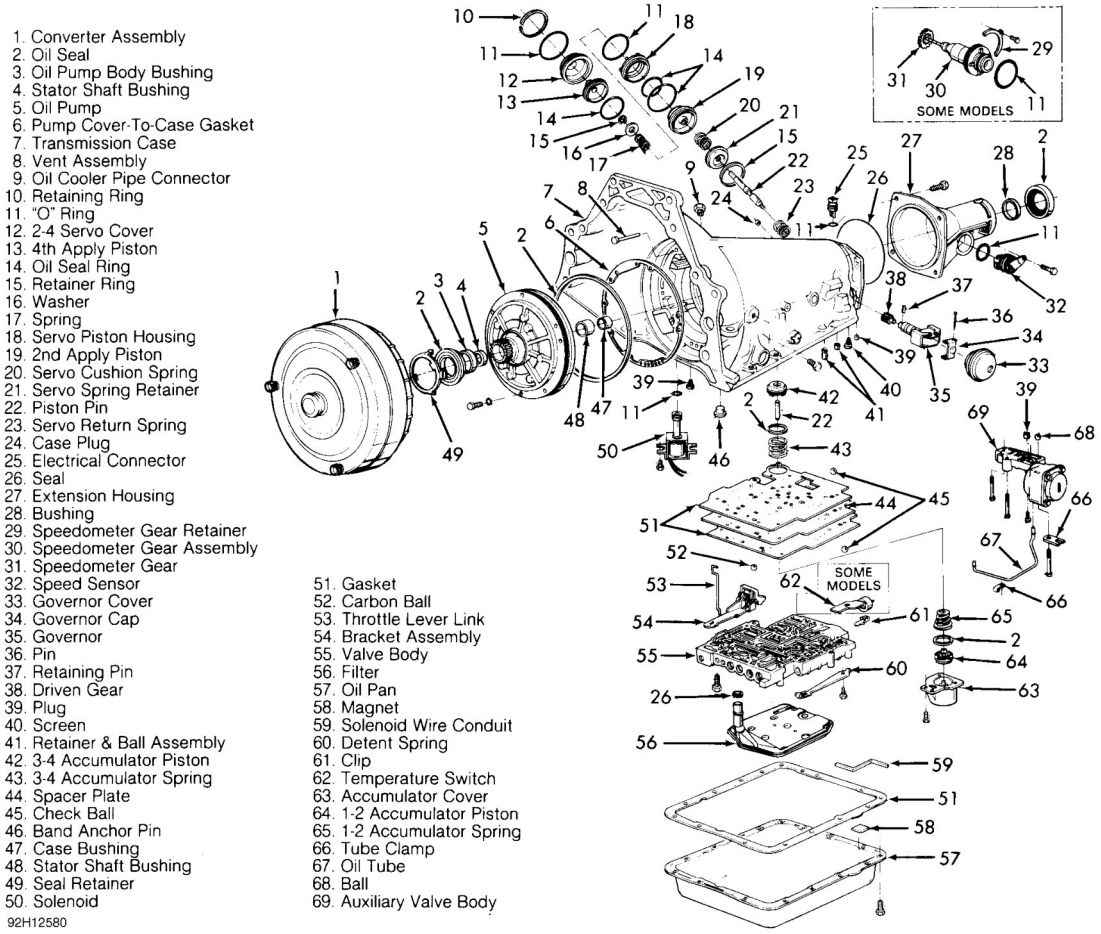
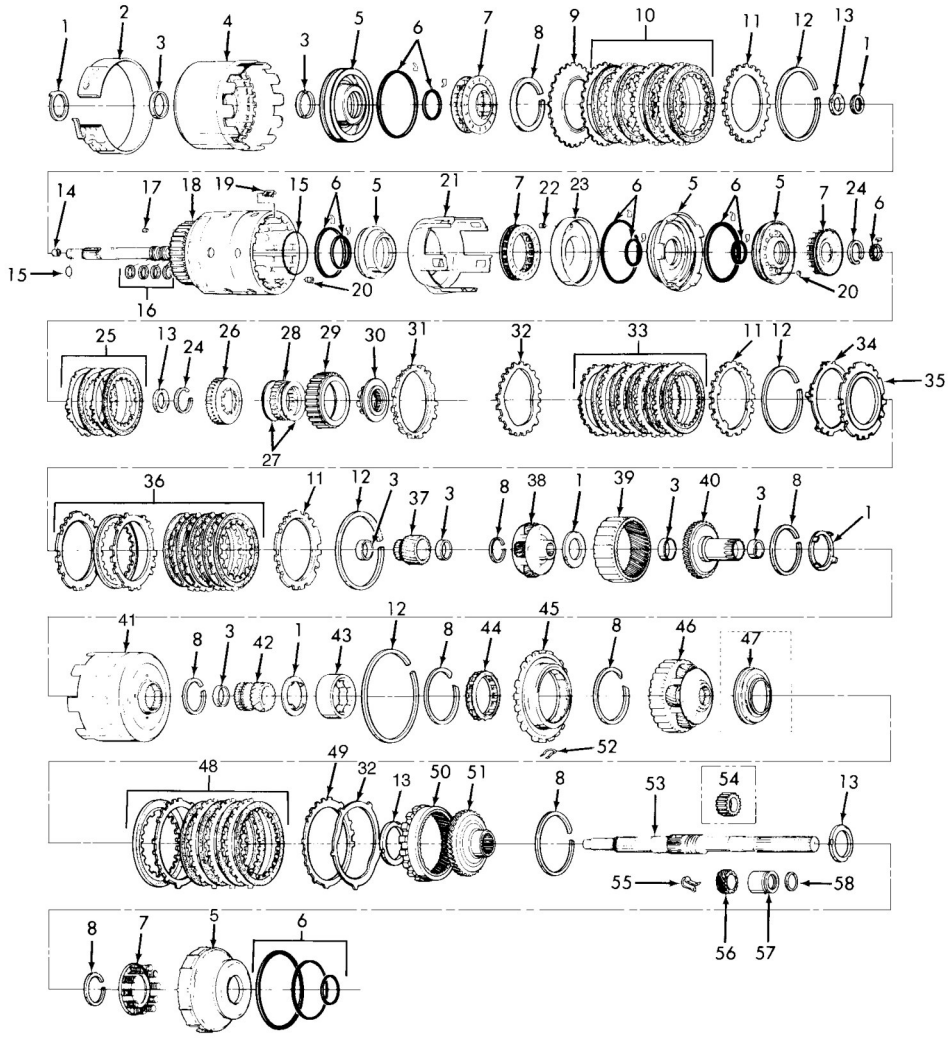


Fig. 21: 4L60 & 4L60-E Transmission External Components
Courtesy of GENERAL MOTORS CORP.



1. Thrust Washer
2. 2-4 Band
3. Bushing
4. Reverse Input Clutch Housing
5. Piston
6. Seal
7. Spring Assembly
8. Retainer Ring
9. Belleville Plate
10. Clutch Assembly
11. Backing Plate
12. Retaining Ring
13. Bearing Assembly
14. Check Valve
15. "O" Ring
16. Oil Seal
17. Cup Plug
18. Input Shaft Housing Assembly
19. Clutch Boost Spring Assembly
20. Check Ball
21. 3-4 Clutch Apply Ring
22. Retainer & Ball Assembly
23. Forward Clutch Housing
24. Snap Ring
25. Overrun Clutch Assembly
26. Overrun Clutch Hub
27. Sprag Retainer Rings
28. Sprag Assembly
29. Forward Clutch Race
30. Sprag Retainer & Race
31. Forward Clutch Apply Plate
32. Waved Plate
33. Forward Clutch Assembly
34. Clutch Retainer Plate
35. 3-4 Clutch Apply Plate
36. 3-4 Clutch Assembly
37. Input Sun Gear
38. Input Carrier Assembly
39. Input Internal Gear
40. Reaction Carrier Shaft
41. Reaction Sun Gear Shell
42. Reaction Sun Gear
43. Low-Reverse Clutch Race
44. Low-Reverse Roller Clutch
45. Support
46. Reaction Carrier Assembly
47. Oil Deflector
48. Low-Reverse Clutch Assembly
49. Spacer Plate
50. Internal Reaction Gear
51. Internal Reaction Gear Support
52. Retainer Spring
53. Output Shaft
54. Rotor
55. Clip
56. Speedometer Drive Gear
57. Output Shaft Sleeve
58. Output Shaft Seal

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Fig. 22: 4L60 & 4L60-E Transmission Internal Components
Courtesy of GENERAL MOTORS CORP.

