

1991 Saturn SC

1991-94 AUTOMATIC TRANSMISSIONS Saturn - Overhaul

1991-94 AUTOMATIC TRANSMISSIONS

Saturn - Overhaul

APPLICATION

TRANSMISSION APPLICATIONS

Application	Engine
1991-94 Saturn	1.9L

NOTE: For testing and diagnostic procedures of electronic components, refer to **AUTO TRANS DIAGNOSIS - SATURN** article.

IDENTIFICATION

All transaxles have an identification code stamped on top of transaxle case. See **Fig. 1** .

Code Breakdown

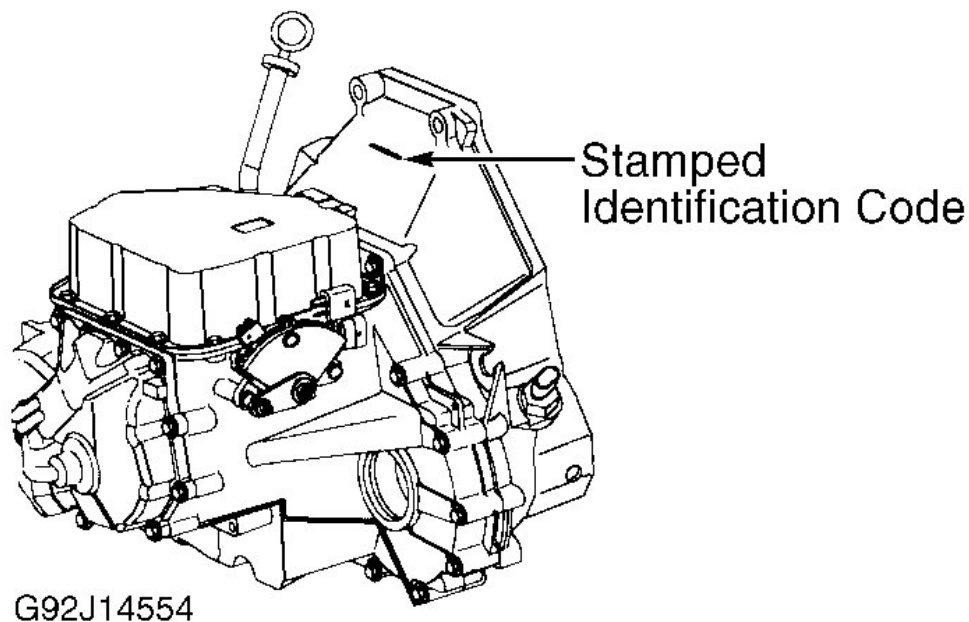
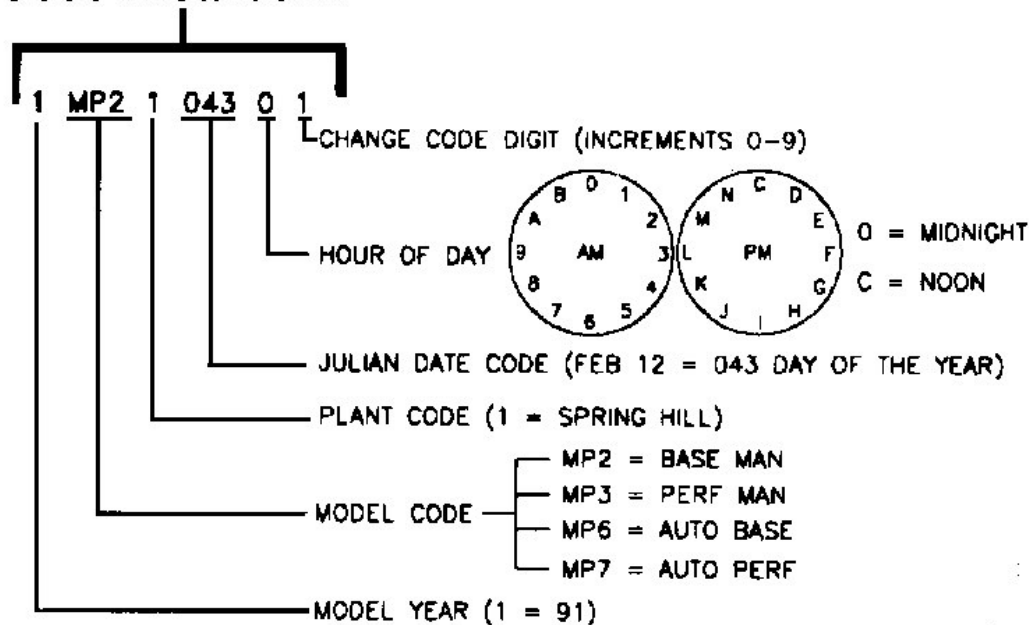


Fig. 1: Locating Transaxle Identification Code
 Courtesy of GENERAL MOTORS CORP.

DESCRIPTION

The Saturn transaxle is a fully automatic 4-speed consisting of a 4-element hydraulic torque converter and converter clutch. Transaxle uses a gear rotor-type pump to supply all hydraulic pressure needed for operation.

The multiplied torque from torque converter is transferred to the transaxle by a gear train assembly. Other internal components consist of 4 multiple disc clutches, a lock-up clutch, a sprag clutch and a servo-actuated dog clutch. The final drive gear and differential assemblies are an integral part of the transaxle.

The transaxle uses 5 electronic valves (line actuators), controlled by the Powertrain Control Module (PCM). This allows for timing all transaxle shifts, shift feel, Torque Converter Clutch (TCC) lock-up and self-diagnostics.

PCM is capable of operating in 2 different modes. The differences between the 2 modes are shift points. NORMAL mode or PERFORMANCE mode may be selected using mode switch. Mode switch is located on center console.

Depending on throttle opening angle, TCC is applied in 2nd, 3rd and 4th gear. TCC will not apply if engine coolant temperature is less than 122°F (50°C), if air and transaxle temperature is less than 7°F (10°C), during coast downshifts or if brake pedal is pushed.

LUBRICATION

See TRANSMISSION SERVICING - A/T article in TRANSMISSION SERVICING.

ADJUSTMENTS

See TRANSMISSION SERVICING - A/T article in TRANSMISSION SERVICING.

ON-VEHICLE SERVICE

Following components can be serviced without removing transaxle from vehicle.

- Converter-To-Flexplate Bolts
- Cooler Lines
- Drive Axle Seals
- End Cover
- Dipstick Tube
- Neutral Safety Switch
- Shift Control Cable
- Shift Solenoids
- Temperature Sensor
- Transaxle Pan
- Transaxle Filter
- Turbine Speed Sensor
- Valve Body

- Vehicle Speed Sensor
- Wiring Harness

DRIVE AXLE SHAFTS

See **AXLE SHAFTS - FRONT** article in DRIVE AXLE section.

OIL COOLER FLUSHING

1. If Line Flusher (J-35944) is available, fill it with solution, and install oil cooler and line flusher to top transaxle cooler line on transaxle. Follow manufacturer's instructions to flush oil cooler and cooler lines.
2. If line flusher is not available, flush cooler and cooler lines with a mixture of clean solvent and water. Flush cooler in both directions until all old fluid and debris is removed. Use compressed air to dry cooler and lines. If necessary, replace plugged or damaged cooler and/or lines.

TURBINE SPEED SENSOR

Removal

1. Remove air induction system from the battery tray, and move aside to gain access to sensor. On DOHC (LLO) engines, remove the air filter box. See **Fig. 2** .
2. Disconnect electrical connector from turbine speed sensor and remove sensor. See **Fig. 3** .

NOTE: **Inspect "O" ring for damage and replace if necessary.**

Installation

1. Install turbine speed sensor. See **Fig. 3** . Clean and lubricate fastener with appropriate transmission fluid. Wipe off excess fluid and install. Tighten to specification. See **TORQUE SPECIFICATIONS** .
2. Connect electrical connector to sensor. Push in until a click is heard and pull back on connector to confirm positive engagement.
3. Install air filter box, if removed. See **Fig. 2** . Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .
4. Install air induction system. See **Fig. 2** . Tighten clamps to specification. See **TORQUE SPECIFICATIONS** .
5. Check transaxle fluid level. See appropriate SERVICING article.

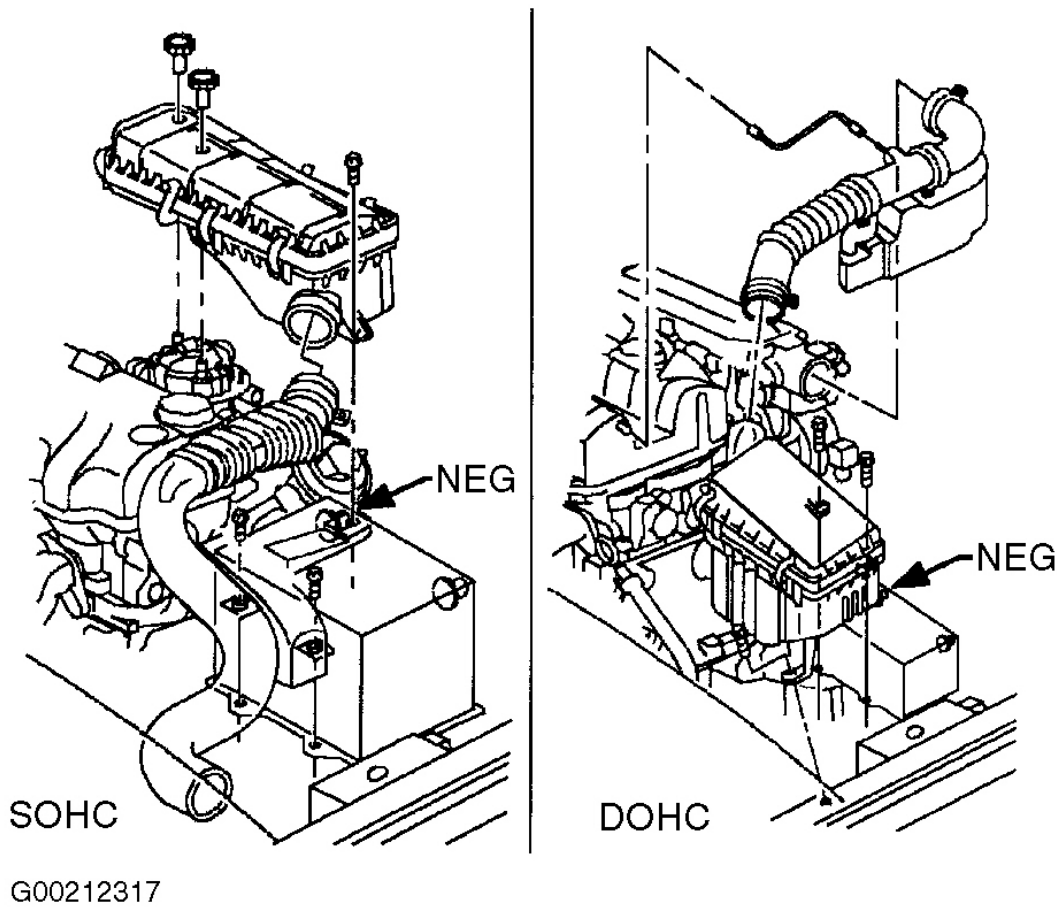
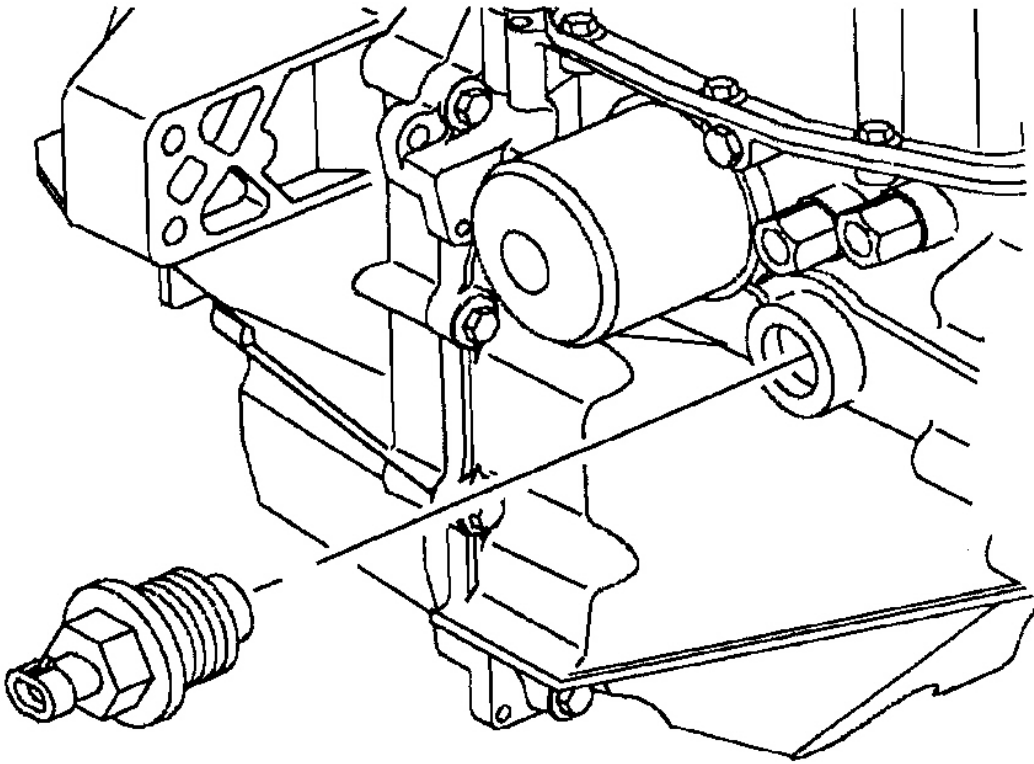


Fig. 2: Removing & Installing Air Induction System
 Courtesy of GENERAL MOTORS CORP.



G00212318

Fig. 3: Removing & Installing Turbine Speed Sensor
Courtesy of GENERAL MOTORS CORP.

VALVE BODY

See TRANSAXLE DISASSEMBLY .

TROUBLE SHOOTING

NOTE: For testing and diagnostic procedures of electronic components, refer to AUTO TRANS DIAGNOSIS - SATURN article. For clutch and actuator applications, see CLUTCH & ACTUATOR APPLICATION .

PCM LEARN MODE

1. PCM will change transaxle shift points depending on driving conditions or changes in engine performance. If PCM memory or vehicle battery is disconnected, PCM must relearn current operating parameters.
2. Perform the following procedures on a clear highway. Place mode select switch (located on center

console) in NORMAL position. With transaxle at normal operating temperature, place gear selector in "D4" position. Open throttle about 30 percent. Perform 10 complete 1-2, 2-3 to 3-4 upshifts.

- While coasting at 35 MPH (DOHC) or 40 MPH (SOHC), open throttle halfway to create a 4-3 downshift. Repeat 5 times. Move gear selector to "D3" position. While coasting at 20 MPH (DOHC) or 30 MPH (SOHC), open throttle 75 percent to create a 3-2 downshift. Repeat 5 times.

QUICK CHECK

- Check level and condition of transaxle fluid. Check PCM memory for any stored trouble codes. See **AUTO TRANS DIAGNOSIS - SATURN** article in the AUTOMATIC TRANSMISSIONS section. If no trouble codes are present, go to next step. If codes are present, diagnose and repair all PCM-related trouble codes. Clear PCM trouble code memory.
- If no codes are present, perform road test. See **ROAD TEST** under TESTING. During road test, record shift points. If shift point timing is incorrect or incorrect shifting occurs, go to SATURN ELECTRONIC DIAGNOSIS article.
- Using scan tool, ensure all selector switch (PRND32) positions are correct. Jumper terminals "A" and "B" of diagnostic connector.
- With Key On Engine Off (KOEO), move gear selector to each gear position. This should cause a specific line actuator to operate. See **LINE ACTUATOR SELECT**.
- If line actuator is operating, it will audibly operate at a fixed duty cycle for 6 seconds and then click on and off. Clicking will repeat until next gear is selected or ignition is turned off.
- If shifts are too harsh or soft, see **HYDRAULIC PRESSURE TESTS** under TESTING. For specific complaints, see appropriate conditions listed under **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING.

LINE ACTUATOR SELECT

Selected Gear	Actuator
"D2"	2nd
"D3"	3rd
"D4"	4th
"R"	TCC
"N" Or "P"	Line

SYMPTOM DIAGNOSIS

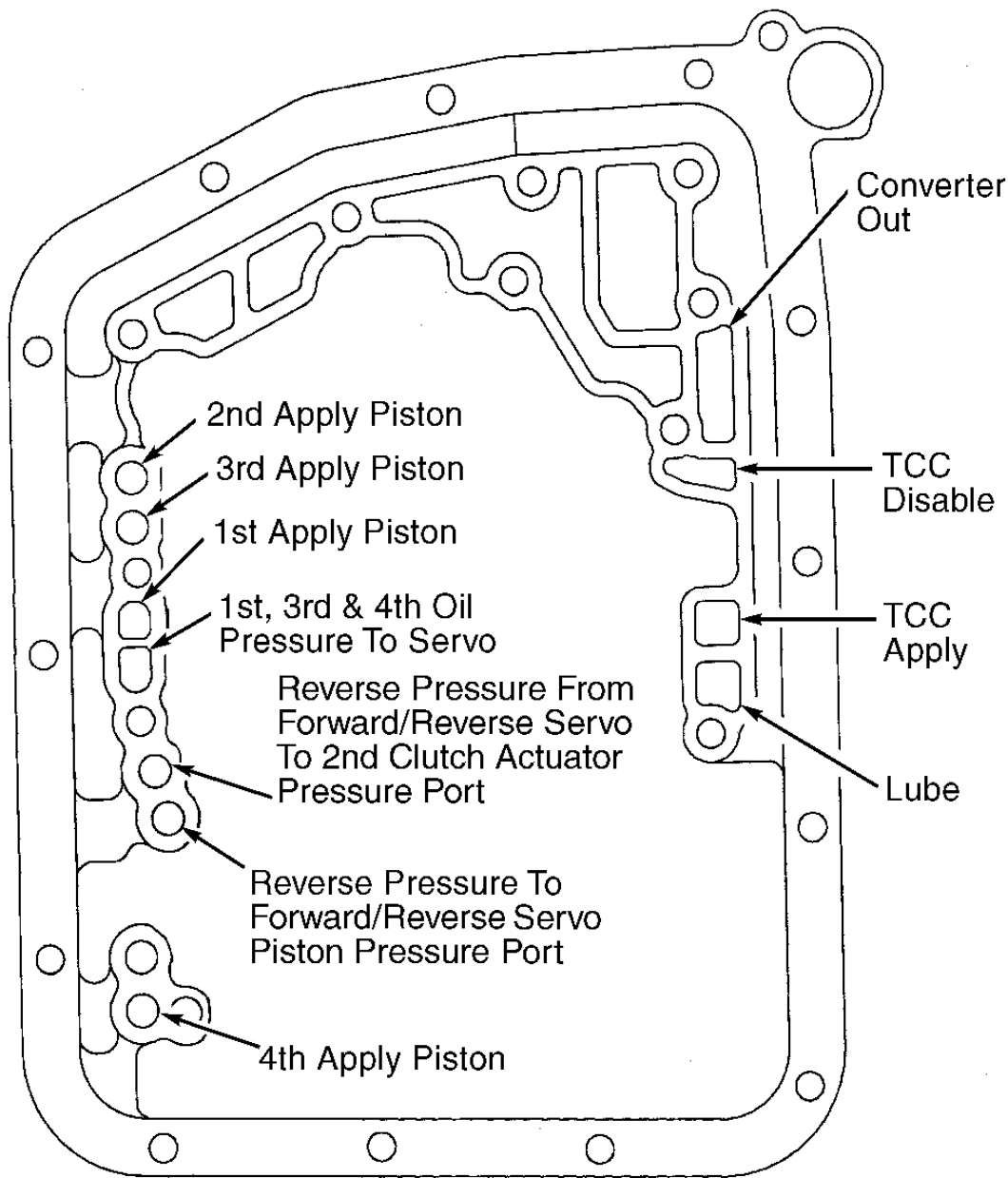
NOTE: Saturn transaxle uses a Powertrain Control Module (PCM) computer. This computer controls TCC, line pressure and clutch or servo shifting solenoids. Because most transaxle operations are PCM-controlled, only a few hydraulic or mechanical problems can cause problems with transaxle operations. For more symptom diagnosis, see SATURN ELECTRONIC DIAGNOSIS article in the AUTOMATIC TRANSMISSIONS section.

Fluid Out Of Vent Or Foaming

Transaxle overfilled. Fluid contaminated with antifreeze. Engine overheating. Problem with clutch assemblies.

No Reverse

1. Low fluid level. Low fluid pressure. High clutch dragging. Check transaxle for 2nd gear operation. If no 2nd gear, refer to DTC 22. See **AUTO TRANS DIAGNOSIS - SATURN** article. If 2nd gear is possible, ensure flat surface of manual valve is facing up.
2. If manual valve is okay, remove valve body. Block off reverse pressure from servo-to-2nd clutch port. Using a rag, cover 1st, 3rd and 4th oil pressure-to-servo port to prevent fluid spray. See **Fig. 4** . Apply air pressure to reverse pressure-to-servo port.
3. If servo does not move, check servo piston for stuck condition and damaged seal. If servo motor moves, repair faulty dog clutch or oil tube hub seal rings.



G92A14555

Fig. 4: Locating Fluid Pressure Ports
 Courtesy of GENERAL MOTORS CORP.

Harsh Upshifts

1. If a new transaxle has been installed, perform test drive to reset PCM adaptive memory. If upshifts are still harsh, quick check line actuator. If line actuators are stuck, replace stuck actuators.

2. If line actuators are okay, check hydraulic pressure in each gear. If line pressure is out of range in any gear, check for a sticking line pressure regulator valve, faulty line actuator in affected range and damaged clutch plates in affected range.

Vehicle Moves In Park

Manual control cable damaged or disconnected. Broken final drive parking pawl spring, parking pawl or parking pawl gear in final drive internal gear assembly. Park actuator spring damaged.

Vehicle Stuck In Park

Problem with shift interlock system. Broken parking pawl assembly. Park actuator lever rod damaged.

NOTE: **Following problems may be related to PCM controls or inputs. If a mechanical or hydraulic problem is not found, go to AUTO TRANS DIAGNOSIS - SATURN article in the AUTOMATIC TRANSMISSIONS section.**

High Line Pressure

Check for a stuck line actuator or faulty pressure regulator valve.

Low Line Pressure

Check for a stuck line actuator, faulty pressure regulator valve or plugged oil filter. If transaxle has reverse only, check 1st clutch for leak and damage. If transaxle will not move in reverse or forward, check input and output shafts for damage.

No 1st Gear

Faulty 1st clutch assembly. Damaged servo piston, problem with piston seals or rear cover seal leaks. Damaged 1st sprag clutch, broken output shaft or blocked fluid passages. See **Fig. 4** .

2nd Gear Stuck ON

Check for a stuck line actuator. Faulty 2nd clutch assembly. Damaged servo piston or problem in piston seals or valve body. Damaged clutch return springs or blocked fluid passages. See **Fig. 4** .

No 2nd Gear

Check for a stuck line actuator. Faulty 2nd clutch assembly. Damaged servo piston or problem in piston seals or valve body. Damaged dog clutch or blocked fluid passages. See **Fig. 4** .

No 3rd Gear

Check for a stuck line actuator. Faulty 3rd clutch assembly. Damaged servo piston or problem in piston seals or valve body. Blocked fluid passages. See **Fig. 4** .

No 4th Gear

Check for a stuck line actuator. Faulty 4th clutch assembly. Damaged servo piston or problem in piston seals or valve body. Blocked fluid passages. See **Fig. 4**.

No Drive In Any Gear

1. Low fluid level. Low fluid pressure. Manual linkage misadjusted or disconnected. Drive axles disengaged. Damaged oil pump drive shaft or complete pump assembly. Torque converter stator roller clutch damaged.
2. Clutch assembly plates burned or clutch plates missing. Clutch piston seals cut or damaged or blocked fluid passages. See **Fig. 4**. Problem with valve body.

NOTE: Saturn transaxles use a Powertrain Control Module (PCM) computer. This computer controls TCC application.

No TCC Apply

Check for a stuck line actuator. Leaking or missing torque converter, input shaft or stator shaft seals. Damaged torque converter.

TCC Stuck On (Engine Stops)

Check for a stuck line actuator. Leaking or missing input shaft seals. Damaged torque converter.

CLUTCH & ACTUATOR APPLICATION

Selector Lever Position	Elements In Use
Drive	
1st Gear	(1) TCC Actuator, 1st Clutch, (2) Dog Clutch & 1st Sprag
2nd Gear	(1) 2nd Actuator, 1st Clutch, 2nd/Reverse Clutch & (2) Dog Clutch
3rd Gear	(1) 3rd Actuator, 1st Clutch, 3rd Clutch & (2) Dog Clutch
4th Gear	(1) 4th Actuator, 1st Clutch, 4th Clutch & (2) Dog Clutch
"R" (Reverse)	(1) 2nd/Reverse & (1) TCC Actuator, 2nd/Reverse Clutch & (3) Dog Clutch
"N" Or "P" (Neutral Or Park)	(1) Line Actuator, All Clutches Released Or Ineffective

- (1) Listed actuators off, all others are on.
- (2) Applied to 2nd driven gear.
- (3) Applied to reverse driven gear.

TORQUE CONVERTER

NOTE: For diagnosing torque converter clutch, refer to **SATURN ELECTRONIC DIAGNOSIS** article.

STALL SPEED TEST

NOTE: Stall speed test information and specifications are not available.

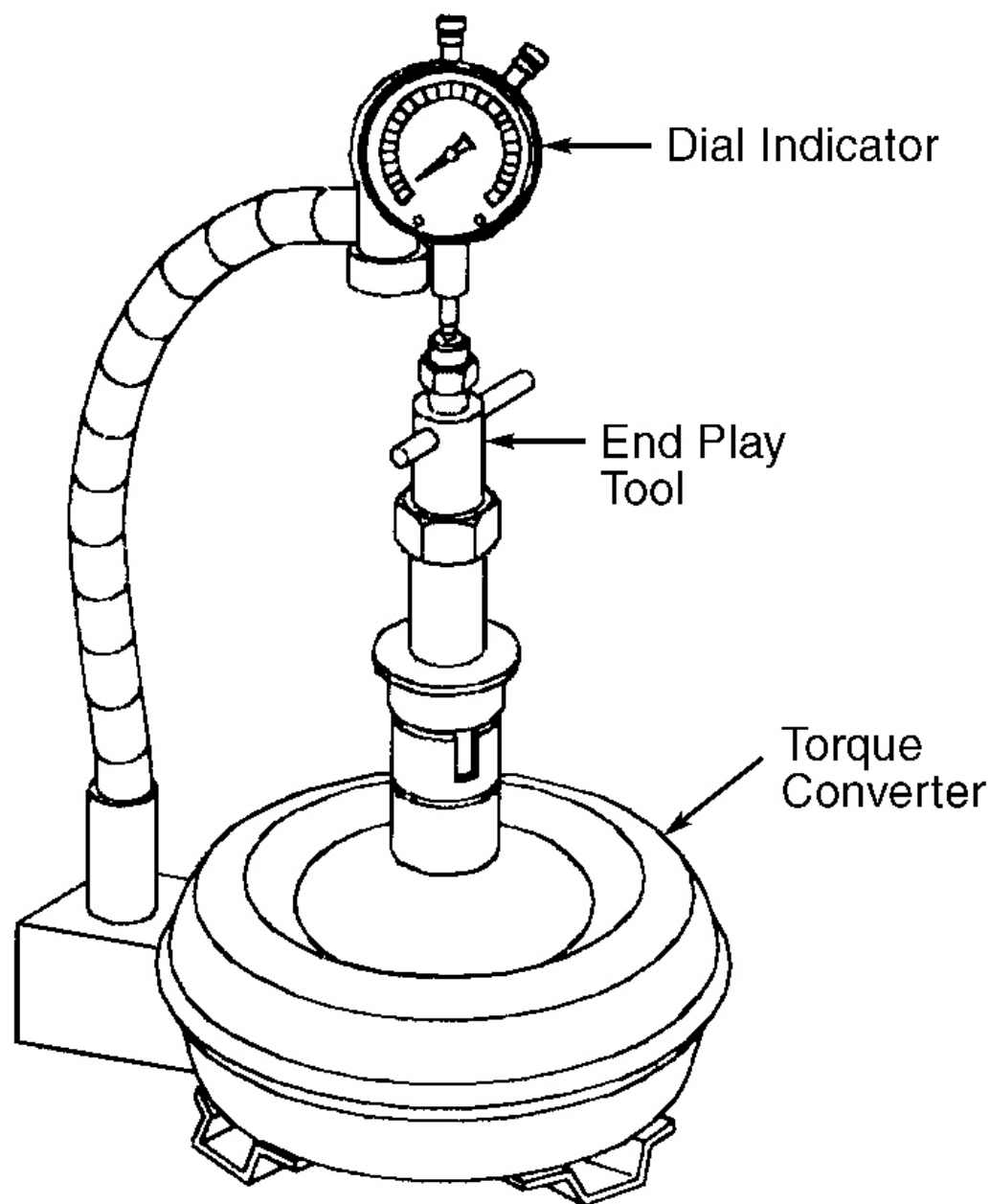
INSPECTION

Torque converter must be replaced for any of following problems.

- Damage To Pump Assembly
- Metal Particles Present In Fluid
- Leaks In Hub Weld Area
- Crankshaft Pilot Broken Or Damaged
- Hub Scored Or Damaged
- Stator Failure
- Torque Converter Imbalance
- Engine Coolant Contamination
- Excessive End Play

END PLAY CHECK

Install End Play Tool (SA9163T) to converter splines. Install dial indicator. See **Fig. 5** . Lift tool handle and measure end play. If end play is greater than .026" (.60 mm), replace torque converter.



G92I14561

Fig. 5: Checking Torque Converter End Play
Courtesy of GENERAL MOTORS CORP.

ELECTRONIC SELF-DIAGNOSTICS & ELECTRONIC TESTING

NOTE: See [AUTO TRANS DIAGNOSIS - SATURN](#) article.

TESTING

ROAD TEST

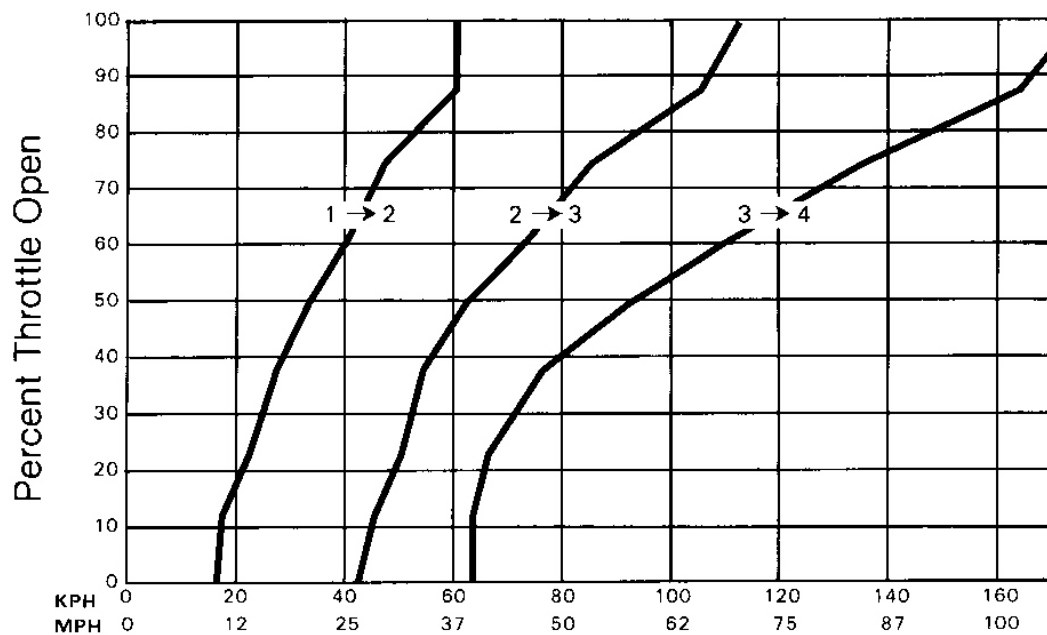
NOTE: Before road testing vehicle, engine and transaxle must be at operating temperature. Torque converter clutch will not engage if transaxle temperature has not reached operating temperature.

Gear Selector Position "D4" (Overdrive)

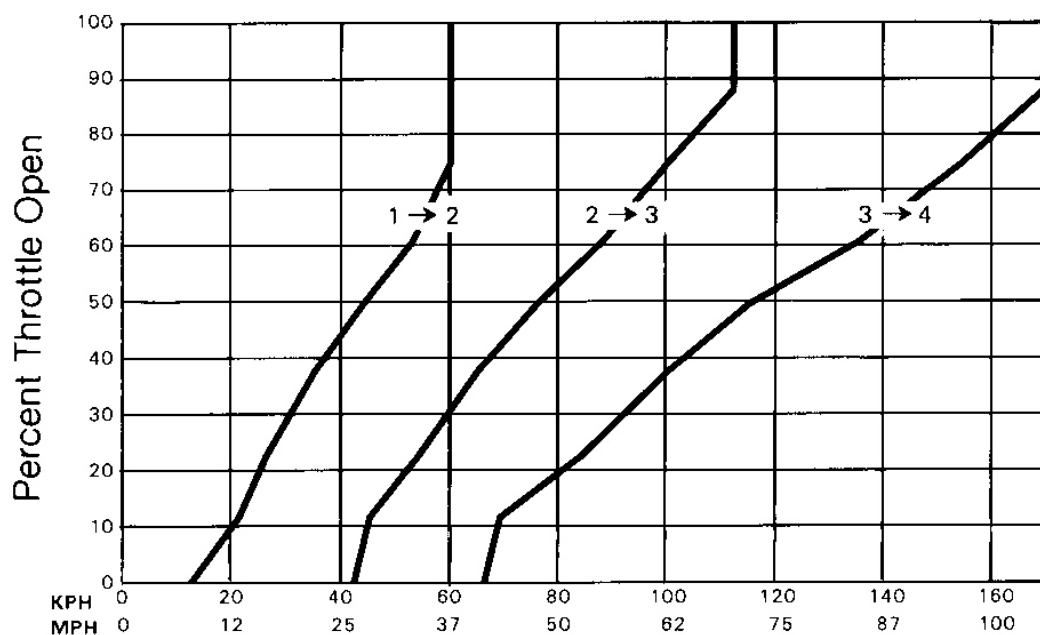
1. With gear selector in "D4" (overdrive) position, accelerate vehicle using steadily increasing throttle pressure. Note shift speed engagement points in 2nd, 3rd and overdrive gear. Use upshift charts as a reference for proper shift speeds. See [Fig. 6](#) and [Fig. 8](#) . Also note when Torque Converter Clutch (TCC) applies while in 2nd, 3rd and overdrive gear.
2. At cruising speeds, quickly push accelerator pedal to half open position (part throttle detent downshift). TCC should release and transaxle should immediately downshift. Note downshift speeds into 1st, 2nd and 3rd gear. Use downshift charts as a reference for proper shift speeds. See [Fig. 7](#) and [Fig. 9](#) .
3. Move gear selector to "D4" (overdrive) position and accelerate to 40-45 MPH. Release accelerator pedal while moving gear selector to "3" (3rd gear) position. TCC should release, transaxle should downshift immediately and engine braking should slow vehicle.
4. Repeat step 3) at slower initial speeds for "2" (2nd gear) position. Note downshift speeds into lower gear. Use downshift charts as a reference for proper shift speeds. See [Fig. 7](#) and [Fig. 9](#) .
5. With gear selector in "D4" (overdrive) position, accelerate vehicle to overdrive gear with TCC applied. Release accelerator pedal and lightly apply brakes. TCC should release. Note speeds at which vehicle downshifts. See [Fig. 7](#) and [Fig. 9](#) .

1991 Saturn SC

1991-94 AUTOMATIC TRANSMISSIONS Saturn - Overhaul



BASE TRANSAXLE (NORMAL MODE UPSHIFT)



BASE TRANSAXLE (PERFORMANCE MODE UPSHIFT)

92B14556

Fig. 6: Upshift Speed Chart (Base Transaxle)
Courtesy of GENERAL MOTORS CORP.

