

## 2001 Toyota Highlander

2001-05 AUTOMATIC TRANSMISSIONS U140E & U140F Overhaul

### 2001-05 AUTOMATIC TRANSMISSIONS

#### U140E & U140F Overhaul

## APPLICATION

**CAUTION:** Flush oil cooler and oil cooler lines prior to transaxle installation. Oil cooling system contamination may cause premature transaxle failure.

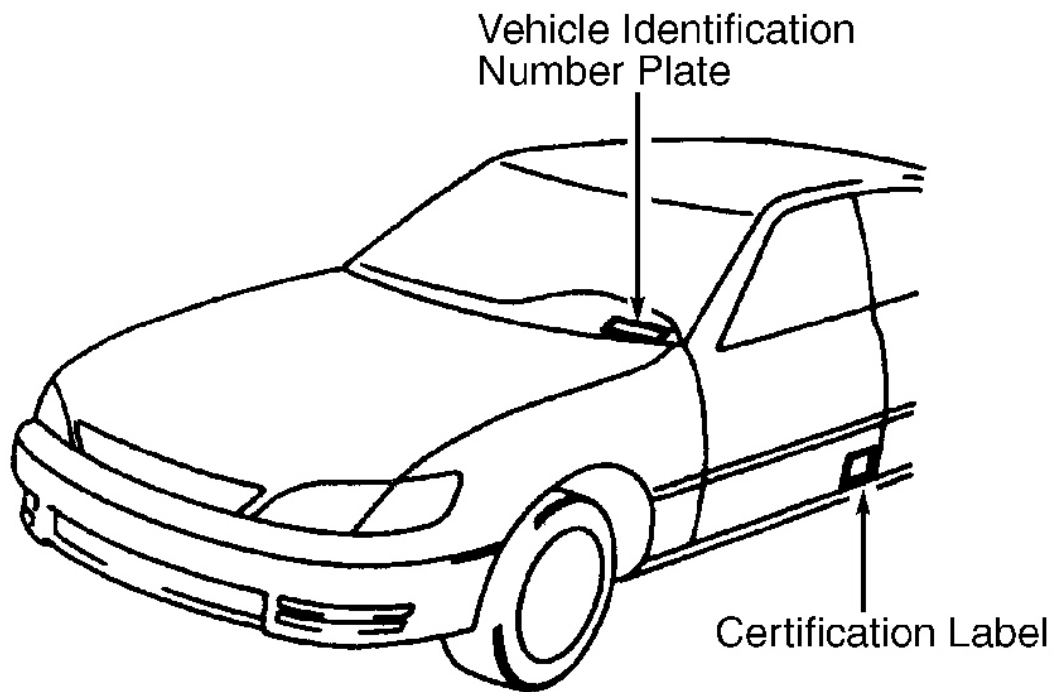
### TRANSAXLE APPLICATION

| Application                      | Transaxle Model |
|----------------------------------|-----------------|
| Camry 3.0L (2002-03)             | U140E           |
| Highlander 2.4L & 3.0L (2001-05) | U140E & U140F   |

## IDENTIFICATION

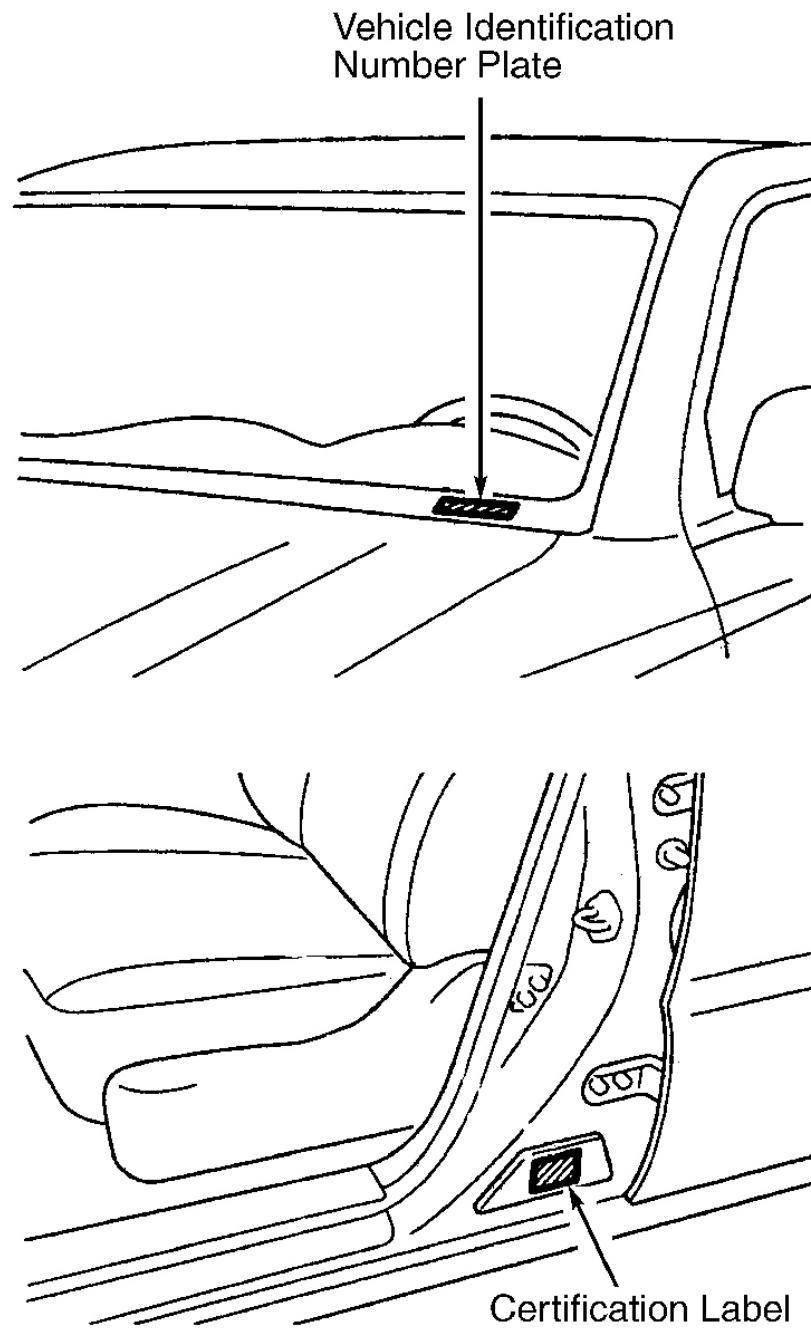
### TRANSAXLE

Vehicle Identification Number (VIN) is used for correct identification of component parts and assemblies. VIN is located at top left corner of instrument panel. Vehicle certification label is located at left corner of driver's door. This label also contains the VIN. See **Fig. 1** and **Fig. 2** . On Camry, transaxle serial number is located at top left corner of transaxle housing. On Highlander, transaxle serial number is located on transaxle case. See **Fig. 3** and **Fig. 4** .



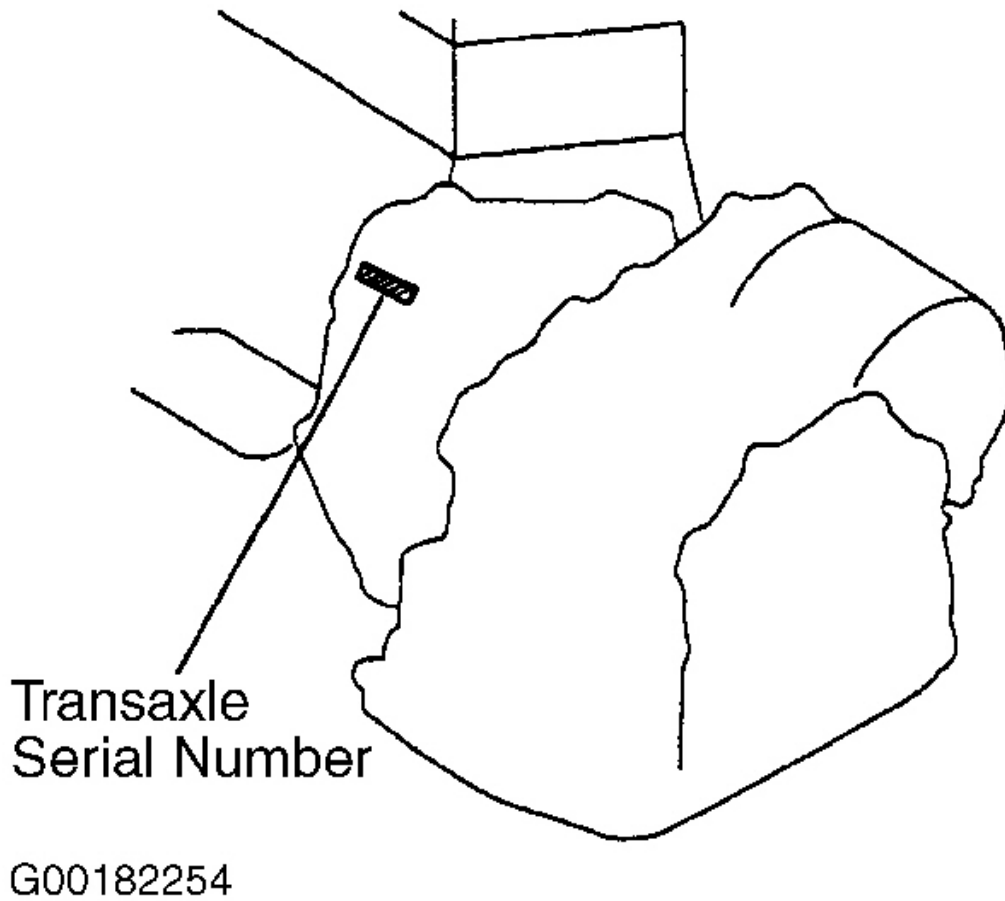
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**Fig. 1: Locating Vehicle Identification Number Plate (Camry)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

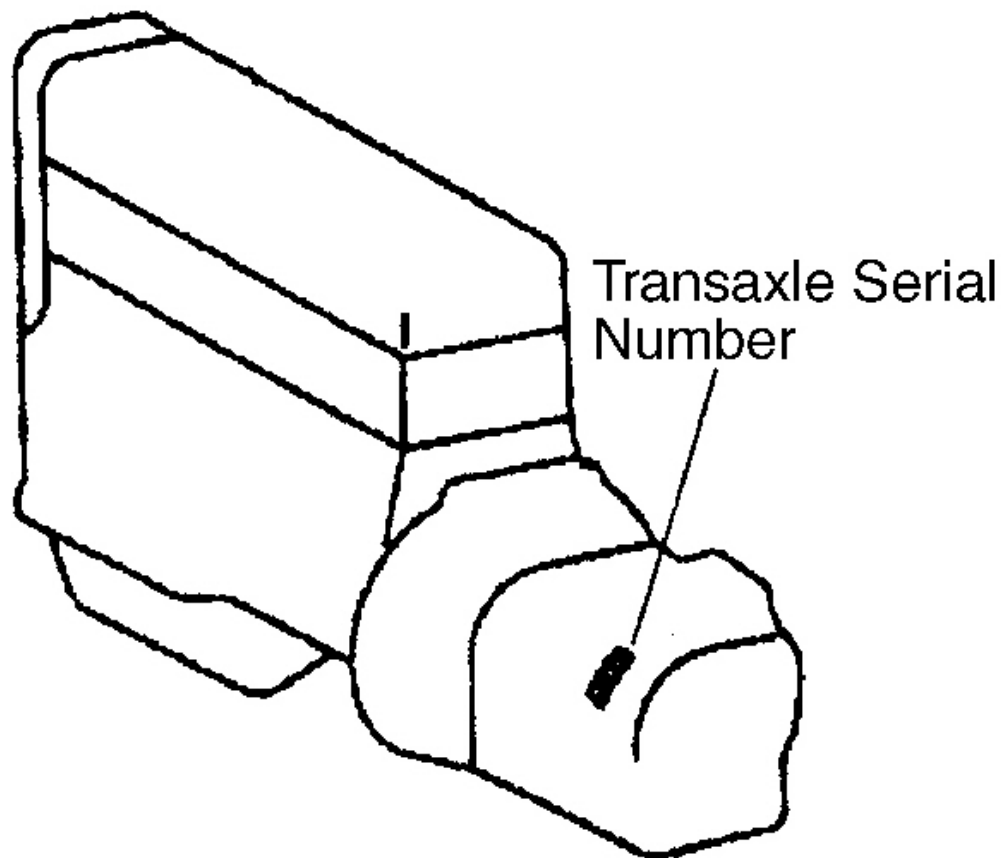


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**Fig. 2: Identifying Vehicle Number Plate Locations (Highlander)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 3: Locating Transaxle Serial Number (Camry)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 4: Locating Transaxle Serial Number (Highlander)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## GEAR RATIOS

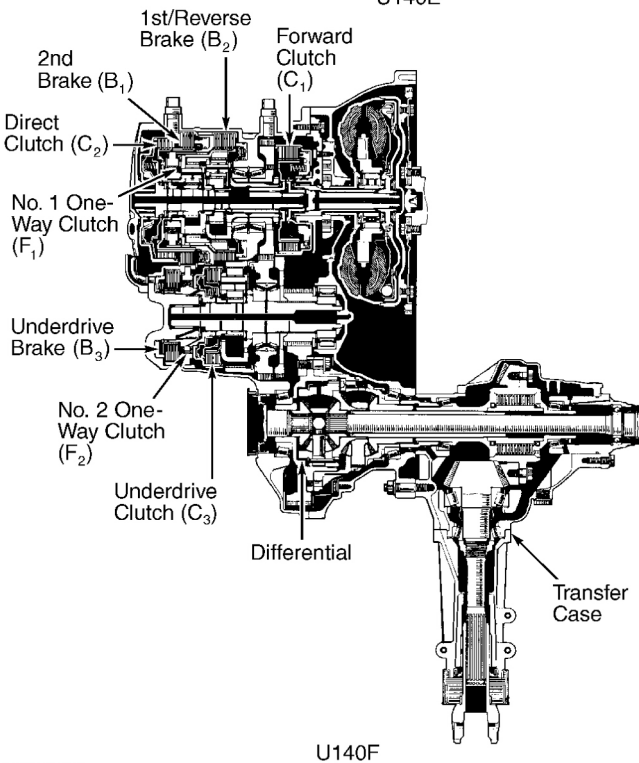
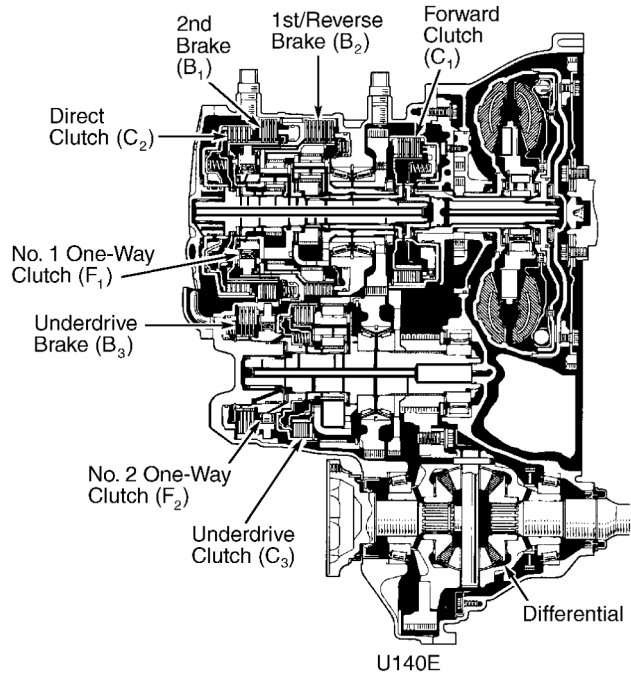
### TRANSAXLE GEAR RATIOS

| Gear Range | Gear Ratio |
|------------|------------|
| 1st        | 3.938:1    |
| 2nd        | 2.194:1    |
| 3rd        | 1.411:1    |
| OD         | 1.019:1    |
| Reverse    | 3.141:1    |

## DESCRIPTION & OPERATION

## INTRODUCTION

The U140E and U140F transaxles are 4-speed electronically controlled transaxles. Transaxle uses a lock-up torque converter, direct clutch, forward clutch, underdrive clutch, underdrive brake, 3 planetary gears, 2nd brake, 2 one-way clutches, 1st/reverse brake, and hydraulic and electronic control systems. U140F transaxle is equipped with a transfer case. See **Fig. 5**.



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**Fig. 5: Identifying Transaxle Component Locations**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## LUBRICATION

**NOTE:** See appropriate **SERVICING** article.

## **TROUBLE SHOOTING**

**NOTE:** Transaxle malfunctions may be caused by poor engine performance, improper adjustments, fluid condition or failure of hydraulic, mechanical or electronic components. Ensure all concerns have been properly checked prior to transaxle overhaul. See appropriate **DIAGNOSIS** article.

## **COMPONENT TESTS**

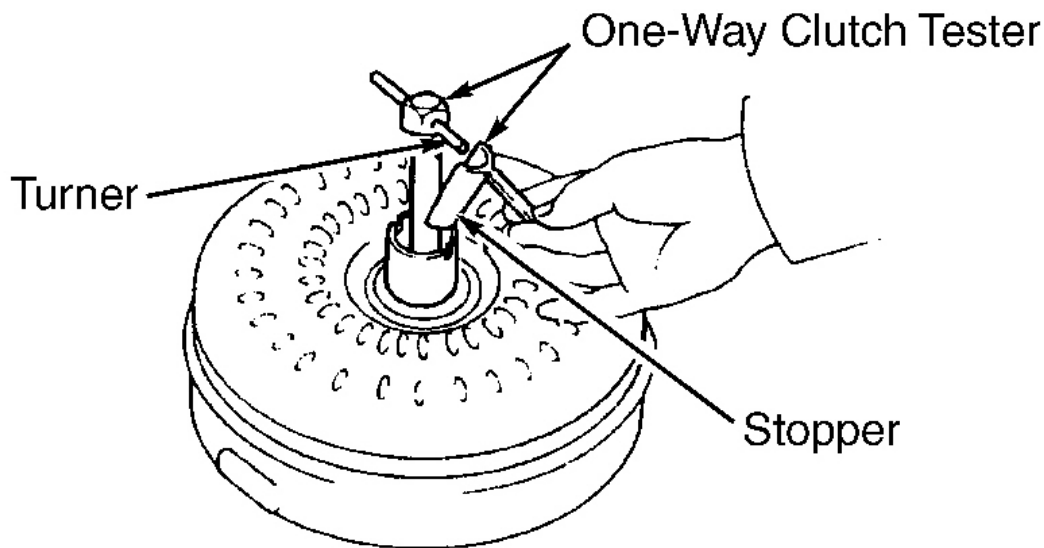
### **TORQUE CONVERTER**

**NOTE:** Torque converter is a sealed unit and is serviced as a complete assembly. Perform the following tests to check for defective converter. Torque converter and transaxle cooler must be thoroughly cleaned and flushed if transaxle is contaminated.

#### **Torque Converter One-Way Clutch Test**

1. Insert a turning tool into inner race of one-way clutch. Install Tester (09351-32010) so it fits in notch of converter hub and outer race of one-way clutch.
2. With converter in normal operating position, clutch should lock-up when turned counterclockwise and should rotate freely and smoothly when turned clockwise. See **Fig. 6**. If one-way clutch fails test in either direction, clean converter. Retest clutch. If clutch fails test, replace torque converter.





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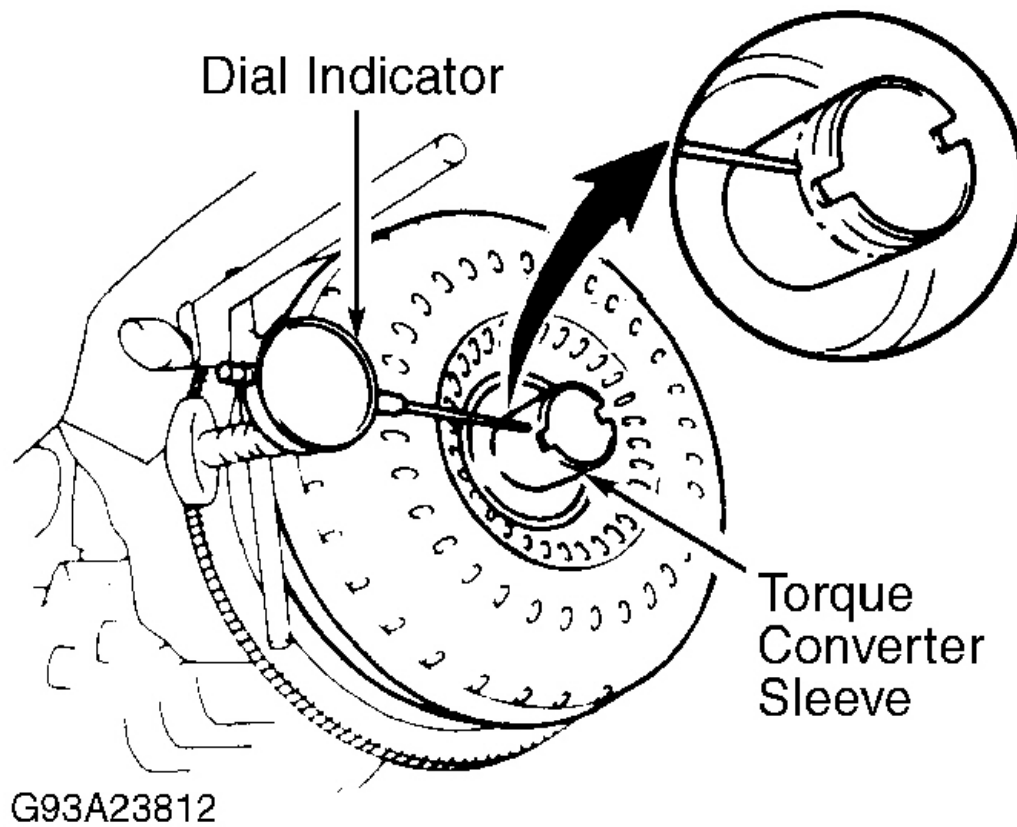
**Fig. 6: Checking Torque Converter One-Way Clutch**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **Torque Converter Sleeve Runout Test**

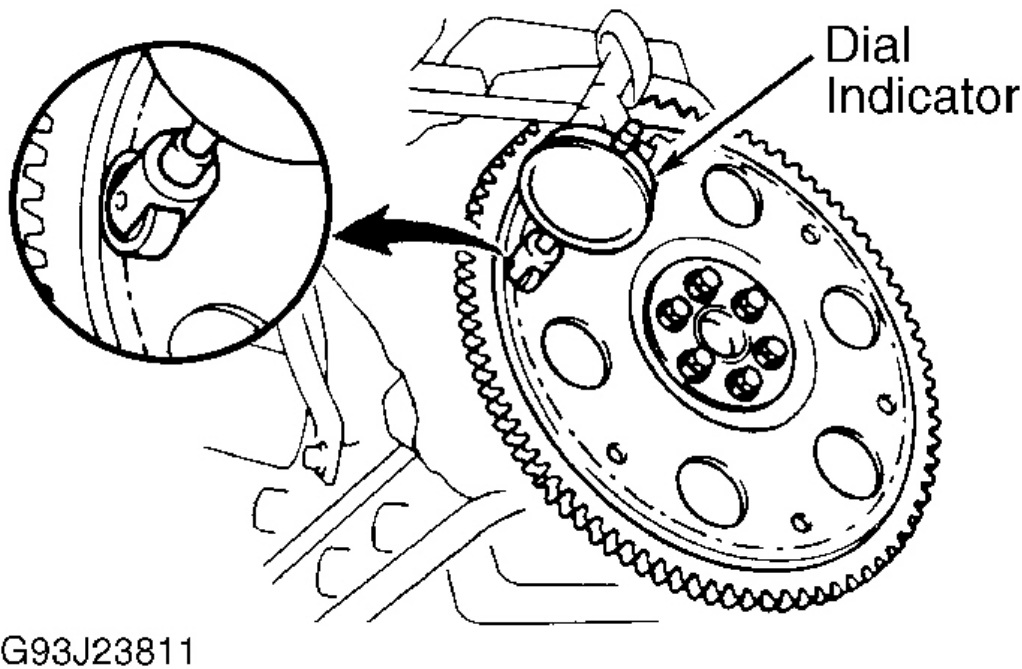
1. Temporarily mount torque converter to drive plate. Mount a dial indicator with needle resting on converter sleeve. See **Fig. 7**. Rotate converter. If runout exceeds .012" (.30 mm), ensure converter is properly mounted to drive plate.
2. If converter is properly mounted and runout exceeds specifications, replace torque converter. Mark position of converter to ensure correct installation. Remove converter from drive plate.

#### **Drive Plate (Flexplate) Runout Test**

Measure drive plate runout. See **Fig. 8**. 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. On 4-cylinder models, tighten bolts to 72 ft. lbs. (98 N.m). On V6 models, tighten bolts to 61 ft. lbs. (83 N.m).



**Fig. 7: Checking Torque Converter Sleeve Runout**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 8: Checking Drive Plate Runout**

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

## TRANSAXLE DISASSEMBLY

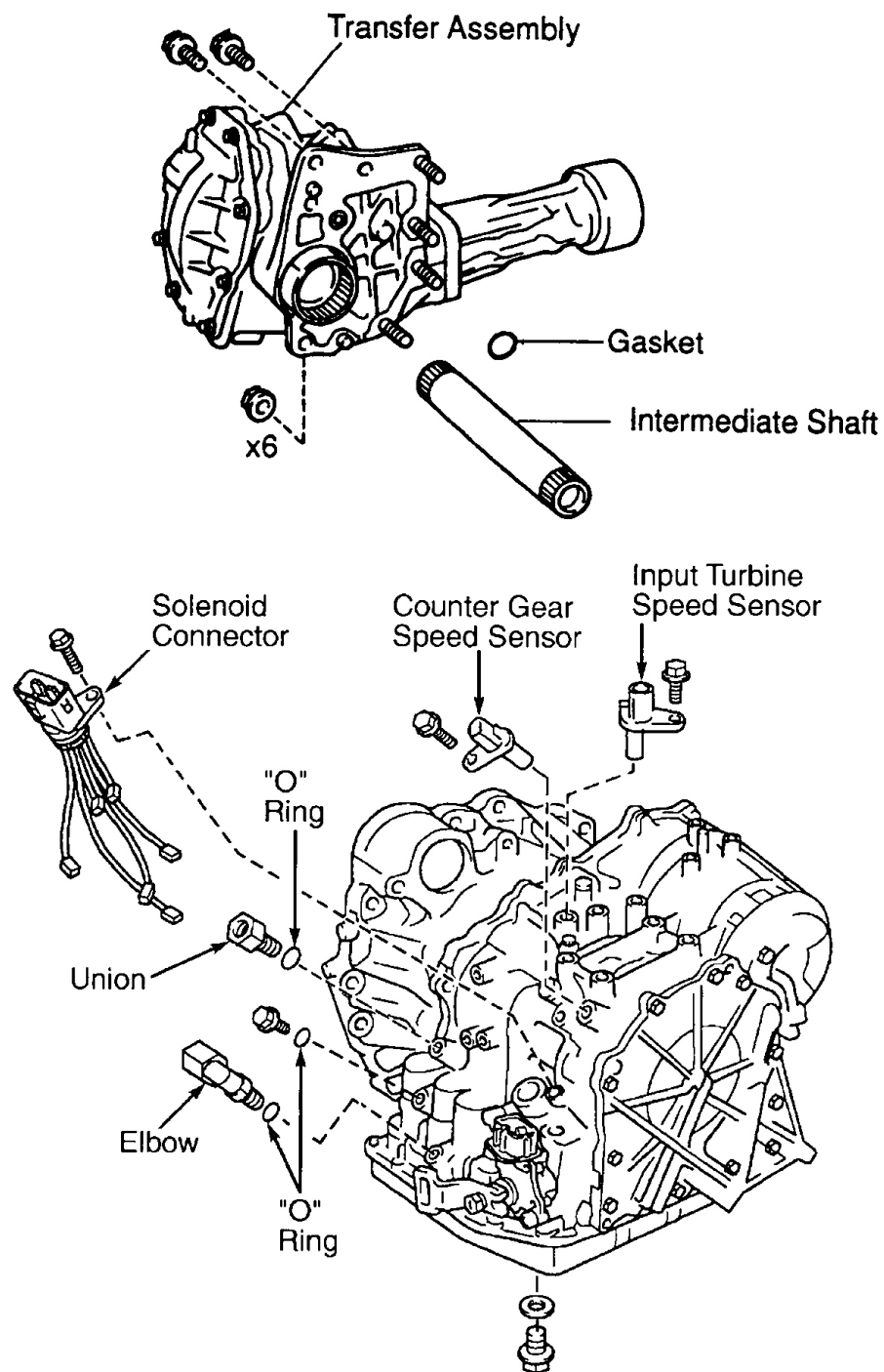
1. On U140F transaxle, remove transfer case. Remove 2 bolts and 6 nuts. Using plastic hammer, drive transfer case from transaxle. Pull transfer case straight up to remove from transaxle. Remove round gasket and intermediate shaft. See **Fig. 9**. On both transaxles, remove nut, washer and control shift lever. Using a screwdriver, unstake lock tab. Remove 2 bolts and nut, and remove park/neutral position switch. See **Fig. 10**.

**NOTE:** Speed sensors may also be referred to as revolution sensors.

2. Remove oil line union and elbow. Remove and discard "O" rings from union and elbow. Remove input turbine and counter gear speed sensors from top of transaxle. See **Fig. 9**. Remove and discard speed sensor "O" rings. Remove transaxle test plug from transaxle case. See **Fig. 11**.
3. Remove 3 transaxle case plugs located on opposite side of transaxle case from test plug. Remove solenoid connector bolt located above park/neutral position switch. DO NOT try to remove solenoid connector from transaxle case at this time.
4. Place transaxle on wooden blocks. Remove 18 bolts, oil pan and gasket. Disconnect 5 shift solenoid connectors. Remove bolts, clamps and fluid temperature sensor. See **Fig. 12**. Remove transaxle wiring harness with solenoid connector from transaxle case. Remove 3 bolts and oil strainer. Remove and

discard gasket from oil strainer. See **Fig. 10**.

5. Remove 17 valve body bolts. Note bolt length and location for reassembly reference. See **Fig. 90**. Remove valve body assembly.
6. Remove governor apply gasket No. 1 and 2nd brake gasket from transaxle case. See **Fig. 13**. Remove brake drum gasket from transaxle case. See **Fig. 14**. Remove check ball body and spring from transaxle case. See **Fig. 15**. Remove spring from underdrive clutch accumulator piston. See **Fig. 16**.
7. Using 57 psi (4 kg/cm<sub>2</sub>) of compressed air applied to transaxle case, remove underdrive clutch accumulator piston. See **Fig. 17**. Cover piston with shop towel during removal. Remove and discard "O" ring from piston.

