

## 1993 Toyota Land Cruiser

1993-94 AUTOMATIC TRANSMISSIONS Toyota A-442F

### 1993-94 AUTOMATIC TRANSMISSIONS

#### Toyota A-442F

## APPLICATION

### TRANSMISSION APPLICATIONS

Vehicle Model	Transmission Model
1993-94 Land Cruiser	A-442F

## IDENTIFICATION

Vehicle Identification Number (VIN) is used for correct application of component parts and assemblies. VIN locations are top left of instrument panel, driver's door post and stamped on front cowl of engine compartment.

## DESCRIPTION

The A-442F is a 4-speed automatic electronically controlled transmission with a 2-speed transfer unit. The transmission has 4 forward speeds and reverse. Transmission consists of a lock-up torque converter, oil pump, valve body assembly with 4 electronic solenoid valves, forward clutch, direct clutch, rear clutch, 3 planetary gear sets and 2 one-way clutches.

Transmission shifting and torque converter lock-up are controlled by an electronic controlled Transmission Control Unit (TCU). To minimize possibility of incorrect operation of vehicle transaxle, a shift lock mechanism has also been added. For more information on shift lock and key lock system, see the appropriate SHIFT LOCK SYSTEM article.

## LUBRICATION & ADJUSTMENT

See appropriate TRANSMISSION SERVICING article in AUTOMATIC TRANSMISSION SERVICING section.

## ON-VEHICLE SERVICE

### DRIVE AXLE SHAFTS

See appropriate AXLE SHAFTS article in AXLE SHAFTS & TRANSFER CASES section.

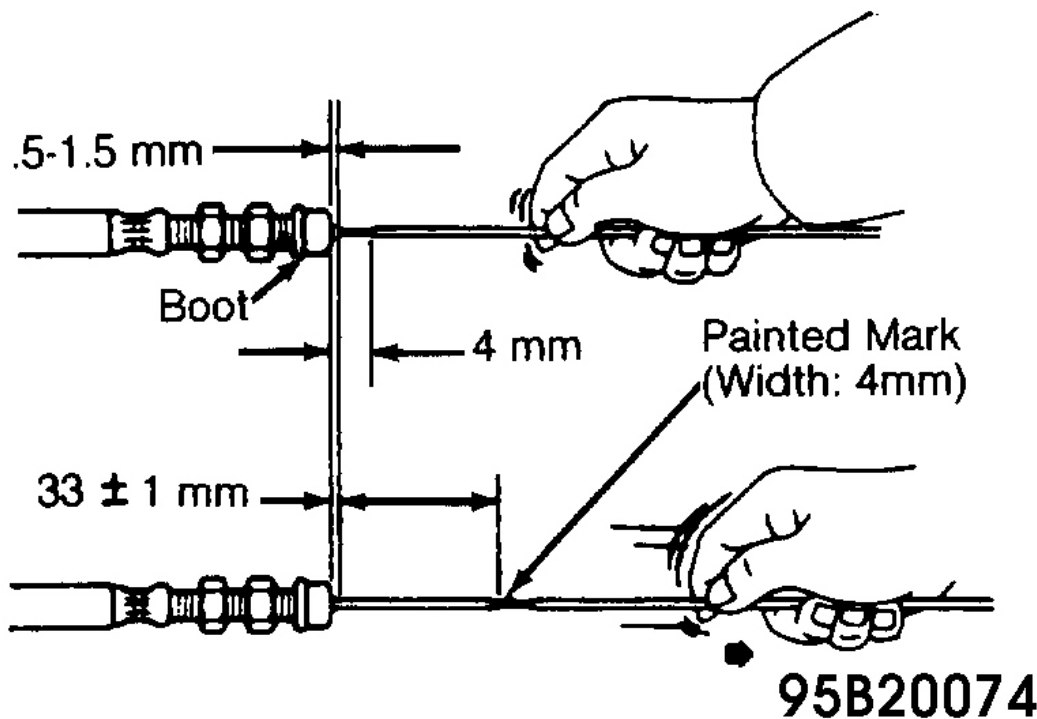
### THROTTLE CABLE

#### Removal

Disconnect throttle cable from throttle linkage. Disconnect throttle cable from cam. Remove valve body assembly. See VALVE BODY ASSEMBLY. Remove 4 center support apply gaskets. Remove frame crossmember. Remove throttle cable clamp. Using a 10 mm socket, remove throttle cable by pushing retainer part of throttle cable. Pull throttle cable from transmission.

### Installation

1. Install throttle cable in transmission case. Ensure cable is fully seated. Install crossmember. Install apply gaskets with pitted side of gasket facing case. Install valve body assembly. Connect throttle cable to cam. New throttle cables do not have a stopper installed.
2. Pull inner cable lightly until a slight resistance is felt. Paint a mark on cable. See **Fig. 1**. Mark should be .16" (4 mm) in width and .020-.059" (.5-1.5 mm) from rubber end of housing. Connect throttle cable to linkage.
3. Adjust throttle cable. See **TRANSMISSION SERVICING - A/T** article in the AUTOMATIC TRANS SERVICING section. Test drive vehicle.



**Fig. 1: Applying Paint Marking On Throttle Cable**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### VALVE BODY ASSEMBLY

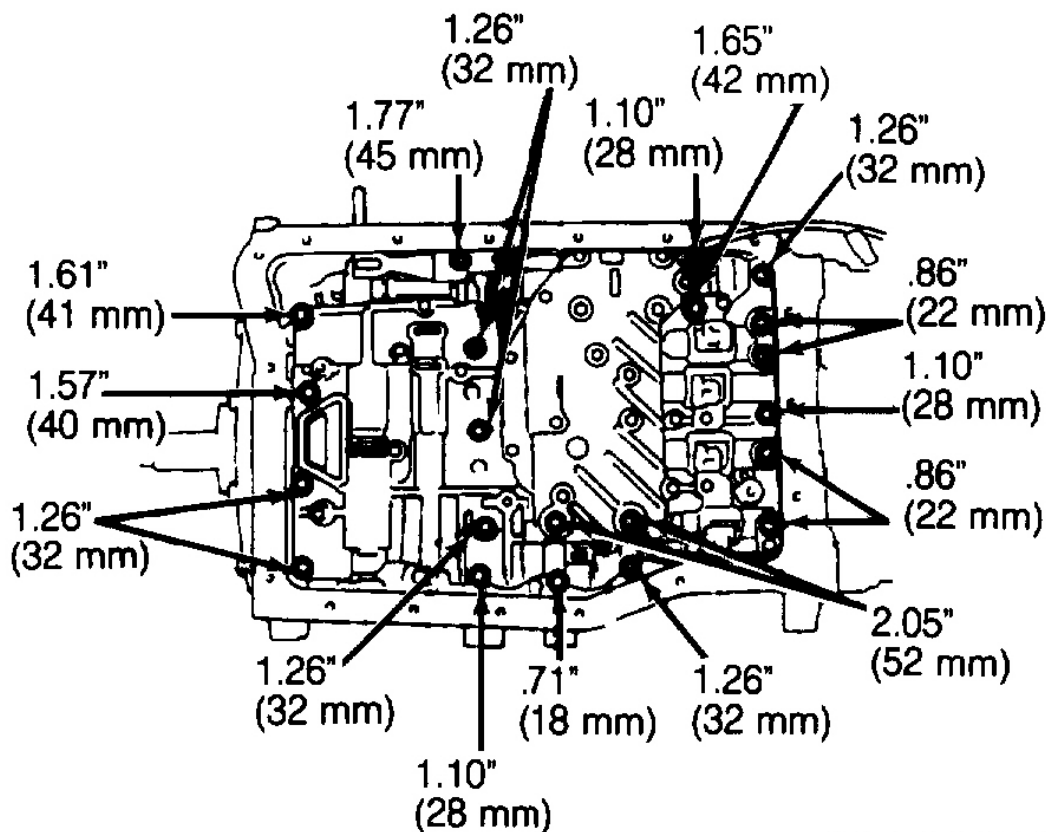
**CAUTION:** Note bolt length and location. Proper length bolts must be installed to prevent case damage.

### Removal

1. Clean exterior of transmission. Drain fluid. Remove oil pan protector (skid plate). Remove oil pan and gasket. Remove magnets. Remove oil strainer (filter).
2. Remove 21 valve body assembly bolts. Note bolt location and length. Disconnect solenoid connectors. Disconnect throttle cable from cam and remove valve body assembly.

### Installation

1. Align groove of manual valve with pin of manual valve lever. Connect throttle cable to cam. Install 21 valve body bolts in specified locations. See **Fig. 2**. Ensure manual valve lever contacts center of roller at tip of detent spring. Tighten bolts to 89 INCH lbs. (10 N.m).
2. Install solenoid connectors. Install new gasket and oil strainer. Install magnets in oil pan. Install new gasket and oil pan. Tighten bolts to 61 INCH lbs. (6.9 N.m). Install the oil pan protector. Fill the transmission using ATF DEXRON IIE. Refer to the **TRANSMISSION SERVICING - A/T** article in the AUTOMATIC TRANS SERVICING section. Test drive vehicle.



**95A20073**

**Fig. 2: Identifying Valve Body Assembly Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## TROUBLE SHOOTING

**NOTE:** For electronic diagnosis and component testing of A-442 transmissions, see the **AUTO TRANS DIAGNOSIS - A-442F** article.

### TROUBLE SHOOTING

#### Preliminary Checks

Automatic transmission malfunctions can be caused by either engine or transmission. Isolate malfunction to engine or transmission before proceeding with trouble shooting. Prior to trouble shooting, check and adjust throttle cable, shift linkage, park/neutral position switch and idle speed RPM as necessary. Ensure fluid level is correct. Check tires for correct inflation.

### SYMPTOM DIAGNOSIS

#### Fluid Discolored Or Smells Burnt

Fluid contaminated, torque converter faulty or transmission faulty.

#### No Movement In Any Forward Gear Or Reverse

Manual linkage out of adjustment, faulty valve body assembly or primary regulator, park lock pawl faulty, faulty torque converter, converter drive plate damaged or broken, oil pump intake screen blocked or transmission faulty.

#### Shift Lever Position Incorrect

Manual linkage out of adjustment, faulty manual valve and lever or transmission faulty.

#### Harsh Engagement Into Any Drive Range

Throttle cable out of adjustment, faulty valve body assembly, primary regulator or accumulator pistons.

#### Delayed 1-2, 2-3 Or 3-OD Upshift, Or Downshifts From OD-3 Or 3-2 Then Shifts Back To OD Or 3

Throttle cable out of adjustment, faulty valve body assembly or throttle cable and cam faulty.

#### Slips On 1-2, 2-3 Or 3-OD Upshift, Or Slips Or Shudders On Acceleration

Manual linkage out of adjustment, throttle cable out of adjustment, faulty valve body assembly or transmission faulty.

#### Drag, Binding Or Tie-Up On 1-2, 2-3 Or 3-OD Upshifts

Manual linkage out of adjustment, valve body assembly faulty, transmission faulty, see the **CLUTCH & BAND APPLICATION** table.

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### No Lock-Up

Valve body assembly faulty, torque converter faulty or transmission faulty.

### Harsh Downshift

Throttle cable out of adjustment, throttle cable and cam faulty, accumulator pistons faulty, valve body assembly faulty or transmission faulty.

### No Downshift When Coasting

Valve body assembly, solenoid valve or TCM.

### Downshift Occurs Too Soon Or Too Late While Coasting

Throttle cable out of adjustment, valve body assembly faulty, transmission faulty, shift solenoid faulty or TCM.

### No OD-3, 3-2 Or 2-1 Kickdown

Shift solenoid faulty, TCM or valve body assembly faulty.

### No Engine Braking In "2" Or "L" Range

Solenoid valve faulty, TCM, valve body assembly faulty or transmission faulty.

### Vehicle Does Not Hold In "P" Range

Manual linkage out of adjustment or parking lock pawl cam and spring faulty.

### CLUTCH & BAND APPLICATION

Selector Lever Position	Elements In Use
"P" (Park)	OD Direct Clutch & OD One-Way Clutch
"R" (Reverse)	OD Direct Clutch, Rear Clutch, 1st & Reverse Brake, & OD One-Way Clutch
"N" (Neutral)	OD Direct Clutch & OD One-Way Clutch
"D" (Drive)	
1st Gear	OD Direct Clutch, Forward Clutch, OD One-Way Clutch & No. 2 One-Way Clutch
2nd Gear	Forward Clutch, 2nd Brake & OD

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	One-Way Clutch
3rd Gear	OD Direct Clutch, Forward Clutch, Rear Clutch & OD One-Way Clutch
Overdrive	Forward Clutch, Rear Clutch & OD Brake
"2" (Second)	OD Direct Clutch, Forward Clutch 2nd Brake & OD One-Way Clutch
"L" (Low)	OD Direct Clutch, Forward Clutch, 1st & Reverse Brake, OD One-Way Clutch & No. 2 One-Way Clutch

## TESTING

### PRELIMINARY CHECKS

**NOTE:**        **DO NOT overfill transmission. If transmission is inadvertently overfilled, drain excess fluid. Use ATF DEXRON II.**

1. Perform following checks before starting test procedures. Check tire inflation. Check idle speed in Neutral. Idle speed should be 650 RPM.
2. Park vehicle on level surface and set parking brake. With engine idling, place shift lever into each shift position from "P" to "L" range. Pull dipstick and check fluid level. Check condition of fluid. If fluid smells burnt or is black in color, drain and replace fluid.
3. Inspect and adjust throttle cable. Adjust shift linkage. Inspect and adjust park/neutral position switch.

### TIME LAG TEST

**CAUTION:** Perform this test at normal operating fluid temperature of 122-176°F (50-80°C). Allow a one minute interval between tests. Make 3 measurements and take the average value.

1. If shift lever is actuated with engine idling, a time lag will be noted before shock can be felt. This test is used for checking condition of Overdrive (OD) clutch, forward clutch, direct clutch and 1st and reverse brake.
2. Apply parking brake. Start engine. Ensure idle speed is 650 RPM in "N" range. Shift transmission from "N" into "D" range. Use a stop watch to measure elapsed time between shifting of lever until shock is felt.
3. Time lag must be less than 1.2 seconds for 1993 models, 0.7 seconds for 1994 models. Repeat procedure shifting from "N" to "R" range. Time lag must be less than 1.5 seconds for 1993 models, 1.2 seconds for

1994 models.

4. Excessive time lag for "N" to "D" range may be caused by low line pressure, defective forward clutch or defective Overdrive (OD) one-way clutch. Excessive time lag for "N" to "R" range may be caused by low line pressure, defective direct clutch, 1st and reverse brake or defective OD one-way clutch.

## ROAD TEST

**CAUTION: Perform test at normal operating fluid temperature of 122-176°F (50-80°C).**

### "D" Range Test

1. Shift into "D" range. Hold accelerator pedal constantly at full throttle position. Check 1-2, 2-3 and 3-OD upshift points. See the **SHIFT SPEED SPECIFICATIONS** table.
  - If no 1-2 upshift occurs, No. 2 shift solenoid is stuck or 1-2 shift valve is stuck.
  - If no 2-3 upshift occurs, No. 1 shift solenoid is stuck or 2-3 shift valve is stuck.
  - If no 3-OD upshift occurs, 3-4 shift valve is stuck.
  - Incorrect shift points indicate that throttle cable requires adjustment or throttle valve, 1-2, 2-3 or 3-OD shift valves are defective.
  - If no lock-up occurs, lock-up solenoid is stuck, lock-up control valve is stuck or lock-up signal valve is stuck.
2. Use procedure outlined in step 1) to check shock and slip between 1-2, 2-3 and 3-OD upshifts. Excessive shock can be caused by excessive line pressure, defective accumulator or defective check ball.
3. Run in OD or lock-up of "D" range. Check for abnormal noise and vibration. Noise and vibration may be unbalanced propeller shaft, differential, torque converter or other drive train components.
4. While running in "D" range, 2nd, 3rd and OD gear, confirm correct kickdown vehicle speed limits for 2-1, 3-2 and OD-3 gears. Check for abnormal shock and slip at kickdown.
5. Check lock-up mechanism. See LOCK-UP SPEEDS table. Drive in OD gear of "D" range, at steady speed (lock-up ON) of 53 MPH. Lightly depress accelerator pedal. Ensure engine RPM does not change abruptly. Large increase in engine RPM indicates there is no lock-up.

### "2" Range Test

1. While running in 2nd gear, check that there is no upshift to 3rd gear.
2. While running in 2nd gear, check that there is no downshift to 1st gear. While running in 2nd gear, release accelerator pedal. Check engine braking effect.
3. Check for abnormal noise during acceleration and deceleration.

### "L" Range Test

1. While running in "L" range, check that there is no upshift to 2nd gear.
2. While running in "L" range, release accelerator pedal. Check engine braking effect. If there is no engine braking effect, 1st and reverse brake is defective. Check for abnormal noise during acceleration and deceleration.

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**"R" Range Test**

Shift into "R" range. While starting at full throttle, check for slipping.

**"P" Range Test**

Stop vehicle on slight grade. Shift transaxle into "P". Release parking brake. Ensure parking pawl holds vehicle in place.

**SHIFT SPEED SPECIFICATIONS <sup>(1)</sup>, <sup>(2)</sup>**

Application	MPH
<b>"D" Position</b>	
1st-2nd	32-36
2nd-3rd	66-73
3rd-OD	94-101
OD-3rd	90-97
3rd-2nd	61-65
2nd-1st	26-29
<b>"2" Position</b>	
1st-2nd	32-36
3rd-2nd	72-79
<b>"L" Position</b>	
2nd-1st	37-40
(1) Wide open throttle.	
(2) Shift speeds specifications apply to NORMAL or POWER mode.	

**LOCK-UP SPEED SPECIFICATIONS <sup>(1)</sup>**

Application	MPH
<b>"D" Position <sup>(2)</sup></b>	
<b>NORMAL</b>	
Lock-Up ON	37-41
Lock-Up OFF	34-37
<b>POWER</b>	
Lock-Up ON	55-58
Lock-Up OFF	42-46
(1) Throttle valve open 5 percent.	
(2) There is no lock-up in "2" or "L" position.	

**STALL TEST**

**CAUTION: Perform test at normal operating fluid temperature, 122-176°F (50-80°C).**



**DO NOT continue test longer than 5 seconds. Allow engine to idle for 2 minutes between tests to cool fluid.**

1. Object of test is to check overall performance of transmission and engine by measuring maximum engine speeds in "D" and "R" ranges.
2. Block front and rear wheels. Connect engine tachometer. Apply parking and service brakes. Start engine.

**NOTE: If stall RPM is more than 600 RPM lower than specification, torque converter may be faulty.**

3. Shift into "D" range. Fully depress accelerator pedal. Immediately note highest engine RPM. Specification is 2000-2300 RPM. DO NOT perform test longer than 5 seconds.
4. Repeat test in "R" range. Check for insufficient engine output or defective stator one-way clutch if stall speed is low but the same for both ranges.
5. If stall speed is higher than specified in "D" range, front clutch may be slipping, one-way No. 2 clutch may not be operating, line pressure may be low, or OD one-way clutch may not be operating.
6. If stall speed in "R" is higher than specified, rear clutch and/or 1st and reverse brake may be slipping, line pressure may be low, or OD one-way clutch may not be operating.
7. If stall speed in "R" and "D" is higher than specified, line pressure may be too low, fluid level may be wrong, or OD one-way clutch is not operating properly.

## HYDRAULIC TEST

**CAUTION: Hydraulic pressure test should be performed with transmission fluid temperature of 122-176°F (50-80°C).**

### Line Pressure Test

1. Remove transmission test plugs and connect pressure gauge. See **Fig. 3** . Block all wheels. Apply parking brake. Start engine and shift into "D" range.
2. Apply brakes and depress accelerator. Note pressure readings at idle and stall speed. Repeat test in "R" range. Compare pressure readings to those listed in LINE PRESSURE SPECIFICATIONS table. If pressure is lower than specified, check throttle cable adjustment.
3. Perform test again after adjustment. High pressure in both ranges indicates that throttle cable may be out of adjustment, defective throttle valve or regulator valve.
4. Low pressure in both ranges indicates throttle cable may be out of adjustment, defective oil pump, throttle valve, regulator valve or Overdrive (OD) direct clutch.
5. Low pressure in "D" range only indicates "D" range circuit leaking pressure or defective forward clutch. Low pressure in "R" range only indicates "R" range circuit leaking pressure, defective direct clutch, 1st and reverse brake.

## LINE PRESSURE SPECIFICATIONS

Application	psi (kg./cm (2))

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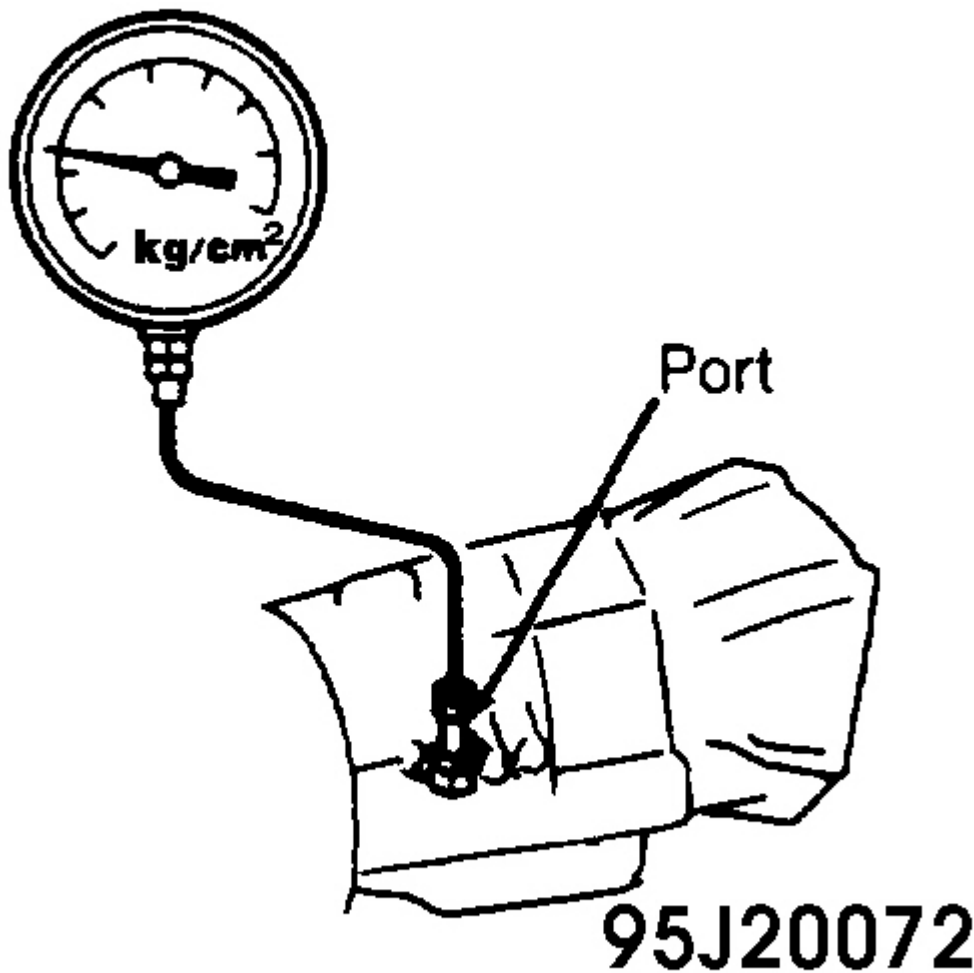
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### "D" Range

Idle Speed	67-75 (4.7-5.3)
Stall Speed	141-178 (9.9-12.5)

### "R" Range

Idle Speed	95-122 (6.7-8.6)
Stall Speed	235-269 (16.5-18.9)



**Fig. 3: Checking Line Pressure**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

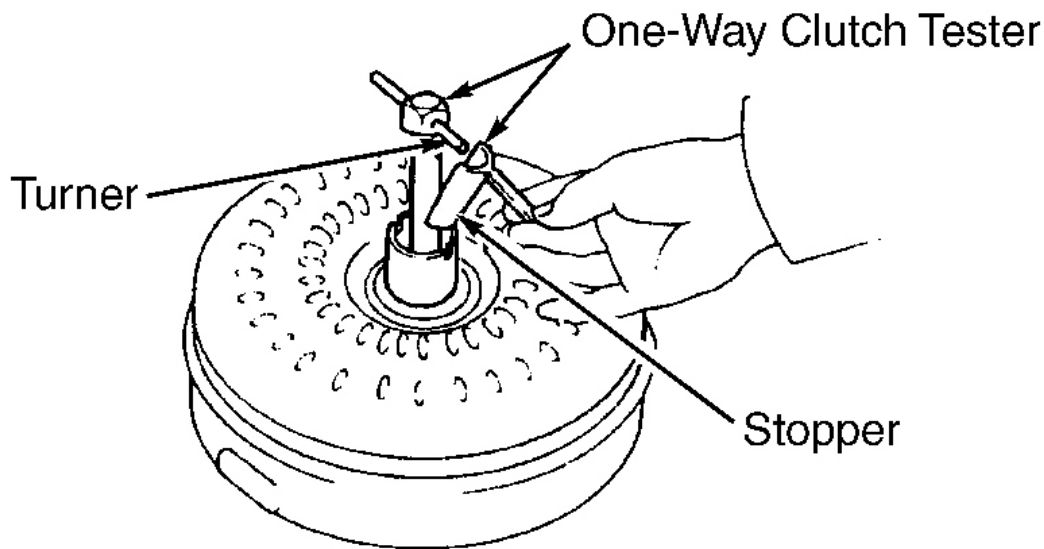
## COMPONENT TESTS

## TORQUE CONVERTER

**NOTE:** The torque converter is a sealed unit and must be serviced as complete unit. Perform following tests to ensure converter is defective. Torque converter and transmission cooler must be thoroughly cleaned and flushed if transmission is contaminated.