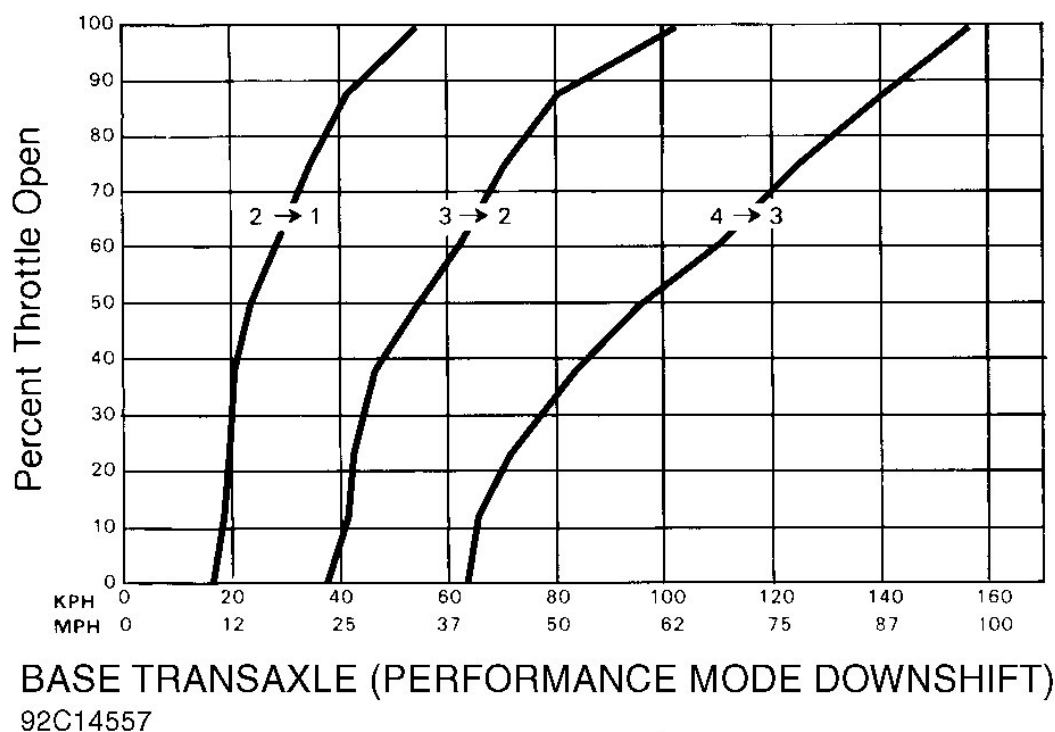
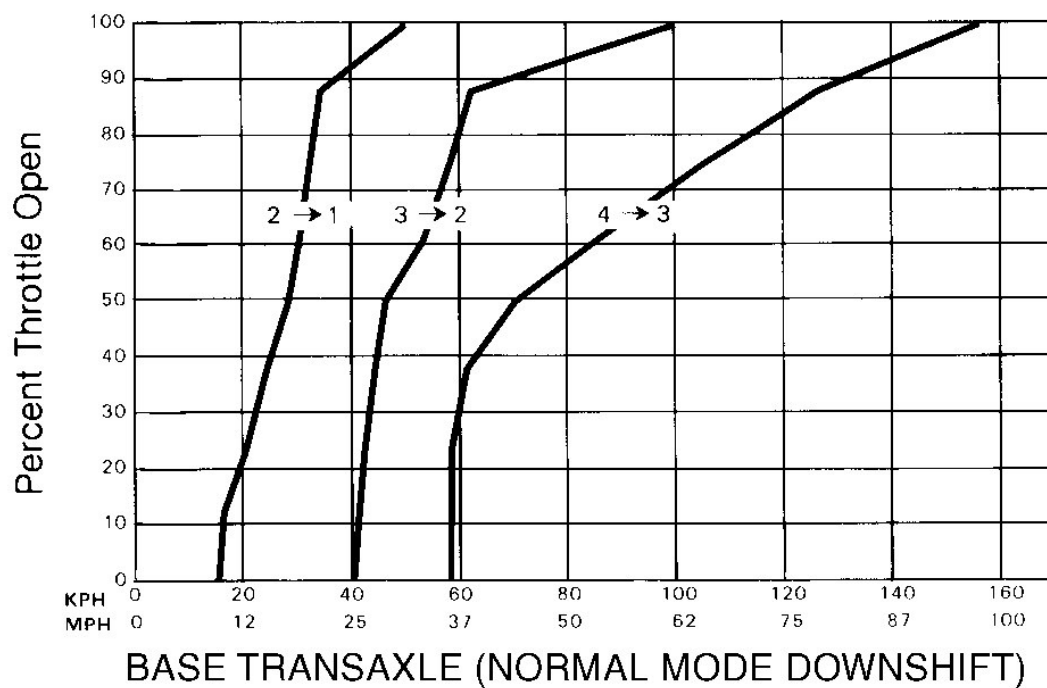
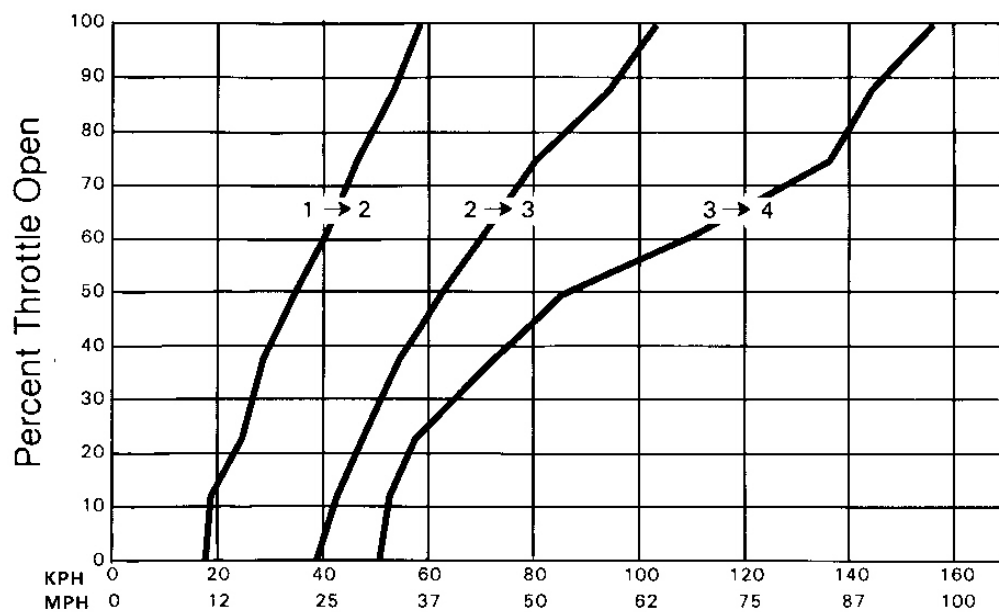


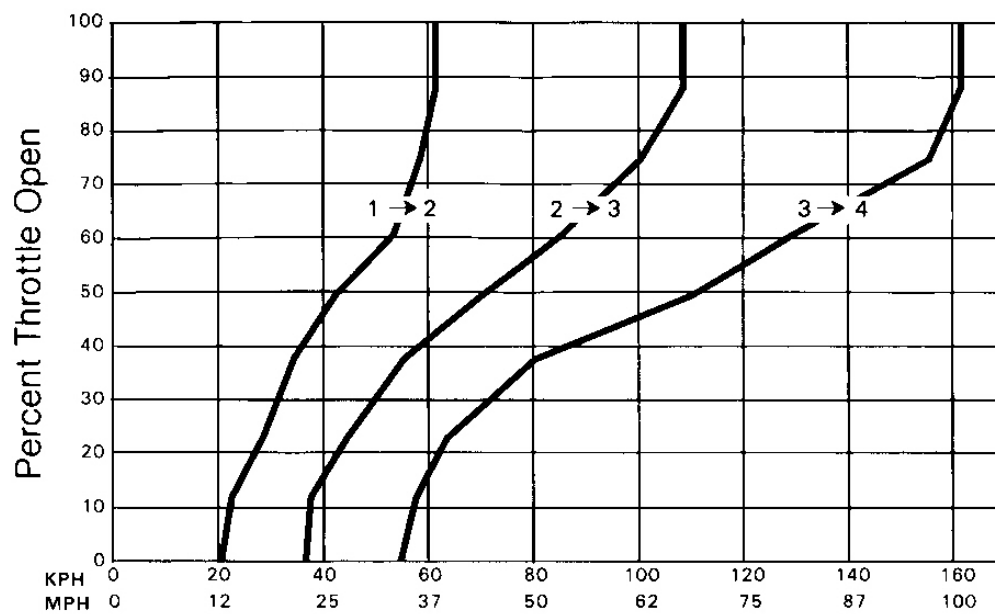
Fig. 7: Downshift Speed Chart (Base Transaxle)
 Courtesy of GENERAL MOTORS CORP.

1991 Saturn SC

1991-94 AUTOMATIC TRANSMISSIONS Saturn - Overhaul



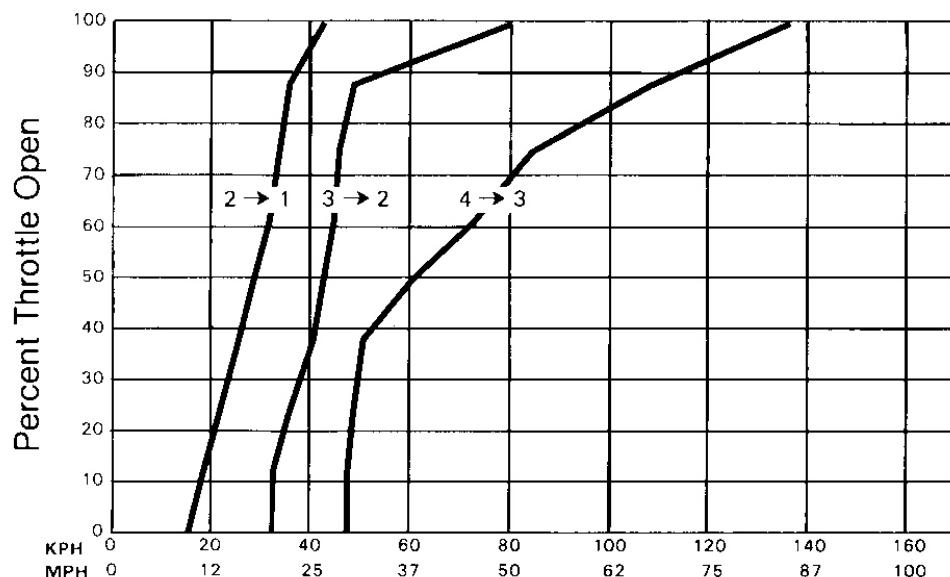
PERFORMANCE TRANSAXLE (NORMAL MODE UPSHIFT)



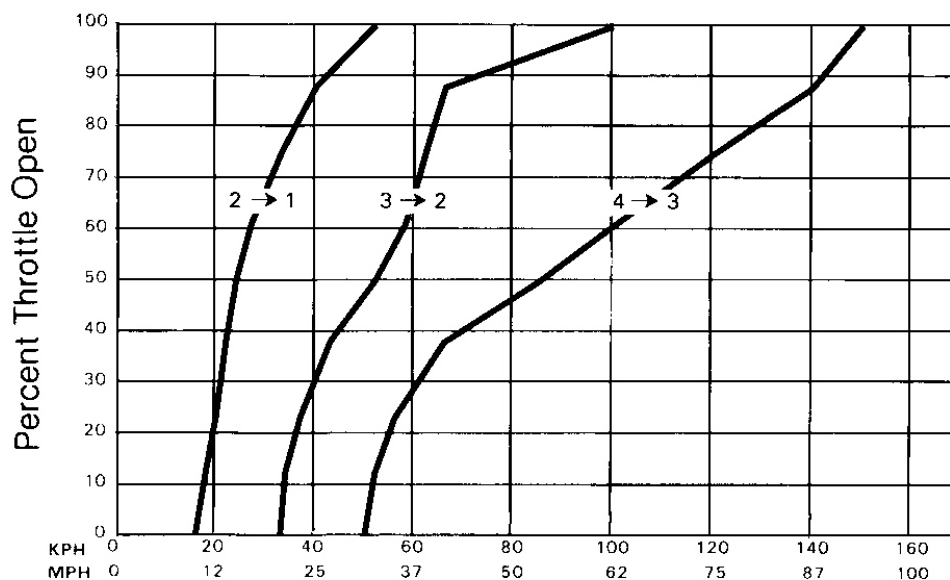
PERFORMANCE TRANSAXLE (PERFORMANCE MODE UPSHIFT)

92D14558

Fig. 8: Upshift Speed Chart (Performance Transaxle)
Courtesy of GENERAL MOTORS CORP.



PERFORMANCE TRANSAXLE (NORMAL MODE DOWNSHIFT)



PERFORMANCE TRANSAXLE (PERFORMANCE MODE DOWNSHIFT)

92E14559

Fig. 9: Downshift Speed Chart (Performance Transaxle)

Courtesy of GENERAL MOTORS CORP.

STALL SPEED TEST

NOTE: Stall speed test information and specifications are not available.

HYDRAULIC PRESSURE TESTS

With Saturn Portable Diagnostic Tool (PDT)

1. Remove transaxle temperature sensor, and install pressure gauge. See **Fig. 10** . Connect PDT to vehicle.
2. With transaxle at operating temperature, turn engine off and ignition to ON position. Go to MENU SELECTION on PDT. Select SPECIAL TEST. On next screen, select LINE PRESSURE.
3. PDT will request that engine be started. Select RUN on PDT; test will begin. PDT will operate engine at 1500 RPM and command line pressure from 58-220 psi (400-1518 kPa) in 15 psi (100 kPa) increments.
4. Ensure actual pressure is within range of that commanded by PDT. See **LINE PRESSURE SPECIFICATIONS** . If line pressure is too high or too low, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING. Using Sealant (21485278) on transaxle temperature sensor threads, install sensor to transaxle case. Clear PCM memory to remove any stored codes.

LINE PRESSURE SPECIFICATIONS

PDT Commanded: psi (kPa)	Actual Pressure: psi (kPa)
58 (400)	58-72 (400-500)
72 (500)	61-80 (425-550)
87 (600)	72-98 (500-675)
102 (702)	87-116 (600-800)
117 (804)	101-134 (700-925)
131 (906)	116-154 (800-1050)
146 (1008)	130-170 (900-1175)
161 (1110)	145-188 (1000-1300)
175 (1212)	159-203 (1100-1400)
191 (1314)	174-218 (1200-1500)
205 (1416)	188-240 (1300-1650)
220 (1518)	218-268 (1500-1850)

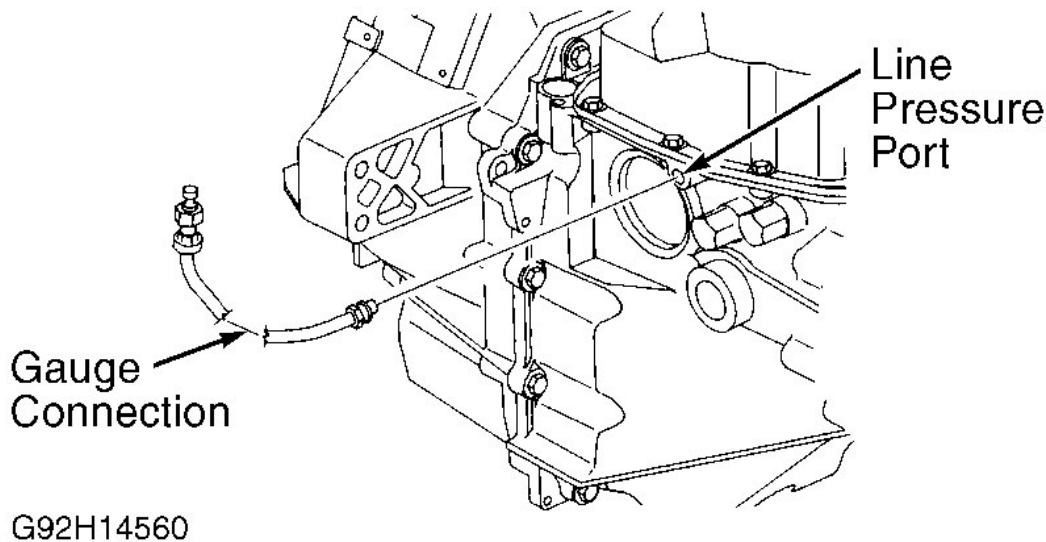


Fig. 10: Locating Line Pressure Port
 Courtesy of GENERAL MOTORS CORP.

Without Saturn Portable Diagnostic Tool (PDT)

1. Remove temperature sensor. Connect an oil pressure gauge to line pressure test port (temperature sensor connection). See **Fig. 10** . With engine idling in Park and transaxle at operating temperature, line pressure should be 58-72 psi (400-500 kPa).
2. Remove line actuator fuse (TRS LP). With engine idling in Park, line pressure should be 218-245 psi (1500-1690 kPa). If line pressure is too high or too low, see **SYMPTOM DIAGNOSIS** under TROUBLE SHOOTING. Using Sealant (21485278) on transaxle temperature sensor threads, install sensor to transaxle case. Clear PCM memory to remove any stored codes.

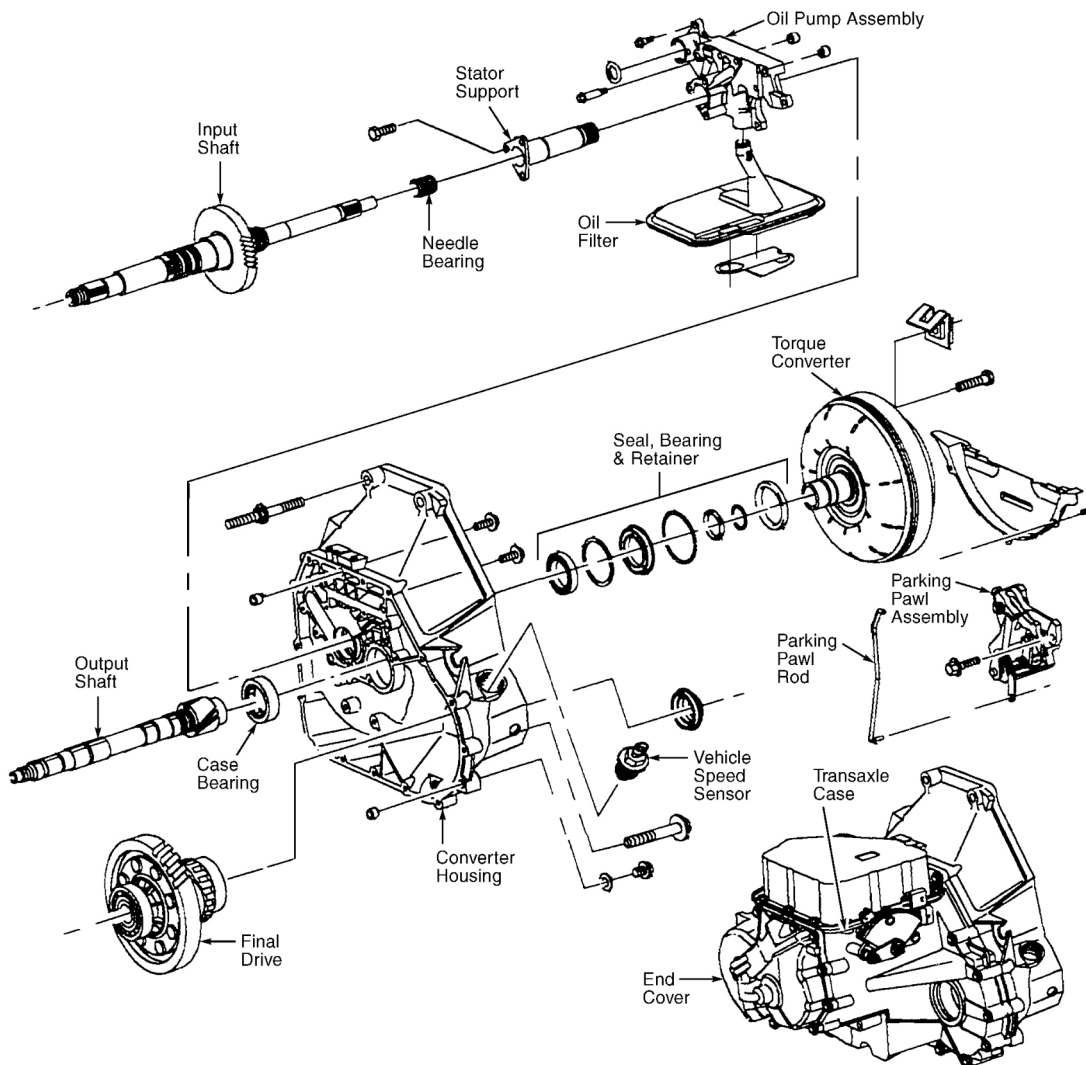
REMOVAL & INSTALLATION

See **TRANSMISSION REMOVAL & INSTALLATION - A/T** article in TRANSMISSION SERVICING.

TRANSAXLE DISASSEMBLY

1. Thoroughly clean transaxle exterior. Drain fluid, and remove torque converter. Remove 2 bolts behind torque converter. Remove pressure filter, temperature sensor, turbine speed sensor, vehicle speed sensor and dipstick tube. See **Fig. 11** .
2. Remove valve body pan and valve body assembly. See **Fig. 12** . Remove 2nd/reverse fork bolt. Remove manual detent lever assembly. See **Fig. 13** . Remove end cover. See **Fig. 14** .
3. Using Input Shaft Holding Tool (SA9119T), hold input shaft and remove input shaft lock nut. See **Fig. 15** . Remove tool. Lock output shaft using parking pawl. Remove output shaft lock nut.

4. Remove 1st clutch housing and 1st drive gear from input shaft. See **Fig. 16** . Remove 1st driven gear and sprag clutch from output shaft. See **Fig. 17** . Remove 2nd/reverse servo assembly. Remove 2nd/reverse clutch fork. See **Fig. 18** .
5. Remove converter housing bolts. If necessary, pry converter housing from case. See **Fig. 19** . Rotate, and at same time, pull input shaft, output shaft and final drive assembly from case. See **Fig. 20** .
6. Remove parking pawl assembly and oil pump assembly from case. See **Fig. 11** , **Fig. 21** and **Fig. 22** . Remove case bearings. Remove reverse idler gear assembly. See **Fig. 23** . Check lube relief valve. If valve is not damaged, **DO NOT** remove. If necessary, use Remover (SA9103E) to remove lube relief valve. See **Fig. 24** .



G92J14562

Fig. 11: Exploded View Of Transaxle Converter Housing & Components
 Courtesy of GENERAL MOTORS CORP.

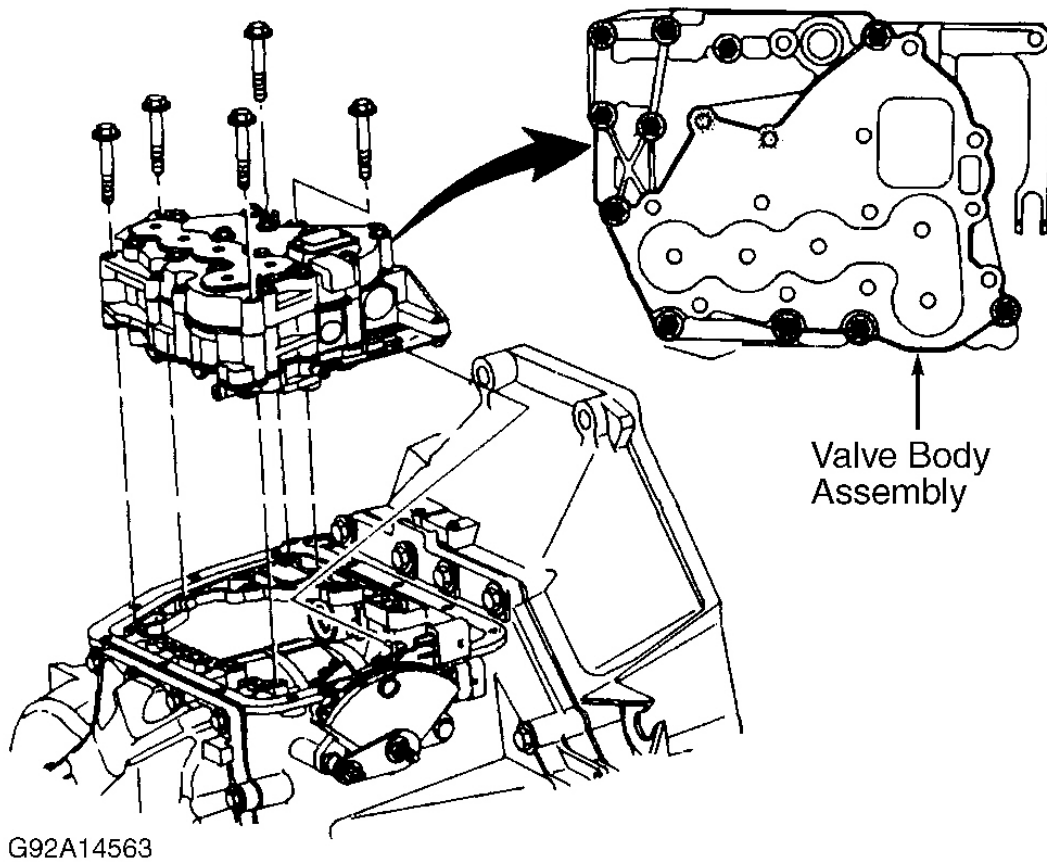


Fig. 12: Removing Valve Body Assembly
Courtesy of GENERAL MOTORS CORP.

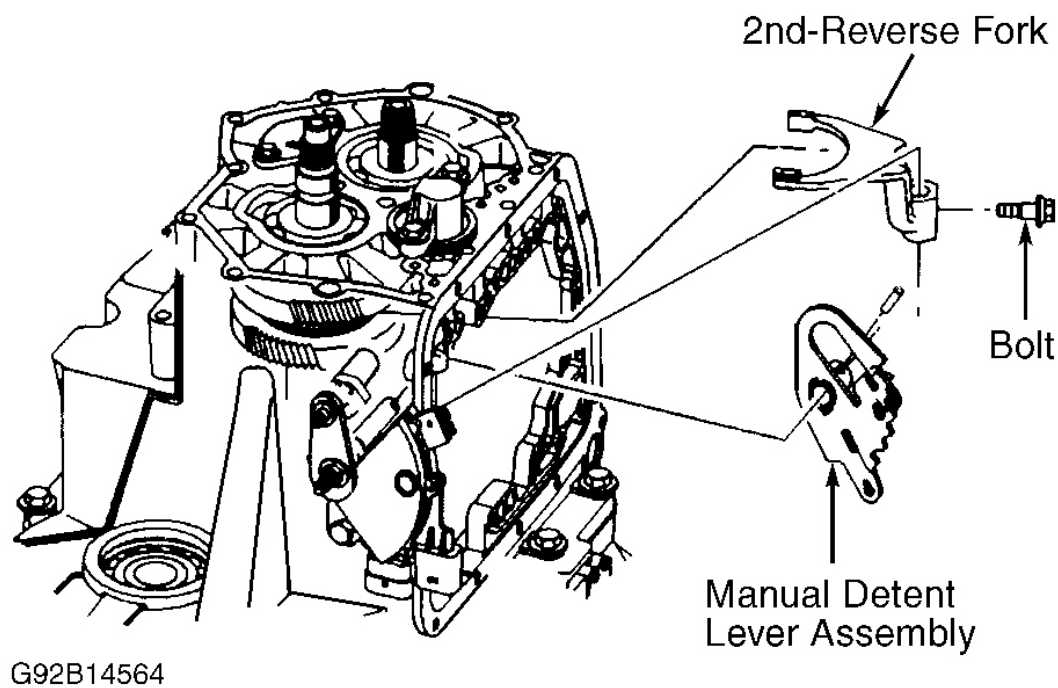


Fig. 13: Removing Manual Detent Lever & Fork Bolt
Courtesy of GENERAL MOTORS CORP.

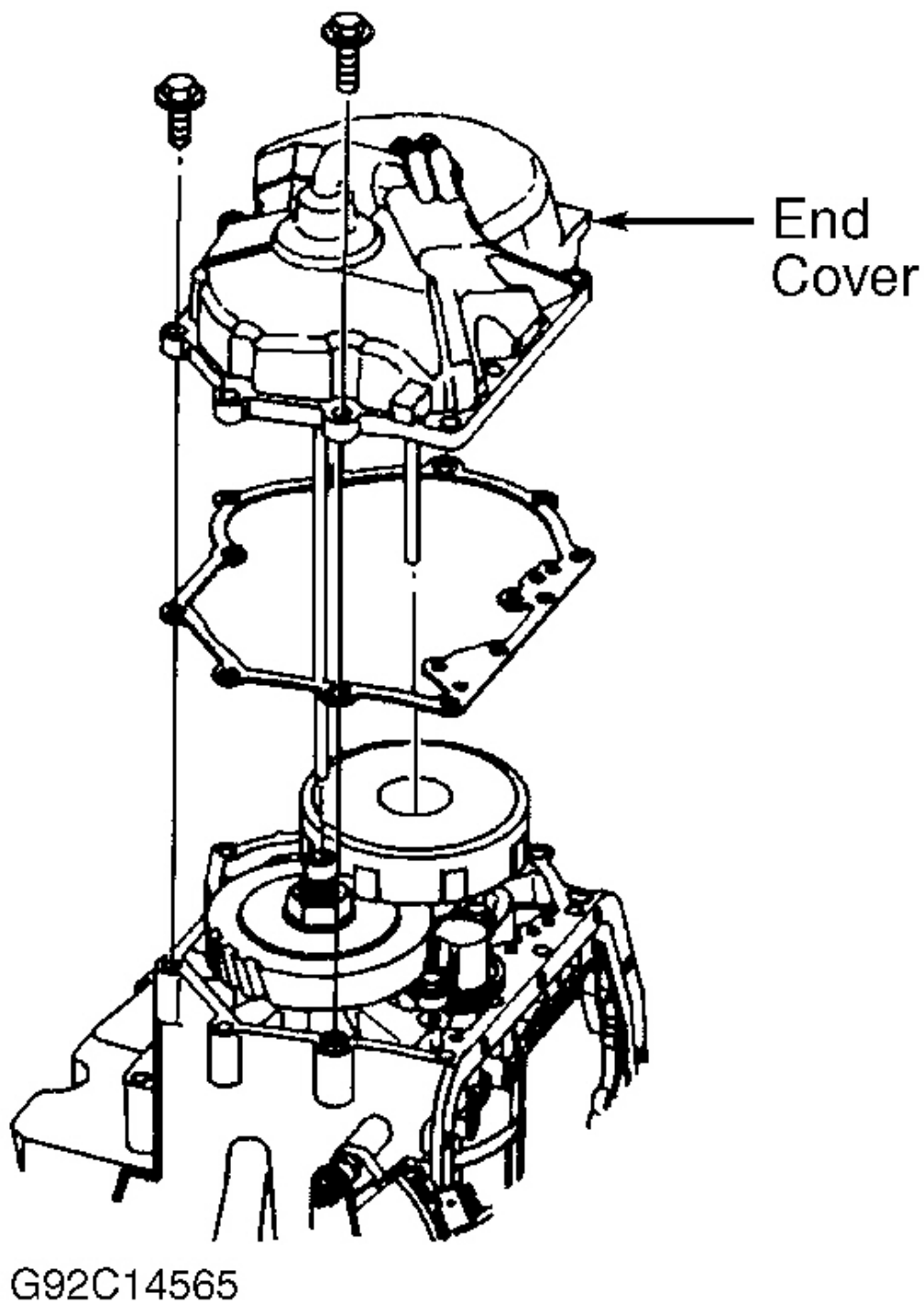
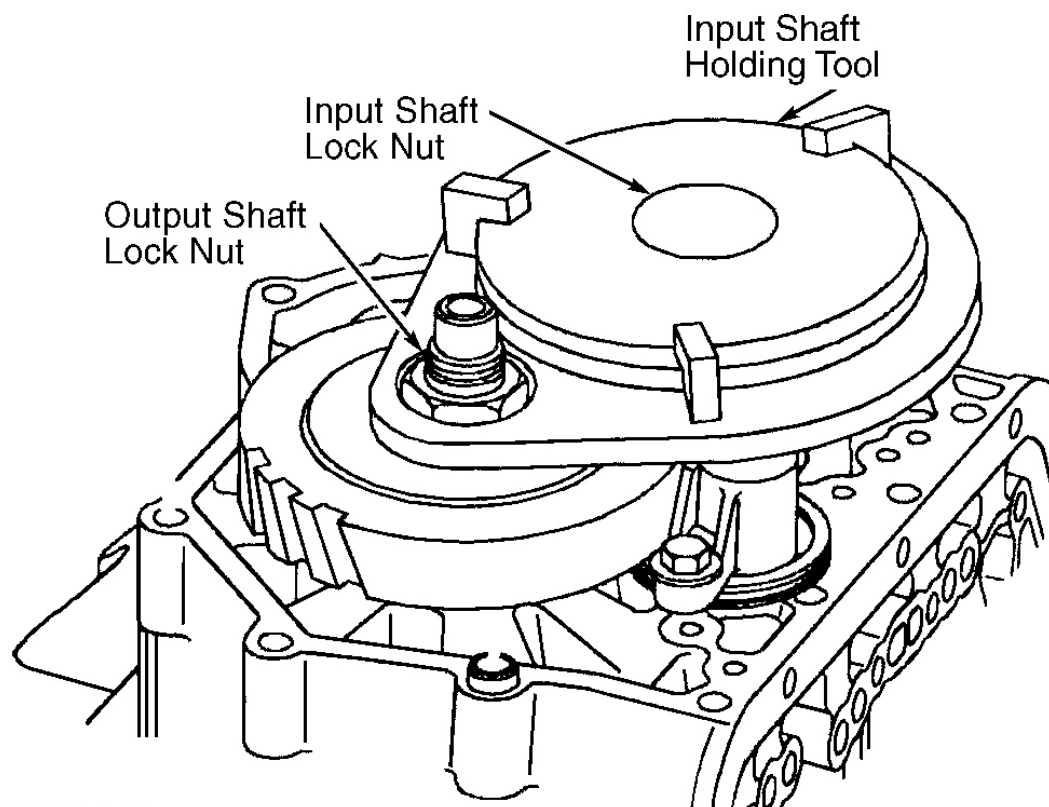


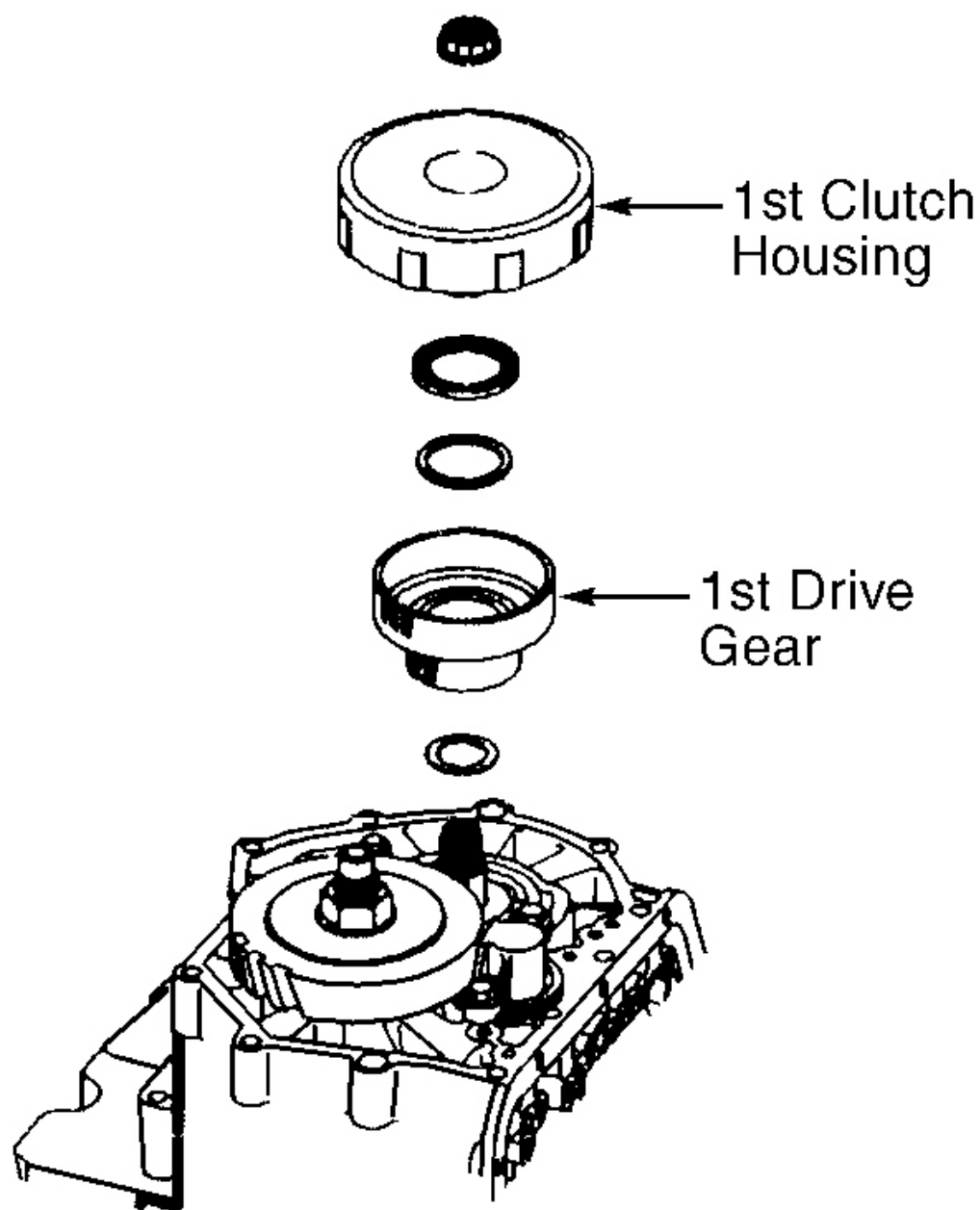
Fig. 14: Removing & Installing End Cover

Courtesy of GENERAL MOTORS CORP.



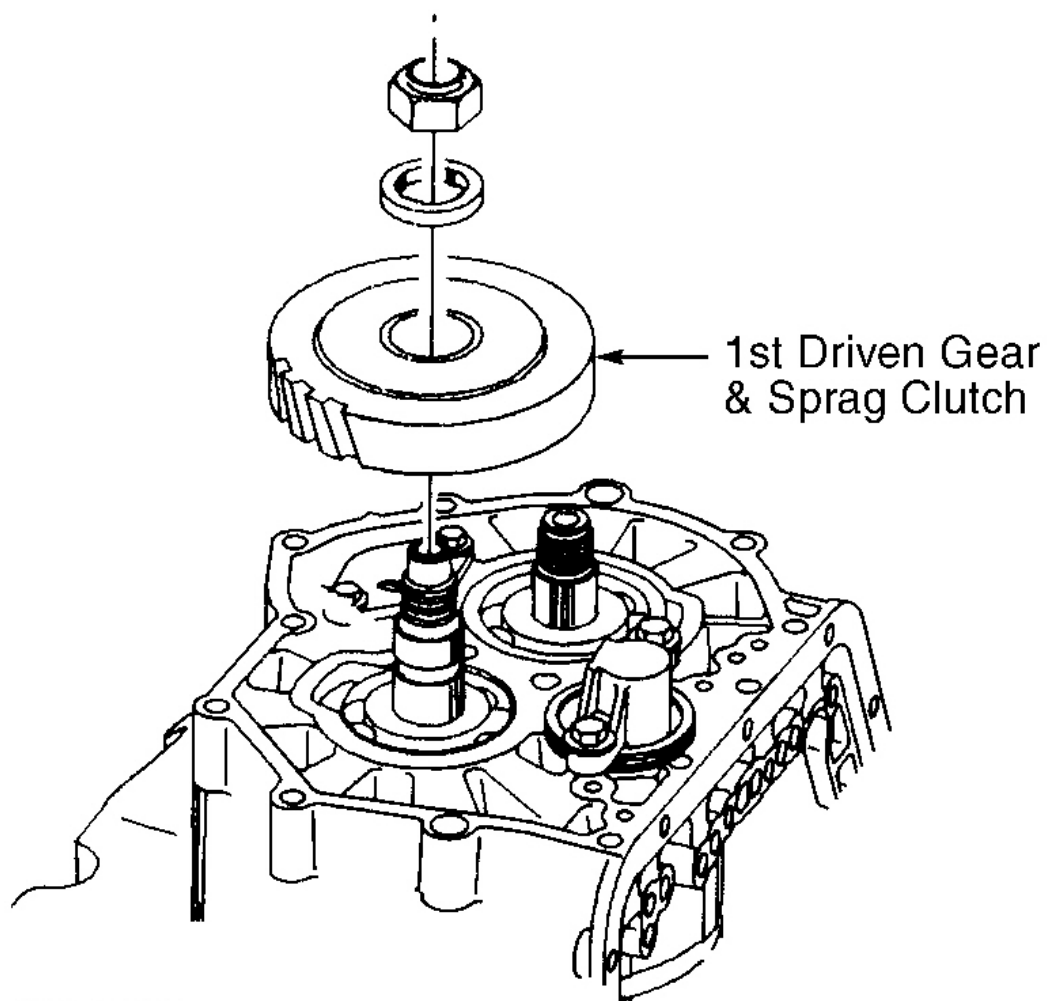
G92D14566

Fig. 15: Locking Input Shaft With Holding Tool
Courtesy of GENERAL MOTORS CORP.