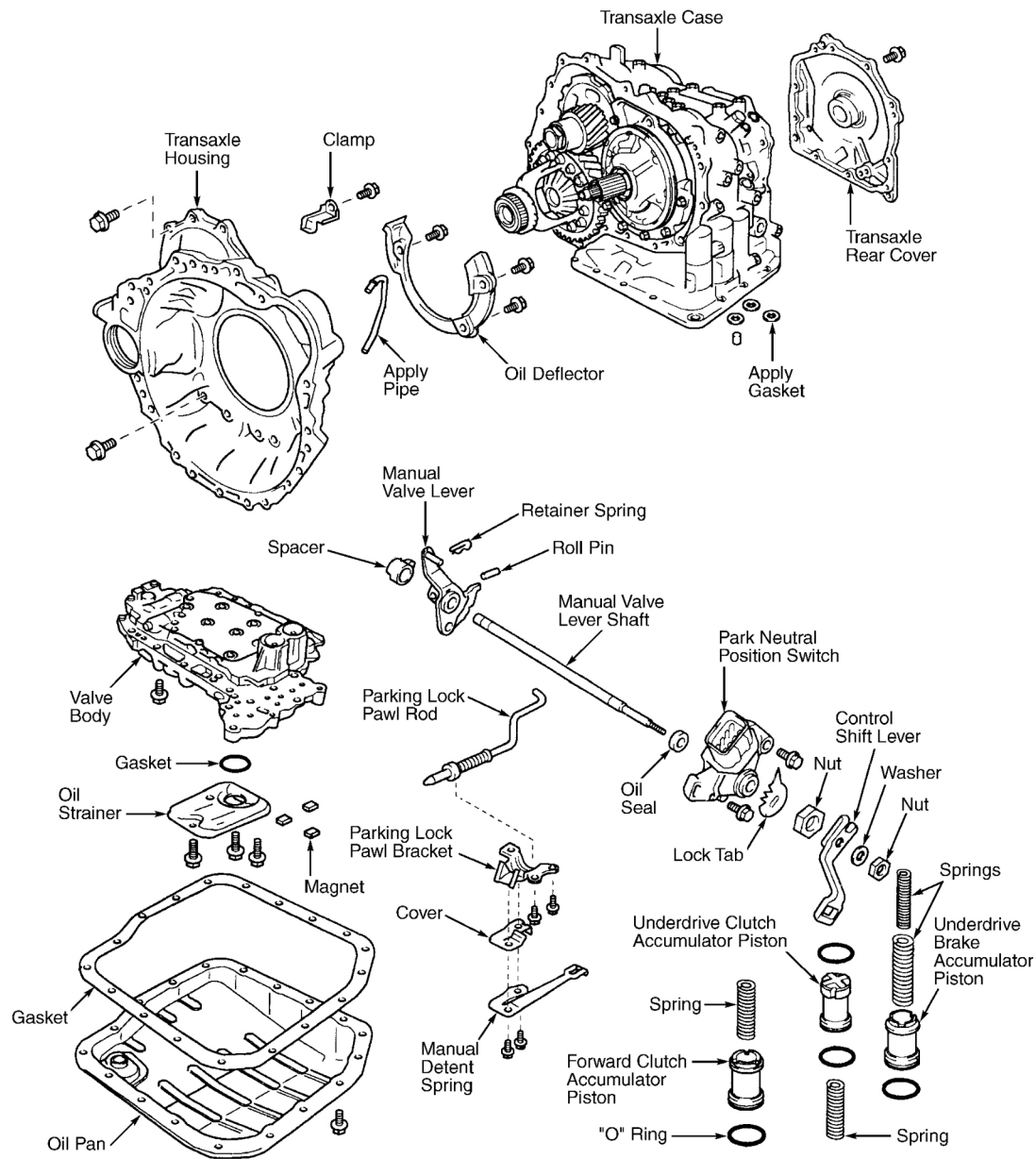


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**Fig. 9: Locating Transfer Assembly & Speed Sensors**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

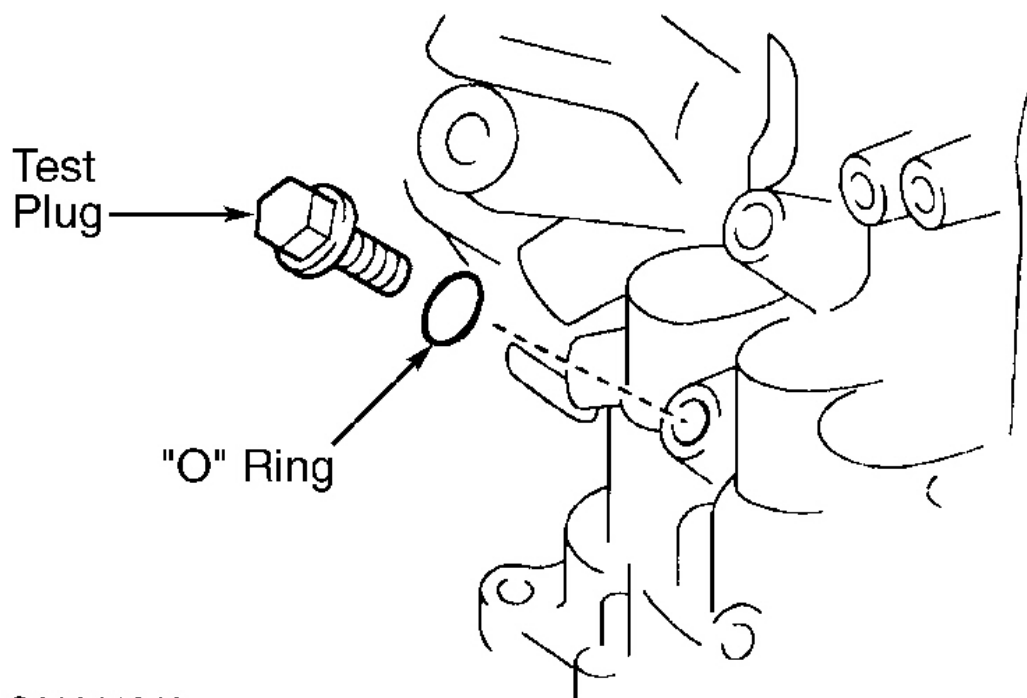
## 2001 Toyota Highlander

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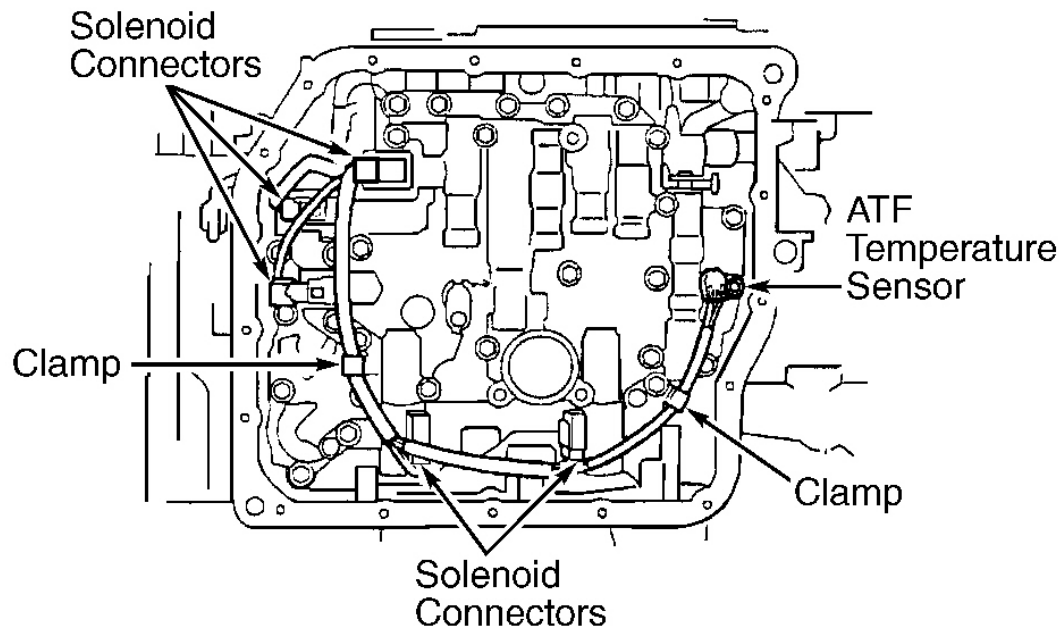
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**Fig. 10: Exploded View Of Transaxle External Components**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



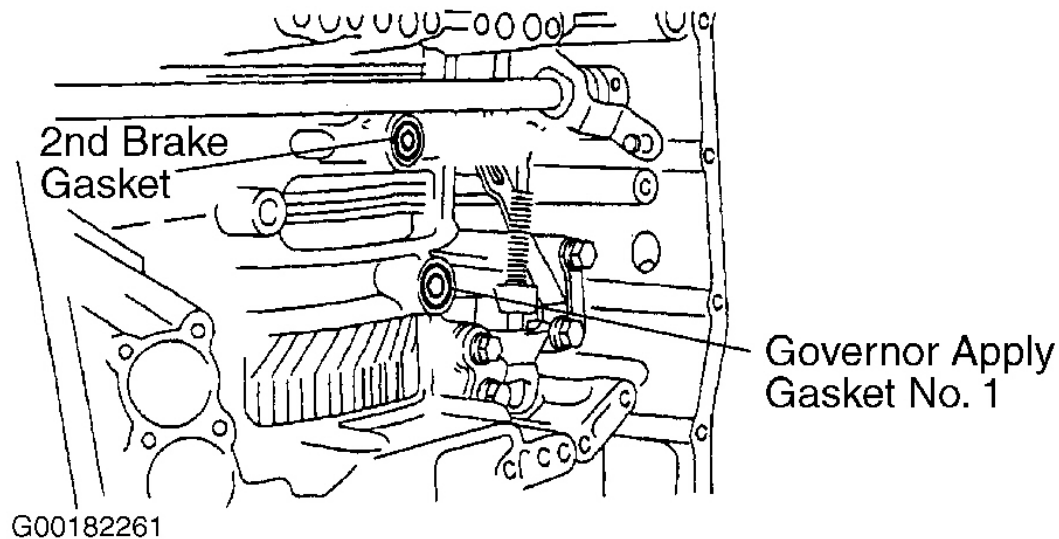
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**Fig. 11: Locating Transaxle Test Plug**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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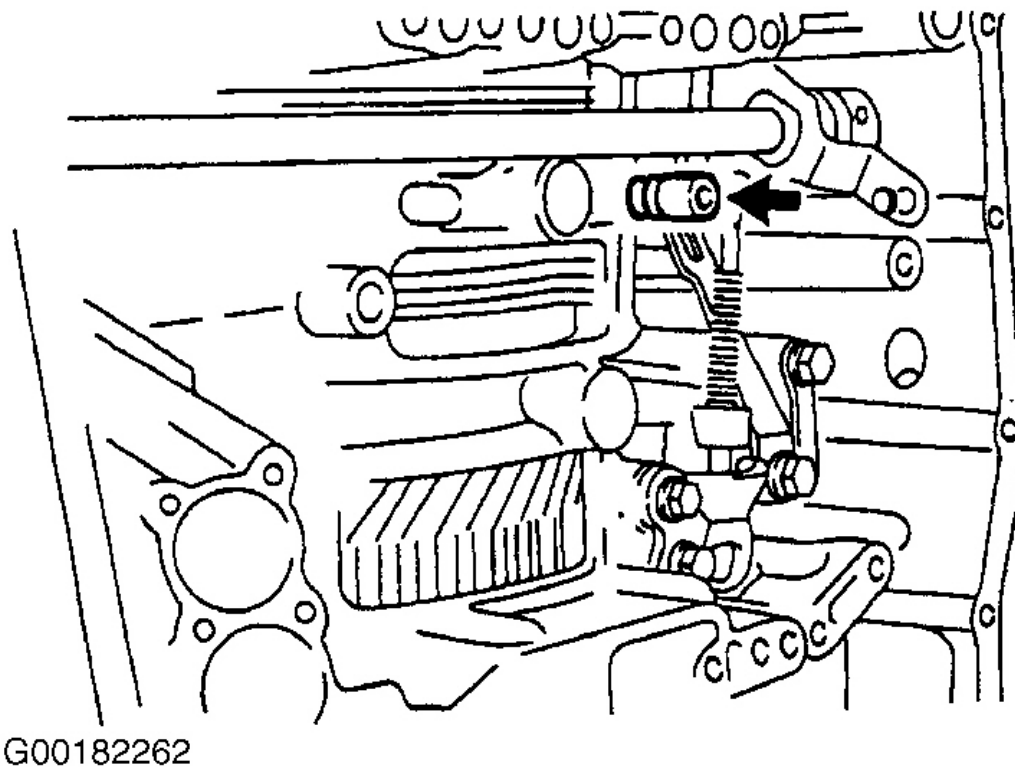
**Fig. 12: Locating Fluid Temperature Sensor & Solenoid Connectors**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



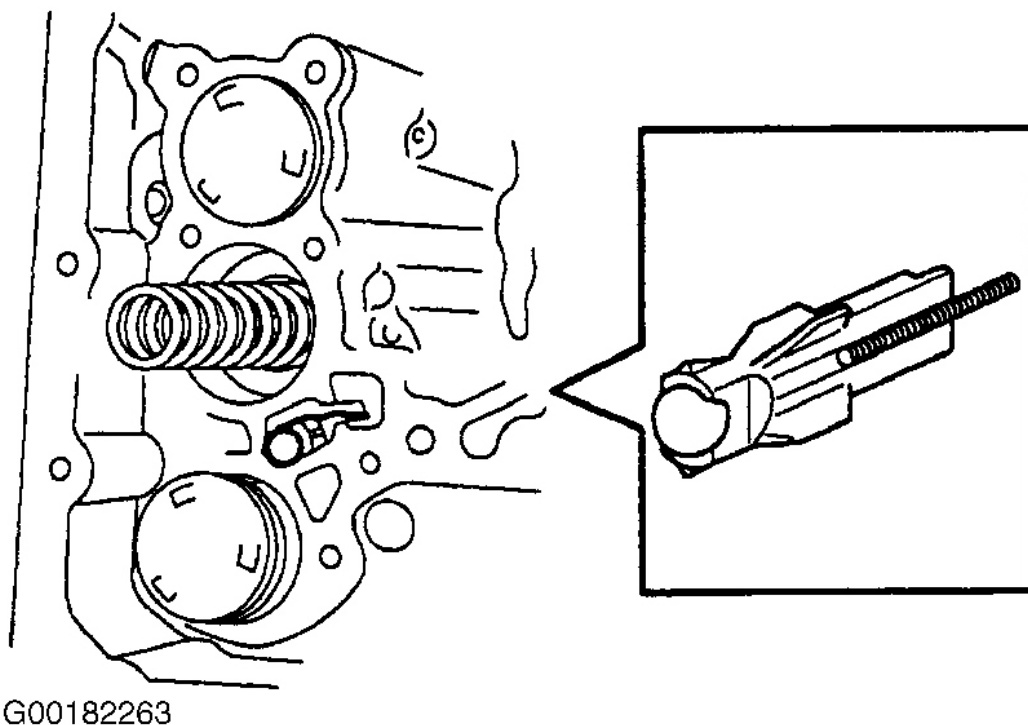
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**Fig. 13: Removing Governor Apply Gasket No. 1 & 2nd Brake Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

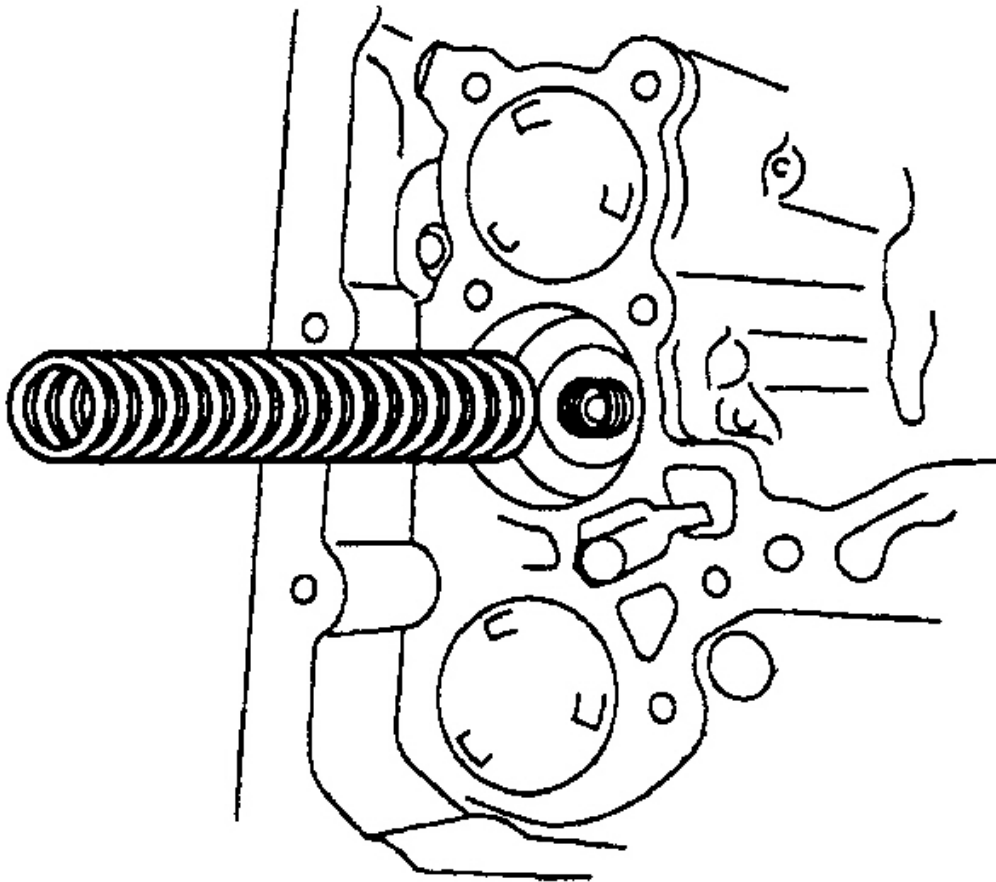




**Fig. 14: Removing Brake Drum Gasket**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

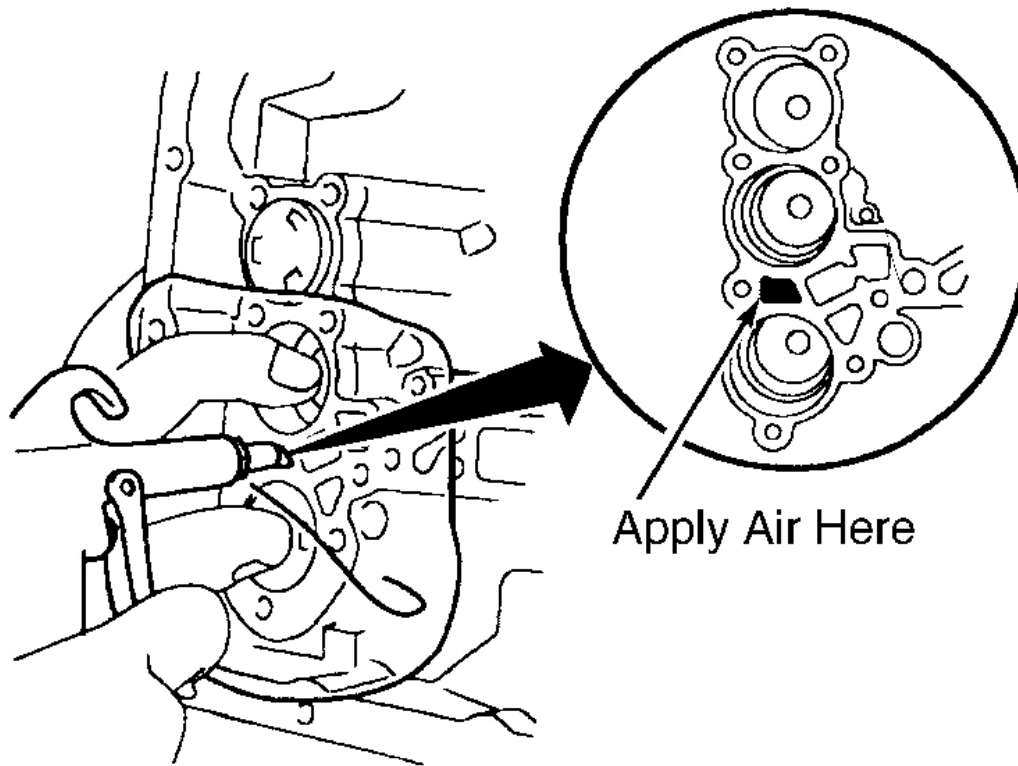


**Fig. 15: Removing Check Ball Body & Spring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 16: Removing Spring From Underdrive Clutch Accumulator Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



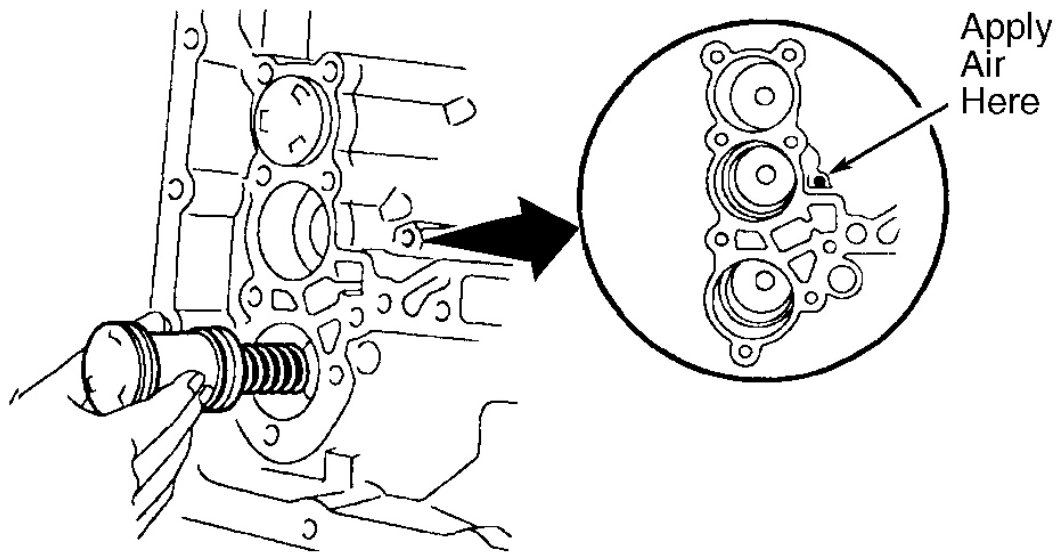
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**Fig. 17: Removing Underdrive Clutch Accumulator Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. Using 57 psi (4 kg/cm<sub>2</sub>) of compressed air applied to transaxle case, remove forward clutch accumulator piston and spring, and underdrive brake accumulator piston and 2 springs. Cover pistons with shop towel during removal. See **Fig. 18** and **Fig. 19**.
9. Using needle nose pliers, remove manual valve lever retainer spring. Remove 2 bolts, manual detent spring and cover. See **Fig. 10**. Remove 2 bolts and parking lock pawl bracket. Using a hammer and chisel, unstake and remove spacer. Using a pin punch and hammer, drive out roll pin. Ensure pin does not fall into transaxle case.
10. Remove manual valve lever shaft and manual valve lever. Remove parking lock pawl rod from manual valve lever. Using a screwdriver, remove shaft oil seal. See **Fig. 10**. Position transaxle case with oil pump assembly facing upward.

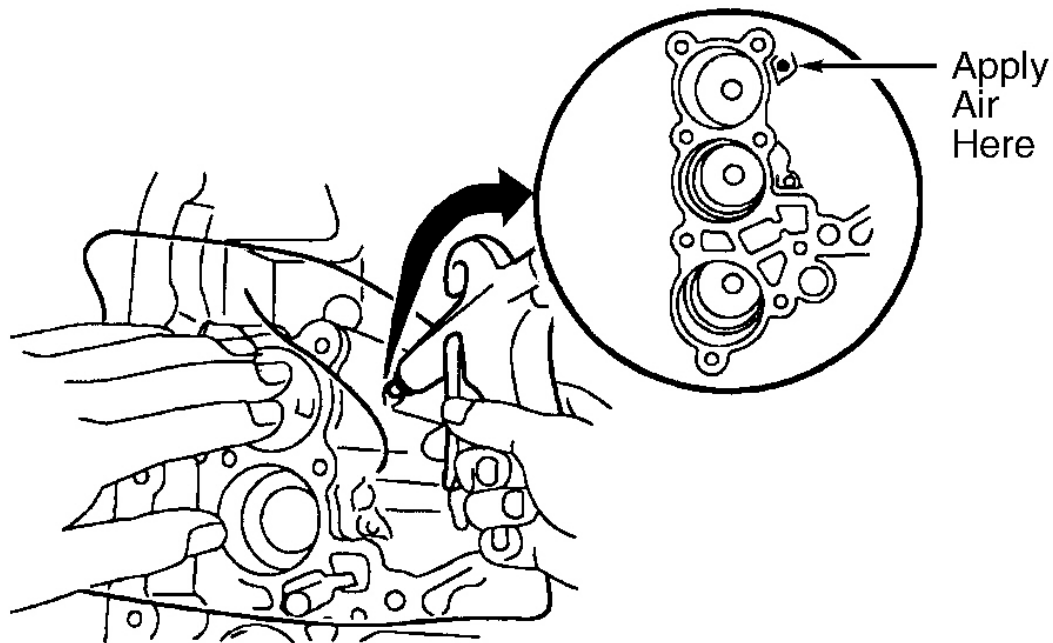
**CAUTION:** Use caution when removing transaxle housing. Differential assembly may attach to transaxle housing during removal.

11. Using a dial indicator, measure input shaft end play. See **Fig. 20**. End play should be .010-.049" (.26-1.25 mm). Remove 16 transaxle housing bolts. Note bolt length and location during removal for reassembly reference. See **Fig. 21**.



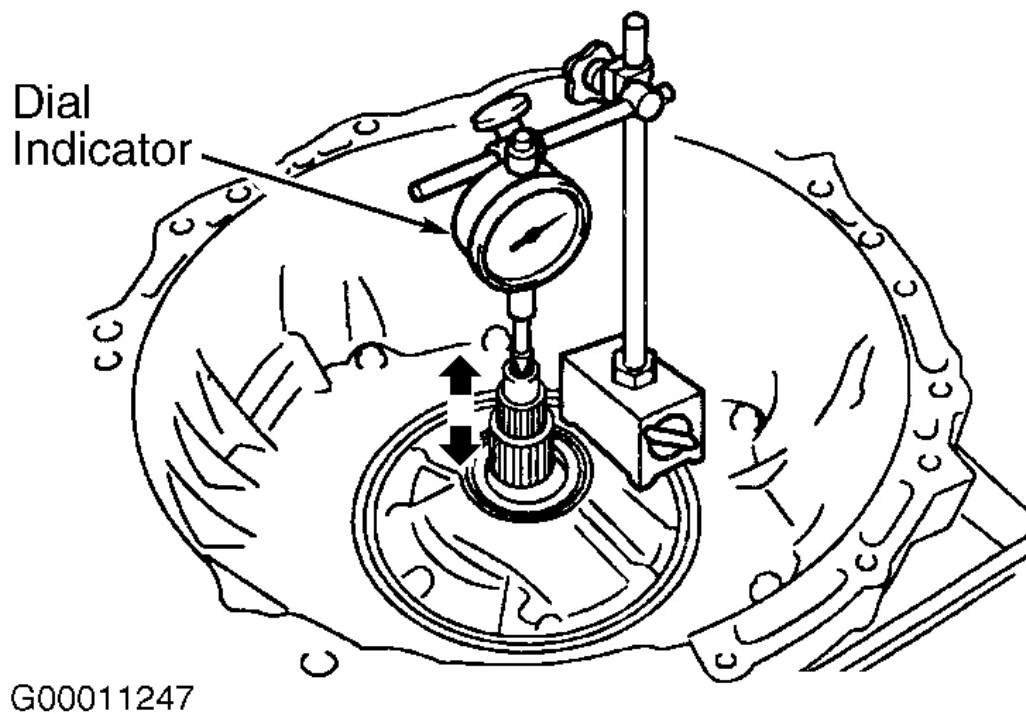
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**Fig. 18: Removing Forward Clutch Accumulator Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

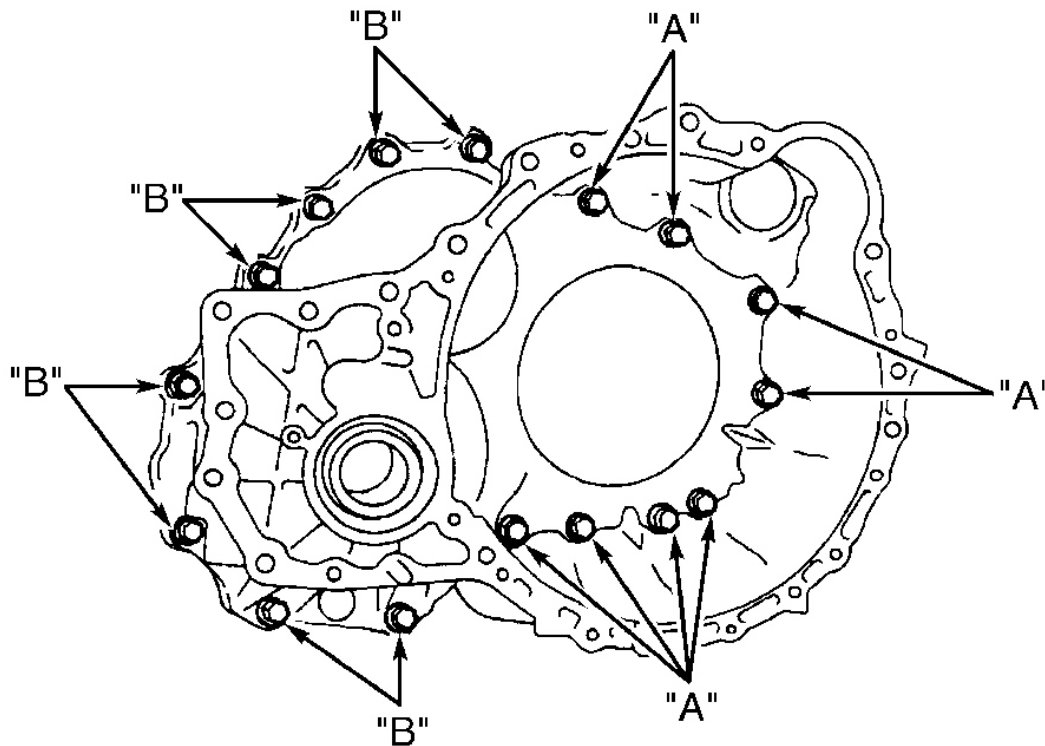


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**Fig. 19: Removing Underdrive Brake Accumulator Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 20: Measuring Input Shaft End Play**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



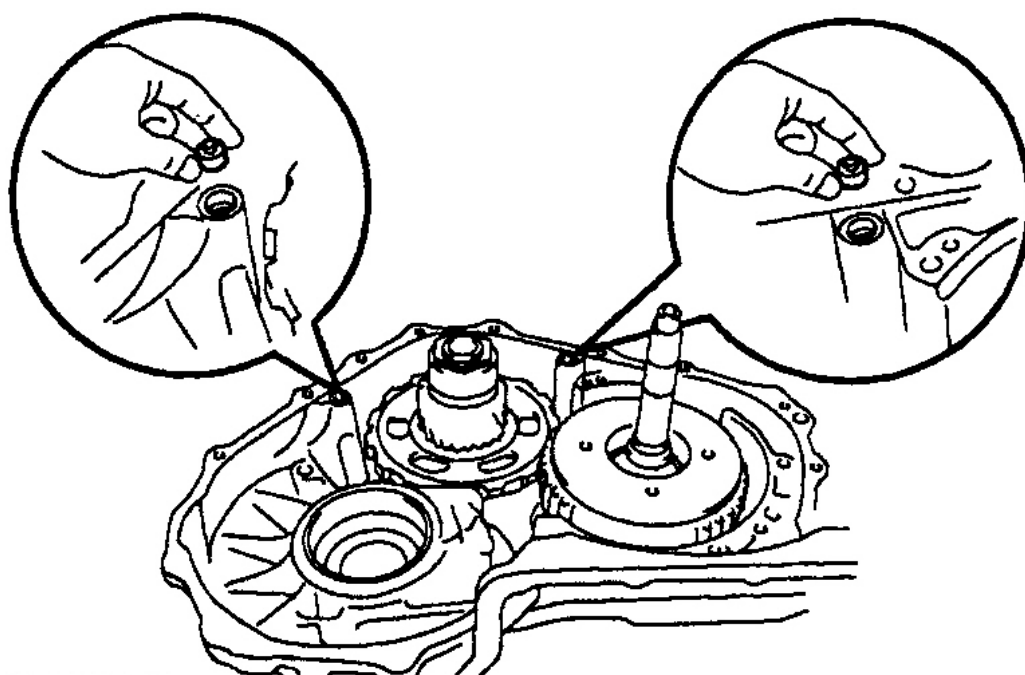
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**Fig. 21: Removing & Installing Transaxle Housing Bolts**

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

12. Remove 7 oil pump bolts and oil pump. Remove thrust bearing and bearing race from underdrive planetary gear assembly. Remove differential assembly. See **Fig. 24**. Remove 2 apply gaskets from front of transaxle case. See **Fig. 22**. Remove forward clutch from transaxle case. Remove multiple clutch hub and needle roller bearing from transaxle case. See **Fig. 23**.
13. Remove one bolt and parking lock pawl clamp. See **Fig. 24**. Remove parking lock pawl shaft. Push parking lock pawl toward transaxle case to prevent interference during underdrive planetary gear assembly removal. See **Fig. 27**. Using both hands, remove underdrive planetary gear assembly. DO NOT allow planetary gear assembly to separate.





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**Fig. 22: Removing 2 Apply Gaskets**

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

14. Remove spring, pawl pin and parking lock pawl. Remove underdrive clutch assembly. See **Fig. 24**. Remove thrust bearing and bearing race. Using a screwdriver, remove No. 2 one-way clutch snap ring. Remove No. 2 one-way clutch from transaxle case. Note position of index marks on No. 2 one-way clutch for reassembly reference. See **Fig. 85**. Note position of outer race retainer on No. 2 one-way clutch for reassembly reference. See **Fig. 28**. Remove outer race retainer from No. 2 one-way clutch.
15. Using a screwdriver, remove underdrive brake snap ring. Remove flange, discs and plates from transaxle case. Note number and location of components during removal for reassembly reference. Using appropriate press, compress underdrive brake piston return spring. Using snap ring expander, remove snap ring from underdrive brake. Remove piston return spring. See **Fig. 24**.
16. Remove 2 transaxle case plugs. See **Fig. 25**. Remove 11 bolts and transaxle rear cover. If necessary, tap on circumference of rear cover with plastic hammer to remove cover. Remove 2 oil seal rings from rear cover. Using a T30 Torx socket, remove 2 screws and transaxle rear cover plate. See **Fig. 26**. Using appropriate puller, remove needle roller bearing from rear cover, if necessary. See **Fig. 23**. Remove bolt, clamp and 2 brake apply pipes. Remove tubes from clamp. Using a screwdriver, remove 2 apply gaskets from rear of transaxle case. See **Fig. 24**.
17. Remove direct clutch with thrust bearing from transaxle case. Remove bearing race from direct clutch (shaft side). Remove rear planetary sun gear assembly from transaxle case. Remove thrust bearing from rear planetary sun gear. Remove thrust washer No. 1 from rear planetary sun gear.
18. Remove No. 1 one-way clutch and thrust bearing from transaxle case. See **Fig. 79**. Remove inner race

from one-way clutch. Remove one-way clutch outer sleeve from transaxle case. Note direction of components for reassembly reference. Using a screwdriver, remove 2nd brake snap ring. Remove flange, discs and plates from transaxle case. Note number and location of components during removal for reassembly reference. See **Fig. 23**.

19. Using a screwdriver, remove rear planetary gear snap ring. Remove rear planetary gear from transaxle case. Remove thrust washer No. 2 from rear planetary gear. Remove 2 bearing races, thrust bearings and front planetary sun gear from transaxle case. See **Fig. 23**.
20. Using a hammer and chisel, unstake washer located on counter drive gear. See **Fig. 23**. Ensure all claws on washer are pushed down to allow socket to fit securely on nut. Using holding tool and socket, remove nut. See **Fig. 29**. Using appropriate adapter and press, remove front planetary gear from counter drive gear. See **Fig. 30**.
21. Using a screwdriver, remove 2nd brake assembly snap ring. Remove brake hub with 2nd brake assembly. Remove brake hub from 2nd brake assembly. See **Fig. 23**. Using a screwdriver, remove snap ring and front planetary ring gear from brake hub. Remove 1st/reverse brake flange, discs and plates from transaxle case. Note number and location of components during removal for reassembly reference.

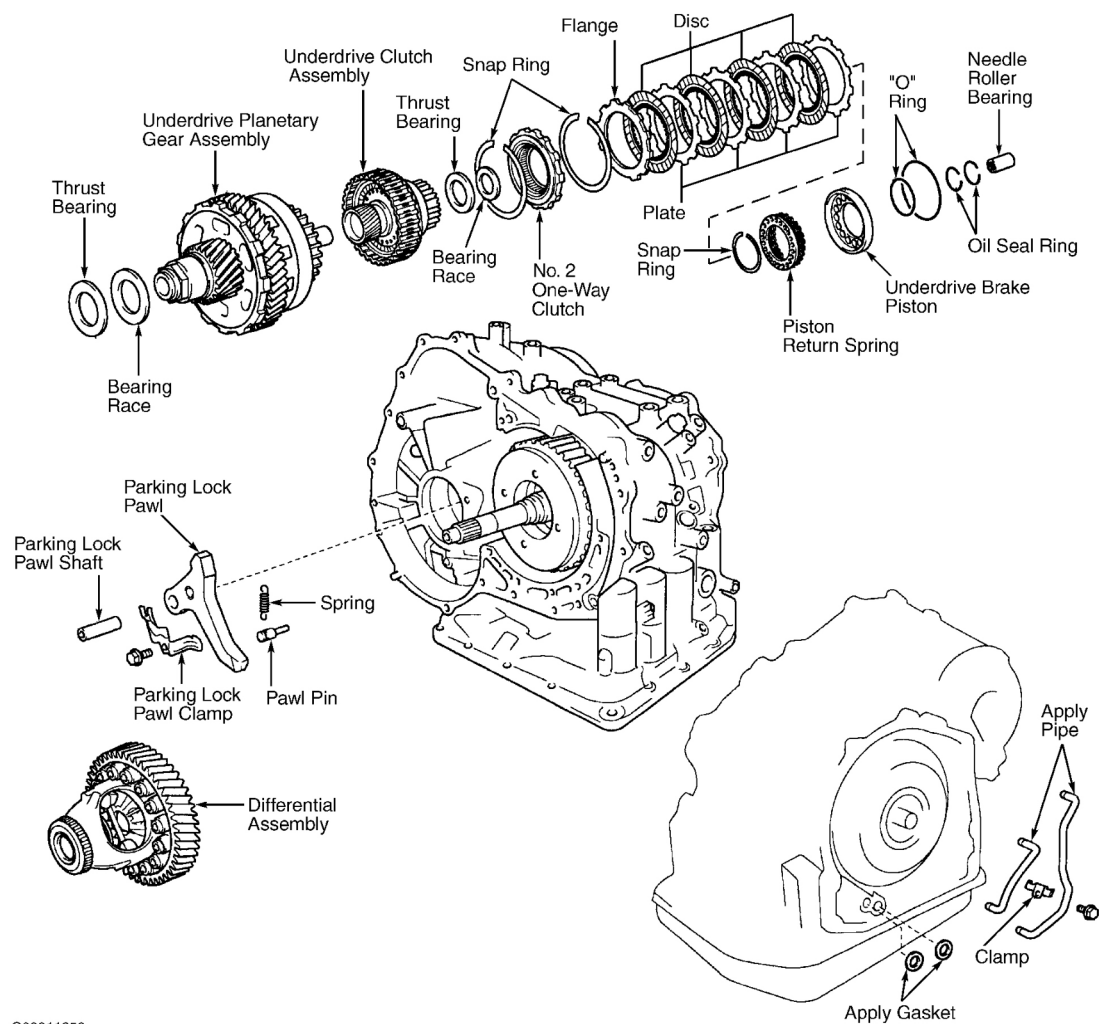
**NOTE:** In the following step, stop press when piston return spring seat is lowered .039-.079" (1.00-2.00 mm) from snap ring groove. This prevents spring seat from becoming deformed. DO NOT expand snap ring excessively.