### ONE-WAY CLUTCH TEST

1. Install turner and stopper of One-Way Clutch Tester (09350-30020) in torque converter. See **Fig. 4** . Turner fits in inner race of one-way clutch. Stopper fits in notch of converter hub and outer race of one-way clutch.
2. Clutch should lock when rotated counterclockwise, and turn freely when rotated clockwise. If necessary, clean converter and retest clutch. Replace converter if clutch does not test as described.

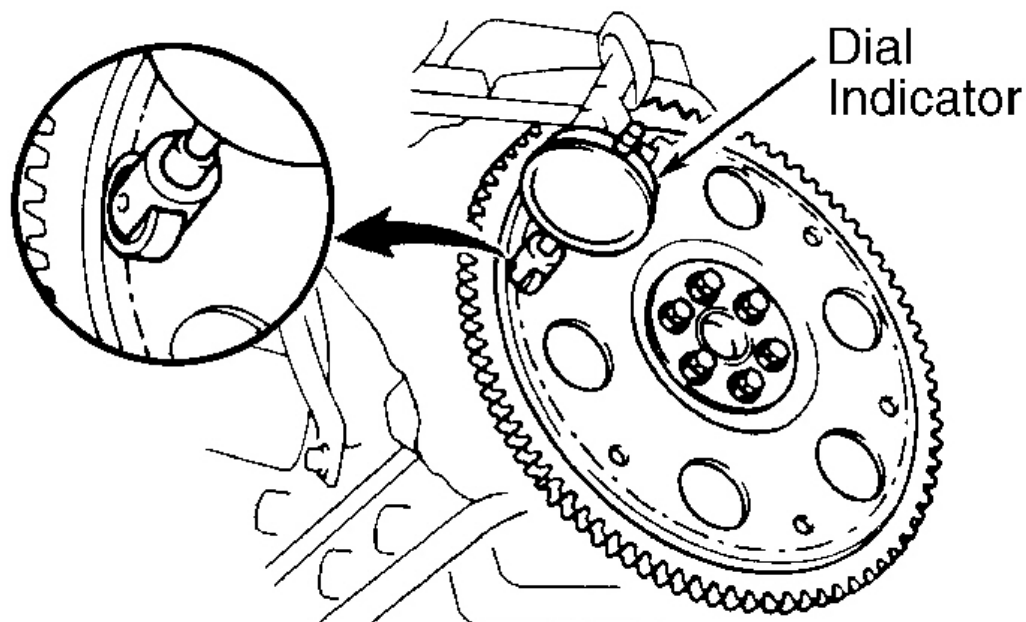


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**Fig. 4: Checking Torque Converter One-Way Clutch**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### DRIVE PLATE RUNOUT TEST

Measure drive plate runout. See **Fig. 5** . If runout exceeds .008" (.20 mm), or if ring gear is damaged, replace drive plate. If installing a new drive plate, note position of spacers. Torque bolts to 64 ft. lbs. (87 N.m).



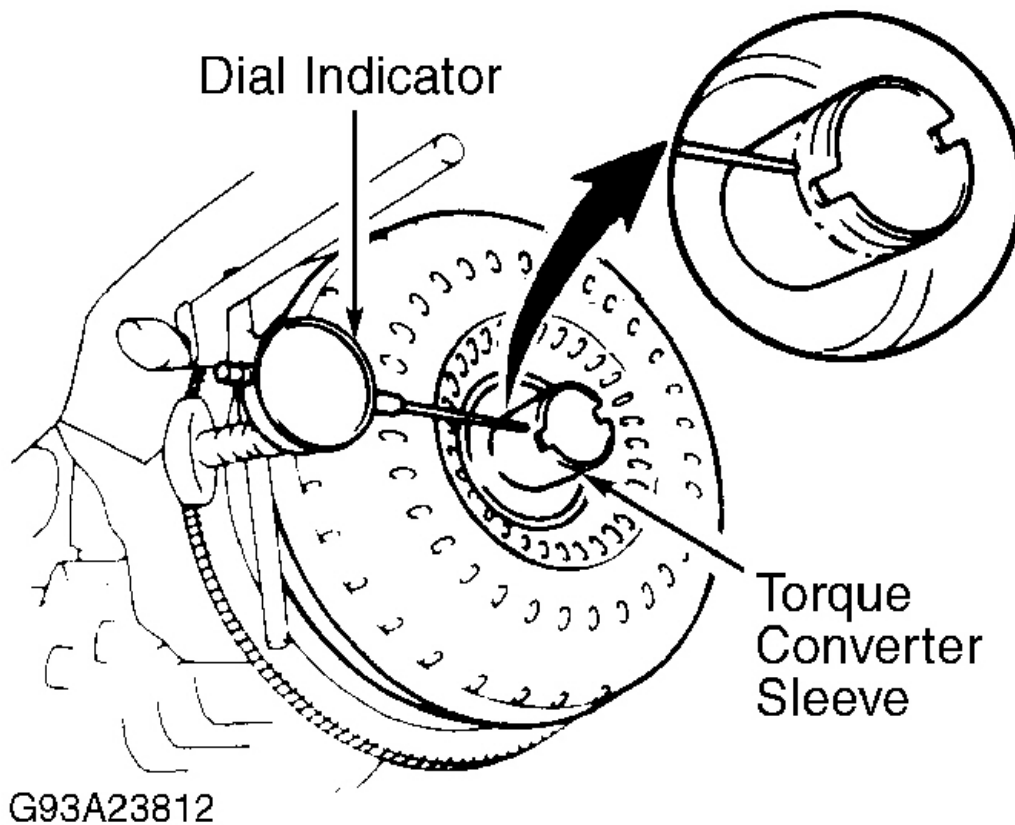
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**Fig. 5: Measuring Drive Plate Runout**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**CONVERTER SLEEVE RUNOUT TEST**

1. Temporarily mount torque converter to drive plate. Mount a dial indicator with needle resting on converter sleeve. See **Fig. 6** . Rotate converter. If runout exceeds .0128" (.30 mm), ensure converter is properly mounted to drive plate.
2. If converter is properly mounted and runout exceeds specifications, replace torque converter. Mark position of converter to ensure correct installation. Remove converter.



**Fig. 6: Measuring Torque Converter Sleeve Runout**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL & INSTALLATION

### TRANSMISSION

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

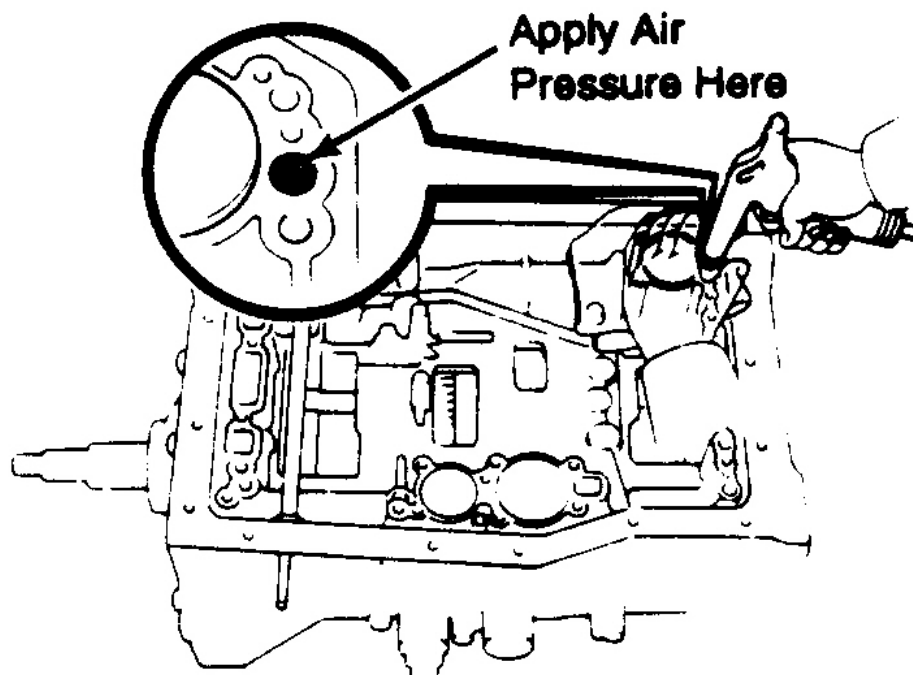
### TRANSMISSION DISASSEMBLY

1. Disconnect connectors and remove transmission wire harness. Using 2 screwdrivers, pry out breather plug. Remove control shaft lever. Remove oil cooler pipe assemblies.
2. Remove park/neutral position switch. Remove oil cooler unions. Remove ATF temperature sensor. Remove throttle cable clamp. Remove converter housing.
3. Remove transfer unit assembly (if applicable). Remove oil pan protector. DO NOT turn transmission over

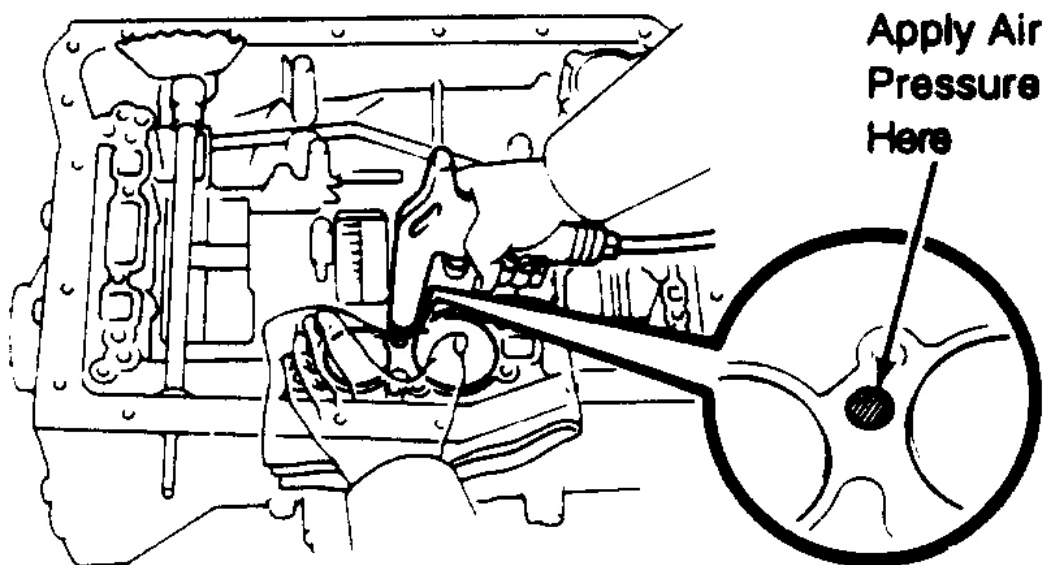
or control valve assembly will be contaminated with any foreign matter at bottom of oil pan. Remove oil pan and gasket. Remove magnets from oil pan.

**CAUTION:** Note control valve assembly bolts length and location. Proper length bolts must be installed in correct locations to prevent transaxle case damage.

4. Remove oil strainer (filter). Remove 21 valve body assembly bolts. Note bolt location and length. Disconnect solenoid connectors. Disconnect throttle cable from cam and remove valve body assembly.
5. Remove center support apply gaskets. Using 10 mm socket, remove throttle cable by pushing retainer part of throttle cable. Remove one-way clutch retainer. Remove rear clutch accumulator piston and spring by applying compressed air to oil hole. See **Fig. 7** . Remove Overdrive (OD) brake accumulator piston together with 2nd brake accumulator piston by applying compressed air to oil hole. See **Fig. 7** . Remove OD brake and 2nd brake accumulator springs. Identify each accumulator piston and spring for reassembly reference.



**REAR CLUTCH ACCUMULATOR**

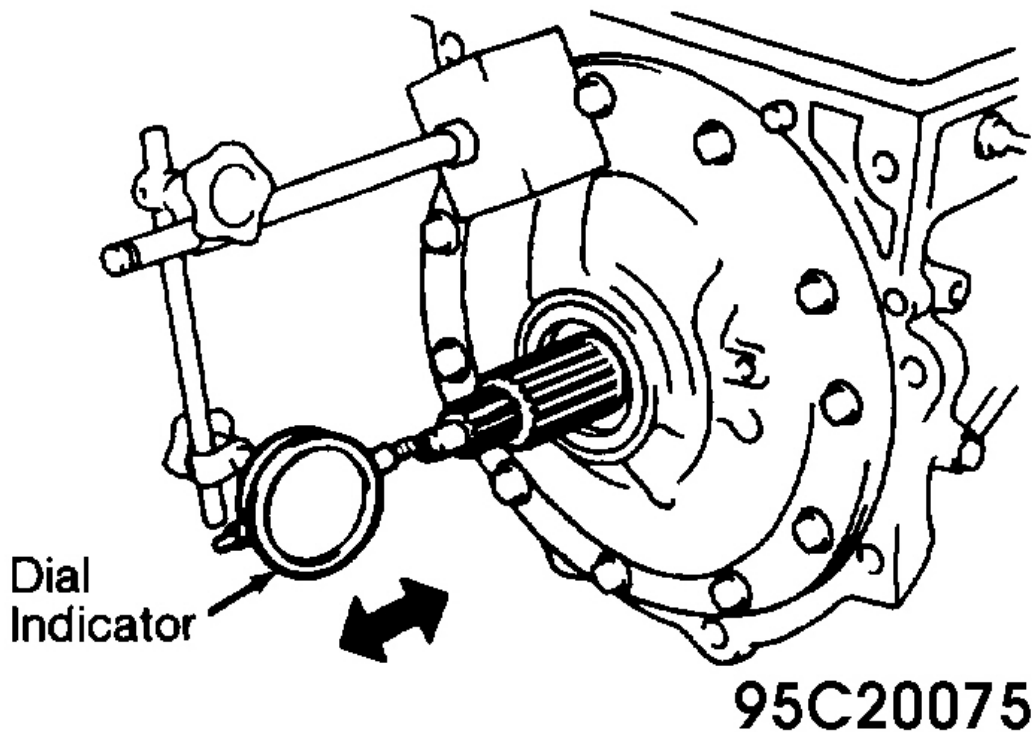


**OVERDRIVE BRAKE  
& 2ND BRAKE ACCUMULATORS**

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**Fig. 7: Removing Accumulator Pistons & Springs**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

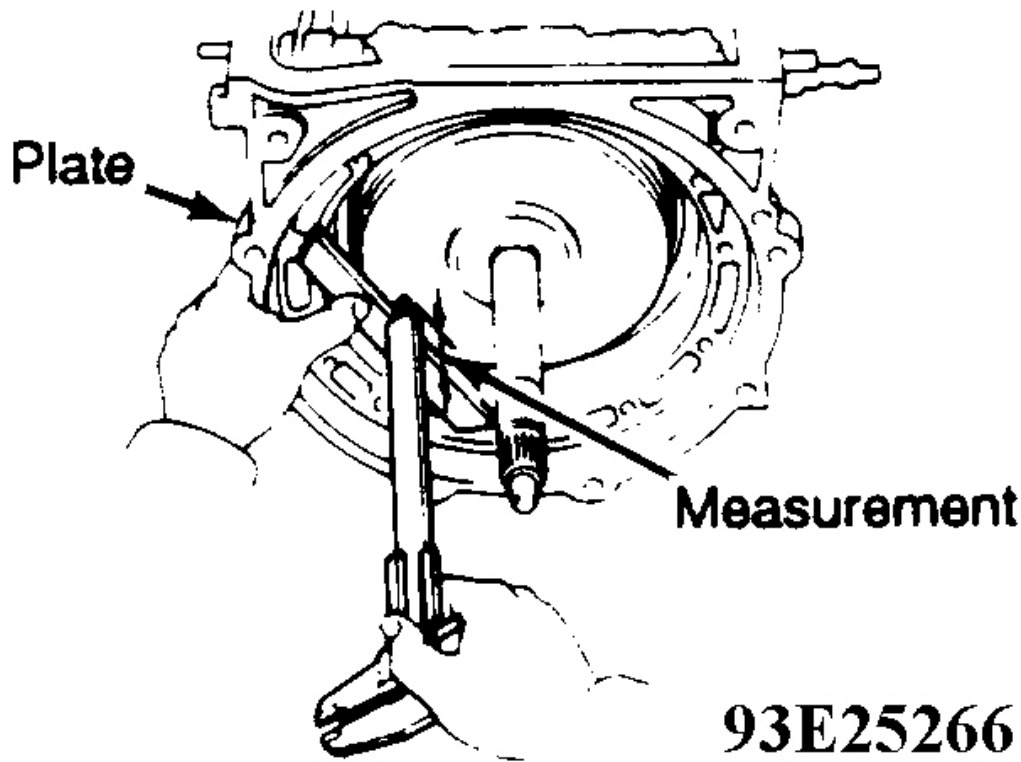
6. Remove solenoid wiring connector. Check thrust clearance of OD input shaft OD planetary gear. Push input shaft toward rear of transmission by applying a force of 11-22 lb. (5-10 kg). Measure thrust clearance of input shaft. See **Fig. 8** . Standard thrust clearance should be .016-.035" (.40-.90 mm). Maximum thrust clearance is .035" (.90 mm).



**Fig. 8: Checking OD Input Shaft Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

7. Remove oil pump retaining bolts. Remove oil pump and gasket. Remove race and thrust bearing from OD direct clutch drum or oil pump.
8. Place plate on installation surface of oil pump. Using vernier caliper, measure distance between top of plate and clutch drum. See **Fig. 9** . Record reading for reassembly reference. Remove OD planetary gear, OD direct clutch and one-way clutch assembly. Remove bearing and race from OD planetary gear or ring gear flange.

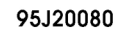




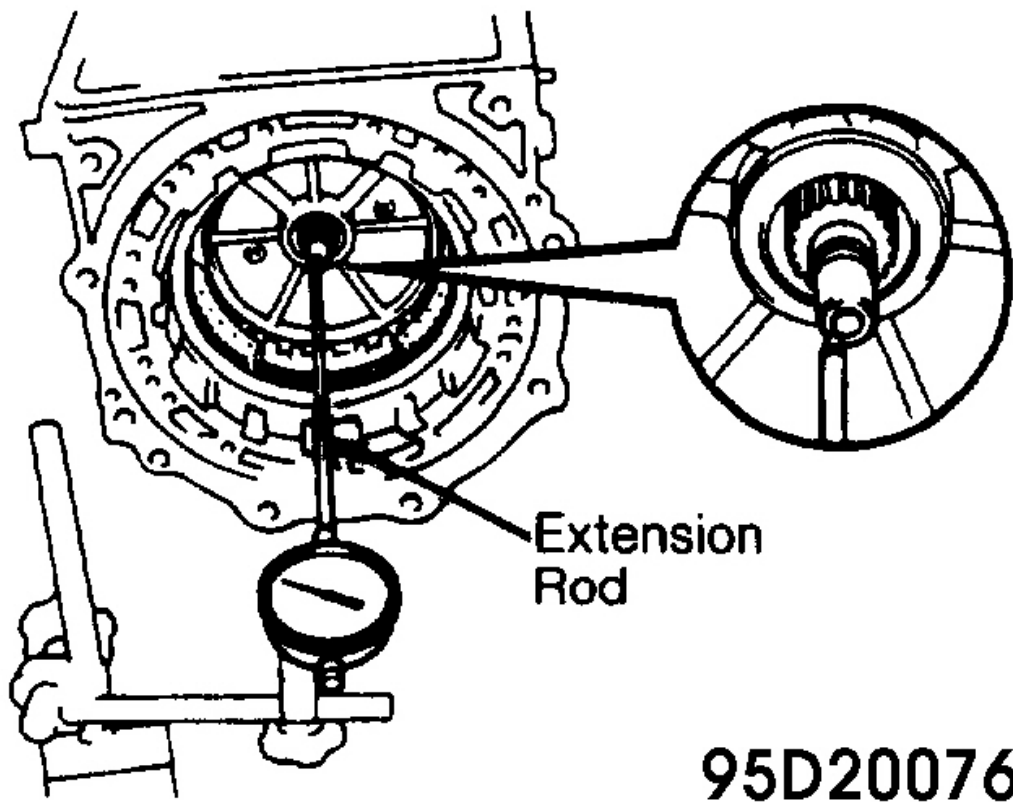
**Fig. 9: Checking OD Planetary Gear, Direct & One-Way Clutch Installation**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. Remove OD planetary ring gear assembly from OD case. Remove thrust bearing and race from OD case or ring gear flange. Check thrust clearance of input shaft front clutch drum. Install 3 bolts to secure OD case assembly. Push transmission output shaft toward front of transmission by applying a force of 11-22 lbs. (5-10 kg).
10. Push OD case toward rear of transmission by applying a force of 11-20 lbs. (5-10 kg). Using dial indicator with extension bar, measure thrust clearance of input shaft. See **Fig. 11** . Standard thrust clearance should be .012-.028" (.30-.70 mm). Remove 3 bolts.

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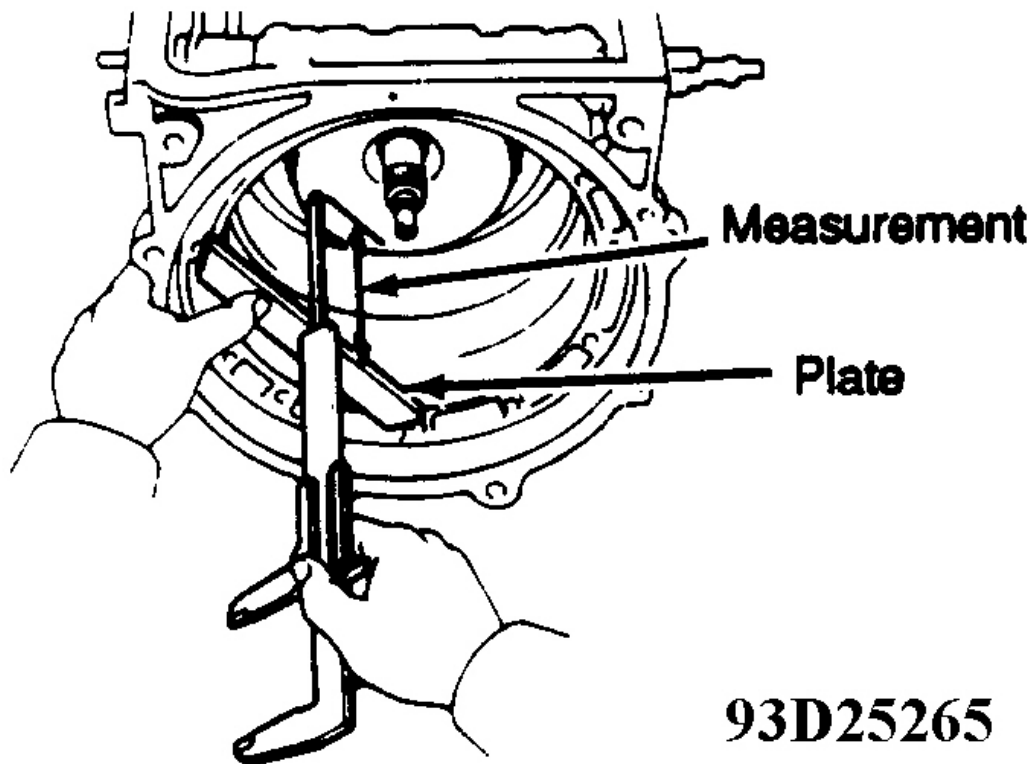
**Fig. 10: Exploded View Of Internal Components**  
**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



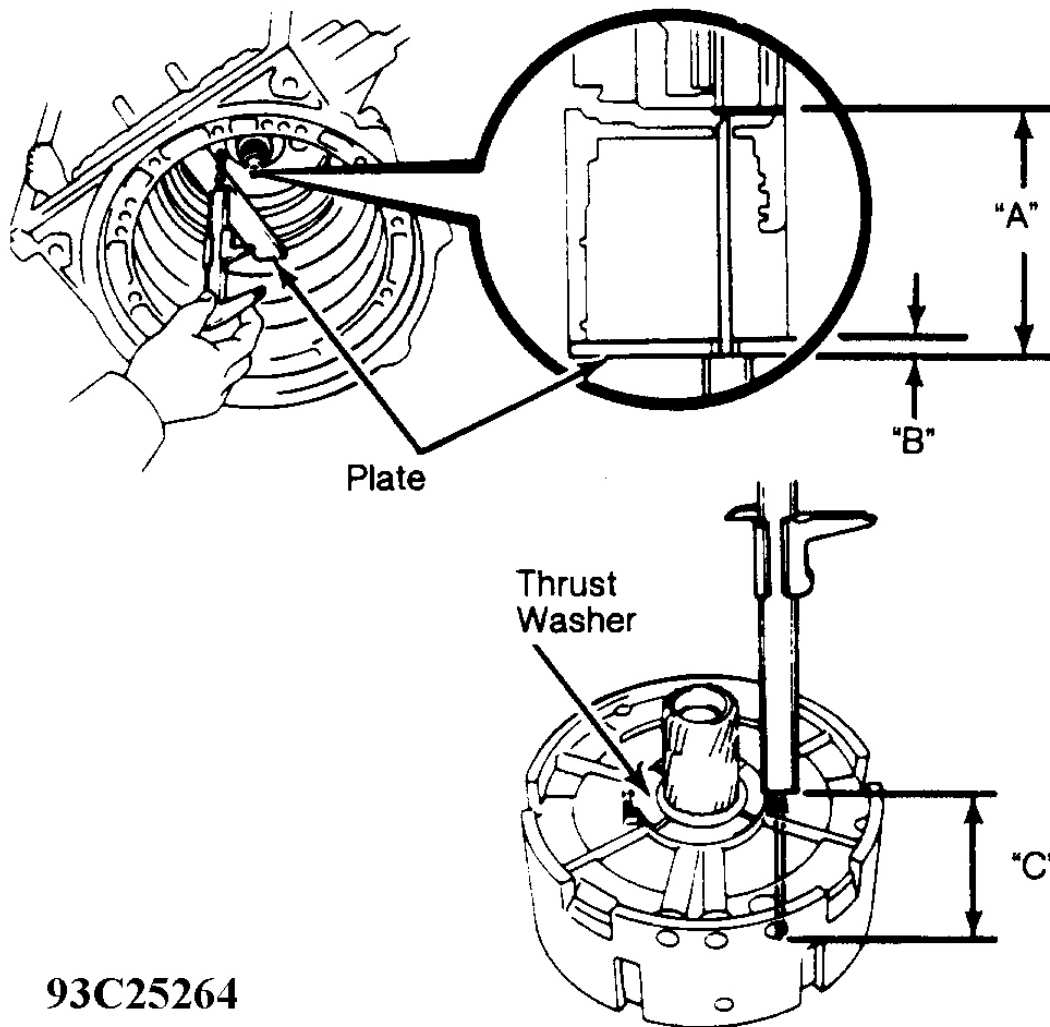
**Fig. 11: Measuring Input Shaft Thrust Clearance (End Play)**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. Using appropriate puller, remove OD case assembly. Remove "O" rings from oil holes in OD case. Remove oil seal ring from input shaft. Remove races, thrust bearing and spacer from front clutch drum or OD case. See **Fig. 10**.
12. Place plate on installation surface of oil pump. Measure distance between top of plate and forward clutch drum. Record reading for reassembly reference. Remove forward clutch. Remove races and thrust bearing from rear clutch drum or forward clutch hub. Insert 2 wires into flukes of clutch discs. Remove rear clutch assembly.
13. Check thrust clearance of center support. Push transmission output shaft toward front of transmission by applying a force of 11-22 lbs. (5-10 kg). Push center support toward rear of transmission by applying a force of 11-22 lbs. (5-10 kg), then pull with same amount of force.
14. Place plate on center support. Using vernier caliper, measure distance "A" between top of plate and thrust washer on front planetary gear. See **Fig. 13**. Using calipers, measure thickness "B" of plate. Record readings for reassembly reference. Remove 3 center support set bolts. Using appropriate puller, remove center support. Remove "O" rings from center support oil holes.