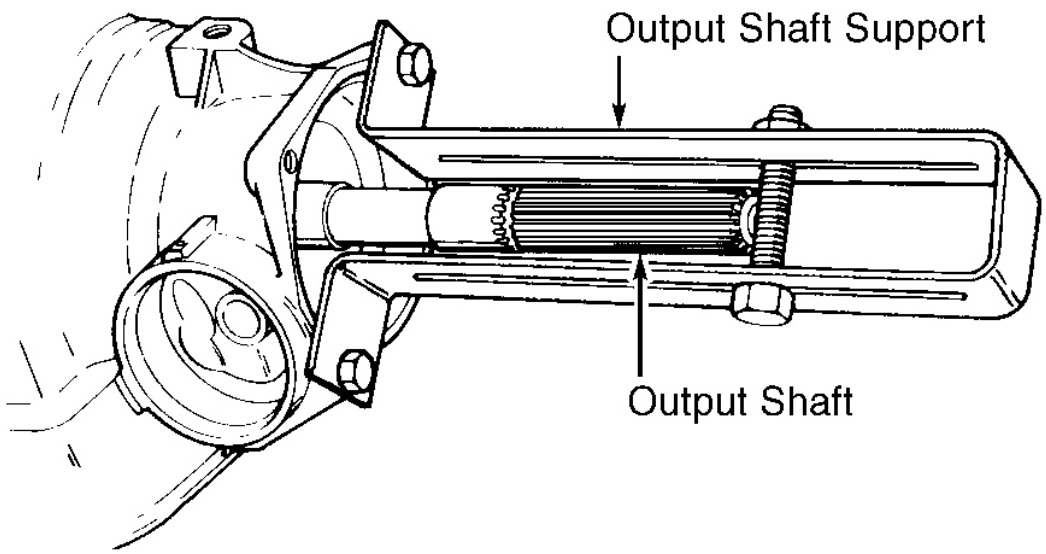

Fig. 23: Installing Output Shaft Support
Courtesy of GENERAL MOTORS CORP.

REACTION GEAR SET

1. Remove input internal gear and reaction carrier shaft. Remove reaction sun shell and thrust washer. Remove sun shell-to-clutch race thrust washer. Remove support-to-case retaining ring.
2. Remove spring retainer from low-reverse support. Remove reaction sun gear, low-reverse clutch race, clutch roller, support assembly and reaction carrier assembly. See **Fig. 23**.
3. Remove low-reverse clutch assembly. Note locations of parts. Remove internal reaction gear and bearing assembly. Remove internal reaction support-to-case bearing assembly.

LOW-REVERSE CLUTCH

NOTE: Parking pawl may require removal to access low-reverse clutch.

1. Remove parking lock bracket retaining bolts. Remove lock bracket. Using screw extractor, remove shaft plug. Remove parking pawl shaft, parking pawl and return spring if necessary.
2. Using Clutch Spring Compressor (J-23327), compress low reverse clutch spring retainer. Remove spring retaining ring and low-reverse spring assembly. Remove low-reverse clutch piston by applying air pressure in case apply passage. See **Fig. 24**.

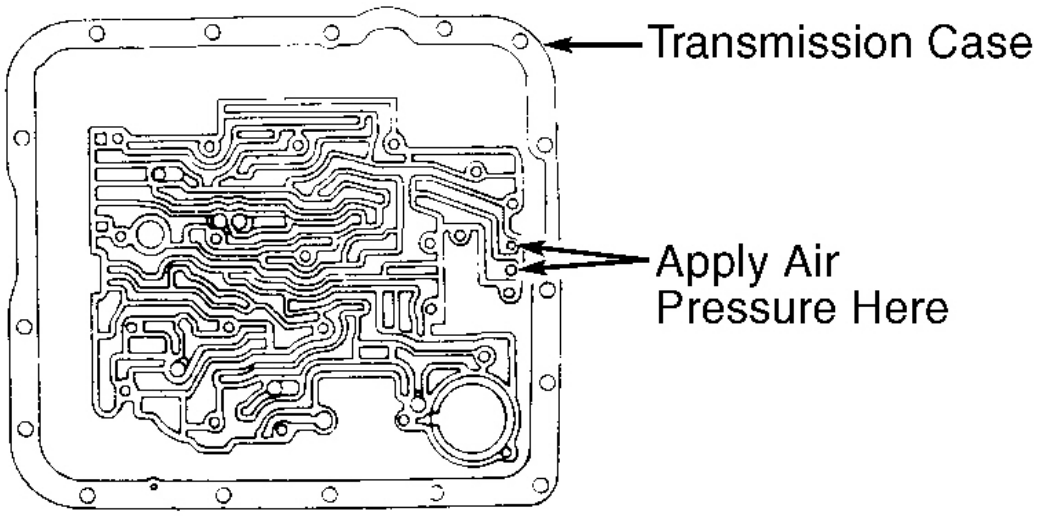

Fig. 24: Removing Low-Reverse Clutch Piston
Courtesy of GENERAL MOTORS CORP.

INNER MANUAL SHAFT LINKAGE

Remove manual shaft nut. Remove manual shaft and retainer. Remove parking lock actuator assembly and inner detent lever. Remove manual shaft seal from transmission case.

3RD ACCUMULATOR CHECK VALVE

1. Check 3rd accumulator check valve before removing it. **DO NOT** remove check valve unless it is leaking. Install servo assembly in bore. Install servo cover and retaining ring. See **Fig. 15**. Pour clean solvent in bore. Inspect for leaks in transmission case. Replace check valve assembly if it leaks. See **Fig. 25**. Remove servo assembly.
2. For check valve removal, install No. 4 screw extractor in check valve assembly. Remove check valve. Ensure bore is free of burrs. Installation tool must be made to ensure proper installation depth is obtained. Using a 3/8" O.D. rod, scribe indicator mark at 1.653" (41.98 mm) from end of rod. Install check valve until scribe mark on rod is flush with case. See **Fig. 25**.

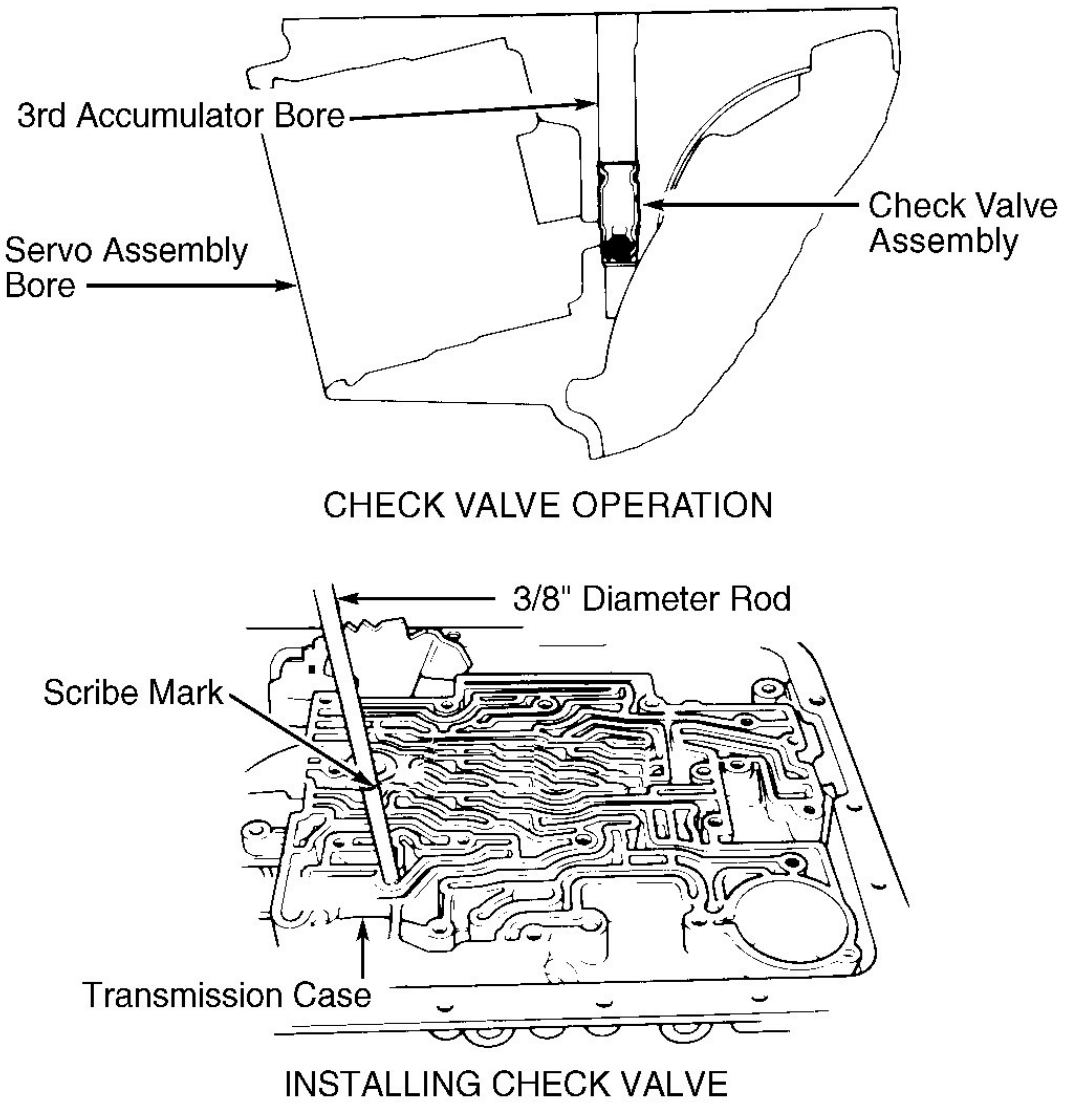

Fig. 25: Installing 3rd Accumulator Check Valve Assembly
Courtesy of GENERAL MOTORS CORP.