22. Using appropriate press, compress 1st/reverse brake piston return spring. Using snap ring expander, remove snap ring from 1st/reverse brake. Remove piston return spring. Using 57 psi (4 kg/cm<sup>2</sup>) of compressed air applied to transaxle case, remove 1st/reverse brake piston from case. See **Fig. 31**. Cover piston with shop towel during removal.
23. Using appropriate adapter and press, remove counter drive gear from transaxle case. Install and tighten 2 bolts opposite each other evenly on counter drive gear. Ensure clearance between counter drive gear and bearing race is about .79" (20.0 mm). Using bearing puller, remove rear tapered roller bearing from counter drive gear. See **Fig. 23**.
24. Using a brass drift and hammer, remove bearing inner and outer races. Remove snap ring at underdrive brake piston from transaxle case. Using 57 psi (4 kg/cm<sup>2</sup>) of compressed air applied to transaxle case, remove underdrive brake piston from case. See **Fig. 32**. Cover piston with shop towel during removal.
25. Using appropriate puller, remove needle roller bearing from transaxle case. Remove 2 oil seal rings from transaxle case. See **Fig. 34**. Using appropriate puller, remove cylindrical roller bearing from transaxle case.
26. Remove oil seal ring from transaxle housing. See **Fig. 33**. Remove bolt, clamp and apply pipe from transaxle case. Remove 3 bolts and oil deflector (if equipped) from transaxle case. See **Fig. 10**.

## 2001-05 AUTOMATIC TRANSMISSIONS U140E & U140F Overhaul

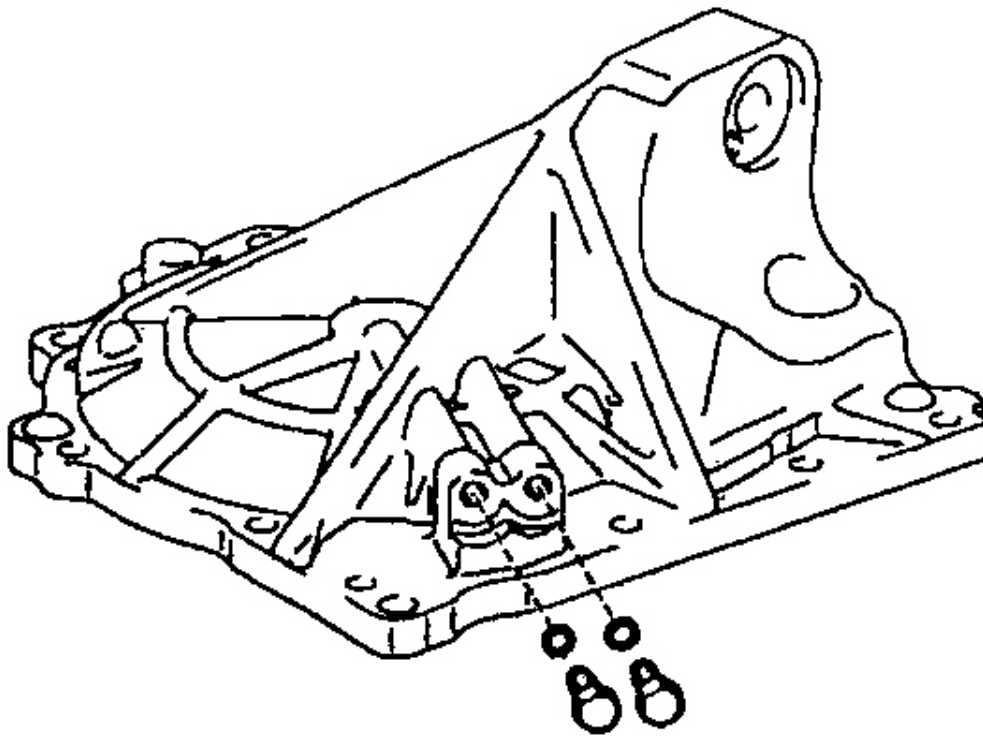


**Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**



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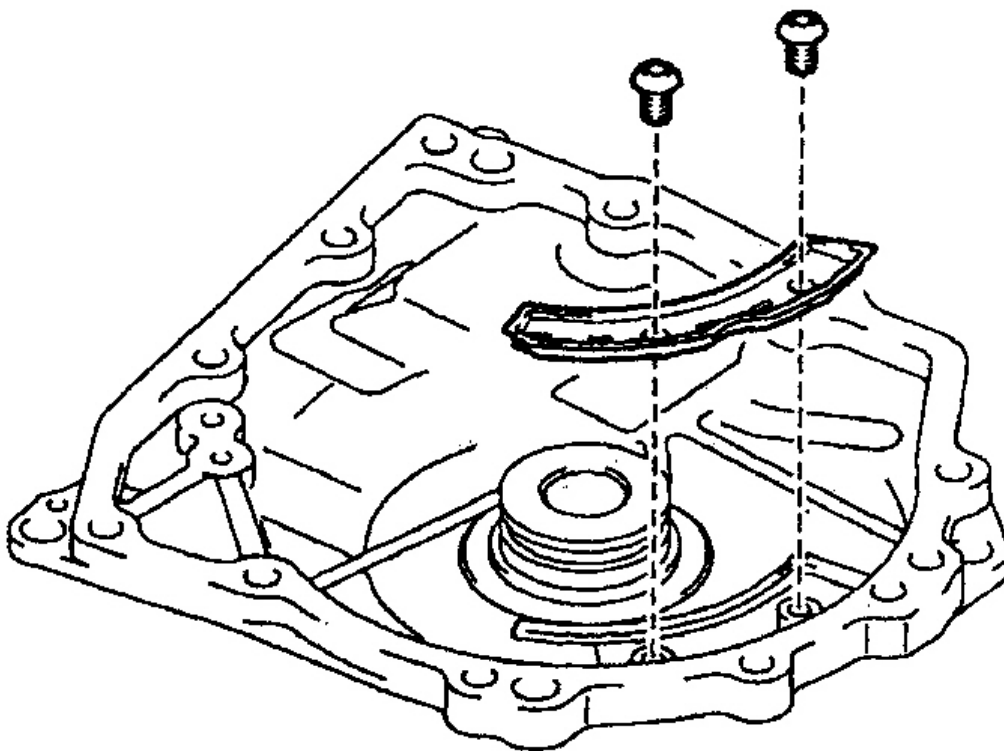
**Fig. 24: Exploded View Of Transaxle Internal Components (2 Of 2)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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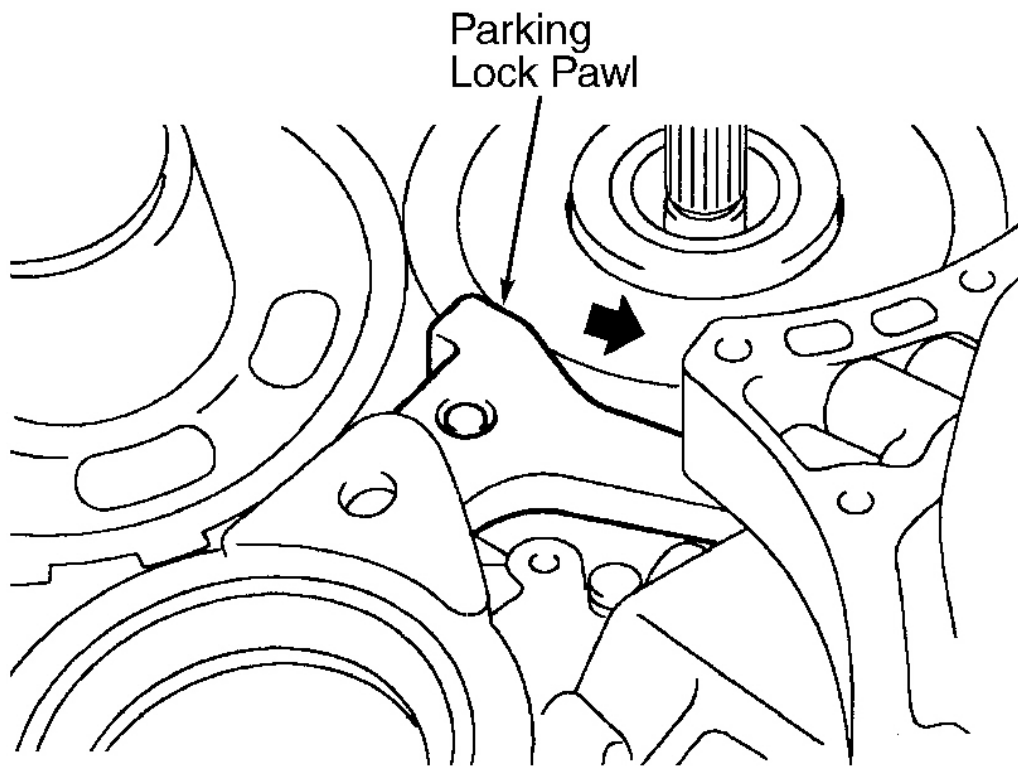
**Fig. 25: Removing 2 Transaxle Case Plugs**

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



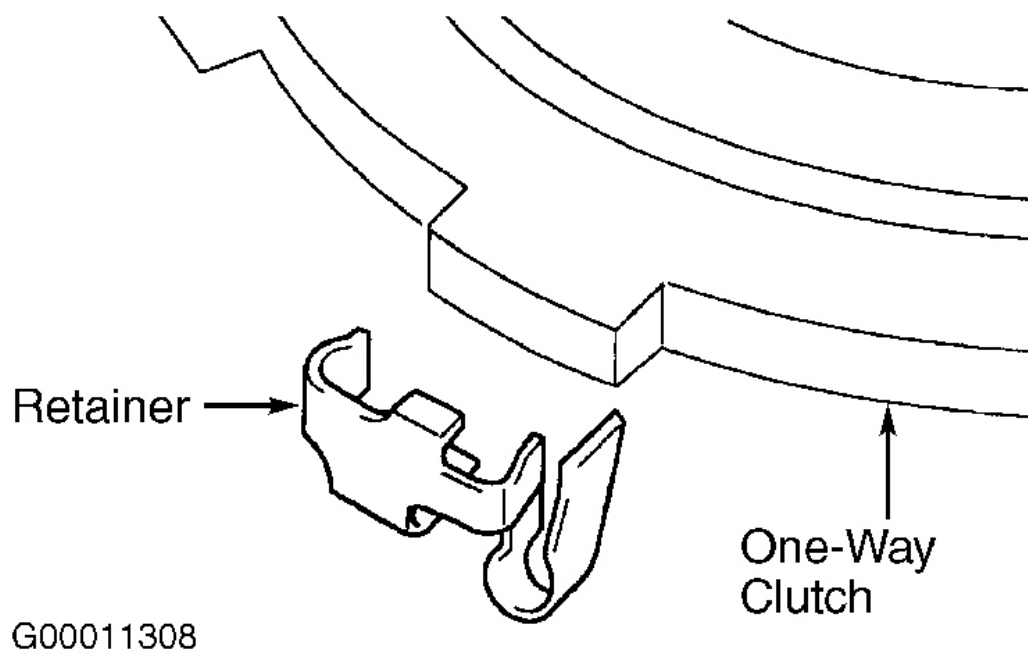
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**Fig. 26: Removing Transaxle Rear Cover Plate**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



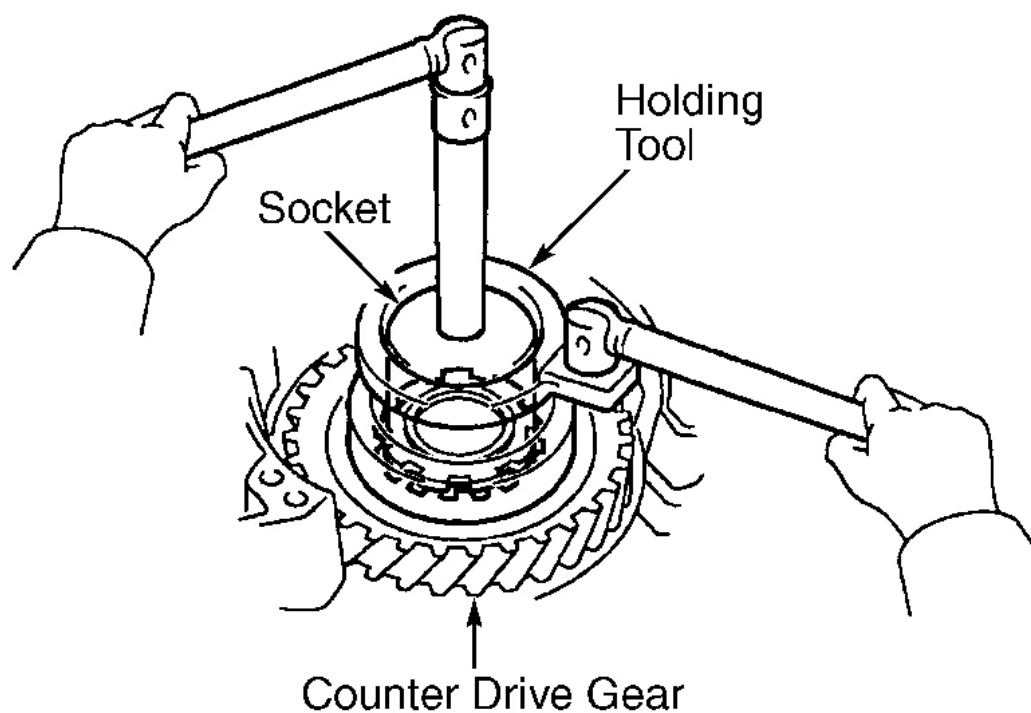
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**Fig. 27: Pushing Parking Lock Pawl Toward Case**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



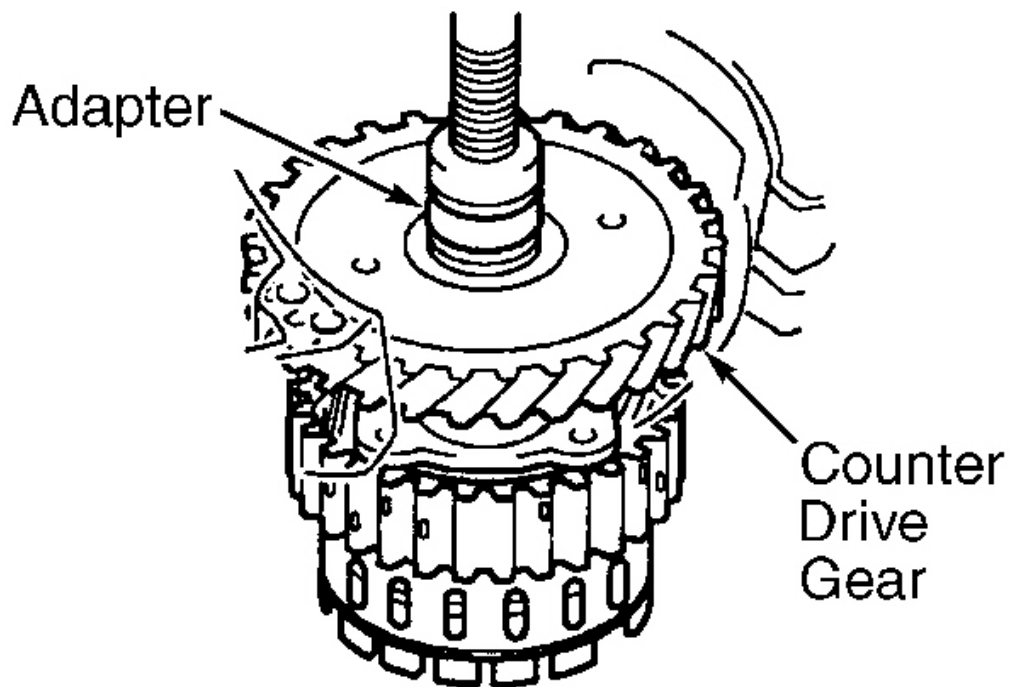
**Fig. 28: Removing & Installing Outer Race Retainer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.





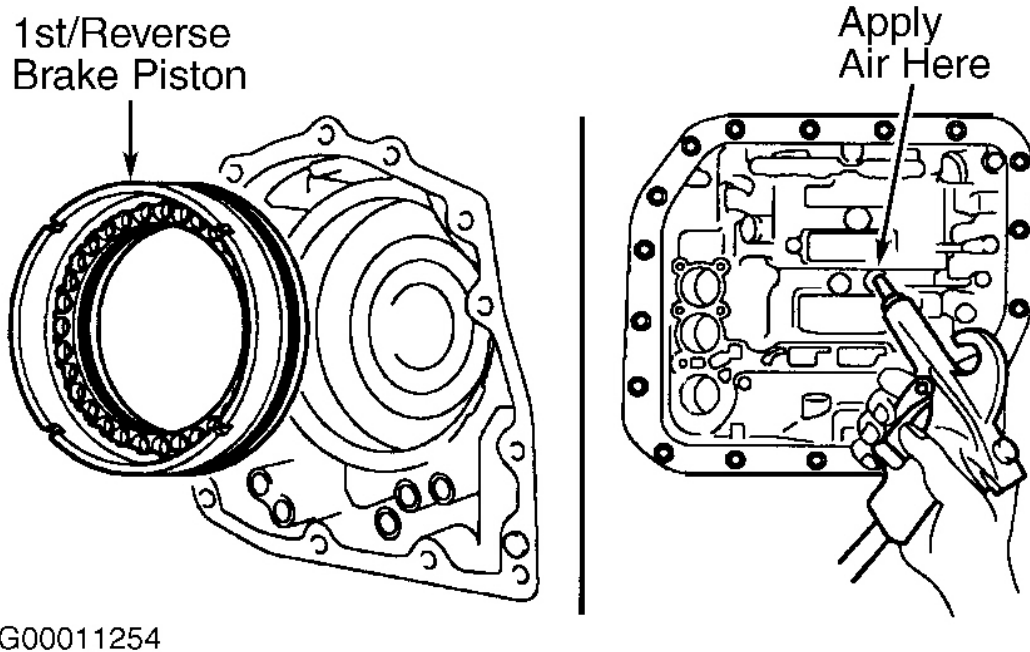
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**Fig. 29: Removing & Installing Counter Drive Gear Nut**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

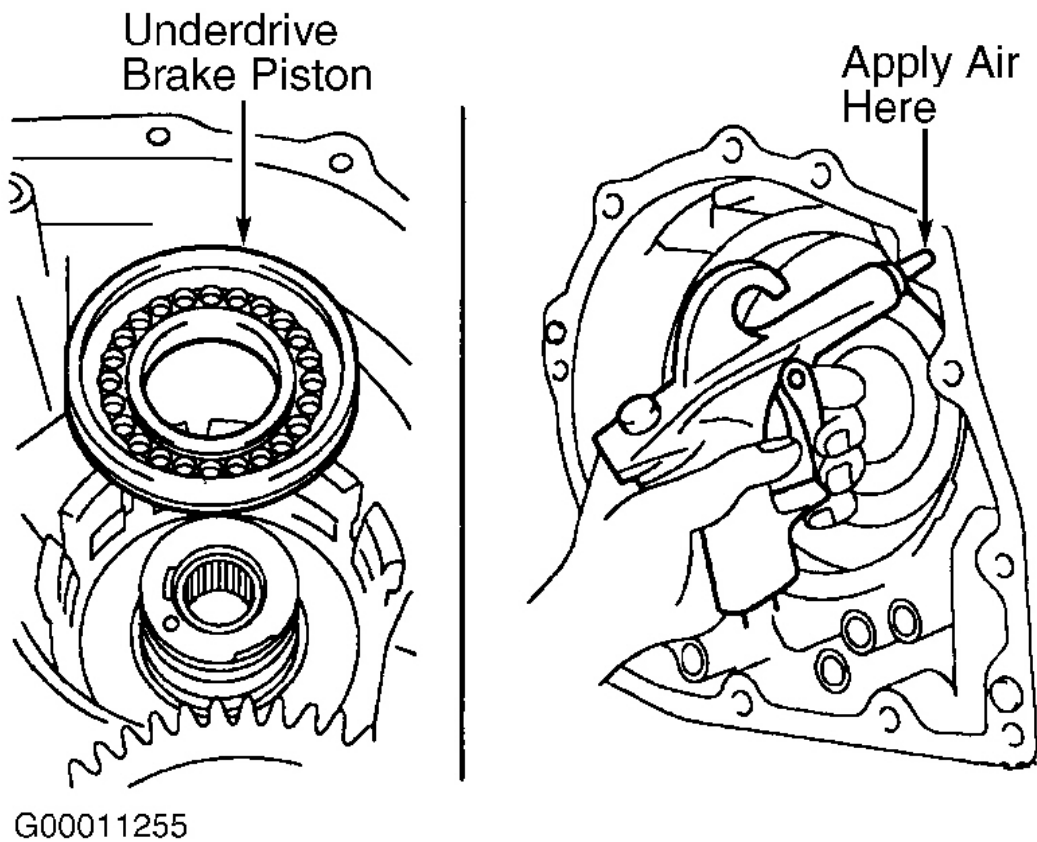


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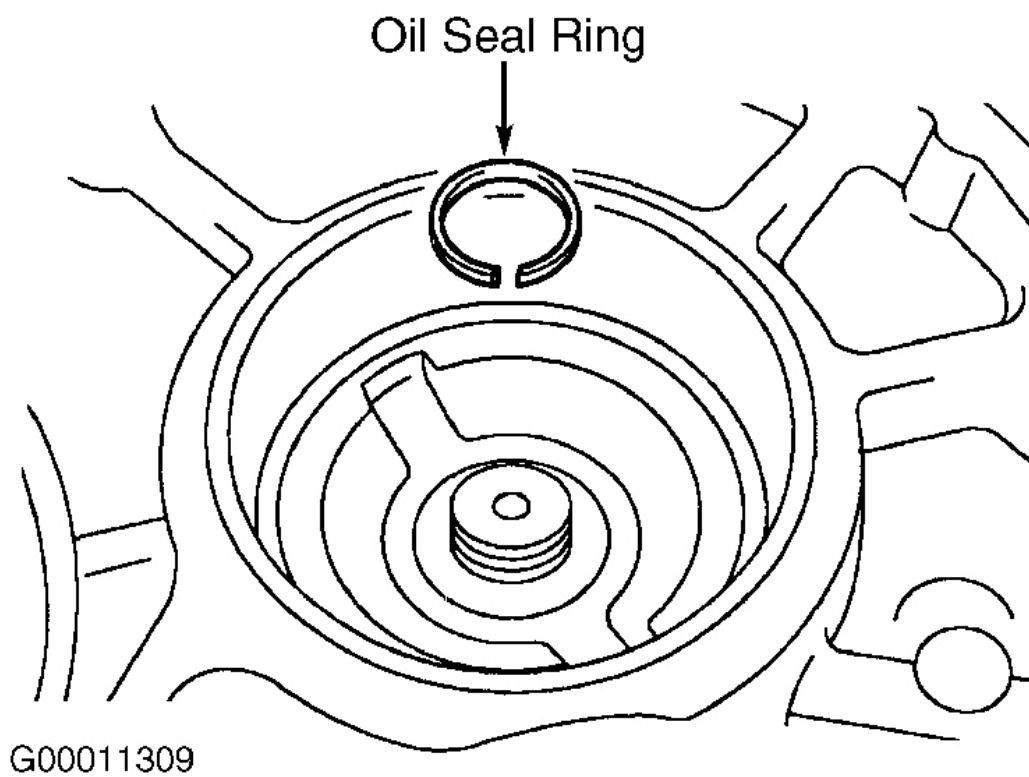
**Fig. 30: Removing Front Planetary Gear From Counter Drive Gear**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



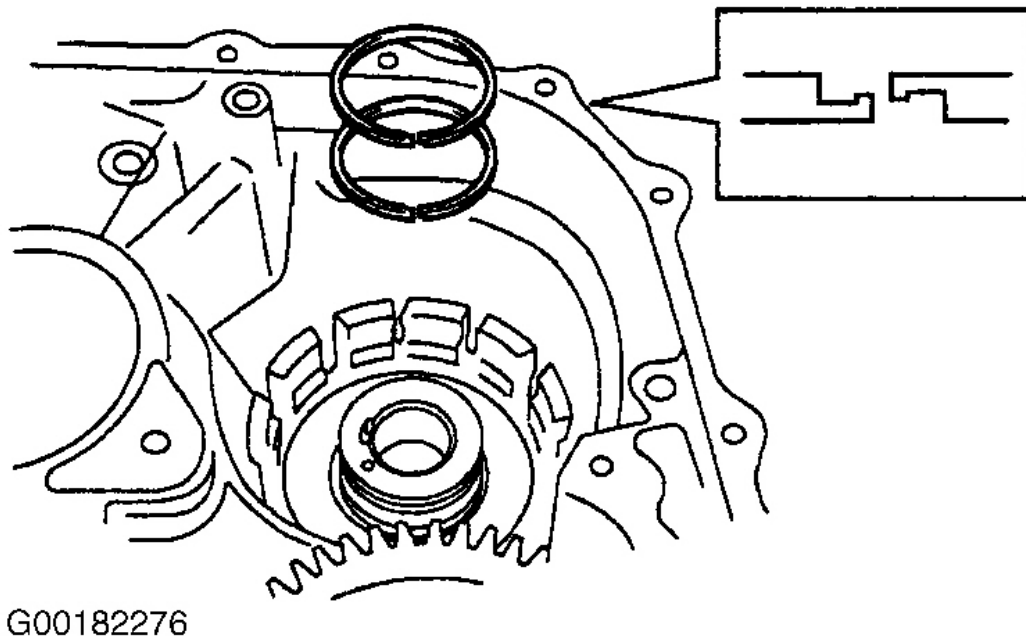
**Fig. 31: Removing 1st/Reverse Brake Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 32: Removing Underdrive Brake Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 33: Removing & Installing Transaxle Housing Oil Seal Ring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 34: Removing Underdrive Clutch Drum Oil Seal Rings**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## COMPONENT DISASSEMBLY & REASSEMBLY

### OIL PUMP ASSEMBLY

#### Disassembly

Using 2 screwdrivers, turn drive gear and check for smooth rotation. Remove 2 oil seal rings. Using T30 Torx socket, remove 11 bolts attaching oil pump body and stator shaft. Remove "O" ring from oil pump body. See **Fig. 35**. Note direction and location of drive and driven gears. Leave gears in oil pump body for inspection.

#### Inspection

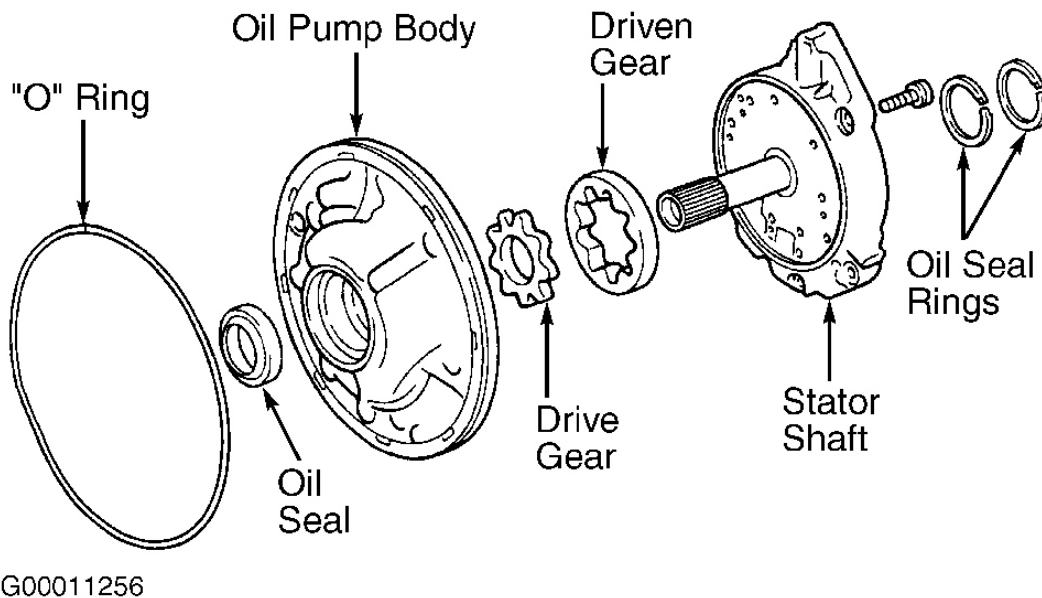
1. Check body clearance of driven gear. Push driven gear to one side of body. Using a feeler gauge, measure clearance. See **Fig. 36**. Body clearance should be .0039-.0067" (.010-.170 mm). Maximum body clearance is .0067" (.170 mm). If body clearance exceeds specification, replace oil pump body.
2. Using a feeler gauge, check tip clearance between drive and driven gear teeth. See **Fig. 37**. Tip clearance is .0028-.0059" (.070-.150 mm). Maximum tip clearance is .0059" (.150 mm). If tip clearance exceeds specification, replace oil pump body.
3. Check side clearance of both gears. Use a steel straightedge and feeler gauge to measure side clearance of both gears. See **Fig. 38**. Clearance is .0008-.0020" (.020-.050 mm). Maximum side clearance is .0020" (.050 mm). Replace gears as necessary. Gears are available in 5 thicknesses from .4209-

.4212" (10.690-10.699 mm) to .4225-.4228" (10.731-10.740 mm), in increments of .0004" (.010 mm). If side clearance is not within specification after gear replacement, replace oil pump body.

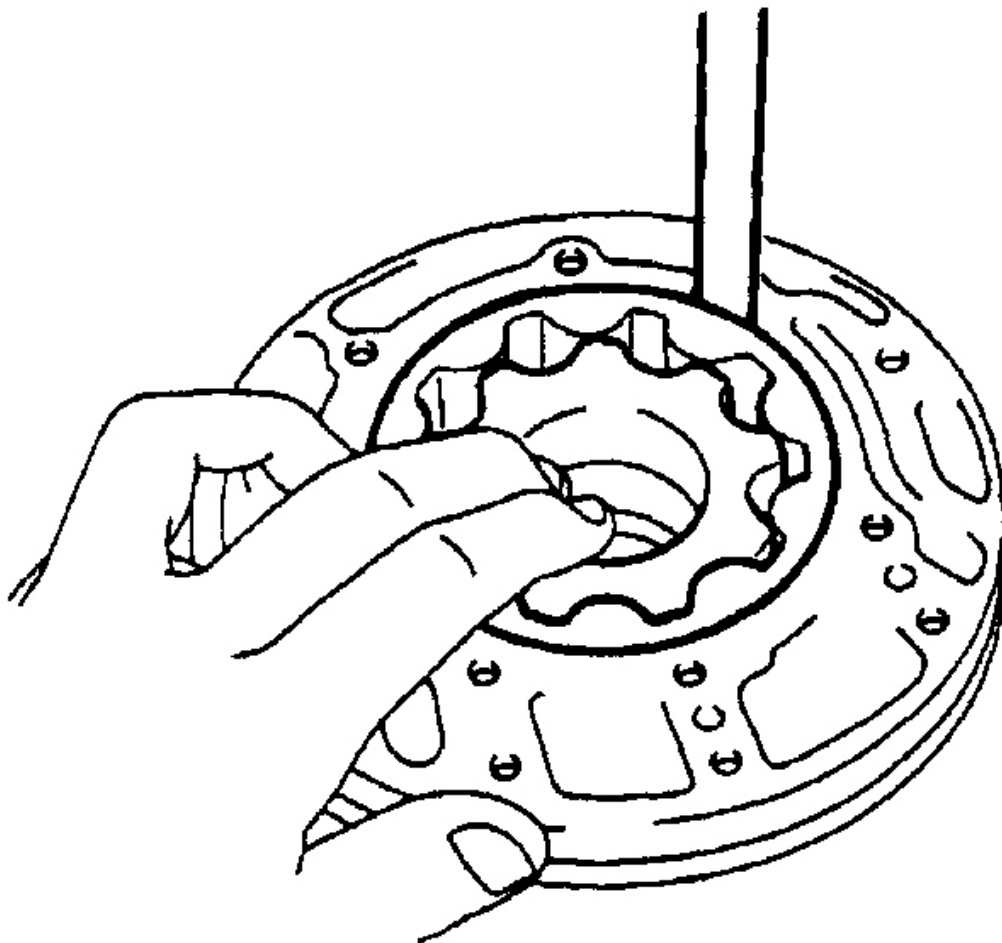
4. Using a dial indicator, measure inside diameter of oil pump body bushing. See **Fig. 39**. Maximum inside diameter is 1.503" (38.18 mm). If inside diameter exceeds specification, replace oil pump body.
5. Using a dial indicator, measure inside diameter of stator shaft bushing. See **Fig. 40**. Maximum inside diameter is .849" (21.57 mm). If inside diameter exceeds specification, replace stator shaft.
6. Inspect front oil seal for cracks, damage or wear. Replace oil seal (if necessary). Remove oil seal with slide hammer. Install a NEW oil seal. Seal is properly installed when it is flush with outer edge of pump body.

### Reassembly

1. Install front oil seal. Install driven gear and drive gear. Ensure gears are installed in correct direction. See **Fig. 41**. Install stator shaft on oil pump body. Align bolt holes. Install 11 stator shaft-to-oil pump body bolts. Tighten bolts in crisscross pattern to 87 INCH lbs. (9.8 N.m).
2. Install 2 oil seal rings on oil pump. DO NOT expand ring ends excessively. Turn drive gear with screwdrivers to ensure a smooth rotation. DO NOT damage oil seal lip.