**Fig. 12: Checking Forward Clutch Installation**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

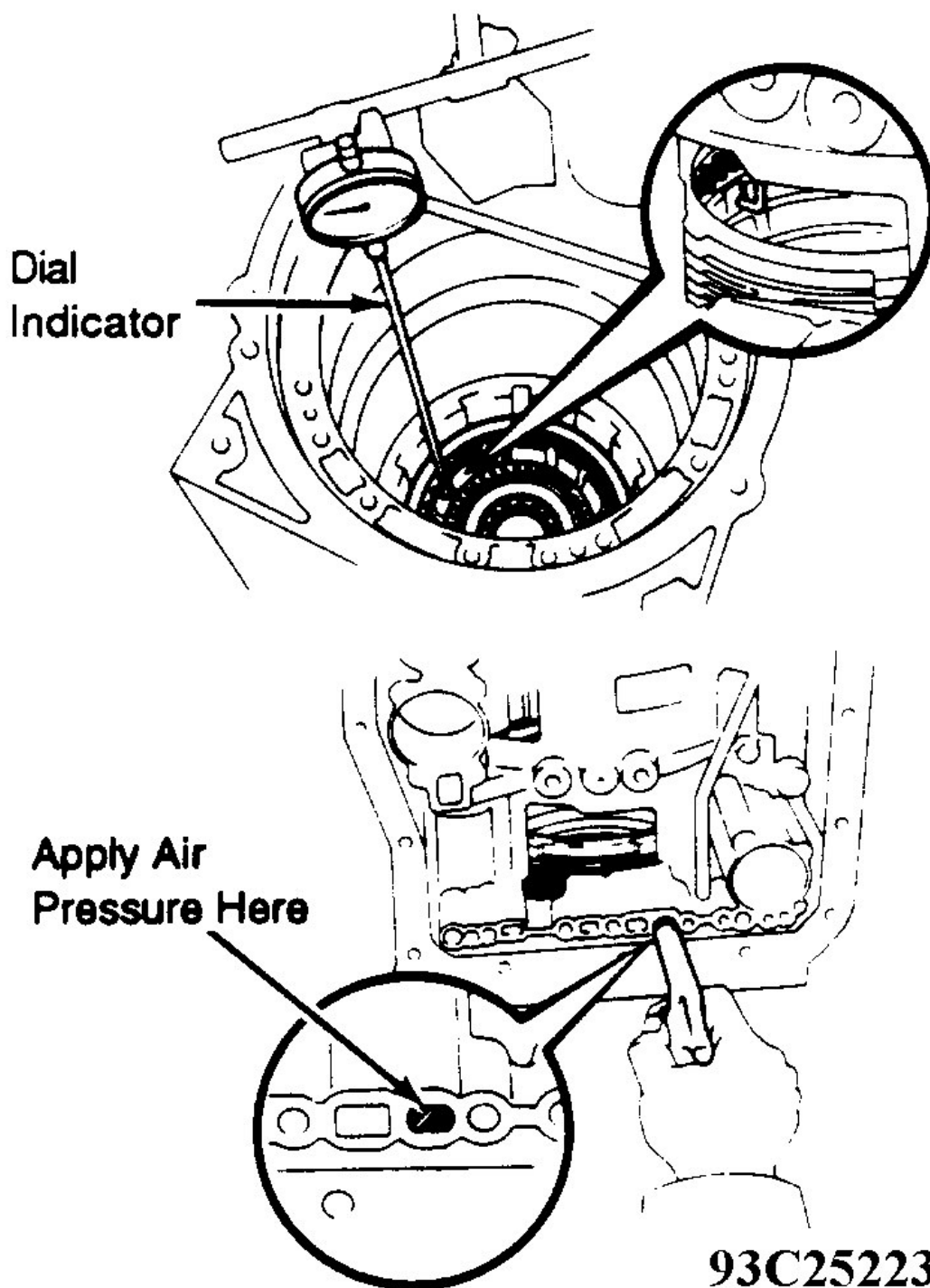


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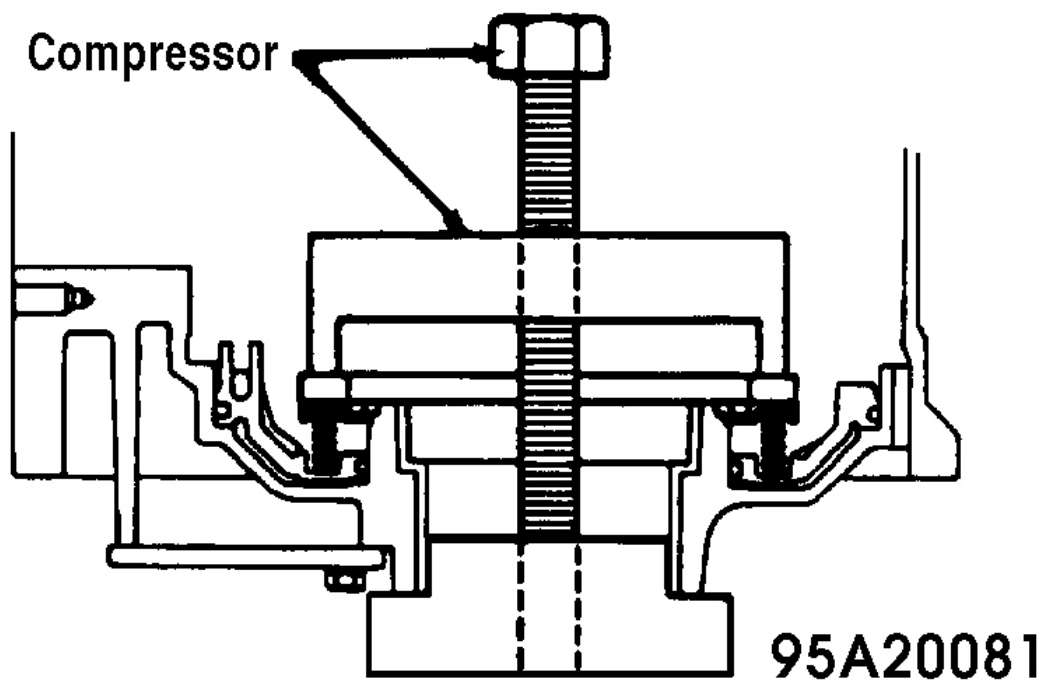
**Fig. 13: Checking Center Support Thrust Clearance**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. Turn center support over together with thrust washer and place on a flat surface. Insert vernier caliper into thrust washer hole, measure distance "C" between thrust washer hole and flat surface. Center support thrust clearance is "A" - ("B" + "C"). Standard thrust clearance should be .012-.028" (.30-.70 mm). Maximum thrust clearance is .035" (.90 mm). Remove thrust washer from center support.
16. Remove speed sensor. Remove transfer adapter rear bearing retainer. Remove snap ring. Remove spacer. Remove transfer adapter. Remove gasket.
17. Remove output shaft snap ring. Remove output shaft spacer. Remove speed sensor rotor. Remove thrust washer from planetary gear. Remove snap ring. Remove planetary gears, one-way clutch and output shaft.
18. Using dial indicator with extension, measure piston stroke of 1st and reverse brake piston by applying compressed air to oil port. See **Fig. 14**. Piston stroke should be .130-.150" (3.30-3.80 mm). If piston stroke is not within specification, inspect discs during disassembly.

19. Remove snap ring. Remove flange, 6 discs, 6 plates and cushion plate. Using appropriate spring compressor, compress return spring. See **Fig. 15** . Remove snap ring. Remove piston return spring. Hold 1st and reverse brake piston with hand, remove 1st and reverse brake piston by applying compressed air to oil hole. See **Fig. 14** . If piston does not pop out with compressed air, carefully lift piston out with needle-nose pliers. Remove 2 "O" rings from piston.
20. Remove forward clutch accumulator cover, gaskets and plate from rear of transmission case. Remove accumulator piston and spring by applying compressed air to oil hole. See **Fig. 16** . Remove "O" rings from accumulator piston.
21. Remove transmission rear cover and gasket. Remove manual valve lever, shaft and oil seals. Using a chisel, cut off spacer and remove from shaft. Tap out pin with a pin punch. Pull manual valve lever shaft out through case. Remove manual valve lever, parking lock rod, 2 plate washers and wave washer. Disconnect parking lock rod from manual valve lever. Using a screwdriver, pry out 2 oil seals.

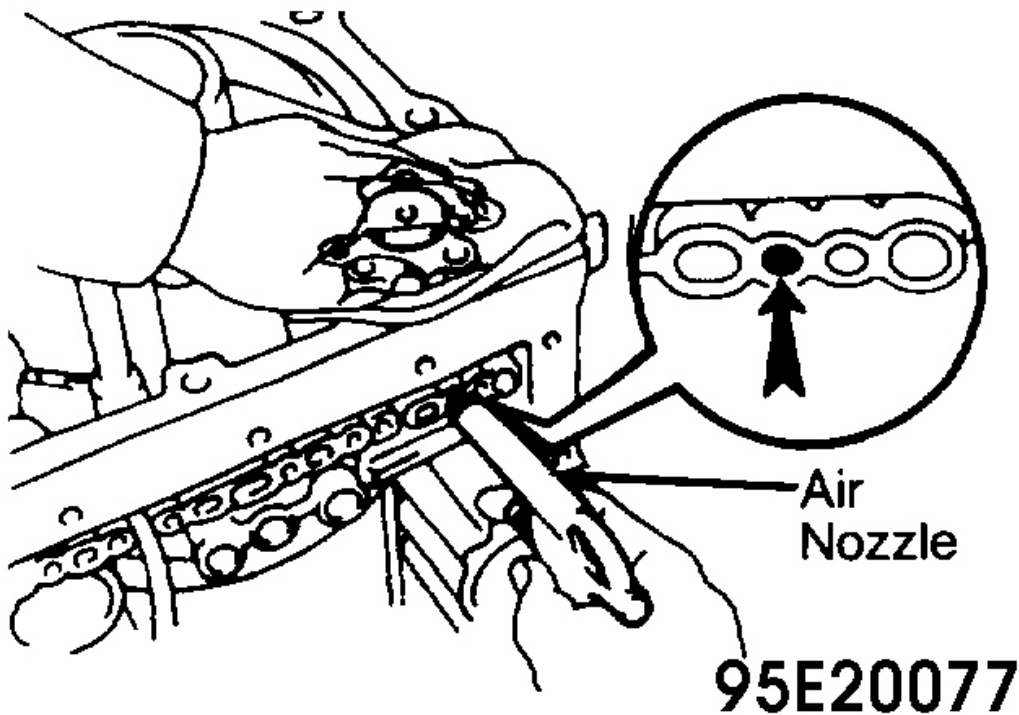


**Fig. 14: Checking 1st & Reverse Brake Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 15: Compressing 1st & Reverse Spring Retainer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.





**Fig. 16: Removing Forward Clutch Accumulator**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## COMPONENT DISASSEMBLY & REASSEMBLY

### OIL PUMP

#### Disassembly

1. Set oil pump shaft in torque converter while working on pump. Remove 2 oil seal rings from pump cover.
2. From side of pump housing, compress spring and remove spring seat. See **Fig. 17** . Remove spring and check ball.
3. Remove oil pump cover. Mark oil pump drive and driven gears for reassembly reference and remove from pump body.

#### Inspection

1. Note position of oil pump gears. Clean all parts with solvent. Use compressed air to ensure that passages are free.
2. Check driven gear-to-body clearance. Push driven gear against one side of pump. Using feeler gauge,

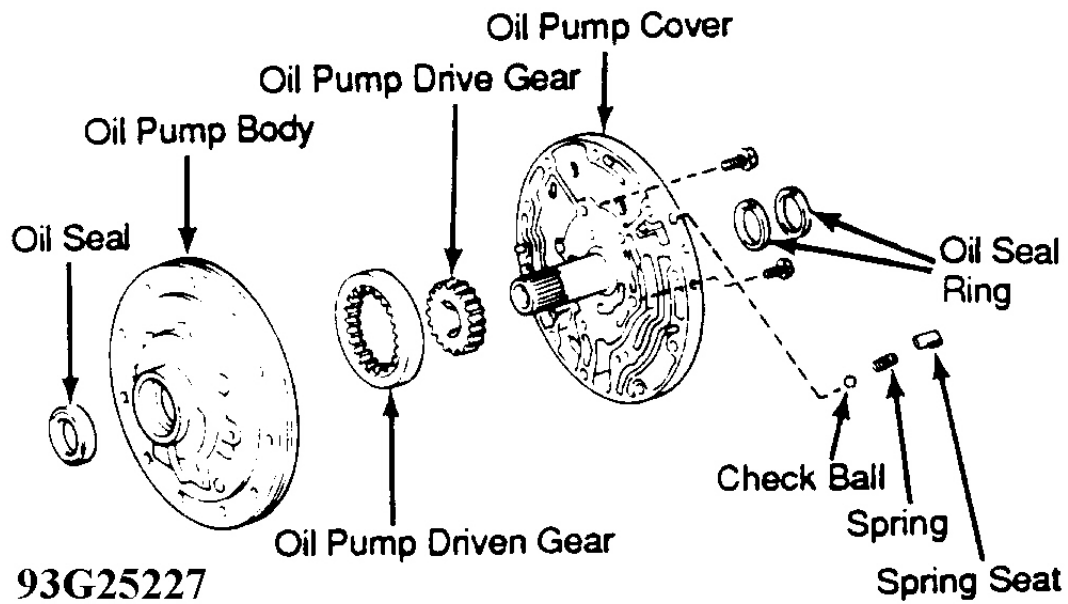
measure clearance between the driven gear and the oil pump body. See **Fig. 18** . Replace drive, driven gear and pump housing if not within specification. Refer to the **OIL PUMP CLEARANCE SPECIFICATIONS** table.

3. Using feeler gauge, measure tip clearance between both gears and crescent-shaped part of pump body. See **Fig. 19** . Replace drive gear, driven gear and pump housing if not within specification. See the **OIL PUMP CLEARANCE SPECIFICATIONS** table.
4. Using feeler gauge and straightedge, measure side clearance of both gears. See **Fig. 20** . Replace driven gear and pump housing if not within specification. See **OIL PUMP CLEARANCE SPECIFICATIONS** table. If side clearance is excessive, select and replace gears as a set. Replacement drive and driven gears are available in the following thicknesses; .7258-.7264" (18.435-18.450 mm) and .7264-.7278" (18.451-18.486 mm). If necessary, replace the oil pump body.

#### **OIL PUMP CLEARANCE SPECIFICATIONS**

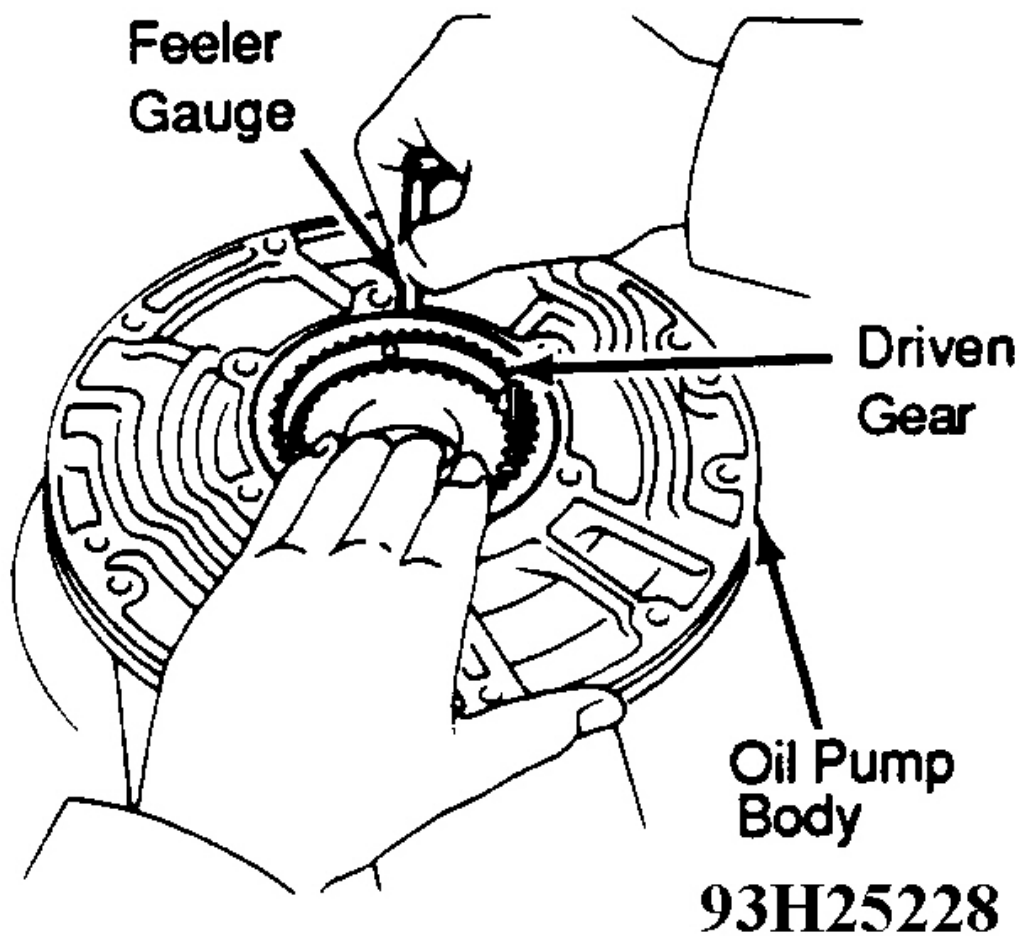
<b>Application</b>	<b>In. (mm)</b>
<b>Driven Gear-To-Pump Body</b>	
Standard	.003-.006 (.07-.15)
Maximum	.012 (.30)
<b>Gear-To-Crescent</b>	
Standard	.004-.009 (.11-.24)
Maximum	.012 (.30)
<b>Gear Side Clearance</b>	
Standard	.0008-.002 (.020-.050)
Maximum	.004 (.10)

5. Measure inside diameter of oil pump body bushing. Standard inside diameter should be 1.6555-1.6565" (42.050-42.075 mm). Maximum inside diameter is 1.6587" (42.130 mm). If inside diameter is excessive, replace pump body.
6. Measure inside diameter of oil pump cover bushings. Standard inside diameter for front bushing is .9449-.9457" (24.000-24.021 mm). Standard inside diameter for rear bushing is 1.0433-1.0441" (26.500-26.521 mm). Maximum inside diameter for front bushing is .9476" (24.07 mm). Maximum inside diameter for rear bushing is 1.0461" (26.57 mm). If inside diameter is excessive, replace pump cover. Replace oil seal if necessary.



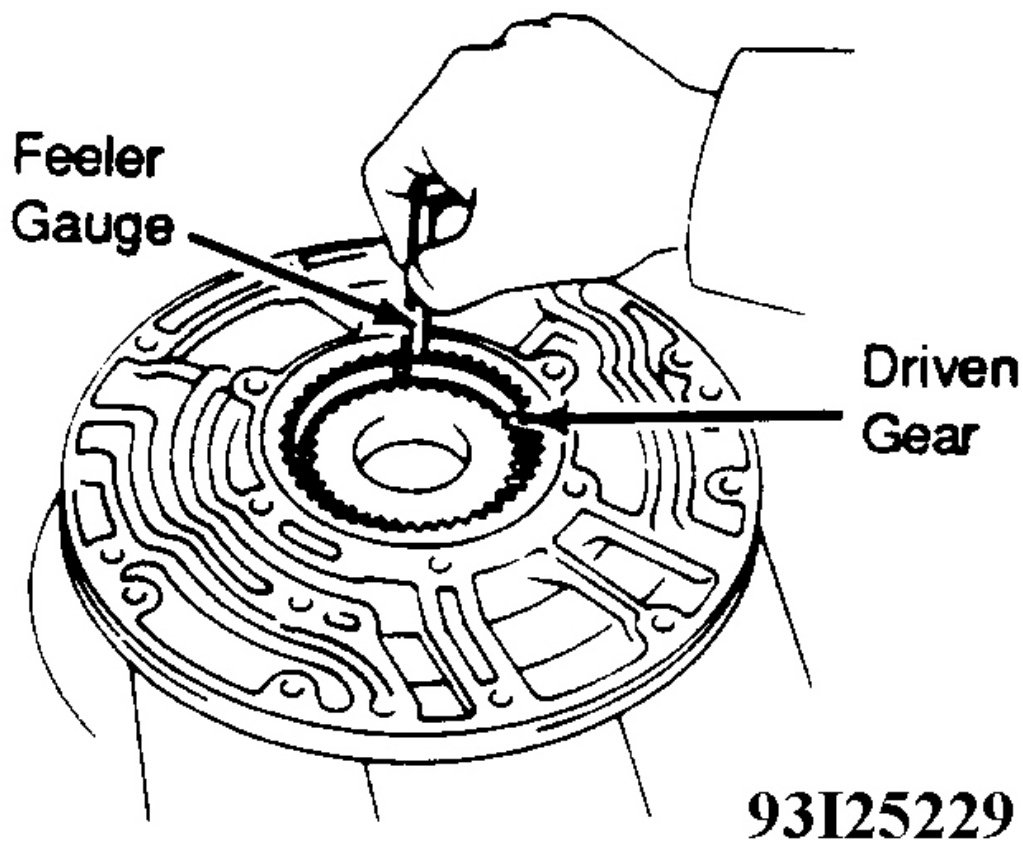
**Fig. 17: Exploded View Of Oil Pump**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