CLEANING & INSPECTION

TRANSMISSION CASE

Cleaning & Inspection

1. Clean case and dry. Inspect case assembly for damage, cracks and damaged bolt hole threads. Inspect valve body surface for flatness and land damage. Check case oil passages for restrictions and blockage.

2. Inspect case internal clutch plate lugs for damage and wear. Inspect speedometer (4L60 only), servo and accumulator bores for damage. Inspect all snap ring grooves for damage. On 4L60 models, measure governor support pin length.
3. Governor support pin length should be 3.30" (83.8 mm) measured from governor cover surface to end of support pin. Incorrect pin length may result in damaged governor gear. Replace transmission case if damaged. Ensure replacement case contains a ribbed area in valve body area. Rib area must be present for use with auxiliary valve body.

CASE ATTACHMENTS

Cleaning & Inspection

1. Clean all parts and dry. Inspect 1-2 and 3-4 accumulator parts for damage to pistons or housing. Inspect for flatness and condition of accumulator, oil passage plate and gasket.
2. Inspect wiring harness leads and connectors for damage. Inspect coil and all connections for damage. Inspect speed sensor/speedometer gear and clip for tooth damage and distortion.

REACTION & INPUT GEAR SETS, LOW-REVERSE CLUTCH & SUPPORT

Cleaning & Inspection

1. Clean all parts and dry. Inspect reaction and input carriers for pinion gear damage, excessive wear and improper staking of pinion pins.
2. Inspect carrier bearings for heat damage, flatness and roller condition. Place output shaft sleeve inside reaction carrier and input carrier.
3. Rotate sleeve and note smoothness of bearing operation. Replace carrier assembly if roughness is felt. Check pinion gear end play on reaction and input carriers.
4. Pinion gear end play should be .008-.024" (.20-.61 mm). Inspect internal reaction gear and support for cracks and damaged splines. Inspect low-reverse clutch plates for wear and signs of excessive heat.
5. Inspect low-reverse clutch piston for roughness or damage in seal ring area. Inspect retainer ring and spring assembly for damage. Inspect sun and internal gears and supports for spline and bushing wear and damage. Replace damaged parts as necessary.

COMPONENT DISASSEMBLY & REASSEMBLY

REVERSE INPUT CLUTCH

Disassembly

1. Remove retaining ring from reverse input clutch housing. Remove selective backing plate, steel clutch plates, friction plates and Belleville plate. See **Fig. 22**. Note number of clutch plates used. Compress reverse input spring assembly.
2. Remove retaining ring. Remove spring assembly. Remove piston and seals. Thickness of friction plates should be .068-.074" (1.73-1.88 mm).

Inspection

Inspect all plates for damage, distortion, flatness and burred edges. Inspect spring retainer for distortion. Check piston for deformation or damage. Inspect clutch housing bushings for wear. Inspect clutch housing for dishing. Replace worn or damaged parts as necessary.

NOTE: Soak clutch plates in ATF before installation.

Reassembly

1. Apply ATF to piston seals. Install seals on piston with seal lips facing away from plates. Install piston in clutch housing. Install spring assembly with large opening toward piston. Compress spring assembly. Install retaining ring.

CAUTION: Ensure correct retaining ring is used. Ensure reverse input clutch retaining ring is not interchanged with low-reverse retaining ring.

2. Install Belleville plate. Install clutch plates. Install backing plate with chamfered side upward. Install retaining ring. Apply even pressure to backing plate using fingers.
3. **DO NOT** apply too much pressure or Belleville plate will be distorted. Using feeler gauge, measure clearance between retaining ring and backing plate. Clearance should be .040-.076" (1.02-1.94 mm). Select backing plate. See **BACKING PLATE SPECIFICATIONS** table.

BACKING PLATE SPECIFICATIONS

Identification Number	Thickness In. (mm)
5	.293-.299 (7.44-7.59)
6	.267-.273 (6.78-6.93)
7	.241-.247 (6.12-6.27)
8	.215-.221 (5.46-5.61)

VALVE BODY

NOTE: Valves are held in valve body by pins. Valves may be under spring pressure. Note locations of all parts during disassembly for reassembly reference.

Disassembly

Remove valve train, and note direction of valve installation. See **Fig. 26** or **Fig. 27**. Remove all valve pins. Remove pressure switches and/or shift solenoids. Note locations of all parts.

Inspection

Inspect valves and sleeves for scoring and cracks. Ensure valves move freely in bores. Inspect valve body for cracks and scored bores. Inspect machined surfaces for damage. Inspect springs for damaged coils. Replace damaged parts as necessary.

Reassembly

For reassembly, reverse disassembly procedure. Ensure all parts are installed in correct location. See **Fig. 26** or **Fig. 27**. Ensure pins are fully installed and do not extend into machined areas. Note position of valve lands and bushing passages.

1. Valve Body
2. Pin
3. Throttle Valve
4. Spring
5. Throttle Valve Plunger
6. Sleeve
7. 3-4 Valve
8. 3-4 Relay Valve
9. Plug
10. Cup Plug
11. 4th Clutch Pressure Switch
12. Throttle Valve Limit Valve
13. Throttle Valve Plug
14. Retainer
15. 1-2 Accumulator Valve
16. Valve Sleeve
17. Line Bias Valve
18. 3-4 Pulse Pressure Switch
19. 3-2 Control Valve
20. 3rd Clutch Pressure Switch
21. Manual Valve
22. T.C.C. Pressure Switch
23. Modulator Downshift Valve
24. Modulator Upshift Valve
25. 3-4 Throttle Valve Sleeve
26. 3-4 Throttle Valve Spring
27. 3-4 Throttle Valve
28. 3-4 Shift Valve
29. 2-3 Shift Valve
30. 2-3 Throttle Valve
31. 2-3 Throttle Valve Spring
32. 2-3 Throttle Valve Sleeve
33. 1-2 Throttle Valve Sleeve
34. 1-2 Throttle Valve Spring
35. 1-2 Throttle Valve
36. 1-2 Shift Valve

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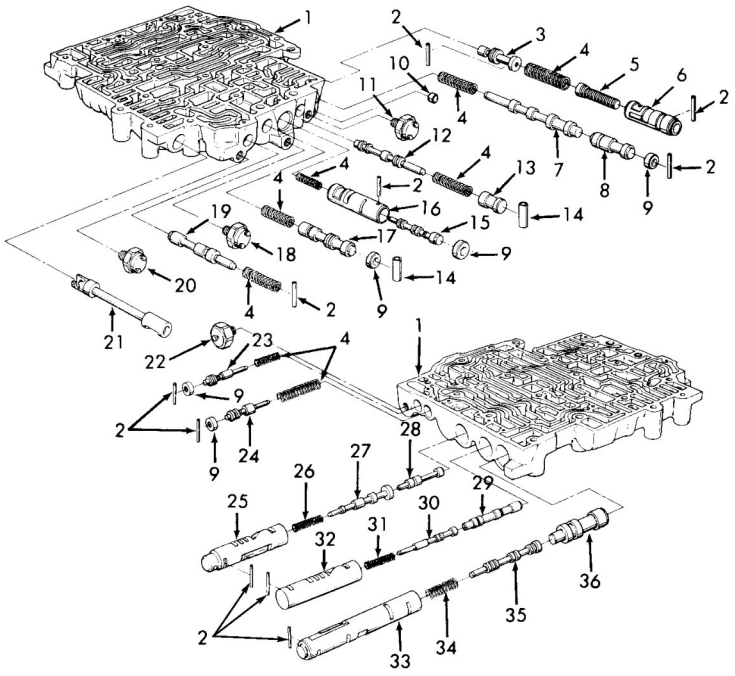

Fig. 26: Exploded View Of Valve Body (4L60)
Courtesy of GENERAL MOTORS CORP.

1. Valve Body
2. Pin
3. Forward Accumulator Piston
4. Forward Accumulator Spring
5. Forward Accumulator Cover
6. Low Overrun Valve
7. Spring
8. Forward Abuse Valve
9. 1-2 Shift Solenoid
10. 1-2 Shift Valve
11. Bore Plug
12. 2-3 Shift Solenoid
13. 2-3 Shuttle Valve
14. Retainer
15. 2-3 Shift Valve
16. 1-2 Accumulator Valve Sleeve
17. 1-2 Accumulator Valve
18. 1-2 Accumulator Valve Spring
19. Pressure Control Solenoid
20. Actuator Feed Limit Valve Spring
21. Manual Valve
22. Actuator Feed Limit Valve Spring
23. 3-2 Control Solenoid
24. 3-2 Control Valve Spring
25. 3-2 Control Valve
26. 3-2 Downshift Valve Spring
27. 3-2 Downshift Valve
28. Reverse Abuse Valve Spring
29. Reverse Abuse Valve
30. 3-4 Shift Valve Spring
31. 3-4 Shift Valve
32. 3-4 Relay Valve
33. 4-3 Sequence Valve
34. 4-3 Sequence Valve Spring
35. Converter Clutch Signal Valve