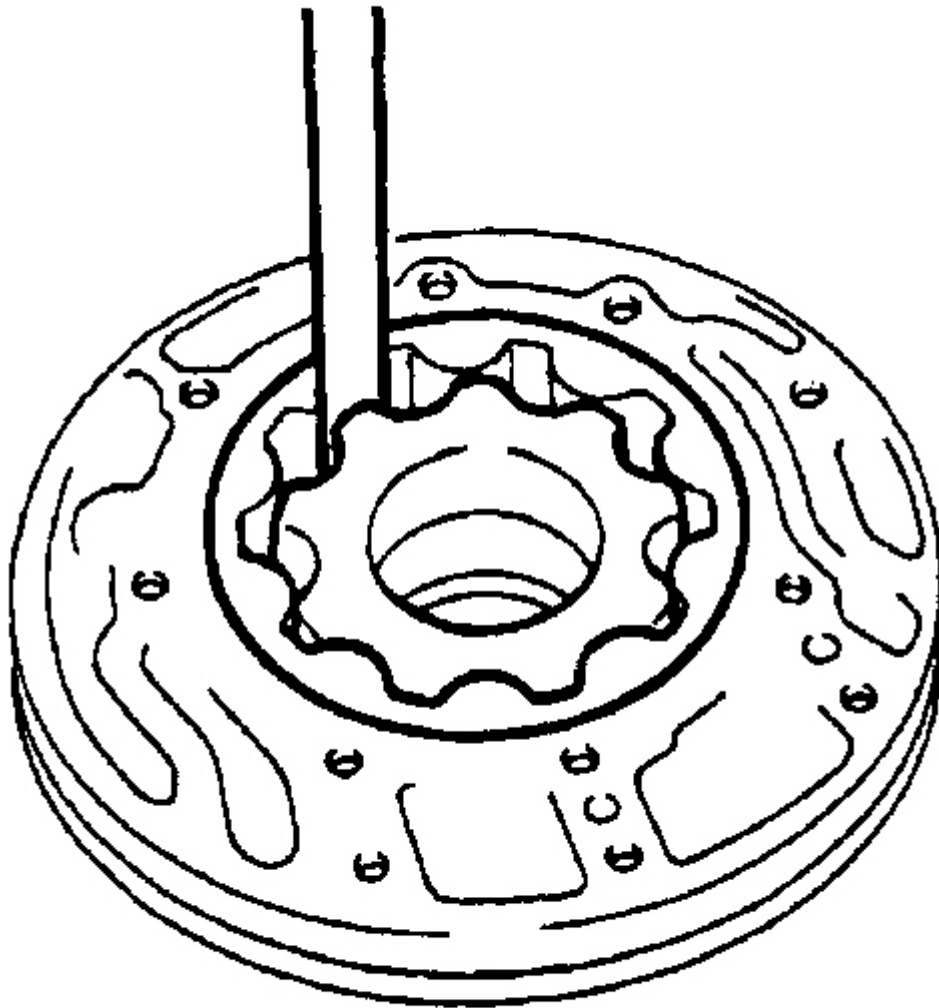
**Fig. 35: Exploded View Of Oil Pump Assembly**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00182306

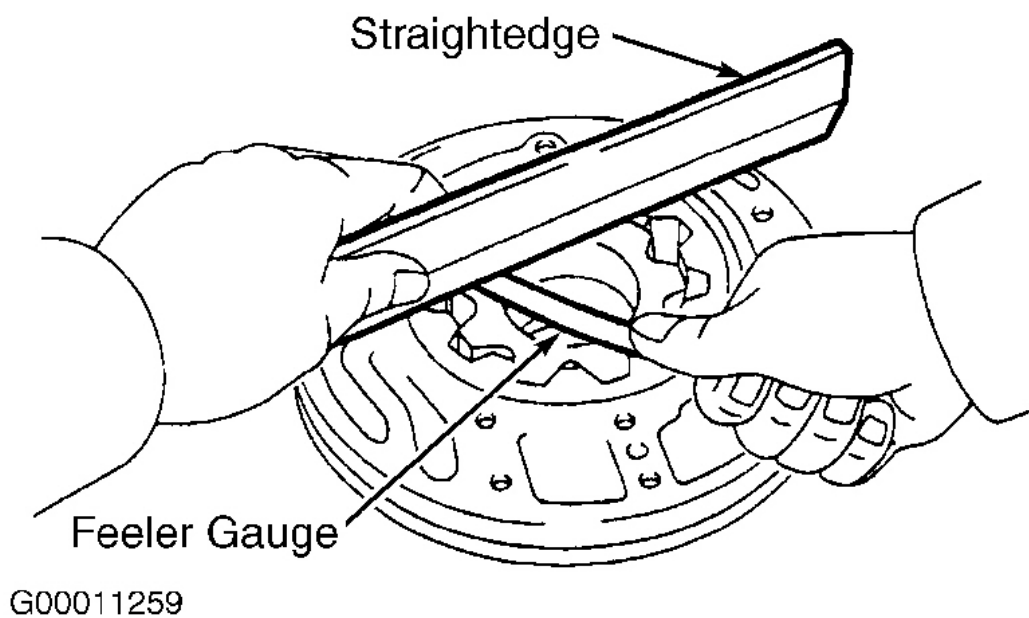
**Fig. 36: Checking Oil Pump Gear Body Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



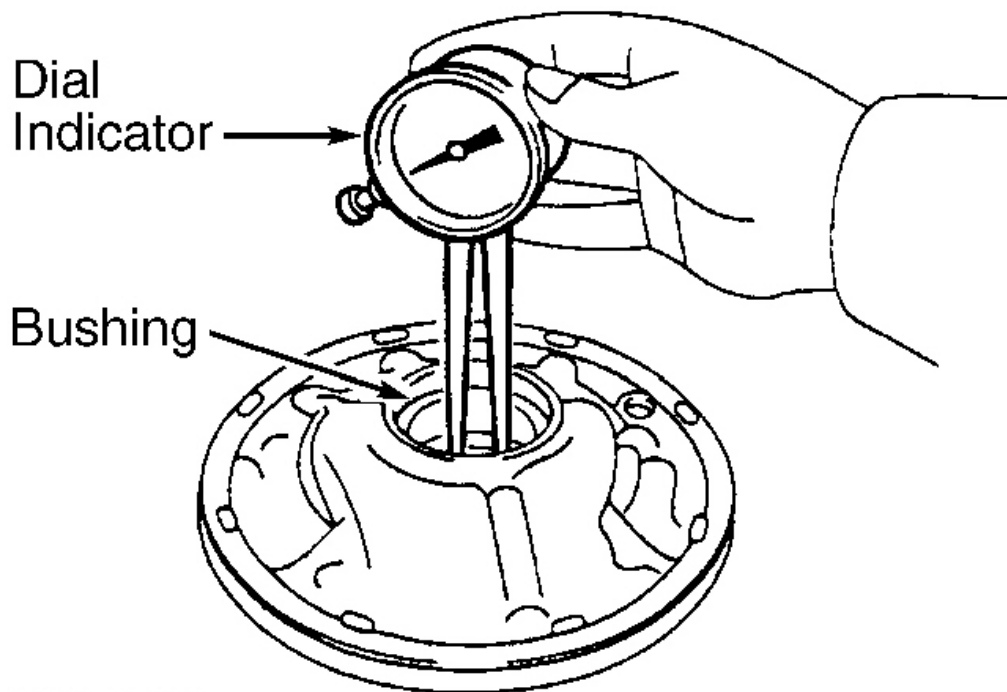


G00182307

**Fig. 37: Checking Oil Pump Gear Tooth Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

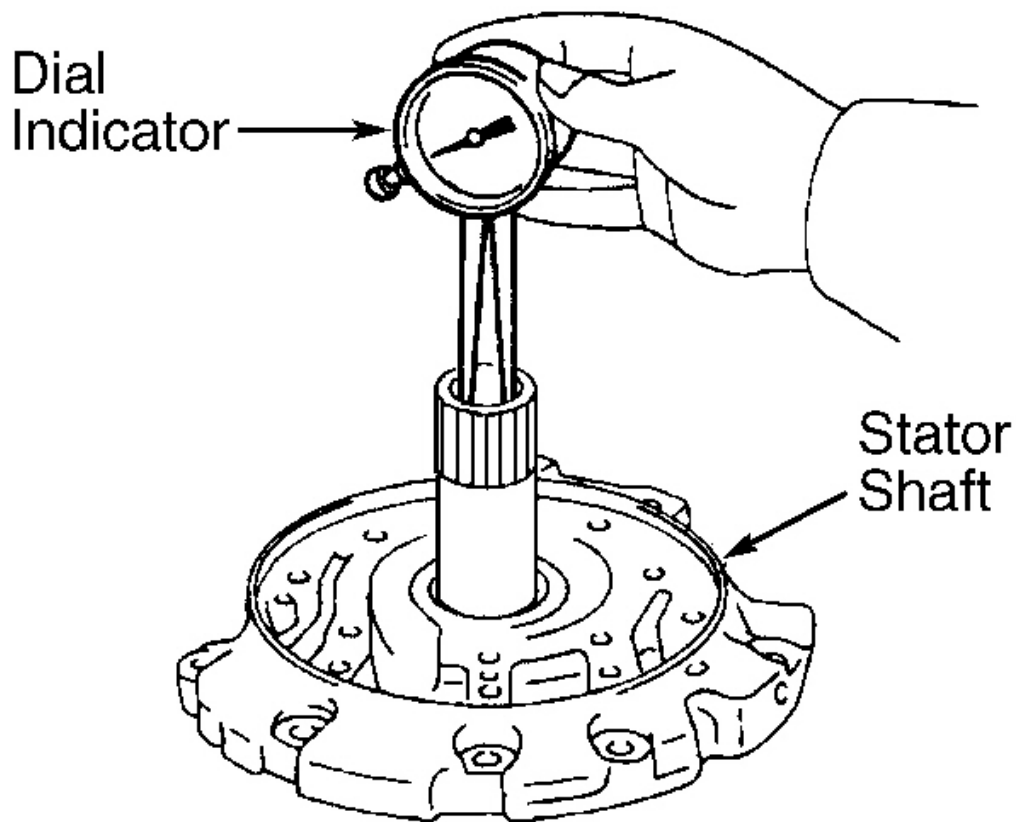


**Fig. 38: Checking Oil Pump Gear Side Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



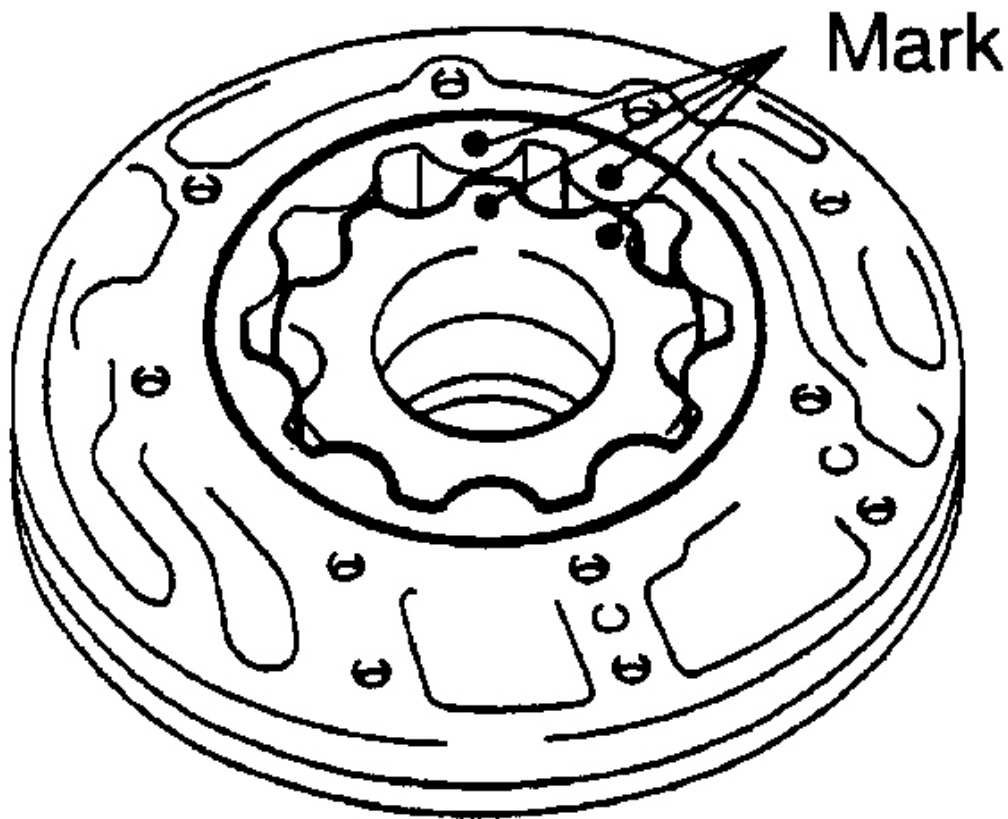
G00011260

**Fig. 39: Checking Oil Pump Body Bushing Diameter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00011261

**Fig. 40: Checking Stator Shaft Bushing Diameter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00182278

**Fig. 41: Identifying Marks On Oil Pump Gears**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## DIRECT CLUTCH

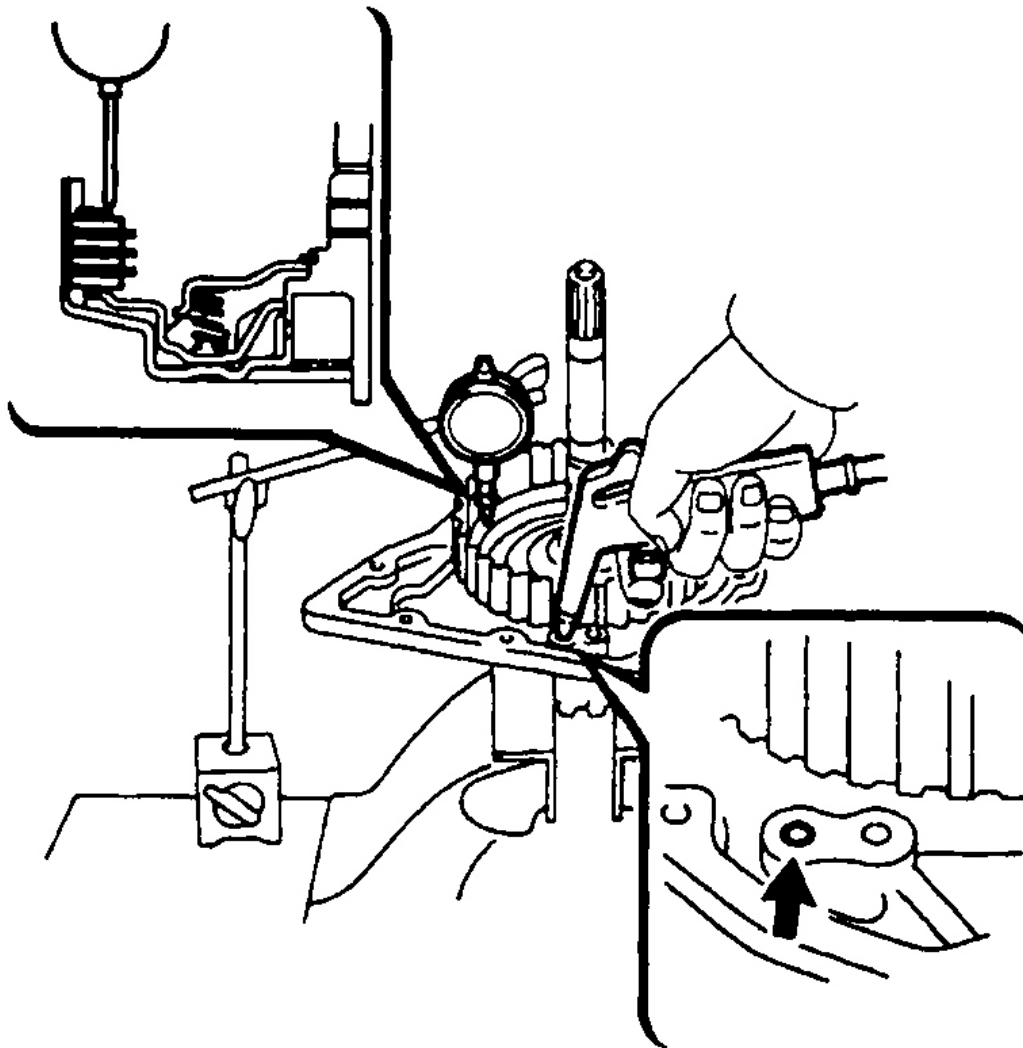
### Disassembly

1. Prior to disassembly, measure piston stroke of direct clutch. Install direct clutch and needle roller bearing on transaxle rear cover. Using a dial indicator, measure direct clutch piston stroke by applying and releasing 57 psi (4 kg/cm<sup>2</sup>) of compressed air to transaxle rear cover. See **Fig. 42**. Piston stroke should be .024-.033" (.61-.83 mm). If piston stroke is not within specification, inspect each component during disassembly.

**NOTE:** In the following step, stop press when piston return spring seat is lowered .039-.079" (1.00-2.00 mm) from snap ring groove. This prevents

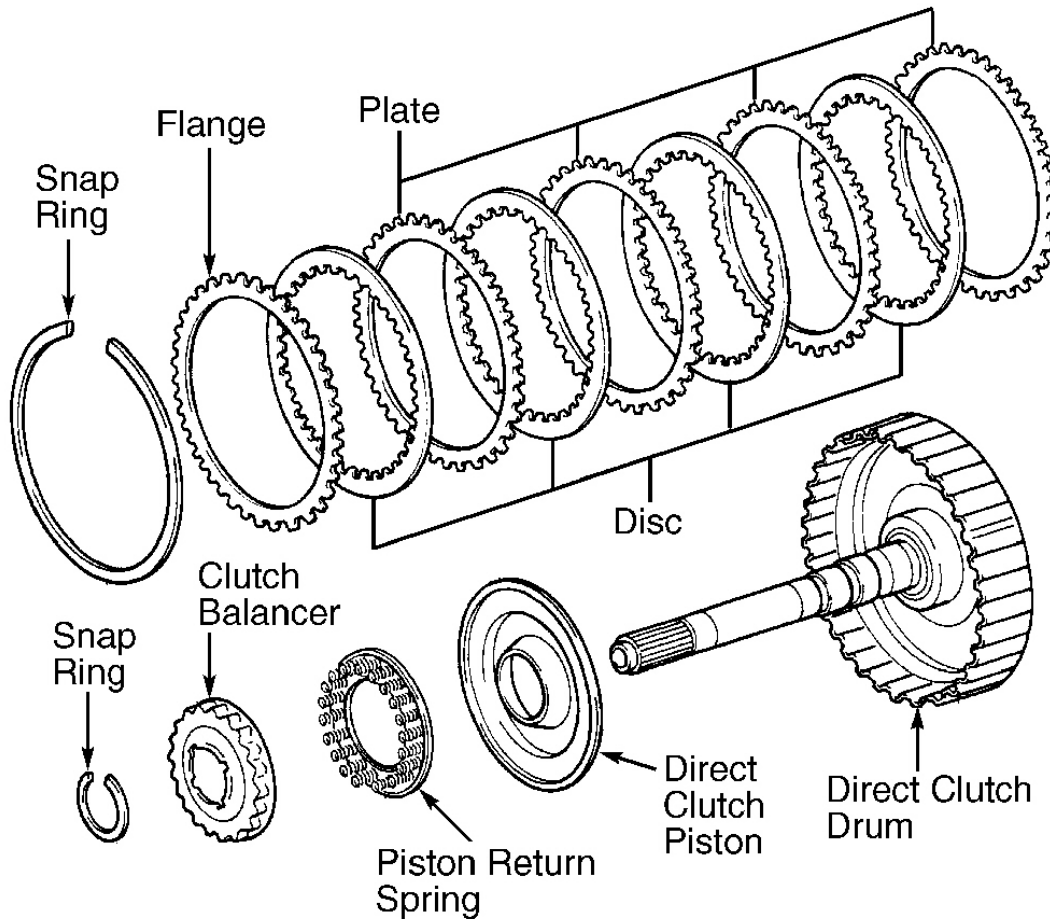
**spring seat from becoming deformed. DO NOT expand snap ring excessively.**

2. Remove direct clutch from transaxle rear cover. Using a screwdriver, remove snap ring from direct clutch drum. Remove flange, discs and plates. Note number and location of components during removal for reassembly reference. Position clutch balancer on a press. Compress piston return springs and remove snap ring. See **Fig. 43**.
3. Remove clutch balancer and piston return springs from clutch drum. Install direct clutch on transaxle rear cover. While holding direct clutch piston, apply 57 psi (4 kg/cm<sup>2</sup>) of compressed air to transaxle rear cover to remove direct clutch piston. See **Fig. 42**.



G00182327

**Fig. 42: Measuring Direct Clutch Piston Stroke**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00011262

**Fig. 43: Exploded View Of Direct Clutch Assembly**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### Inspection

1. Clean all parts (except discs) with solvent. Dry parts using compressed air. Inspect discs and plates for wear or burnt areas. If disc lining is peeled or discolored, replace discs as necessary. Replace all damaged components.
2. Using vernier calipers, measure direct clutch piston return spring free length with spring mounted to spring seat. Free length should be .889" (22.58 mm). Replace springs as necessary.

**NOTE:** New discs must be soaked in ATF at least 15 minutes prior to reassembly.

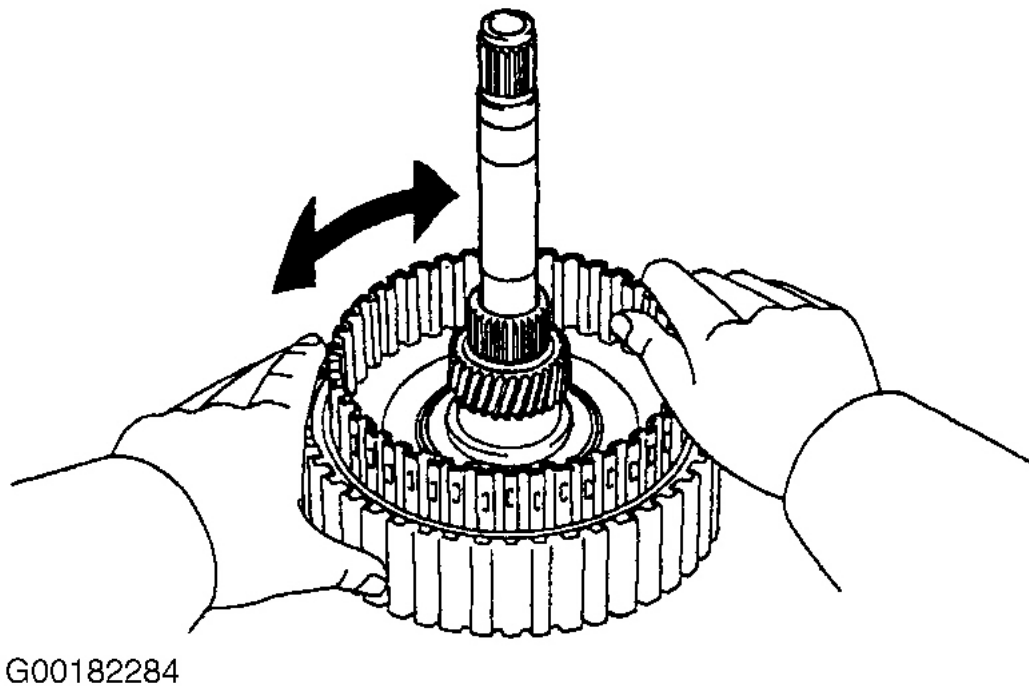
**Reassembly**

1. Coat piston with ATF. Using hand pressure, press piston into direct clutch drum. Ensure piston lip seal is not damaged. Install piston return springs and clutch balancer onto direct clutch drum. Set snap ring in position.

**NOTE:** In the following step, stop press when piston return spring seat is lowered .039-.079" (1.00-2.00 mm) from snap ring groove. This prevents spring seat from becoming deformed. DO NOT expand snap ring excessively.

2. Using appropriate press positioned on clutch balancer, compress piston return springs. Using snap ring expander, install snap ring in direct clutch drum groove. Ensure end gap of spring is not aligned with gaps in clutch balancer hub.
3. Install appropriate number of plates and discs, starting with plate and alternating with disc. See **CLUTCH DISC & PLATE QUANTITY** table under TRANSAXLE SPECIFICATIONS. Install flange on top of disc. See **Fig. 43**. Install snap ring. Ensure end gap of snap ring is not aligned with cutouts of direct clutch drum.
4. If disc, plate or flange have been replaced, check piston stroke. Install direct clutch and needle roller bearing on transaxle rear cover. Using a dial indicator, measure direct clutch piston stroke by applying and releasing 57 psi (4 kg/cm<sub>2</sub>) of compressed air to transaxle rear cover. See **Fig. 42**.
5. Piston stroke should be .024-.033" (.61-.83 mm). If piston stroke is not within specification, disassemble and reassemble direct clutch components.
6. Measure piston stroke again. If measurement is still not within specification, replace flange. Flange is available in 6 thicknesses, from .118" (3.00 mm) to .138" (3.50 mm) in increments of .004" (.10 mm).
7. Check direct clutch operation. Insert rear planetary sun gear into direct clutch. Ensure rear planetary sun gear rotates in both directions. See **Fig. 44**. If sun gear does not rotate as described, disassemble and inspect direct clutch.





**Fig. 44: Checking Direct Clutch Operation**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## FORWARD CLUTCH

### Disassembly

1. Prior to disassembly, measure piston stroke of forward clutch. Install forward clutch on oil pump assembly. Using a dial indicator, measure forward clutch piston stroke by applying and releasing 57 psi (4 kg/cm<sup>2</sup>) of compressed air to oil pump. See **Fig. 45**. Opening in oil pump is large. To prevent air from discharging, surround air nozzle with shop towel. For piston stroke specification, see **FORWARD CLUTCH PISTON STROKE SPECIFICATIONS** table. If piston stroke is not within specification, inspect each component during disassembly.

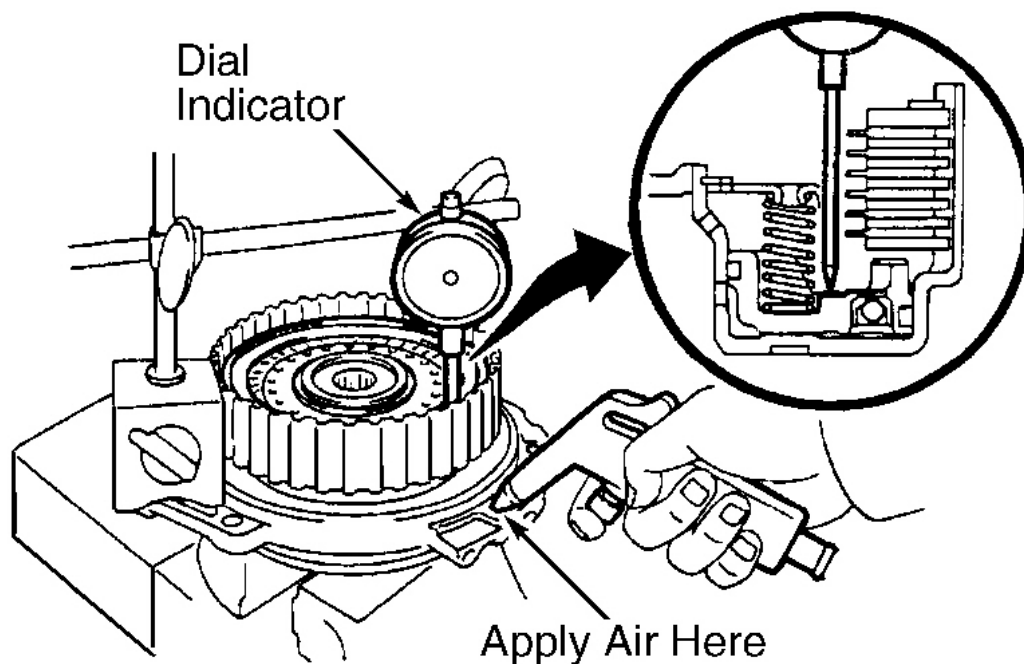
### FORWARD CLUTCH PISTON STROKE SPECIFICATIONS

| Application | In. (mm)              |
|-------------|-----------------------|
| 4-Cylinder  | .069-.082 (1.74-2.08) |
| V6          | .082-.095 (2.08-2.42) |

2. Remove forward clutch from oil pump assembly. Using a screwdriver, remove snap ring from forward clutch drum. Remove flange, discs and plates. Note number and location of components during removal for reassembly reference. Using appropriate press, compress piston return springs. Using snap ring

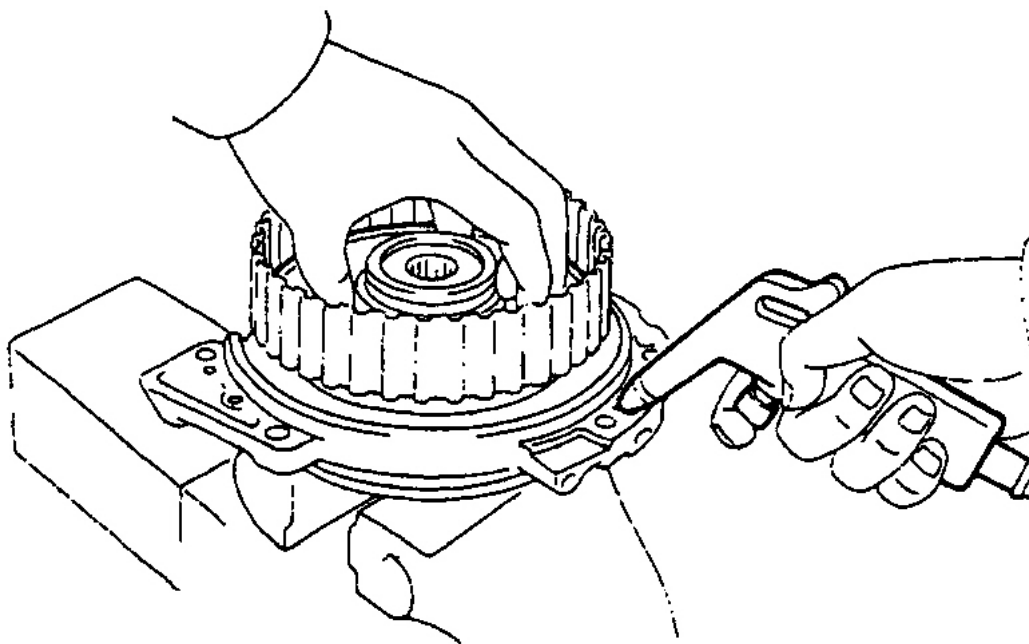
expander, remove snap ring. See **Fig. 47**.

3. Remove press and piston return springs. Install forward clutch on oil pump assembly. While holding forward clutch piston, apply 57 psi (4 kg/cm<sup>2</sup>) of compressed air to oil pump to remove forward clutch piston. See **Fig. 46**. Opening in oil pump is large. To prevent air from discharging, surround air nozzle with shop towel.
4. If piston cannot be removed using compressed air, wrap needle nose pliers tips with vinyl tape and remove piston using pliers. Remove 2 "O" rings from piston. Remove oil seal ring from input shaft. See **Fig. 49**.



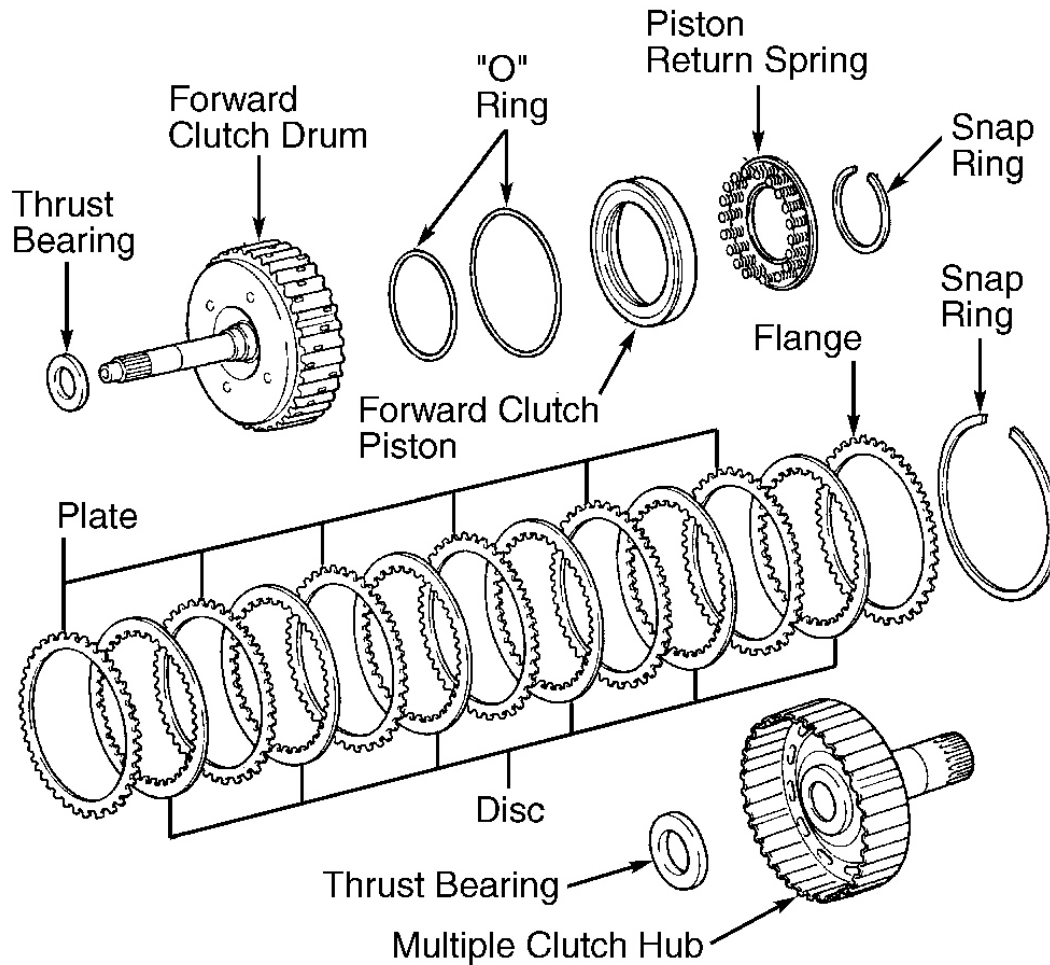
G00011265

**Fig. 45: Measuring Forward Clutch Piston Stroke**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00182286

**Fig. 46: Removing Forward Clutch Piston**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

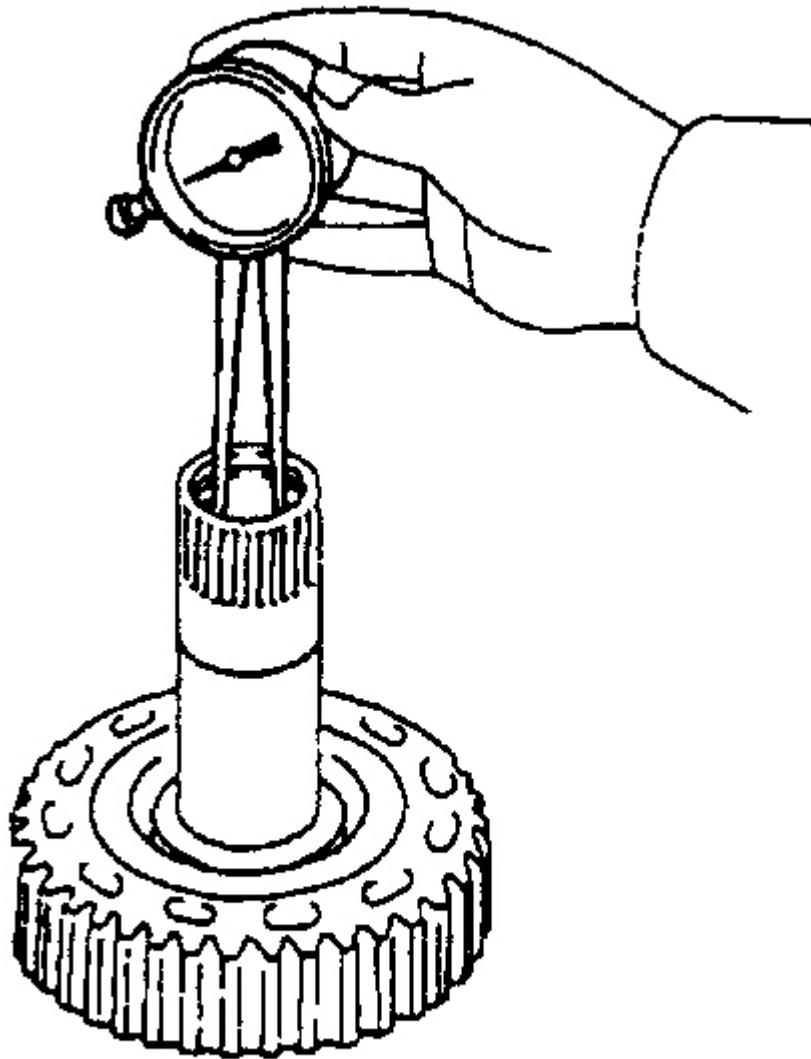


G00011264

**Fig. 47: Exploded View Of Forward Clutch Assembly With Multiple Clutch Hub**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### Inspection

1. Clean all parts (except discs) with solvent. Dry parts using compressed air. Ensure check ball is free in piston. Apply low air pressure to small hole in piston to check for air leakage around piston valve. Inspect discs and plates for wear or burnt areas. If disc lining is peeled or discolored, replace discs as necessary. Replace all damaged components.
2. Using vernier calipers, measure forward clutch piston return spring free length with spring mounted to spring seat. Free length should be 1.111" (28.23 mm). Replace springs as necessary.
3. Using a dial indicator, measure inside diameter of multiple clutch hub bushing. See **Fig. 48**. Maximum inside diameter is .909" (23.09 mm). If inside diameter exceeds specification, replace multiple clutch hub.