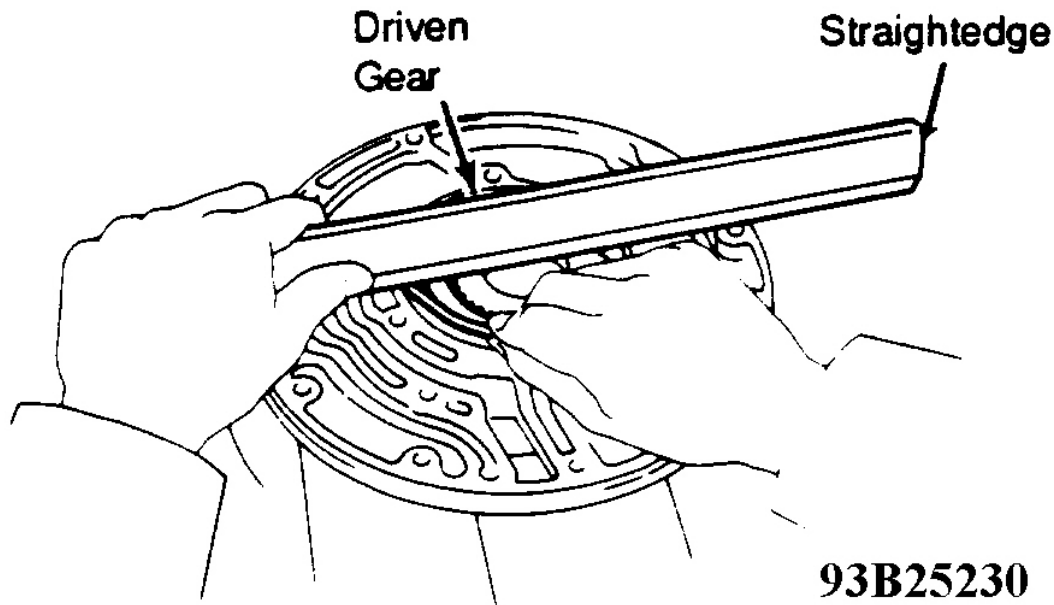


**Fig. 18: Checking Driven Gear Clearance**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 19: Checking Driven Gear Tip Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 20: Checking Gear Side Clearance**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### Reassembly

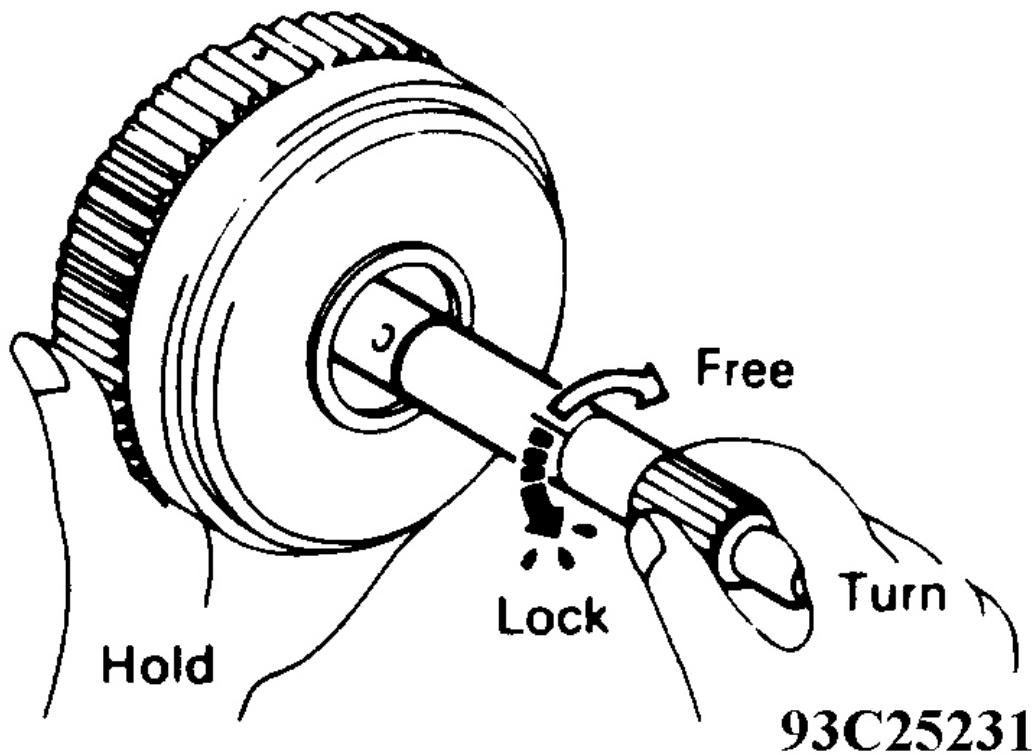
1. Place oil pump on torque converter. Coat driven and drive gears with ATF. Install driven and drive gears.
2. Align bolt holes of pump body and cover. Install pump cover bolts. Torque 10 mm head bolts to 78 INCH lbs. (8.8 N.m). Torque 12 mm head bolts to 15 ft. lb. (21 N.m).
3. Install check ball and spring. Compress spring and install spring seat. Coat 2 oil seal rings with ATF. Install oil seal rings on stator shaft. DO NOT spread ring ends more than required for installation. Ensure oil seal rings rotate smoothly. Ensure drive gear rotates smoothly when installed to torque converter.

#### OVERDRIVE DIRECT CLUTCH, PLANETARY GEAR & ONE-WAY CLUTCH

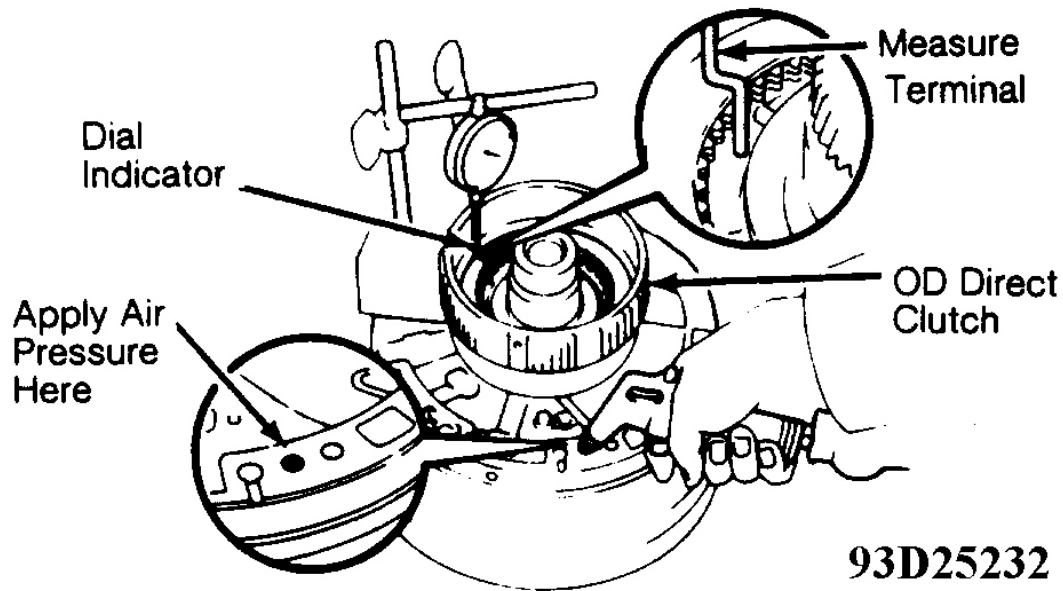
##### Disassembly

1. Hold OD direct clutch drum and turn input shaft. Input shaft should turn freely clockwise and lock counterclockwise. See **Fig. 21**.
2. Remove OD direct clutch assembly from OD planetary gear. Place oil pump on torque converter. Place OD direct clutch assembly on oil pump. Using dial indicator, measure piston stroke by applying compressed air to oil pump passage. See **Fig. 22**. Piston stroke should be .071-.079" (1.80-2.00 mm). If piston stroke is not within specification, inspect discs for proper assembly.
3. Using screwdriver, remove snap ring. Remove flange, 3 discs and 3 plates. See **Fig. 23**. Using appropriate spring compressor, compress return spring. Remove snap ring with snap ring pliers. Remove spring seat and return springs.

4. Place oil pump on torque converter. Place OD direct clutch on oil pump. Hold clutch piston with hand, apply compressed air to oil hole of oil pump to remove direct clutch piston. See **Fig. 22** . Remove "O" rings from clutch piston.
5. Remove oil seal ring from ring gear flange. Remove snap ring. Remove ring gear flange. Remove snap ring. Remove No. 4 thrust washer. Remove one-way clutch and outer race. Remove No. 3 thrust washer. Remove 2 retainers and one-way clutch from outer race.

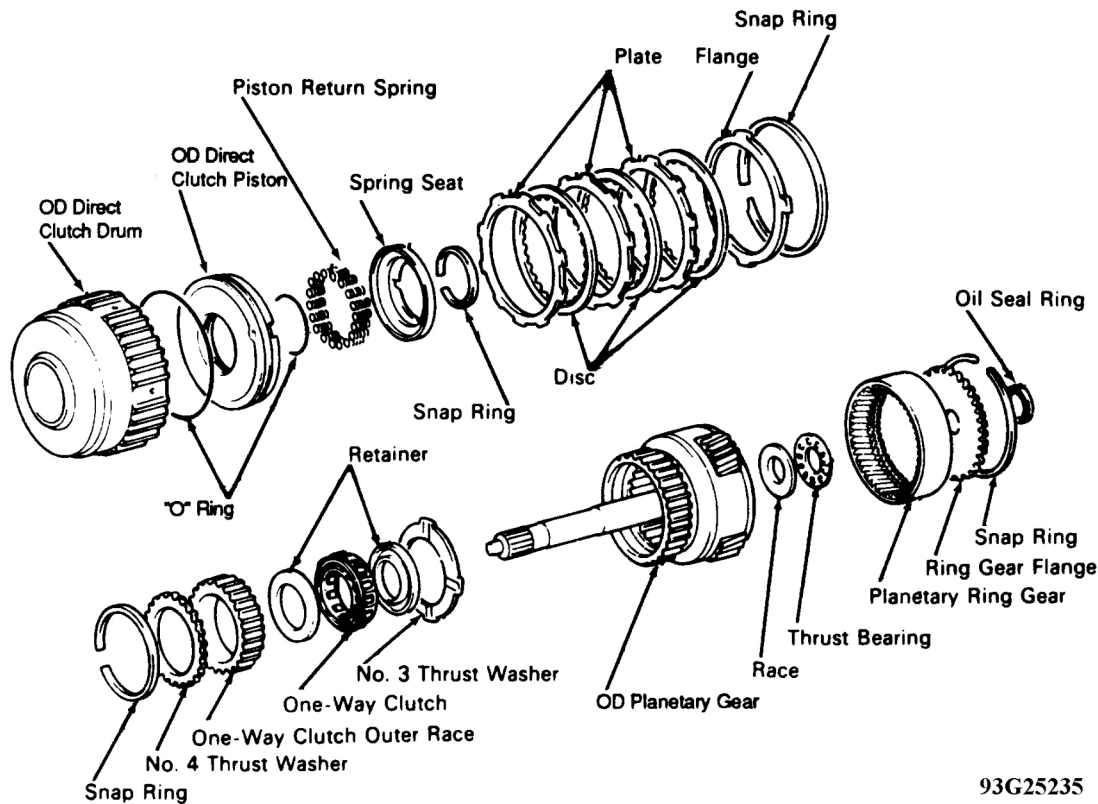


**Fig. 21: Checking OD One-Way Clutch Operation**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 22: Checking OD Direct Clutch Piston Stroke**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

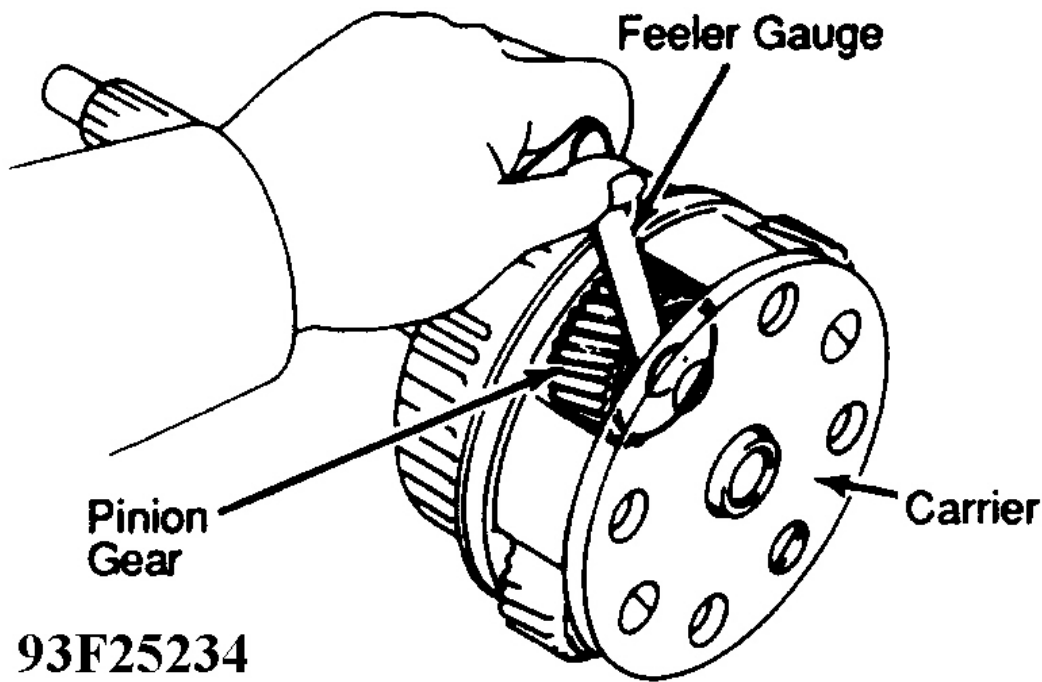




**Fig. 23: Exploded View Of OD Planetary Gear, Direct Clutch & One-Way Clutch**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### Inspection

1. Inspect discs, plates and flange. Clean all parts thoroughly in solvent. Air dry parts with compressed air. Soak new discs in ATF for 15 minutes before installation.
2. Inspect OD direct clutch piston. Shake piston to ensure check ball is free. Ensure that valve does not leak by applying low pressure compressed air. Replace parts as necessary.
3. Inspect bushings of OD direct clutch drum. Measure inside diameter. Standard inside diameter is 1.0433-1.0441" (26.500-26.521 mm). Maximum inside diameter is 1.0461" (26.570 mm). If inside diameter is excessive, replace clutch drum.
4. Inspect bushing of OD planetary gear. Measure inside diameter. Standard inside diameter is .4724-.4731" (12.000-12.018 mm). Maximum inside diameter is .4752" (12.070 mm). If inside diameter is excessive, replace planetary gear.
5. Inspect planetary pinion gear thrust clearance. Measure thrust clearance between pinions and carriers. See **Fig. 24**. Standard clearance is .0079-.0232" (.200-.590 mm). Maximum clearance is .0315" (.800 mm). If thrust clearance is excessive, replace planetary gear.



**Fig. 24: Measuring Planetary Pinion Thrust Clearance (Typical)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### Reassembly

1. Install No. 3 thrust washer, grooved side facing upward. Install one-way clutch and 2 retainers into outer race. Install one-way clutch and outer race assembly with flanged side of one-way clutch facing upward. Install No. 4 thrust washer. Install snap ring. See [Fig. 23](#).
2. Install ring gear flange to OD planetary ring gear. Install snap ring. Coat oil seal ring with ATF. Install oil seal ring to ring gear flange. DO NOT spread ring ends more than necessary. After installing oil seal ring, ensure ring moves smoothly.
3. Coat new "O" rings with ATF. Install "O" rings on OD direct clutch piston. Push clutch piston into clutch drum with both hands. Do not damage "O" rings.
4. Place return springs and spring seat on clutch piston. Compress springs and install snap ring. Ensure end-gap of snap ring is not aligned with spring retainer claw. Install plates and discs in order. Install flange with rounded edge facing upwards. Install snap ring.
5. Place oil pump on torque converter. Place OD direct clutch assembly on oil pump. Using dial indicator, measure piston stroke by applying compressed air. Piston stroke should be .071-.079" (1.80-2.00 mm). If piston stroke is less than specified, parts may have been assembled incorrectly. Check and reassemble.
6. Install direct clutch assembly on OD planetary gear. Mesh spline of OD planetary gear with flukes of discs by rotating and pushing OD direct clutch counterclockwise. Hold OD direct clutch drum and turn input shaft. Input shaft should turn freely clockwise and should lock counterclockwise.

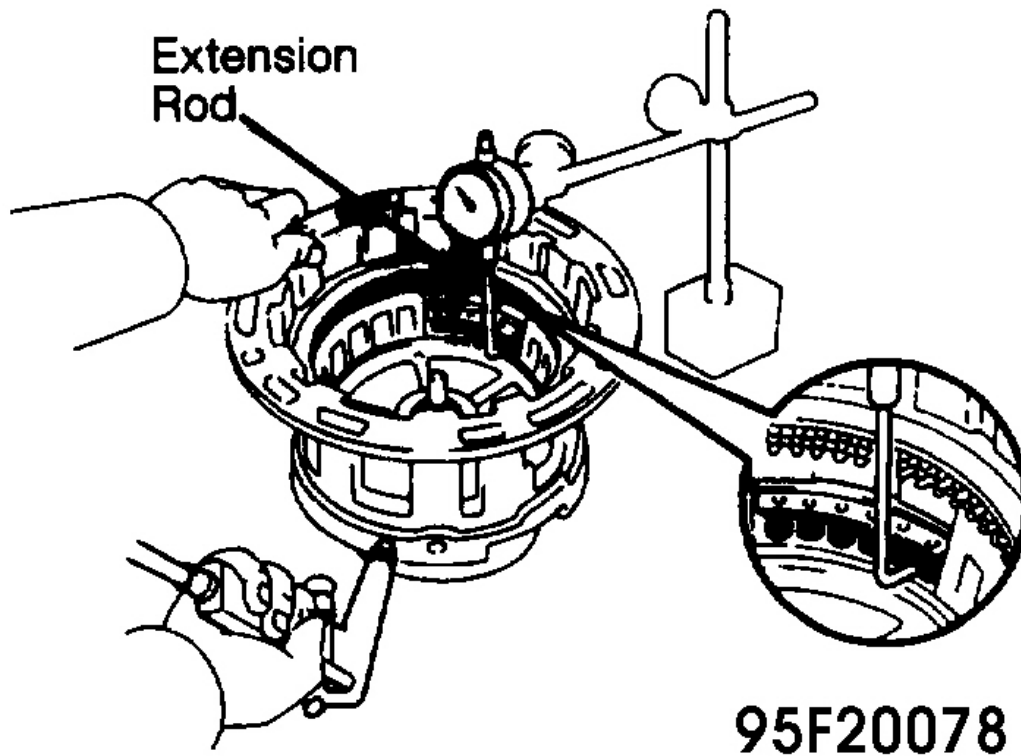
## OVERDRIVE BRAKE

### Disassembly

1. Using needle nose pliers, remove 3 ring retainers from oil holes on OD case. Place OD case on rear clutch. Using dial indicator, measure piston stroke by applying compressed air. Piston stroke should be .0492-.0728" (1.250-1.850 mm). If piston stroke is greater than specified, inspect discs. See **Fig. 25** .
2. Using screwdriver, remove snap ring. Remove flange, 3 discs and 3 plates. Compress return spring and remove snap ring. Remove return spring.
3. Place return spring on brake piston. Place spring compressor on return spring. Hold spring compressor so it does not slant. Apply compressed air into oil hole of OD case to remove brake piston. See **Fig. 25** . Remove 2 "O" rings from OD case. Remove 2 oil seal rings from OD case.

### Inspection

1. Clean all parts thoroughly in clean solvent. Air dry parts with compressed air. Inspect all parts for wear or damage. Replace as necessary. Check piston return springs for wear, damage and collapsed coils. Inspect clutch plates, discs and flange for signs of burning.
2. Inspect bushing of OD case. Measure inside diameter. Standard inside diameter is 1.3031-1.3051" (33.100-33.150 mm). Maximum inside diameter is 1.3071" (33.200 mm). If inside diameter is excessive, replace OD case.

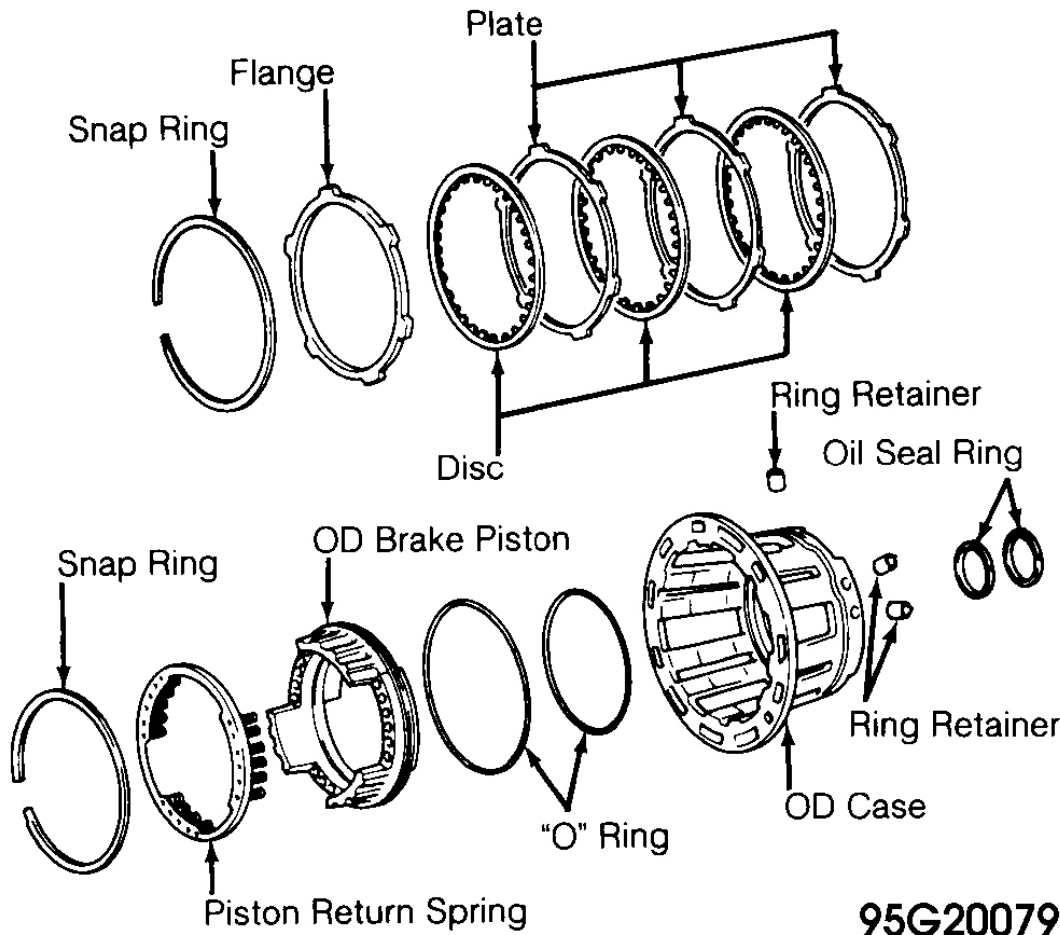


**Fig. 25: Removing OD Brake Piston**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### Reassembly

1. Coat oil seal rings with ATF. Install oil seal rings on OD case. DO NOT spread ring ends more than necessary. Ensure oil seal rings rotate smoothly after installation.
2. Install new "O" rings on OD brake piston. Align protrusions of brake piston with grooves of OD case. Push brake piston into OD case with both hands. DO NOT damage "O" rings.
3. Place return spring on brake piston. Place spring compressor on spring seat. Compress return spring with an arbor press. Install snap ring. Ensure end-gap of snap ring is not aligned with cutout portion of OD case.
4. Install 3 plates and 3 discs in order. Install flange with rounded edge facing upward. See **Fig. 26** . Install snap ring. Ensure end gap of snap ring is not aligned with cutout portion of OD case.
5. Place OD case on rear clutch. Using dial indicator, measure piston stroke by applying compressed air. Piston stroke should be .0492-.0728" (1.25-1.850 mm). If piston stroke is less than specified, parts may have been assembled incorrectly. Check and reassemble again. Using needle nose pliers, install 3 ring retainers into oil holes of OD case. See **Fig. 26** .



**Fig. 26: Exploded View Of OD Brake**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## FORWARD CLUTCH

### Disassembly

1. Place forward clutch on Overdrive (OD) case. Remove snap ring. Lift out rear and front clutch hubs. Remove 2 races and thrust bearing.
2. Remove 6 discs, 6 plates and cushion plate. Place appropriate spring compressor on spring seat, compress return spring. Remove snap ring. Remove spring seat and return springs.
3. Hold clutch piston by hand. Apply compressed air into oil hole in OD case to remove clutch piston. Remove 2 "O" rings from clutch piston. Remove oil seal ring from clutch drum.