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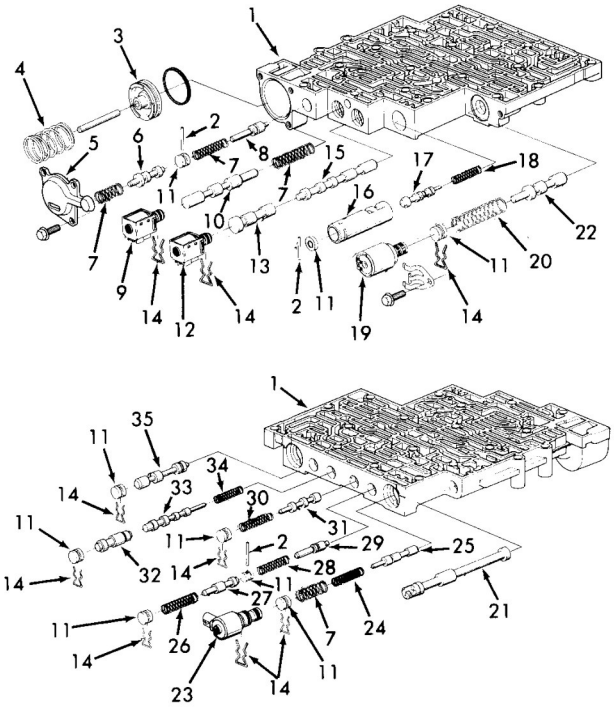


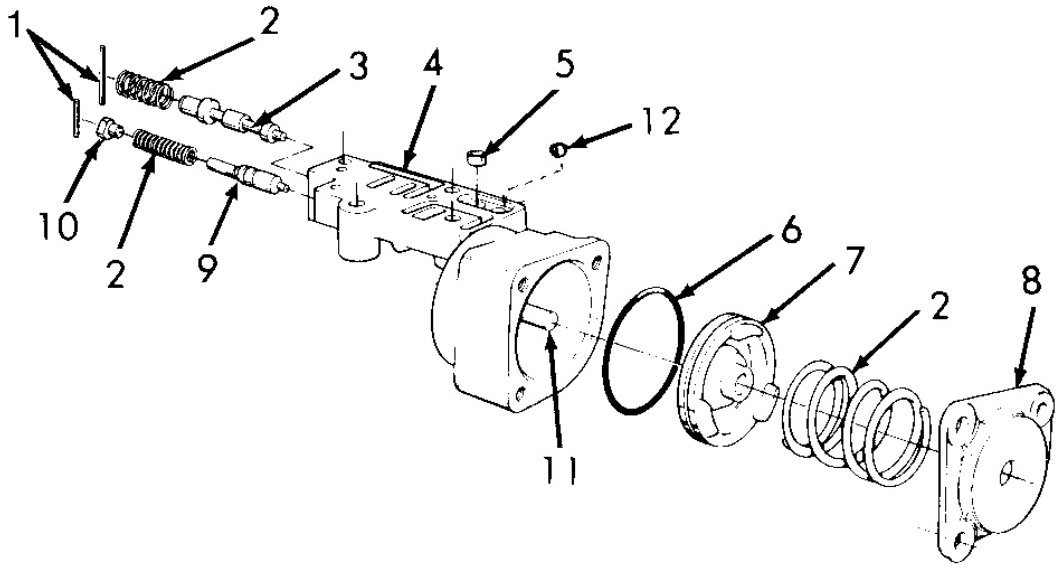
Fig. 27: Exploded View Of Valve Body (4L60-E)
Courtesy of GENERAL MOTORS CORP.

AUXILIARY VALVE BODY (4L60 ONLY)

CAUTION: Note location of all parts during disassembly for reassembly reference.

Disassembly

1. Auxiliary valve cover is under spring tension. Carefully remove cover retaining bolts. Remove cover and spring. Remove piston and "O" ring. See **Fig. 28**. Press low-overrun clutch valve downward.
2. Remove pin, spring and low-overrun valve. Remove pin, abuse valve stop, spring and abuse valve. **DO NOT** remove orifice plug unless it is damaged.



1. Pin
2. Spring
3. Low-Overrun Clutch Valve
4. Auxiliary Valve Body
5. Orifice Plug
6. "O" Ring
7. Piston
8. Cover
9. Abuse Valve
10. Abuse Valve Stop
11. Piston Pin
12. Check Ball

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Fig. 28: Exploded View Of Auxiliary Valve Body (4L60 Only)
Courtesy of GENERAL MOTORS CORP.

Inspection

1. Inspect piston for cracks and roughness. Inspect valves and piston bore for nicks and scoring. Inspect springs for damaged coils.
2. Ensure valves operate freely in bores. Inspect valve body for damaged or rough machined surfaces. Ensure overrun valve pin is tight in valve body. If pin has come out of valve body, loss or slipping in "D" range may occur or forward and overrun clutches may be burnt.

Reassembly

1. Install orifice plug (if removed) using 3/8" diameter rod. Orifice plug must be positioned flush with mounting surface. For reassembly, reverse disassembly procedure.
2. Lubricate and install "O" ring on piston. Install piston and spring. Install cover and retaining bolts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** table.

LOW-REVERSE SUPPORT ASSEMBLY

CAUTION: Note direction roller clutch is installed in support. Roller clutch must be installed in proper direction to provide lockup of inner race when rotated.

Disassembly & Inspection

Remove inner race and retainer ring. Remove roller clutch assembly. Check inner race for damage and surface finish. See **Fig. 29**. Inspect roller and springs for damage and distortion. Inspect support for loose cam, cracks and damaged surface finish. Replace damaged parts as necessary.

Reassembly

1. Install roller clutch assembly in low-reverse support. See **Fig. 29**. Place support in case with hub facing downward. Install inner race. Rotate inner race while pushing downward. Use care not to damage roller and springs during installation.
2. Ensure inner race is fully seated. Bottom tangs will be flush with carrier hub when fully seated. Inner race should rotate clockwise and lock counterclockwise with clutch hub downward. Insert support retainer spring into case between case lug and open notch in support.

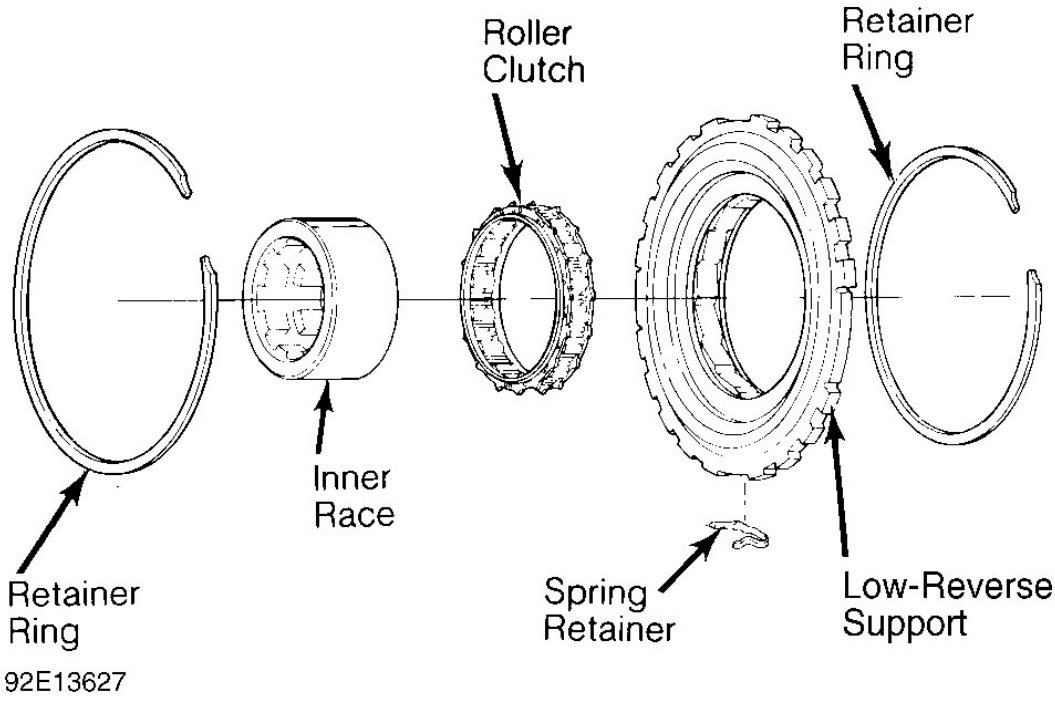


Fig. 29: Exploded View of Low-Reverse Clutch Assembly
Courtesy of GENERAL MOTORS CORP.

INPUT CLUTCH & FORWARD CLUTCH HUB ASSEMBLY

Disassembly

1. Remove backing plate. Remove 3-4 clutch plates. Note number and locations of parts. Remove 3-4 apply plate and clutch ring retainer. See **Fig. 22**.
2. Remove forward clutch retainer ring, and remove backing plate. Remove forward clutch sprag assembly and bearing. Remove input housing seal. Remove forward clutch plates. Note number and locations of parts.
3. Remove waved and apply plates. Remove overrun clutch plates (2 steel and 2 friction). Compress overrun clutch spring retainer.
4. Remove retainer ring. Remove overrun piston and forward clutch piston. Remove seals from pistons. Note direction of seals. Remove forward clutch housing. Remove 3-4 spring, 3-4 apply ring and piston. Remove "O" ring from input housing. Remove turbine shaft seal rings.
5. Remove forward clutch race. Remove snap ring and overrun clutch hub. Remove sprag retainer and race. Note direction race is installed. Use care not to lose rollers from roller cage.