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**Fig. 48: Measuring Multiple Clutch Hub Bushing Inside Diameter**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**NOTE:** New discs must be soaked in ATF for 15 minutes prior to reassembly.

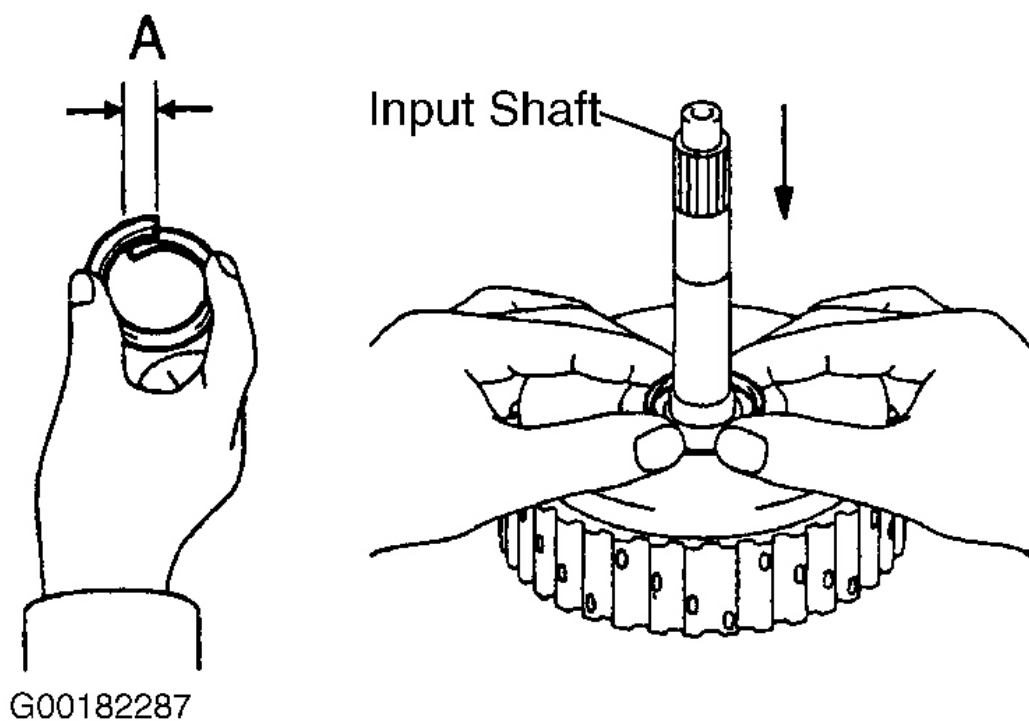
**Reassembly**

1. Coat oil seal ring with ATF and install it onto input shaft. Compress oil seal ring from both sides to

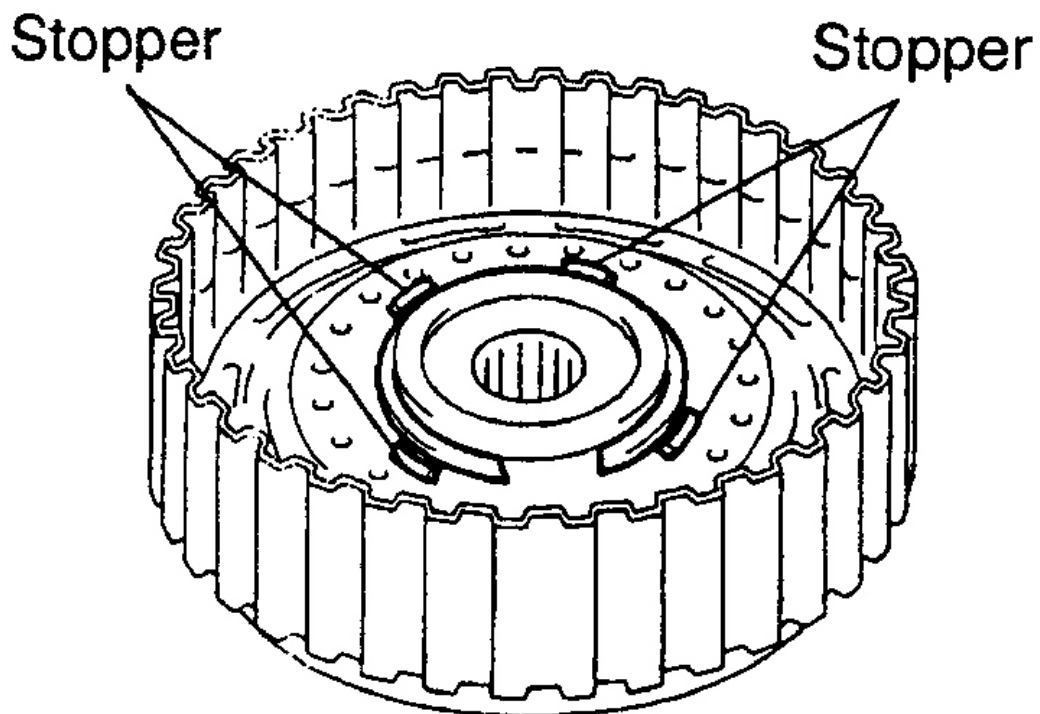
reduce dimension "A" to .197" (5.00 mm). See **Fig. 49**. Coat NEW piston "O" rings with ATF. Install "O" rings on forward clutch piston. Using hand pressure, press piston into forward clutch drum. Ensure "O" rings are not damaged. Set piston return springs in position.

**NOTE:** In the following step, stop press when piston return spring seat is lowered .039-.079" (1.00-2.00 mm) from snap ring groove. This prevents spring seat from becoming deformed. DO NOT expand snap ring excessively.

2. Position spring seat on a press. Compress piston return springs. Using snap ring expander, install snap ring in forward clutch drum groove. Ensure end gap of spring is not aligned with gap in spring retainer hub. End gap of snap ring should not align with stoppers. See **Fig. 50**. Remove press.
3. Install appropriate number of plates and discs, starting with plate and alternating with disc. See **CLUTCH DISC & PLATE QUANTITY** table under TRANSAXLE SPECIFICATIONS. Install flange on top of disc. See **Fig. 47**. Install snap ring. Ensure end gap of snap ring is not aligned with cutouts of forward clutch drum.
4. If disc, plate or flange have been replaced, check piston stroke. Install forward clutch on oil pump assembly. Using a dial indicator, measure forward clutch piston stroke by applying and releasing 57 psi (4 kg/cm<sup>2</sup>) of compressed air to oil pump. See **Fig. 45**. Opening in oil pump is large. To prevent air from discharging, surround air nozzle with shop towel. For piston stroke specification, see **FORWARD CLUTCH PISTON STROKE SPECIFICATIONS** table. If piston stroke is not within specification, disassemble and reassemble forward clutch components.
5. Measure piston stroke again. If measurement is still not within specification, replace flange. Flange is available in 5 thicknesses from .118" (3.00 mm) to .142" (3.60 mm) in increments of .006" (.15 mm). Coat thrust bearings with ATF and install.
6. Check forward clutch operation. Insert multiple clutch hub into forward clutch. Ensure forward clutch rotates in both directions. See **Fig. 51**. If forward clutch does not rotate as described, disassemble and inspect forward clutch.



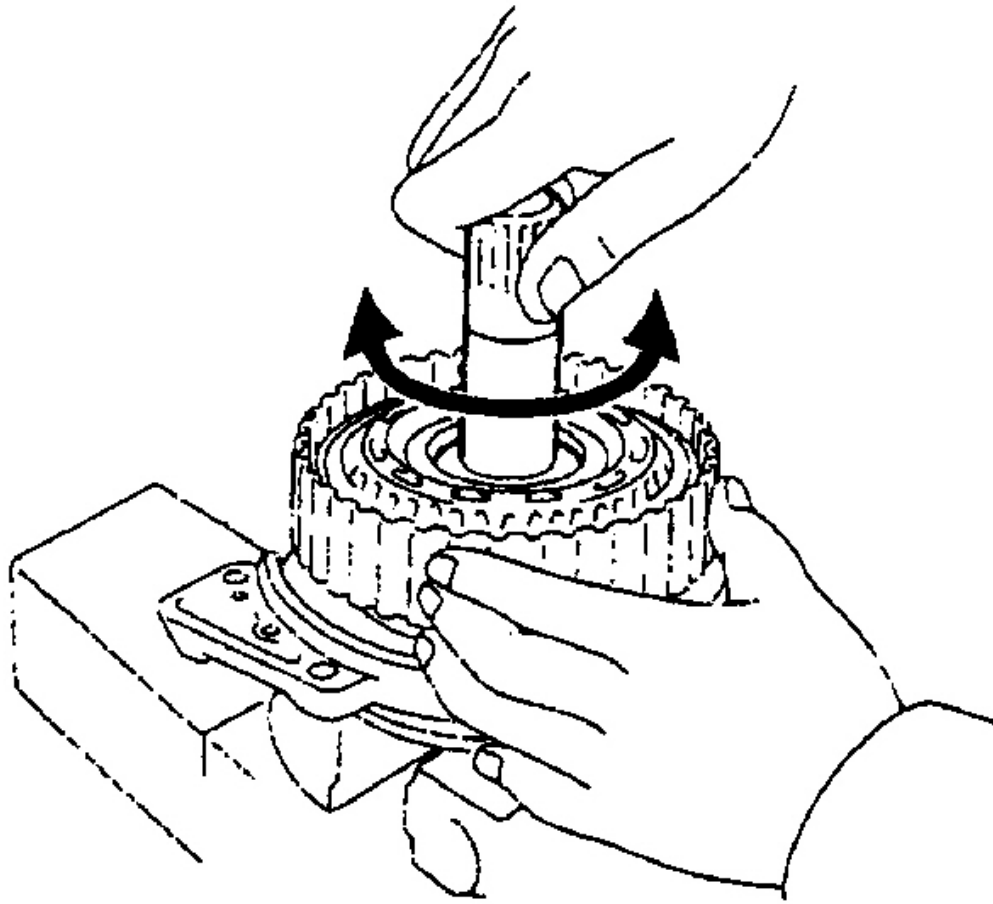
**Fig. 49: Installing Input Shaft Oil Seal Ring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00182283

**Fig. 50: Installing Forward Clutch Drum Snap Ring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.





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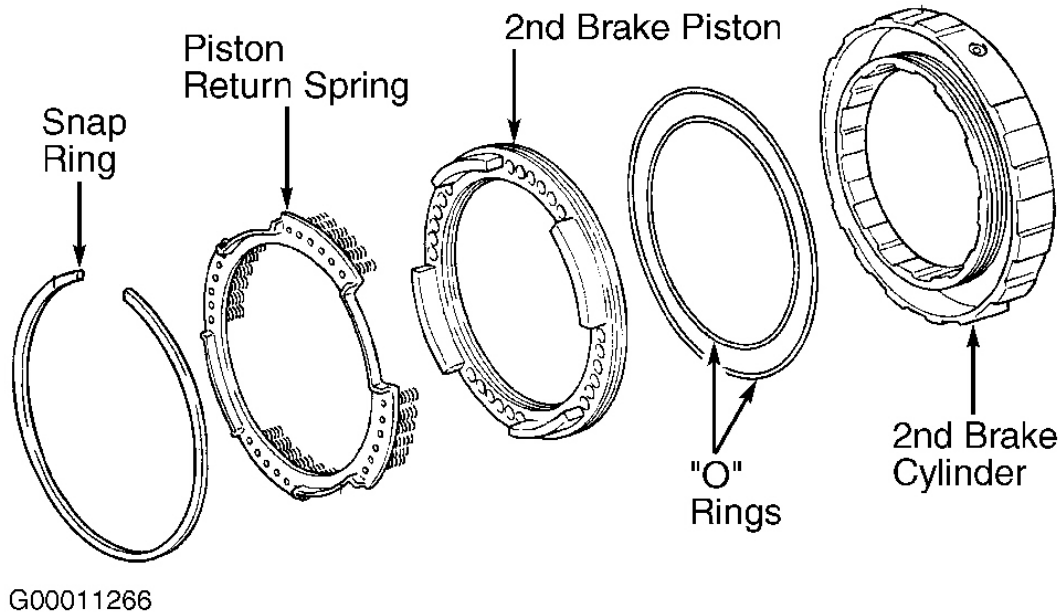
**Fig. 51: Checking Forward Clutch Operation**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## 2ND BRAKE

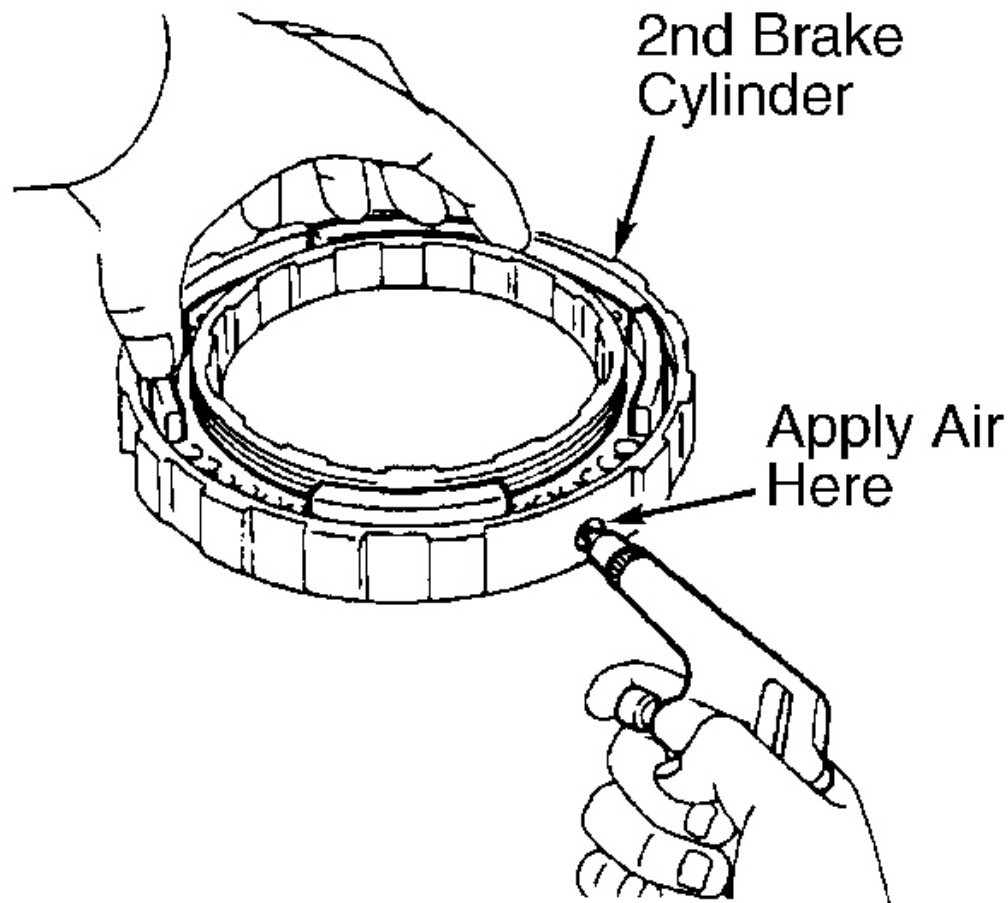
### Disassembly & Reassembly

1. Using appropriate press, position press on piston return springs and compress springs. Using a screwdriver, remove snap ring. Remove press and piston return springs. See **Fig. 52**. While holding 2nd brake piston, apply 57 psi (4 kg/cm<sup>2</sup>) of compressed air to 2nd brake cylinder to remove piston. See **Fig. 53**. Remove 2 "O" rings from piston.
2. Using vernier calipers, measure 2nd brake piston return spring free length with spring mounted to spring seat. Free length should be .654" (16.61 mm). Replace springs as necessary. Coat NEW "O" rings with ATF and install on piston.

3. Carefully press 2nd brake piston by hand into 2nd brake cylinder. See **Fig. 52**. Using appropriate press, compress piston return springs and install snap ring. Ensure end gap of snap ring is not aligned with gap in piston return spring hub.



**Fig. 52: Exploded View Of 2nd Brake Assembly**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00011267

**Fig. 53: Removing 2nd Brake Piston**

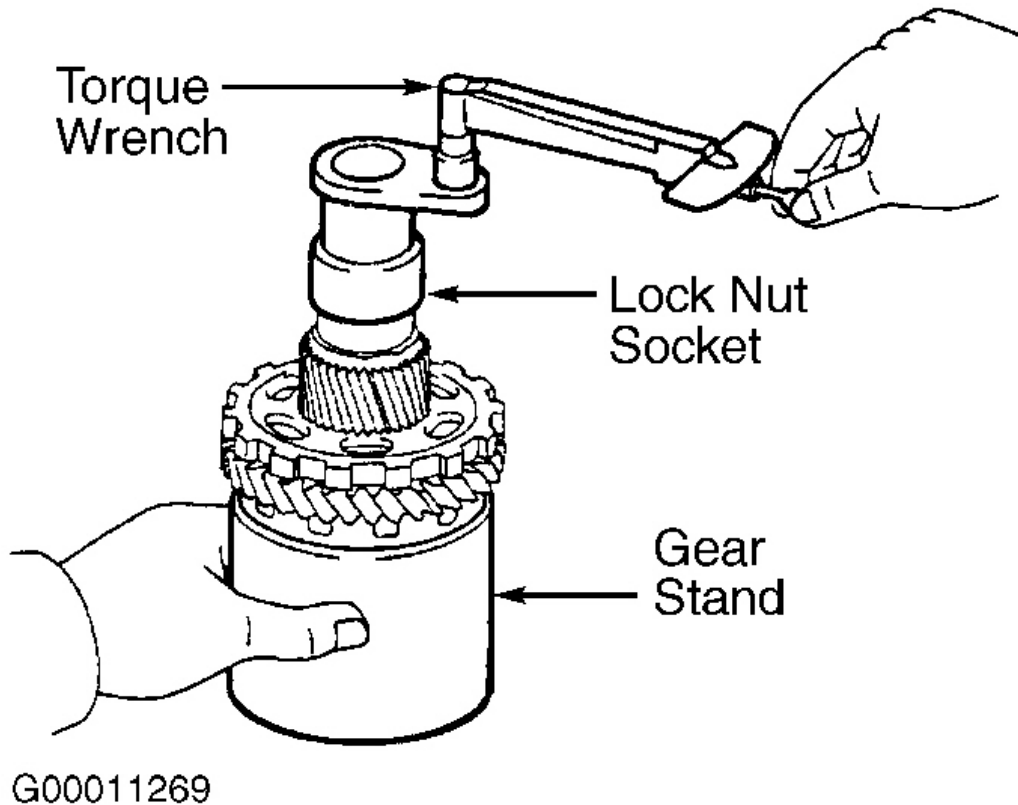
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## UNDERDRIVE PLANETARY GEAR

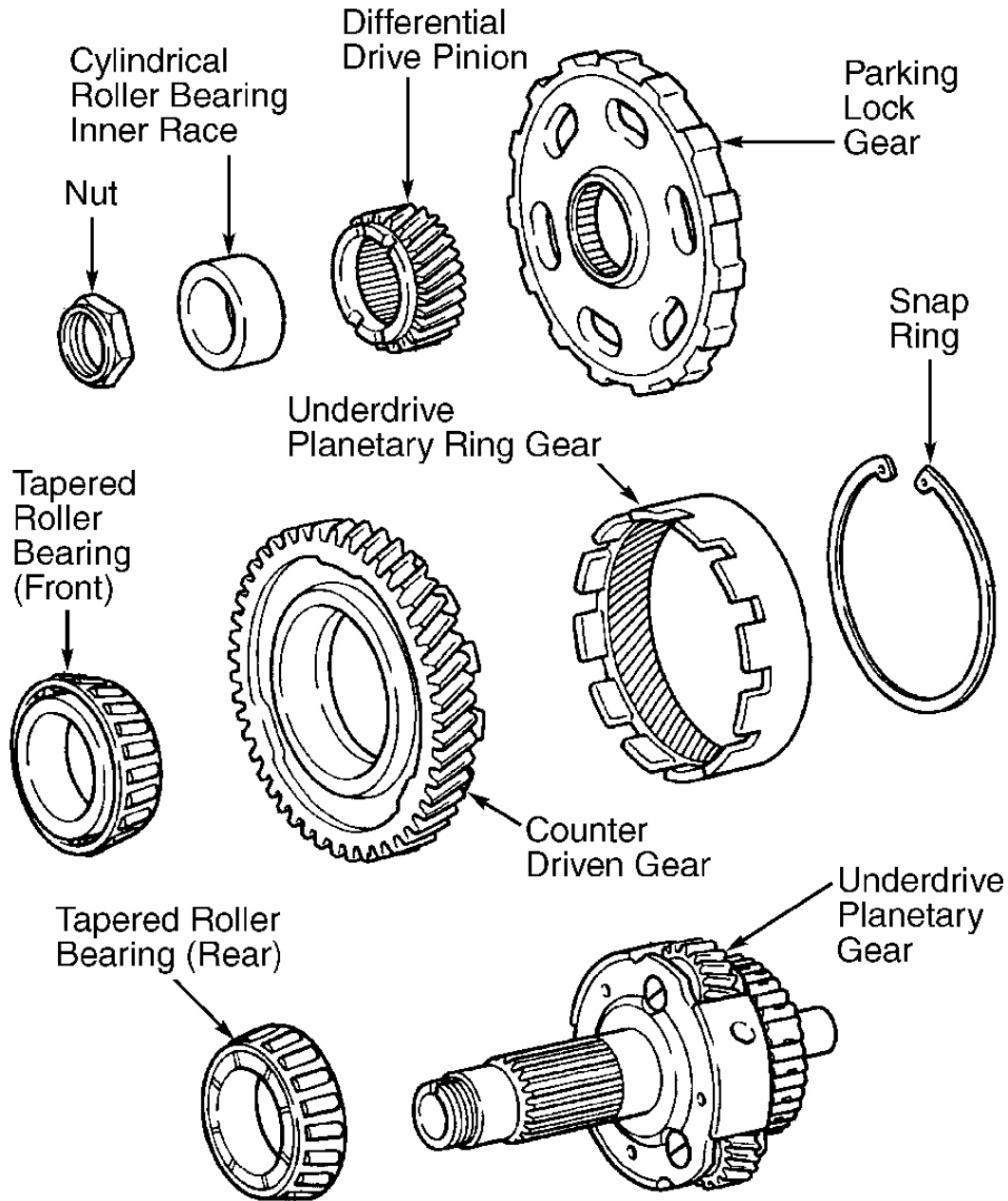
### Disassembly

1. Using gear stand, lock nut socket, adapter and INCH-lb. torque wrench with a fulcrum length of 6.30" (160.0 mm), measure underdrive input shaft starting torque for reference. See **Fig. 54**. Starting torque should be .9-39 INCH lbs. (.10-4.41 N.m).
2. Using pin punch and hammer, loosen staked part of lock nut. Clamp underdrive planetary gear in a soft-jawed vise. Use care not to damage differential drive pinion. Using appropriate socket, remove lock nut. Remove gear from vise. Using appropriate puller, remove cylindrical roller bearing inner race. See **Fig. 55**.

3. Using gear stand and appropriate press, remove differential drive pinion, parking lock gear, counter driven gear with underdrive planetary ring gear and front tapered roller bearing. See **Fig. 55**.
4. Clamp underdrive planetary gear in soft-jawed vise. Using appropriate puller, remove rear tapered roller bearing from underdrive planetary gear. Using snap ring pliers, remove snap ring. Remove underdrive planetary ring gear from counter driven gear.



**Fig. 54: Measuring Underdrive Planetary Gear Input Shaft Starting Torque**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00011268

**Fig. 55: Exploded View Of Underdrive Planetary Gear Assembly**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### Reassembly

1. Install NEW snap ring to outer race of tapered roller bearing. Using a piston ring compressor, squeeze snap ring. Using appropriate adapter and a press, press outer race into counter driven gear. Install

underdrive planetary ring gear into counter driven gear. Install snap ring. Using appropriate press, install rear tapered roller bearing onto underdrive planetary gear. Press bearing until it becomes flat at the bottom.

2. Install counter driven gear with underdrive planetary ring gear onto underdrive planetary gear. Using appropriate press, install front tapered roller bearing onto underdrive planetary gear while rotating counter driven gear.
3. Using appropriate press, install parking lock gear while rotating counter driven gear. Using press, install differential drive pinion, then install cylindrical roller bearing inner race while rotating counter driven gear.
4. Clamp underdrive planetary gear in a soft-jawed vise. Use care not to damage differential drive pinion. Using appropriate socket, install NEW lock nut and tighten to 207 ft. lbs. (280 N.m). Remove gear from vise. Using gear stand, lock nut socket, adapter and INCH-lb. torque wrench with a fulcrum length of 6.30" (160.0 mm), ensure underdrive input shaft starting torque is .9-39 INCH lbs. (.10-4.41 N.m). See **Fig. 54**. Using pin punch and hammer, stake lock nut. Ensure lock nut is not cracked.

## UNDERDRIVE CLUTCH

### Disassembly

1. Prior to disassembly, check piston stroke of underdrive clutch. Install underdrive clutch into transaxle case. DO NOT damage oil seal rings. Install dial indicator onto underdrive clutch flange. See **Fig. 56**. Apply and release 57 psi (4 kg/cm<sub>2</sub>) of compressed air to transaxle case. See **Fig. 57**.
2. Piston stroke should be .059-.075" (1.51-1.90 mm). If piston stroke is not within specification, inspect discs and plates during disassembly. Using a screwdriver, remove drum snap ring. Remove flange, discs and plates from underdrive clutch drum. Note number and location of components during removal for reassembly reference. See **Fig. 60**.

**NOTE:** In the following step, stop press when piston return spring seat is lowered .039-.079" (1.00-2.00 mm) from snap ring groove. This prevents spring seat from becoming deformed. DO NOT expand snap ring excessively.

3. Using appropriate press placed on clutch balancer, compress piston return springs. Using snap ring expander, remove snap ring. Remove press, clutch balancer and piston return springs.
4. Install underdrive clutch into transaxle case. DO NOT damage oil seal rings. While holding underdrive clutch piston, apply 57 psi (4 kg/cm<sub>2</sub>) of compressed air to transaxle case to remove underdrive clutch piston. See **Fig. 57**. Remove "O" ring from underdrive clutch drum.

### Inspection

1. Clean all parts (except discs) with solvent. Dry parts using compressed air. Inspect discs and plates for wear or burnt areas. If disc lining is peeled or discolored, replace discs as necessary. Replace all damaged components.
2. Using vernier calipers, measure underdrive clutch piston return spring free length with spring mounted to spring seat. Free length should be .675" (17.14 mm). Replace springs as necessary.

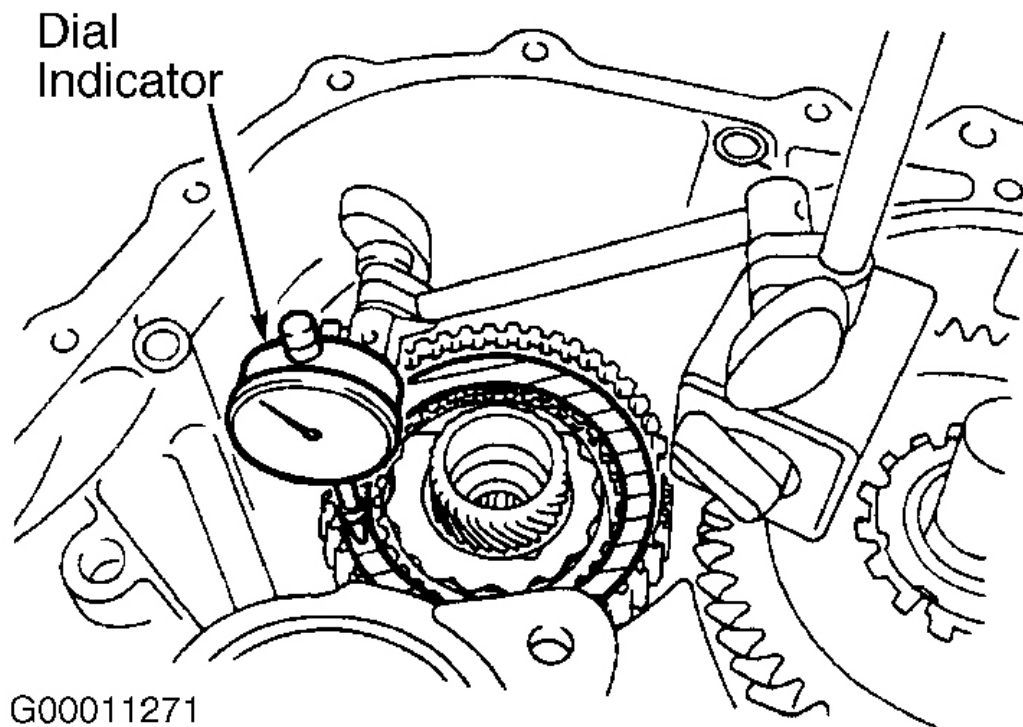
3. Using a dial indicator, measure inside diameter of underdrive clutch drum bushing. See **Fig. 58**. Maximum inside diameter is 1.462" (37.13 mm). If inside diameter exceeds specification, replace underdrive clutch drum.

### Reassembly

1. Coat NEW "O" ring with ATF and install on underdrive clutch drum. Coat underdrive clutch piston with ATF. Using hand pressure, install piston into underdrive clutch drum. Use care not to damage "O" ring. Install piston return springs and clutch balancer to underdrive clutch drum. Set snap ring in position.

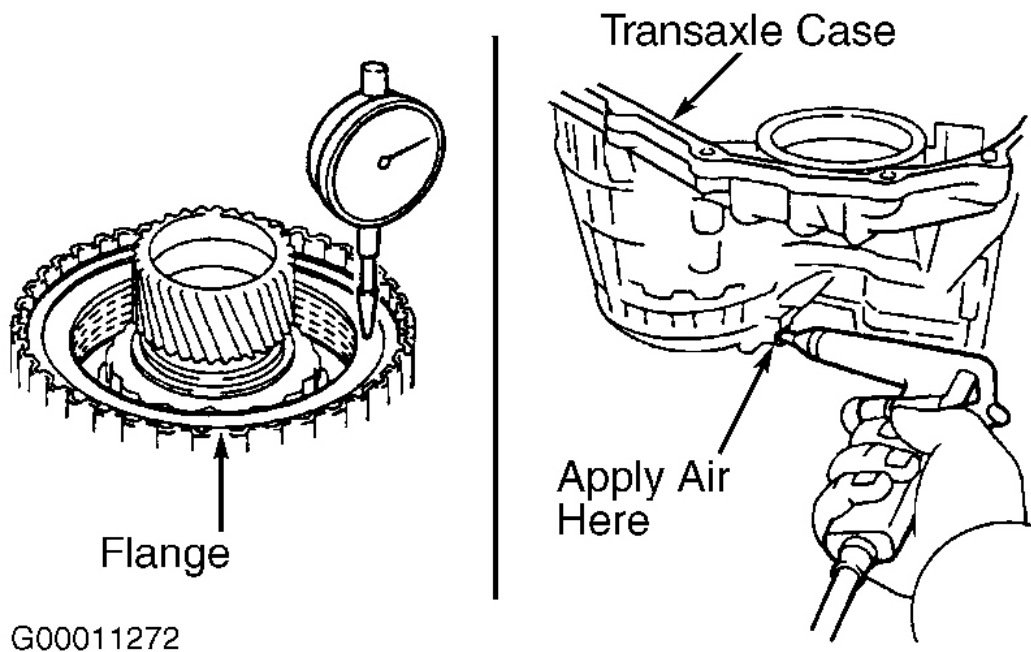
**NOTE:** In the following step, stop press when piston return spring seat is lowered .039-.079" (1.00-2.00 mm) from snap ring groove. This prevents spring seat from becoming deformed. DO NOT expand snap ring excessively.