G92E14567

Fig. 16: Removing 1st Clutch Housing & 1st Drive Gear
Courtesy of GENERAL MOTORS CORP.



G92F14568

Fig. 17: Removing & Installing Driven Gear & Sprag Clutch
Courtesy of GENERAL MOTORS CORP.

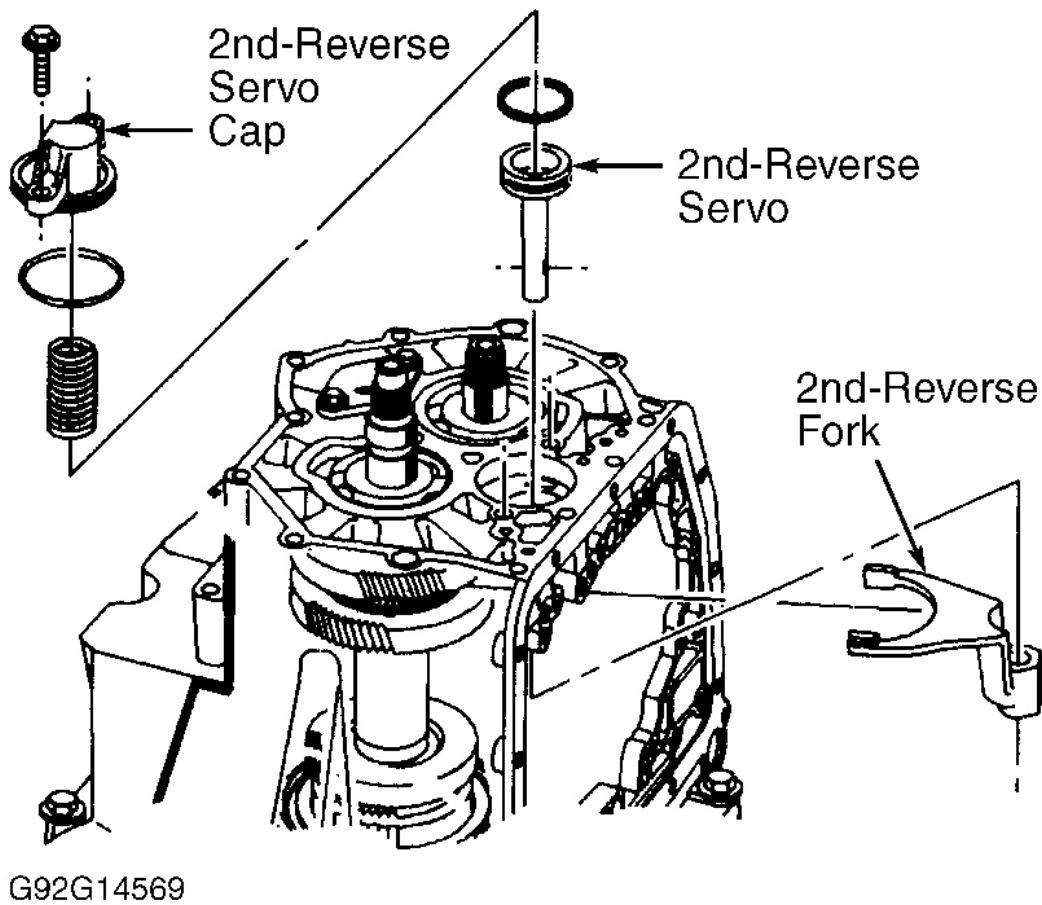


Fig. 18: Removing & Installing 2nd/Reverse Servo & Fork Assembly
Courtesy of GENERAL MOTORS CORP.

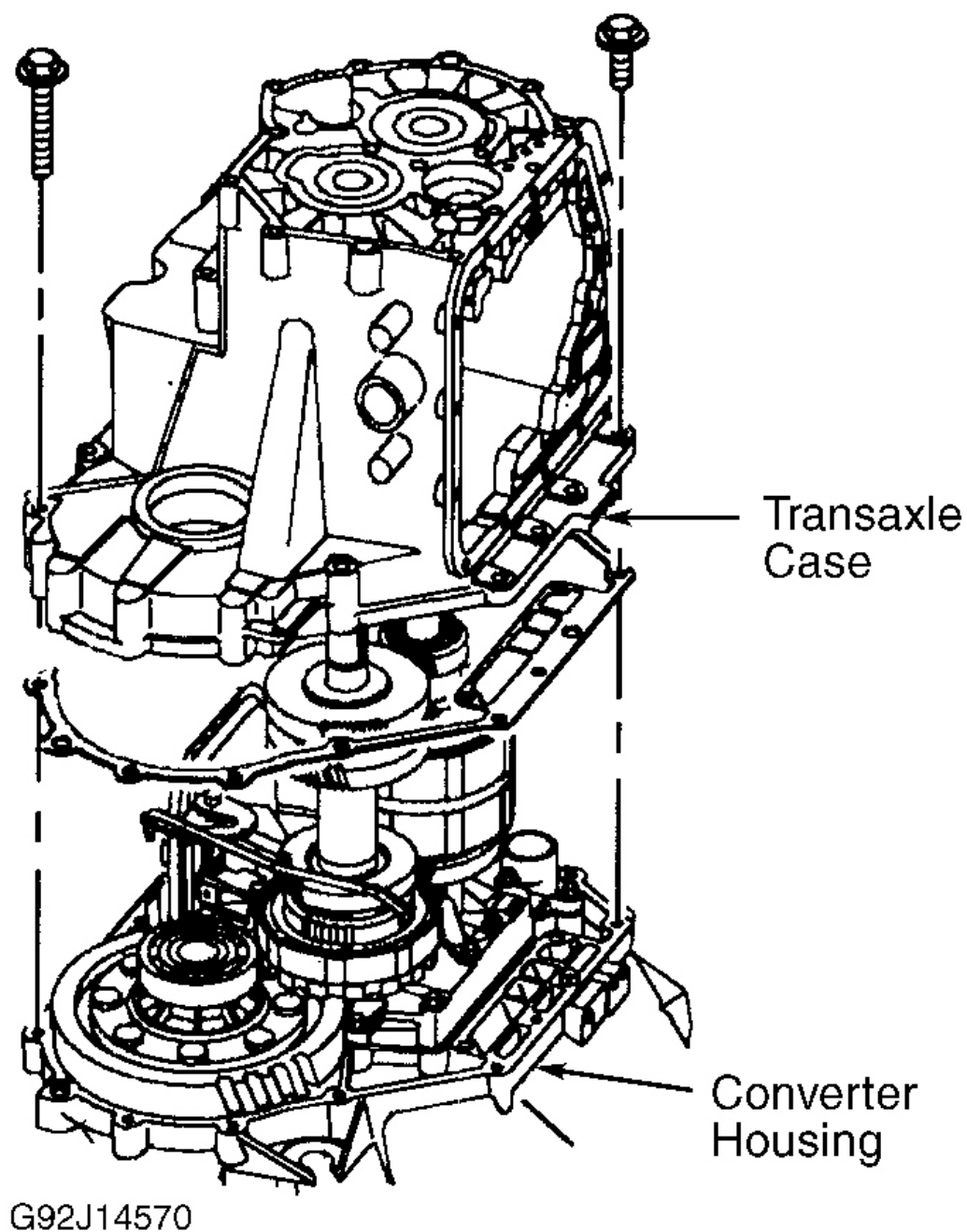
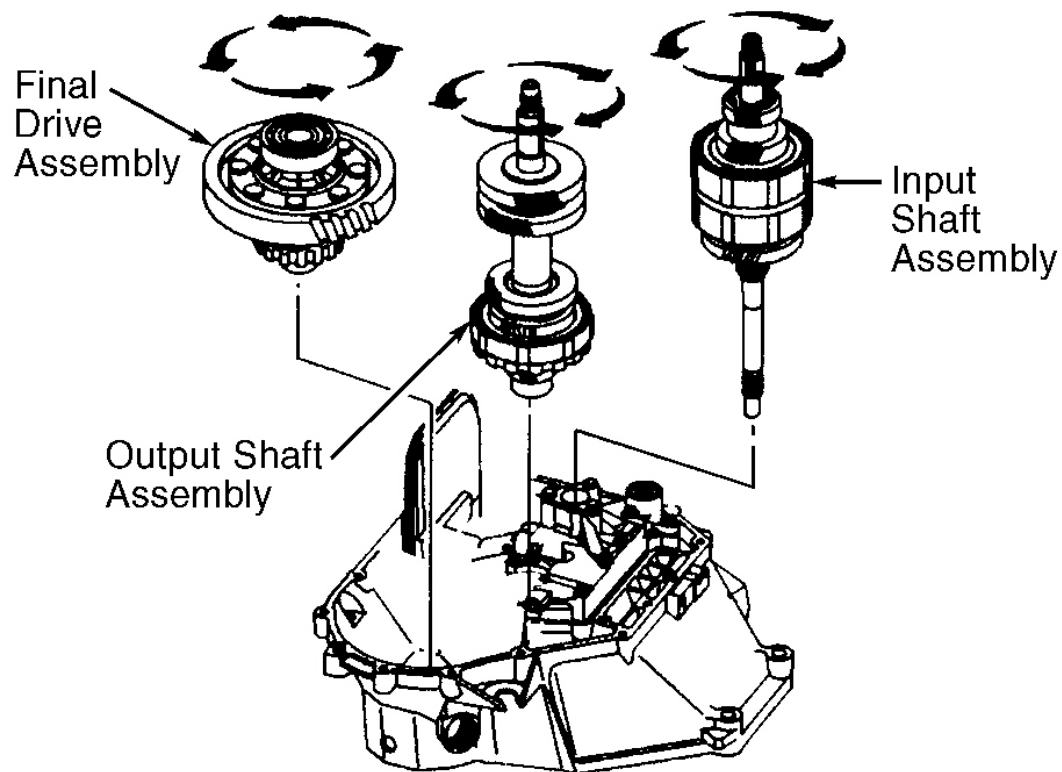
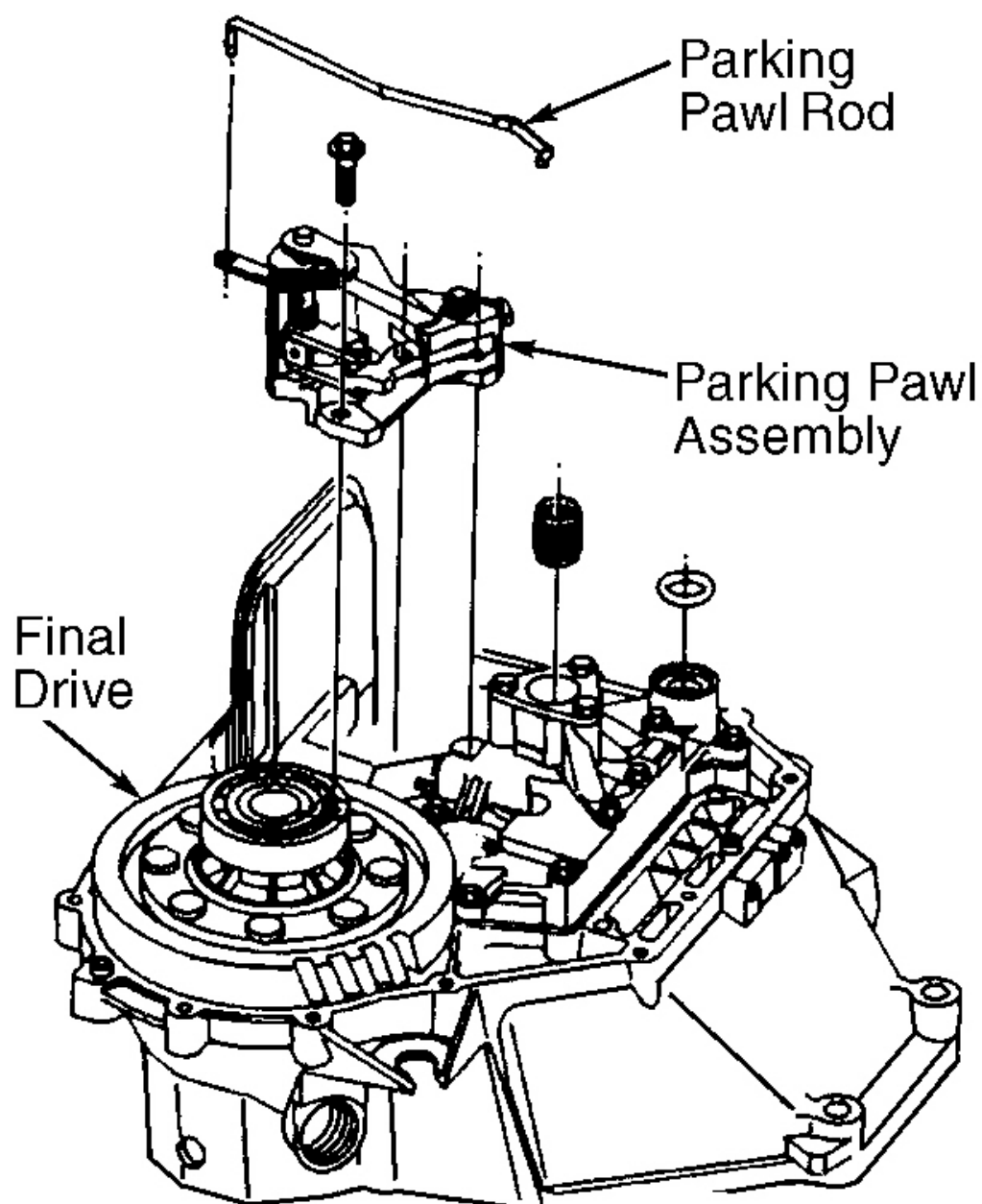


Fig. 19: Removing Transaxle Case From Converter Housing
Courtesy of GENERAL MOTORS CORP.



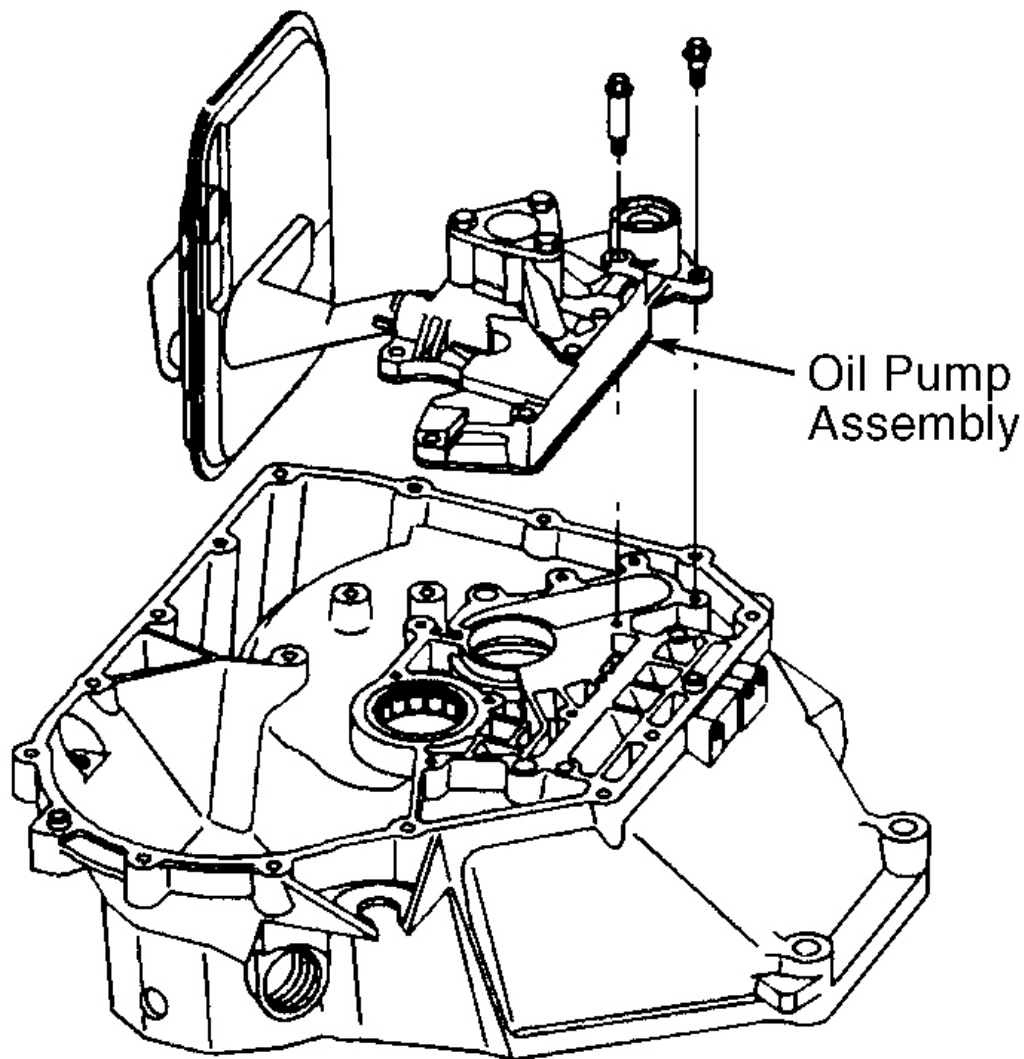
G92A14571

Fig. 20: Removing Input & Output Shafts & Final Drive Assembly
Courtesy of GENERAL MOTORS CORP.



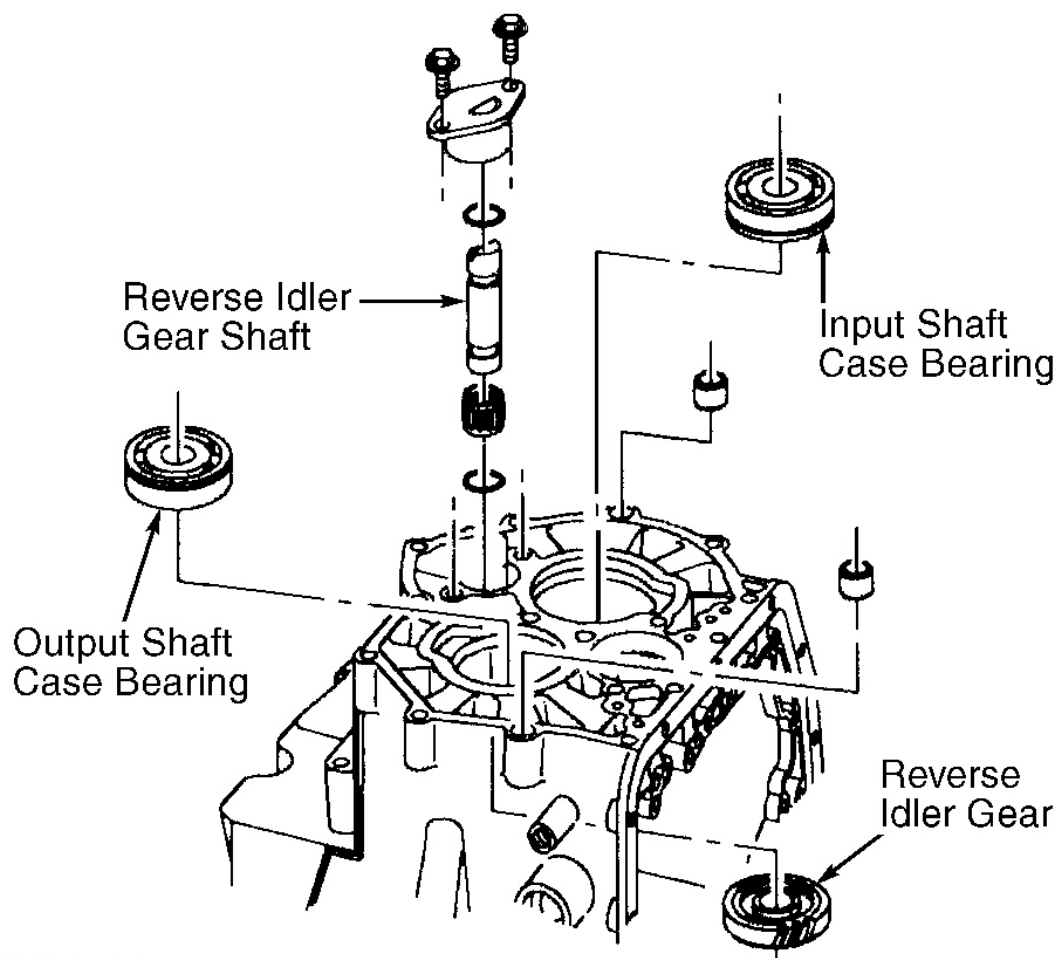
G92B14572

Fig. 21: Removing Parking Pawl Assembly
 Courtesy of GENERAL MOTORS CORP.



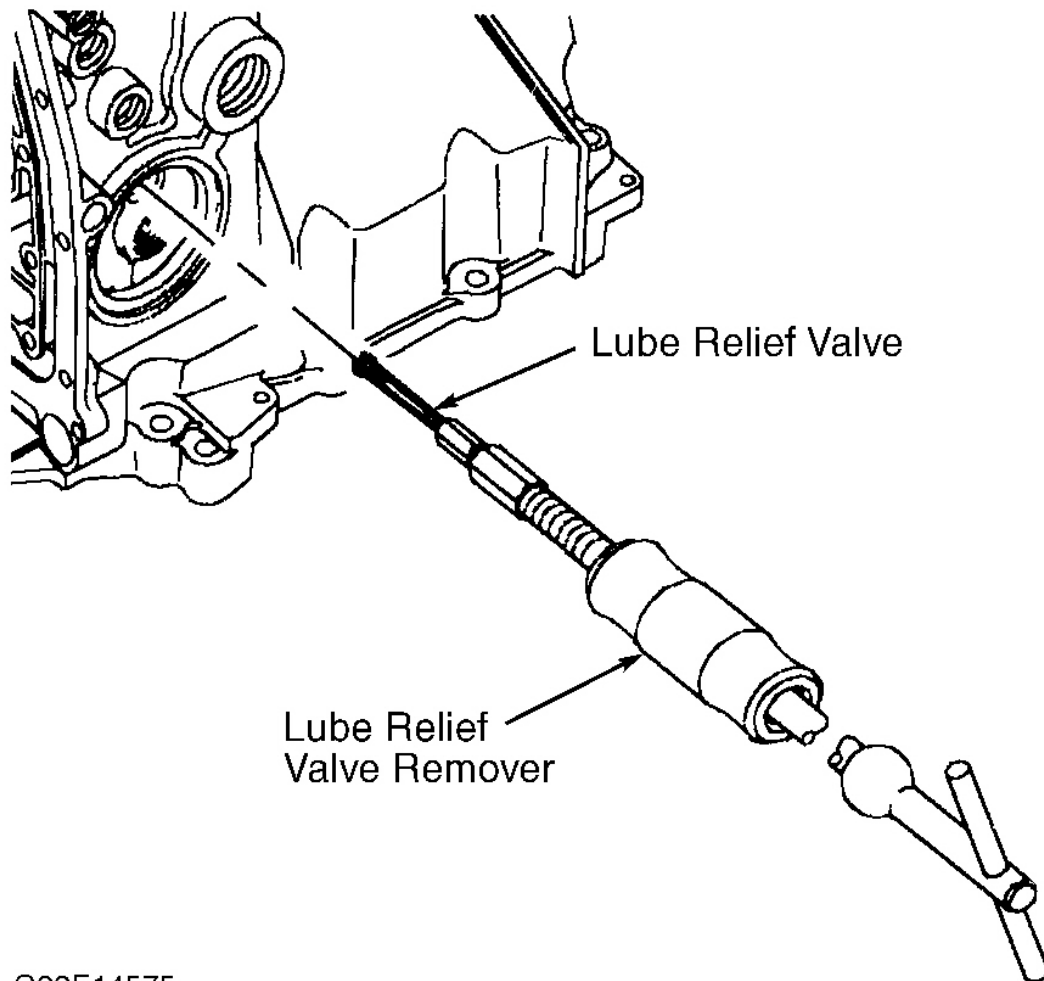
G92C14573

Fig. 22: Removing & Installing Oil Pump Assembly
Courtesy of GENERAL MOTORS CORP.



G92D14574

Fig. 23: Input/Output Shaft Bearings & Idler Gear Assembly
Courtesy of GENERAL MOTORS CORP.



G92E14575

Fig. 24: Removing Lube Relief Valve
Courtesy of GENERAL MOTORS CORP.

COMPONENT DISASSEMBLY & REASSEMBLY

NOTE: Exploded views of internal components, thrust washer and bearing locations can be found in [Fig. 11](#) , [Fig. 23](#) , [Fig. 38](#) and [Fig. 52](#) .

TRANSAXLE CASE

Cleaning & Inspection

Clean transaxle case thoroughly, and air dry. Inspect transaxle case for damage to bearing seats, snap ring grooves and interconnected or damaged fluid passages and servo bores. See [Fig. 4](#) and [Fig. 11](#) . Inspect case for

stripped threads in bolt holes and casting porosity. Repair or replace case if necessary.

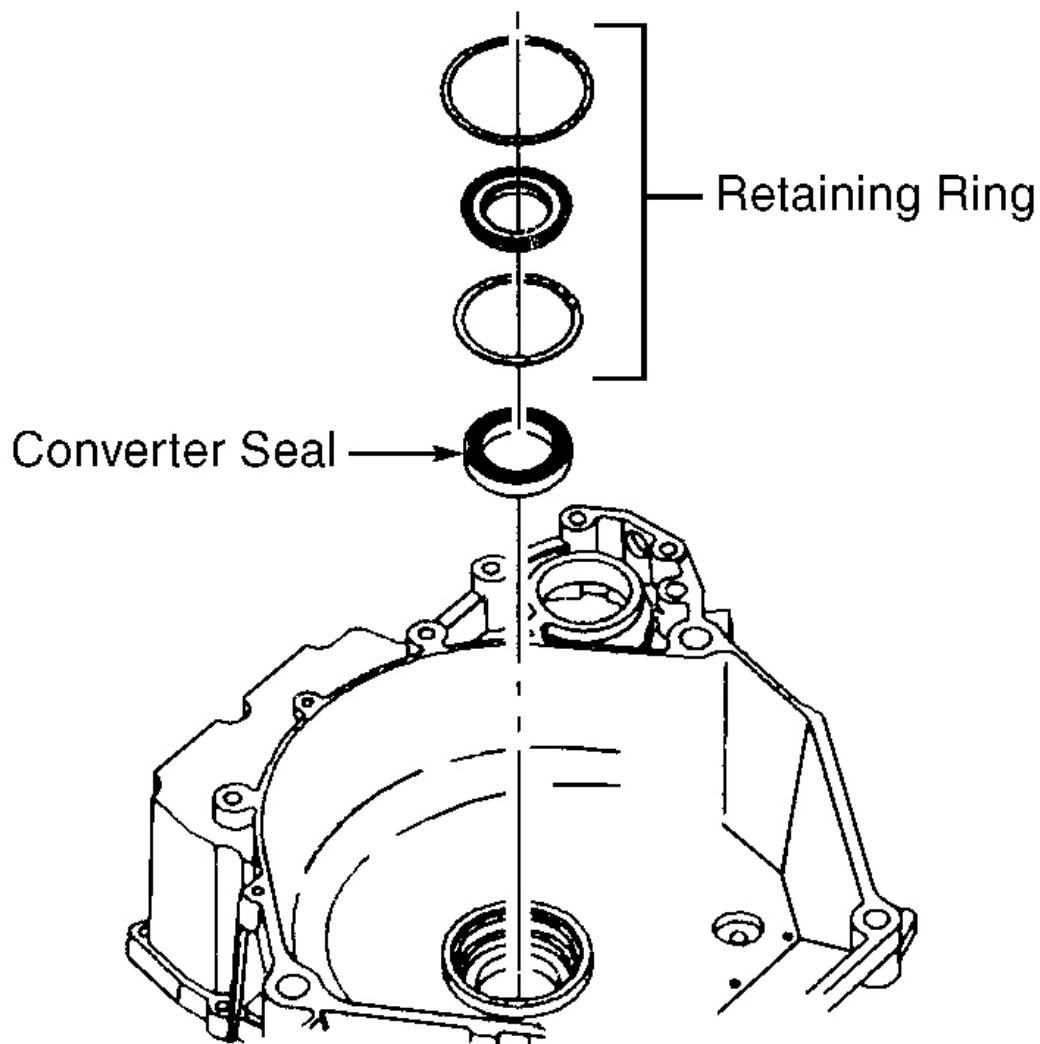
NOTE: DO NOT remove bearings and seals unless replacement is necessary.

Bearing & Seals

1. Using Bearing Puller (SA91113T) and Slide Hammer (SA9173G), remove converter retaining ring, seal and bearing. See **Fig. 25** and **Fig. 26** . Remove axle shaft seals.
2. Replace all worn or damaged parts. Press converter bearing into case. Ensure bearing is flush or below converter housing surface. Install new output shaft and converter seals.
3. Install output and input shaft bearing snap rings into transaxle case. Ensure output shaft bearing snap ring groove faces up and input shaft bearing snap ring groove faces down. Install input and output shaft bearings to transaxle case. See **Fig. 23** .

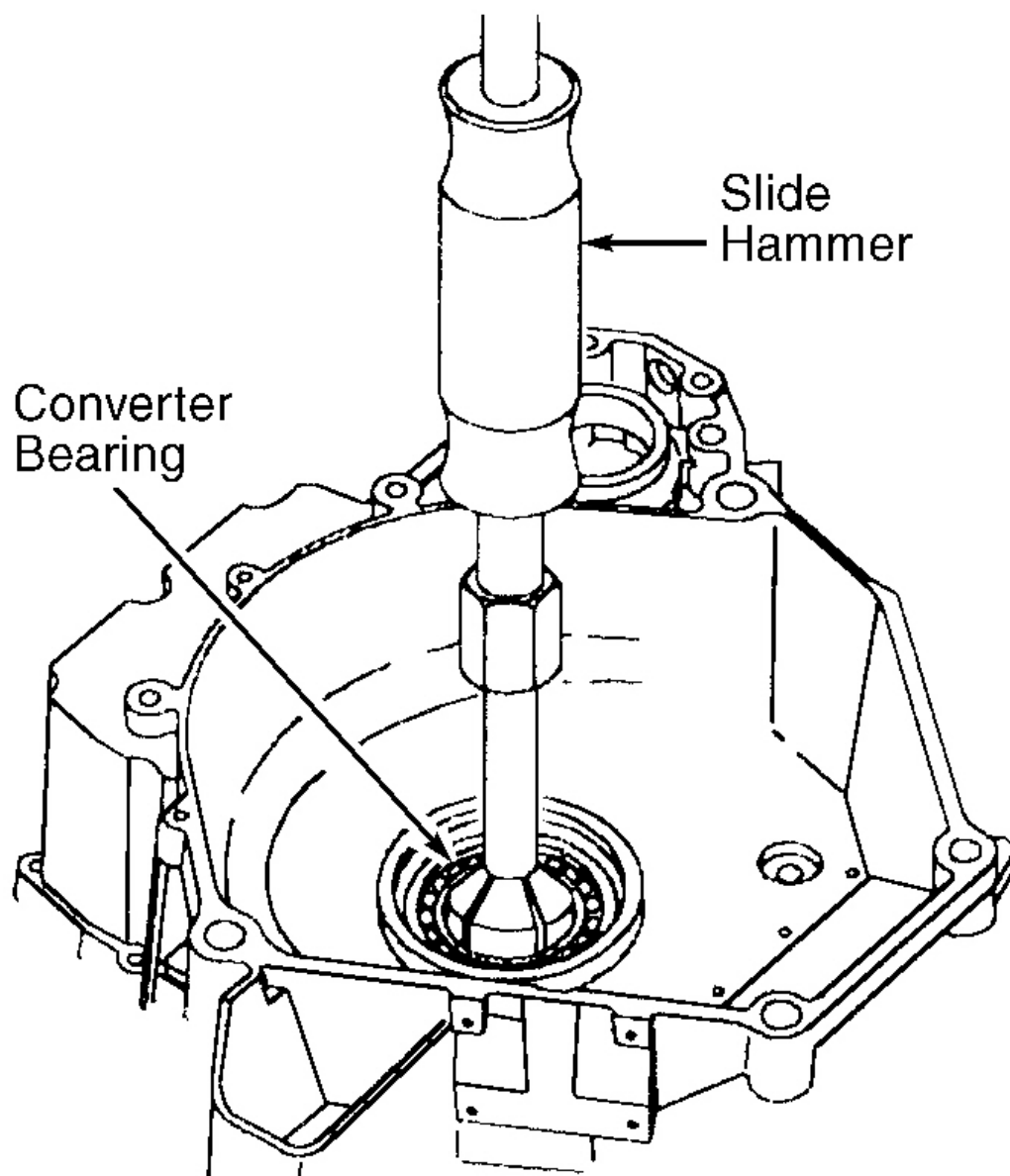
Parking Pawl Assembly

Disassembly and reassembly information is not available.



G92F14576

Fig. 25: Removing Converter Seal & Retaining Ring
Courtesy of GENERAL MOTORS CORP.



G92G14577

Fig. 26: Removing Converter Bearing
Courtesy of GENERAL MOTORS CORP.

END COVER

Disassembly & Reassembly

1. Remove input and output shaft oil tubes and hubs. Separate oil tubes from hubs. Inspect all parts for signs of wear and damage. See **Fig. 27** and **Fig. 28**.
2. Ensure hub seal rings are not rolled. See **Fig. 29**. If necessary, remove seals from hub. Lubricate new seals with ATF prior to installation. Using Seal Sizer Tools (SA9136T-1, SA9136T-4, SA9136T-2 and SA9143T), install and size seals. See **Fig. 30** and **Fig. 31**.
3. Install input oil tube to hub. See **Fig. 32**. Ensure roll pin aligns with slot in hub. Install gasket to hub. Lube seal, and install it in end cover. Tighten hub mounting bolts to 106 INCH lbs. (12 N.m). Install output shaft to output shaft hub. Ensure roll pin aligns with slot in hub. Lube seal, and install it in transaxle case. See **Fig. 27**.

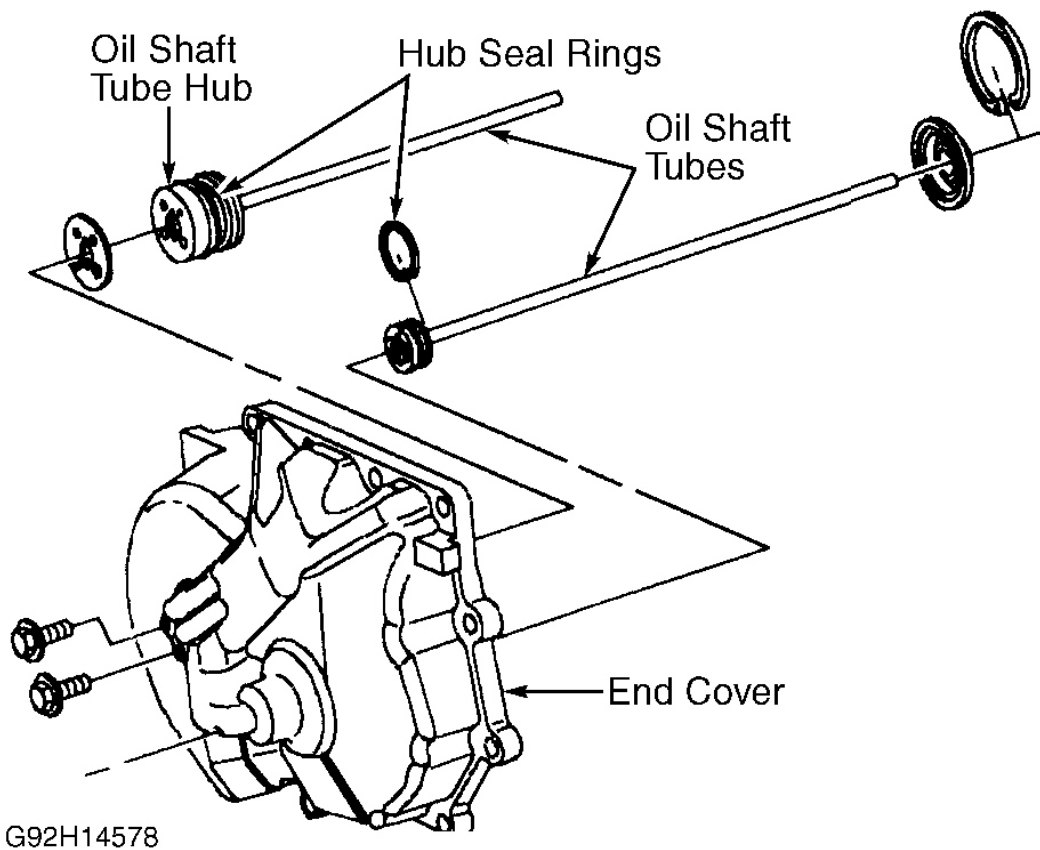


Fig. 27: Removing & Installing Oil Tubes from End Cover
Courtesy of GENERAL MOTORS CORP.