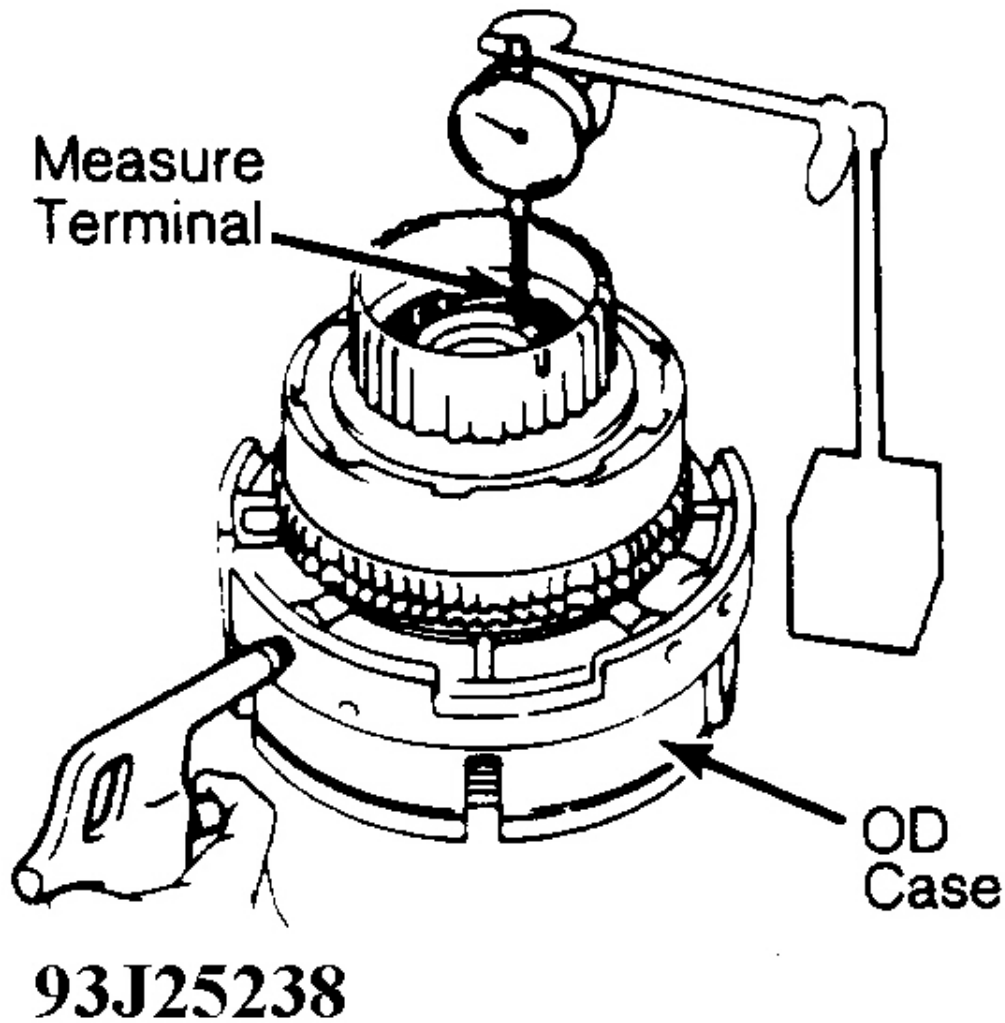
### Inspection

Clean all parts and inspect for wear and damage. Check clutch plates and discs for signs of burning. Replace as

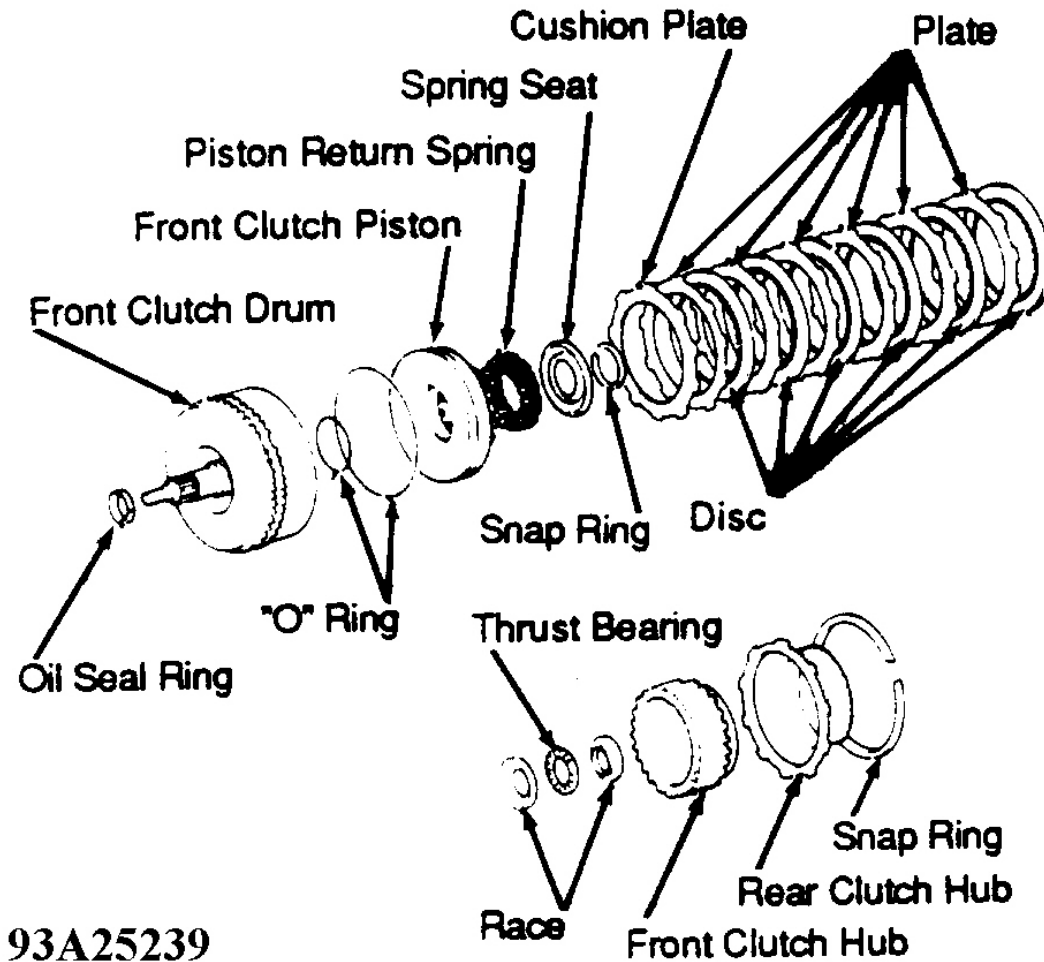
necessary. Soak new clutch discs in ATF for 15 minutes before installation. Inspect forward clutch piston. Ensure check ball is free by shaking piston. Ensure valve does not leak by applying low pressure compressed air.

**Reassembly**

1. Lubricate and install new "O" ring on clutch piston. Carefully install clutch piston into clutch drum. DO NOT damage "O" rings. Position piston return spring and spring seat on clutch piston. Compress springs and install snap ring. Ensure end-gap of ring is not aligned with spring seat claw.
2. Install cushion plate with rounded edge facing inward. Install plates and discs in order.
3. Check piston stroke of forward clutch. Install dial indicator and place on clutch piston. Install rear clutch hub with snap ring.
4. Using dial indicator, measure piston stroke by applying compressed air. See **Fig. 27** . Piston stroke should be .155-.167" (3.93-4.23 mm). If piston stroke is less than specified, parts may have been assembled incorrectly. Check and reassemble. If piston stroke exceeds limit, clutch pack may be worn. Select different thickness plate. Plate thicknesses available are: .071" (1.80 mm), .079" (2.00 mm), .087" (2.20 mm) and .094" (2.40 mm).
5. Coat thrust bearing and races with petroleum jelly. Install on forward clutch drum. Install forward clutch hub into clutch drum. Mesh spline of forward clutch hub with flukes of discs by rotating forward clutch hub clockwise or counterclockwise. Install rear clutch hub on clutch drum. Using screwdriver, install snap ring. Ensure end-gap of snap ring is not aligned with cutout portion of forward clutch drum. See **Fig. 28** .



**Fig. 27: Checking Forward Clutch Piston Stroke**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 28: Exploded View Of Forward Clutch**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REAR CLUTCH

### Disassembly

1. Remove snap ring. Remove flange, 5 discs and 5 plates from rear clutch drum. Compress return spring with appropriate spring compressor. Remove snap ring. Remove spring seat and return springs.
2. Place center support on wooden blocks. Position clutch drum on center support. Hold piston with hand and apply compressed air to oil hole in center support. Remove clutch piston. See **Fig. 29**. Remove 2 "O" rings from clutch piston.

### Inspection

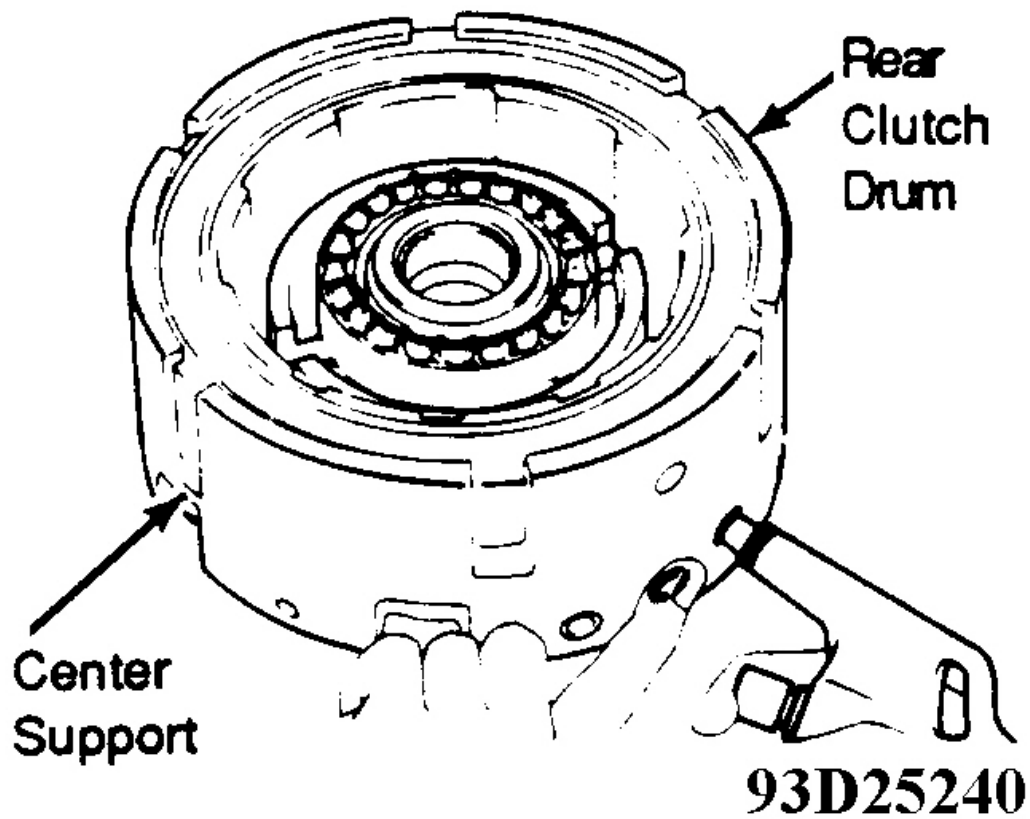
Thoroughly clean all parts and inspect for wear and damage. Inspect clutch plates and discs for signs of burning.



Soak new clutch discs in ATF for 15 minutes before installation. Inspect rear clutch piston. Shake piston and ensure check ball is free. Ensure valve does not leak by applying low pressure compressed air.

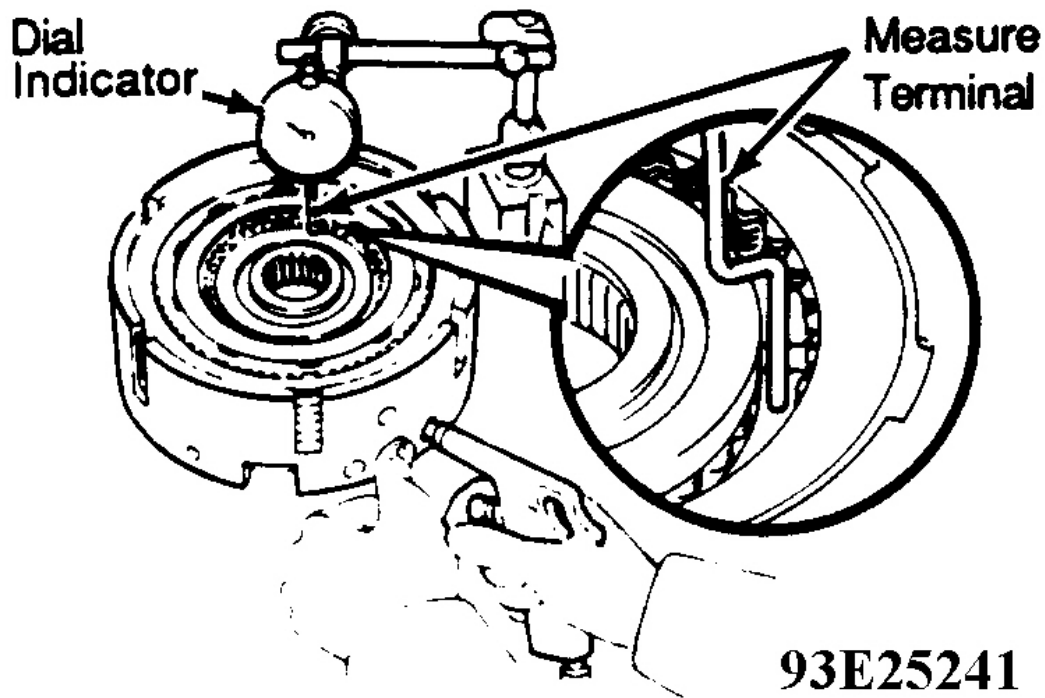
**Reassembly**

1. Lubricate and install "O" rings on clutch drum. Insert piston carefully into clutch drum, being careful not to damage "O" rings.
2. Place return springs and spring seat on clutch piston. Compress return springs and install snap ring. Ensure end-gap of snap ring is not aligned with spring retainer claw.
3. Install plates and discs in order. Install flange with rounded edge facing upward. Install snap ring. See **Fig. 31** . Ensure end-gap of snap ring is not aligned with cutout portion of rear clutch drum.
4. Position center support on wooden block. Provide clearance so that sun gear does not touch rear clutch drum. Place rear clutch on center support. Using dial indicator, measure piston stroke by applying compressed air. See **Fig. 30** . Piston stroke should be .079-.086" (2.00-2.20 mm).
5. If piston stroke is less than specified, components may have been assembled incorrectly. Check and reassemble. If piston stroke exceeds limit, clutch pack may be worn. Select different thickness flange. Flange thicknesses available are: .181" (4.60 mm), .189" (4.8 mm), .197" (5.00 mm), .205" (5.20 mm), .213" (5.40 mm) and .220" (5.60 mm).

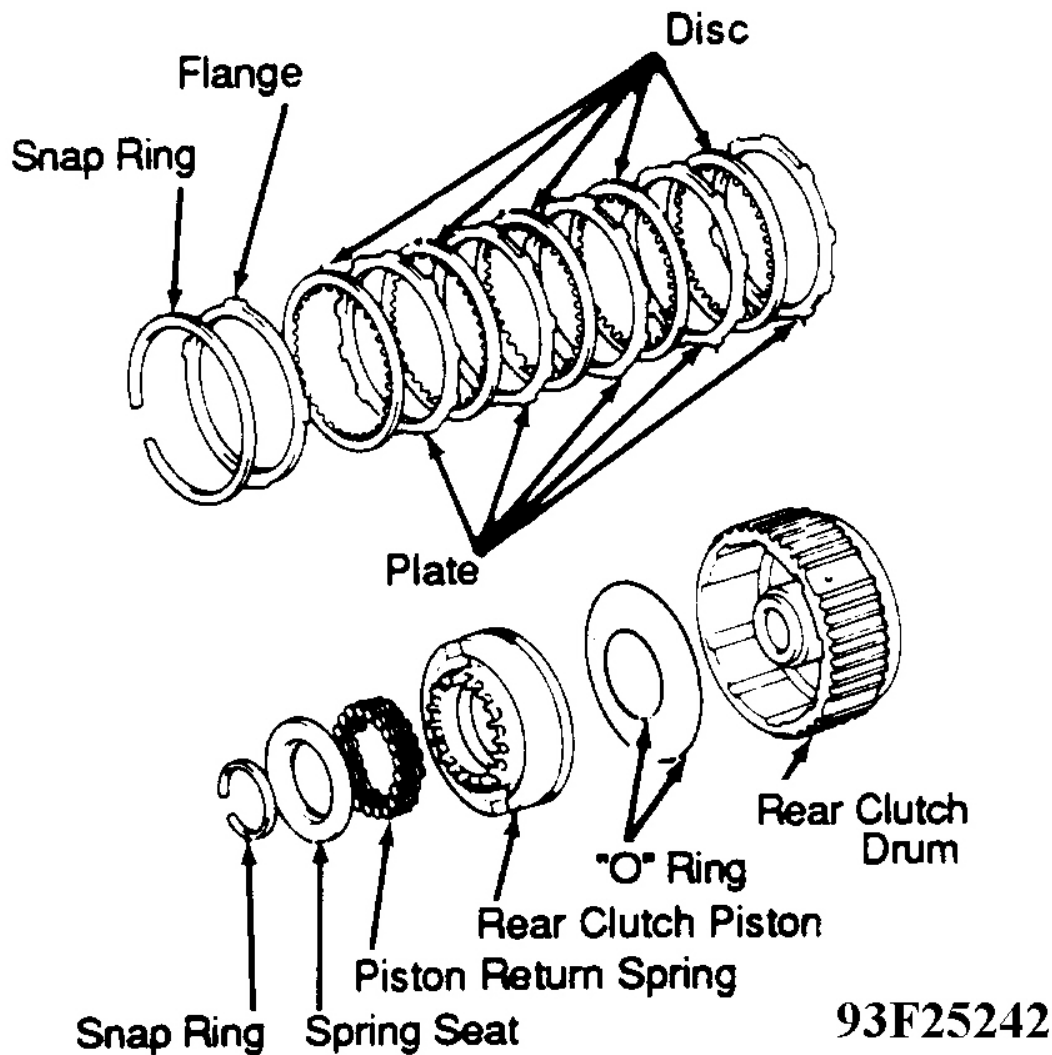


**Fig. 29: Removing Rear Clutch Piston**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 30: Checking Rear Clutch Piston Stroke**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 31: Exploded View Of Rear Clutch**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2ND BRAKE

### Disassembly

1. Using needle-nose pliers, remove 3 ring retainers from oil holes of center support. Remove snap ring. Remove front planetary sun gear.
2. Using screwdriver, remove snap ring. Remove flange, 5 discs and 5 plates. Compress return spring with appropriate spring compressor. Remove snap ring and return spring.
3. Position return spring on brake piston. Place spring compressor on return spring. Hold spring compressor so it does not slant. Apply compressed air into oil hole of center support to remove brake piston. Remove

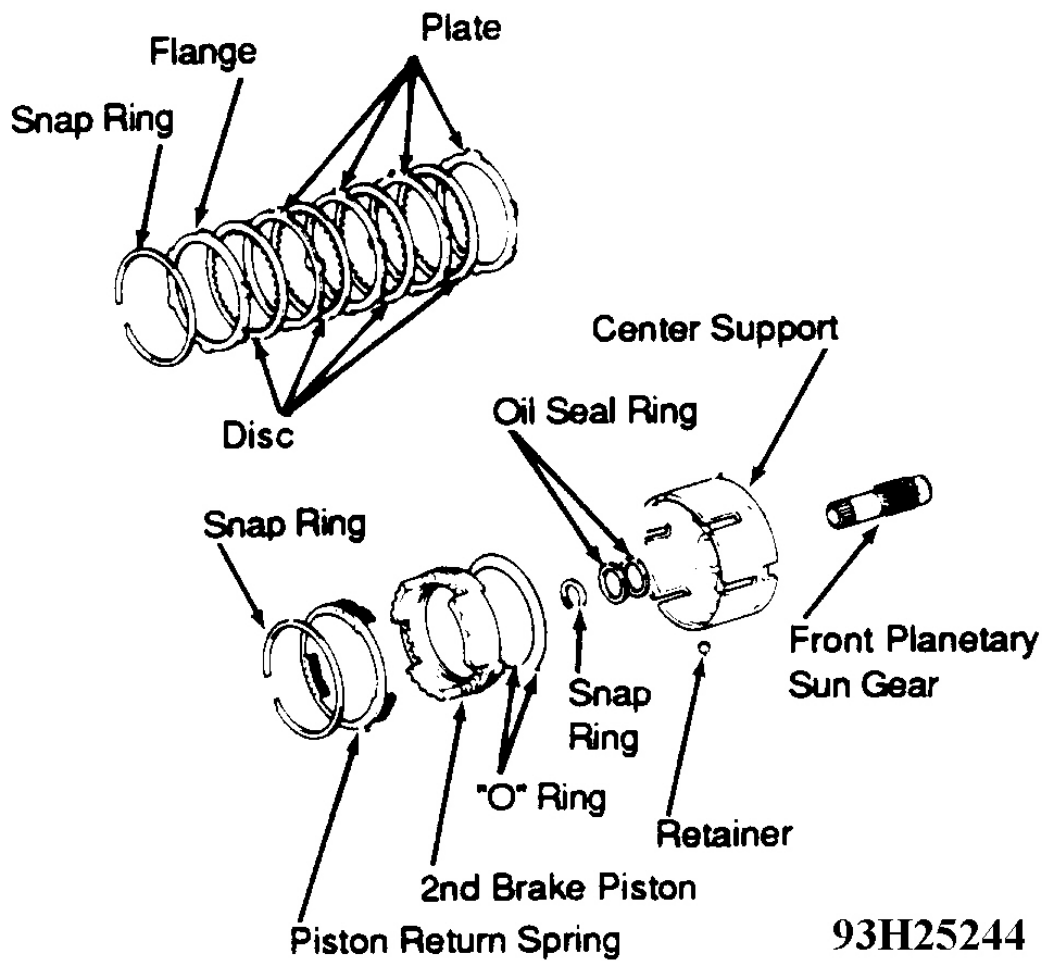
2 sealing rings from center support.

**Inspection**

1. Check all parts for wear and damage. Check plates and discs for signs of burning. Soak new discs in ATF for 15 minutes before installation.
2. Inspect center support bushing. Measure inside diameter. Standard inside diameter should be 1.378-1.379" (35.00-35.03 mm). Maximum inside diameter is 1.381" (35.08 mm). If inside diameter is excessive, replace center support.
3. Inspect front planetary sun gear bushings. Measure inside diameter. Standard inside diameter should be .945-.946" (24.00-24.02 mm). Maximum inside diameter is .948" (24.07 mm).

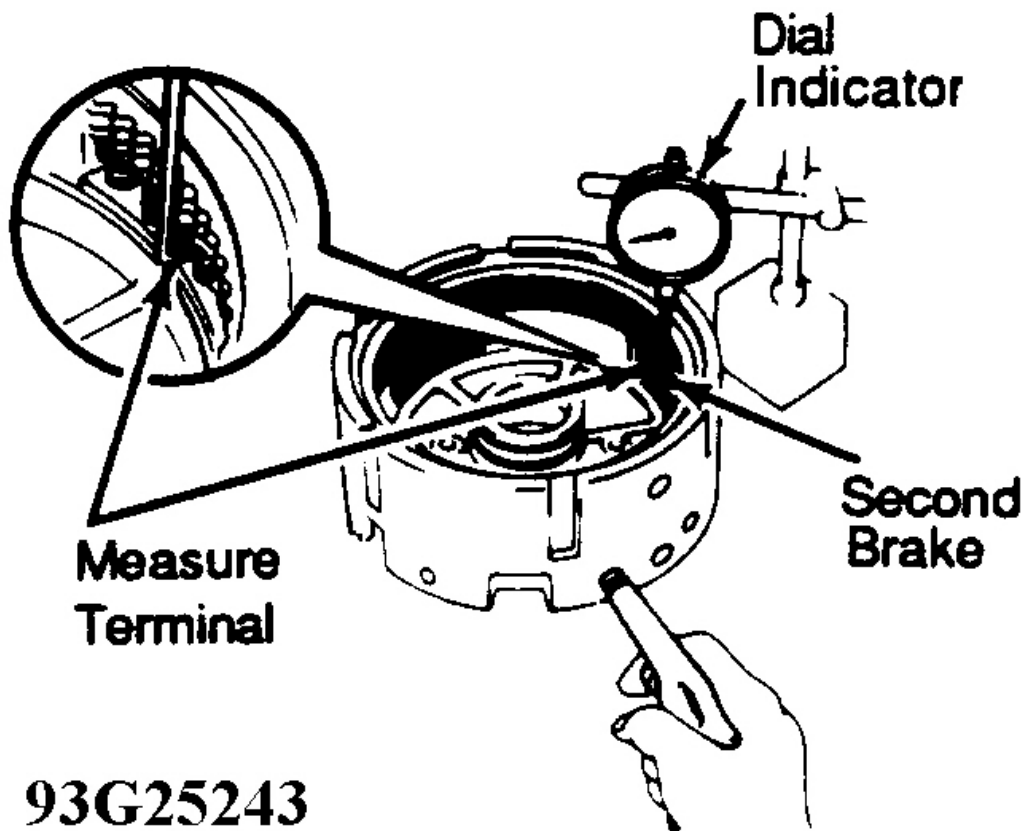
**Reassembly**

1. Install 2 oil seal rings on center support. DO NOT spread ring ends more than necessary. Ensure oil seal rings rotate smoothly.
2. Install new "O" rings on 2nd brake piston. Align protrusions of brake piston with grooves of center support. Push brake piston into center support with both hands. DO NOT damage "O" rings.
3. Position return spring on brake piston. Compress return springs and install snap-ring. Ensure snap ring end-gap is not aligned with cutout portion of center support.
4. Install plates and discs in order. See **Fig. 32** . Install flange with rounded edge facing inward. If flange is step edged, install flange with step edge facing inward. Install snap ring. Ensure snap ring end-gap is not aligned with cutout portion of center support.
5. Using dial indicator, measure piston stroke by applying compressed air. See **Fig. 33** . Piston stroke should be .073-.081" (1.86-2.06 mm).
6. If piston stroke is less than specified, parts may have been assembled incorrectly. Check and reassemble. If piston stroke exceeds limit, clutch pack may be worn. Select different thickness flange. Flange thicknesses available are: .197" (5.00 mm), .205" (5.20 mm), .213" (5.40 mm) and .220" (5.60 mm).
7. Install front planetary sun gear. Install snap ring. Using needle nose pliers, install 3 ring retainers into center support oil holes. See **Fig. 32** .