2. Using appropriate press positioned on clutch balancer, compress piston return springs. Using snap ring expander, install snap ring in underdrive clutch drum groove. Ensure end gap of spring is not aligned with gap in clutch balancer hub. End gap of snap ring should not align with stoppers. See **Fig. 59**.
3. Install appropriate number of plates and discs, starting with plate and alternating with disc. See **CLUTCH DISC & PLATE QUANTITY** table under TRANSAXLE SPECIFICATIONS. Install flange on top of disc. See **Fig. 60**. Install snap ring. Ensure end gap of snap ring is not aligned with cutouts of underdrive clutch drum.
4. Check piston stroke of underdrive clutch. Install underdrive clutch into transaxle case. DO NOT damage oil seal rings. Install dial indicator onto underdrive clutch flange. See **Fig. 56**. Apply and release 57 psi (4 kg/cm<sub>2</sub>) of compressed air to transaxle case. See **Fig. 57**.
5. Piston stroke should be .059-.075" (1.51-1.90 mm). If piston stroke is not within specification, replace flange. Flange is available in thicknesses of .118" (3.00 mm), .126" (3.20 mm) and .134" (3.40 mm).

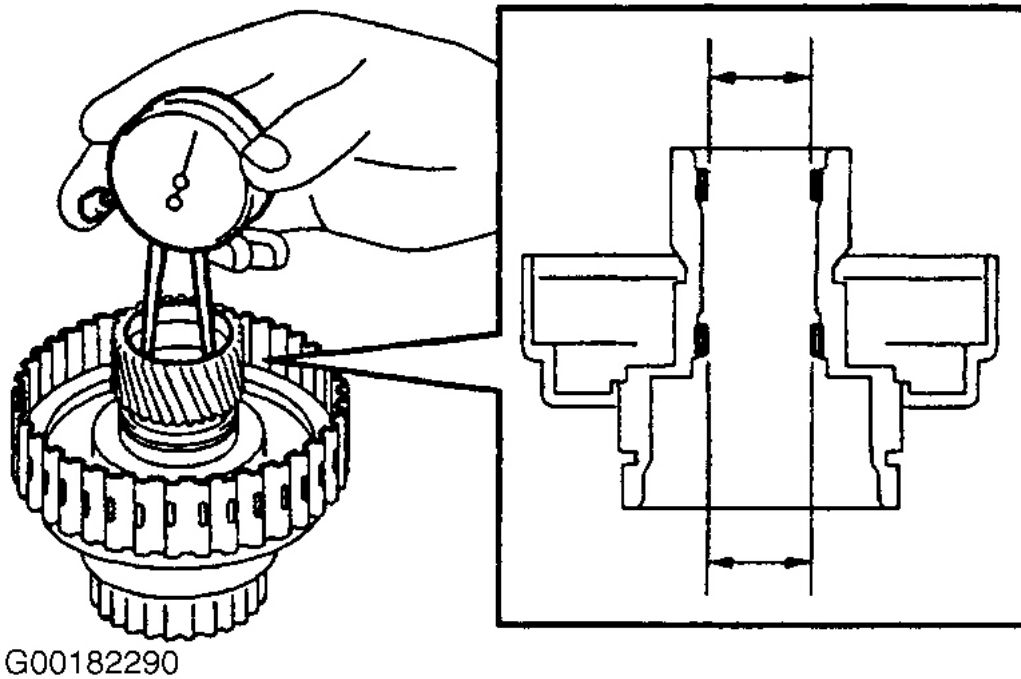


**Fig. 56: Installing Dial Indicator Onto Underdrive Clutch Flange**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

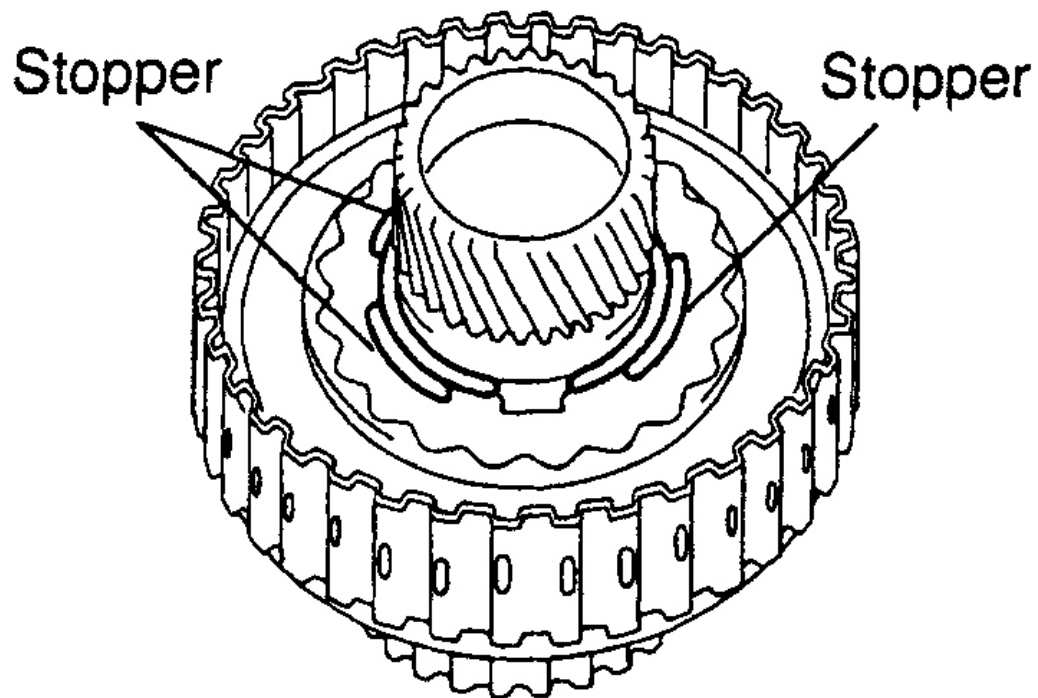




**Fig. 57: Measuring Underdrive Clutch Piston Stroke**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

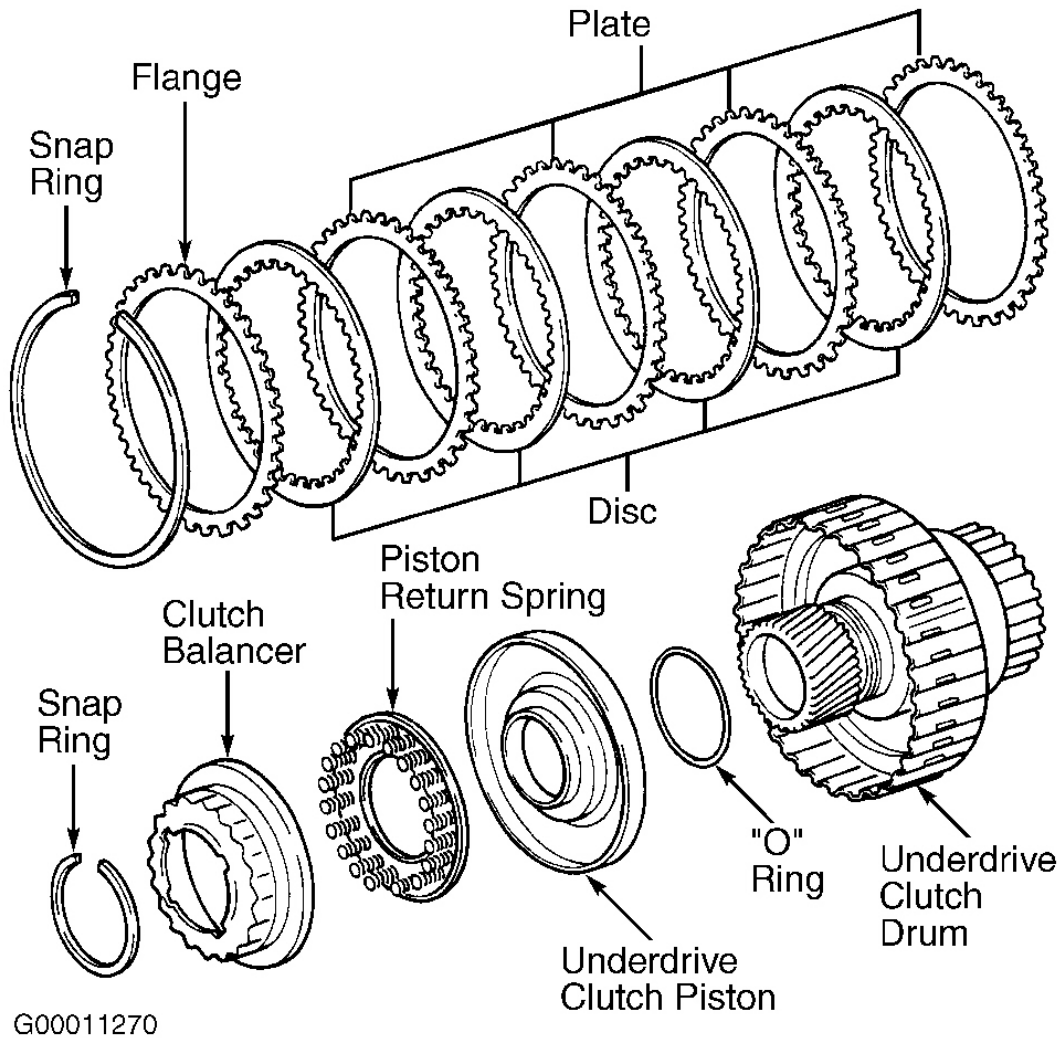


**Fig. 58: Checking Underdrive Clutch Drum Bushing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00182291

**Fig. 59: Installing Underdrive Clutch Drum Snap Ring**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 60: Exploded View Of Underdrive Clutch Assembly**

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

## VALVE BODY ASSEMBLY

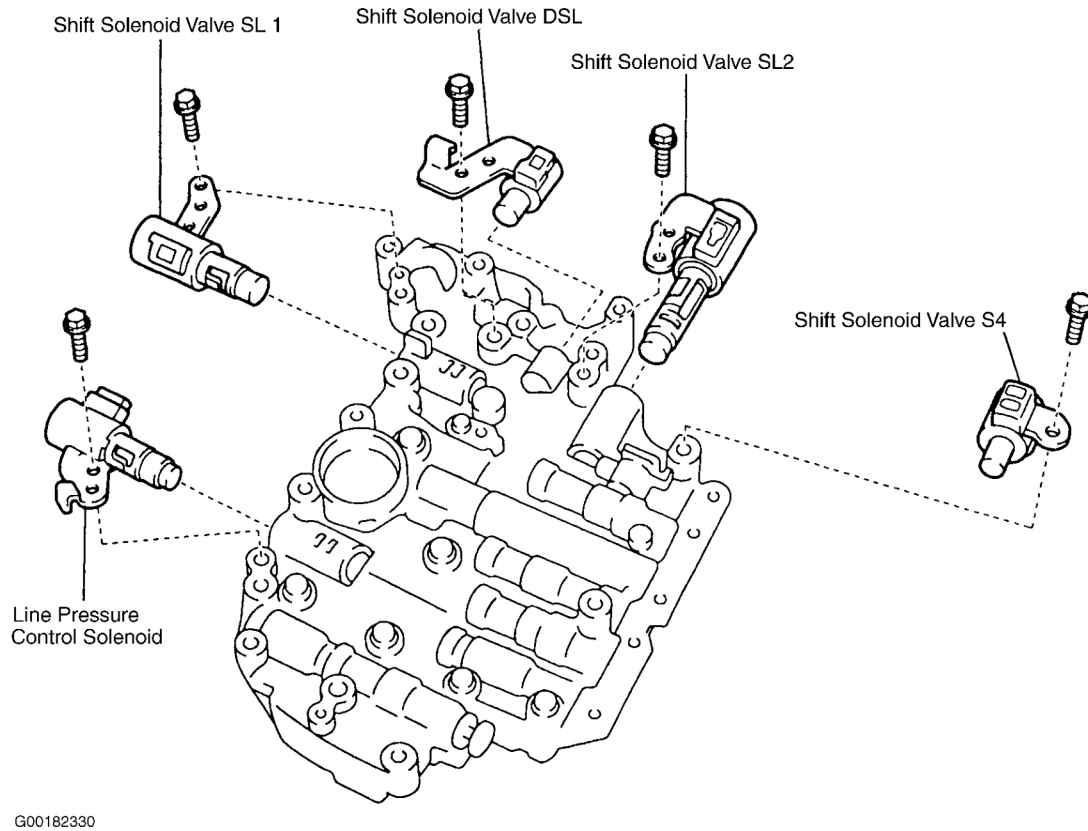
**NOTE:** All valve body components must be installed in original location. Lay all components in sequence during removal for reassembly reference. Manufacturer does not supply exploded views or specifications for valve body assembly.

### Disassembly, Inspection & Reassembly

1. Remove 5 bolts and 5 shift solenoid valves. See **Fig. 61**. Clean all valve body parts with solvent. Dry parts with compressed air. Ensure all valve body oil passages are clear. Inspect valves for scoring or

roughness. Inspect valve springs for damage, squareness, rust and collapsed coils.

2. Install 5 shift solenoid valves and bolts. Tighten all shift solenoid valve bolts to 97 INCH lbs. (11 N.m). See **Fig. 61**.



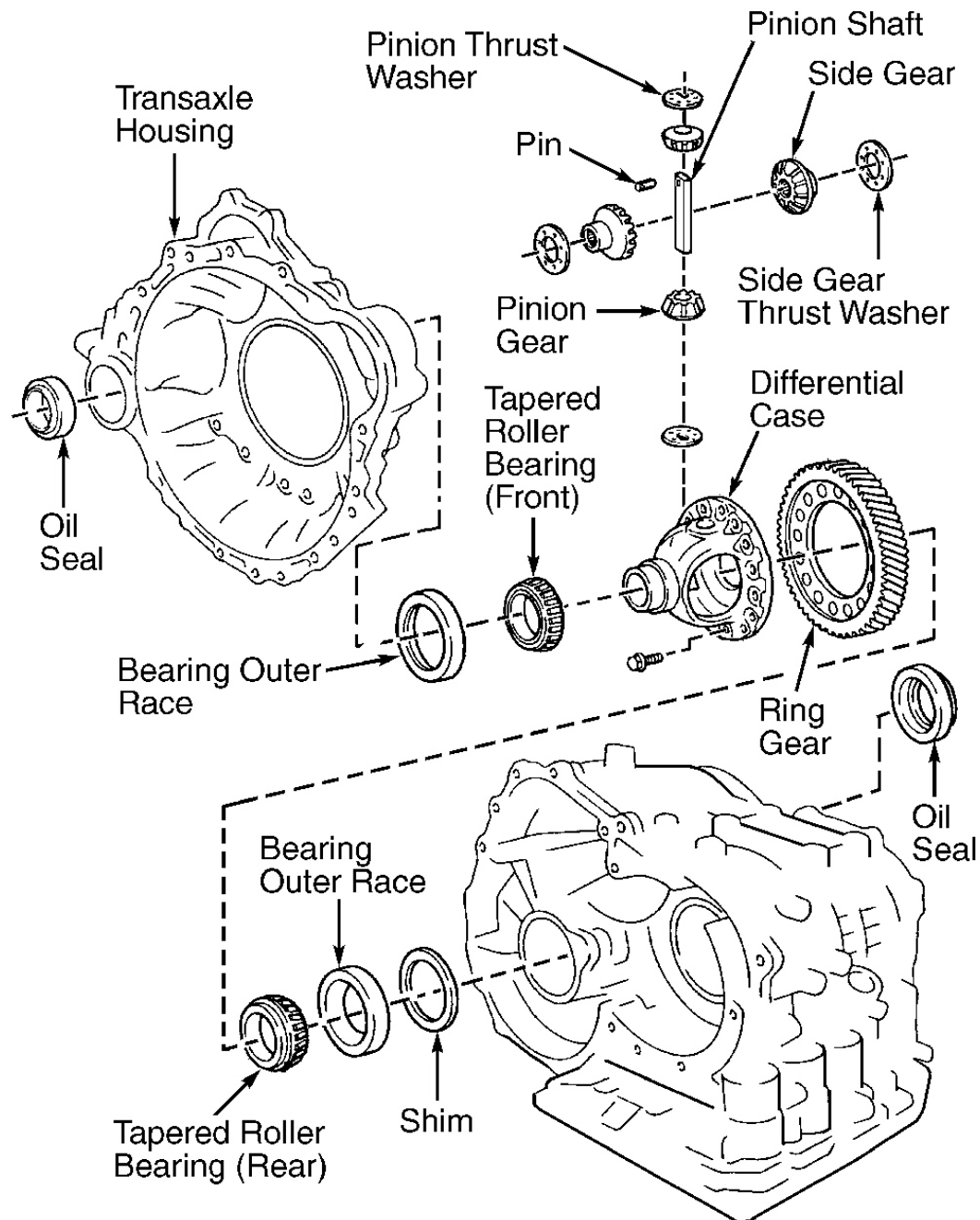
**Fig. 61: Locating Valve Body Shift Solenoid Valves**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## DIFFERENTIAL ASSEMBLY

### Disassembly (U140E)

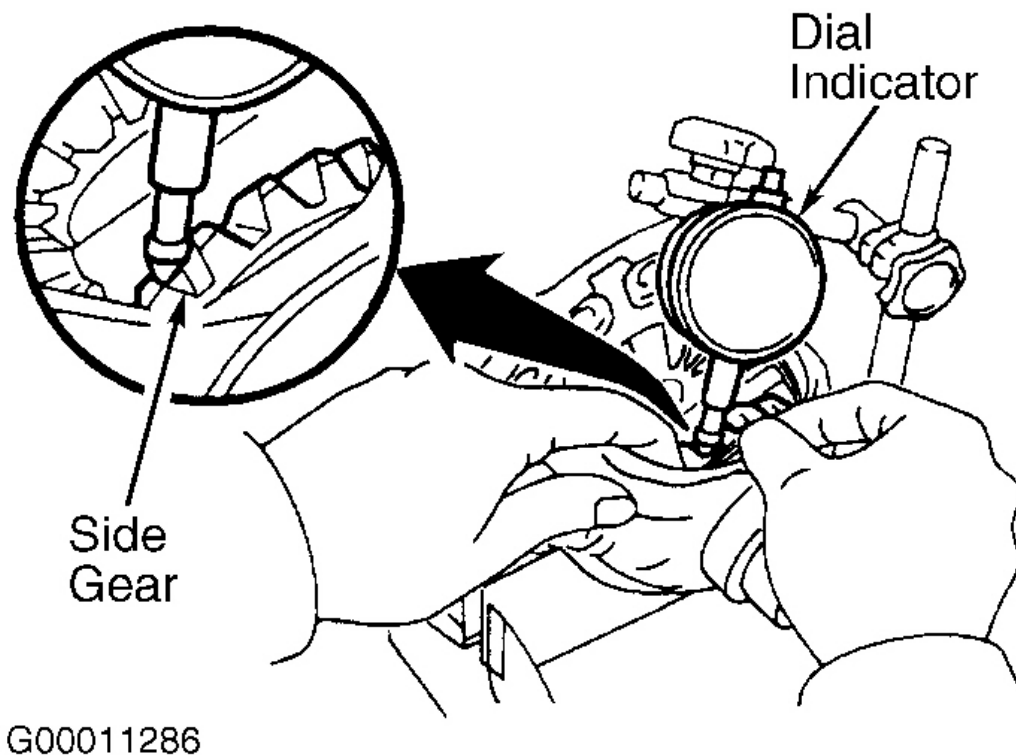
1. Perform pre-disassembly inspection. Position dial indicator assembly on transaxle case. Position dial indicator tip against side gear. See **Fig. 63**. Measure side gear backlash while holding one pinion gear toward case. Backlash should be .002-.008" (.05-.20 mm). Note and record reading.
2. Mark ring gear and differential case for reassembly reference. Remove 12 ring gear bolts. Using a plastic hammer, tap on ring gear to remove it from differential case. See **Fig. 62**.
3. Using appropriate puller, remove front and rear tapered roller bearings (if necessary). Using a pin punch and hammer, drive out pinion shaft pin from ring gear side of case. Remove differential pinion shaft from differential case.
4. Remove 2 differential pinion gears, side gears, and 4 thrust washers. Using appropriate puller, remove side gear bearing outer races and shim from transaxle housing and transaxle case. Remove oil seals from

transaxle housing and transaxle case.



G00011285

**Fig. 62: Exploded View Of Differential Assembly (U140E)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 63: Measuring Side Gear Backlash (U140E)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### **Cleaning & Inspection (U140E)**

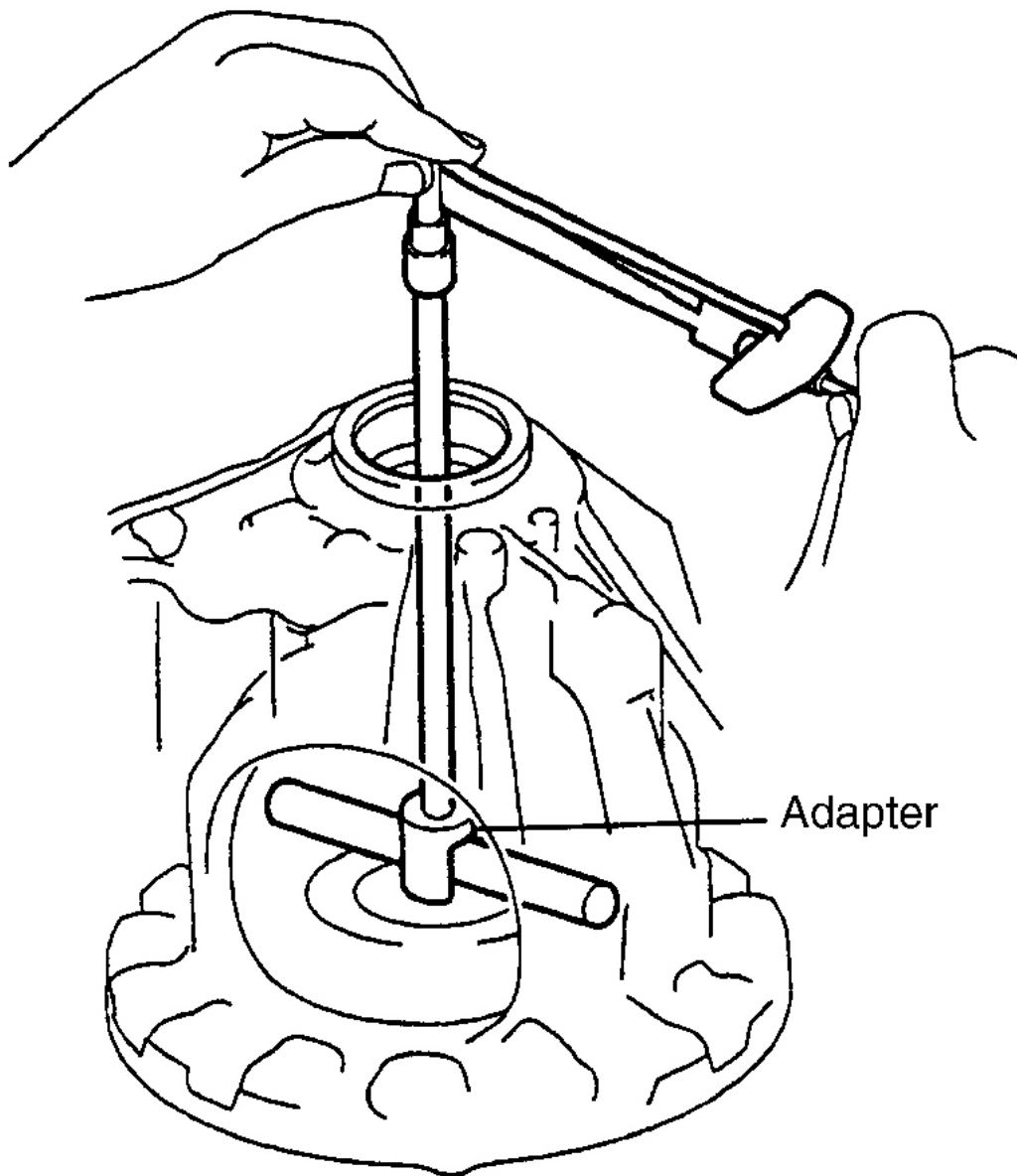
Clean all parts with solvent. Dry with compressed air. Check bearings, races and gears for wear or damage. Replace if necessary.

#### **Reassembly (U140E)**

1. Install original shim (if removed) into transaxle case. Using appropriate race installer and hammer, install outer race into transaxle housing and transaxle case (if removed). Drive outer races in until shim and outer race contact housing or case surface.
2. Coat thrust washers, side gears and pinion gears with ATF. Install 2 thrust washers onto 2 differential side gears. Install 2 thrust washers with 2 side gears, and 2 thrust washers with pinion gears into differential case. Install pinion shaft, aligning lock pin holes on pinion shaft and differential case.
3. Mount differential case in a soft-jawed vise. Using a dial indicator, check side gear backlash. Hold one pinion gear against case. Measure side gear backlash. See **Fig. 63**. Backlash must be .002-.008" (.05-.20 mm). If backlash is not within specification, side gear thrust washers must be replaced.
4. Select appropriate thrust washers to obtain correct side gear backlash. Thrust washers are available in

- thicknesses from .064" (1.63 mm) to .072" (1.83 mm) in .004" (.10 mm) increments. Install thrust washers and side gears in differential case. If possible, install same size thrust washers on both sides. Install pinion gears and pinion shaft. Check side gear backlash to ensure proper thrust washers are used.
5. Using a pin punch and hammer, drive pinion shaft pin through transaxle case and pinion shaft. Stake differential case. Using appropriate press, install differential case tapered roller bearings.
  6. Remove any material from transaxle housing and case mating surfaces. DO NOT allow oil to contact surfaces. Install differential assembly into transaxle case. Install transaxle housing onto transaxle case. Install 5 lower bolts inside transaxle housing and tighten to 16 ft. lbs. (22 N.m). Install all other bolts and tighten to 21 ft. lbs. (29 N.m). Ensure bolts are in correct locations. Longest bolts go inside transaxle housing. See **Fig. 21**.
  7. Using appropriate adapter and ratchet, rotate differential assembly in both directions to seat bearings. Using an INCH-lb. torque wrench, measure differential side bearing preload. See **Fig. 64**. Preload should be 1.8-6.1 INCH lbs. (.20-.69 N.m) for new bearings and .9-3.1 INCH lbs. (.10-.35 N.m) for used bearings.
  8. If preload is not within specifications, remove 16 transaxle housing bolts. Using a plastic hammer, remove transaxle housing from transaxle case. Remove differential assembly from transaxle case and replace shim at rear tapered roller bearing with appropriate shim.
  9. Adjustment shims are marked in numeric and alphabetic order and available in thicknesses from .079 (2.00 mm), marked with a zero, to .096" (2.45 mm), marked with the number "9", and from .098" (2.50 mm), marked with the letter "A", to .112" (2.85 mm), marked with the letter "H". Shims increase in increments of .002" (.05 mm). Recheck preload after shim replacement.
  10. Clean contact surface of differential case and ring gear using cleaning solvent. Heat ring gear to 212°F (100°C) in water. DO NOT heat ring gear above 230°F (110°C).
  11. After moisture on ring gear has completely evaporated, quickly align match marks made during disassembly. Install ring gear on differential case. Install ring gear bolts and tighten to 70 ft. lbs. (95 N.m). Install NEW oil seals in transaxle housing and transaxle case. Coat lip of oil seals with lubricant.





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**Fig. 64: Measuring Side Bearing Preload (U140E)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### Disassembly (U140F)

1. Mark ring gear and differential case for reassembly reference. Remove 16 bolts. Using a plastic hammer, tap on ring gear to remove it from differential case. Remove left side differential case from differential intermediate case. Remove front differential case from left side differential case. See **Fig. 65**.

2. Remove front differential side gear, front differential side gear thrust washer, conical spring and center differential side gear thrust washer No. 2 from left side differential case. Remove snap ring from front differential case. Using a pin punch and hammer, drive out 3 pins from front differential case. Remove 3 pinion shafts from front differential case. See **Fig. 65**.
3. Remove 4 front differential pinion gears, thrust washers, pinion shaft holder, side gear and thrust washer from front differential case. Using appropriate puller, remove tapered roller bearing from left side differential case. See **Fig. 65**.
4. Mark differential intermediate case and right side differential case for reassembly reference. Using appropriate Torx socket, remove 15 bolts. Remove differential intermediate case from right side differential case. Remove center differential side gear, conical spring and center differential side gear thrust washer No. 1 from right side differential case. See **Fig. 65**.
5. Remove center differential pinion thrust washers, center differential pinion gears and center differential pinion spider from differential intermediate case. Using appropriate puller, remove tapered roller bearing from right side differential case. Remove transaxle housing bearing race. Remove transaxle housing oil seal. Remove transaxle case bearing race and plate washer. Remove transaxle case oil seal. See **Fig. 65**.

## 2001-05 AUTOMATIC TRANSMISSIONS U140E & U140F Overhaul



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

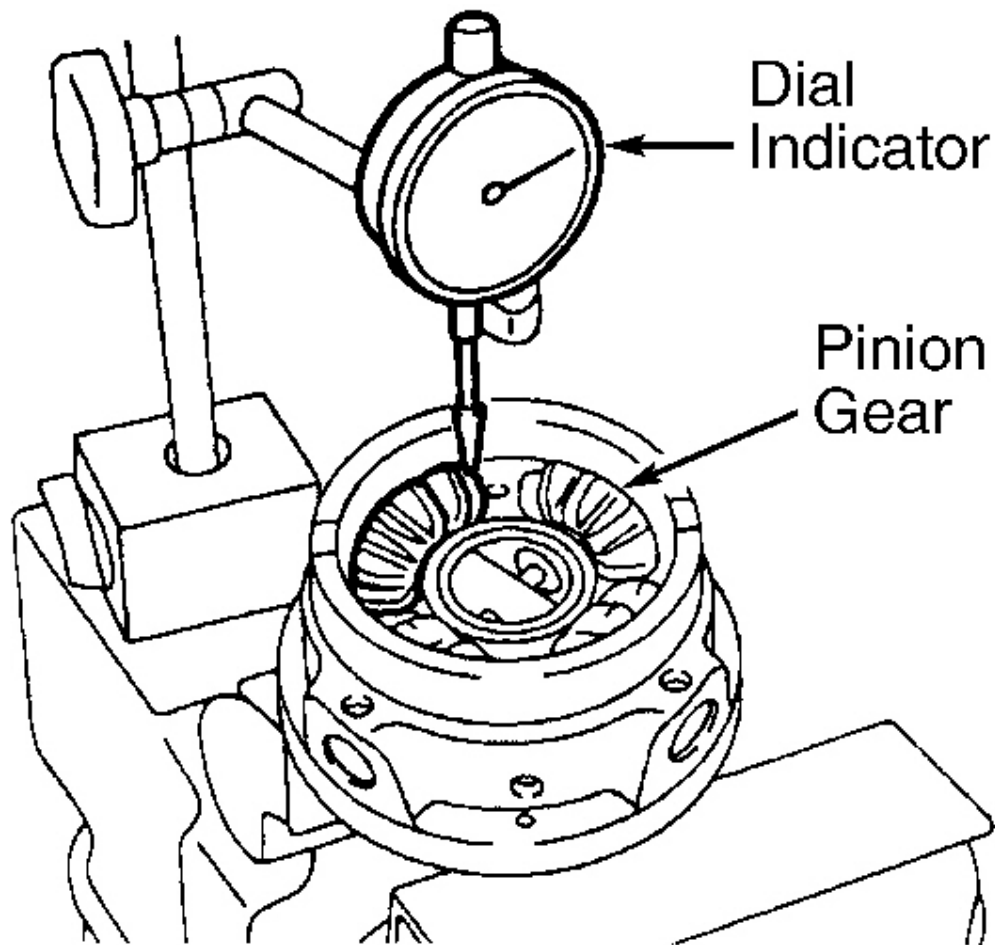
## Cleaning & Inspection (U140F)

Clean all parts with solvent. Dry with compressed air. Check bearings, races and gears for wear or damage. Replace as necessary.

## Reassembly (U140F)

**NOTE:** Coat all sliding and rotating surfaces with ATF prior to reassembly.

1. Using appropriate race installer and a hammer, install transaxle housing bearing race. Install plate washer of lesser thickness than washer removed during disassembly into transaxle case. Using appropriate race installer and a hammer, install transaxle case bearing race. See **Fig. 65**.
2. Coat front differential side gear thrust washer, front differential side gear, front differential pinion shaft holder, 4 front differential pinion thrust washers and 4 front differential pinion gears with ATF, and install components into front differential case. Install 3 pinion shafts into front differential case. See **Fig. 65**.
3. Mount front differential case in soft-jawed vise. DO NOT damage surface of front differential case which contacts vise. Using a dial indicator, measure front differential pinion gear backlash while holding front differential side gear toward front differential case. See **Fig. 66**.
4. Backlash should be .002-.008" (.05-.20 mm). If backlash is not within specification, select appropriate thrust washer to ensure backlash is within specification. Thrust washers are marked in alphabetical order from "A" to "K" (except "I"), and are available in thicknesses from .037" (.95 mm) to .055" (1.40 mm) in increments of .002"(.05 mm).

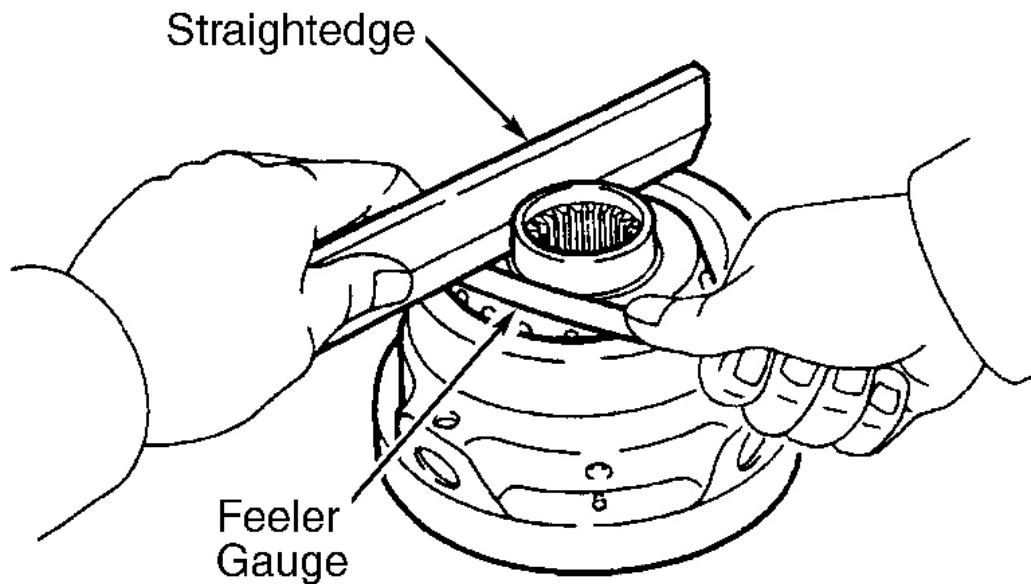


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**Fig. 66: Measuring Front Differential Pinion Gear Backlash (U140F)****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

5. Engage side gear to front differential case. Install left side differential case to front differential case. Ensure side gear is centered. Once side gear is centered, remove left side differential case.
6. Using a straightedge and feeler gauge, measure clearance between front differential case and side gear. See **Fig. 67**. Use the following formula to determine correct thrust washer thickness for specified clearance: thrust washer thickness equals clearance (feeler gauge thickness) minus .006-.010" (.16-.26 mm).
7. Thrust washers are marked in alphabetical order from "A" to "K" (except "I"), and are available in

thicknesses from .037" (.95 mm) to .055" (1.40 mm) in increments of .002" (.05 mm). If clearance is not as specified, ensure components were assembled correctly.