Inspection

1. Inspect sprag assembly for weak or damaged springs and retainers and worn rollers. Inspect overrun clutch hub for spline damage, excessive wear and open oil passages. Inspect retainer and race for spline damage, surface wear and damaged ring grooves.
2. Replace sprag assembly if damaged. Inspect forward clutch race for spline damage, excessive wear and open oil passages. Inspect input shaft and housing for spline damage, wear and open feed passages.
3. Inspect 3 sealing balls located in rear of turbine shaft for tightness. Turbine shaft contains one open lubrication hole. Ensure orifice plug is installed.
4. Inspect check valve located in end of turbine shaft for tightness in shaft. Check ball must move freely. Replace check valve if damaged. Inspect turbine shaft seal areas for roughness and burrs.
5. Inspect check ball located in input housing for free operation. Inspect pistons for wear, damage and porosity. Inspect spring assemblies for damage and distortion.
6. Inspect steel and friction clutch plates for damage. Inspect retainer rings for distortion and damage. Check backing plates for flatness and distortion. Inspect clutch apply rings for distortion and damaged tangs.
7. Inspect forward clutch housing check ball for proper operation (if equipped). Inspect housing for cracks and damage in seal areas. Inspect bearings for excessive wear, flatness, damage and flat rollers.

Reassembly

1. If turbine shaft check valve requires replacement, straighten tangs of retainer and remove check ball. Using No. 4 screw extractor, remove check valve. Remove retainer from shaft by turning.
2. Position check valve in turbine shaft. Using a 3/8" diameter rod, drive retainer and check valve assembly into shaft. Check valve must be positioned 1/8" below top surface of turbine shaft. Ensure check ball is loose.
3. For input housing check ball replacement, drive retainer and ball assembly from housing using 1/4" diameter drift. Install NEW check ball assembly using 1/4" drift. Check ball assembly should seat on housing shoulder. Assemble forward clutch sprag assembly.
4. Install sprag assembly in forward clutch race. Notches located in sprag must face upward. See **Fig. 30**. Install retainer ring on sprag retainer and race. Retainer ring flange must face away from retainer and

race.

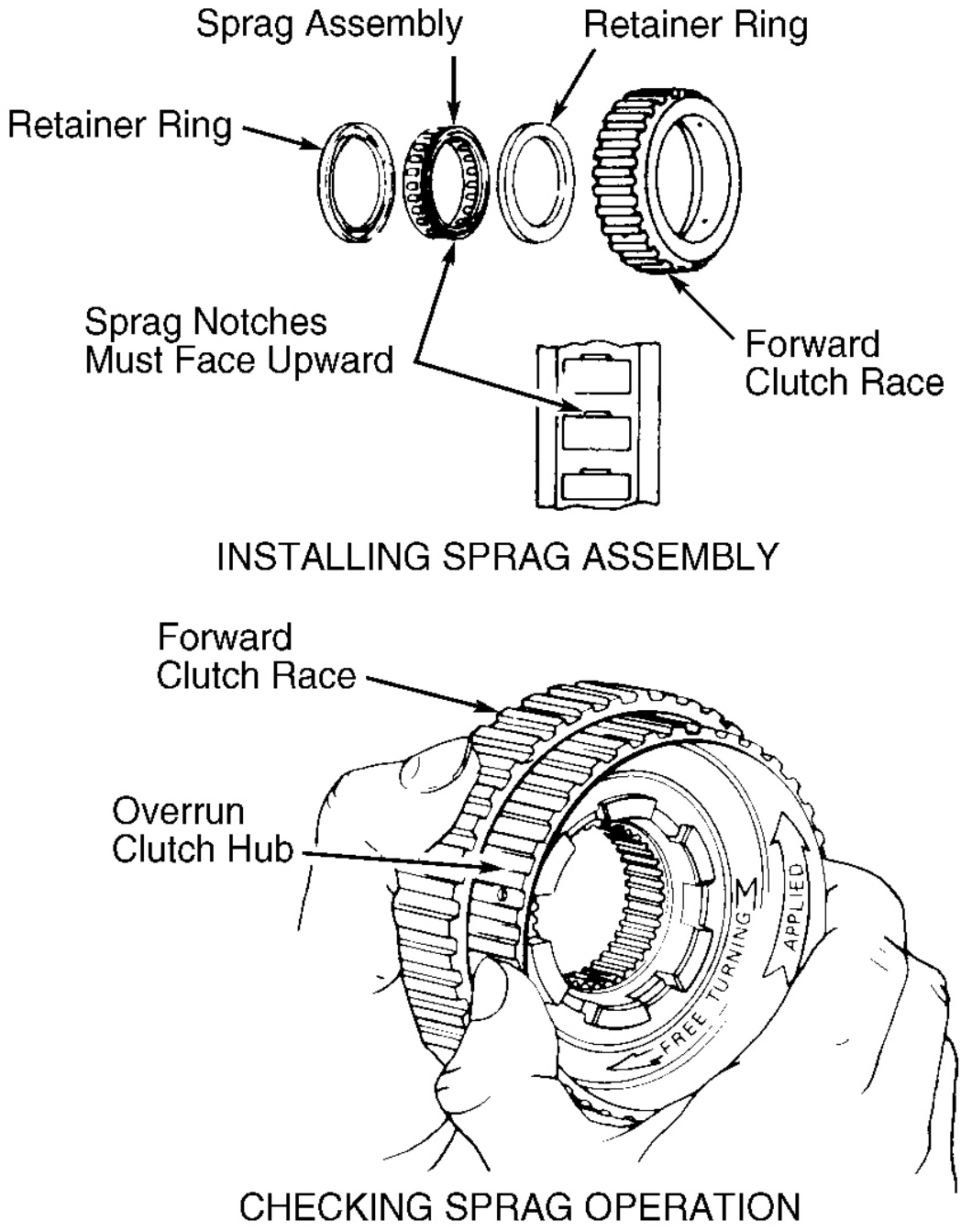


Fig. 30: Installing & Checking Clutch Sprag Assembly
Courtesy of GENERAL MOTORS CORP.

5. Hold outer race in left hand. Support sprag assembly. Install sprag retainer and race in sprag assembly. Rotate retainer and race left. Install remaining retainer ring. Install overrun clutch hub. Install snap ring.
6. Check sprag operation. Holding forward clutch race, rotate overrun clutch hub. Overrun clutch hub should turn freely clockwise and lock counterclockwise. See **Fig. 30**.
7. Place input clutch housing with turbine shaft downward. Install 3-4 piston seals with lips facing away from hub. Install 3-4 piston in input housing.
8. Install 3-4 clutch apply ring. Install "O" ring in input clutch housing. Install forward clutch housing. Install seals on forward clutch piston with lips facing away from tangs.
9. Install forward clutch piston in forward clutch housing. Install 3-4 spring on 3-4 clutch apply ring. Install forward clutch assembly on3-4 spring assembly. Align forward clutch piston legs with tangs of 3-4 apply ring. Install Seal Protector (J-29883) on input housing.
10. Install 3-4 apply ring and forward clutch assembly in input clutch housing. Hold apply ring tangs while installing. **DO NOT** allow forward clutch piston to separate from assembly. Ensure assembly is firmly seated.
11. Install Seal Protector (J-29883) on input housing. Install overrun clutch piston with hub facing upward. If fully seated, overrun piston should be 3/16" below top of snap ring groove in input housing hub.
12. Install spring assembly on overrun piston. Compress springs, and install snap ring. Install input housing seal.

NOTE: Soak clutch plates in ATF before installation. Coat all seals and "O" rings with ATF. Coat thrust washers and bearings with petroleum jelly.

13. Install 4 overrun clutch plates, starting with steel plate. Align wide notches with case lugs. Install remaining clutch plates, alternating steel and friction plates.
14. Install bearing assembly on input clutch hub. Bearing inner race must face input housing hub. Ensure bearing is centered. Align clutch plate tabs. Install forward clutch sprag assembly in input housing. Align overrun clutch hub with clutch plates.
15. Install forward clutch apply plate in input housing. Install waved forward clutch plate. Ensure all plates are aligned with input housing tangs. Starting with steel plate, install clutch plates, alternating steel and friction plates. Install backing plate and retainer ring. See **FORWARD CLUTCH PLATE SPECIFICATIONS** table.
16. Using 2 feeler gauges, measure clearance between backing plate and retainer ring. Clearance should be .030-.063" (.75-1.60 mm). Install proper size backing plate with chamfered side upward. See **FORWARD CLUTCH BACKING PLATE SPECIFICATIONS** table. Install retainer ring.
17. Install 3-4 clutch plates and backing plate. Install clutch plates and backing plate with chamfered side upward. Install retainer ring.
18. Measure clearance between backing plate and first friction plate. Clearance should be .060-.095" (1.52-2.42 mm) on 4L60 or .035-.083" (.90-2.10 mm) on 4L60-E.
19. Select proper backing plate to obtain correct clearance. See 3-4 BACKING PLATE SPECIFICATIONS table. Air check all clutches at feed holes in turbine shaft.
20. During overrun clutch test, air pressure will blow past forward clutch piston seals and exit out forward clutch feed hole in turbine shaft. Turbine shaft seals require sizing and should be installed just before oil pump installation.