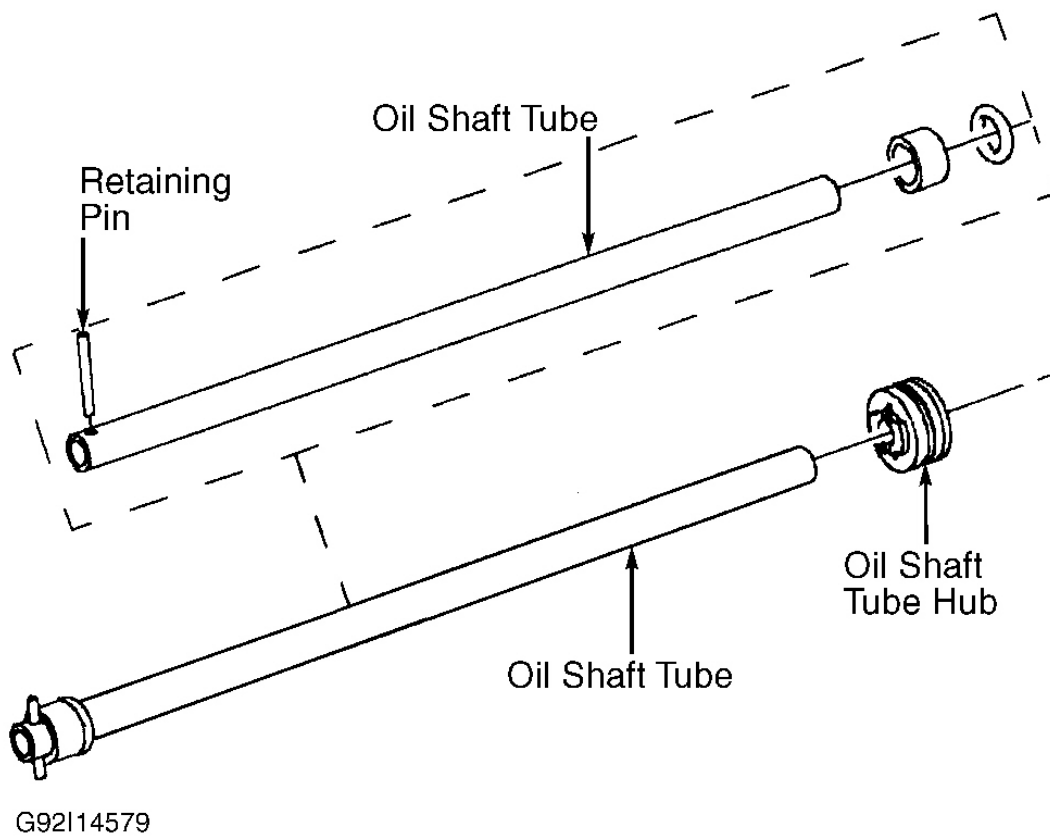
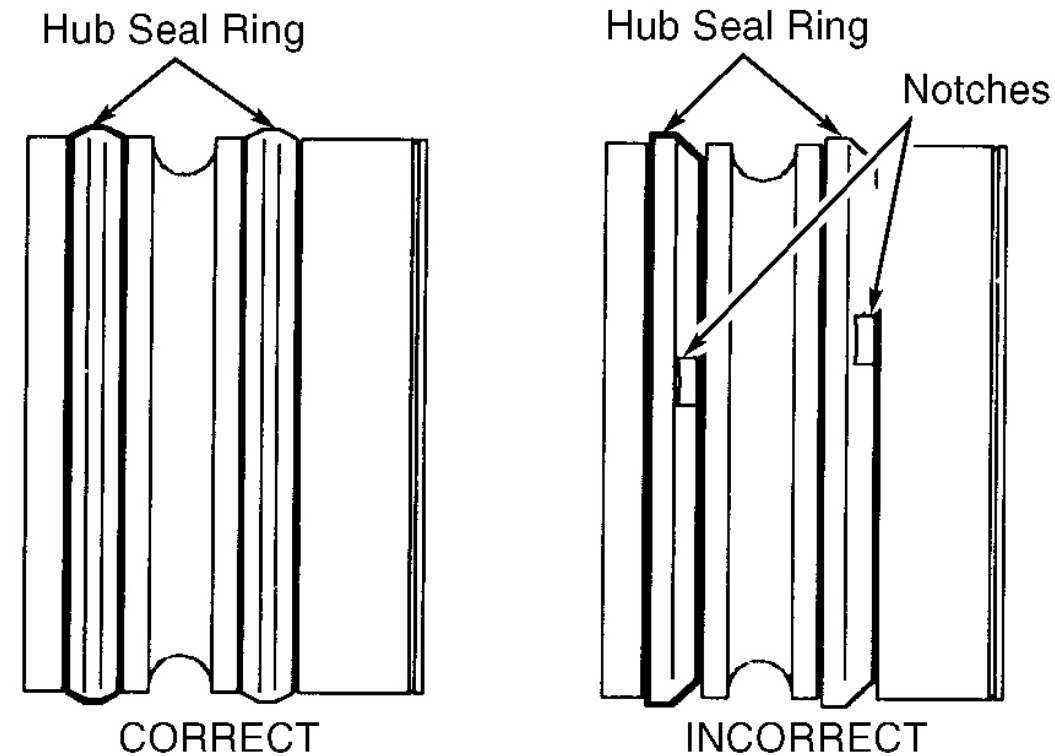


Fig. 28: Removing & Installing Oil Tubes & Hubs
 Courtesy of GENERAL MOTORS CORP.



G92B14580

Fig. 29: Checking Hub Seal Rings
Courtesy of GENERAL MOTORS CORP.

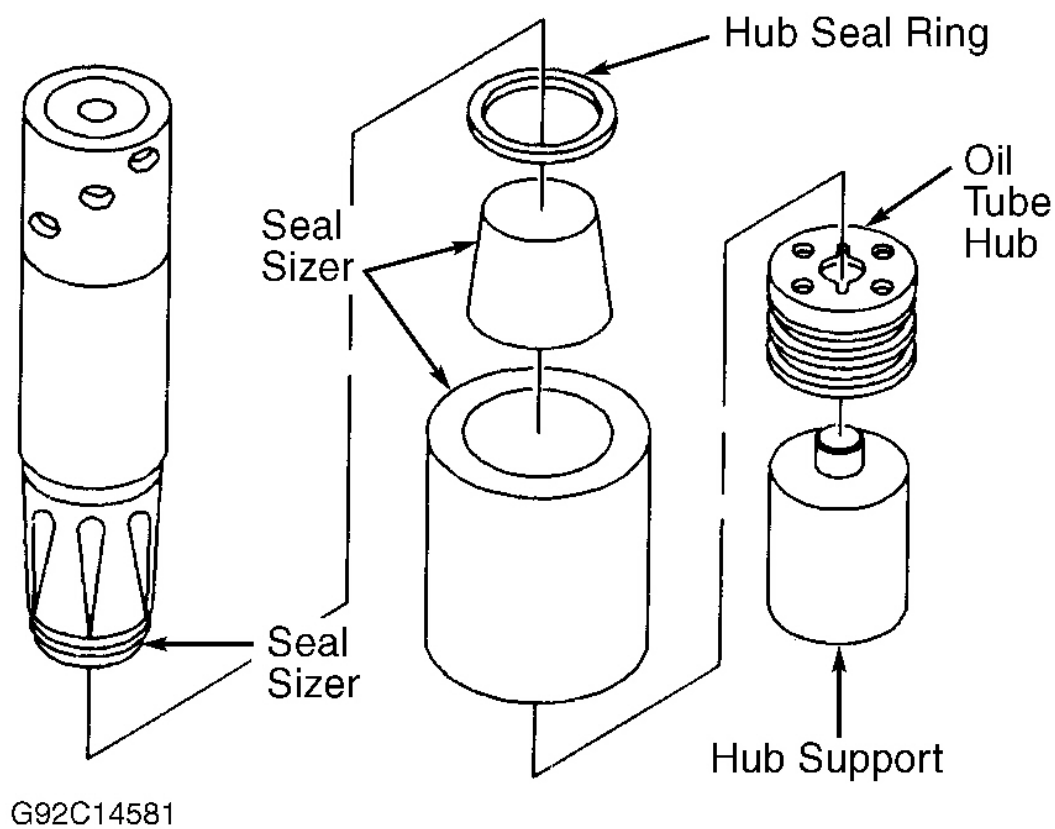
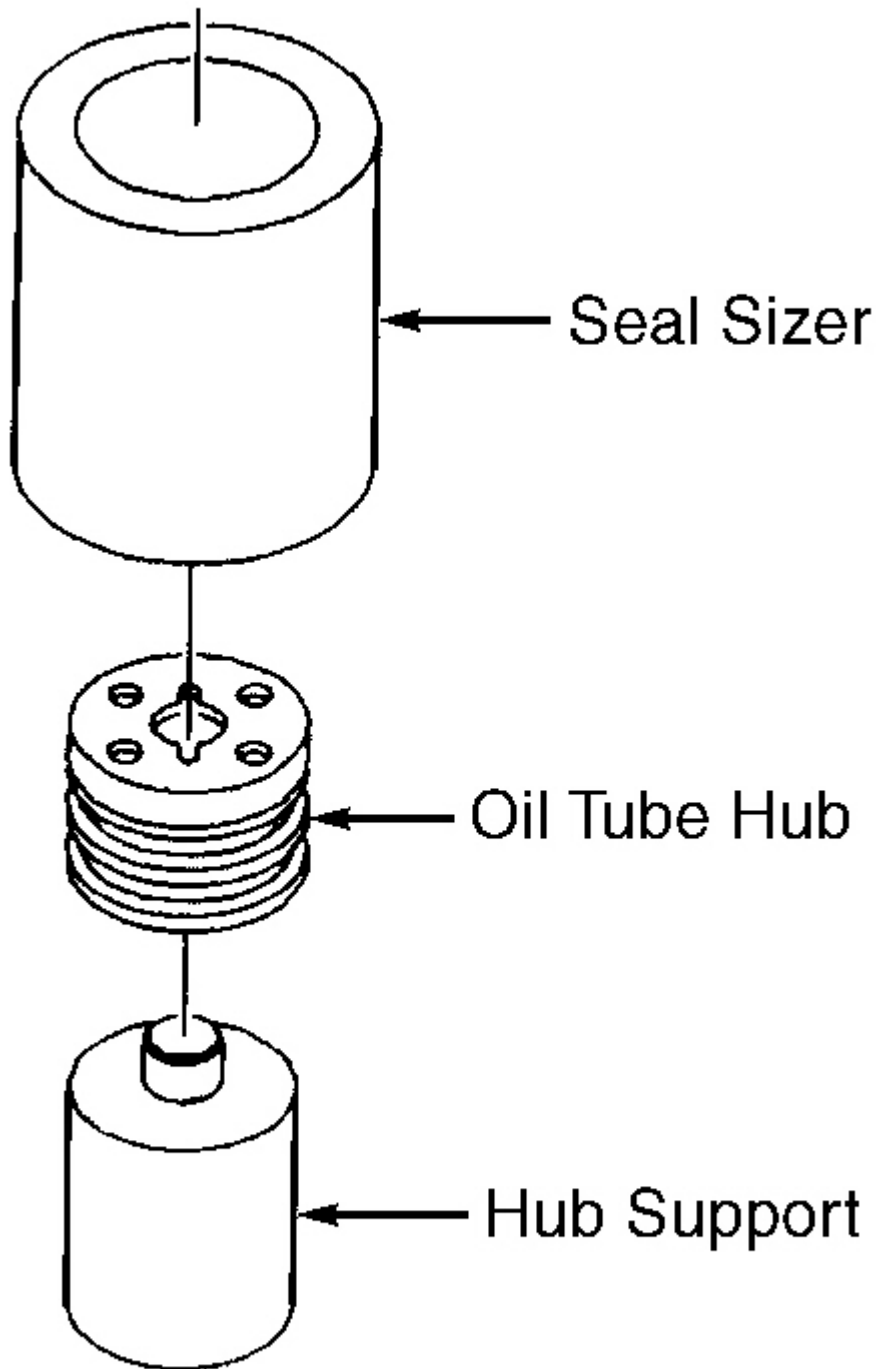


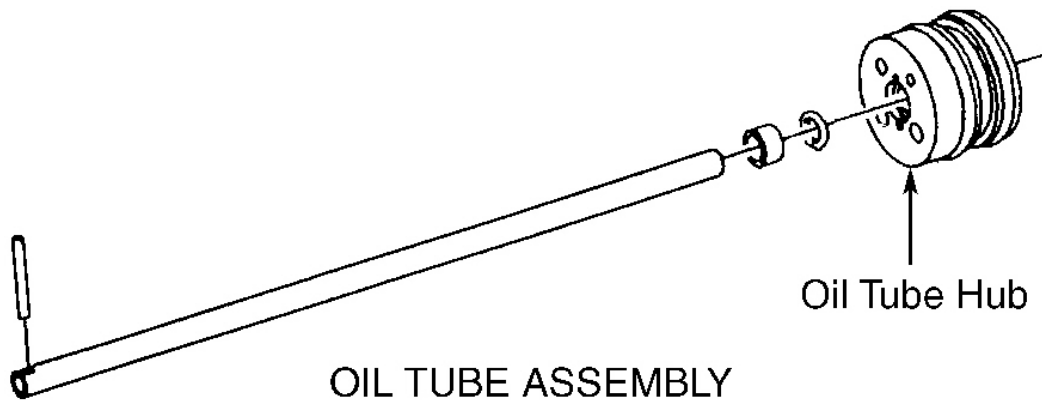
Fig. 30: Installing Seal Rings To Hub
Courtesy of GENERAL MOTORS CORP.



G92D14582

Fig. 31: Sizing Hub Seals

Courtesy of GENERAL MOTORS CORP.



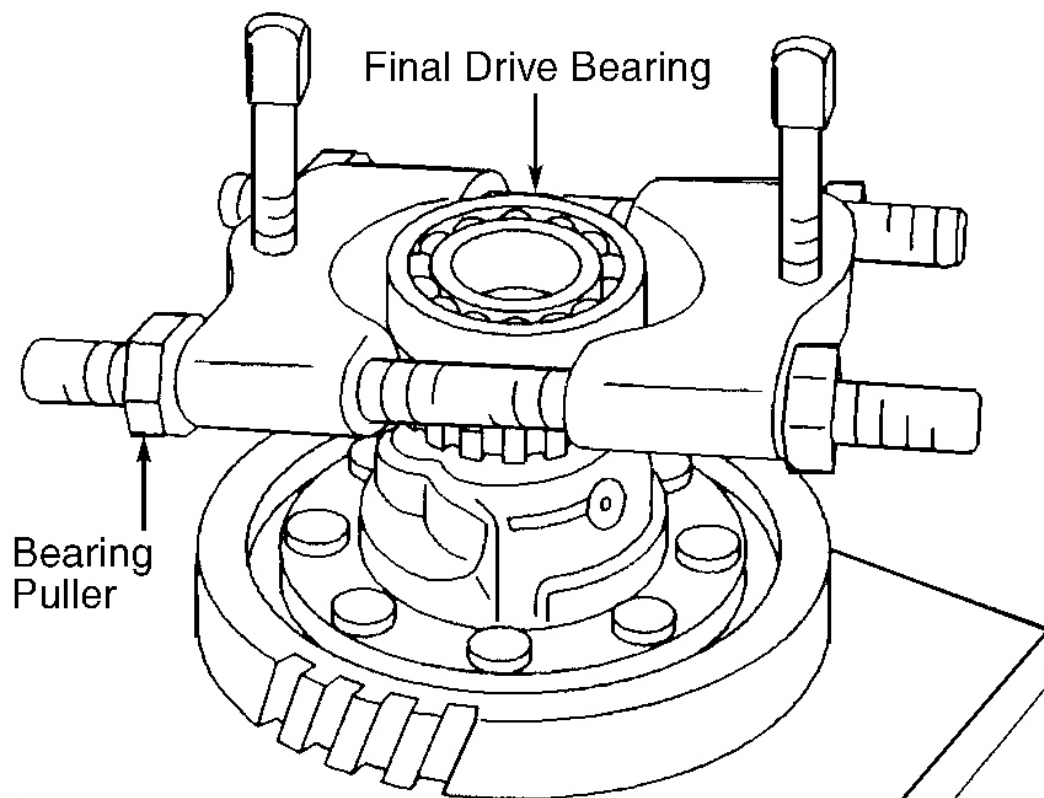
G92E14583

Fig. 32: Installing Oil Tube To Hub

Courtesy of GENERAL MOTORS CORP.

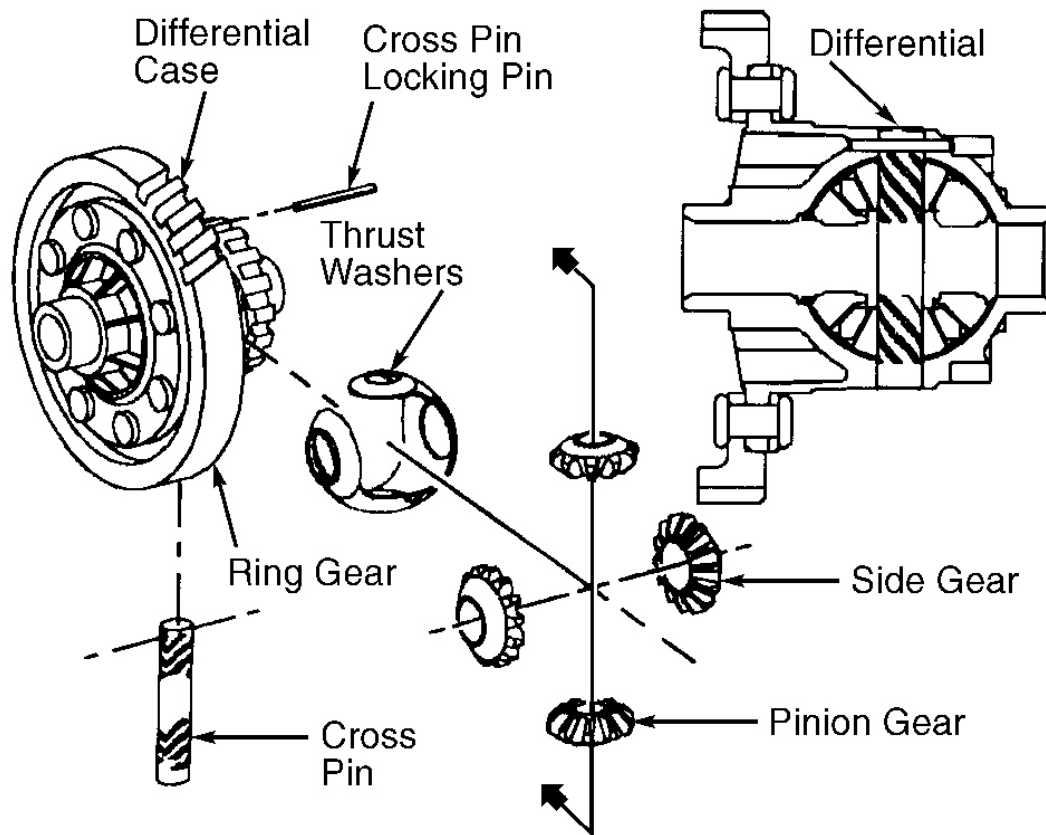
FINAL DRIVE ASSEMBLY**Disassembly & Inspection**

1. Inspect final drive gear for damaged teeth and worn bearing surfaces. Inspect thrust bearings for wear and damage. If necessary, remove differential side bearings. See **Fig. 33** . Check differential pinion gears for excessive backlash. Backlash specification is not available.
2. If necessary, replace thrust washers. Using a pin punch, drive cross pin locking pin from case. See **Fig. 34** . Remove pinion shaft, pinion and side gears, and thrust washers. Inspect all parts for damage and abnormal wear.



G92F14584

Fig. 33: Removing Differential Side Bearing
Courtesy of GENERAL MOTORS CORP.



G92G14585

Fig. 34: Identifying Final Drive Assembly Components
 Courtesy of GENERAL MOTORS CORP.

Reassembly

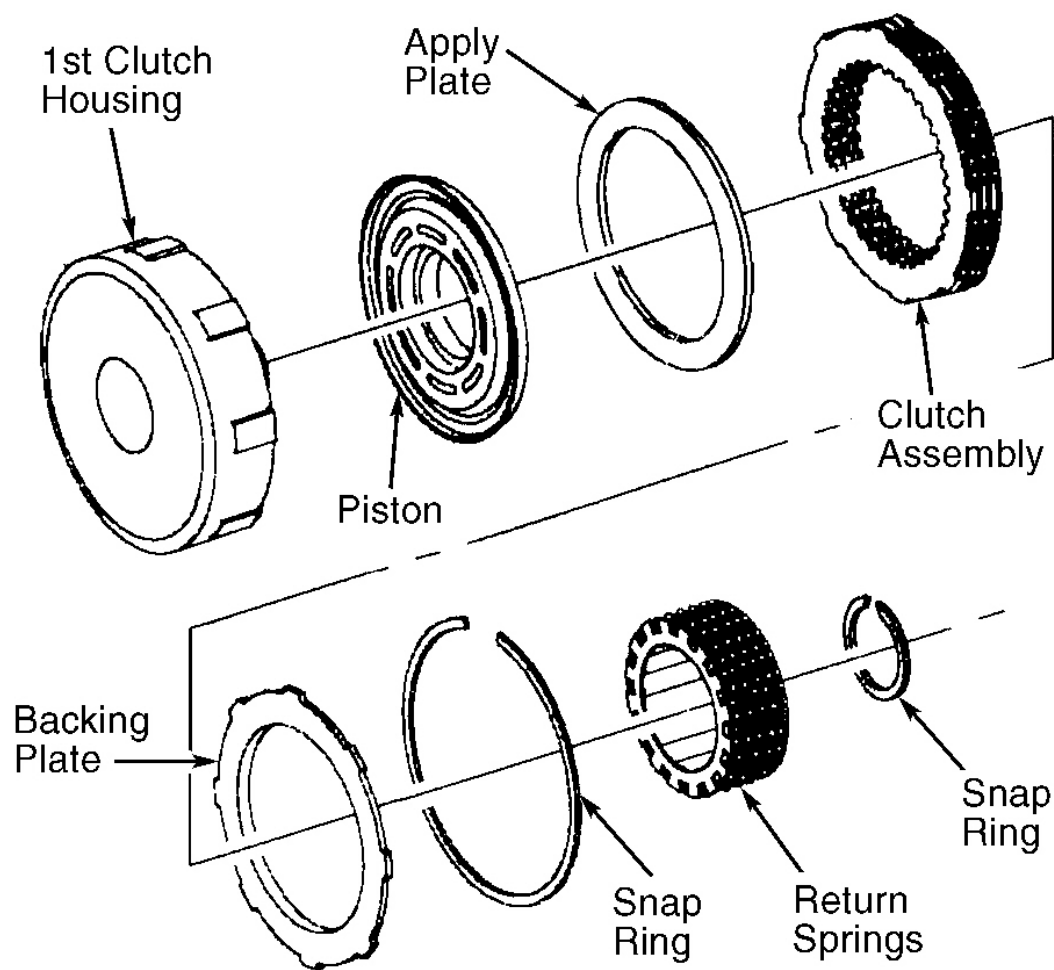
1. Assemble differential side gears and thrust washers into case. Set thrust washers onto pinion gears. Assemble pinion gears and washers into case. See **Fig. 34** .
2. Slide cross pin through both pinion gears for alignment, and then remove pin. Rotate side gears into position, and then install cross pin. Tap cross pin locking pin into position. Install side bearings to differential (if removed).

1ST CLUTCH

Disassembly & Inspection

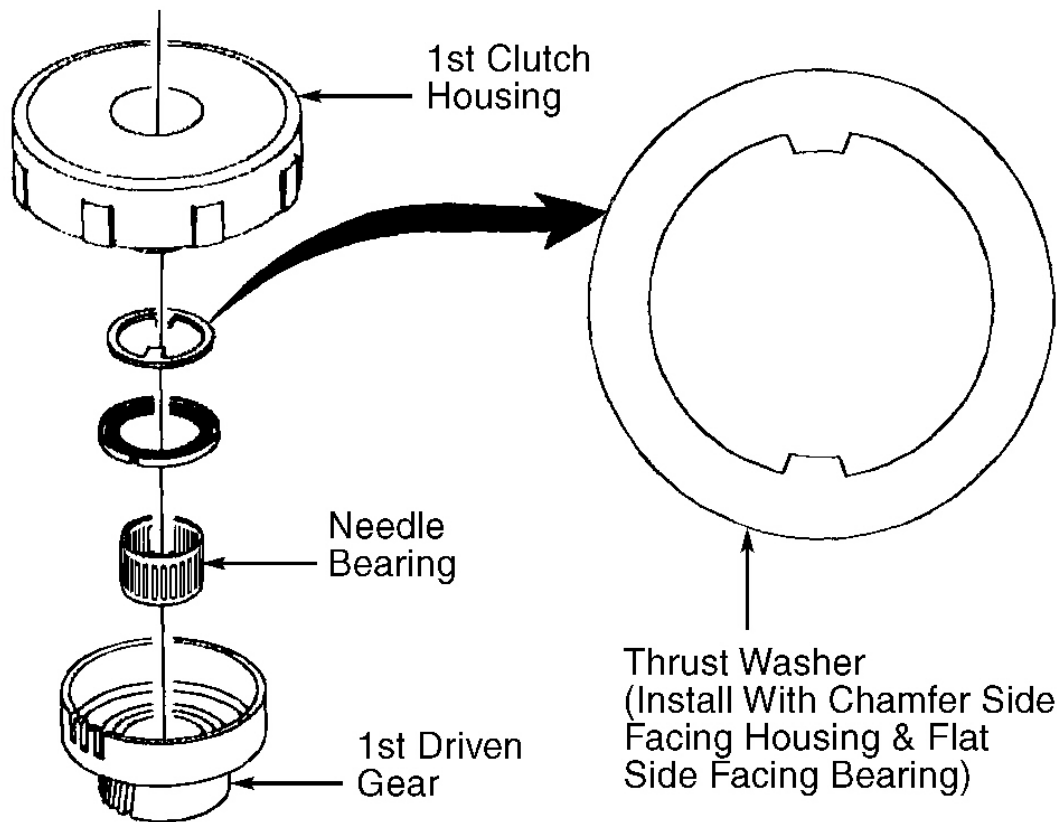
1. Remove large snap ring. Lift out backing plate, clutch plates and apply plate (Belleville spring). See **Fig. 35** . Compress clutch spring retainer to remove small snap ring, spring retainer and clutch return springs.
2. Apply air pressure to clutch fluid passage to remove piston. Remove and discard piston seal rings. If necessary, remove needle bearing by separating bearing from inner race. Remove 1st gear thrust washer.

Inspect for wear and damage. If 1st clutch housing is replaced, install a new needle bearing and race. See **Fig. 36**.



G92D14665

Fig. 35: Exploded View Of 1st Clutch (Other Clutch Assemblies Are Similar)
Courtesy of GENERAL MOTORS CORP.



G92E14666

Fig. 36: Exploded View Of 1st Clutch Housing
 Courtesy of GENERAL MOTORS CORP.

Reassembly

1. Install 1st gear thrust washer. Ensure flat side faces bearing and chamfer side faces housing. Ensure thrust washer tabs line up with slots on hub. Install thrust bearing (roller faces thrust washer) and 1st gear needle bearing. See **Fig. 36**.
2. Lubricate new piston oil seals. Install Clutch Housing Seal Protector (SA9117T-3) in clutch housing. Using Seal Installer Set (SA9117T), install clutch piston in clutch housing. Install return springs and spring retainer.
3. Compress return spring retainer and install snap ring. Install apply plate (Belleville spring) with convex side toward piston. See **Fig. 35**. Install 3 internal tanged and 3 external tanged clutch plates. Install clutch plates with fiber side up. Starting with external tanged plate, alternate external and internal tanged plates. Install backing plate and snap ring. See **Fig. 35**.
4. Using both Clutch Checking Weights (SA9111T-1 and SA9111T-2), place weights on top of clutch backing plate. See **Fig. 37**. Apply 60 psi (415 kPa) of compressed air to each clutch fluid passage and check operation. Using a dial indicator, check clutch end play.

5. End play for 1st clutch should be .038-.055" (.96-1.40 mm). If end play is not as specified, selective size snap rings are available from .063-.113" (1.60-2.87 mm) in .007" (.18 mm) increments.

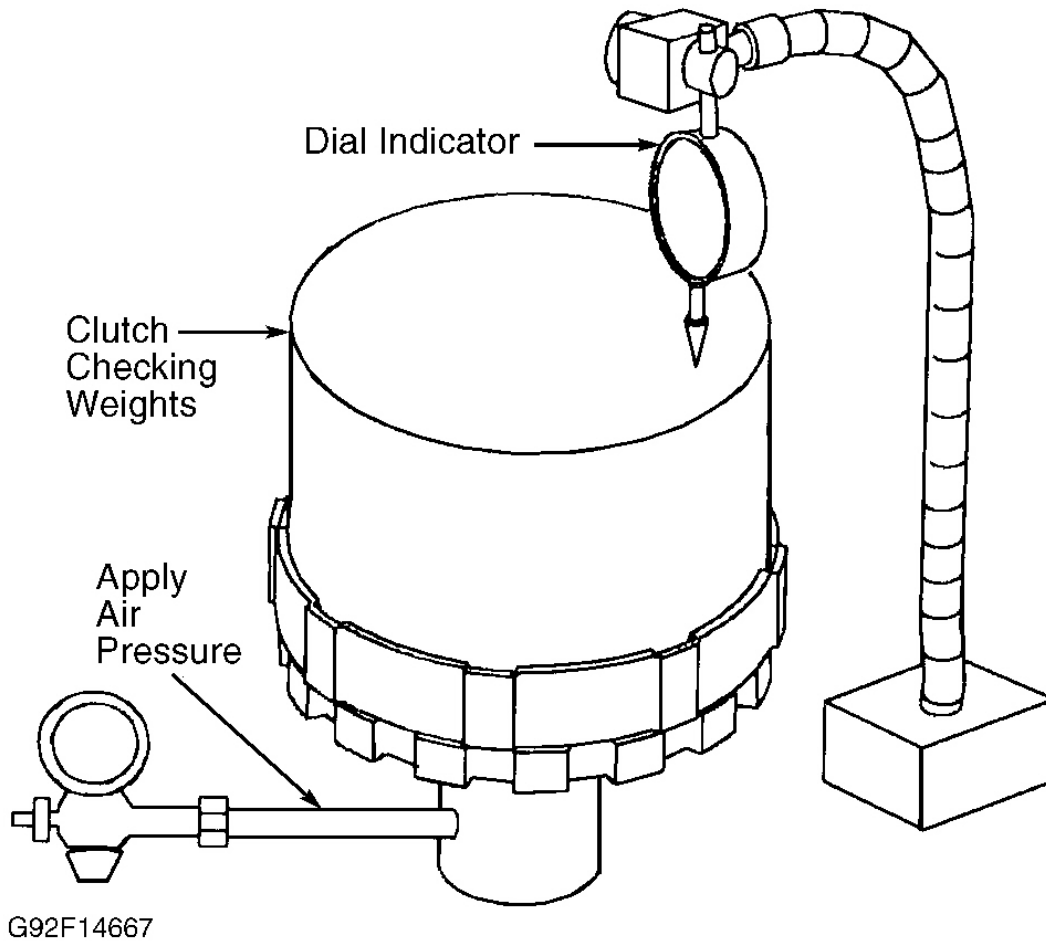


Fig. 37: Checking Clutch End Play
Courtesy of GENERAL MOTORS CORP.

INPUT SHAFT

Disassembly

Remove seal ring, thrust bearings, and 2nd/reverse gear and bearing assembly. See [Fig. 38](#) and [Fig. 39](#). Using a press, remove 2nd/3rd clutch housing from input shaft. See [Fig. 40](#). Remove thrust washers, 3rd gear and 3rd gear bearing. Remove seal rings. See [Fig. 38](#) and [Fig. 41](#).

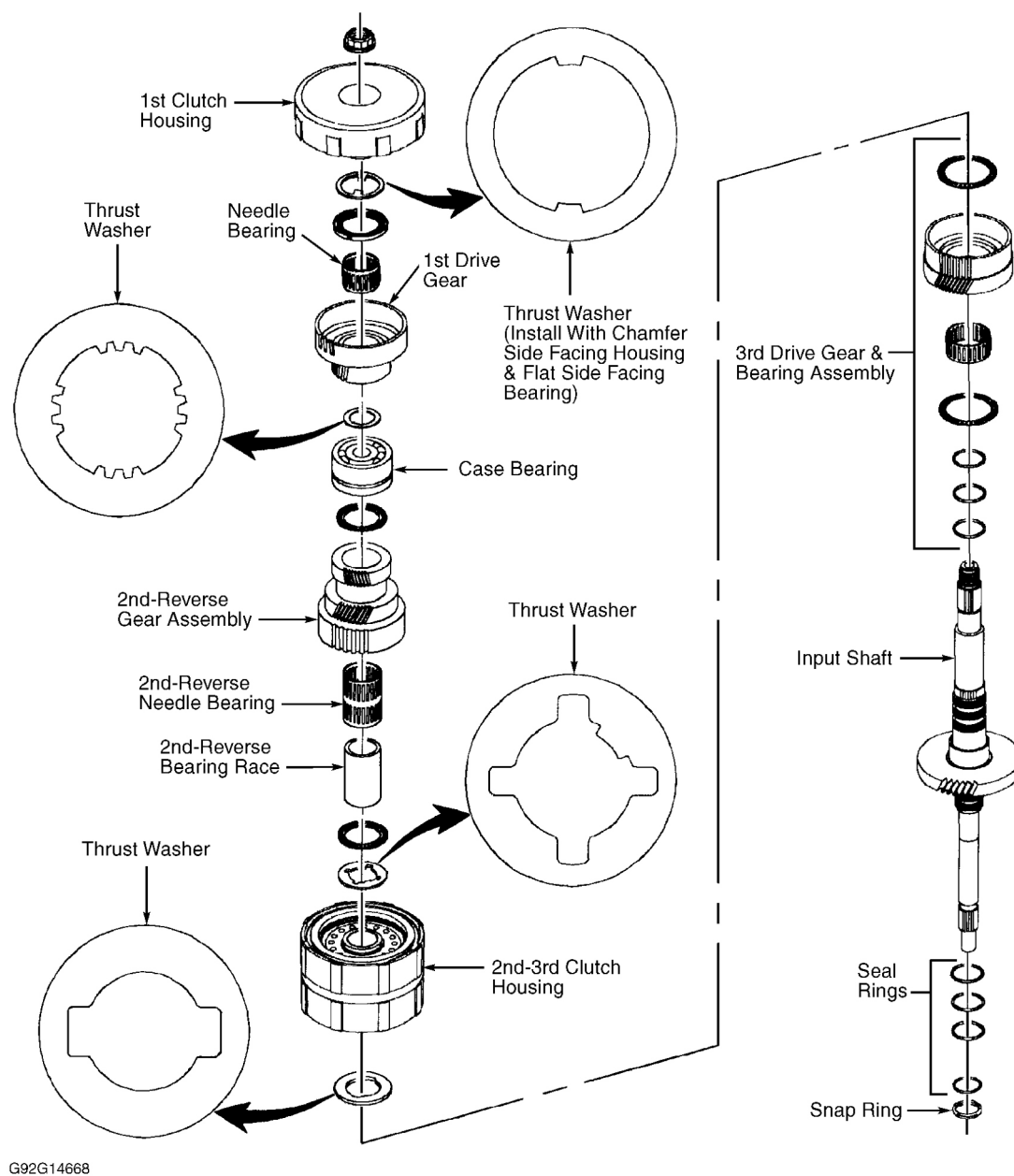
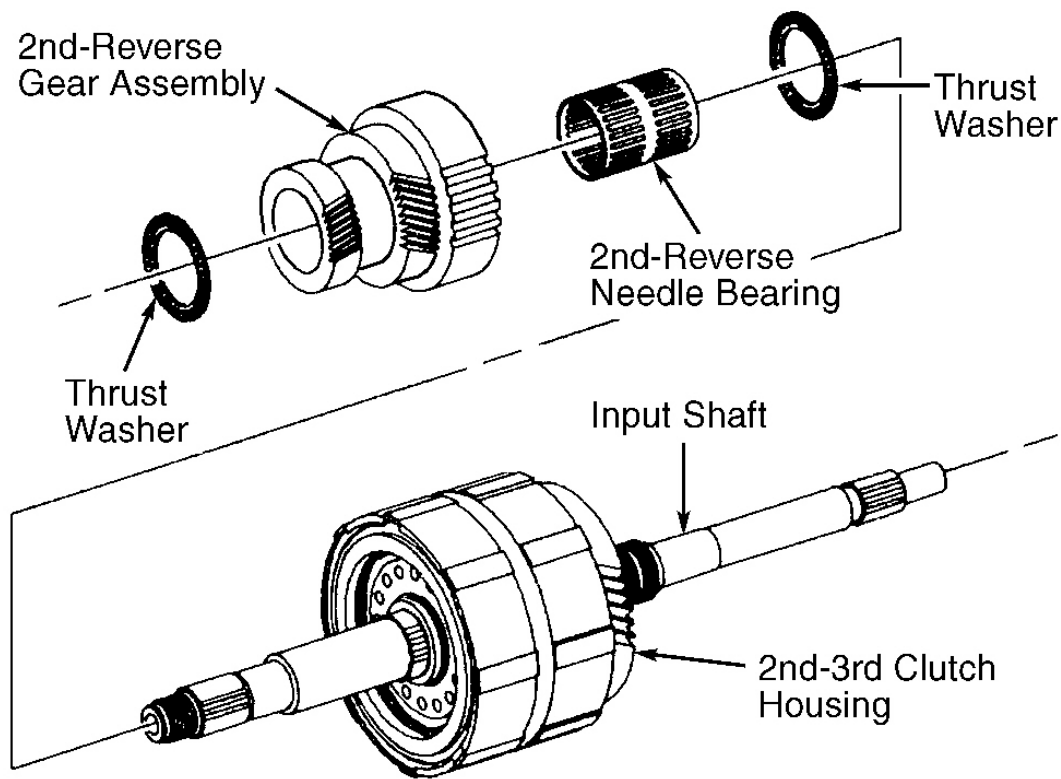


Fig. 38: Identifying Input Shaft Assembly Components
Courtesy of GENERAL MOTORS CORP.