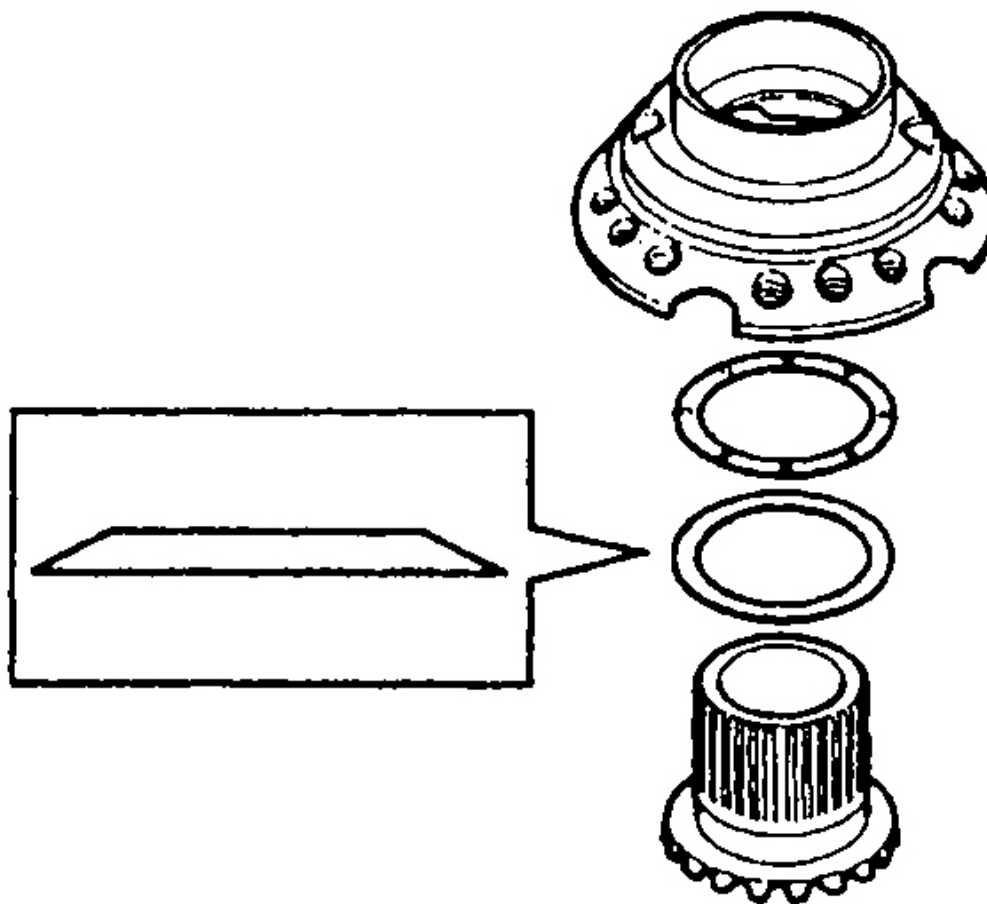


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**Fig. 67: Measuring Front Differential Case-To-Side Gear Clearance (U140F)**

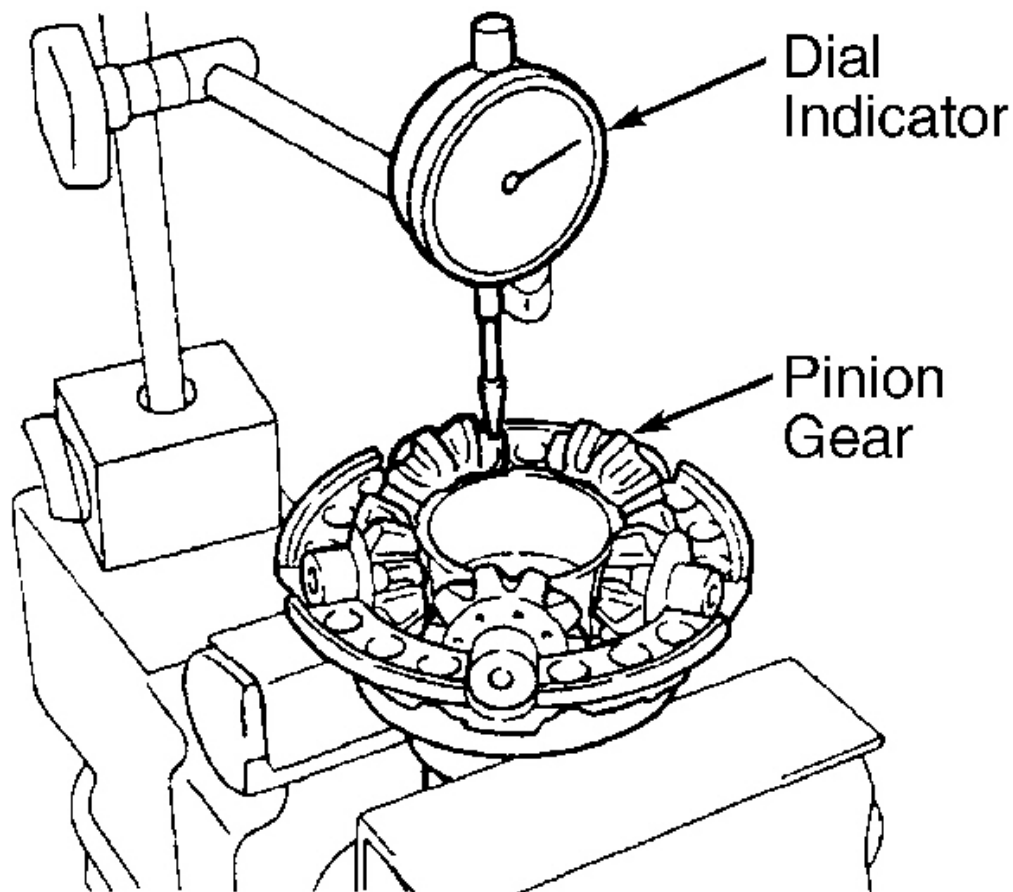
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

8. Using a pin punch and a hammer, install 3 pinion shaft pins. Install snap ring on front differential case. Install center differential side gear thrust washer No. 1, conical spring and center differential side gear to right side differential case. Install conical spring with correct side facing right side differential case. See **Fig. 68**.
9. Mount right side differential case in soft-jawed vise. Install 5 center differential pinion gears, 5 thrust washers and center differential pinion spider onto right side differential case. Using dial indicator, measure center differential pinion gear backlash, while holding center differential side gear toward case. See **Fig. 69**.
10. Backlash should be .002-.008" (.05-.20 mm). If backlash is not within specification, select appropriate thrust washer to ensure backlash is within specification. Thrust washers are marked in alphabetical order from "MA" to "MN" (except "MI"), and are available in thicknesses from .032" (.80 mm) to .055" (1.40 mm) in increments of .002" (.05 mm).



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**Fig. 68: Installing Conical Spring To Right Side Differential Case (U140F)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



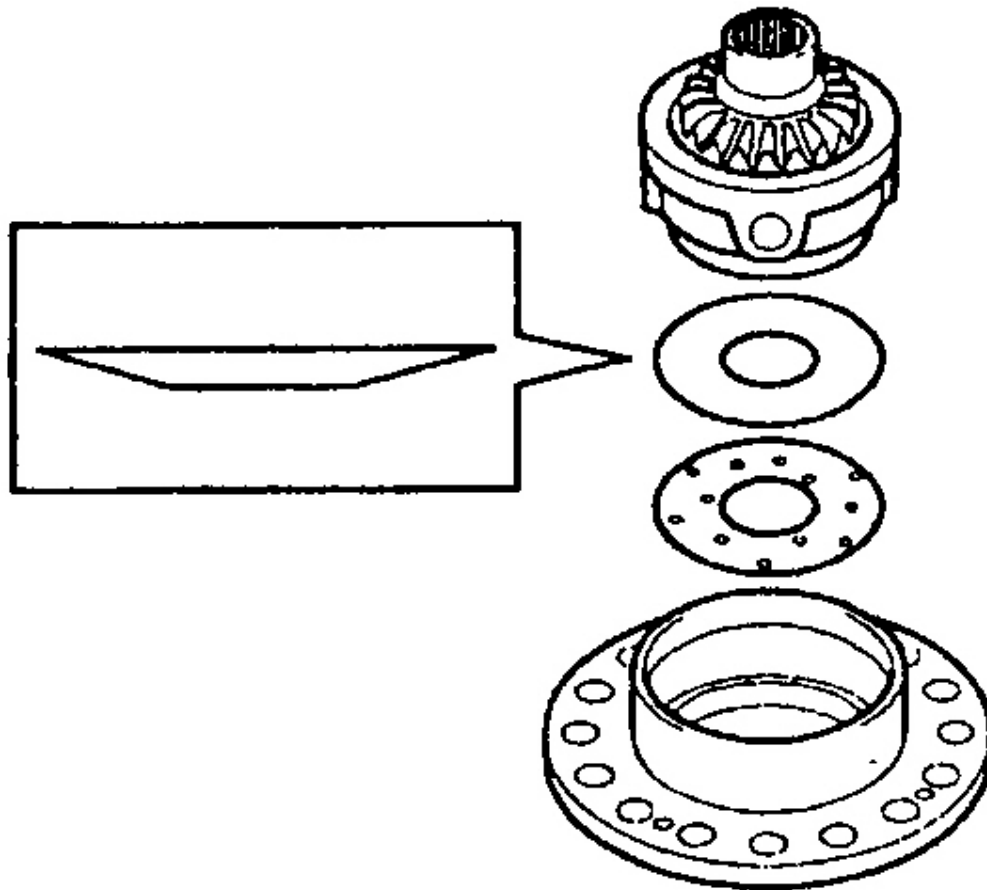
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**Fig. 69: Measuring Center Differential Pinion Gear Backlash (U140F)****Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.**

11. Temporarily install center differential side gear thrust washer No. 2, conical spring, front differential side gear thrust washer, front differential side gear and front differential case into left side differential case. Install conical spring with correct side facing toward left side differential case. See **Fig. 70**. Temporarily install differential intermediate case and 4 bolts to left side differential case.
12. Install center differential pinion spider, center differential pinion gears and thrust washers onto differential intermediate case. Using dial indicator, measure front differential side gear backlash while holding front differential case on left side differential case. See **Fig. 71**.
13. Turn front differential side gear to seat gears and ensure maximum backlash value. Backlash should be .002-.008" (.05-.20 mm). If backlash is not within specification, select appropriate thrust washer to ensure backlash is within specification.

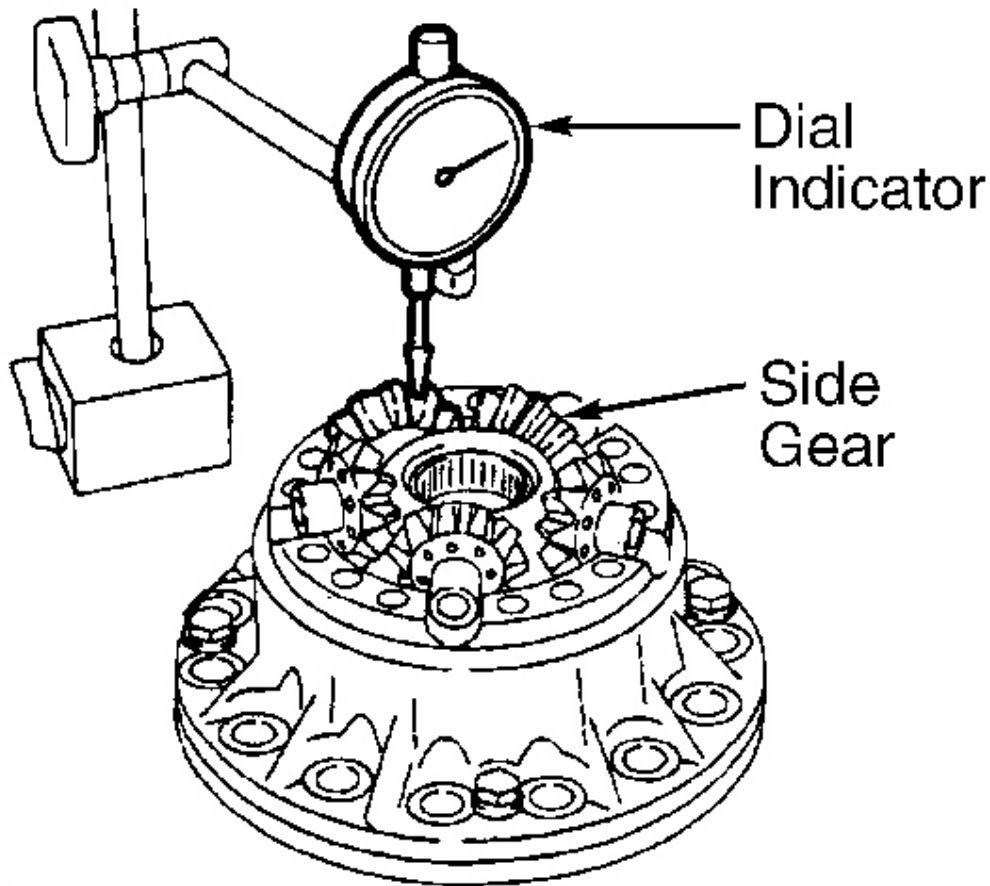


14. Thrust washers are marked in alphabetical order from "MA" to "MN" (except "MI"), and are available in thicknesses from .032" (.80 mm) to .055" (1.40 mm) in increments of .002" (.05 mm).



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**Fig. 70: Installing Conical Spring To Left Side Differential Case (U140F)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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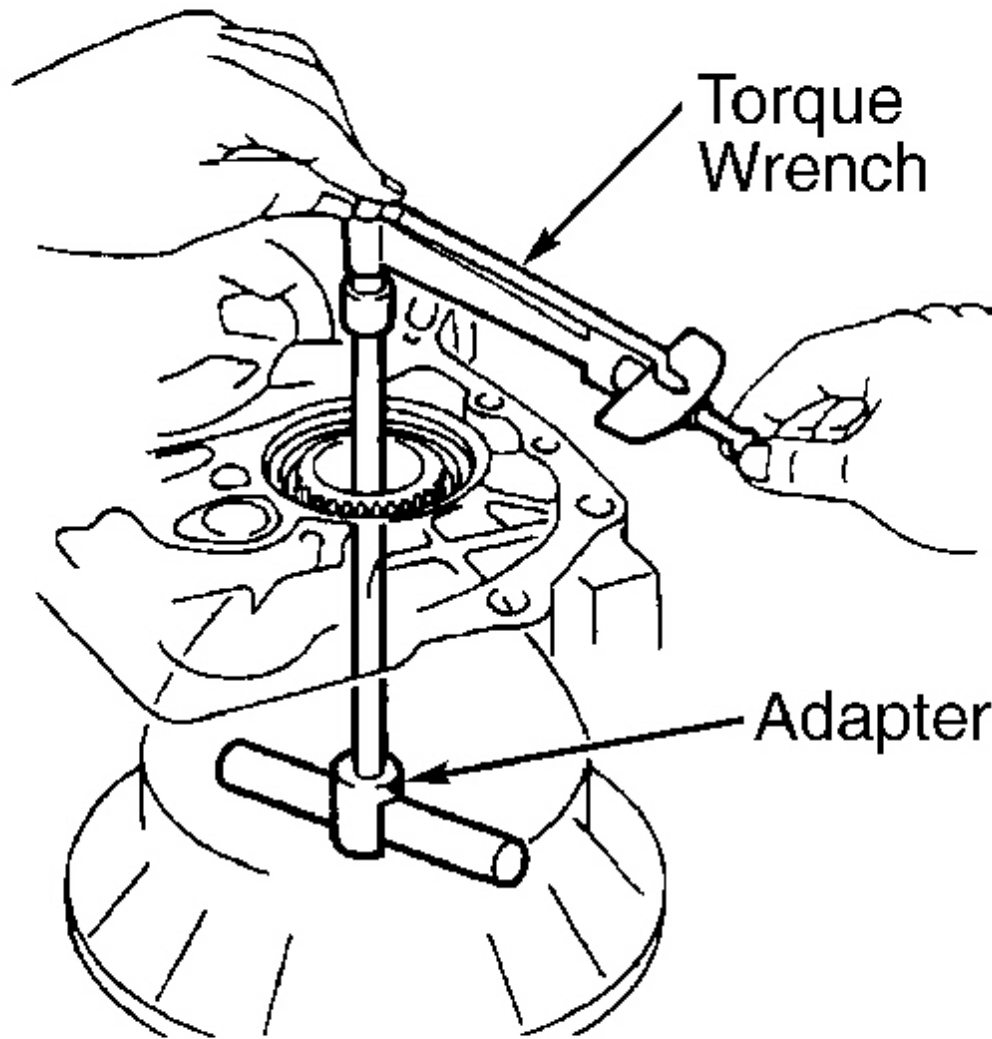
**Fig. 71: Measuring Front Differential Side Gear Backlash (U140F)**

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

15. Remove 4 bolts and differential intermediate case from left side differential case. Remove front differential case from left side differential case. Install selected center differential side gear thrust washer No. 2, conical spring, front differential side gear thrust washer, and front differential side gear to left side differential case.
16. Install front differential case into left side differential case. Using mark made during disassembly procedure, align and install right side differential case to differential intermediate case. Install 15 bolts. Using appropriate Torx socket, tighten bolts to 46 ft. lbs. (63 N.m). Install left side differential case and 4 bolts to differential intermediate case.
17. Using appropriate adapter and press, install differential case tapered roller bearings. Remove any material from transaxle housing and transaxle case mating surfaces. DO NOT allow oil to contact surfaces. Install differential assembly into transaxle case. Install transaxle housing onto transaxle case. Install 5 lower

bolts inside transaxle housing and tighten to 16 ft. lbs. (22 N.m). Install all other bolts and tighten to 21 ft. lbs. (29 N.m). Ensure bolts are in correct locations. Longest bolts go inside transaxle housing. See **Fig. 21**.

18. Temporarily install transfer case intermediate shaft. Turn intermediate shaft right and left several times to allow bearings to seat. Remove intermediate shaft. Using appropriate adapter and INCH-lb. torque wrench, measure differential preload. See **Fig. 72**. Preload should be 1.8-6.1 INCH lbs. (.20-.69 N.m) for new bearings and .9-3.1 INCH lbs. (.10-.35 N.m) for used bearings.
19. If preload is not within specification, remove 16 transaxle housing bolts. Using a plastic hammer, remove transaxle housing from transaxle case. Remove differential assembly from transaxle case and replace plate washer behind transaxle case bearing race. See **Fig. 65**.
20. Plate washers are marked in numeric and alphabetic order and are available in thicknesses from .079" (2.00 mm), marked with a zero, to .096" (2.45 mm), marked with the number "9", and from .098" (2.50 mm), marked with the letter "A", to .112" (2.85 mm), marked with the letter "H". Washers increase in increments of .002" (.05 mm). Recheck preload after washer replacement.



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**Fig. 72: Measuring Differential Preload (U140F)**

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

21. Clean contact surface of differential case and ring gear using cleaning solvent. Heat ring gear to 212°F (100°C) in water. DO NOT heat ring gear above 230°F (110°C).
22. Carefully remove ring gear from water and quickly align match marks made during disassembly. Install ring gear on differential case. Install but DO NOT tighten 8 ring gear bolts, in pairs of 2, in a crisscross pattern. Ensure ring gear is properly seated and aligned. Install remaining 8 ring gear bolts and tighten all

bolts to 70 ft. lbs. (95 N.m). Install NEW oil seal in transaxle case. Coat oil seal lip with lubricant.

23. For transaxle housing oil seal, wrap vinyl tape around seal installer at a position .236" (6.00 mm) above bottom end of installer, until thickness of tape is about .197" (5.00 mm). Coat NEW oil seal lip with lubricant. Install oil seal until wound vinyl tape contacts transaxle housing. Oil seal installed depth should be .22-.26" (5.5-6.5 mm).

## TRANSAXLE 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 cutouts of drum. Check thrust bearings and races for wear or damage. Use petroleum jelly to secure parts in place. Clutch discs should be soaked in ATF for at least 15 minutes before installation.

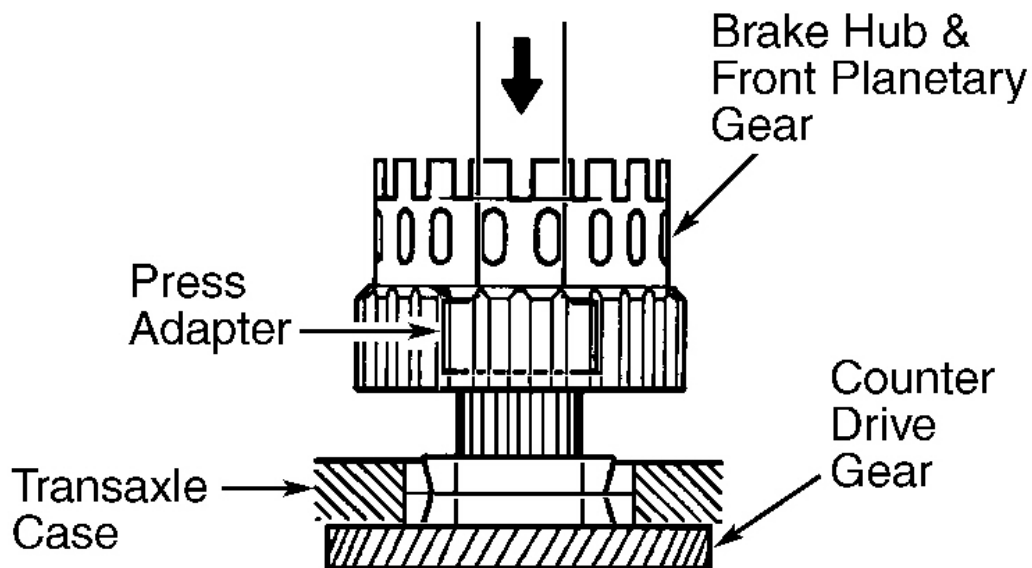
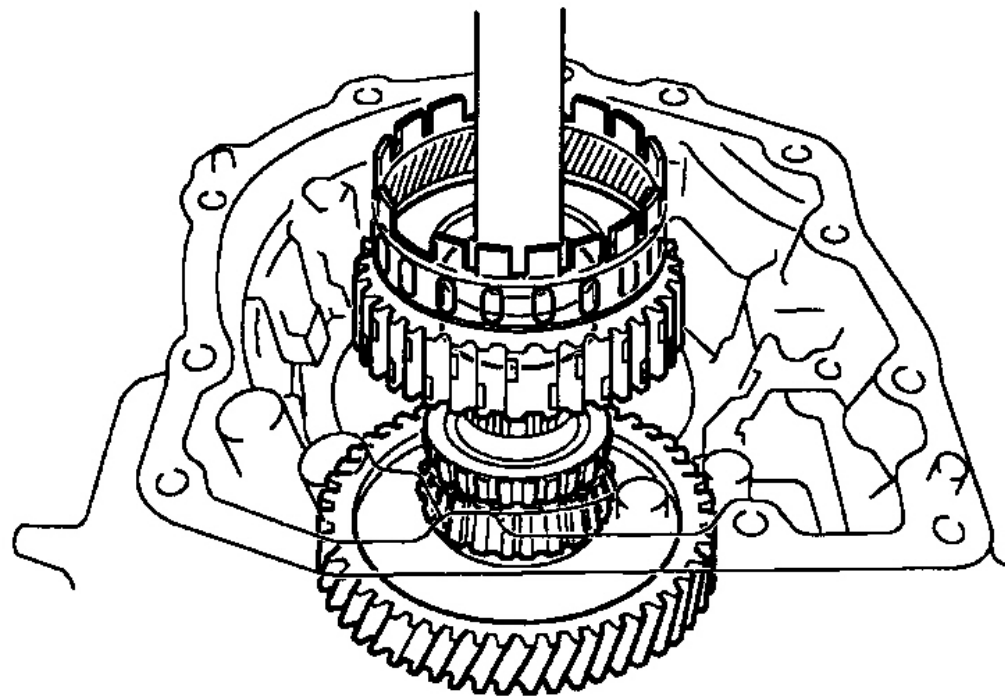
**NOTE:** Refer to illustration for thrust bearing and race locations. See **Fig. 93**. For component dimensions, see **THRUST BEARING & RACE SPECIFICATIONS table**.

1. Install oil deflector (if equipped) with 3 bolts to transaxle housing. Install apply pipe and clamp. See **Fig. 10**. Install bolt and tighten to 87 INCH lbs. (9.8 N.m). Ensure pipe is installed to stopper. Install oil seal ring to transaxle housing. See **Fig. 33**. Using appropriate adapter and press, install underdrive cylindrical roller bearing into transaxle housing. DO NOT apply excessive pressure to bearing.
2. Using vernier calipers, measure underdrive brake piston return spring free length with spring mounted to spring seat. Free length should be .553" (14.04 mm). Replace springs as necessary. Install 2 oil seal rings to transaxle case. See **Fig. 34**.
3. For needle roller bearing installation, wrap vinyl tape around bearing installer at a position .157" (4.00 mm) above bottom end of installer, until thickness of tape is about .197" (5.00 mm). Using bearing installer and press, install needle roller bearing to transaxle case until wound vinyl tape contacts transaxle case.
4. Coat 2 NEW "O" rings with ATF and install on underdrive brake piston. See **Fig. 24**. Using hand pressure, install piston into transaxle case. Using appropriate adapter and press, compress underdrive brake piston return springs into transaxle case and install snap ring. DO NOT apply excessive force.
5. Install counter drive gear snap ring into transaxle case. Using appropriate bearing race adapter and press, install 2 bearing outer races into transaxle case. Press each outer race into transaxle case until race contacts snap ring. See **Fig. 23**. Using appropriate adapter and press, install tapered roller bearing to counter drive gear until bearing contacts gear. DO NOT apply excessive force.
6. Using appropriate adapter and press, install counter drive gear and bearing into transaxle case. DO NOT apply excessive pressure. Using vernier calipers, measure 1st/reverse brake piston return spring free length with spring mounted to spring seat. Free length should be .611" (15.51 mm). Replace springs as necessary.

**NOTE:** In the following step, stop press when piston return spring seat is lowered .039-.079" (1.00-2.00 mm) from snap ring groove. This prevents spring seat from becoming deformed. DO NOT expand snap ring

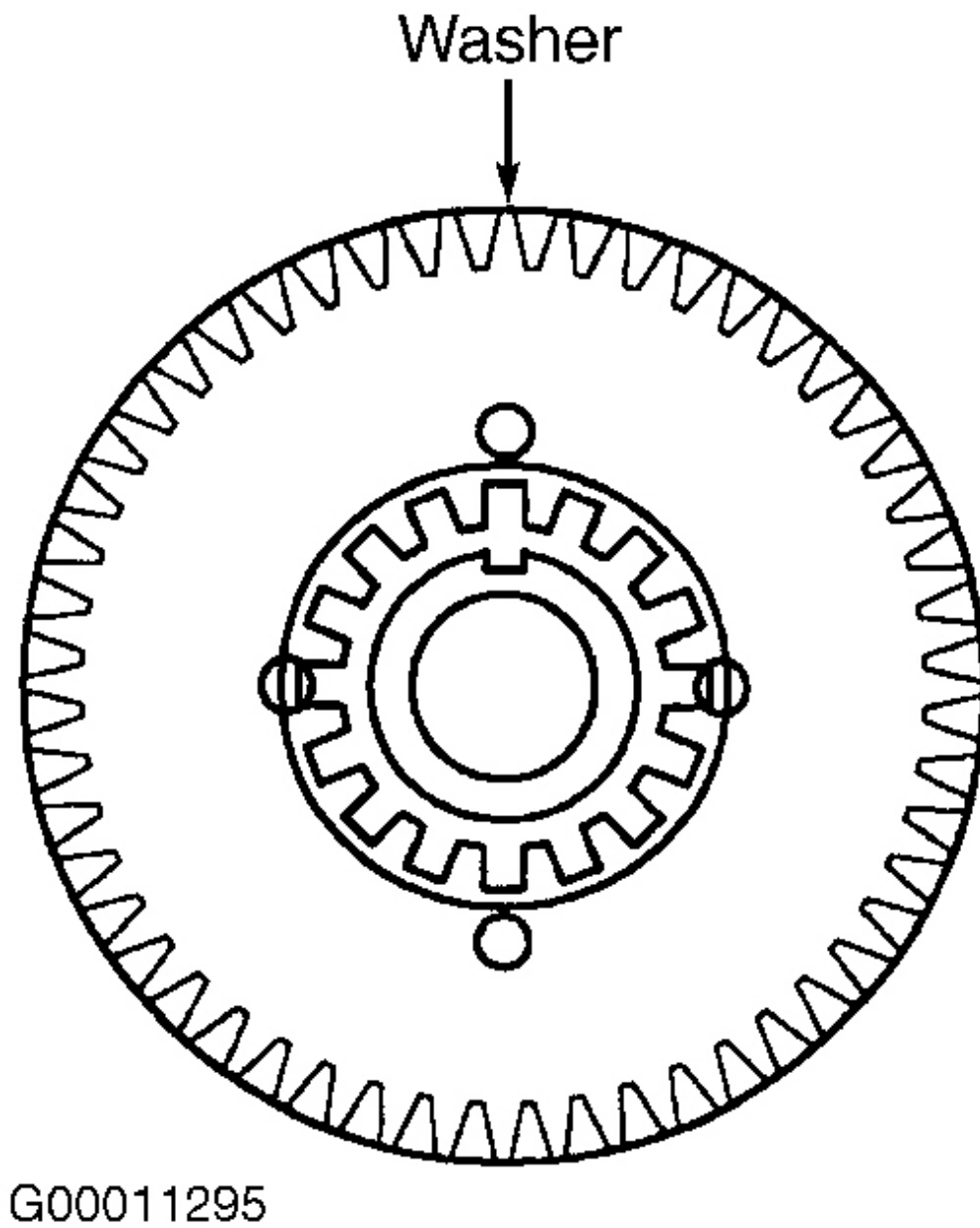
**excessively.**

7. Coat 2 NEW "O" rings with ATF and install on 1st/reverse brake piston. Using hand pressure, install piston into transaxle case. See **Fig. 23**. Using appropriate adapter and press, compress 1st/reverse brake piston return springs into transaxle case and install snap ring. DO NOT apply excessive force.
8. Install front planetary ring gear and snap ring to brake hub. Install front planetary gear to brake hub. Using appropriate adapter and press, install brake hub with front planetary gear into transaxle case. See **Fig. 73**. Install washer on counter drive gear in correct direction. See **Fig. 74**.
9. Using holding tool, socket and torque wrench, install nut and tighten to 207 ft. lbs. (280 N.m). Using socket, adapter and INCH-lb. torque wrench, measure counter drive gear tapered roller bearing starting torque. Starting torque should be 4.4-8.7 INCH lbs. (.5-1.0 N.m) for new bearings and 2.7-4.4 INCH lbs. (.3-.5 N.m) for used bearings. See **Fig. 75**. If starting torque is not within specification, gradually tighten nut until starting torque is within specification.
10. Install 2 thrust bearings, bearing race and front planetary sun gear to front planetary gear. Coat bearing race with ATF and install race to rear planetary gear. Install thrust washer No. 2. Install rear planetary gear into transaxle case. Install snap ring.



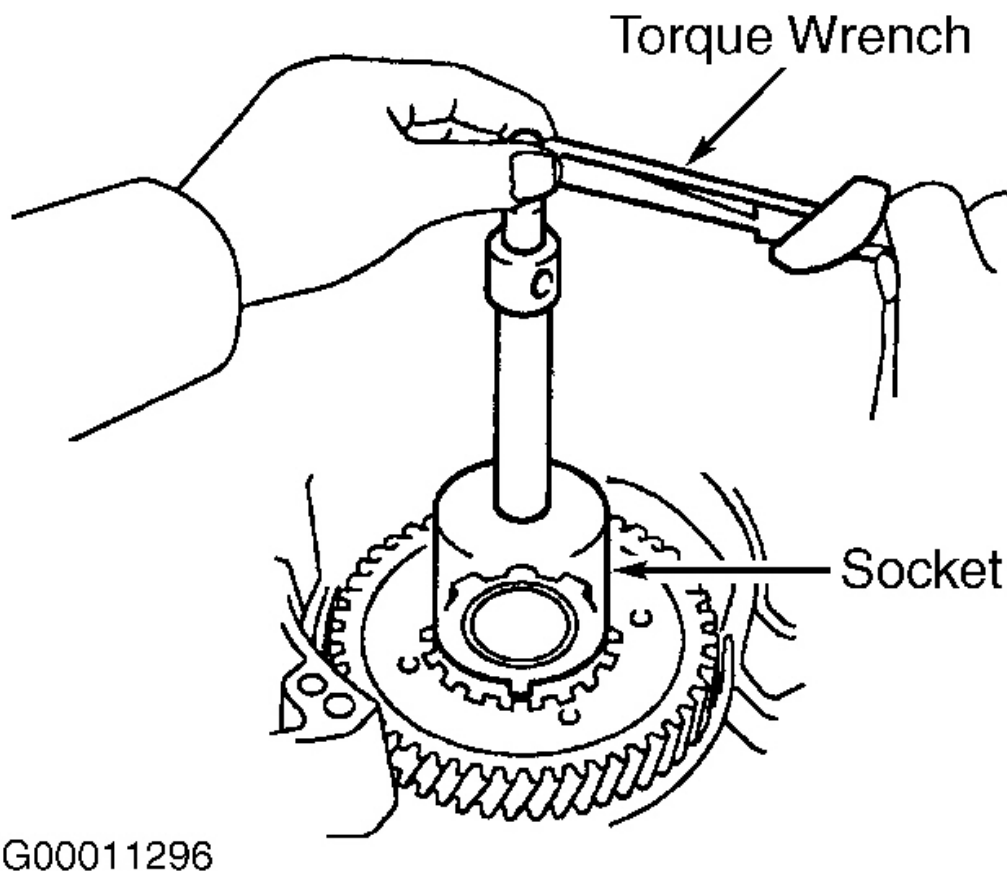
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**Fig. 73: Installing Front Planetary Gear With Brake Hub Into Transaxle Case**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 74: Installing Counter Drive Gear Washer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.