FORWARD CLUTCH PLATE SPECIFICATIONS

Plate Type	Quantity	Thickness In. (mm)
Apply	1	.169 (4.29)
Waved Steel	1	.070 (1.78)
Flat Steel	5	.090 (2.29)
Friction	5	.070 (1.78)
Backing	1	Selective

FORWARD CLUTCH BACKING PLATE SPECIFICATIONS

Identification Letter	Thickness In. (mm)
A	.274-.278 (6.96-7.06)
B	.251-.255 (6.38-6.48)
C	.228-.232 (5.79-5.89)
D	.205-.208 (5.20-5.28)
E	.180-.185 (4.57-4.70)

3-4 CLUTCH PLATE SPECIFICATIONS (4L60 ONLY)

Plate Type	Quantity	Thickness In. (mm)
Stepped Apply	1	.183 (4.65)
Flat Steel (1)	1	.070 (1.78)
Flat Steel (2)	5 Or 6	.070 (1.78)
Friction (3)	5 Or 6	.079 (2.01)
Backing	1	Selective

(1) Same spline configuration as apply plate.

(2) 6 plates on SAM models.

(3) 5 plates on SAM models.

3-4 CLUTCH PLATE SPECIFICATIONS (4L60-E ONLY)

Plate Type	Quantity	Thickness In. (mm)
Stepped Apply	1	.220 (5.60)
Flat Steel (1)	1	.070 (1.78)
Flat Steel	5	.107 (2.71)
Friction	6	.079 (2.01)
Backing	1	Selective

(1) Same spline configuration as apply plate.

3-4 BACKING PLATE SPECIFICATIONS (4L60 ONLY)

Identification	Thickness In. (mm)
5 (1)	.251-.259 (6.38-6.58)

6 (1)	.218-.226 (5.54-5.74)
7 (2)	.186-.194 (4.72-4.93)
8 (2)	.153-.161 (3.89-4.09)

(1) FBM and SAM models only.

(2) Except FBM and SAM models.

3-4 BACKING PLATE SPECIFICATIONS (4L60-E ONLY)

Identification	Thickness In. (mm)
A	.224-.231 (5.68-5.88)
B	.187-.196 (4.76-4.99)
C	.153-.161 (3.89-4.09)

OIL PUMP ASSEMBLY

Disassembly

1. Remove reverse input clutch drum-to-pump thrust washer, pump-to-case gasket and pump-to-case oil seal ring from pump assembly. Remove pump cover retaining bolts. Separate pump cover from pump body.

CAUTION: Pump slide spring and pressure relief spring rivet are under high pressure. To prevent possible injury, cover springs during removal.

2. Using needle-nose pliers, compress pump slide spring. Remove from pump by pulling straight out. Remove pump vane rings, pump vanes, pump rotor and rotor guide from pump pocket.

CAUTION: Keep pump vanes in installed position. If pump vanes are installed upside-down or backwards, they will quickly wear out.

3. Remove slide from pump pocket. Remove slide seal and seal support from pump slide. See **Fig. 31**. Remove pivot pin and pivot pin spring. Remove seal ring and "O" ring from pump slide. Remove seal retainer and seal from pump body.
4. Check condition of pump bushing. If bushing is in good condition, **DO NOT** remove it. Push inward on converter clutch valve stop to compress spring. Remove snap ring. Remove valve stop, converter clutch apply valve and springs.
5. Using a small punch, remove pressure relief spring retaining rivet. Remove relief spring and ball. Remove oil screen and "O" ring from pump cover. Using a small screwdriver, compress throttle valve boost valve bushing. Remove snap ring.
6. On 4L60 models, remove Throttle Valve (T.V.) boost bushing and throttle valve boost valve. On all models, remove reverse boost valve sleeve. Remove reverse boost valve, pressure regulator valve spring and pressure regulator valve.

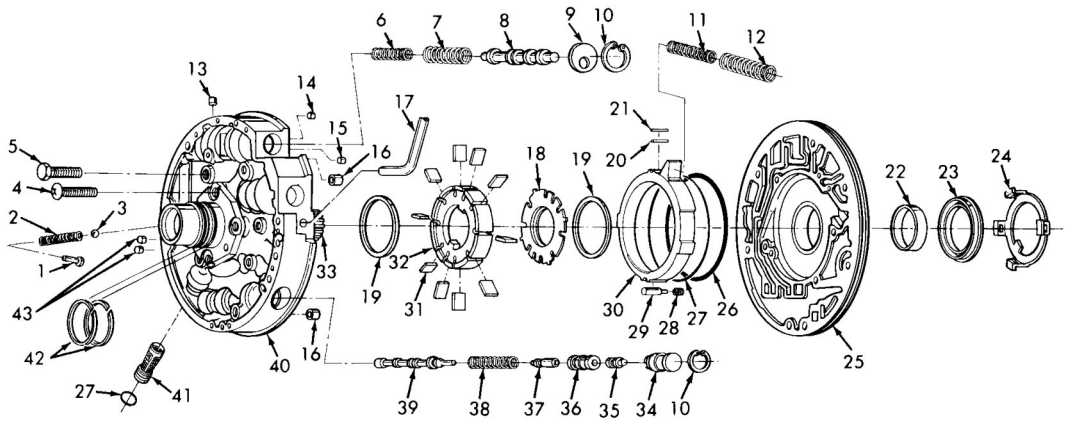


Fig. 31: Exploded View Of Oil Pump Assembly
Courtesy of GENERAL MOTORS CORP.

Inspection

1. Inspect all valves, springs, sleeves and bushings for chips, burrs, distortion and freeness in bores. Check pressure relief ball and spring for damage and distortion. Low main line pressure will exist if ball and spring are damaged.

NOTE: Use compressed air to blow out all passages, especially converter passage between TCC apply valve and stator support shaft.

2. Inspect pump cover screen and "O" ring for wear and damage. Clean pump body and cover. Check all bores for obstructions. Inspect mating sides of cover and body for scoring, flatness and damage between channels. Check channels for dirt and damaged passages. Inspect stator shaft and pump body bushings for damage.
3. Inspect rotor and slide for scoring, cracks and damage. Check rotor guide and pump vane rings for excessive wear and damage. Inspect all seals for damage. Measure pump rotor and slide thickness in undamaged area if replacement is required. Replacement parts must be same size as those removed to provide proper end clearance.
4. Lay pump body flat on bench, and install rotor into rotor and slide cavity. Lay straight edge over pump body and rotor. Use feeler gauge to check rotor-to-stator (cover) clearance. Specification is .0010-.0015" (.025-.038 mm). If pump cover is replaced, ensure reverse input feed hole in stator hub is same diameter as in hub removed.

Reassembly

1. Install "O" ring and seal ring in groove on back side of pump slide. Retain seal ring using petroleum jelly. Install pivot pin and spring in pump body. Install pump slide. Notch in pump slide must align with pivot pin hole and with flat oil seal ring facing downward in pump pocket. Install slide seal and support.

CAUTION: Keep pump vanes in installed position. If pump vanes are installed upside-down or backwards, they will quickly wear out.

2. Install pump vane ring into pump pocket. Coat rotor guide with petroleum jelly. Install rotor guide on rotor. Install rotor and guide into pump pocket with guide toward pump pocket. Install vanes in rotor. Install vane guide ring. Compress pump slide spring and install into pump pocket. All parts must be even with pump body surface. Install "O" ring on pump screen, and install screen in pump cover with seal end last.
3. Install seal in pump body. Install seal retainer. Install pressure relief check ball and spring in pump cover. Install retaining rivet. Install converter clutch valve springs and converter clutch valve. Install valve stop and snap ring. Install pressure regulator valve and spring in pump cover. See **Fig. 31**.
4. On 4L60 models, coat T.V. boost valve with petroleum jelly. Install T.V. boost valve in throttle valve bushing. Long area on valve must be positioned in large hole of bushing. On all models, coat reverse boost valve with petroleum jelly. Install reverse boost valve in boost valve sleeve with small end first. Install reverse boost valve sleeve in pump cover.
5. Install T.V. boost valve sleeve (4L60 only) in pump cover. Install snap ring. Ensure snap ring is fully seated. Install pump cover on pump body. Install retaining bolts finger tight. Align pump body and cover using Alignment Strap (J-21368). Place bolt through pump-to-case bolt hole. Tighten retaining bolts to specification. See **TORQUE SPECIFICATIONS** table. Remove alignment strap.
6. Position pump-to-case gasket on pump, and retain it using petroleum jelly. Install oil seal rings on stator hub. Retain oil seal rings using petroleum jelly. Install pump-to-case oil seal on cover. Ensure seal is not twisted. Coat seal with ATF. Install pump-to-drum thrust washer. Ensure tangs on washer engage with holes in hub.

2-4 SERVO ASSEMBLY

Disassembly

1. Remove 4th apply piston and housing from 2nd apply piston assembly. Remove return spring from apply pin. Install Piston Compressor (J-22269-01) on second apply piston. See **Fig. 17**.
2. Compress 2nd servo apply piston assembly. Remove retainer ring. Separate 2nd apply piston, spring and retainer. Remove retainer ring, washer and spring from apply pin, and remove pin. Remove all oil seal rings. See **Fig. 16**.