G92H14669

Fig. 39: Removing & Installing 2nd/Reverse Assembly
 Courtesy of GENERAL MOTORS CORP.

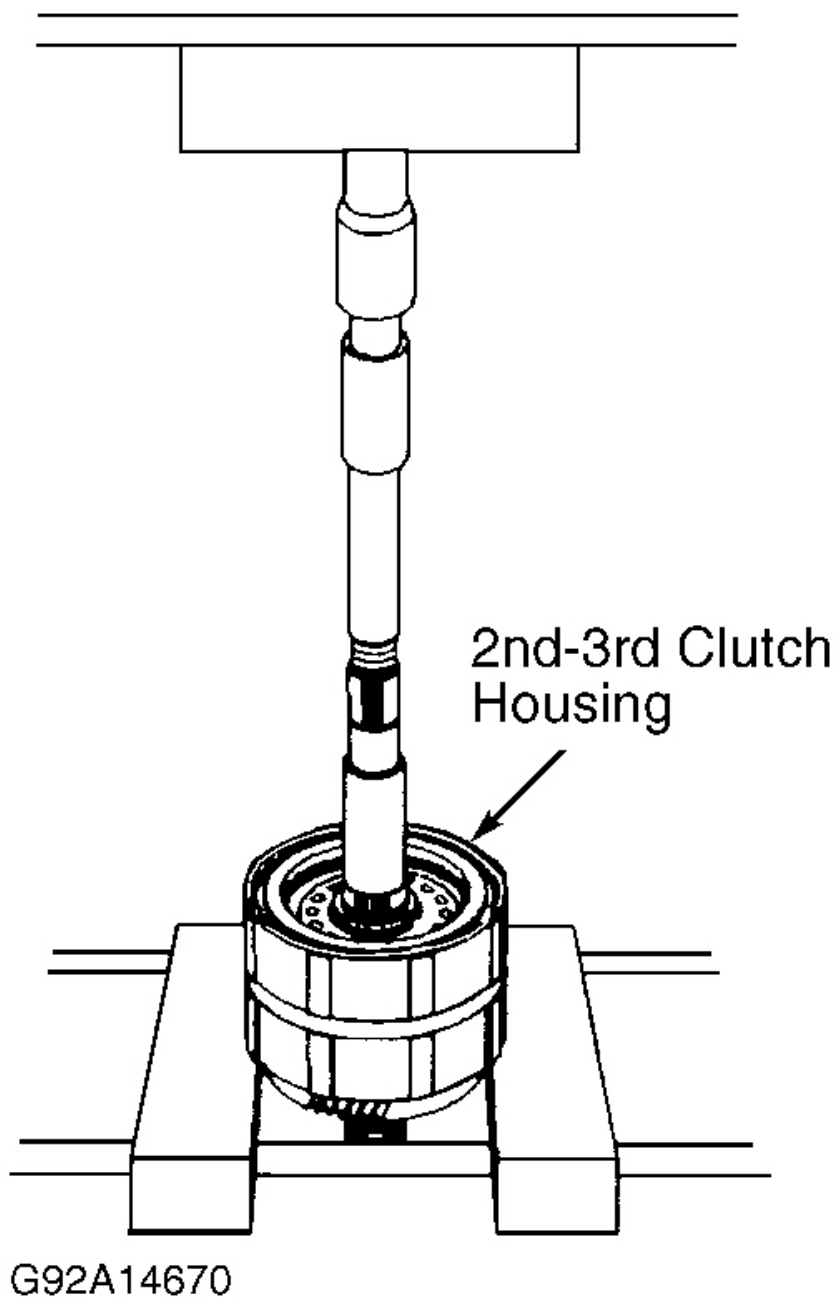


Fig. 40: Pressing Off 2nd/3rd Clutch Housing
Courtesy of GENERAL MOTORS CORP.

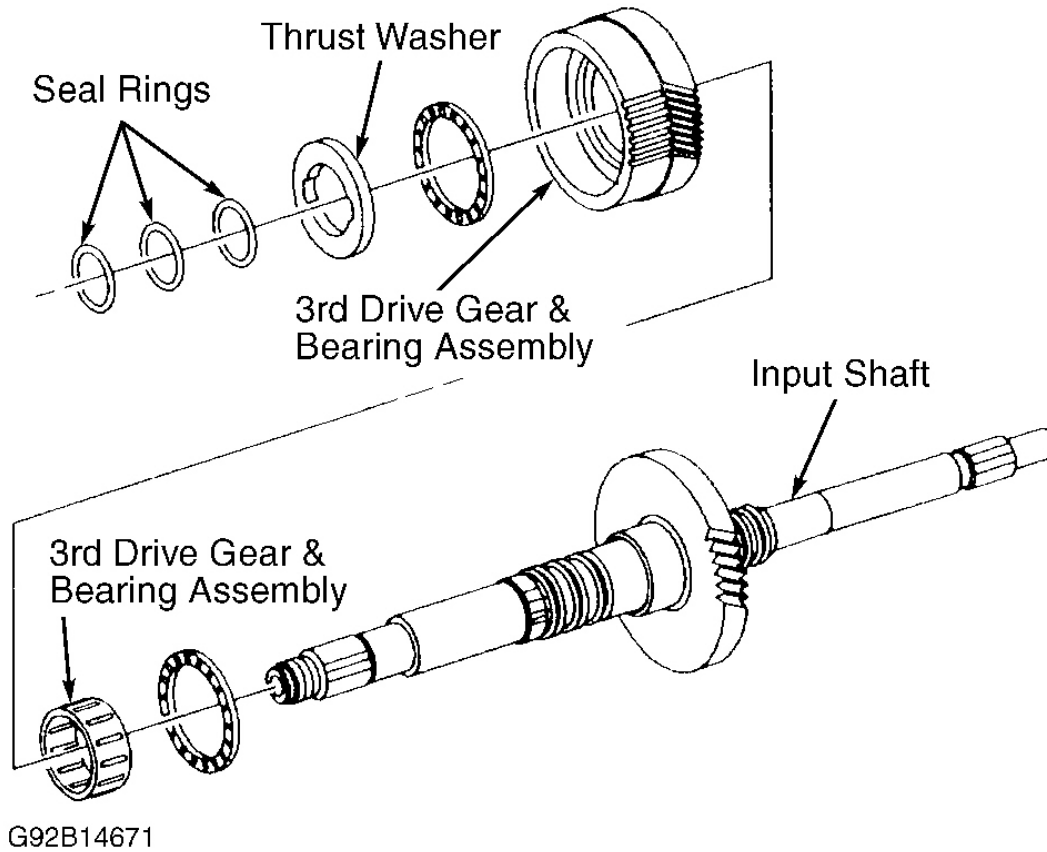


Fig. 41: Removing & Installing 3rd Drive Assembly
 Courtesy of GENERAL MOTORS CORP.

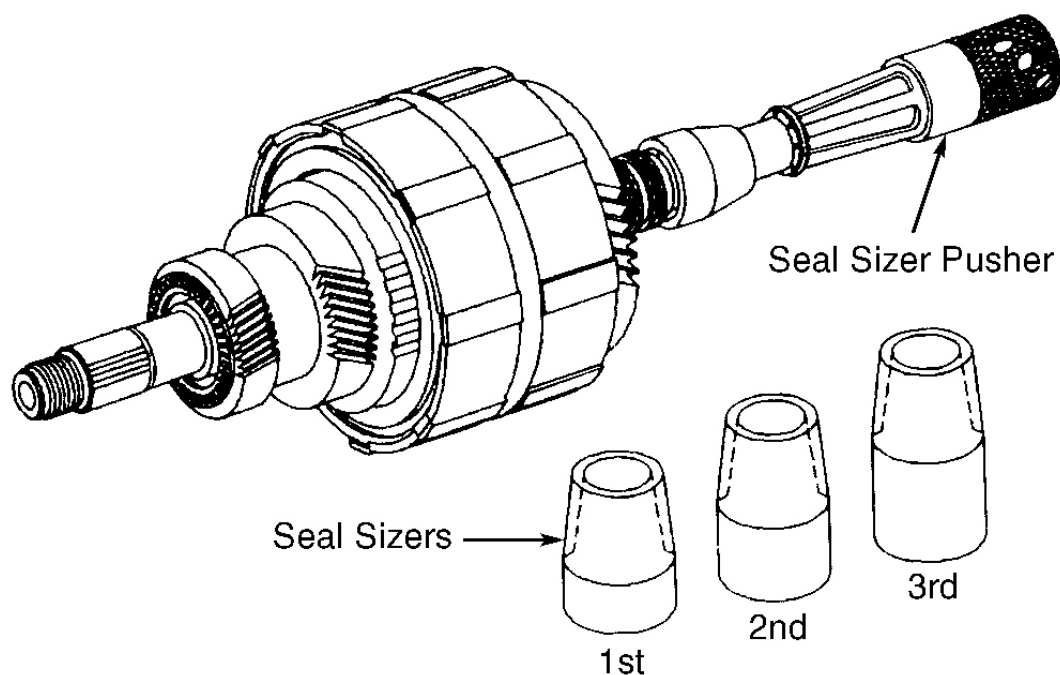
Reassembly

1. Using Seal Sizer Set (SA9144T), size input shaft seal rings. See **Fig. 42** . Lubricate and install 3rd gear bearing. Lubricate and install seal rings. See **Fig. 43** .
2. Using petroleum jelly, install thrust washers to clutch hub and 2nd/3rd clutch housing. See **Fig. 38** . Install washer on 3rd gear side of clutch housing. Ensure washer slots line up with clutch housing tangs.
3. Twist input shaft while installing it into 3rd gear clutch assembly. Ensure 3rd gear contacts 4th gear. Line up 2nd/reverse thrust washer internal tang with lube slot on shaft, and install thrust washer.
4. Using a heat gun, heat 2nd/reverse needle bearing race and install race. Install 2nd/reverse gear assembly. See **Fig. 44** . Ensure all clutch tangs are aligned to gear. Ensure 2nd/reverse thrust bearing is installed with tab toward gear.

INPUT SHAFT CLEARANCE SPECIFICATIONS

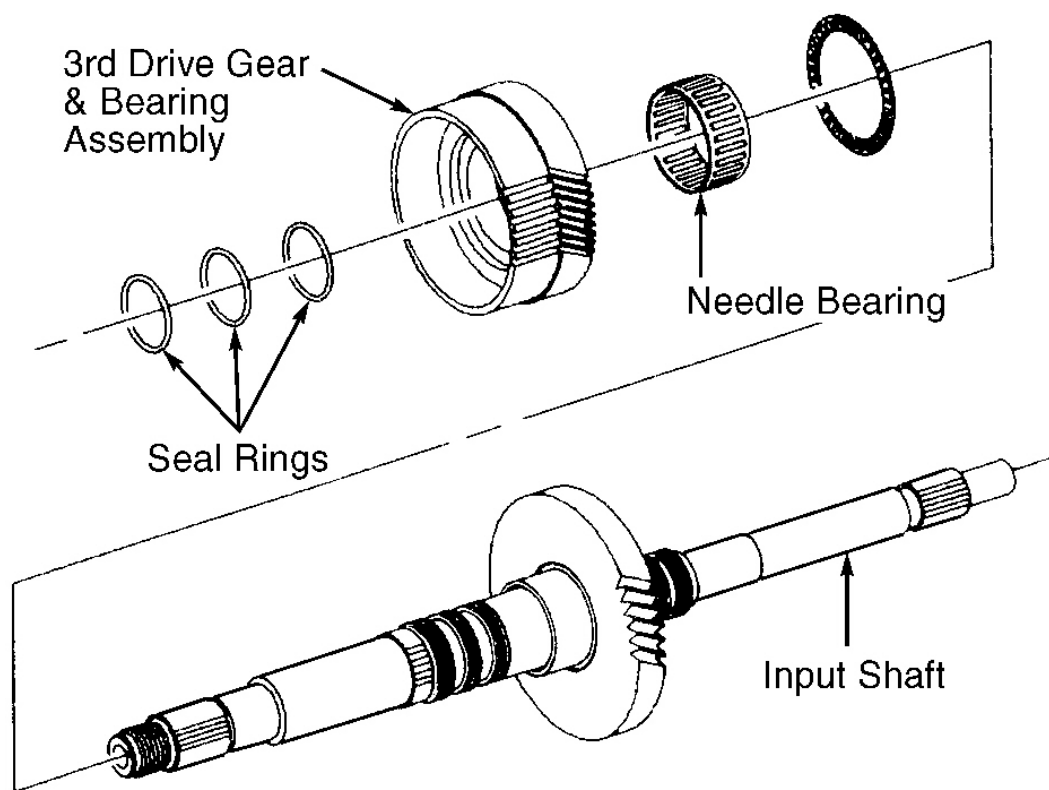
Application	Clearance
1st Gear-To-Thrust Washer	.003-.017" (.08-.43 mm)

2nd/Reverse-To-Thrust Washer	.001-.006" (.03-.15 mm)
4th Gear-To-Thrust Washer	.002-.009" (.05-.23 mm)



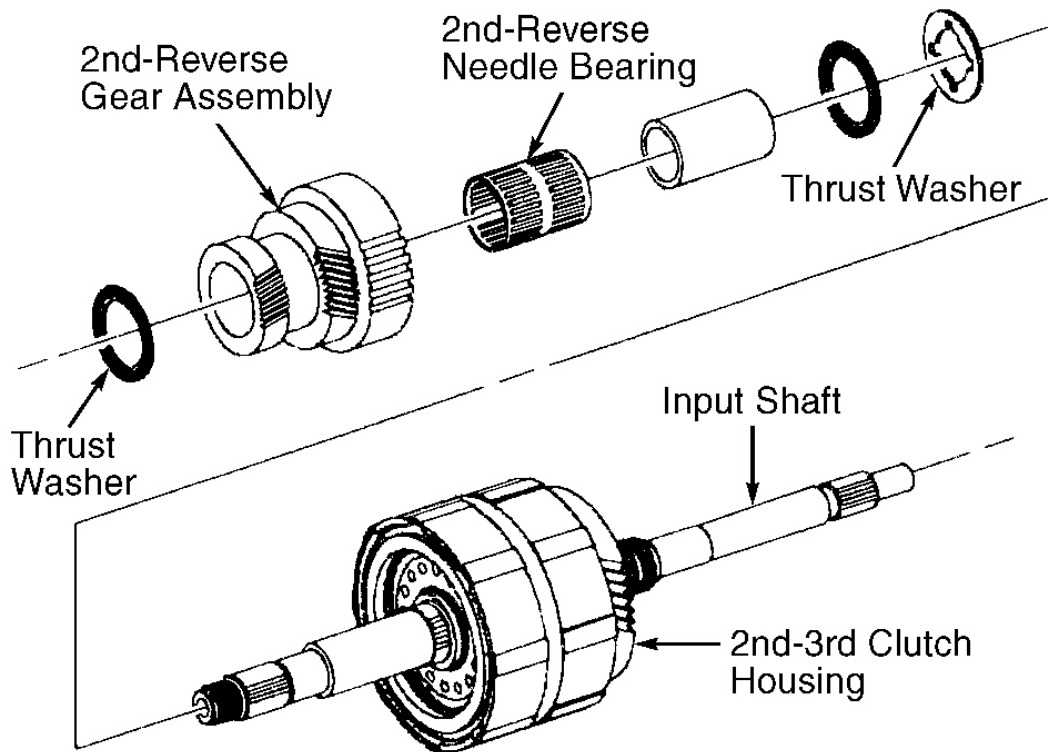
G92C14672

Fig. 42: Sizing Input Shaft Seal Rings
 Courtesy of GENERAL MOTORS CORP.



G92D14673

Fig. 43: Installing 3rd Drive Gear & Bearing Assembly
 Courtesy of GENERAL MOTORS CORP.



G92E14674

Fig. 44: Installing 2nd/Reverse Gear & Bearing Assemblies
 Courtesy of GENERAL MOTORS CORP.

5. Install case bearing, 1st gear thrust washer, 1st gear and 1st clutch assembly onto input shaft. Install and tighten input shaft lock nut to 110 ft. lbs. (150 N.m). See **Fig. 45**.
6. Using a feeler gauge, measure clearance between gears and thrust washers. See **Fig. 46 -Fig. 48**. If clearance is not as specified, check for correct reassembly. See **INPUT SHAFT CLEARANCE SPECIFICATIONS**. Remove input shaft nut and 1st clutch assembly. Remove thrust washer and input shaft case bearing.

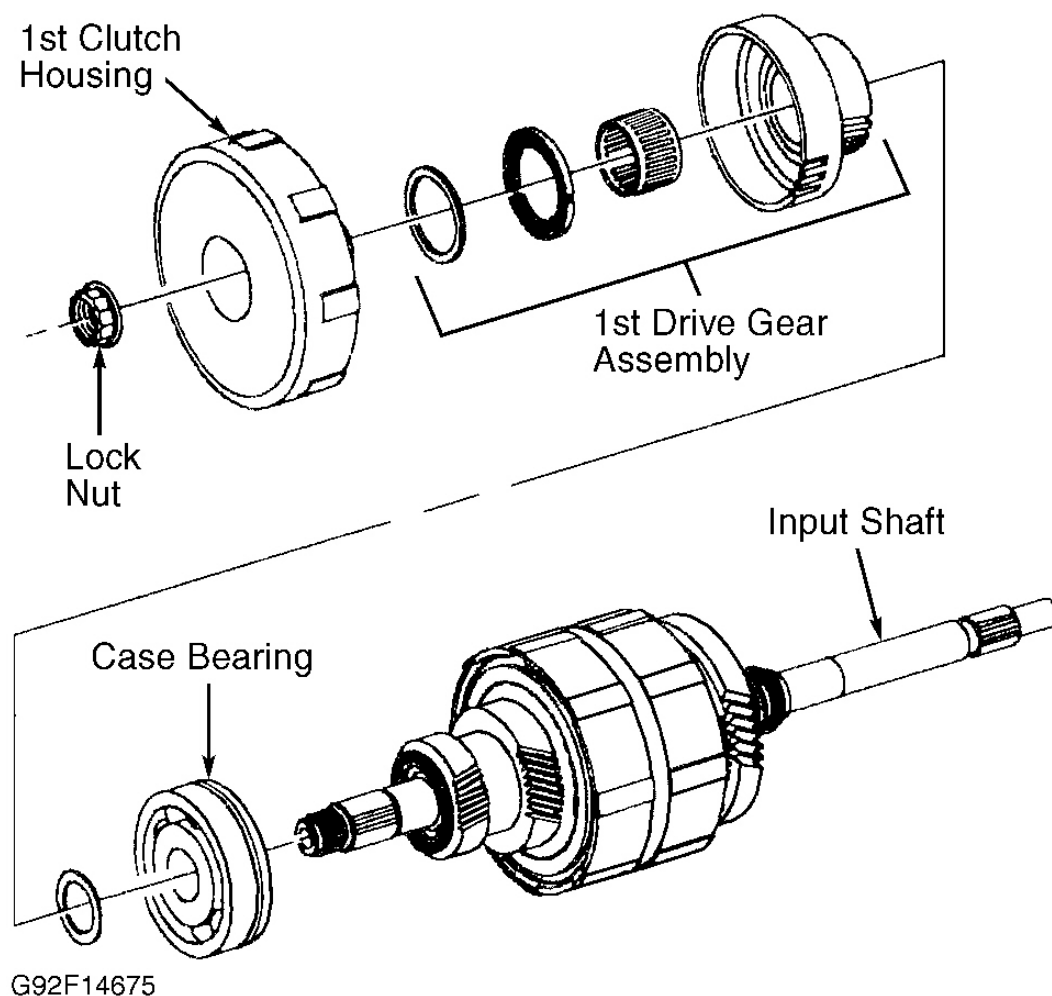


Fig. 45: Installing 1st Clutch Assembly
 Courtesy of GENERAL MOTORS CORP.

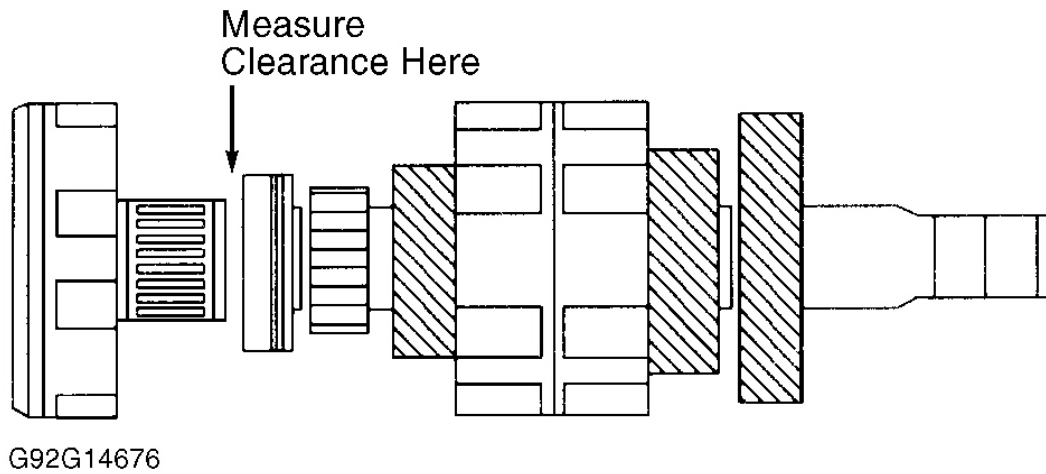


Fig. 46: Checking 1st Gear-To-Thrust Washer Clearance
 Courtesy of GENERAL MOTORS CORP.

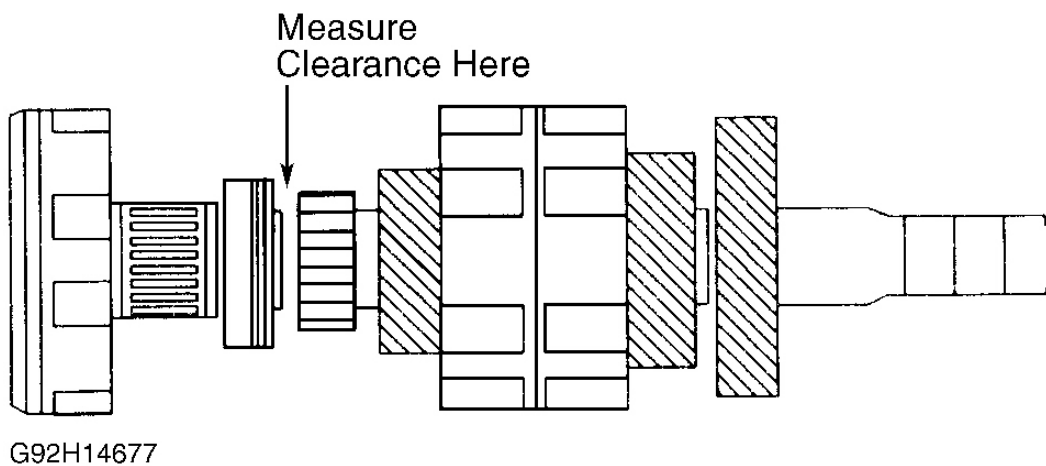


Fig. 47: Checking 2nd/Reverse Gear-To-Thrust Washer Clearance
 Courtesy of GENERAL MOTORS CORP.

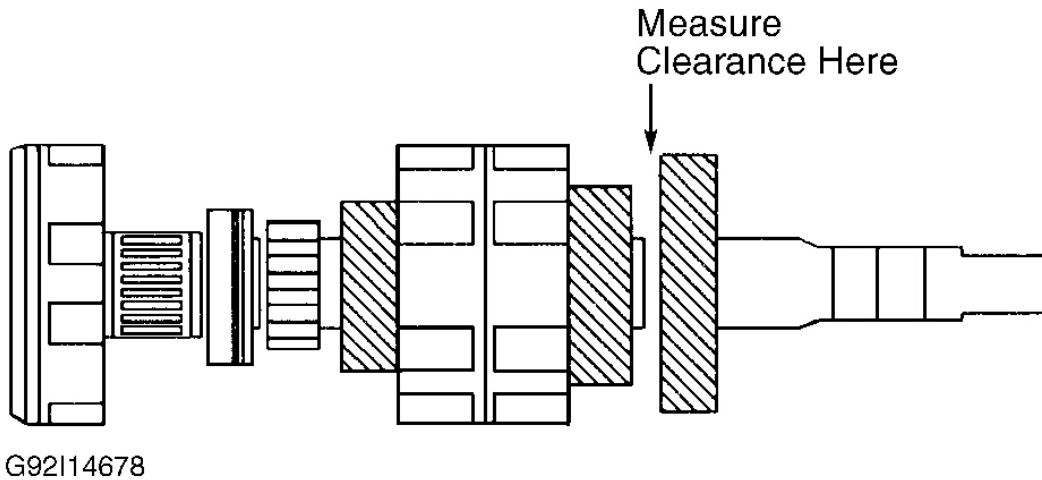


Fig. 48: Checking 4th Gear-To-Thrust Washer Clearance
 Courtesy of GENERAL MOTORS CORP.

2ND/3RD CLUTCH

Disassembly & Inspection

Remove large snap ring. Lift out backing plate, clutch plates and apply plate. Compress clutch spring retainer to remove small snap ring, spring retainer and clutch return springs. See **Fig. 35** . Apply air pressure to each clutch fluid passage to remove piston. Remove and discard piston seal rings. Inspect for wear and damage.

Reassembly

1. Lubricate new piston oil seals. Install Clutch Housing Step (SA9117T-2) and Seal Protector (SA9117T-3) in clutch housing. Using Seal Installers from (SA9117T), install clutch piston in clutch housing. Install return springs and spring retainer.
2. Compress return spring retainer and install snap ring. Install apply plate. Install clutch plates with fiber side up. Starting with internal tanged plate, alternate internal and external tanged plates. See **2ND/3RD CLUTCH PLATE APPLICATION** . Install backing plate and snap ring.

2ND/3RD CLUTCH PLATE APPLICATION

Application	Quantity
2nd Clutch	
Internal Tanged	5
External Tanged	4
3rd Clutch	
Internal	4

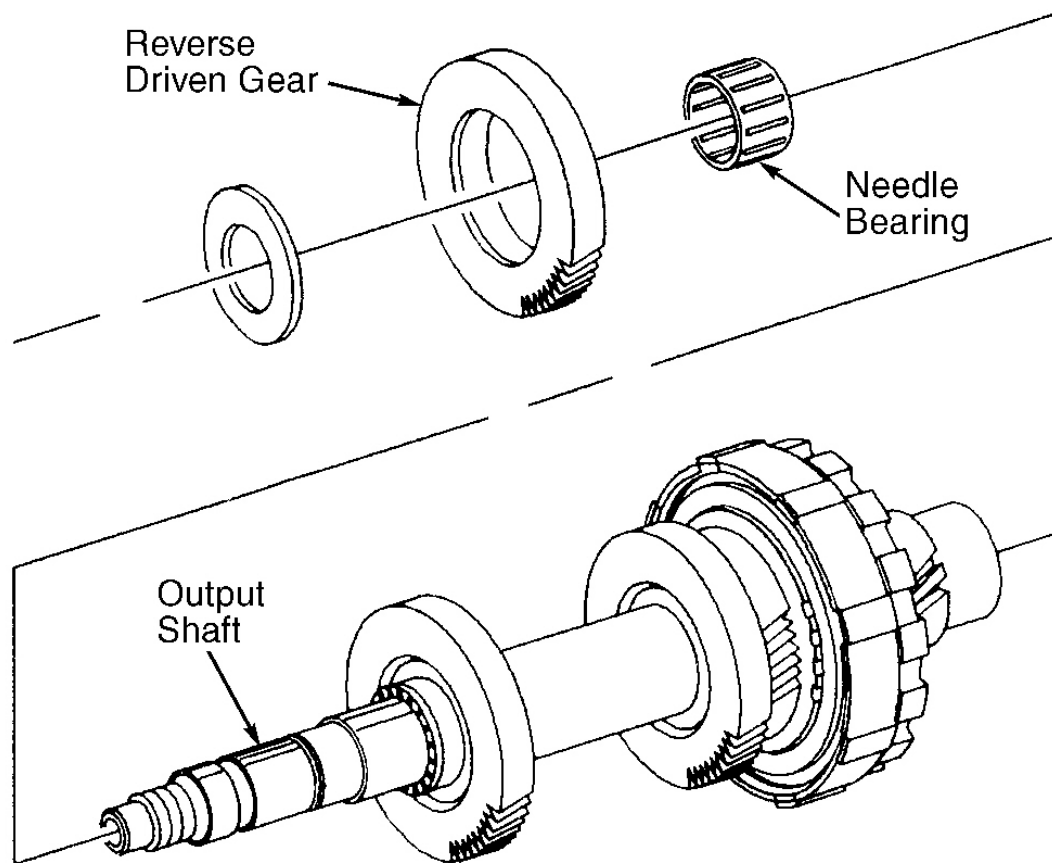
Tanged	
External Tanged	3

- Using both Clutch Checking Weights (SA9111T-1 and SA9111T-2), place weights on top of clutch backing plate. See **Fig. 37** . Apply 80 psi (550 kPa) of compressed air to each clutch fluid passage and check operation. Using a dial indicator, check clutch end play.
- End play for 2nd clutch should be .060-.086" (1.52-2.18 mm). End play for 3rd clutch should be .046-.061" (1.17-1.55 mm). If end play is not as specified, selective size snap rings are available from .063-.113" (1.60-2.87 mm) in .007" (.18 mm) increments.

OUTPUT SHAFT

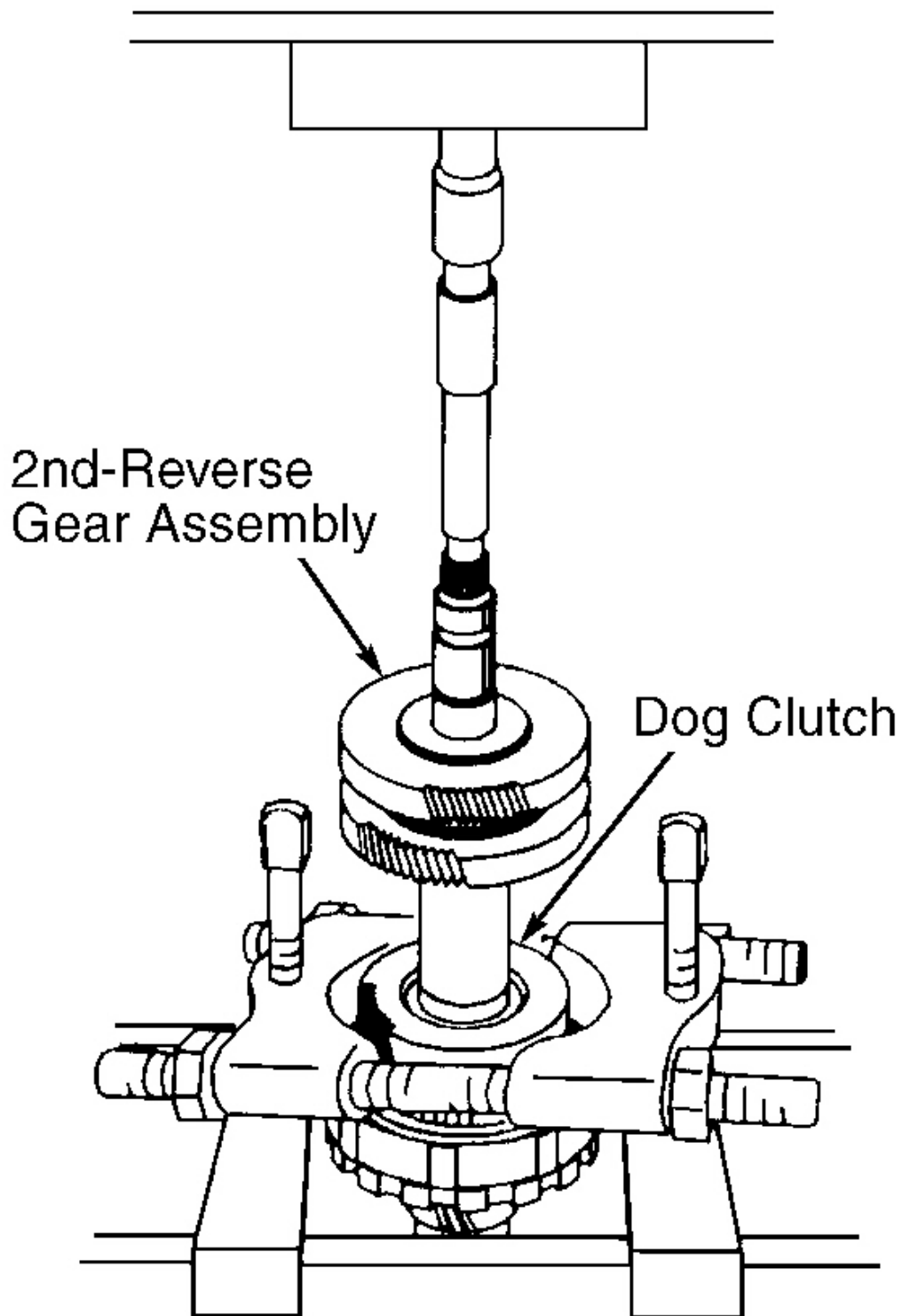
Disassembly

- Remove reverse driven gear assembly. See **Fig. 49** . Using a press, remove dog clutch sleeve and hub and 2nd/reverse gear assembly. See **Fig. 50** .
- Remove 2nd/3rd gear spacer. If necessary, use a gear puller to remove 3rd gear. Remove 3rd gear split thrust washer. See **Fig. 51** . Remove 4th gear assembly. Remove 4th clutch assembly. See **Fig. 51** and **Fig. 52** . Remove shaft seals from output shaft.



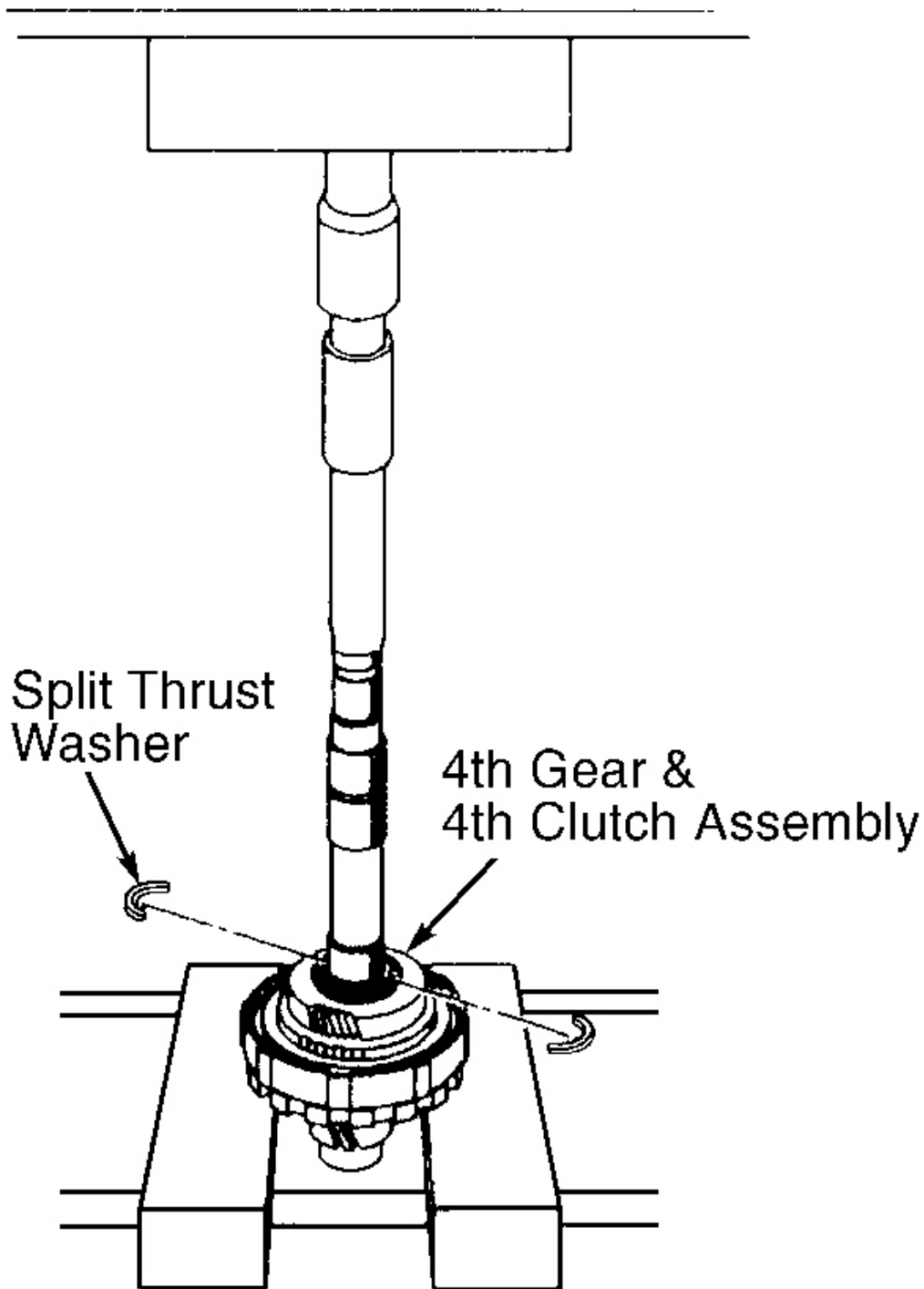
G92J14679

Fig. 49: Removing Reverse Driven Gear Assembly
Courtesy of GENERAL MOTORS CORP.



G92C14680

Fig. 50: Removing Dog Clutch & 2nd/Reverse Gear Assembly
Courtesy of GENERAL MOTORS CORP.



G92D14681

Fig. 51: Removing Split Thrust Washer
 Courtesy of GENERAL MOTORS CORP.