**Fig. 32: Exploded View Of 2nd Brake**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 33: Checking 2nd Brake Piston Stroke**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## FRONT & REAR PLANETARY GEAR UNIT

### Disassembly

1. Remove rear planetary gear and output shaft from front planetary gear. Remove No. 1 rear thrust washer from front planetary gear. See **Fig. 34**.
2. Remove one-way clutch from front planetary gear. Using snap ring pliers and screwdriver, pry out front planetary ring gear while compressing snap ring.
3. Remove No. 2 thrust washer from rear planetary gear. Remove snap ring. Remove output shaft from rear planetary gear. Remove thrust bearing and race from rear side of ring gear flange.
4. Remove ring gear and intermediate shaft from rear planetary gear. Remove thrust bearing and race from front side of ring gear flange. Remove sun gear from rear planetary gear. Using small screwdriver, remove oil seal ring.
5. Remove snap ring from rear side of intermediate shaft. Remove ring gear and flange from intermediate

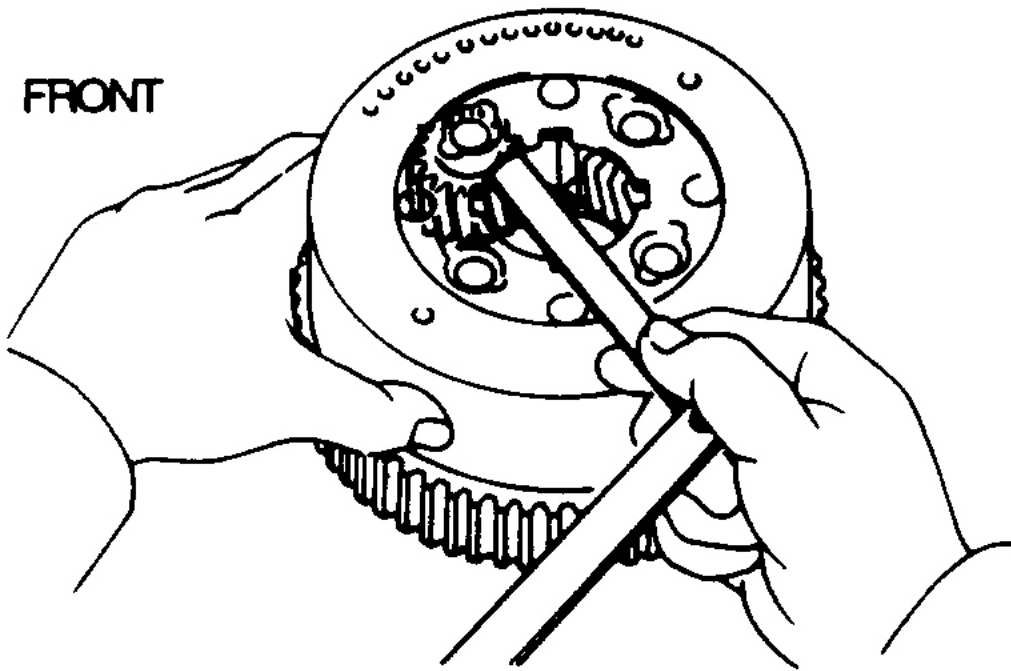
shaft. Remove snap ring from front side of intermediate shaft. Remove snap ring and ring gear flange from rear planetary ring gear.

**Inspection**

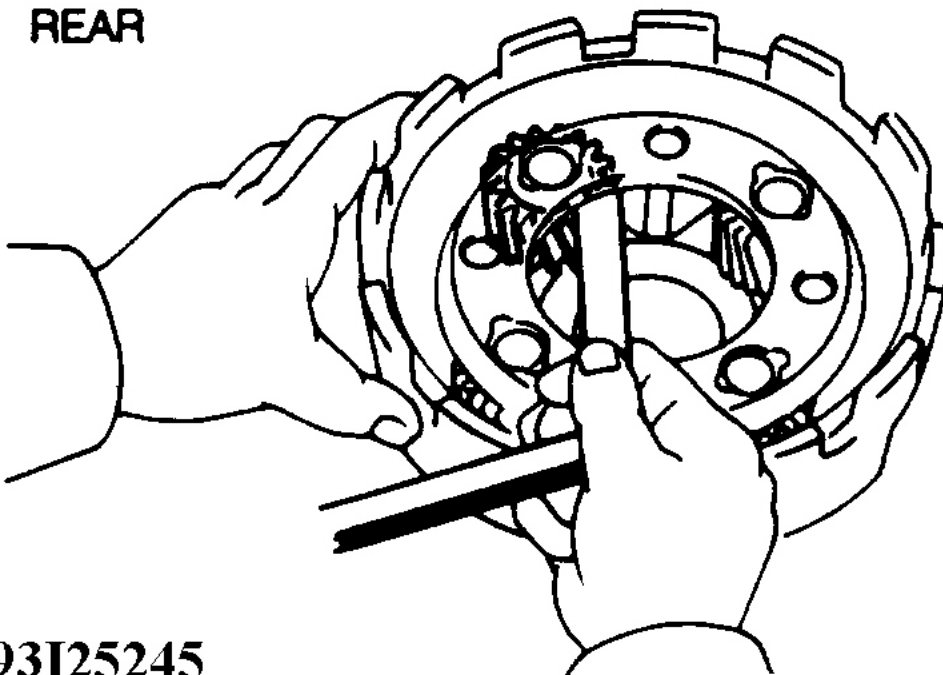
1. Inspect output shaft bushing. Measure inside diameter. Standard diameter is .6693-.6700" (17.000-17.021 mm). Maximum inside diameter is .6720" (17.070 mm). If inside diameter is excessive, replace output shaft.
2. Inspect planetary pinion gear thrust clearance. Measure thrust clearance between pinions and carrier. See **Fig. 24** . Standard clearance should be .008-.023" (.20-.59 mm). Maximum clearance is .030" (.75 mm). If thrust clearance is excessive, replace planetary gear.



FRONT



REAR

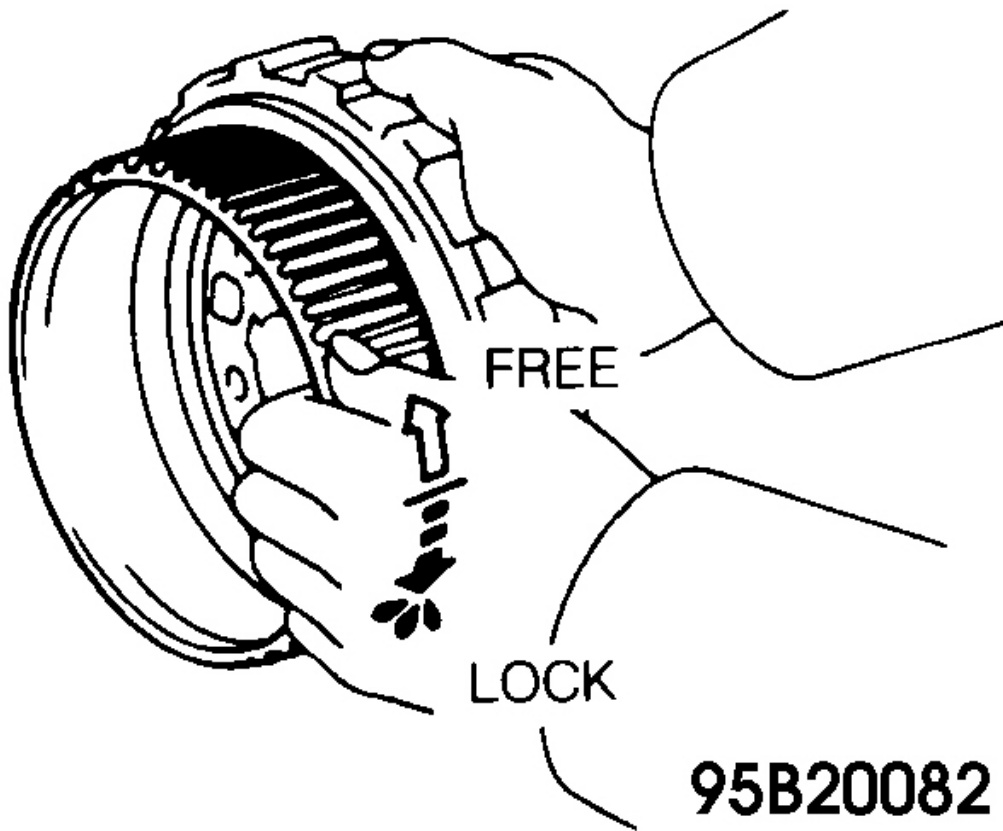


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**Fig. 34: Exploded View Of Planetary Gears, One-Way Clutch & Output Shaft**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Reassembly

1. Install ring gear flange on rear planetary ring gear. Install snap ring. Install snap ring on front side of intermediate shaft. Install ring gear and flange. Install snap ring on rear side of intermediate shaft.
2. Install new oil seal ring on intermediate shaft. Install sun gear to rear planetary gear. Install race and thrust bearing on front side of ring gear flange. Install ring gear and intermediate shaft to rear planetary gear.
3. Install race and thrust bearing on rear side of ring gear flange. Install output shaft to rear planetary gear. Install snap ring. Ensure snap ring end-gap is not aligned with cutout portion of rear planetary gear.
4. Install No. 2 thrust washer on rear planetary gear. Securely fit lips of thrust washer into holes of rear planetary gear.
5. Install front planetary ring gear. Align snap ring end with wide cutout portion of rear planetary gear. Using snap ring pliers and plastic hammer, tap in ring gear while compressing snap ring. Ensure snap ring is installed in rear planetary groove.
6. Position one-way clutch on front planetary gear, with flanged side of one-way clutch facing inward. Install one-way clutch on front planetary gear by rotating one-way clutch counterclockwise.
7. Hold one-way clutch outer race and turn front planetary gear. Front planetary gear should turn freely counterclockwise and lock clockwise. See **Fig. 35** . If operation is not as specified, replace one-way clutch.
8. Install No. 1 rear thrust washer on rear side of front planetary gear. Securely fit claws of thrust washer into grooves of front planetary gear. See **Fig. 34** .



**Fig. 35: Checking Front Planetary Gear One-Way Clutch**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 1ST & REVERSE BRAKE

### Disassembly

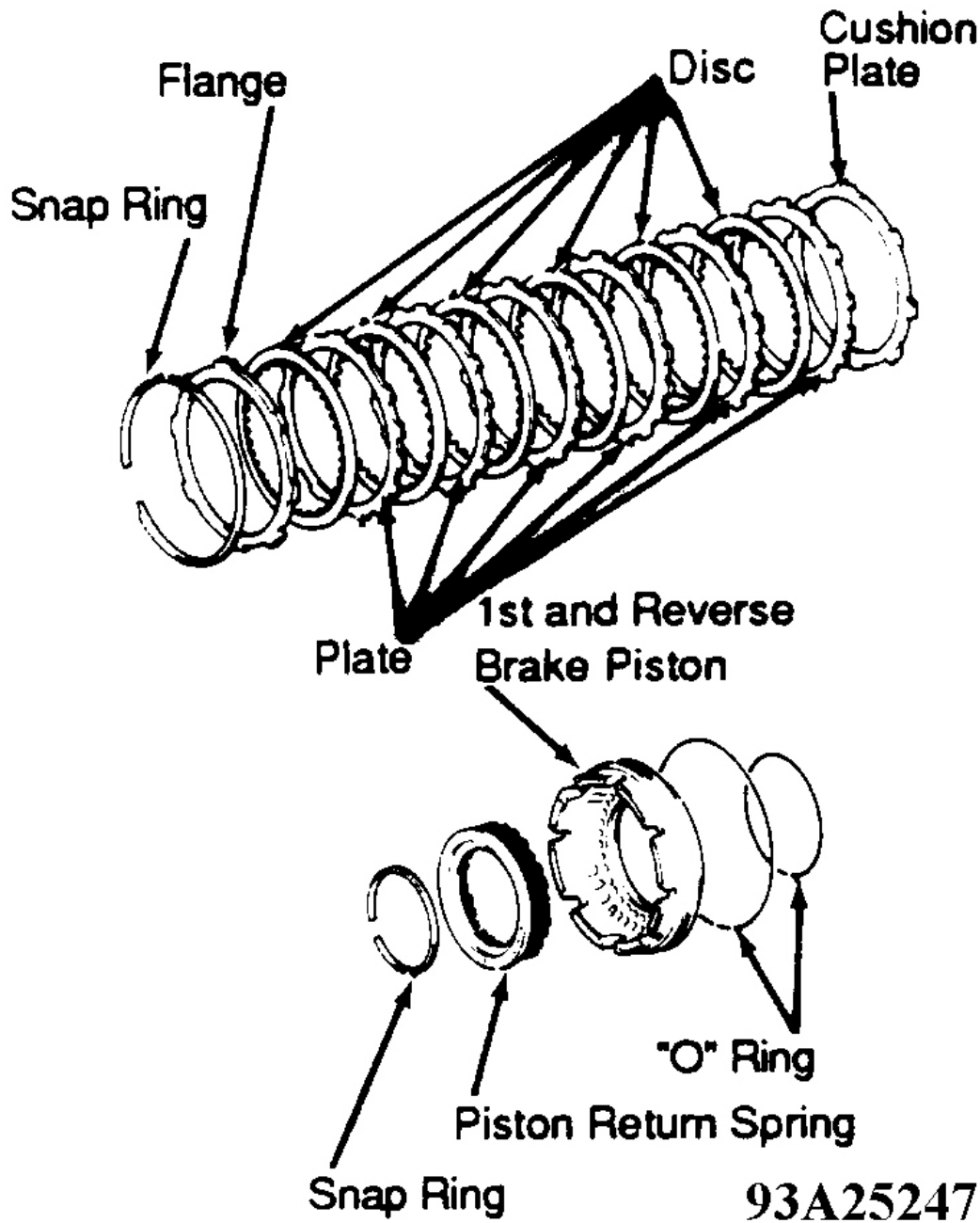
1. Remove snap ring. Remove flange, 6 discs, 6 plates and cushion plate. Using appropriate spring compressor, compress return spring. See **Fig. 15** . Remove snap ring.
2. Remove piston return spring. Hold 1st and reverse brake piston with hand, remove piston by applying compressed air into oil hole of transmission case. If piston does not pop out with compressed air, lift piston out with needle-nose pliers. Remove 2 "O" rings from piston.

### Inspection

Clean all parts in solvent and blow dry with compressed air. Inspect piston for scoring, wear or damage. Check discs, plates and flange for wear or burning. Soak new discs in ATF for 15 minutes before installation.

**Reassembly**

1. Install new "O" rings on piston and coat with ATF. Push in brake piston.
2. Position return spring on brake piston. Using spring compressor, compress return spring. Using screwdriver, install snap ring.
3. Install cushion plate with rounded edge facing inward. Install plate and discs in order. Install flange with rounded edge facing outward. If flange is step edged, install flange with step edge facing inward. Install snap ring. Ensure end of snap ring is not aligned with cutout portion of transmission case. See **Fig. 36** .



**Fig. 36: Exploded View Of 1st & Reverse Brake**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

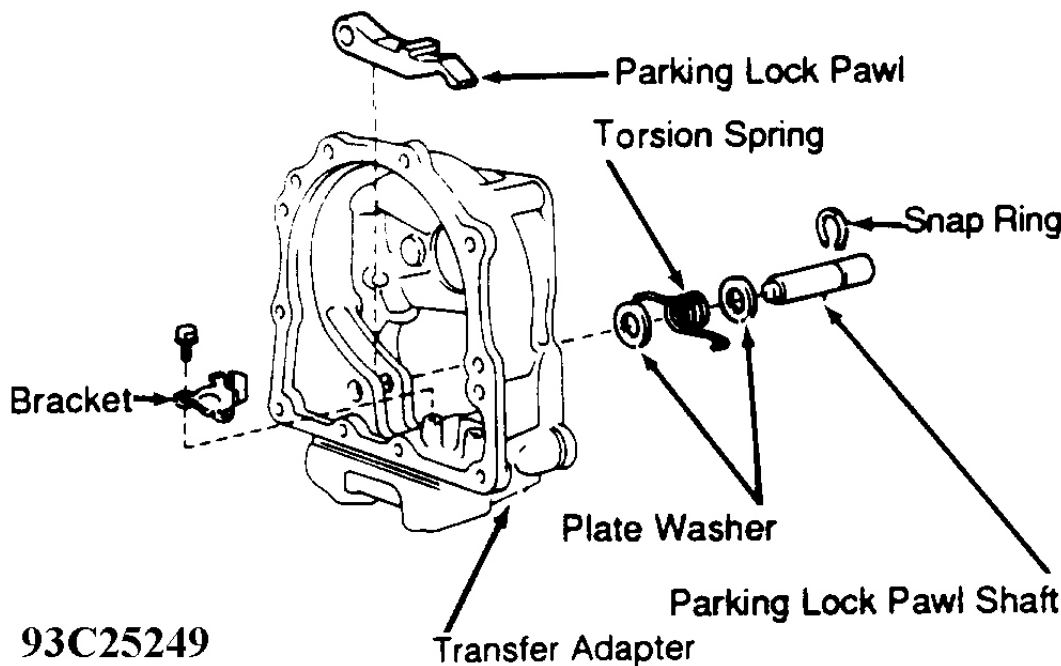
## PARKING LOCK PAWL

### Disassembly

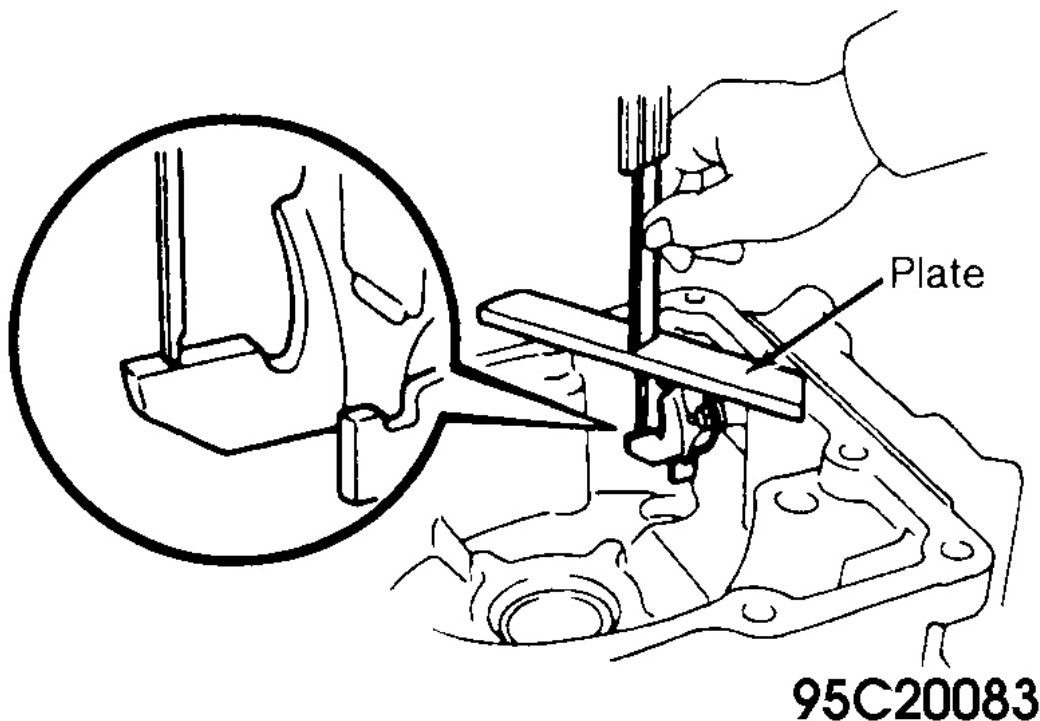
Remove pawl shaft, 2 plate washers and spring. Remove snap ring. Remove parking lock pawl. Remove parking lock pawl bracket. See **Fig. 37**.

#### Reassembly

1. Temporarily install pawl bracket with 2 bolts. Using appropriate plate and vernier caliper, set pawl bracket so distance between transfer adapter surface and top of bracket tab is specified distance. See **Fig. 38**. Standard distance = total distance minus plate thickness. Standard distance should be 1.870-1.874" (47.50-47.60 mm). Torque bolts to 14 ft. lbs. (19 N.m).
2. Install parking lock pawl. Install snap ring. Install plate washer, spring and plate washer. Insert spring end in hole of transfer adapter. Install pawl shaft. Hold pawl shaft, hook other spring end to pawl with screwdriver. Ensure pawl moves smoothly. See **Fig. 37**.



**Fig. 37: Exploded View Of Parking Lock Pawl**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 38: Checking Park Pawl Installation**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## VALVE BODY ASSEMBLY

**CAUTION:** All valve body assembly components must be installed in original location. Lay all components in sequence during removal for reassembly reference. Note diameter and location of check balls. Throttle pressure is changed according to number of adjusting rings. When assembling valve body, install same number of adjusting rings as were removed. Some valve bodies do not have adjusting rings. Note valve body assembly bolts length and location. Proper length bolts must be installed in correct locations to prevent transaxle case damage.

### Disassembly (Valve Body Assembly)

1. Remove drain tube. Remove 2 oil tubes. Remove manual valve. Turn control valve assembly over. Remove bolt, wave washer, spring cover, manual detent spring and spacer.
2. Remove shift solenoid valves. See **Fig. 39**. Remove 16 bolts, wave washers, lower valve body cover, 2 gaskets and body plate. Remove 2 plates.
3. Remove 13 bolts from upper valve body. Turn assembly over. Remove 5 bolts from lower valve body.

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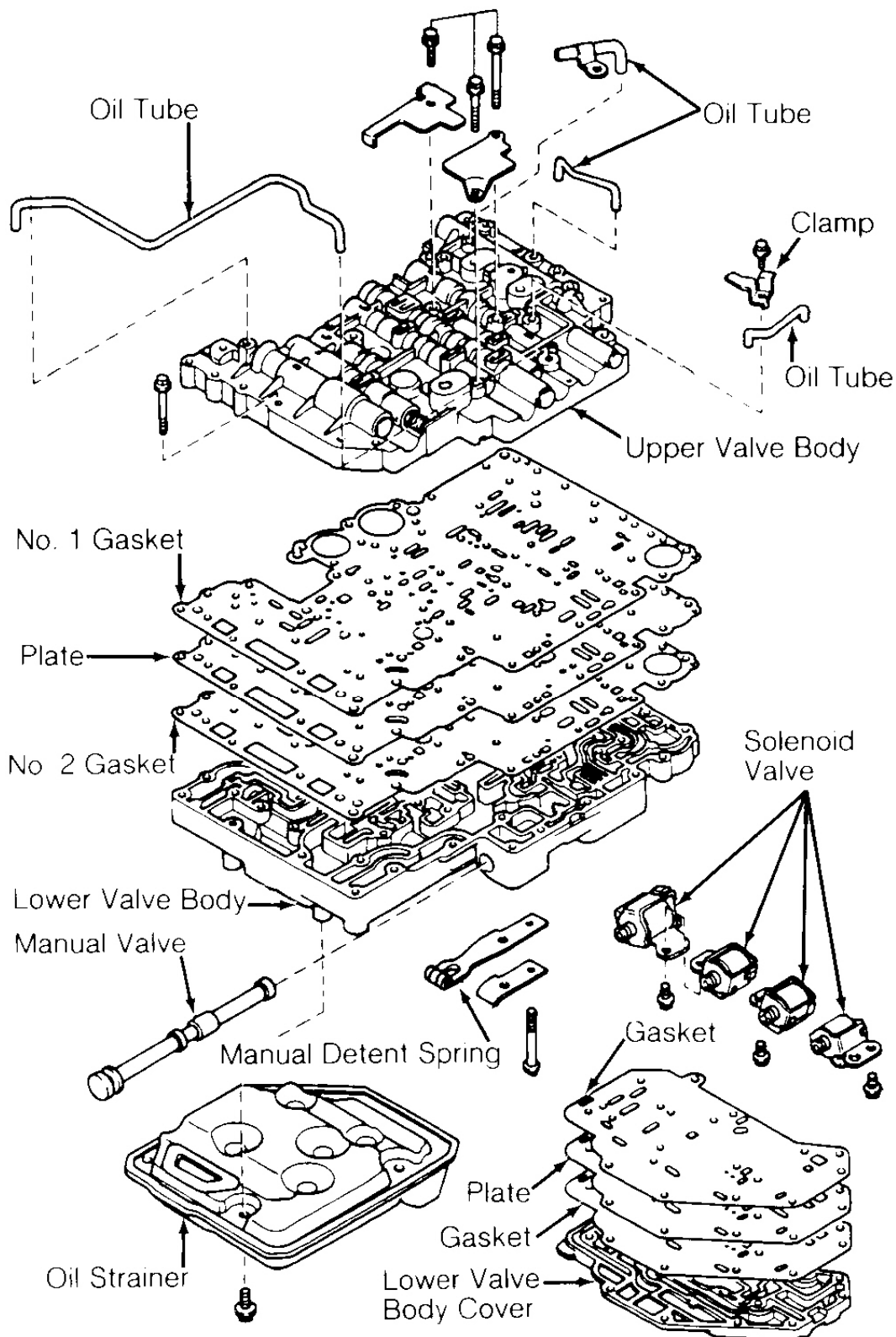
1993-94 AUTOMATIC TRANSMISSIONS Toyota A-442F

Remove lower valve body with separator plate to prevent check balls from being lost. Remove 2 gaskets and body plate.