Inspection

Inspect all pistons for porosity and damage. Check for ring groove damage and servo bore in case for any wear which may cut servo seals. Check all springs and oil seal rings for distortion and damage.

Reassembly

Different servo piston housings and 2nd apply pistons are used for different applications. If servo piston

housing or 2nd apply piston is replaced, inside dimension of parts must be checked. Measure inside of piston housing and 2nd apply piston. Dimension must be same as original. To assemble, reverse disassembly procedure. Coat seals with petroleum jelly before assembly.

TRANSMISSION REASSEMBLY

NOTE: To locate seals, bearings and thrust washers, see SEALS, BEARINGS & THRUST WASHERS under TRANSMISSION REASSEMBLY. See Fig. 32.

LOW-REVERSE CLUTCH

1. Place transmission in a vertical position. Install seals on low-reverse clutch piston. Apply petroleum jelly to seals.
2. Align and install piston with notch in bottom of transmission case. Ensure piston is fully seated and parking pawl aligns with opening in piston wall. Install spring assembly with flat side of retainer upward. Compress springs and install retainer ring.
3. Coat bearing assembly with petroleum jelly. Install bearing assembly on case hub with outside bearing race toward case hub. Install internal reaction gear and support. Install bearing assembly onto support with outside bearing race toward support. Install oil deflector (if equipped) and reaction carrier assembly in case. See **Fig. 22**. Ensure clutch plates are proper thickness.
4. Install clutch plates. See **LOW-REVERSE CLUTCH PLATE USAGE** table. Ensure clutch plates align with splines of reaction carrier and case and that steel plates are aligned. Place waved plate on work bench. Install 5 friction plates and 4 steel plates alternately, starting with friction plate.
5. Install low-reverse support. Apply light pressure to low-reverse support. **DO NOT** flatten waved plate. Measure height of clutch pack from work bench to top of low-reverse support. Using height dimension, determine proper selective spacer plate to be used. See SPACER PLATE SELECTION table.
6. Place spacer plate between waved plate and first friction clutch plate with identification facing upward. Measure overall height of clutch pack. Overall height should be 1.20-1.24" (30.5-31.5 mm). Install clutch pack assembly in transmission case.
7. Install low-reverse support in case with hub downward. Install inner race by pushing downward while rotating until it is fully engaged. Bottom tangs will be flush with hub when fully installed. Install spring retainer in case between case lug and open notch in support. Install low-reverse retainer ring.

LOW-REVERSE CLUTCH PLATE USAGE

Type	No. Used	Thickness In. (mm)
Flat Steel	5	.069 (1.75)
Friction	5	.088 (2.24)

SPACER PLATE SELECTION (1) (4L60)

Measured Clutch Pack Height (2) In. (mm)	Plate Thickness In. (mm)
1.136-1.164 (28.85-29.57)	.066-.073 (1.67-1.85)
1.155-1.185 (29.35-30.09)	.046-.052 (1.17-1.31)
1.115-1.144 (28.32-29.06)	.087-.092 (2.19-2.34)

(1) Spacer plates are available in select sizes. Plate .066-.073" (1.67-1.85 mm) thick has no identifying marks. Other plates are marked "0" or "1".
(2) Clutch pack height is measured without spacer plate in position.

SPACER PLATE SELECTION (1) (4L60-E)

Measured Clutch Pack Height (2) In. (mm)	Plate Thickness In. (mm)
1.081-1.102 (27.55-28.06)	.066-.073 (1.67-1.85)
1.102-1.122 (28.06-28.59)	.046-.052 (1.17-1.31)
1.061-1.081 (27.03-27.54)	.087-.092 (2.19-2.34)

(1) Spacer plates are available in select sizes. Plate .066-.073" (1.67-1.85 mm) thick has no identifying marks. Other plates are marked "0" or "1".
(2) Clutch pack height is measured without spacer plate in position.

REACTION & INPUT GEAR SETS

1. Install snap ring on reaction sun gear (if removed). Install sun gear into reaction carrier. Install thrust washer on low-reverse clutch race. Install reaction sun gear shell on reaction sun gear.
2. Install thrust washer on reaction sun gear shell. Ensure thrust washer tangs engage on gear shell. Install input internal gear and reaction carrier shaft in sun gear shell. Carrier shaft splines must engage with reaction carrier. See **Fig. 22**.
3. Install thrust washer on reaction carrier shaft. Outer race must face toward reaction carrier shaft. Install output shaft in transmission. Ensure output shaft engages with all parts.
4. Install Output Shaft Support (J-29837). Adjust support so output shaft is positioned upward as far as possible. Install input carrier assembly with hub end down on output shaft. Install NEW retainer ring on output shaft. Remove output shaft support. Install input sun gear, indexing gear end with input carrier pinions.

REVERSE INPUT ASSEMBLY & INPUT CLUTCH

Install selective thrust washer on input housing. Install bearing assembly on selective thrust washer. Inner race (Black) must go toward oil pump. Position reverse input assembly on input clutch assembly. Reverse input clutch plates must align with input clutch hub. Ensure all clutch plates are fully engaged.

REVERSE & INPUT CLUTCHES

Install reverse and input clutch assemblies in case as an assembly. Align 3-4 clutch plates of input assembly with input internal gear. Assembly is fully seated when reverse housing is just below oil pump face of case.

2-4 BAND & SERVO ASSEMBLY

1. Install 2-4 band in case. Align band anchor pin end with case pin hole. Install band anchor pin in case. Ensure band anchor pin aligns with end of 2-4 band.
2. Install 2-4 servo assembly into case, and index apply pin on band end. Check for proper engagement of

apply pin on band end. Recheck 2-4 servo apply pin selection to ensure correct pin is installed. See **CHECKING SERVO PIN LENGTH** under TRANSMISSION DISASSEMBLY. Different length servo pins are available. See SERVO PIN SPECIFICATIONS table. Select proper length servo pin.

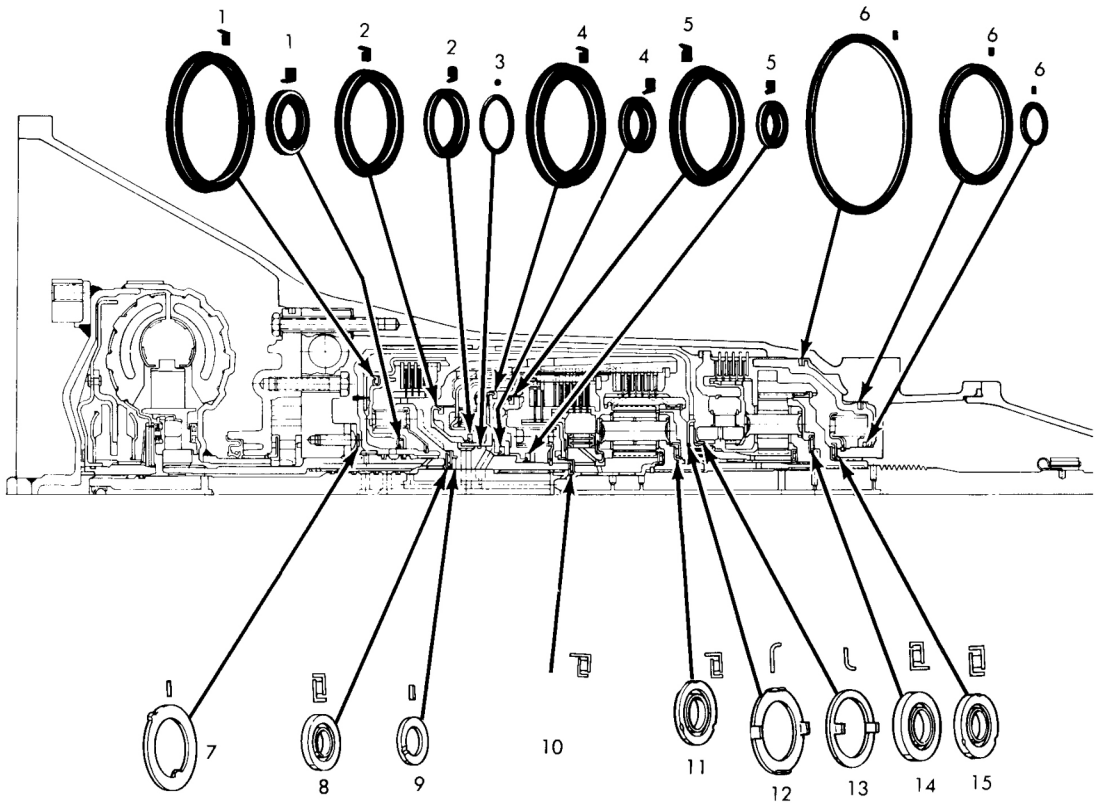
3. Install servo cover and "O" ring. Compress cover and install cover retaining ring. Index ring ends with slot in case.

SERVO PIN SPECIFICATIONS

Pin Identification	Pin Length In. (mm)
1 Groove	2.59-2.60 (65.8-66.1)
3 Grooves (1)	2.65-2.66 (67.2-67.5)
No Groove	2.70-2.71 (68.6-68.9)
(1) Pin has 2 grooves on 4L60-E transmission.	