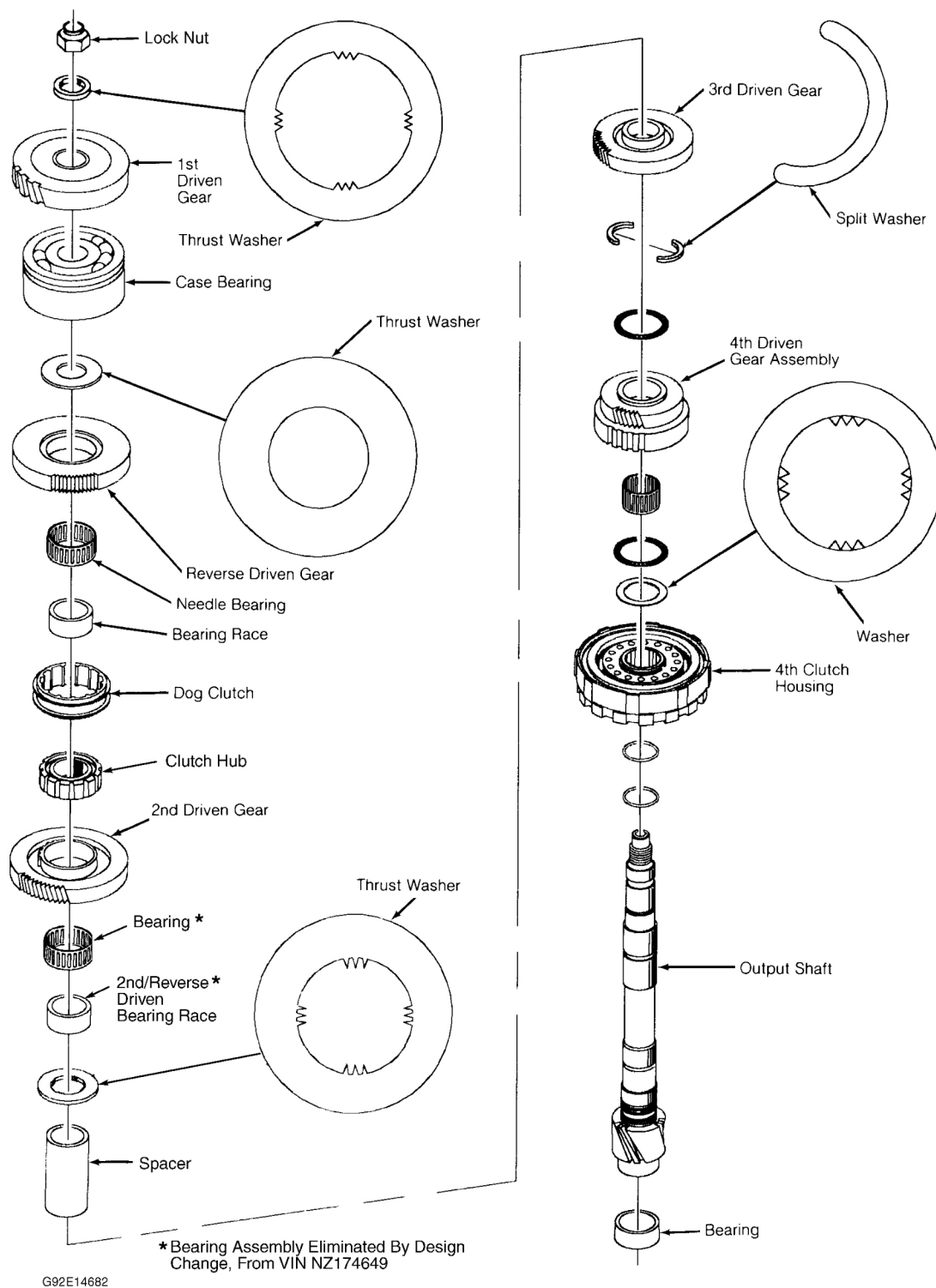


Fig. 52: Identifying Output Shaft Assembly Components

Courtesy of GENERAL MOTORS CORP.

Reassembly

1. Lubricate and install shaft seal rings to output shaft. Install 4th clutch assembly and 4th gear assembly. Install bearings, washers and 3rd gear assembly. See **Fig. 52** and **Fig. 53**.
2. Using a heat gun, heat 2nd gear bearing race. Install race. Install bearing and 2nd gear assembly. Install dog clutch hub with wide slots facing 2nd gear. See **Fig. 54**. Install dog clutch sleeve with groove on outside of sleeve facing reverse gear.
3. Heat and install reverse 2nd gear bearing race. Assemble and install remaining parts on output shaft. See **Fig. 52** and **Fig. 54**. Reassemble 1st gear and sprag clutch assembly. See **Fig. 55**.
4. Install case bearing, 1st gear thrust washer, 1st gear and sprag clutch assembly onto output shaft. See **Fig. 52**. Install and tighten output shaft nut to 110 ft. lbs. (150 N.m).
5. Using a feeler gauge, measure clearance between gears and thrust washers. See **Fig. 56 -Fig. 59**. If clearance is not as specified, check for correct reassembly. See **OUTPUT SHAFT CLEARANCE SPECIFICATIONS**. Remove output shaft nut, 1st gear and sprag clutch assembly. Remove thrust washer and output shaft case bearing. See **Fig. 52**.

OUTPUT SHAFT CLEARANCE SPECIFICATIONS

Application	Clearance
1st Gear-To-Thrust Washer	.004-.016" (.10-.40 mm)
2nd Gear-To-Dog Clutch Hub	.002-.006" (.05-.15 mm)
3rd Gear-To-Thrust Washer	.007-.018" (.18-.46 mm)
Reverse Gear-To-Thrust Washer	.003-.007" (.08-.18 mm)

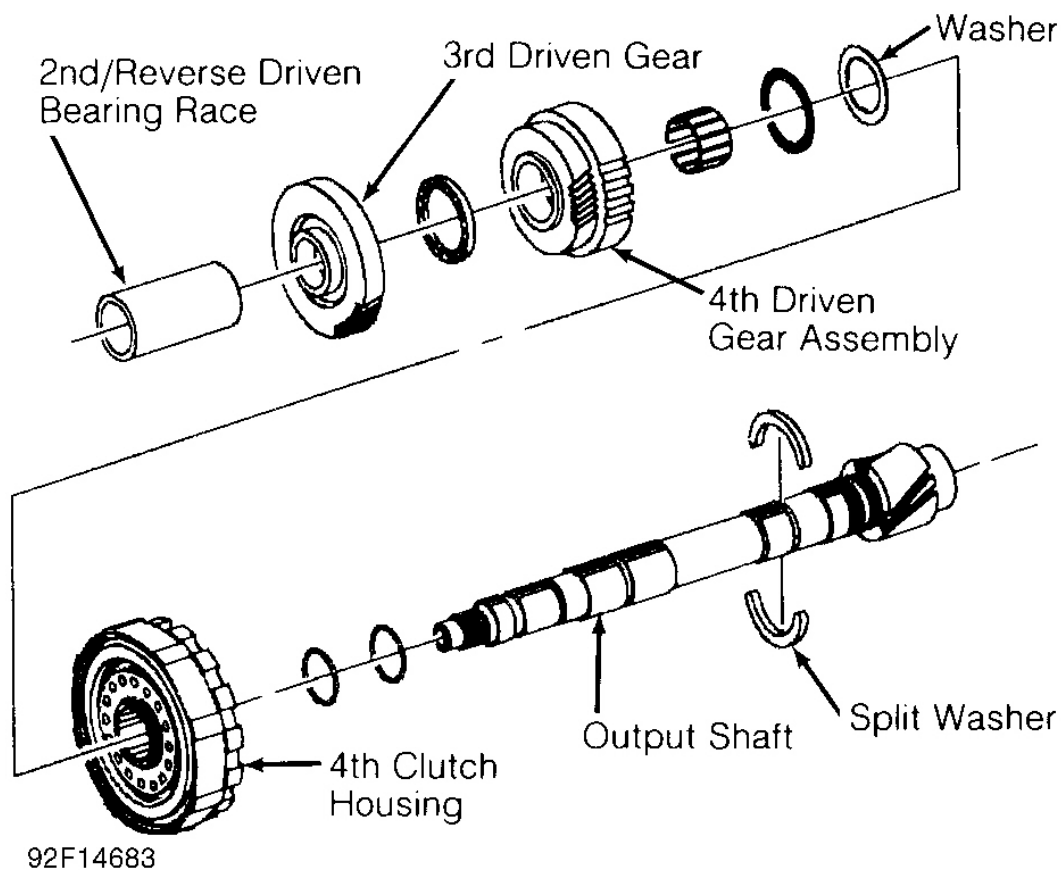
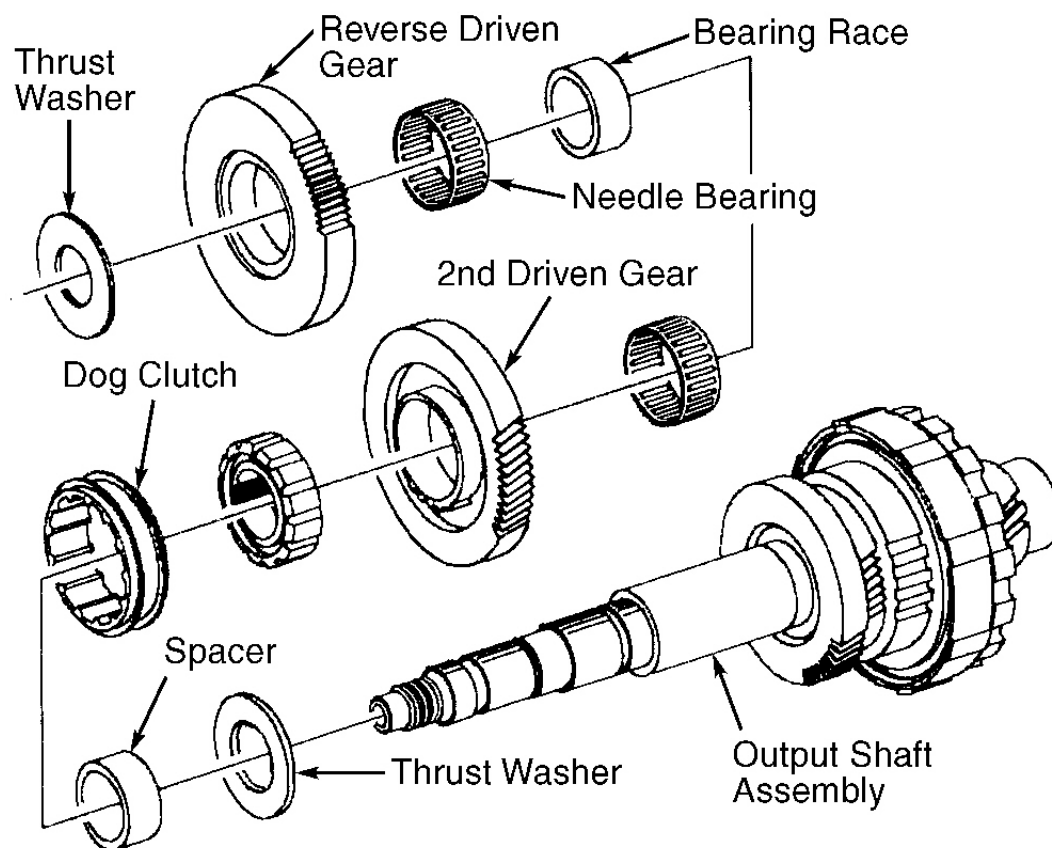
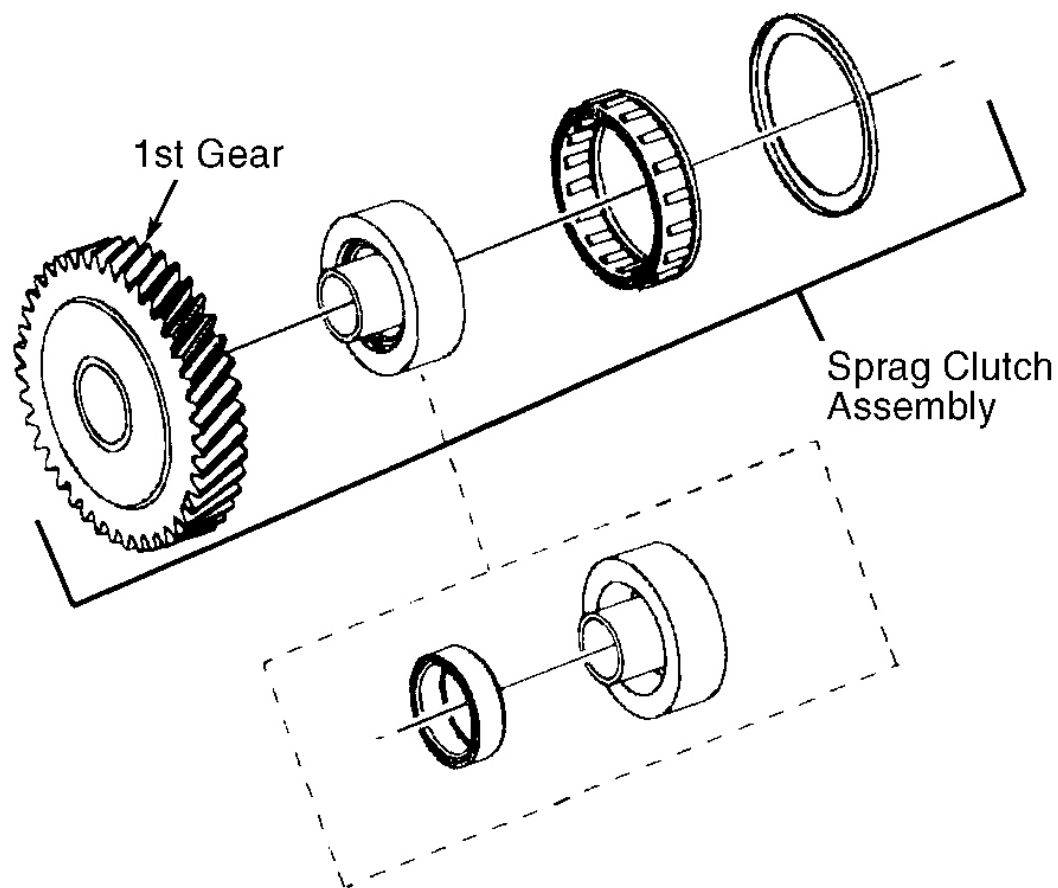


Fig. 53: Installing 4th Clutch & 3rd Gear Assembly
 Courtesy of GENERAL MOTORS CORP.



G92G14684

Fig. 54: Installing 2nd Gear, Dog Clutch & Reverse Assemblies
Courtesy of GENERAL MOTORS CORP.



G92H14685

Fig. 55: Assembling 1st Gear & Sprag Clutch
Courtesy of GENERAL MOTORS CORP.

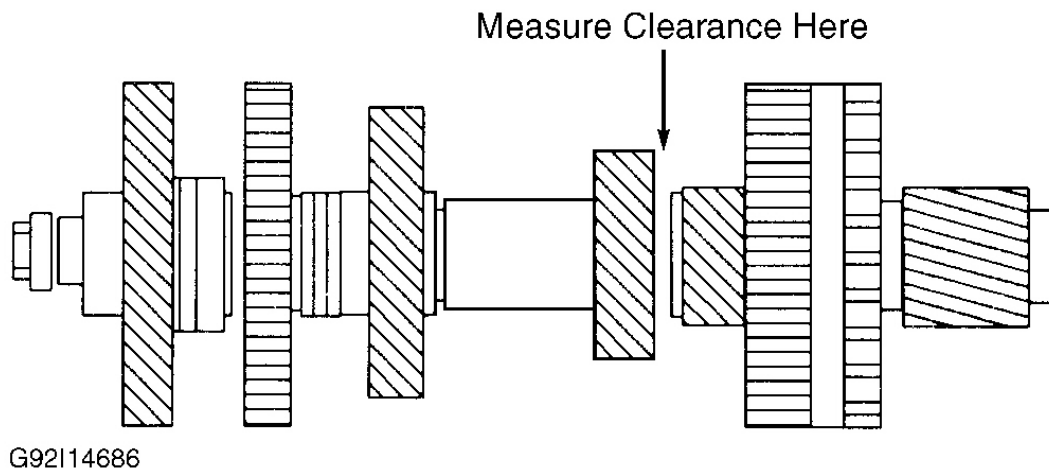


Fig. 56: Checking 3rd Gear-To-Thrust Washer Clearance
 Courtesy of GENERAL MOTORS CORP.

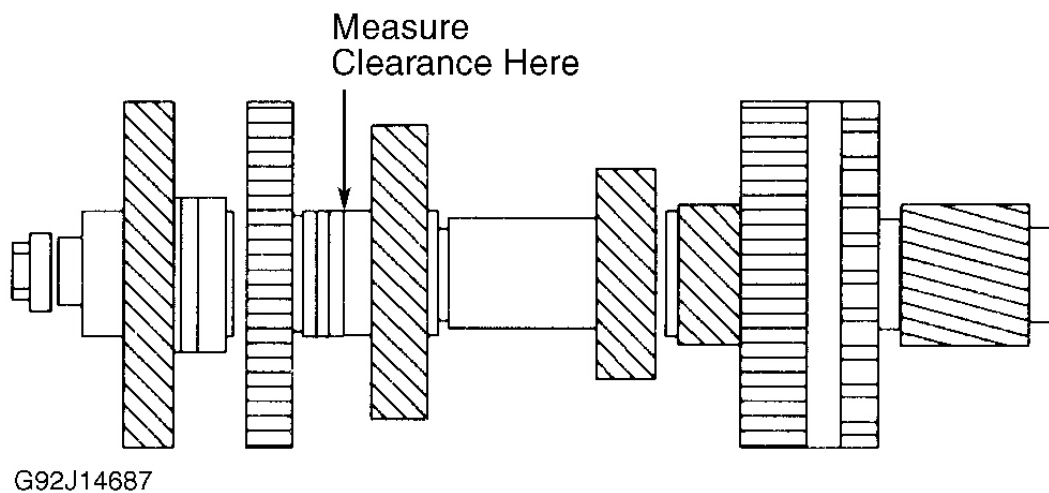


Fig. 57: Checking 2nd Gear-To-Dog Clutch Hub Clearance
 Courtesy of GENERAL MOTORS CORP.

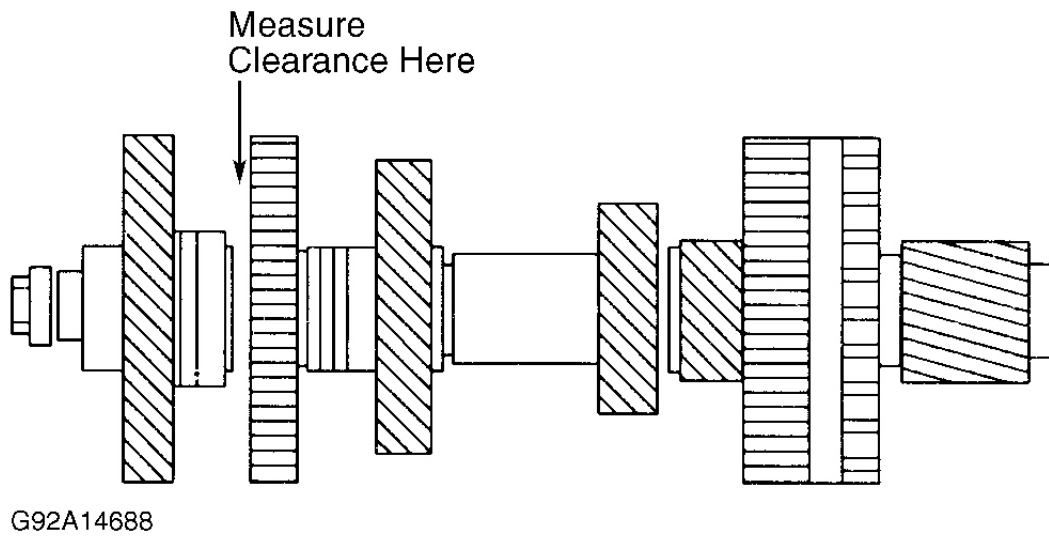


Fig. 58: Checking Reverse Gear-To-Thrust Washer Clearance
 Courtesy of GENERAL MOTORS CORP.

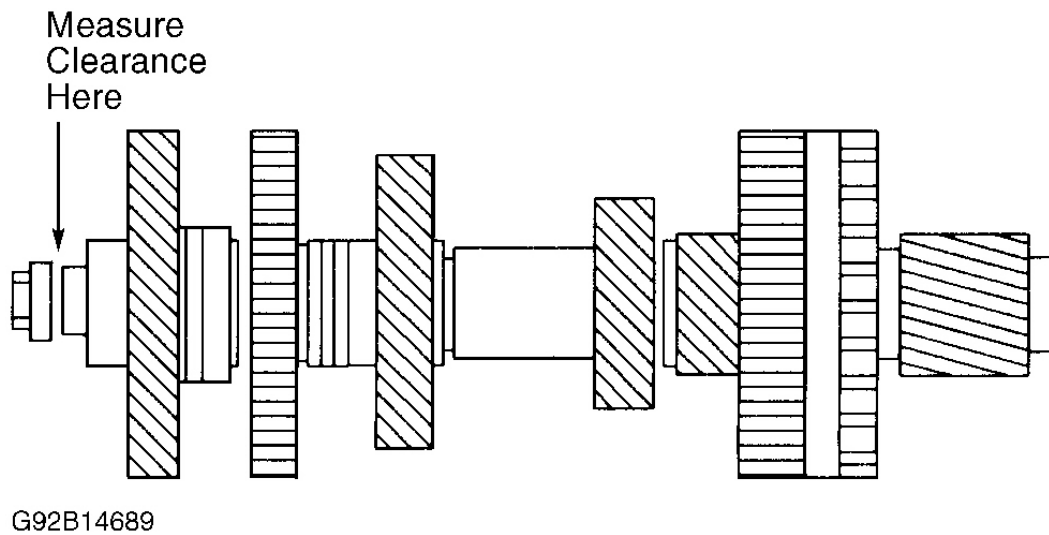


Fig. 59: Checking 1st Gear-To-Thrust Washer Clearance
 Courtesy of GENERAL MOTORS CORP.

4TH CLUTCH

Disassembly & Inspection

Remove large snap ring. Lift out backing plate, clutch plates and apply plate. Compress clutch spring retainer to remove small snap ring, spring retainer and clutch return springs. See **Fig. 35** . Apply air pressure to each clutch fluid passage to remove piston. Remove and discard piston seal rings. Inspect for wear and damage.

Reassembly

1. Lubricate new piston oil seals. Install Clutch Housing Step (SA9117T-2) and Seal Protector (SA9117T-3) in clutch housing. Using Seal Installers from Installer Kit (SA9117T), install clutch piston in clutch housing. Install return springs and spring retainer.
2. Compress return spring retainer and install snap ring. Install apply plate. Install 3 internal tanged and 2 external tanged clutch plates. Install clutch plates with fiber side up. Starting with internal tanged plate, alternate internal and external tanged plates. Install backing plate and snap ring.
3. Using both Clutch Checking Weights (SA9111T-1 and SA9111T-2), place weights on top of clutch backing plate. See **Fig. 37** . Apply 80 psi (550 kPa) of compressed air to clutch fluid passage and check operation. Using a dial indicator, check clutch end play.
4. End play should be .036-.046" (0.91-1.17 mm). If end play is not as specified, selective size snap rings are available from .063-.113" (1.60-2.87 mm) in .007" (.18 mm) increments.

REVERSE IDLER GEAR

Inspection

Inspect gear and bearing for wear and damage. See **Fig. 23** . Replace all worn parts as necessary.

VALVE BODY

Disassembly

1. Remove line actuator cover bolts. See **Fig. 60** . Carefully remove cover and connector plate. Remove line actuators by twisting line actuator as it is pulled from valve body. See **Fig. 60** .
2. Remove through bolts. Separate valve body and separator plate. Remove check balls. See **Fig. 61** . Remove manual valve. Remove each valve assembly. Retain in proper order for reassembly. See **Fig. 62** and **Fig. 63** .

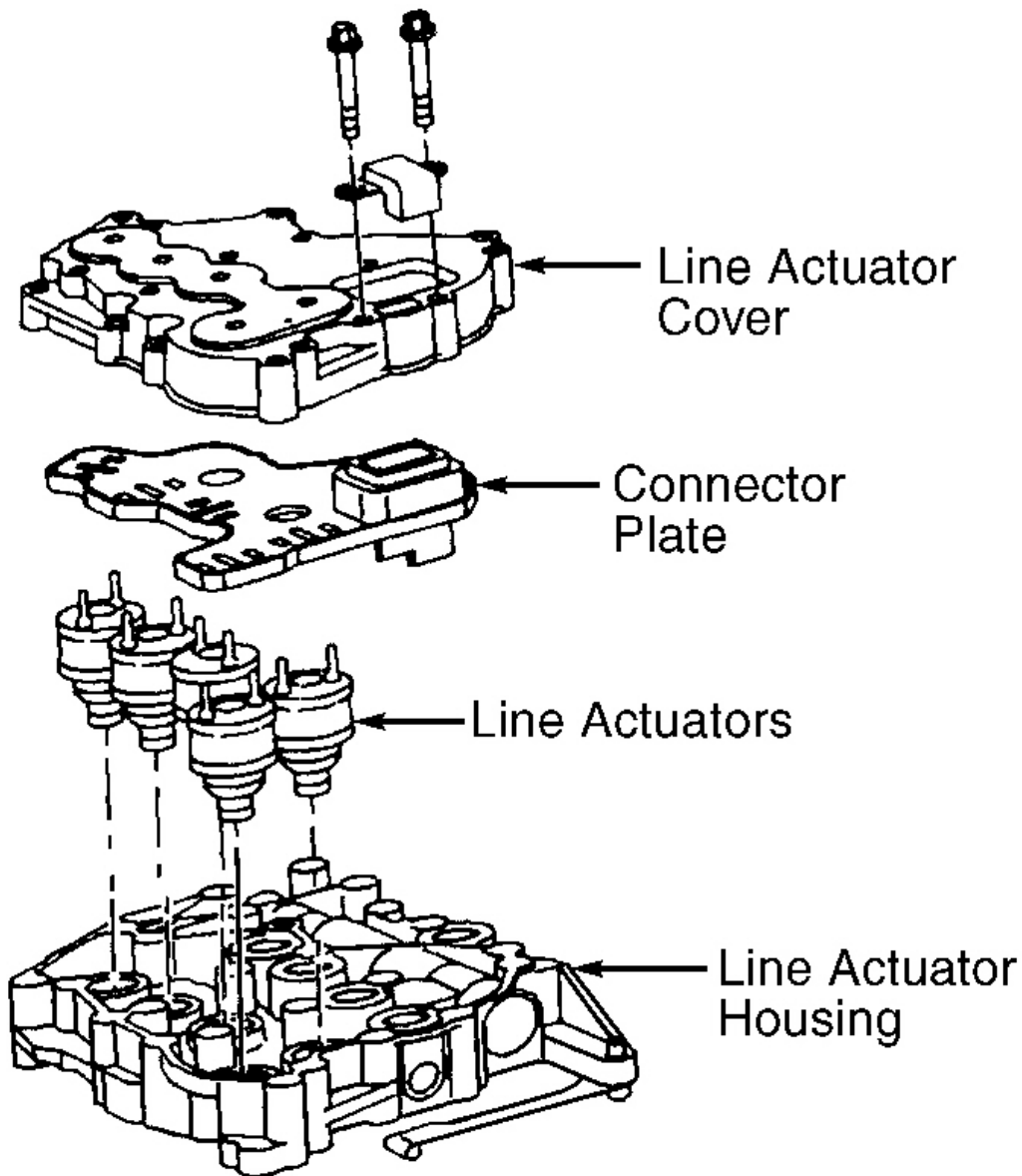
Inspection

Inspect valves for scoring, nicks and scratches. Inspect springs for damaged or distorted coils. Using a No. 43 (2.25 mm) drill bit, insert drill bit shank into connector plate terminals. Ensure drill bit drags slightly in each terminal. If bit does not drag slightly, replace connector plate. Inspect valve body casting for porosity, interconnected fluid passages and damaged machined surfaces. See **Fig. 62** and **Fig. 63** .

Reassembly

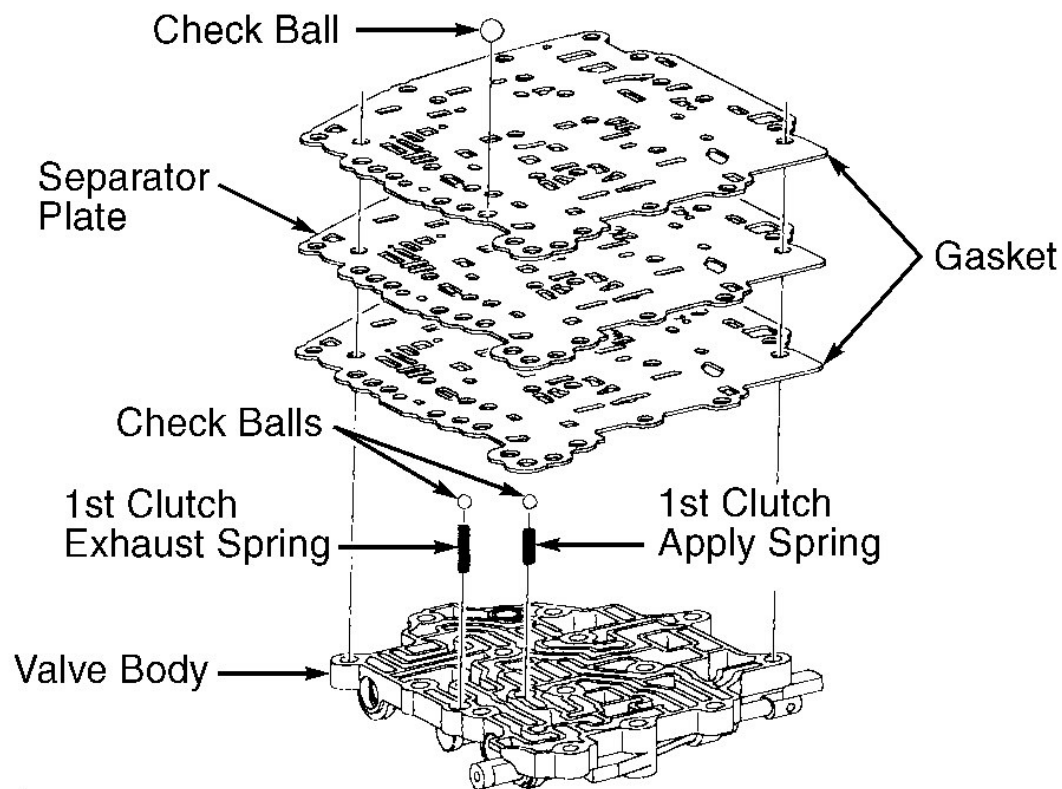
1. To reassemble, reverse disassembly procedures. Assemble each valve, spring, plug and key. See **Fig. 62** and **Fig. 63** . **DO NOT** push in using too much force. Install separator plate, gaskets and check balls to valve body. See **Fig. 61** . Install line actuator housing to valve body. Install one valve body bolt. See **Fig. 65** .

2. Lubricate line actuators. Using a twisting motion, install line actuators. Ensure line actuator terminals line up with connector plate. Install connector plate. Install cover. See **Fig. 60** . Ensure dowel bolts are installed in correct positions. See **Fig. 65** and **Fig. 66** . Finger-tighten cover bolts.



G92F14717

Fig. 60: Removing Line Actuators
Courtesy of GENERAL MOTORS CORP.



G92E14690

Fig. 61: Identifying Separator Plates & Valve Body Components
Courtesy of GENERAL MOTORS CORP.

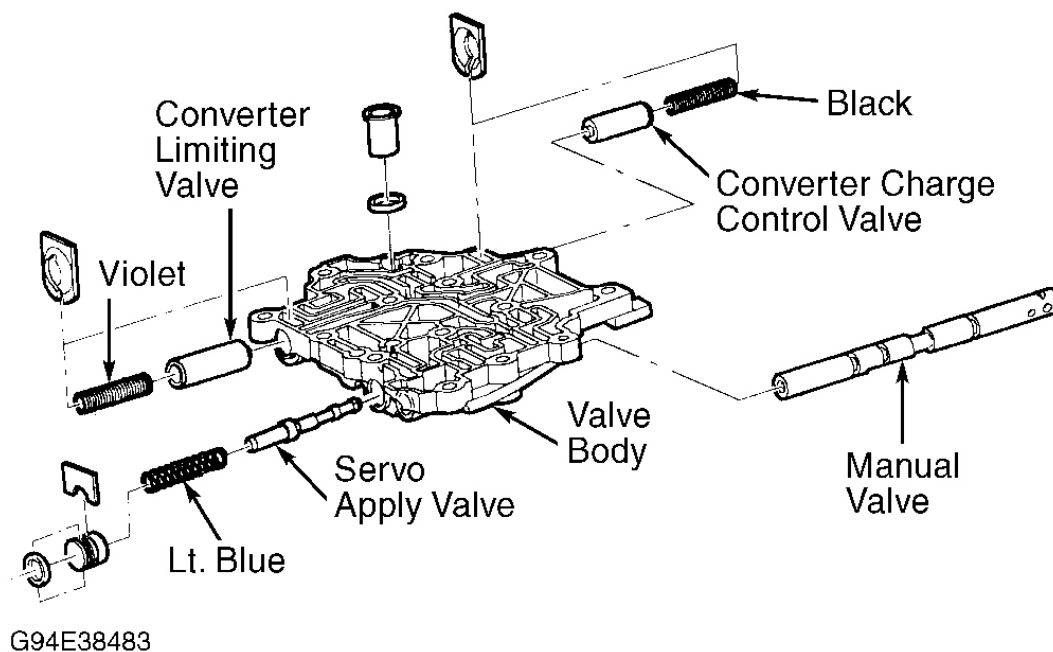


Fig. 62: Identifying Valve Body & Related Valves
 Courtesy of GENERAL MOTORS CORP.

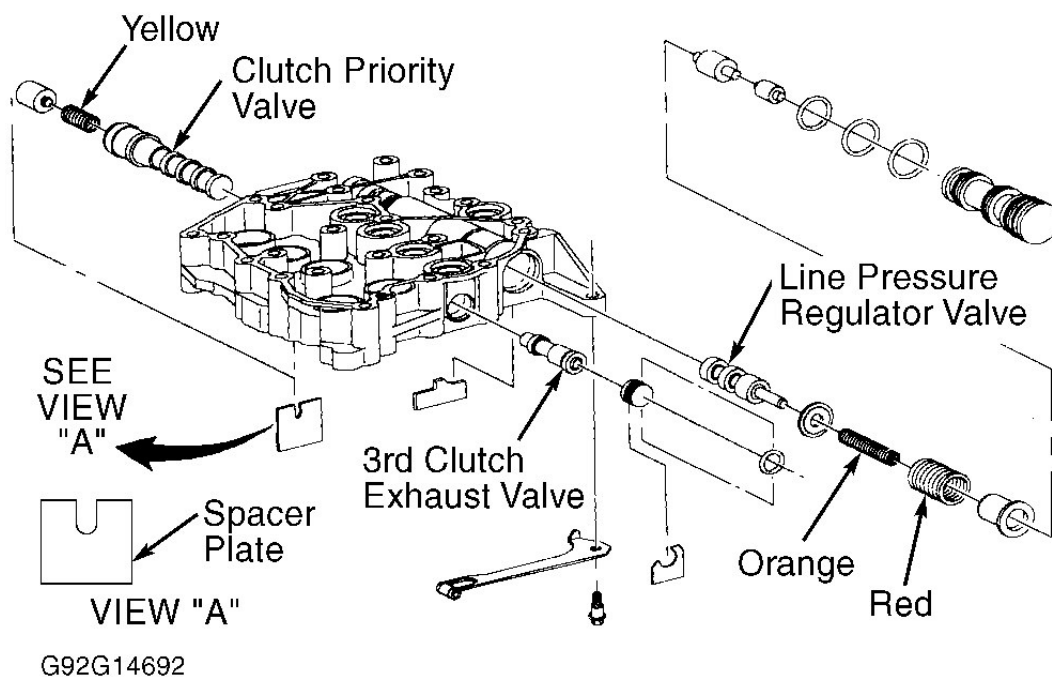
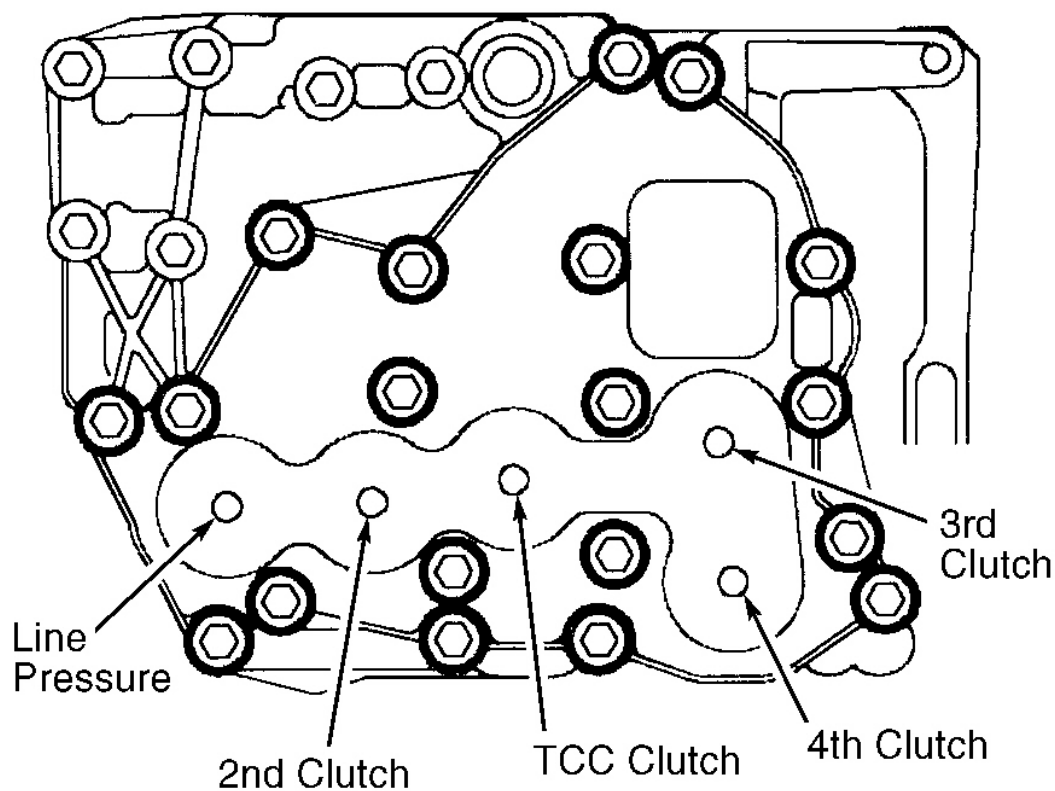
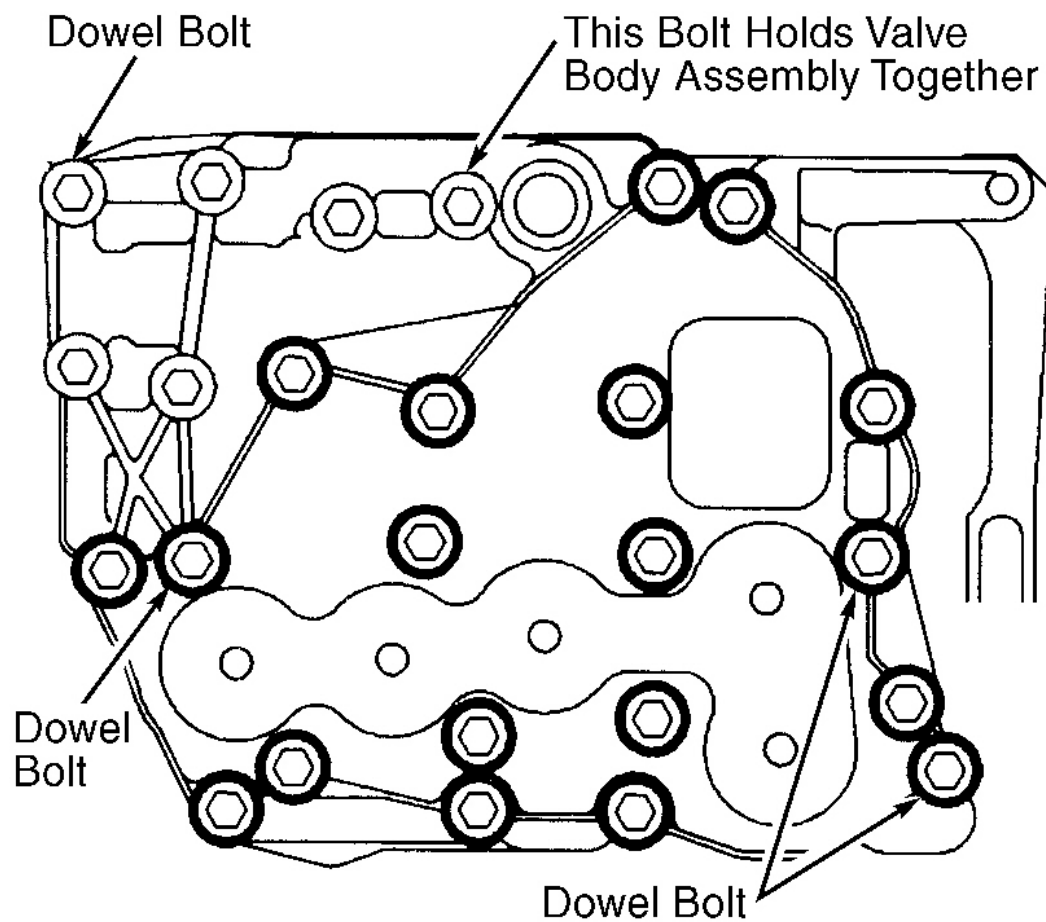


Fig. 63: Identifying Actuator Housing & Related Valves
 Courtesy of GENERAL MOTORS CORP.