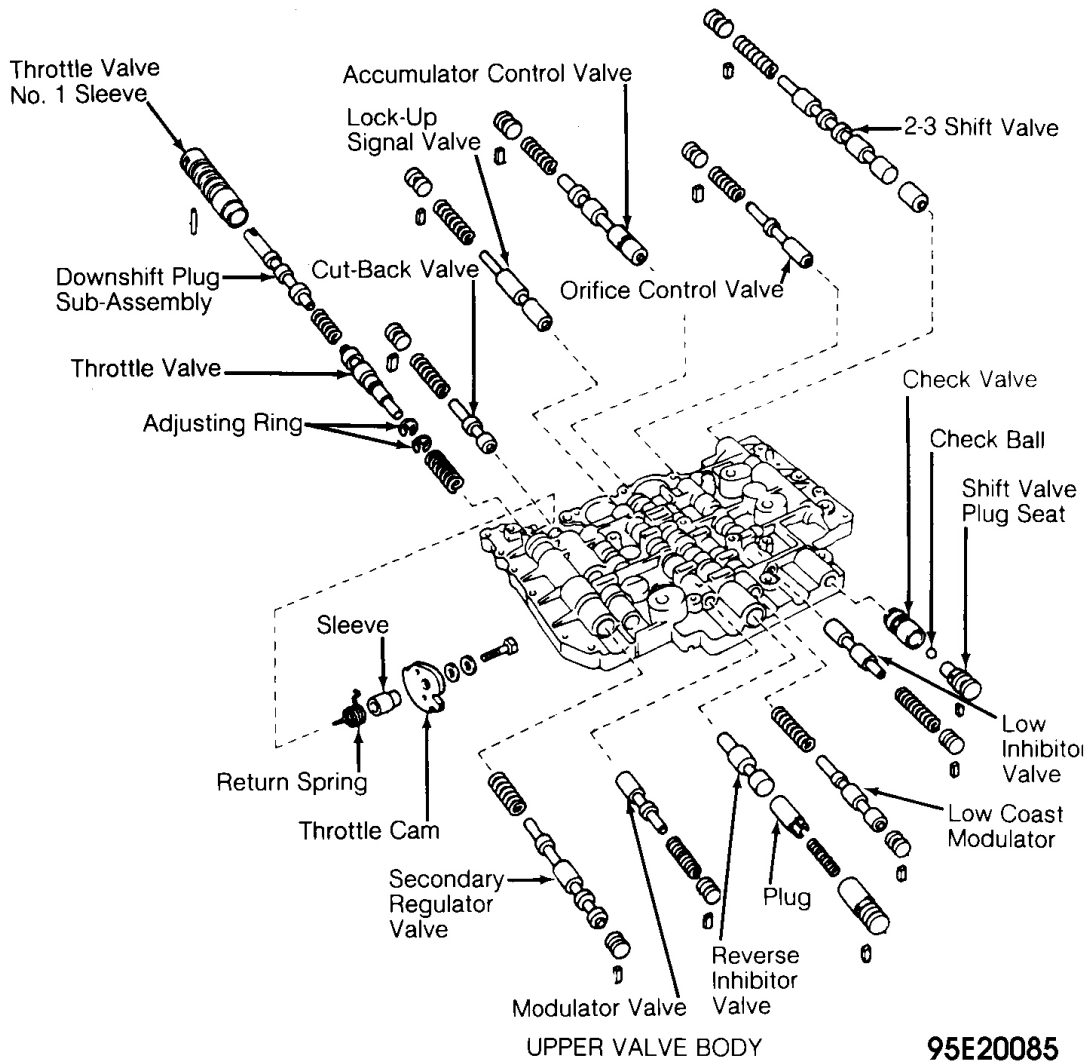
## 1993 Toyota Land Cruiser

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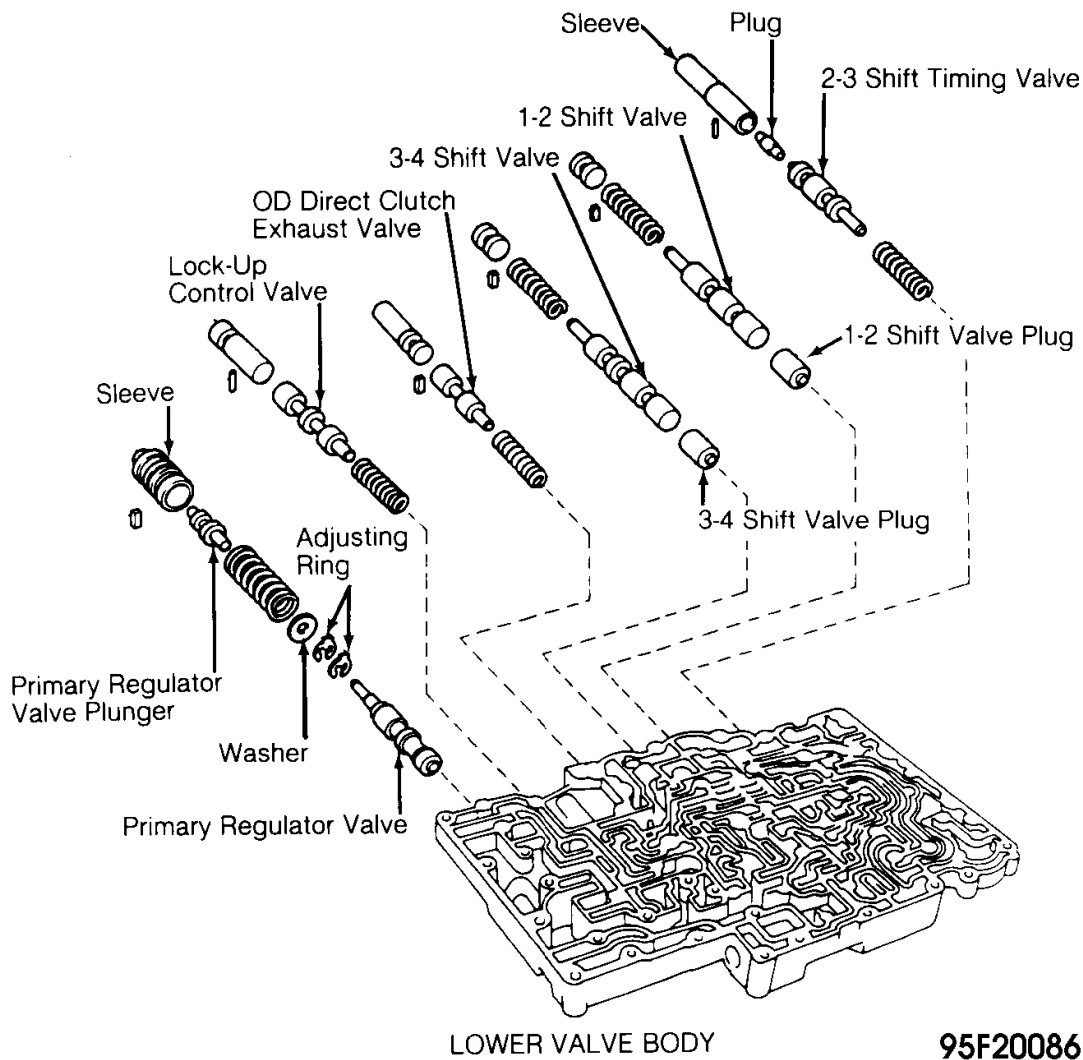


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**Fig. 39: Exploded View Of Valve Body Assembly**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 40: Exploded View Of Upper & Lower Valve Bodies**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 41: Exploded View Of Upper & Lower Valve Bodies**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### Inspection

1. Clean all parts in solvent. Clean all fluid passages and holes. Dry with compressed air. Ensure strainer is not damaged or clogged. Inspect valves for scoring or roughness.
2. Ensure valves slide freely in bores. Inspect valve springs for damage, squareness, corrosion and collapsed coils. Measure spring free length. Replace spring if not within specification. See appropriate **VALVE BODY SPRING SPECIFICATIONS** table.

**CAUTION:** All valve body assembly components must be installed in original location. Note diameter and location of check balls. Ensure pressure relief valve and check balls for upper and lower valve bodies are in correct

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location. See Fig. 42 and Fig. 43 . Throttle pressure is changed according to number of adjusting rings. When assembling valve body, install same number of adjusting rings as were removed. Some valve bodies do not have adjusting rings. Note valve body assembly bolts length and location. Proper length bolts must be installed in correct locations to prevent transaxle case damage.

**VALVE BODY SPRING SPECIFICATIONS****UPPER VALVE BODY SPRING SPECIFICATIONS (1993)**

<b>Application</b>	<b>Color Code</b>	<b>Free Length: In. (mm)</b>
2-3 Shift Valve	Orange	1.466 (37.23)
Reverse Inhibiter Valve	Lt. Blue	1.154 (29.30)
Modulator Valve	Brown	1.252 (31.80)
Throttle Valve	White	.996 (25.30)
Throttle Valve	Blue	1.057 (26.85)
Secondary Regulator Valve	None	1.811 (46.00)
1 Cut-Back Valve	Purple	1.198 (30.44)
Lock-Up Signal Valve	Purple	1.198 (30.44)
Accumulator Control Valve	Green	1.079 (27.40)
Low Coast Modulator Valve	Red	1.252 (31.80)
Orifice Control Valve	Yellow	1.534 (38.97)
Low Inhibiter Valve	Purple	1.198 (30.44)

**UPPER VALVE BODY SPRING SPECIFICATIONS (1994)**

<b>Application</b>	<b>Color Code</b>	<b>Free Length: In. (mm)</b>
2-3 Shift Valve	Orange	1.466 (37.23)
Reverse Inhibiter Valve	Lt. Blue	1.154 (29.30)
Modulator Valve	Brown	1.244 (31.60)
Throttle Valve	White	.996 (25.30)
Throttle Valve	Blue	1.057 (26.85)
Secondary Regulator Valve	Red	1.101 (27.96)
Cut-Back Valve	Purple	1.198 (30.44)
Lock-Up Signal Valve	Purple	1.198 (30.44)
Accumulator Control Valve	Blue	.976 (24.80)
Low Coast Modulator Valve	Tan	1.209 (30.70)
Orifice Control Valve	Yellow/Green	.886 (22.50)
Low Inhibiter Valve	Purple	1.198 (30.44)

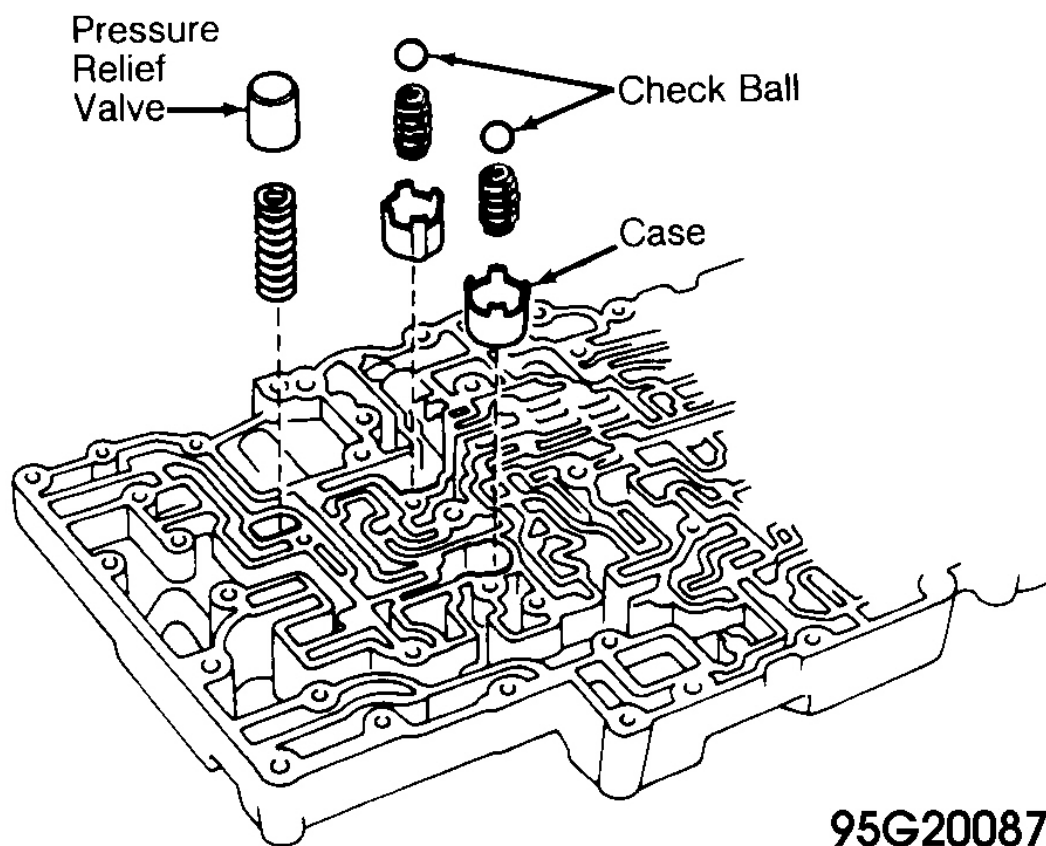
**LOWER VALVE BODY SPRING SPECIFICATIONS (1993-94)**

<b>Application</b>	<b>Color Code</b>	<b>Free Length: In. (mm)</b>
1-2 Shift Valve	Orange	1.705 (43.30)

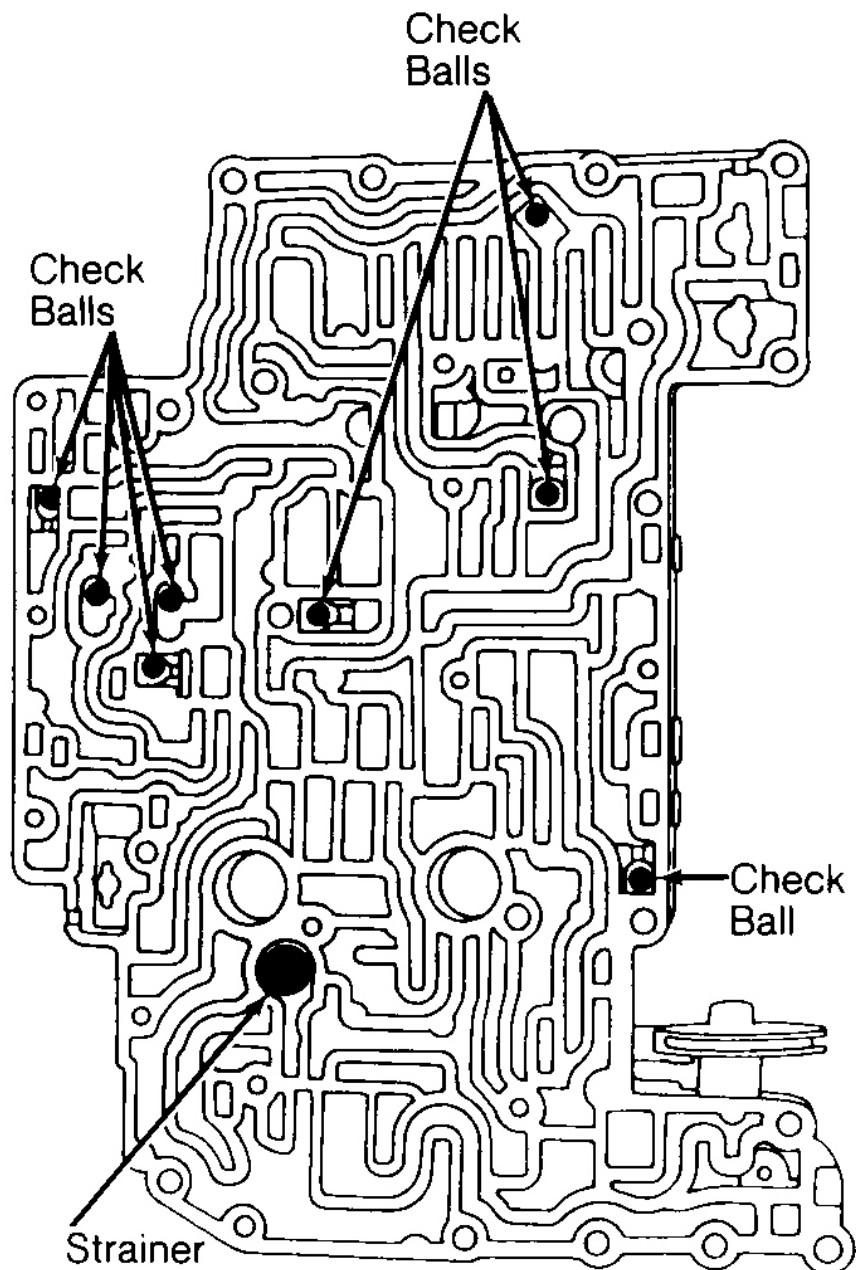
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3-4 Shift Valve	Orange	1.543 (39.20)
Check Ball	None	1.508 (38.30)
Pressure Relief Valve	White	1.197 (30.40)
Primary Regulator Valve	Red	2.102 (53.40)
Lock-Up Control Valve	White	1.311 (33.30)
OD Direct Clutch Exhaust Valve	Yellow	.886 (22.50)
2-3 Timing Valve	Yellow	.886 (22.50)



**Fig. 42: Locating Pressure Relief Valve & Check Balls In Lower Valve Body**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

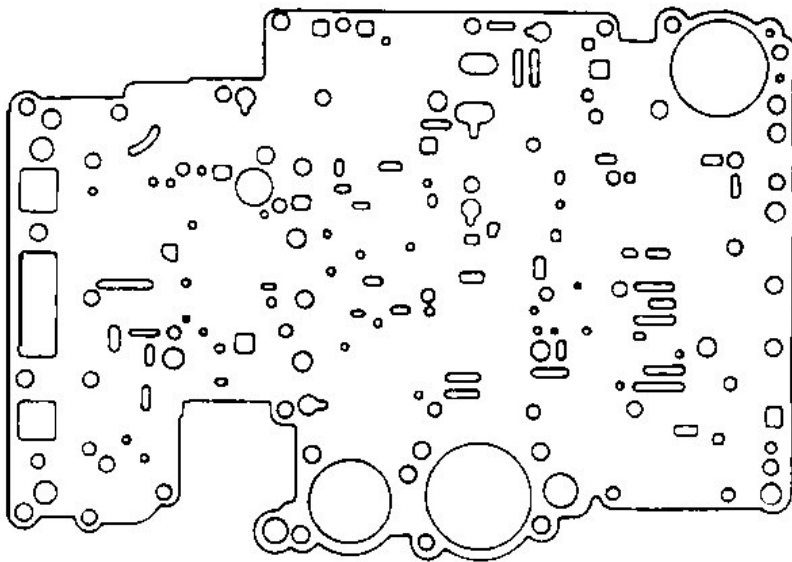


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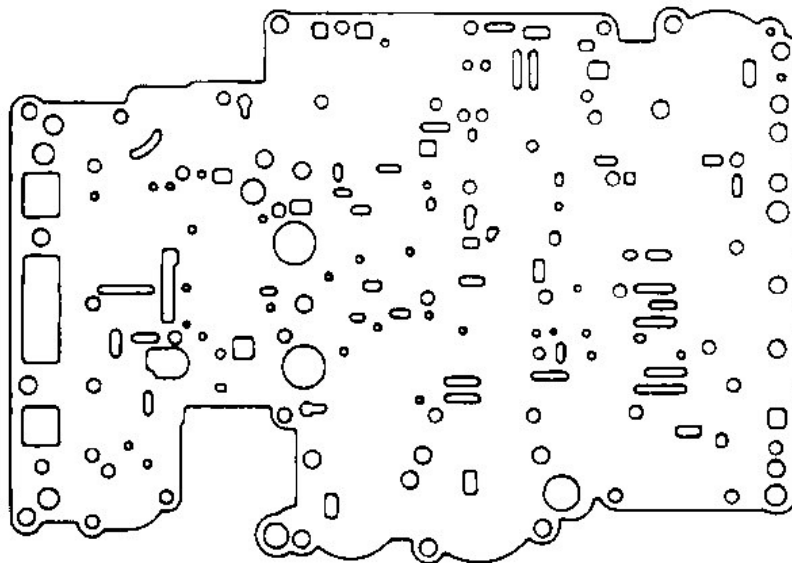
**Fig. 43: Locating Check Balls In Upper Valve Body**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Reassembly (Valve Body Assembly)

1. Place new No. 1 gasket, separator plate and new No. 2 gasket on lower valve body. For gasket identification, See **Fig. 44** . Hold gaskets and separator plate together and install on upper valve body.
2. Temporarily install 5 bolts. Turn valve assembly over and install 20 bolts. See **Fig. 45** . Install 2 plates. See **Fig. 46** . Install lower valve body plate with separator plate and new gaskets. Install 14 bolts. See **Fig. 47** .
3. Tighten all bolts to specification. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . Install 4 shift solenoid valves. Install manual detent spring. Install manual valve. Install oil tubes and clamps. Install drain tube.



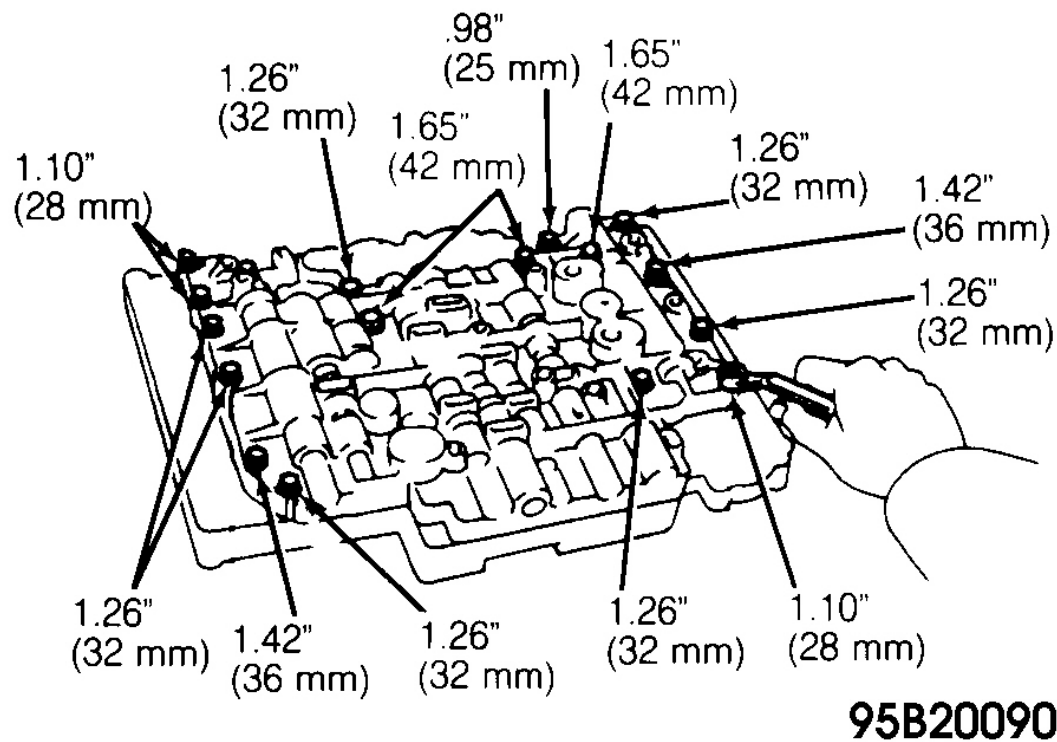
NO. 1 GASKET



NO. 2 GASKET **95120089**

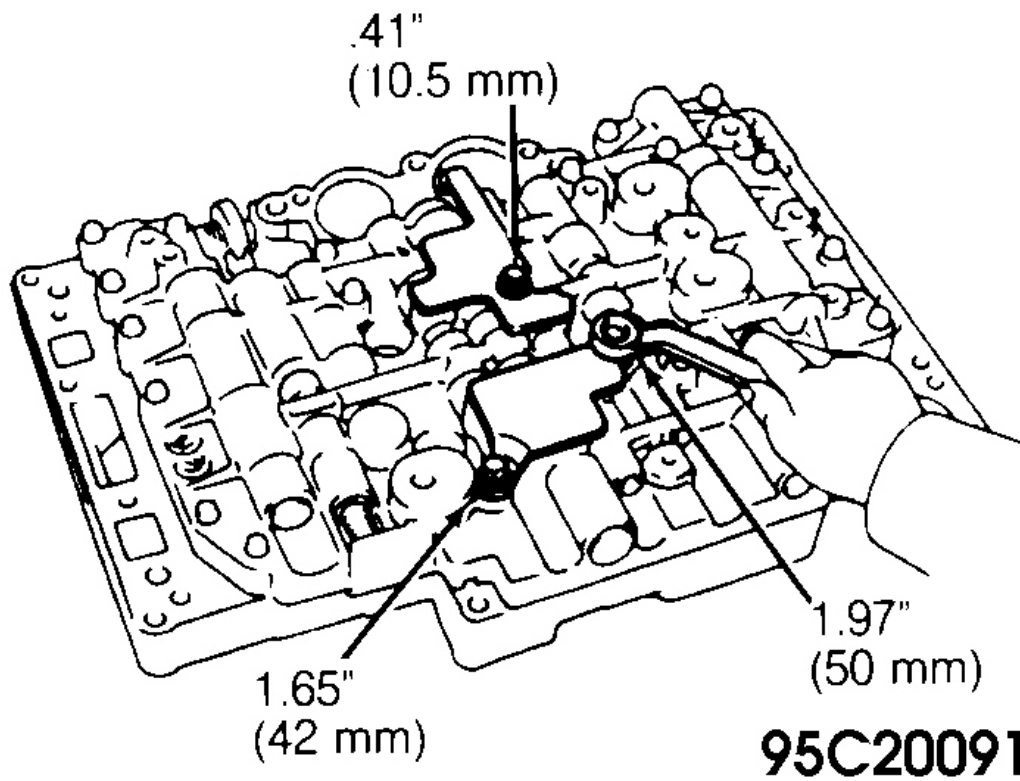
**Fig. 44: Identifying Lower Valve Body Gaskets**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.