SEALS, BEARINGS & THRUST WASHERS

NOTE: To identify seals, bearings and thrust washers locations, see Fig. 32.



1. Reverse Input Clutch Seals
2. 3-4 Clutch Seals
3. Input-To-Forward Housing "O" Ring
4. Forward Clutch Seals
5. Overrun Clutch Seals
6. Low-Reverse Clutch Seals
7. Pump-To-Input Drum Thrust Washer
8. Stator Shaft Bearing
9. Selective Thrust Washer
10. Input Sun Gear Bearing
11. Input Carrier-To-Reaction Shaft Thrust Washer
12. Reaction Shaft-To-Shell Thrust Washer
13. Reaction Shell-To-Shaft Thrust Washer
14. Reaction Carrier-To-Support Bearing
15. Reaction Gear-To-Case Bearing

Fig. 32: Exploded View Of Seals, Bearings & Thrust Washers
Courtesy of GENERAL MOTORS CORP.

OIL PUMP ASSEMBLY

1. Turbine shaft seals should be installed just before oil pump installation. Position Seal Installer (J-36418-1) on input shaft. See **Fig. 33**. Adjustment screw in seal installer must be adjusted to obtain correct height for each seal installation. Install 4 turbine shaft seals.

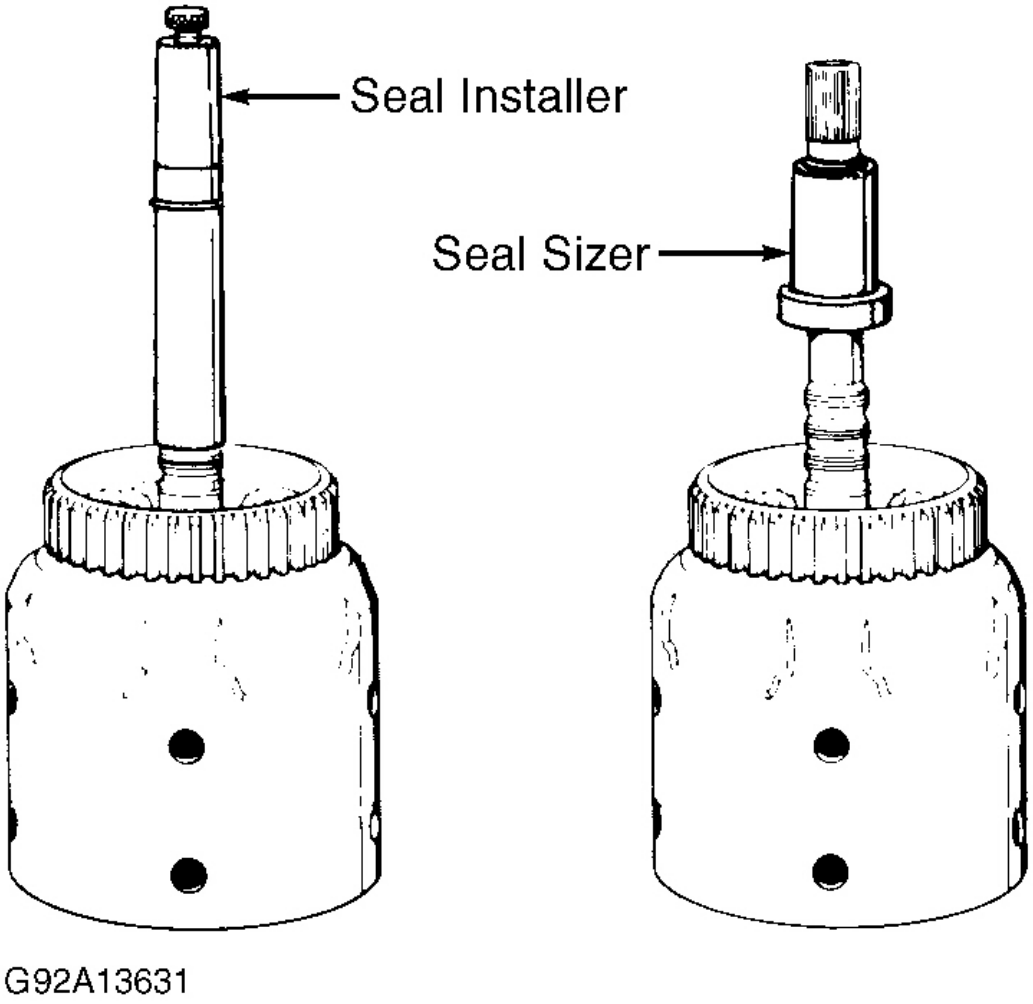


Fig. 33: Installing & Sizing Turbine Shaft Seals
Courtesy of GENERAL MOTORS CORP.

2. Turbine shaft seals must be sized using Seal Sizer (J-36418-2A) after installation. Install aligning pins in 2 opposing pump bolt holes in case. Ensure thrust washer is installed on rear of oil pump. Thrust washer can be retained using petroleum jelly.
3. Install pump into case, aligning filter and pressure regulator holes with holes in case. Install retaining bolts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** table. Place transmission in a horizontal position.
4. Turbine shaft should rotate by hand. If turbine shaft will not rotate, loosen pump retaining bolts and attempt to rotate shaft again. If shaft now turns, reverse and input assemblies have not been indexed properly or some other assembly problem has occurred, such as thrust washer not positioned properly.
5. Check transmission end play. See TRANSMISSION END PLAY CHECK under **TRANSMISSION**

DISASSEMBLY. Transmission end play should be .005-.036" (.13-.91 mm). If transmission end play is not within specification, thrust washer must be changed between oil pump and input housing.

6. See **OIL PUMP THRUST WASHER SPECIFICATIONS** table. Install thrust washer, and recheck end play. Install torque converter. Ensure converter hub is aligned with oil pump. Install torque converter retaining strap to hold converter.

OIL PUMP THRUST WASHER SPECIFICATIONS

Identification Number	Thickness In. (mm)
67	.074-.078 (1.88-1.98)
68	.080-.084 (2.03-2.13)
69	.087-.091 (2.21-2.31)
70	.094-.098 (2.39-2.49)
71	.100-.104 (2.54-2.64)
72	.107-.111 (2.72-2.82)
73	.113-.118 (2.87-3.00)
74	.120-.124 (3.05-3.15)

1-2 ACCUMULATOR & SPACER PLATES

CAUTION: If spacer plate and gasket replacement is required, ensure NEW spacer plate and gasket are identical as those removed.

1. Install 3-4 accumulator piston pin in case. Install 3-4 piston seal on piston. Install 3-4 accumulator piston on pin. Legs of piston must face valve body.
2. Install 3-4 accumulator spring. Install check balls and oil screens in proper locations. Install special retainer and ball assembly. See **Fig. 10** and **Fig. 19** for check ball and filter installation locations. Install spacer plate gasket and spacer plate.
3. Install 1-2 accumulator spring, oil seal ring and 1-2 accumulator piston. Install accumulator cover and bolts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** table.

VALVE BODY & AUXILIARY VALVE BODY

Install valve body and auxiliary valve body. See VALVE BODY and AUXILIARY VALVE BODY under **ON-VEHICLE SERVICE**.

EXTENSION HOUSING

1. Install speed sensor wheel/speedometer gear and retaining clip on output shaft. On 4L60, if output shaft has 2 locating holes, use hole nearest yoke on Corvette only. Install "O" ring in output shaft sleeve.
2. On all models, install output sleeve on output shaft. **DO NOT** position output sleeve past machined surface of output shaft. Install seal ring on extension housing.
3. Position extension housing on transmission case. Install retaining bolts. Install oil seal in extension housing.
4. Install speed sensor/speedometer driven gear and fitting assembly. Install retainer and bolt. Tighten bolt

to specification. See **TORQUE SPECIFICATIONS** table. Install outside electrical connector and manual shift lever.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Cooler Pipe Connector	28 (38)
Detent Spring-To-Valve Body Bolt	18 (24)
Extension Housing Bolt	26 (35)
Manual Shaft-To-Detent Lever Nut	23 (31)
Oil Pump Cover-To-Body Bolt	18 (24)
Oil Pump-To-Case Bolt	18 (24)
Park Bracket-To-Case Bolt	23 (31)
Pressure Plugs 1/4 X 18"	18 (24)
Torque Converter-To-Flexplate Bolt	46 (62)
	INCH Lbs. (N.m)
Accumulator Cover-To-Case Bolt	96 (11)
Auxiliary Valve Body Bolt (4L60 Only)	96 (11)
Oil Pan-To-Case Bolt	96 (11)
Oil Passage Cover Bolt	96 (11)
Pressure Plugs 1/8 X 27"	96 (11)
Pressure Switches (4L60 Only)	96 (11)
Pressure Switch Assembly (4L60-E Only)	96 (11)
Solenoid Bolt	96 (11)
Speed Sensor/Speedometer Bolt	89 (10)
T.V. Cable Bolt (4L60 Only)	75 (8.5)
Valve Body-To-Case Bolt (1)	96 (11)
(1) Tighten valve body bolts in a spiral pattern starting in center of valve body.	