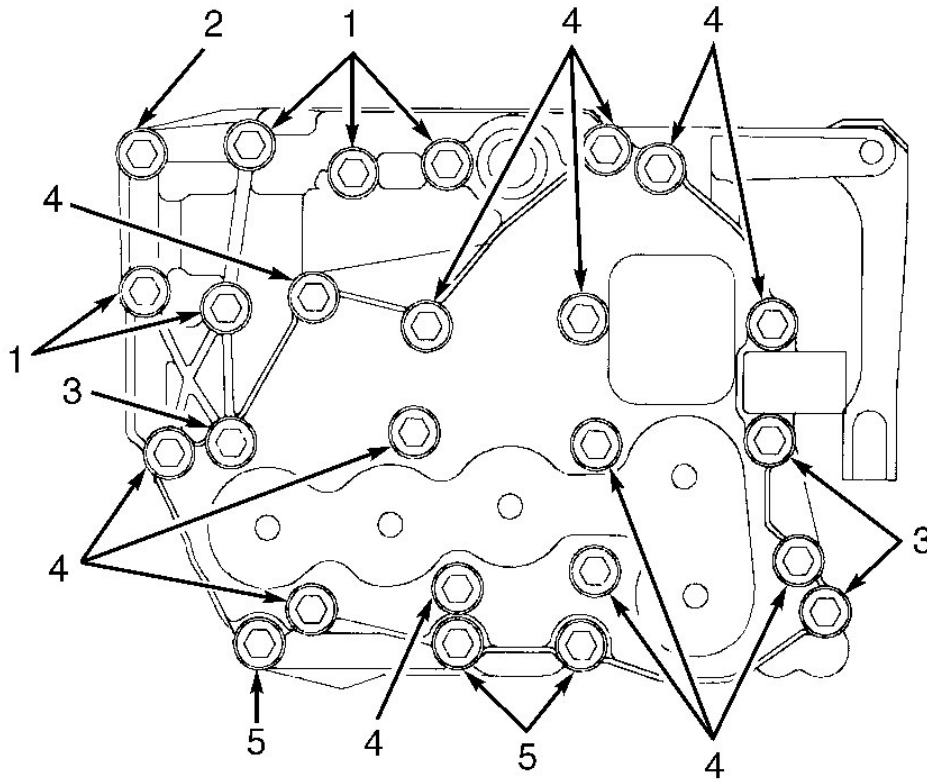
G92H14693

Fig. 64: Locating Line Actuator Ports In Valve Body
Courtesy of GENERAL MOTORS CORP.



G92I14694

Fig. 65: Identifying Dowel Bolt & Valve Body Bolt Locations
Courtesy of GENERAL MOTORS CORP.



VALVE BODY BOLT LOCATION & LENGTH

Application	Length In. (mm)
1	1.97 (50)
2 (Dowel Type)	2.24 (57)
3 (Dowel Type)	3.27 (83)
4	2.95 (75)
5	2.56 (65)

G92J14695

Fig. 66: Identifying Length Of Valve Body Bolts
 Courtesy of GENERAL MOTORS CORP.

OIL PUMP ASSEMBLY

Disassembly

Remove oil pump cover from oil pump housing. See **Fig. 67** . Remove drive gear, driven gear and pressure relief valve assembly.

Inspection

Inspect drive and driven gear surfaces and bushings for wear and damage. Replace any defective part. Measure oil pump clearances. Using straight edge and feeler gauge, measure drive and driven gear side clearance. See **Fig. 68** . Measure driven gear-to-oil pump housing clearance. See **Fig. 69** . Use feeler gauge to measure between each gear and crescent. See **Fig. 70** and **Fig. 71** . See **OIL PUMP SPECIFICATIONS** . Replace any part not within specification.

Reassembly

To reassemble, reverse disassembly procedures. Lubricate all parts.

OIL PUMP SPECIFICATIONS

Application	Clearance: In. (mm)
Drive Gear Side Clearance	.0005-.0016 (.012-.041)
Driven Gear Side Clearance	.0005-.0016 (.012-.041)
Driven Gear-To-Housing	.0025-.0055 (.064-.139)
Driven Gear-To-Crescent	.0075-.0134 (.191-.341)
Drive Gear-To-Crescent	.0050-.0109 (.128-.278)

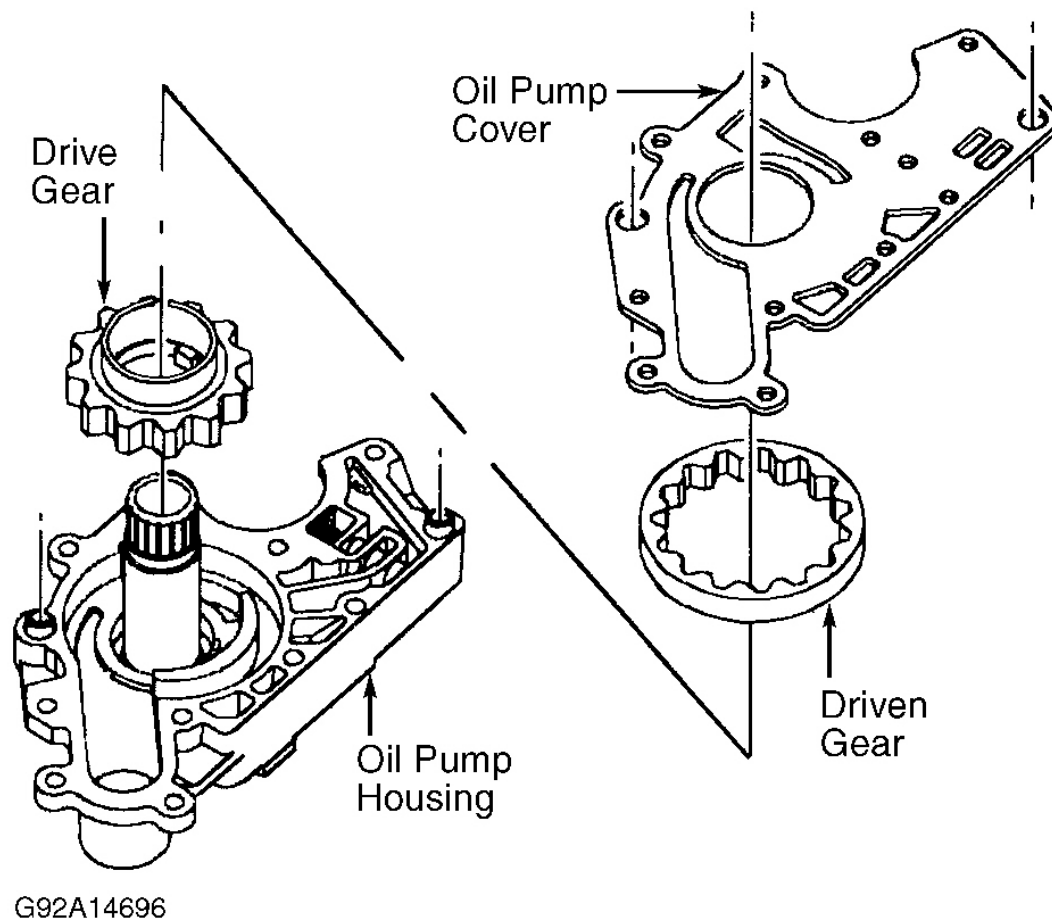


Fig. 67: Identifying Oil Pump Assembly Components
 Courtesy of GENERAL MOTORS CORP.

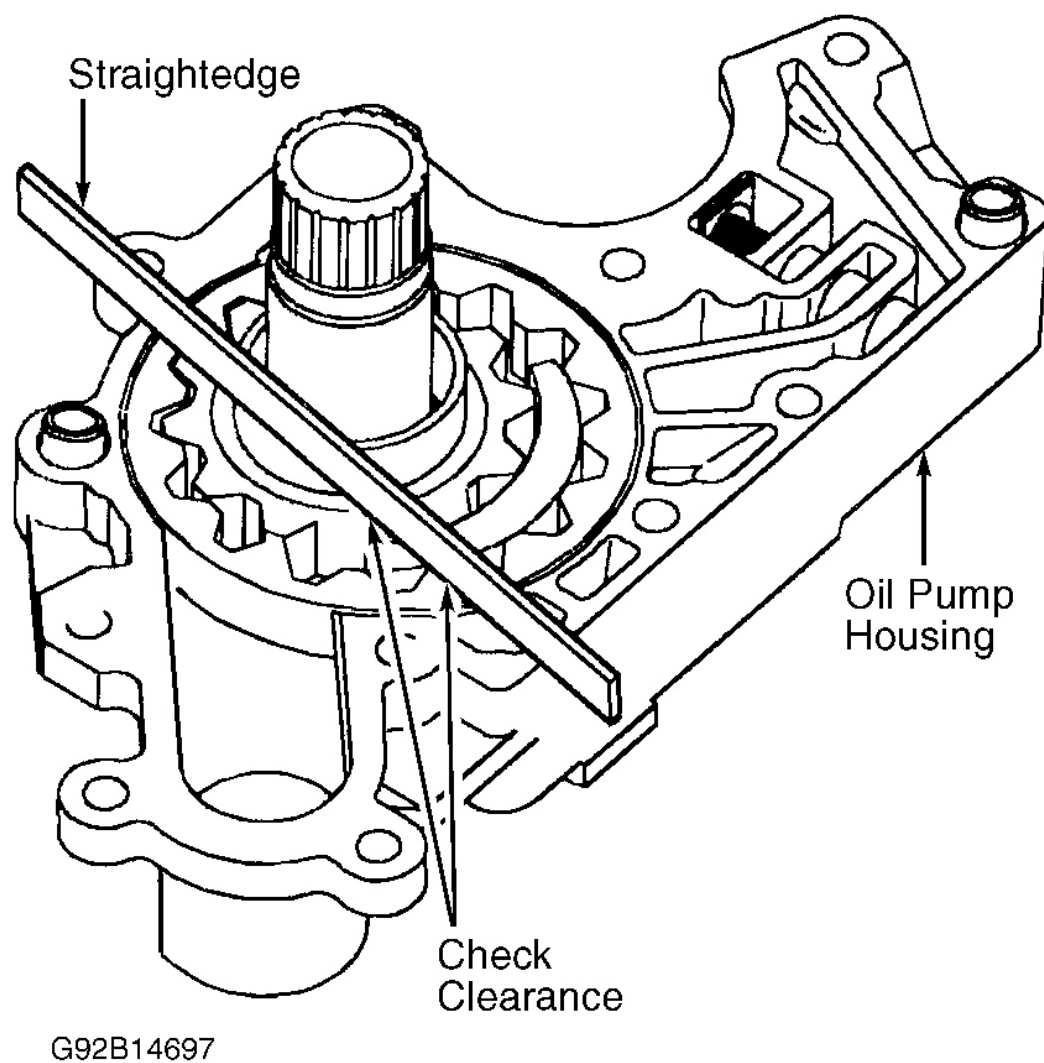
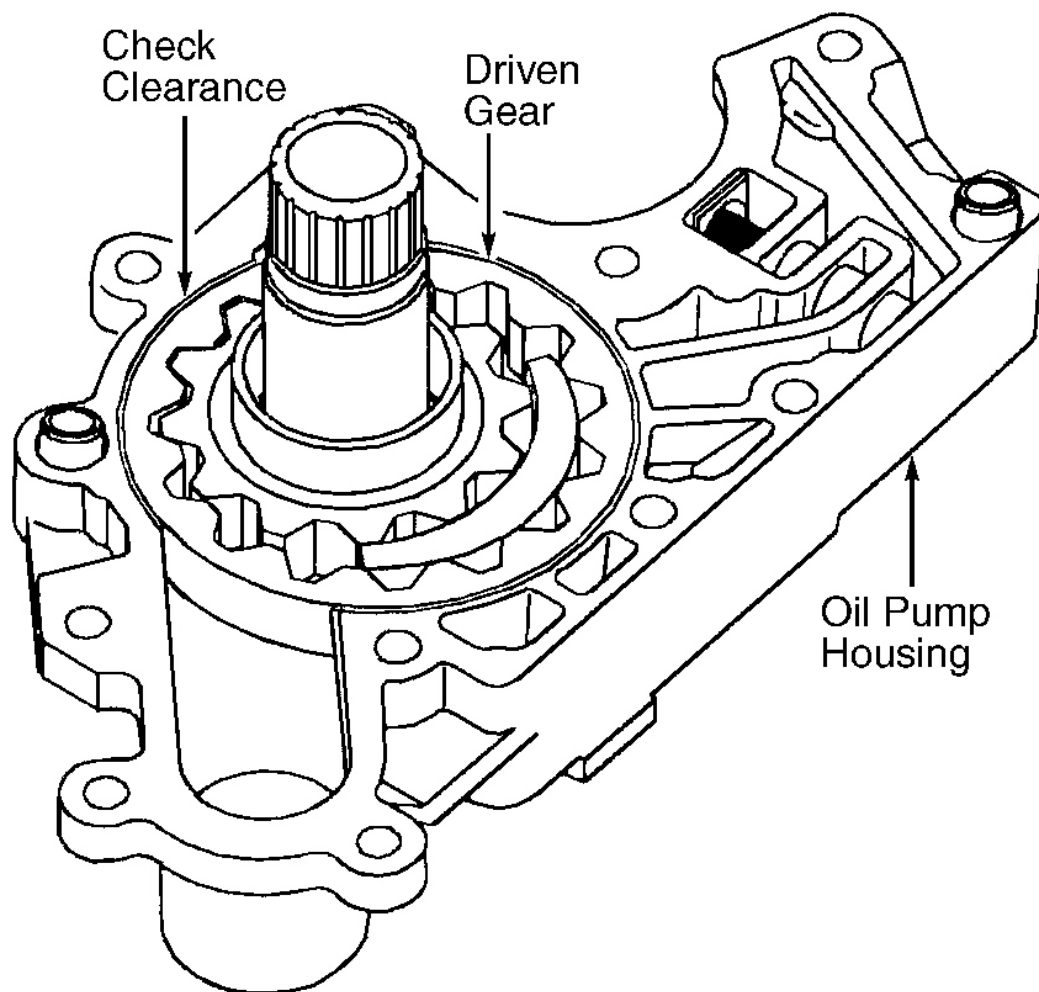
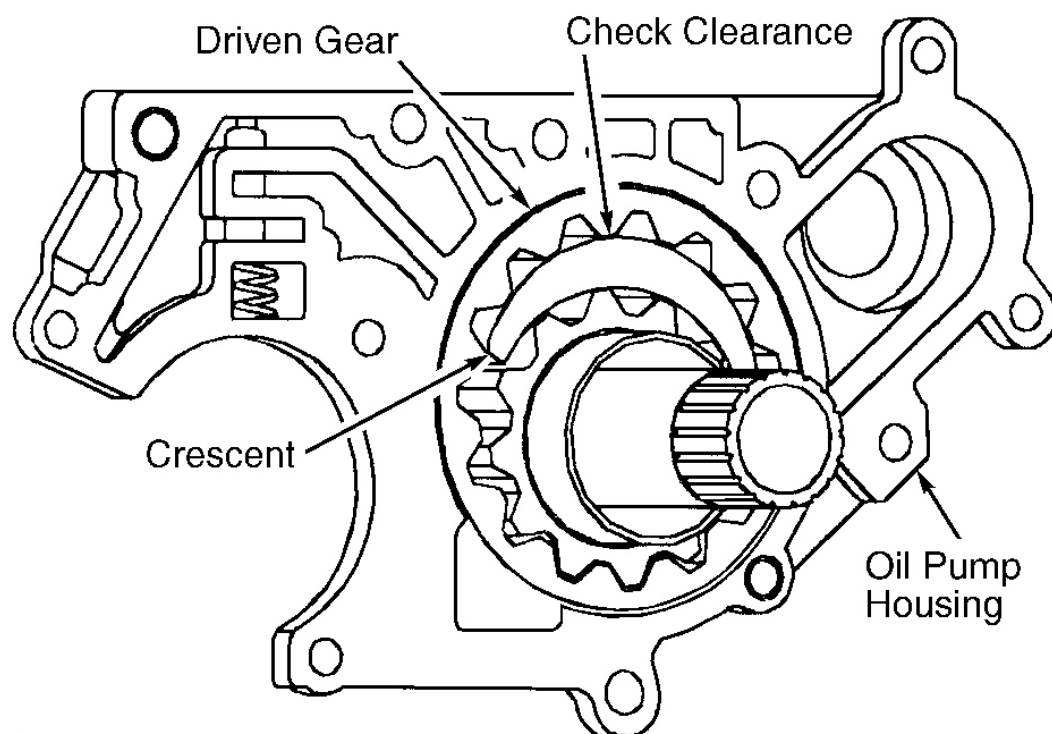


Fig. 68: Checking Gear Side Clearance
Courtesy of GENERAL MOTORS CORP.



G92C14698

Fig. 69: Checking Driven Gear-To-Housing Clearance
Courtesy of GENERAL MOTORS CORP.



G92D14699

Fig. 70: Checking Driven Gear-To-Crescent Clearance
Courtesy of GENERAL MOTORS CORP.

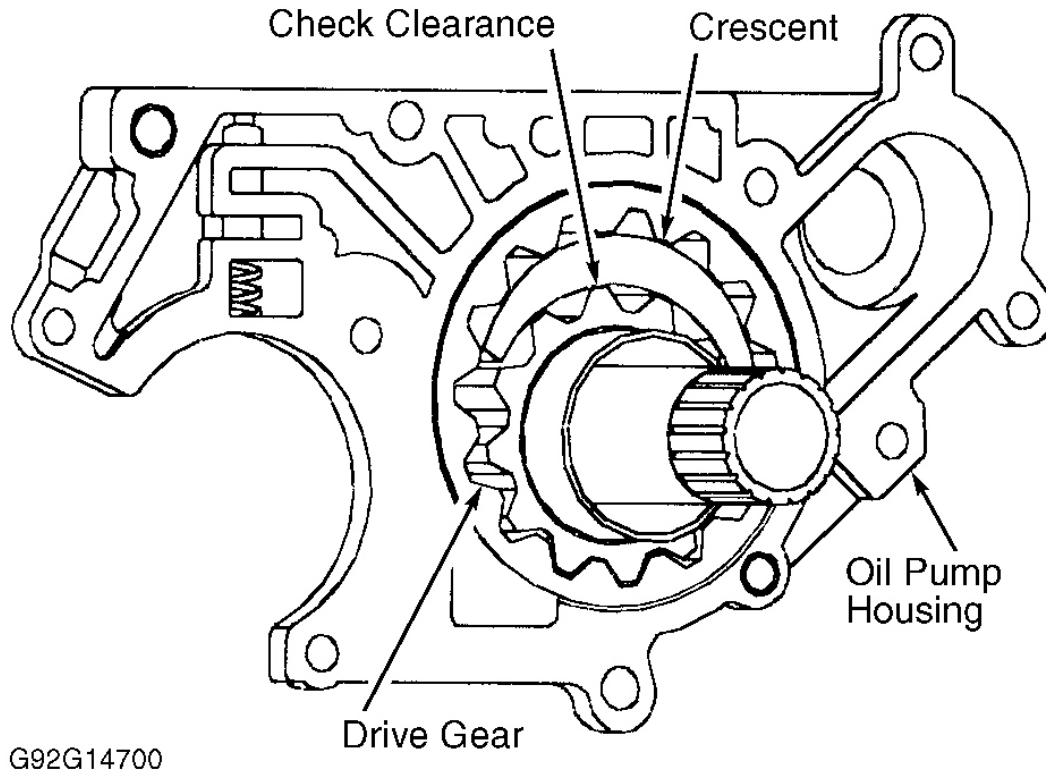


Fig. 71: Checking Drive Gear-To-Crescent Clearance
Courtesy of GENERAL MOTORS CORP.

TRANSAXLE REASSEMBLY

NOTE: Exploded views of internal components, thrust washer and bearing locations can be found in [Fig. 11](#) , [Fig. 23](#) , [Fig. 38](#) and [Fig. 52](#) .

Case Assembly

1. Apply petroleum jelly to output shaft bearing, and install bearing on output shaft. With another technician, align input shaft, output shaft and final drive assemblies. Carefully install assemblies into converter housing.

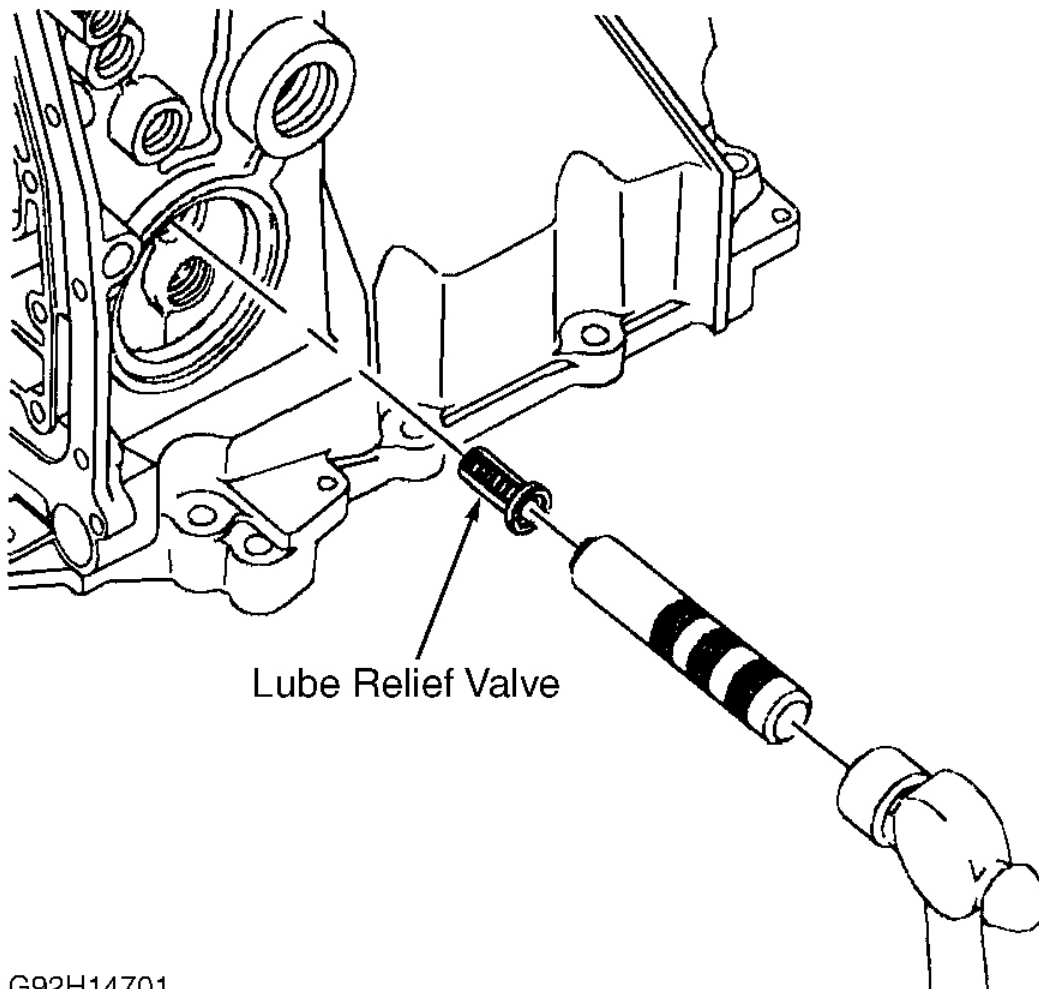
CAUTION: If shaft assemblies are not installed at same time, output shaft bearing or bearing race may be damaged.

2. Lubricate and install reverse idler gear, shaft and bearing assembly. See [Fig. 23](#) . Ensure chamfer side of gear faces rear of transaxle case. Install reverse idler gear cap housing, and tighten bolts to 15 ft. lbs. (20 N.m).

3. If necessary, use Driver (SA9103E) to install new lube relief valve. See **Fig. 72** . Install manual shaft oil seal. Ensure seal is seated in transaxle case.
4. Install oil pump assembly. See **Fig. 22** . Tighten oil pump body bolts in sequence. See **Fig. 73** . If necessary, install stator support and needle bearing. See **Fig. 11** . Install parking pawl assembly. See **Fig. 11** and **Fig. 21** . Install oil pump case "O" ring.

NOTE: Stator support bolts **DO NOT** have washer-type heads.

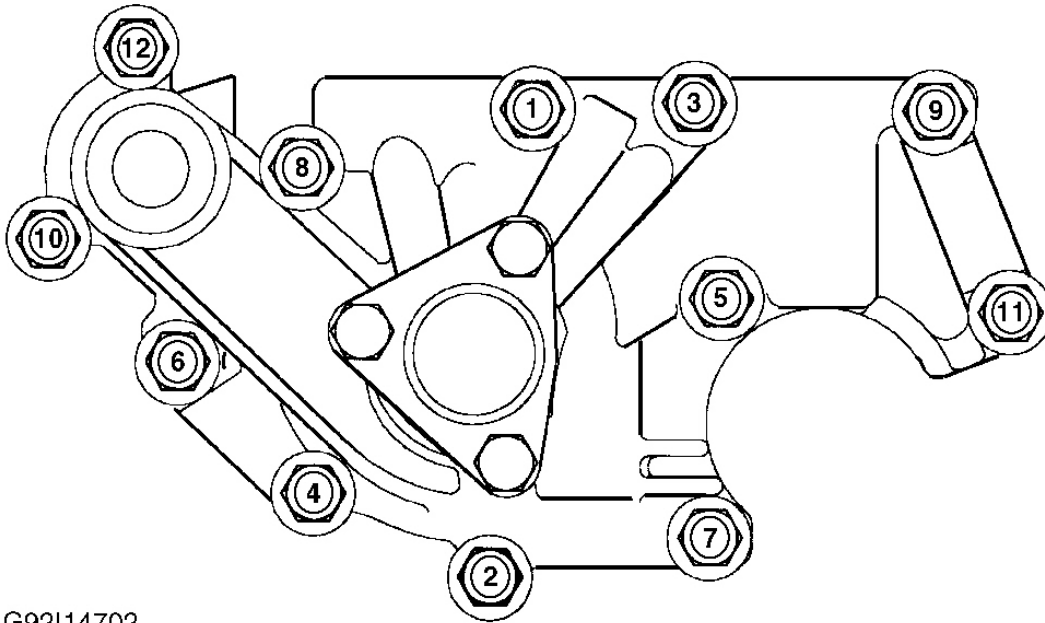
5. Position gasket on converter housing. Apply an even coat of Sealant 515 (21005993) to converter housing and transaxle case. Install transaxle case over converter housing. If necessary, turn reverse idler gear to allow transaxle case to clear.
6. Lightly lubricate case bolts. Install bolts, and tighten in sequence. See **Fig. 74** . Remaining 2 case bolts are installed after end cover is installed. Ensure both shafts still rotate.



G92H14701

Fig. 72: Installing Lube Relief Valve

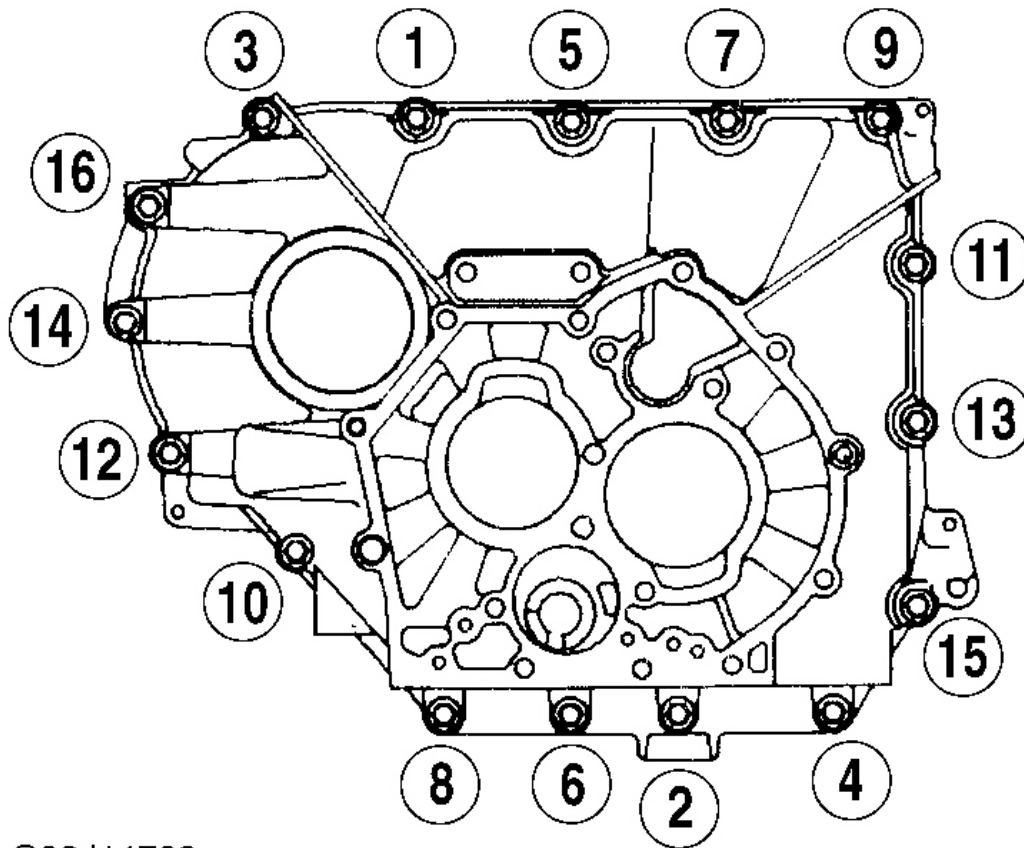
Courtesy of GENERAL MOTORS CORP.



G92114702

Fig. 73: Oil Pump Bolt Tightening Sequence

Courtesy of GENERAL MOTORS CORP.

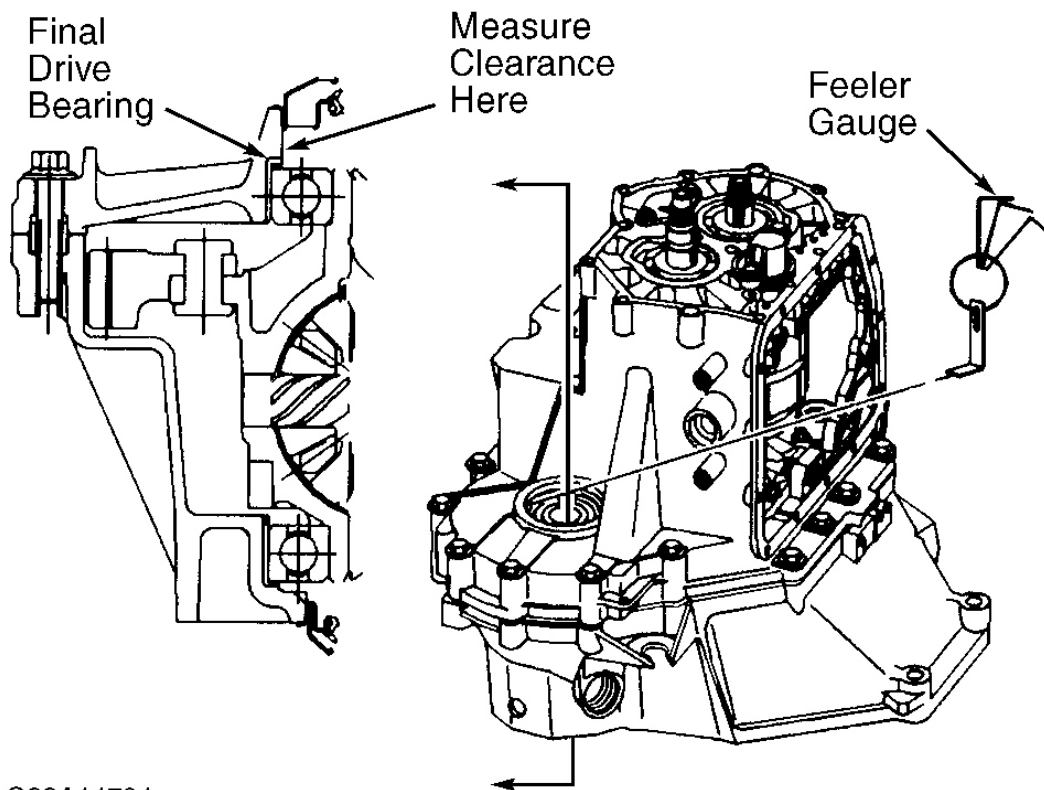


G92J14703

Fig. 74: Transaxle Case Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS CORP.

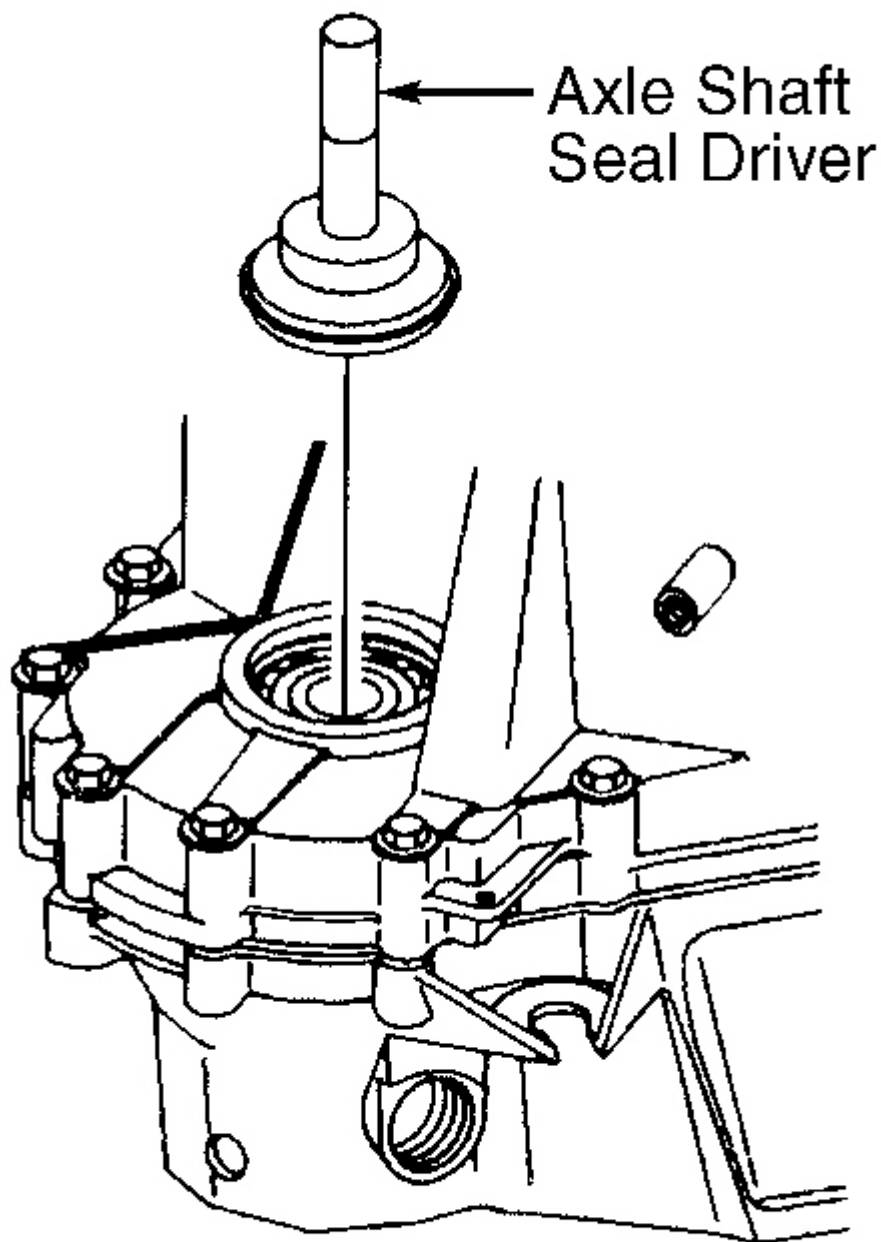
Differential End Play

1. Differential end play is not specified. If possible, install old snap ring into transaxle case. Using feeler gauge(s), measure clearance between case and differential side bearing outer race. See **Fig. 75**.
2. Record clearance. Select a snap ring which provides smallest possible end play. Selective snap rings are available from dealer. Install axle shaft seal and retaining ring. See **Fig. 76**.