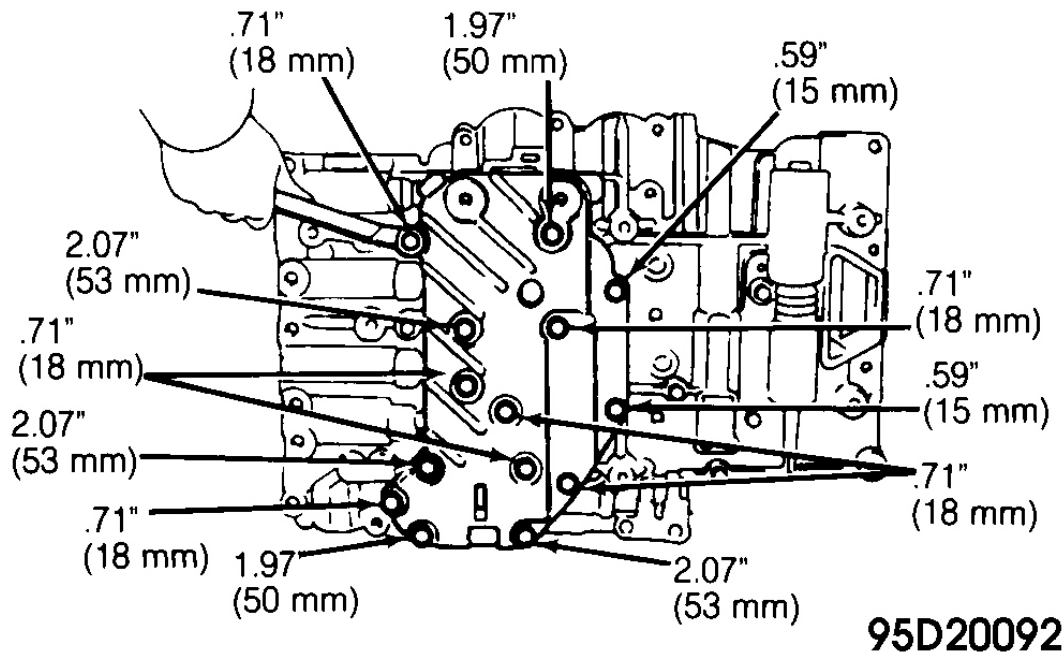
**Fig. 45: Identifying Upper Valve Body Bolts**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 46: Installing Valve Body Plates**

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 47: Install Lower Valve Body Cover Bolts**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## TRANSMISSION REASSEMBLY

**NOTE:** Coat all oil seal rings, clutch discs, clutch plates, rotating parts, and sliding surfaces with ATF prior to reassembly. All gaskets and rubber "O" rings should be replaced. Ensure ends of snap rings are not aligned with cut-outs and are installed correctly in groove. If a worn bushing is to be replaced, replacement must be made with the subassembly containing that bushing. Check thrust bearings and races for wear or damage. Use petroleum jelly to hold parts in place. Replace parts as necessary. Soak clutch plates in ATF for 15 minutes prior to installation.

**NOTE:** For thrust bearing locations, see [Fig. 49](#) .

1. Install manual lever shaft seal. Assemble NEW spacer to manual valve lever. Connect parking lock rod to manual valve lever.
2. Install manual valve lever shaft to transmission case through plate, wave washer, manual valve lever and plate. Using hammer, tap in pin with slot at right angle to shaft. Align spacer hole with notch in lever and stake in position using a hammer and punch. Ensure manual valve lever shaft turns smoothly.
3. Install NEW gasket and rear cover with 3 bolts and 6 screws. Torque bolts to 69 INCH lbs. (7.8 N.m). Install NEW "O" rings on forward clutch accumulator piston. Install spring and accumulator piston into bore of case. Install 2 NEW gaskets with plate in between. Install forward clutch accumulator cover.

Tighten bolts to 69 INCH lbs. (7.8 N.m).

4. Place transmission case on a cylinder for assembly purposes. DO NOT damage case. Tape top of cylinder to protect case. Install NEW "O" rings on 1st and reverse piston and coat with ATF. Push in brake piston.
5. Position return spring on brake piston. Using spring compressor, compress return spring. See **Fig. 15** . Using screwdriver, install snap ring.
6. Install cushion plate with rounded edge facing inward. Install plates and discs in order. Install flange with rounded edge facing outward. If flange is step edged, install flange with step edge facing inward. Install snap ring. Ensure end of snap ring is not aligned with cutout portion of transmission case.
7. Using dial indicator, measure piston stroke of 1st and reverse brake piston by applying compressed air. See **Fig. 14** . Piston stroke should be .130-.150" (3.30-3.80 mm). If piston stroke is less than specified, parts may have been assembled incorrectly. Check and reassemble. If piston stroke is greater than specified, select different thickness flange. See the **1ST & REVERSE BRAKE FLANGE SPECIFICATIONS** table.

#### 1ST & REVERSE BRAKE FLANGE SPECIFICATIONS

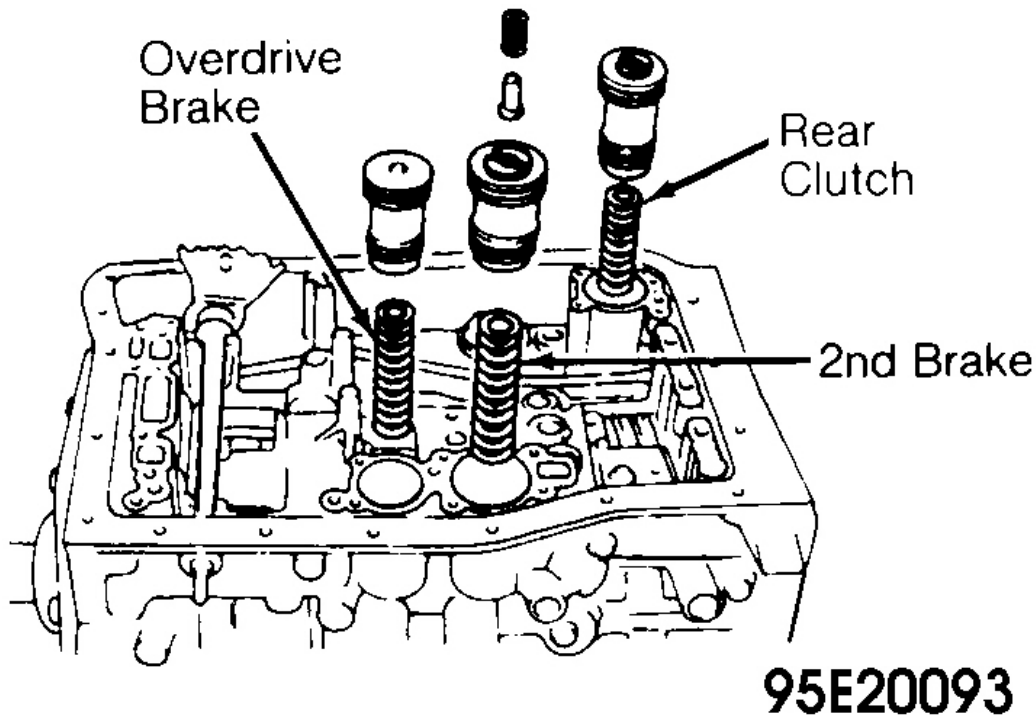
Identifying Mark	Thickness In. (mm)
None Or E	.2618 (6.650)
1 Or F	.2776 (7.050)
2 Or G	.2933 (7.450)

8. Install planetary gears, one-way clutch and output shaft assembly. Place case on a cylinder see step 4). Install rear planetary carrier and output shaft assembly to case.
9. Temporarily install 2 bolts to front planetary carrier. Use 6 mm bolts. DO NOT screw in over 5 revolutions. Align spline of one-way clutch with spline groove of case.
10. Install front planetary carrier and one-way clutch assembly into case. Mesh front planetary carrier spline with disc tabs by rotating and pushing front planetary carrier clockwise. If front planetary carrier will not rotate clockwise, check installation of one-way clutch. Remove bolts.
11. Using a screwdriver, install snap ring. Ensure end of snap ring is not aligned with cutout portion of case. Coat thrust washer with petroleum jelly and install on front planetary carrier. Securely position claws of thrust washer into grooves of front planetary gear.
12. Install speed sensor rotor onto output shaft. Install 2 spacers on output shaft. Install snap ring. Place NEW gasket on transmission case. Insert parking lock rod between parking lock pawl and bracket. Attach transfer adapter on case. Apply sealant to bolt threads. Install NEW gasket and transfer adapter. Tighten bolts to 27 ft. lbs. (37 N.m).
13. Slide spacer on output shaft with cut-out part facing outward. Install snap ring. Install output shaft bearing retainer. Install speed sensor.
14. Temporarily install center support assembly. Install thrust washer on rear side of center support. Securely fit thrust washer claws into center support grooves. Temporarily install 2 bolts to center support to assist installation. Align center support and case oil and bolt holes. Install center support into case.
15. Adjust thrust clearance of center support. Push transmission output shaft toward front of transmission by applying a force of 11-22 lbs. (5-10 kg). Push center support toward rear of transmission by applying a force of 11-22 lbs. (5-10 kg), then pull with same amount of force.
16. Position plate on center support. Using vernier caliper, measure distance "A" between top of plate and thrust washer on front planetary gear. See **Fig. 13** . Using caliper, measure thickness "B" of plate.

17. Remove 3 center support set bolts. Remove center support from case. Turn center support and thrust washer over. Place assembly on flat surface. Inserting vernier caliper into thrust washer hole, measure distance "C" between thrust washer hole and flat surface. See **Fig. 13**.
18. Center support thrust clearance is "A" - ("B"+"C"). Standard thrust clearance should be .0118-.0276" (.300-.700 mm). Maximum thrust clearance is .0354" (.900 mm). If thrust clearance is excessive, select and install replacement thrust washer. Thrust washers range in thicknesses of .059" (1.50 mm) to .106" (2.70 mm) in .30 mm increments.
19. Install 3 new "O" rings in center support oil holes. Align center support and case oil and bolt holes. Install center support into case. Apply sealant to center support bolt threads. Install 3 center support bolts and tighten to 18 ft. lb. (25 N.m).
20. Install rear clutch into case. Mesh rear clutch drum splines and disc tabs by rotating and pushing rear clutch drum clockwise or counterclockwise.
21. Install races on rear clutch drum and front clutch hub. Install front clutch into case. Mesh front clutch hub splines and disc tabs by rotating and pushing front clutch drum clockwise or counterclockwise.
22. Position plate on installation surface of oil pump. Using vernier caliper, measure distance between top of plate and front clutch drum. See **Fig. 12**. If distance corresponds to measurement taken during disassembly, front clutch assembly is installed correctly.
23. Temporarily install Overdrive (OD) case. Remove oil seal ring from input shaft. Install races, bearing and spacer on front clutch drum. Temporarily install bolts to OD case to assist installation. Align OD and transmission case oil and bolt holes. Install 3 OD case set bolts. Tighten to 18 ft. lbs. (25 N.m).
24. Push transmission output shaft toward front of case by applying a force of 11-22 lbs. (5-10 kg). Push OD case toward rear of transmission by applying a force of 11-22 lbs. (5-10 kg).
25. Using extension bar with dial indicator, measure thrust clearance of input shaft. Standard thrust clearance should be .012-.028" (.30-.70 mm). If thrust clearance is greater than maximum specification, adjust with replacement spacer.
26. Remove 3 OD case set bolts. Remove OD case. Remove races, thrust bearing and spacer from front clutch drum or OD case. Select spacer. Spacer thicknesses available are: .035" (.90 mm), .047" (1.20 mm), .059" (1.50 mm), .071" (1.80 mm) and .083" (2.10 mm). Install spacer, races and bearing on front clutch drum. Reinstall oil seal to input shaft.
27. Install OD case. Install new "O" rings on OD case oil holes. Align transmission and OD case oil and bolt holes. Apply sealant to OD case bolt threads. Install 3 OD case set bolts and tighten to 18 ft. lbs. (25 N.m).
28. Install race on OD case. Install bearing on ring gear flange. Install OD ring gear assembly. Install bearing and race on OD planetary gear. Install OD planetary gear, OD direct clutch and one-way clutch assembly into transmission case. Mesh OD direct clutch drum splines with disc tabs by rotating and pushing OD direct clutch drum clockwise or counterclockwise.
29. Position plate on installation surface of oil pump. Using vernier caliper, measure distance between top of plate and OD clutch drum. See **Fig. 9**. If distance corresponds to measurement taken during disassembly, OD planetary gear, OD direct clutch and one-way clutch assembly is installed properly.
30. Temporarily install oil pump. Install races and bearing on OD direct clutch drum. Position gasket on transmission case. Align pump body and case bolt holes. Install and tighten bolts to 15 ft. lbs. (21 N.m).
31. Adjust OD planetary gear input shaft clearance. Push OD input shaft toward rear of transmission by applying a force of 11-20 lbs. (5-9 kg). Measure thrust clearance of input shaft. Standard thrust clearance should be .016-.035" (.40-.90 mm). See **Fig. 8**. If maximum thrust clearance is excessive, adjust with

replacement race.

32. Remove 11 oil pump set bolts. Remove oil pump and gasket. Remove race from oil pump cover. Select race. There are 3 different thicknesses of races: .031" (.80 mm), .039" (1.00 mm) and .055" (1.40 mm). Coat race with petroleum jelly and install on oil pump cover.
33. Install oil pump. Position NEW gasket on case. Install "O" ring on pump body. Align pump body and case bolt holes. Using plastic hammer, lightly tap in oil pump to case. Apply sealant to oil pump set bolt threads. Install and tighten bolts to 15 ft. lbs. (21 N.m).
34. Install rear clutch, OD brake and 2nd brake accumulator pistons and springs. See **Fig. 48** . Install NEW "O" rings on pistons. Install pistons and springs into transmission case bores. See the **ACCUMULATOR SPRING SPECIFICATIONS** table.



**Fig. 48: Exploded View Of Accumulators & Springs**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ACCUMULATOR SPRING SPECIFICATIONS

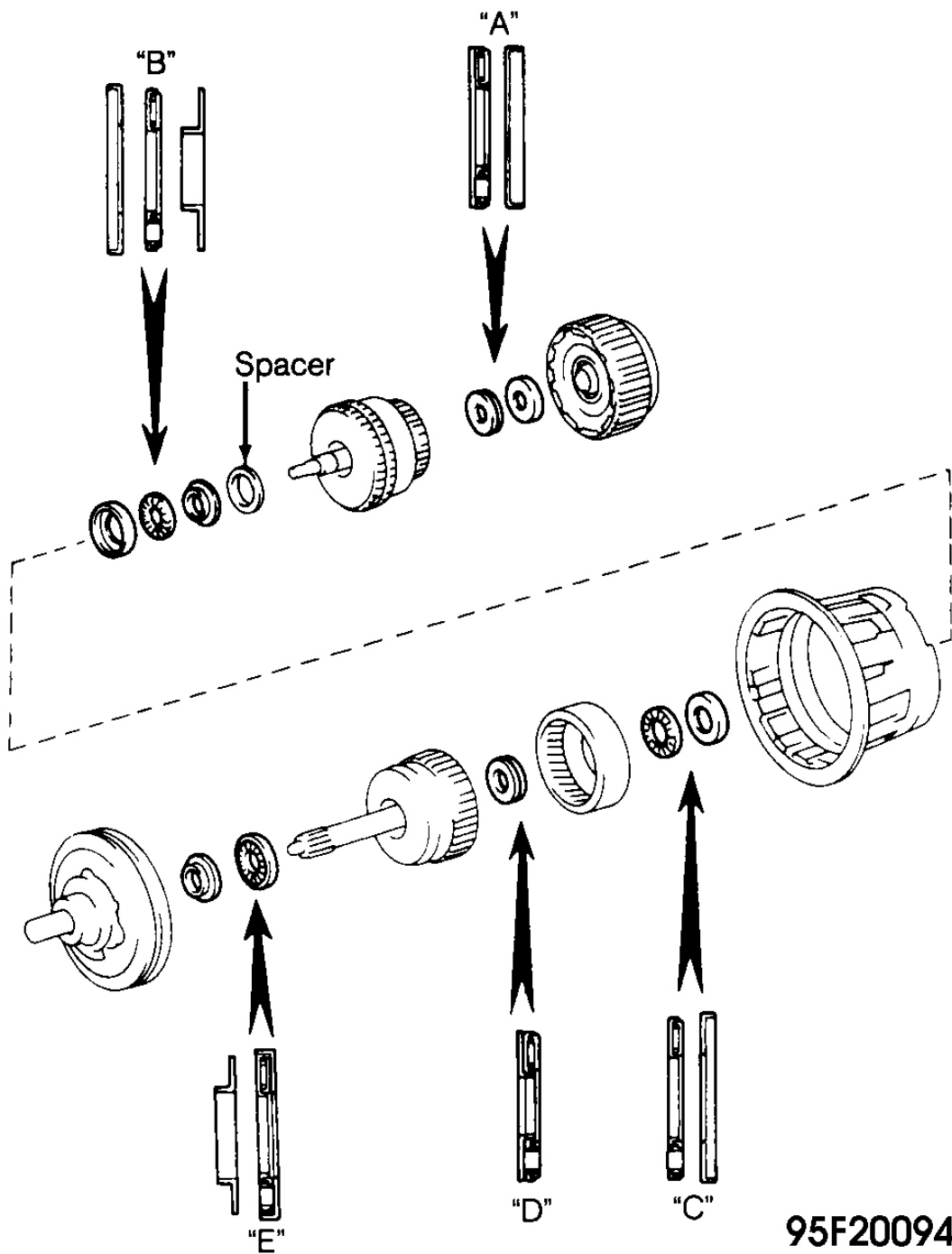
Application	Color Code	Free Length In. (mm)	Diam. In. (mm)
OD Brake	Lt. Green	2.48 (63.1)	.815 (20.07)
2nd Brake	Blue	2.56 (65.0)	.988 (25.10)
Rear Clutch			

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1993	Green	3.29 (83.5)	.854 (21.70)
1994	Green	3.23 (82.0)	.862 (21.90)

35. Install NEW "O" ring on throttle cable. Install throttle cable to case. Install 4 NEW center support apply gaskets with pitted side facing toward case.
36. Install the control valve assembly. See procedures for **VALVE BODY ASSEMBLY** under ON-VEHICLE SERVICE. Ensure proper length bolt is installed in correct location
37. Install NEW gasket and oil strainer (filter). Install 10 mm head bolts. Torque 8 mm head bolts to 48 INCH lbs. (5.4 N.m) and 10 mm head bolts to 89 INCH lbs. (10 N.m).
38. Install magnets in oil pan. Install NEW gasket and oil pan. Tighten bolts to 61 INCH lbs. (6.9 N.m). Install oil pan protector.
39. Install converter housing. Tighten bolts to 47 ft. lbs. (64 N.m). Install throttle cable to case. Install new "O" ring on ATF temperature sensor. Install sensor. Tighten to 25 ft. lbs. (34 N.m). Install wire clamp. Install oil cooler unions. Tighten to 21 ft. lbs. (29 N.m).
40. Install control shaft lever. Tighten to 115 INCH lbs. (13 N.m). Temporarily install neutral start switch with 2 bolts. Install grommet, NEW lock washer and nut. Tighten to 61 INCH lbs. (6.9 N.m). Fully turn control shaft lever back and return 2 notches. Lever is now in Neutral position. Align neutral basic line with switch groove. Tighten bolts to 115 INCH lbs. (13 N.m). Bend tabs of lock washer. Bend at least 2 tabs.
41. Install oil cooler pipes with 2 unions and bolt. Tighten to 25 ft. lbs. (34 N.m). Install NEW "O" ring on breather plug. Install breather plug and hose. Connect 4 connectors and install transmission wire harness.



**Fig. 49: Locating A-442F Thrust Bearings**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**THRUST BEARING & RACE SPECIFICATIONS**



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<b>Application</b>	<b>Outer Diam. In. (mm)</b>	<b>Inner Diam. In. (mm)</b>
<b>"A"</b>		
Rear Race	2.047 (52.0)	1.457 (37.0)
Bearing	2.047 (52.0)	1.291 (32.8)
<b>"B"</b>		
Front Race	2.047 (52.0)	1.457 (37.0)
Rear Race	1.984 (50.4)	1.291 (32.8)
Bearing	2.047 (52.0)	1.366 (34.7)
<b>"C"</b>		
Rear Race	2.047 (52.0)	1.457 (37.0)
Bearing	2.047 (52.0)	1.366 (34.7)
<b>"D"</b>		
Bearing	1.654 (42)	.913 (23.2)
<b>"E"</b>		
Front Race	1.693 (43)	<sup>(1)</sup> 1.067 (27.1)
Bearing	1.819 (48)	1.122 (28.5)
(1) Optional races available are 1.098" (27.9 mm) and 1.114" (28.3 mm) inner diameters. Outer diameter is unchanged.		

**TRANSAXLE SPECIFICATIONS****TRANSAXLE SPECIFICATIONS**

<b>Application</b>	<b>In. (mm)</b>
<b>Bushing Inside Diameter (Maximum)</b>	
Case Bushing	2.524 (64.10)
Center Support	1.381 (35.08)
Oil Pump Body	1.659 (42.13)
Rear Sun Gear	.948 (24.07)
OD Case	1.307 (33.20)
OD Direct Clutch	1.0461 (26.57)
OD Planetary Gear	.475" (12.070 mm)
Output Shaft	.672 (17.07)
Input Shaft End Play	.018-.035 (.40-.90)
<b>Piston Stroke</b>	
Forward Clutch	.155-.167 (3.93-4.23)
OD Brake	.049-.073 (1.25-1.850)
OD Direct Clutch	.070-.079 (1.8-2.0)
Rear Clutch	.079-.086 (2.00-

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	2.20)
1st & Reverse Brake	.130-.150 (3.3-3.8)
Planetary Pinion Gear Clearance	.0295 (.75)
Torque Converter Depth	.618 (15.70)

**TORQUE SPECIFICATIONS****TORQUE SPECIFICATIONS**

<b>Application</b>	<b>Ft. Lbs. (N.m)</b>
ATF Temperature Sensor-To-Transmission Case Bolt	25 (34)
Center Support Set Bolt	18 (25)
Control Valve Assembly-To-Transmission Case Bolt	89 (10)
OD Case Set Bolt	18 (25)
Oil Cooler Pipe-To-Oil Cooler Union Bolt	25 (34)
Oil Cooler Pipe Union Nut	25 (34)
Oil Cooler Union-To-Transmission Case Bolt	21 (29)
Oil Pump Cover-To-Oil Pump Body 12 mm Head Bolt	15 (21)
Oil Pump-To-Transmission Case Bolt	15 (21)
Parking Lock Pawl-To-Transfer Adapter Bolt	14 (19)
Propeller Shaft-To-Transfer Bolt	65 (88)
Transfer Adapter-To-Transmission Case Bolt	27 (37)
Transmission Housing-To-Transmission Case Bolt	47 (64)
Torque Converter-To-Drive Plate Bolt	21 (28)
<b>INCH Lbs. (N.m)</b>	
Control Shaft-To-Transmission Case Bolt	115 (13)
Front Accumulator Cover-To-Transmission Case Bolt	69 (7.8)
Front Upper Valve Body-To-Lower Valve Body Bolt	48 (5.4)
Governor Cover-To-Governor Valve Body Support Bolt	89 (10)
Lock-Up Relay Valve Body Plate-To-Valve Body	
8 mm Head Bolt	48 (5.4)
10 mm Head Bolt	89 (10)
Lower Valve Body Cover-To-Lower Valve Body Bolt	48 (5.4)
Manual Detent Spring-To-Lower Valve Body Bolt	48 (5.4)
Neutral Start Switch-To-Manual Valve Shaft Bolt	61 (6.9)
Neutral Start Switch-To-Transmission Case Bolt	115 (13)
Oil Pan-To-Transmission Case Bolt	61 (6.9)
Oil Pump Cover-To-Oil Pump Body 10 mm Head Bolt	78 (8.8)
Oil Strainer-To-Valve Body	
8 mm Head Bolt	48 (5.4)
10 mm Head Bolt	89 (10)
Rear Upper Valve Body-To-Lower Valve Body Bolt	48 (5.4)

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Transmission Rear Cover-To-Transmission Case Bolt	69 (7.8)
Valve Body-To-Transmission Case Bolt	89 (10)