G92A14704

Fig. 75: Measuring Differential Bearing Race Clearance
Courtesy of GENERAL MOTORS CORP.

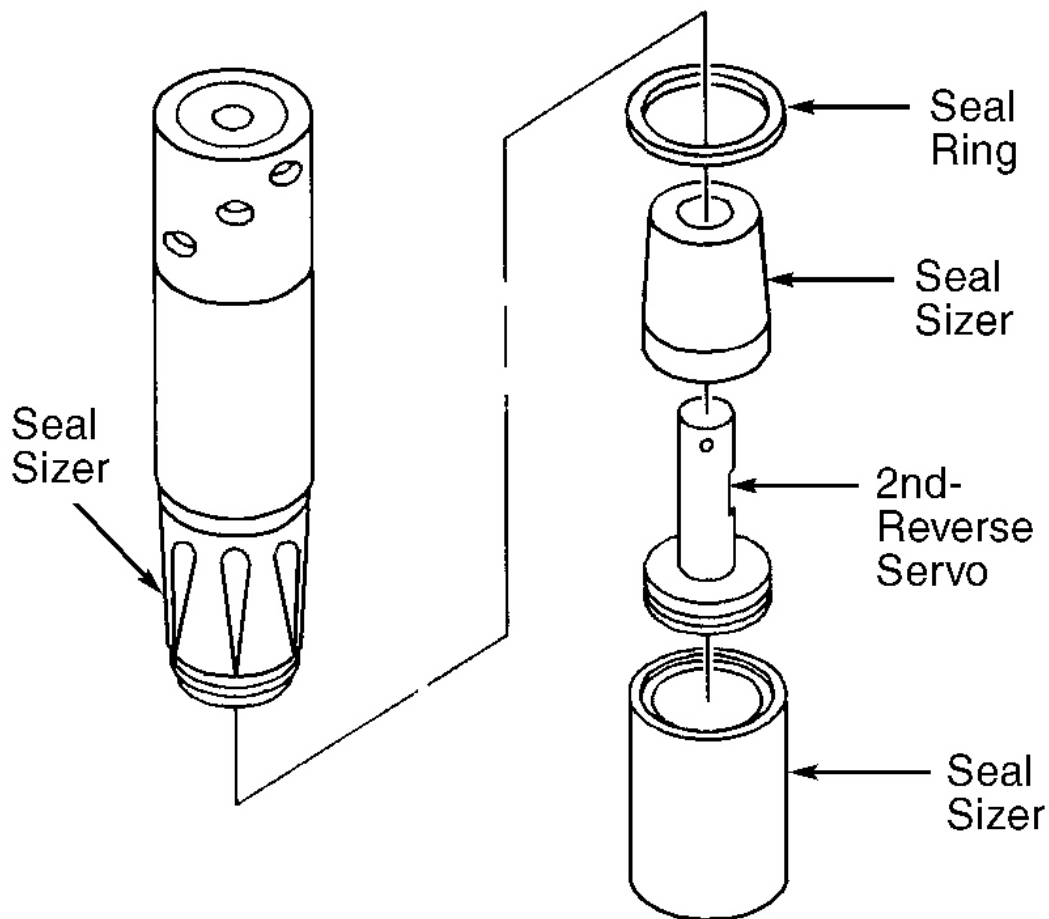


G92B14705

Fig. 76: Installing Axle Shaft Seal
Courtesy of GENERAL MOTORS CORP.

End Cover

1. If necessary, use Seal Sizer Set (SA9137T) to install and size 2nd/reverse servo piston seal. Slide 2nd/reverse fork on dog clutch sleeve. See **Fig. 18** , **Fig. 77** and **Fig. 78** .
2. Install servo piston. Align servo shaft with 2nd/reverse fork. Apply Loctite 242 to bolt. Install and tighten bolt in 2nd/reverse fork. See **Fig. 18** . Install servo spring and cover and tighten servo cover bolts.
3. Install 1st driven gear and sprag assembly. See **Fig. 17** . Ensure threads on input shaft are clean. Engage parking pawl to hold shaft. Tighten new input shaft lock nut to 110 ft. lbs. (150 N.m).
4. Install 1st drive gear and hub assembly. See **Fig. 79** . Ensure hub tangs and clutch tangs line up. Install Input Shaft Holder (SA9119T) to 1st drive gear. Ensure threads on output shaft are clean. Tighten a new output shaft lock nut to 110 ft. lbs. (150 N.m). See **Fig. 15** .



G92C14706

Fig. 77: Sizing 2nd/Reverse Servo Seal (1 Of 2)
Courtesy of GENERAL MOTORS CORP.

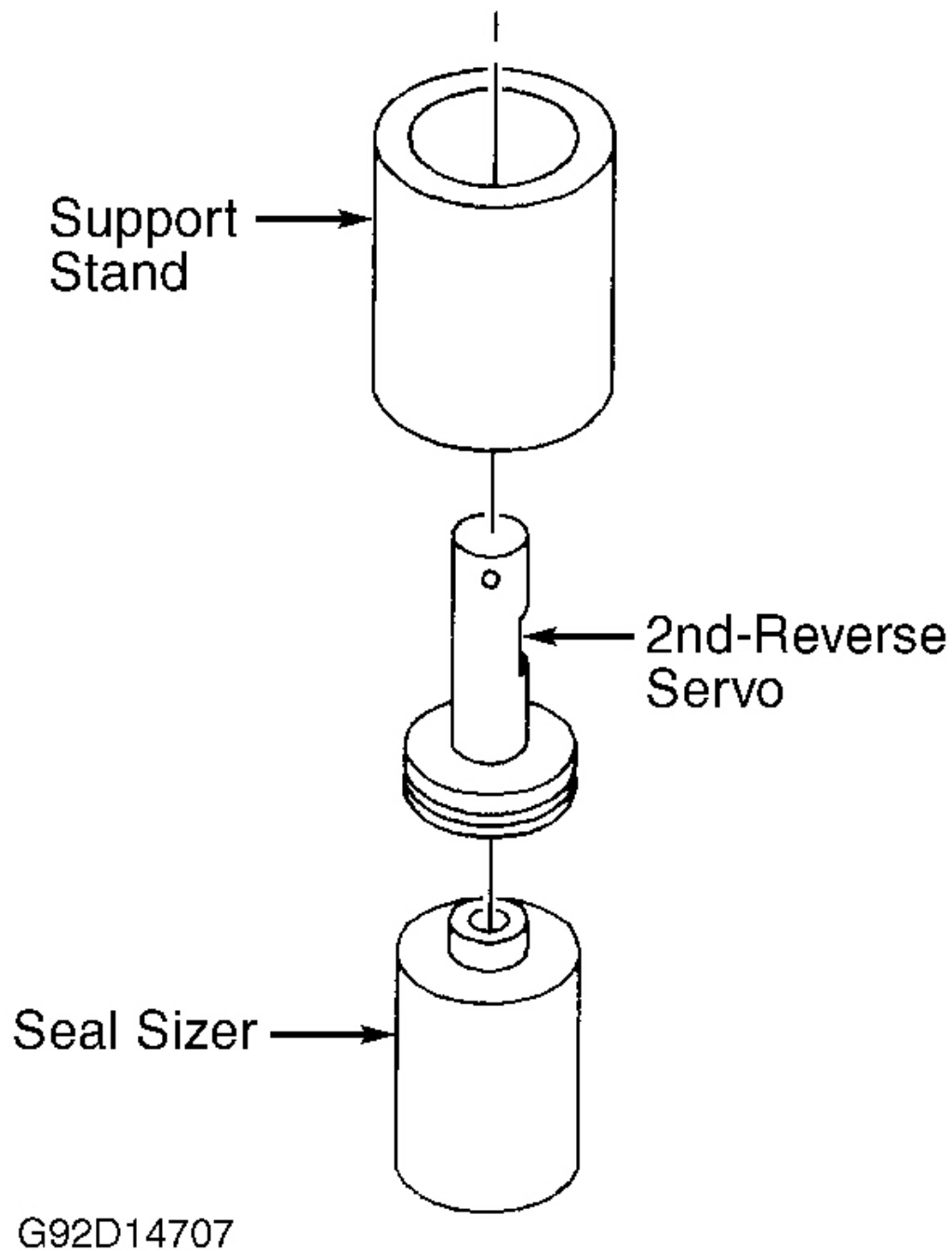
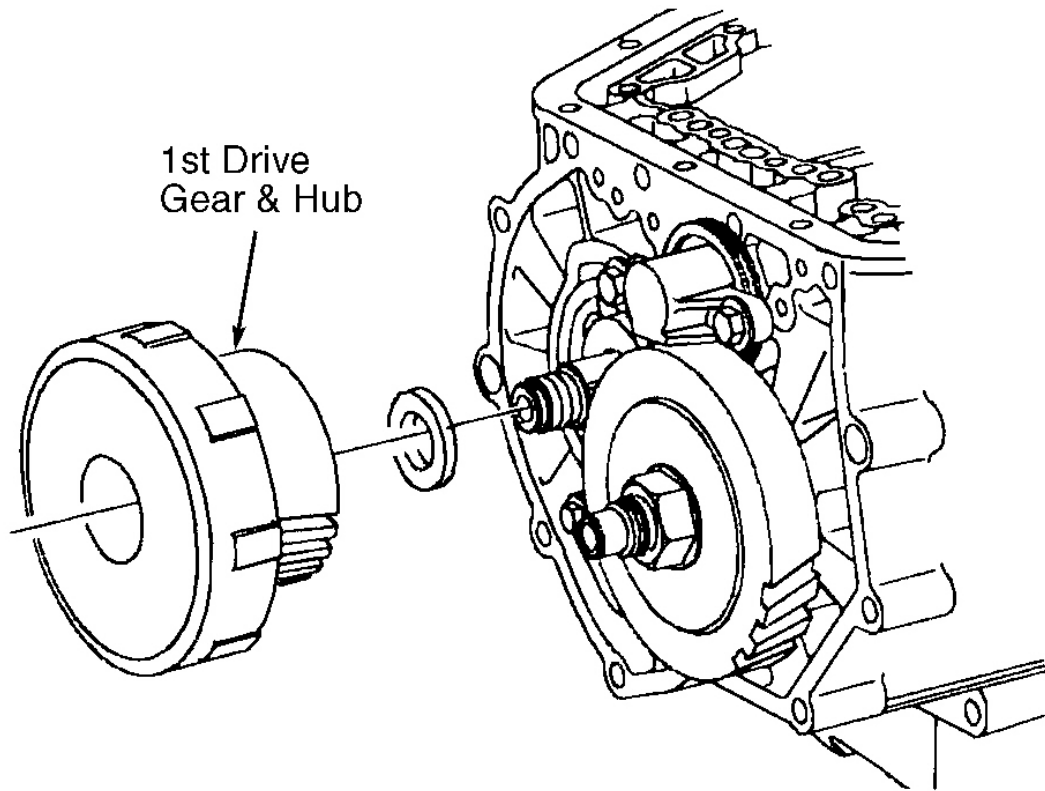


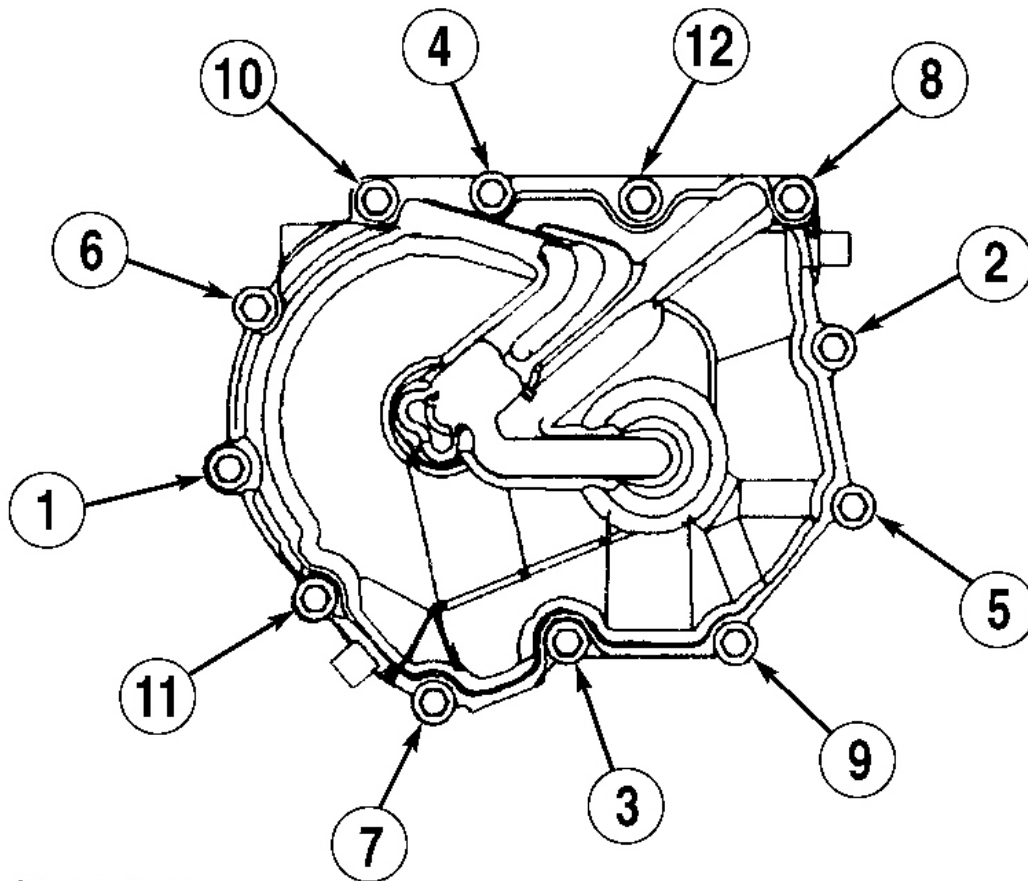
Fig. 78: Sizing 2nd/Reverse Servo Seal (2 Of 2)
Courtesy of GENERAL MOTORS CORP.



G92I14710

Fig. 79: Installing 1st Drive Gear & Hub
Courtesy of GENERAL MOTORS CORP.

5. Check clearance between 1st drive gear and 1st thrust washer. Clearance should be .003-.017" (.08-.43 mm). If clearance is not as specified, check position of 1st clutch, gear and hub assembly.
6. Disengage parking pawl. Rotate 1st clutch. Ensure all drive gears on input shaft rotate. If all drive gears **DO NOT** rotate, clutch plates may not be positioned correctly.
7. Line up and install manual valve link assembly. Assemble detent lever to lever shaft. Install new roll pin or nut to detent lever assembly. See **Fig. 13** . Install, but **DO NOT** tighten, neutral safety switch.
8. Install end cover gasket. See **Fig. 14** . Line up and insert shaft oil tubes into both shafts. **DO NOT** force tubes into shafts. Lightly lubricate end cover bolts. Install bolts. Tighten end cover bolts in sequence. See **Fig. 80** .

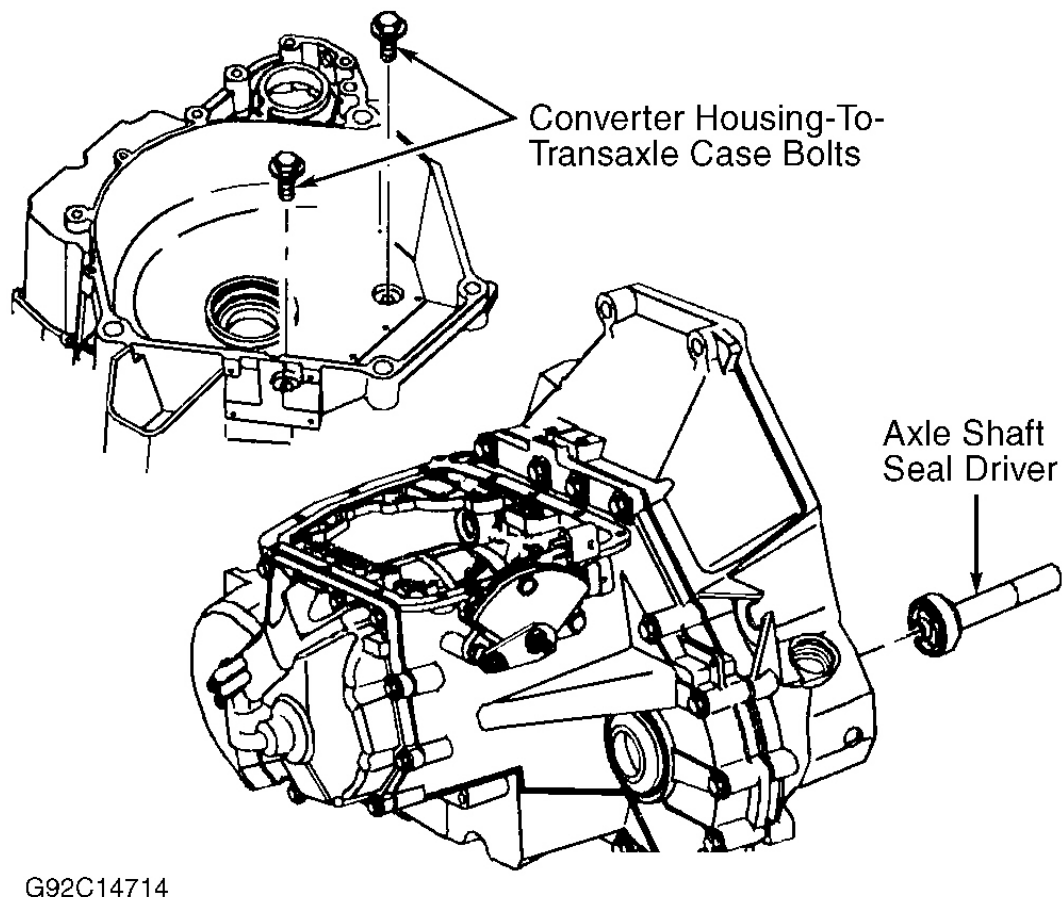


G92B14713

Fig. 80: End Cover Bolt Tightening Sequence
 Courtesy of GENERAL MOTORS CORP.

Final Assembly

1. Install axle shaft seal into converter housing. Lightly lubricate and install remaining case bolts. See **Fig. 81** . Ensure flat surface on manual valve faces up. Lightly lubricate valve body mounting bolts.
2. Install valve body mounting bolts into valve body. Ensure dowel bolts are correctly installed. See **Fig. 65** and **Fig. 66** . Line up manual valve with valve link. Lower valve body onto transaxle case. Tighten line actuator cover bolts in sequence. See **Fig. 82** . Tighten valve body to transaxle case bolts. See **Fig. 83** .



G92C14714

Fig. 81: Installing Axle Shaft Seal & 2 Case Bolts
Courtesy of GENERAL MOTORS CORP.

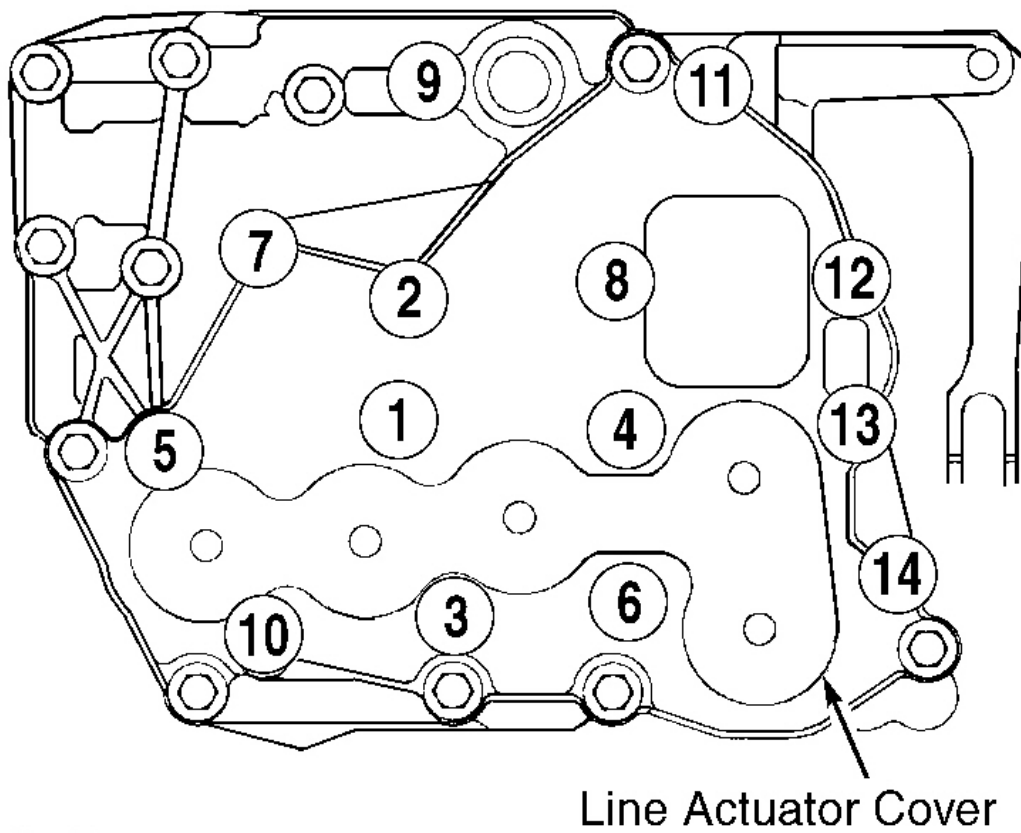


Fig. 82: Line Actuator Cover Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

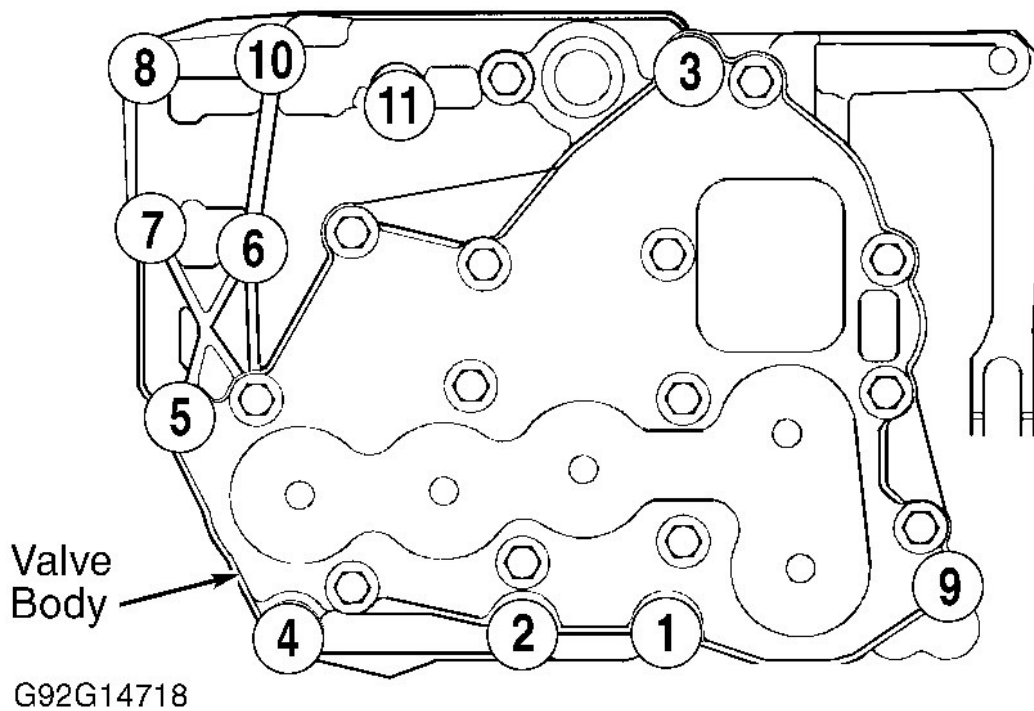


Fig. 83: Valve Body-To-Case Bolt Tightening Sequence
Courtesy of GENERAL MOTORS CORP.

3. Install neutral safety switch (if not already installed). Move parking pawl to "D4" position. Neutral safety switch should have continuity. See **Fig. 84** . Rotate switch to obtain continuity. Tighten neutral safety switch attaching bolts.
4. Install oil pan and bolts. Tighten oil pan bolts in a crisscross pattern. Install pressure filter, temperature sensor, turbine speed sensor, vehicle speed sensor and dipstick tube.
5. Install input shaft seal. See **Fig. 85** . Ensure seal is between back-up ring and converter case and not next to input shaft splines. Using Expander (SA9135T), install spiral ring to input shaft. See **Fig. 86** . Install "O" ring to torque converter, and install torque converter. See **Fig. 11** . Recheck converter end play.

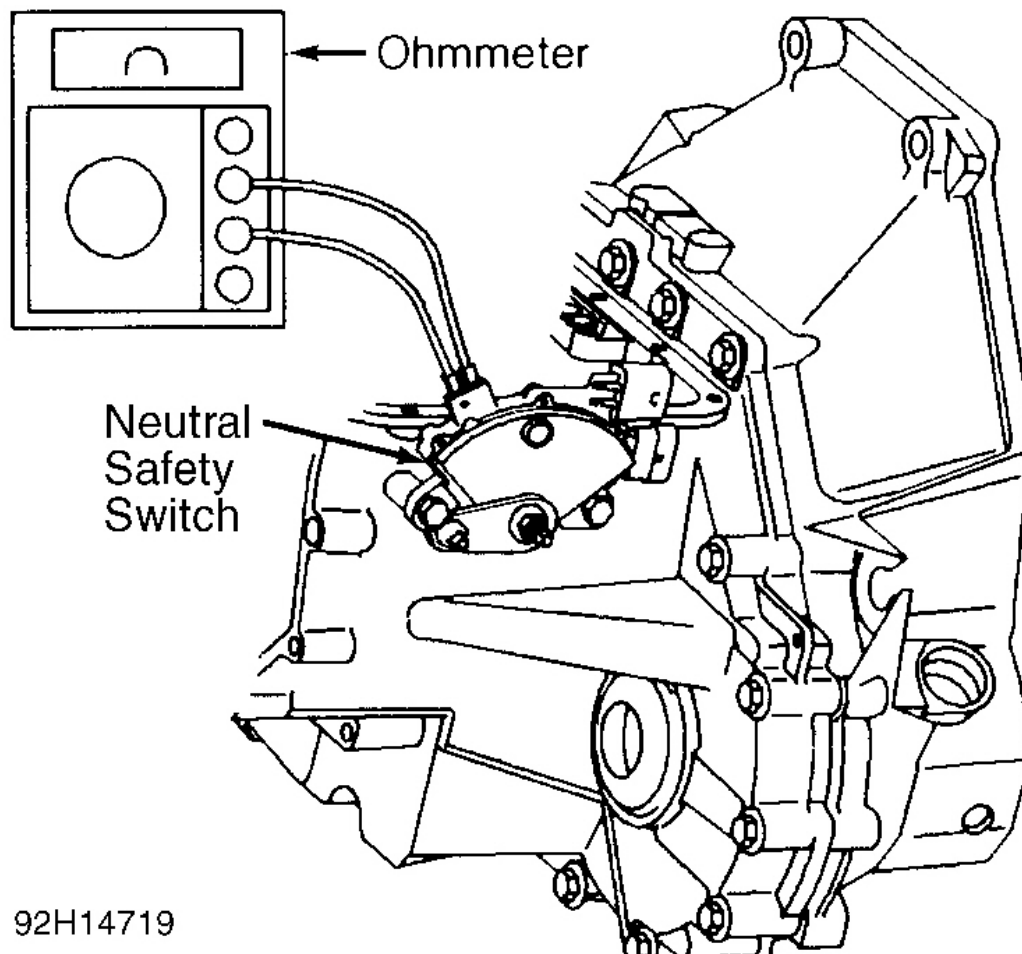
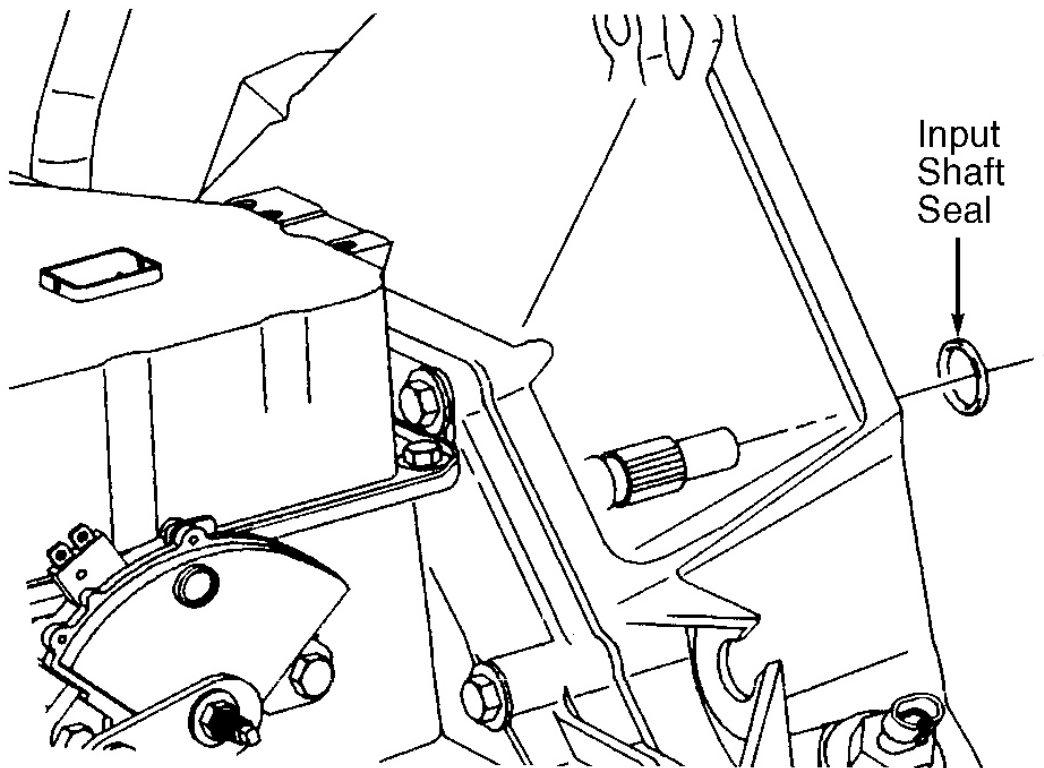
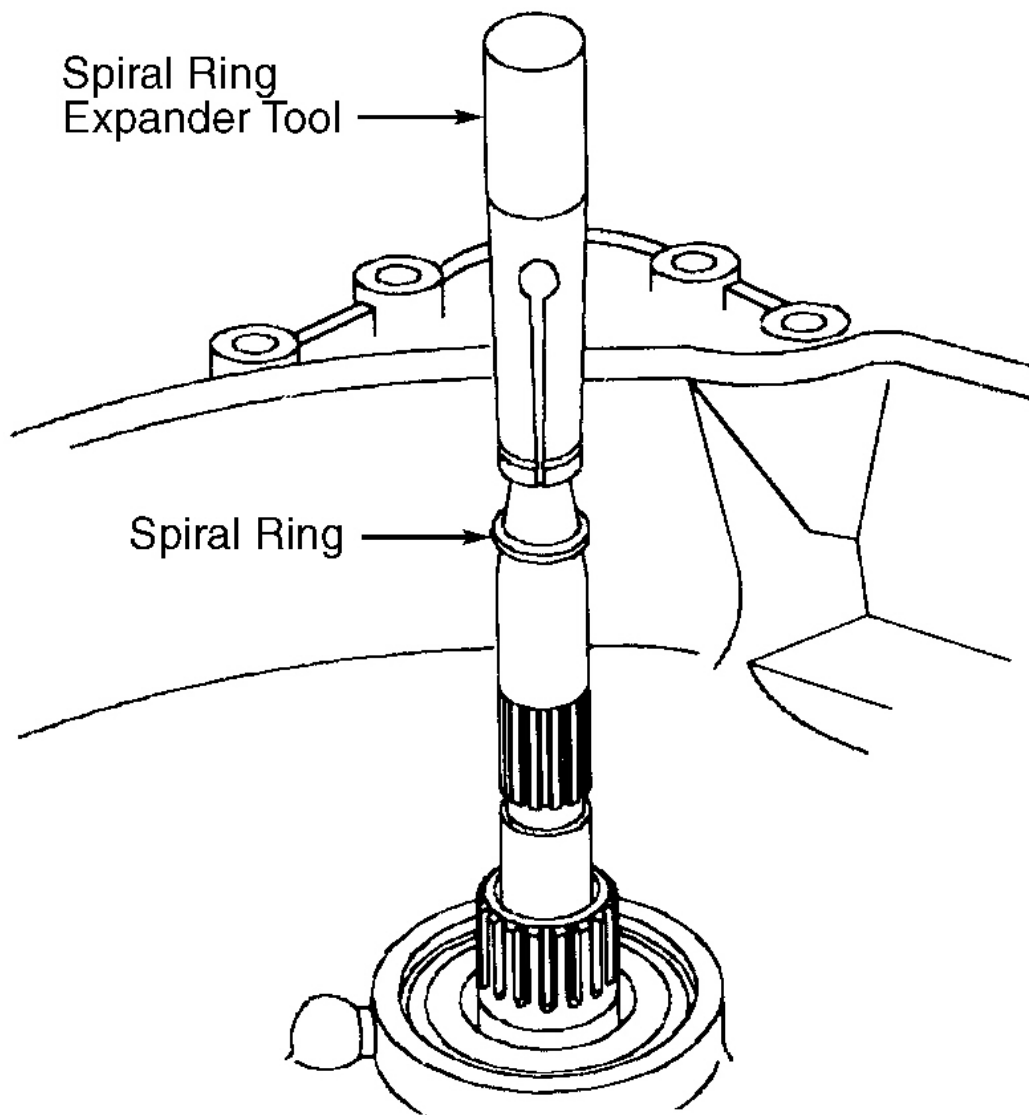


Fig. 84: Adjusting Neutral Safety Switch
Courtesy of GENERAL MOTORS CORP.



G92A14720

Fig. 85: Installing Input Shaft Seal
Courtesy of GENERAL MOTORS CORP.



G92B14721

Fig. 86: Installing Spiral Ring
 Courtesy of GENERAL MOTORS CORP.

TRANSAXLE SPECIFICATIONS

TRANSAXLE SPECIFICATIONS

Application	In. (mm)
Clearance - Input Shaft	
1st Gear-To-Thrust Washer	.003-.017 (.08-.43)

1991 Saturn SC

1991-94 AUTOMATIC TRANSMISSIONS Saturn - Overhaul

2nd/Reverse-To-Thrust Washer	.001-.006 (.03-.15)
4th Gear-To-Thrust Washer	.002-.009 (.05-.23)
Clearance - Oil Pump	
Drive Gear Side	.0005-.0016 (.012-.041)
Driven Gear Side	.0005-.0016 (.012-.041)
Driven Gear-To-Housing	.0025-.0055 (.064-.139)
Drive Gear-To-Crescent	.0050-.0109 (.128-.278)
Driven Gear-To-Crescent	.0075-.0134 (.191-.341)
Clearance - Output Shaft	
1st Gear-To-Thrust Washer	.004-.016 (.10-.40)
2nd Gear-To-Dog Clutch	.002-.006 (.05-.15)
3rd Gear-To-Thrust Washer	.00008-.018 (.0020-.46)
Reverse Gear-To-Thrust Washer	.003-.007 (.08-.18)
End Play	
Torque Converter (Maximum)	.026 (.60)
1st Clutch	.038-.055 (0.96-1.40)
2nd Clutch	.060-.086 (1.52-2.18)
3rd Clutch	.046-.061 (1.17-1.55)
4th Clutch	.036-.046 (0.91-1.17)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
End Cover Bolt	21 (28)
Input Shaft Lock Nut	110 (149)
Oil Pan Drain Plug	
With Aluminum Washer	33 (45)
With Rubber Washer	22 (30)
Output Shaft Lock Nut	110 (149)
Parking Pawl Assembly Bolt	22 (30)
Reverse Idler Gear Cap Housing Bolt	15 (20)
Speed Sensors	19 (26)
Stator Support Bolt	22 (30)
Torque Converter Housing-To-Transaxle Case Bolt	
Short	18 (25)
Long	21 (28)
Transaxle Filter Tube Bolt	23 (31)
2nd/Reverse Servo Cover Bolt	15 (20)
INCH Lbs. (N.m)	
Air Induction System Clamps	18 (2)

1991 Saturn SC

1991-94 AUTOMATIC TRANSMISSIONS Saturn - Overhaul

Air Filter Box Fasteners	89 (10)
Dipstick Tube-To-Case Bolt	106 (12)
Line Actuator Cover Bolt	97 (11)
Manual Detent Shaft Nut	106 (12)
Neutral Safety Switch Bolt	124 (14)
Oil Pan Bolt	89 (10)
Oil Pump Bolt	106 (12)
Temperature Sensor	71 (8)
Valve Body-To-Case Bolt	97 (11)
2nd/Reverse Fork Lock Bolt	89 (10)