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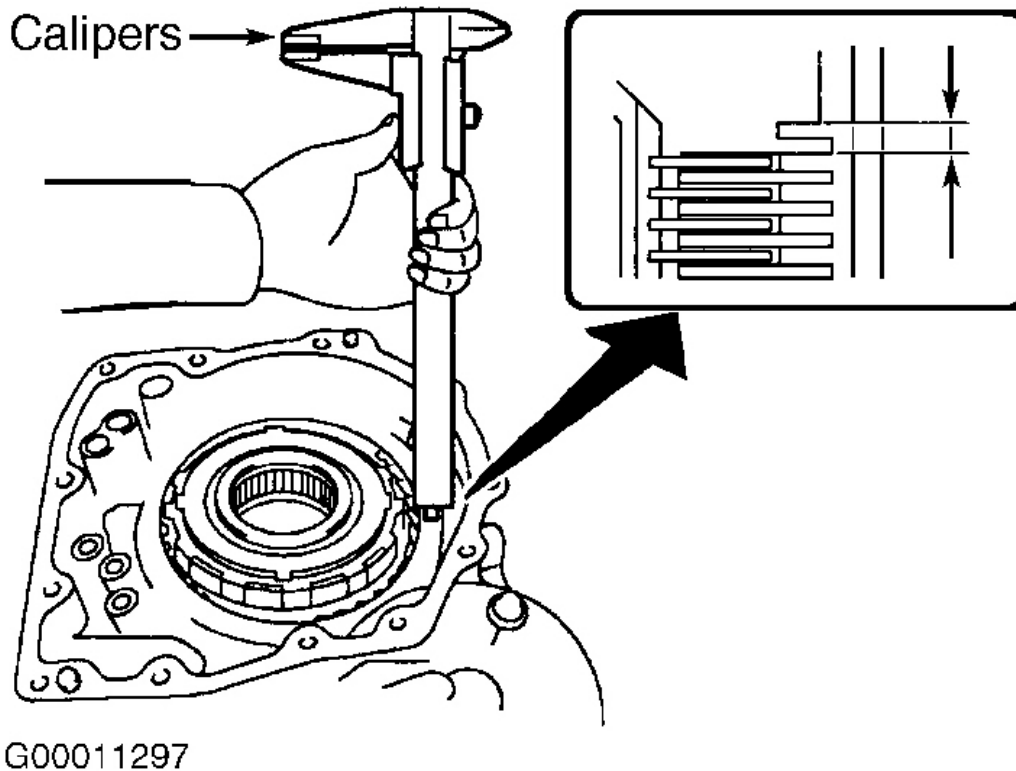
**Fig. 75: Measuring Counter Drive Gear Bearing Starting Torque**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. Install 1st/reverse brake. Install appropriate number of plates and discs, starting with a plate and alternating with a disc. See **CLUTCH DISC & PLATE QUANTITY** table under TRANSAXLE SPECIFICATIONS. DO NOT install flange. Measure 1st/reverse brake piston stroke. Using vernier calipers, measure distance between disc surface and contact surface of 2nd brake assembly at transaxle case. See **Fig. 76**.
12. For piston stroke specification, see **1ST/REVERSE BRAKE PISTON STROKE SPECIFICATIONS** table. Select appropriate flange to ensure piston stroke is within specification. Flanges are marked in numeric order and are available in thicknesses from .071" (1.80 mm), marked with the number "1", to .098" (2.50 mm), marked with the number "8", in increments of .004" (.10 mm). Recheck piston stroke after flange is installed.

#### 1ST/REVERSE BRAKE PISTON STROKE SPECIFICATIONS

| Application | In. (mm) |
|-------------|----------|
|             |          |

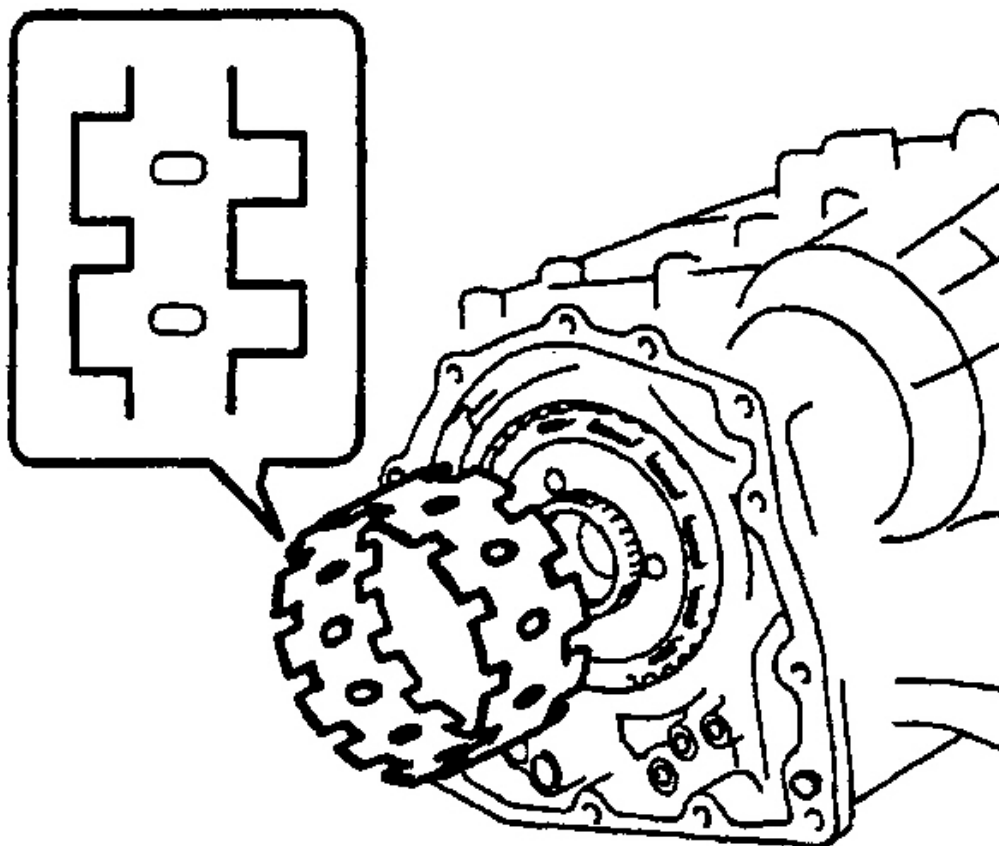
|            |                       |
|------------|-----------------------|
| 4-Cylinder | .040-.048 (1.02-1.21) |
| V6         | .043-.051 (1.10-1.29) |



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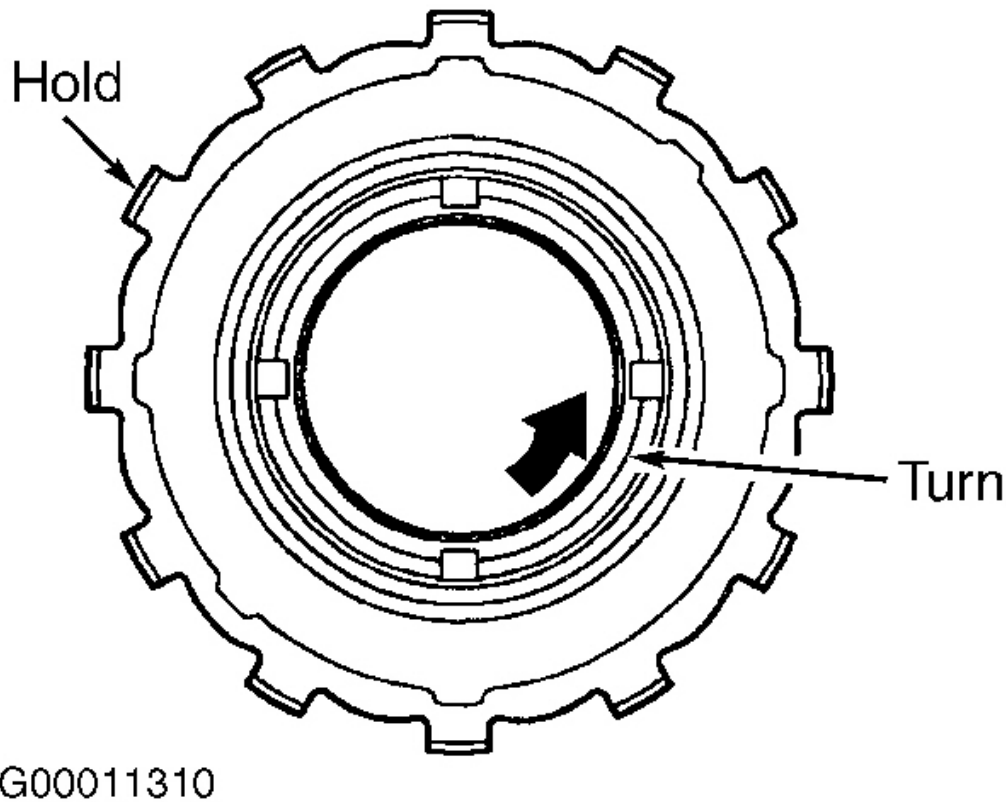
**Fig. 76: Measuring 1st/Reverse Brake Piston Stroke**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. Install 2nd brake assembly into transaxle case. Install snap ring and measure inside diameter. Snap ring inside diameter should be more than 6.57" (167.0 mm). Snap ring has a specific tapered installation direction. If inside diameter is not within specification, ensure snap ring is installed in correct direction. If snap ring is installed correctly, replace snap ring.
14. Install one-way clutch outer sleeve to 2nd brake assembly. Ensure sleeve is positioned correctly. See **Fig. 77**. Install one-way clutch inner race to No. 1 one-way clutch. Ensure inner race is installed correctly. Check No. 1 one-way clutch operating direction. One-way clutch should rotate in counterclockwise direction and lock in clockwise direction. See **Fig. 78**.



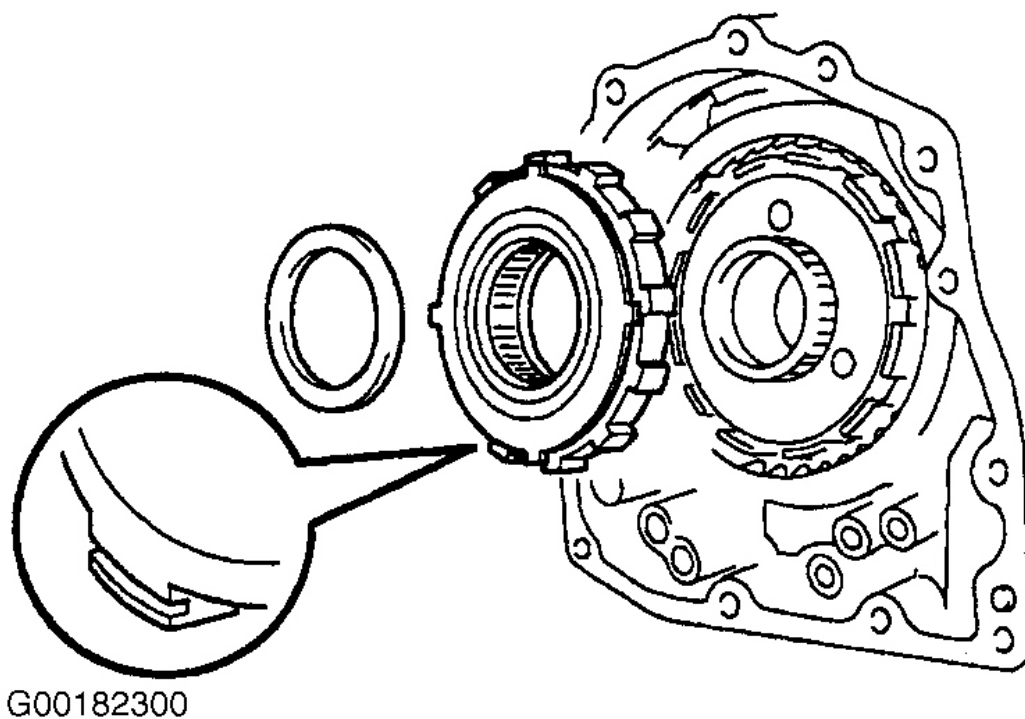
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**Fig. 77: Installing Sleeve Into 2nd Brake**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

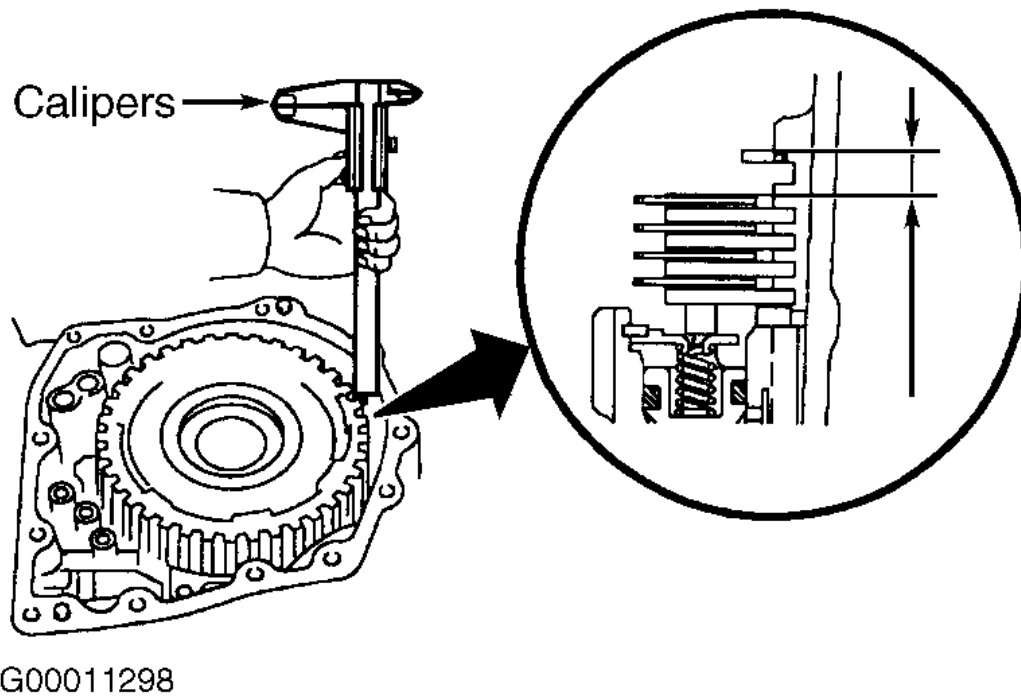


**Fig. 78: Checking No. 1 One-Way Clutch Rotation**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

15. Install No. 1 one-way clutch and thrust bearing into outer sleeve. See **Fig. 79**. Ensure no colored race on thrust bearing is visible upon installation. Coat thrust washer No. 1 with petroleum jelly and install on rear planetary sun gear. Coat thrust bearing with petroleum jelly and install on rear planetary sun gear. Install rear planetary sun gear onto rear planetary gear.
16. Install 2nd brake. Install appropriate number of discs and plates, starting with a plate and alternating with a disc. See **CLUTCH DISC & PLATE QUANTITY** table under TRANSAXLE SPECIFICATIONS. DO NOT install flange at this time. Temporarily install snap ring. Using vernier calipers, measure 2nd brake piston stroke between disc surface and snap ring surface. See **Fig. 80**. Piston stroke should be .024-.036" (.62-.91 mm).



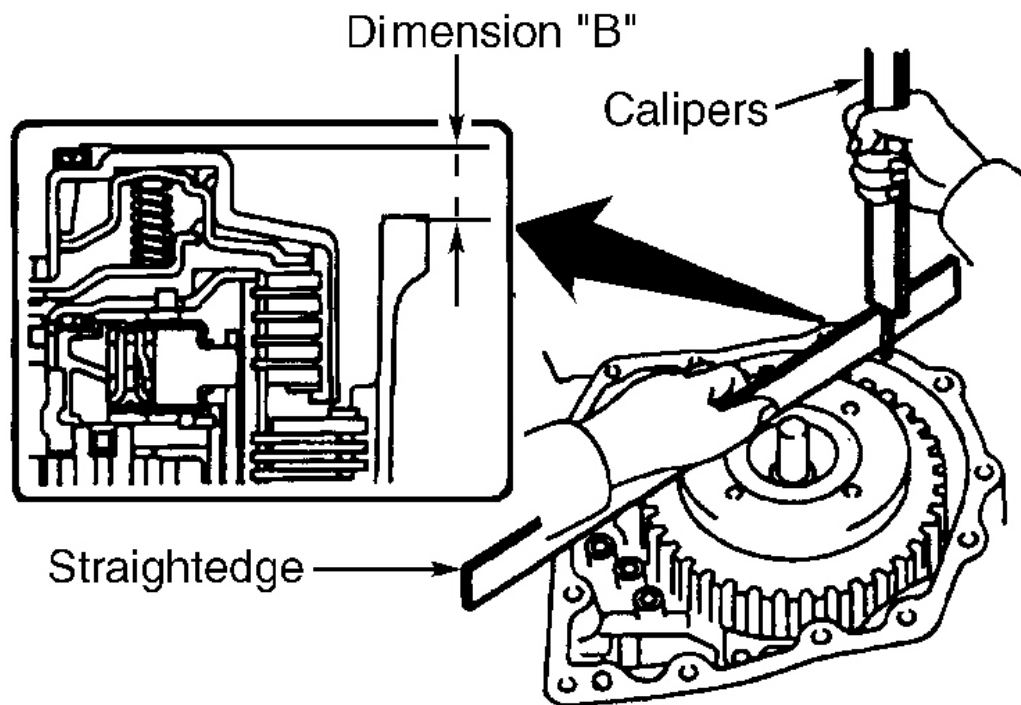
**Fig. 79: Installing No. 1 One-Way Clutch & Bearing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



**Fig. 80: Measuring 2nd Brake Piston Stroke**

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

17. Select appropriate flange to ensure piston stroke is within specification. Use the following formula to determine flange thickness: measured distance, minus flange thickness, minus snap ring thickness of .063" (1.60 mm). Flanges are available in thicknesses from .118" (3.00 mm) to .142" (3.60 mm) in increments of .004" (.10 mm), and are marked in numeric order from "1" to "7". Remove snap ring, install appropriate flange and reinstall snap ring. Ensure snap ring end gap is visible through groove in transaxle case.
18. Install bearing race over shaft and onto direct clutch. Install direct clutch assembly and thrust bearing onto rear planetary sun gear assembly. See **Fig. 23**. Ensure discs in direct clutch completely mate with rear planetary sun gear to ensure rear cover can be installed correctly.
19. Ensure transaxle case and rear cover mating surfaces are clean. Place a straightedge onto direct clutch drum. Using vernier calipers, measure distance between bottom of straightedge and transaxle case (dimension "B"). See **Fig. 81**.

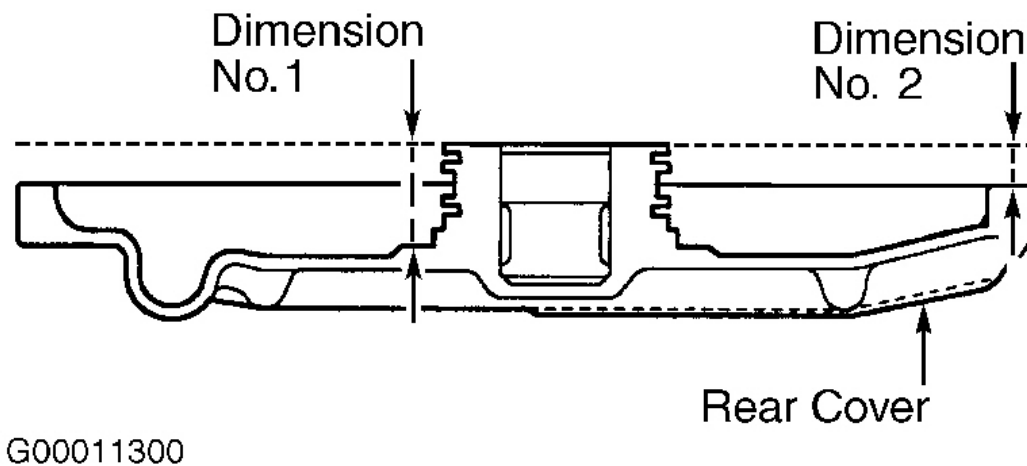


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**Fig. 81: Measuring Direct Clutch End Play (Dimension "B")**

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

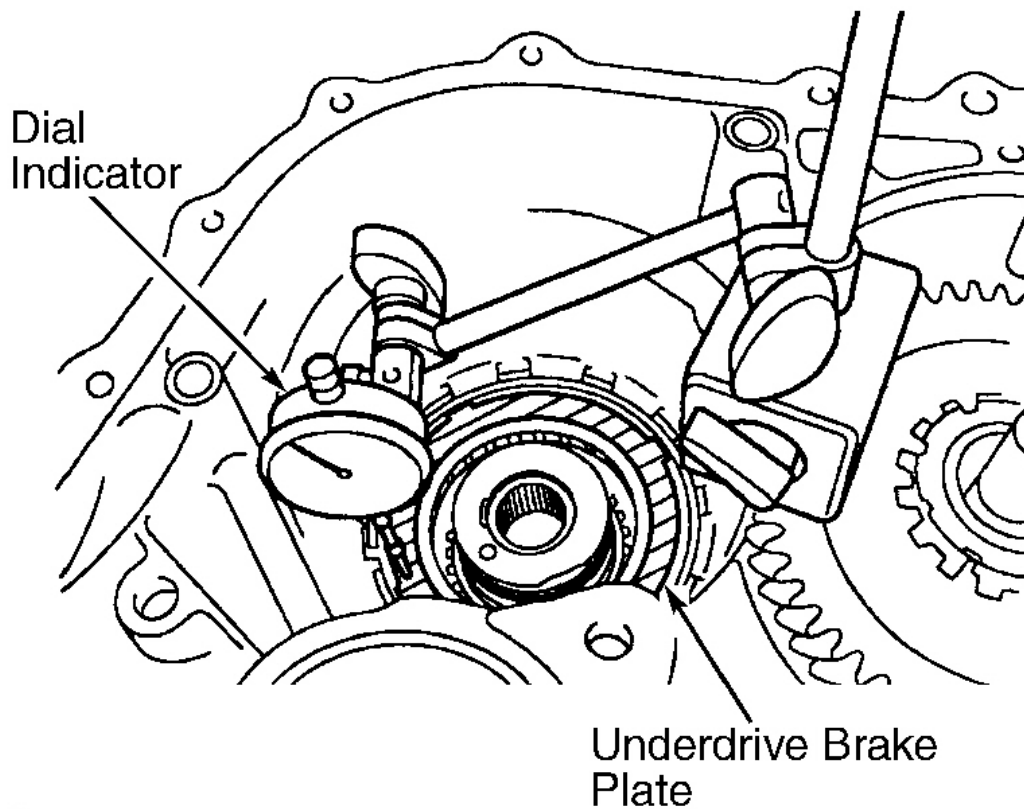
20. Measure dimension No. 1 and dimension No. 2 of rear cover in 2 places. See **Fig. 82**. Subtract dimension No. 2 from dimension No. 1. This total equals dimension "C". Calculate direct clutch end play by subtracting dimension "B" from dimension "C". End play should be .008-.037" (.20-.94 mm).
21. Select a thrust bearing to ensure end play is within specification. Thrust bearings are available in 2 thicknesses of .140" (3.55 mm) with an outside diameter of 2.74" (69.6 mm), and .152" (3.85 mm) with an outside diameter of 2.76" (70.18 mm). Inside diameter of both thrust bearings is 2.11" (53.6 mm). During installation, ensure colored race side of thrust bearing is facing direct clutch.



**Fig. 82: Measuring Distance Between Rear Cover Surfaces (Dimensions No. 1 & 2)**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

22. Install 2 NEW apply gaskets to transaxle case. Install clamp to apply pipes prior to installing pipes to transaxle case. This will prevent apply pipes from being deformed or damaged. Install 2 apply pipes, clamp and bolt. See **Fig. 24**. Ensure pipes are securely inserted into transaxle case until they reach the pipe stopper on pipe. Tighten bolt to 48 INCH lbs. (5.4 N.m).
23. Install NEW "O" rings to 2 transaxle case plugs. Install case plugs and tighten to 65 INCH lbs. (7.4 N.m). See **Fig. 25**. Install needle roller bearing onto transaxle rear cover with inscribed mark on bearing facing up. Using appropriate adapter and press, install needle roller bearing to transaxle rear cover. Press bearing in to a depth of .474-.502" (12.05-12.75 mm).
24. Apply thread sealant to transaxle rear cover plate screws. Install cover plate and screws. Tighten screws to 66 INCH lbs. (7.5 N.m). See **Fig. 26**. Coat 2 oil seal rings with ATF and install on transaxle rear cover. See **Fig. 23**.
25. Install underdrive brake. Install appropriate number of discs and plates, starting with a plate and alternating with a disc. See **CLUTCH DISC & PLATE QUANTITY** table under TRANSAXLE SPECIFICATIONS. DO NOT install flange at this time. Temporarily install snap ring. Using a dial indicator, measure underdrive brake piston stroke by applying and releasing 57 psi (4 kg/cm<sub>2</sub>) of compressed air to transaxle case. See **Fig. 32** and **Fig. 83**.
26. Piston stroke should be .071-.087" (1.81-2.20 mm). Select appropriate flange to ensure piston stroke is within specification. Flanges are available in 3 thicknesses of .118" (3.00 mm), .126" (3.20 mm) and .134" (3.40 mm), and are marked in numeric order from "1" to "3". Remove snap ring, install appropriate flange and reinstall snap ring.

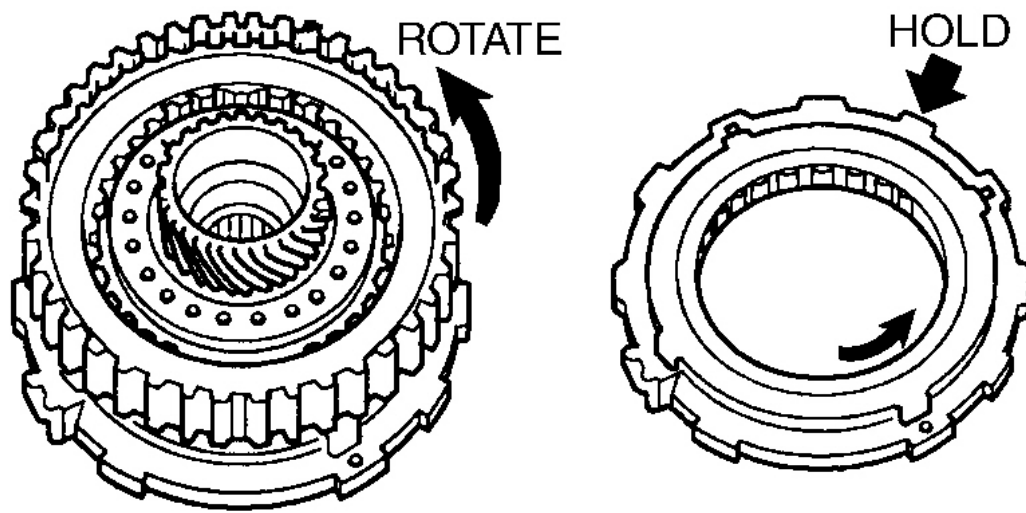




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**Fig. 83: Measuring Underdrive Brake Piston Stroke**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

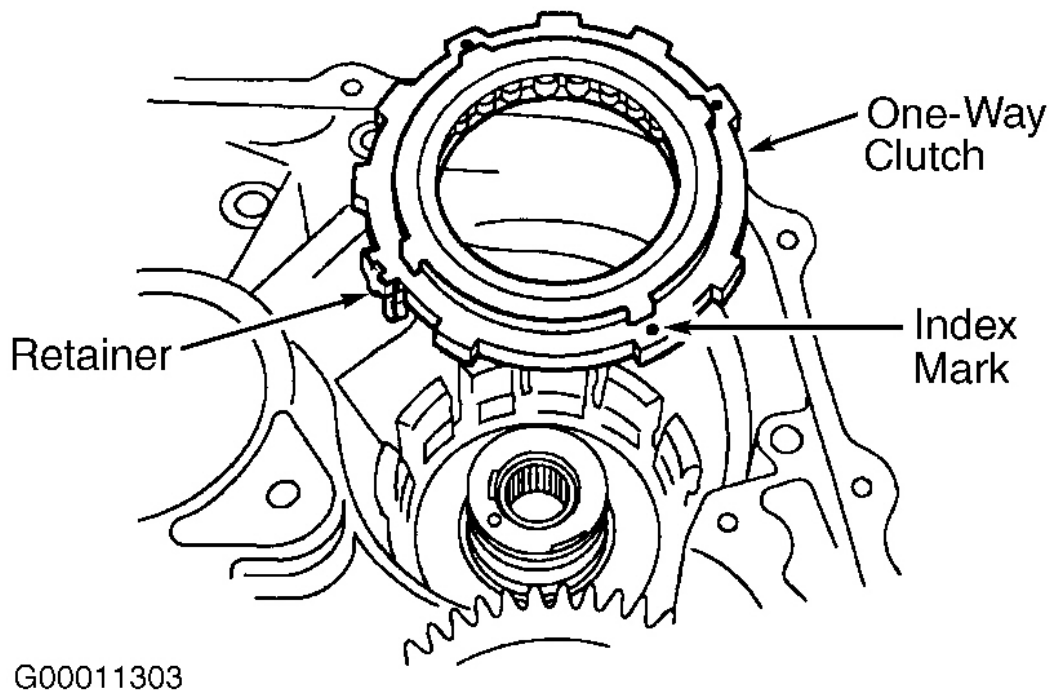
27. Ensure transaxle case and rear cover surfaces are clean. DO NOT allow oil to contact surfaces. Coat needle roller bearing with ATF. Apply Three Bond (1281) or equivalent gasket sealant to rear cover around inside edges of bolt holes. Install rear cover onto transaxle case. Apply thread sealant to 3 lower left bolts and tighten to 14 ft. lbs. (19 N.m). Install 8 remaining bolts and tighten to 18 ft. lbs. (24 N.m).
28. Install outer race retainer to No. 2 one-way clutch, ensuring long finger of retainer is facing up. See **Fig. 28**. Install underdrive clutch to No. 2 one-way clutch. Rotate underdrive clutch to ensure correct installation. Underdrive clutch should rotate in a counterclockwise direction, and lock in a clockwise direction. See **Fig. 84**.



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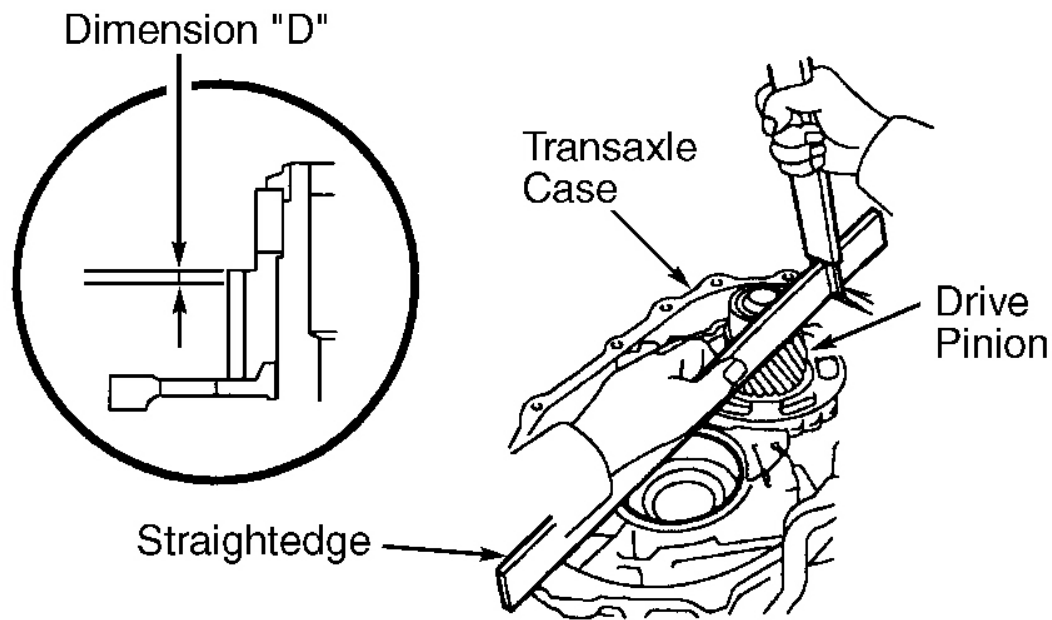
**Fig. 84: Checking Underdrive Clutch Assembly Rotation**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

29. Install No. 2 one-way clutch into transaxle case. Note position of index marks on No. 2 one-way clutch. Ensure marks are facing up. See **Fig. 85**. Install snap ring into transaxle case. Coat thrust bearing and bearing race with petroleum jelly and install onto underdrive clutch. Install underdrive clutch into transaxle case.



**Fig. 85: Installing No. 2 One-Way Clutch & Retainer**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

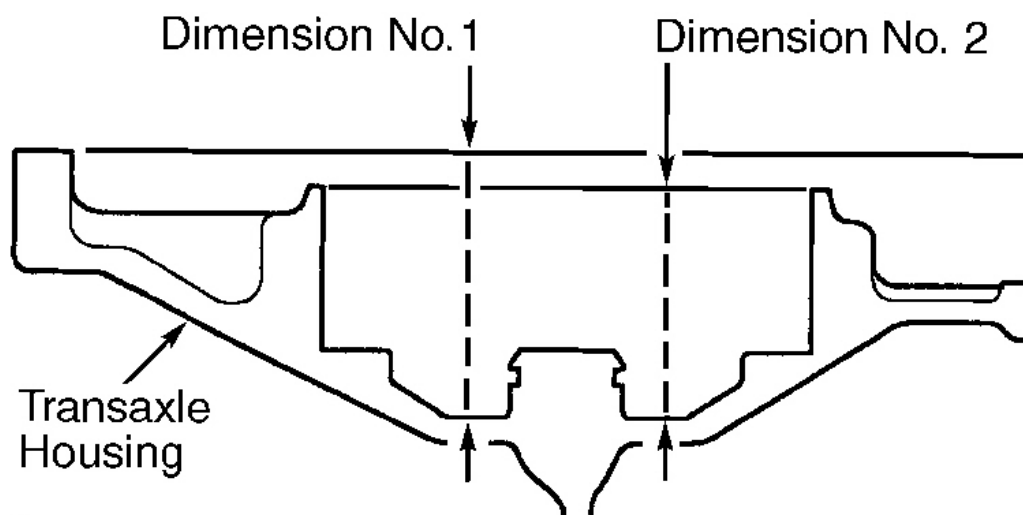
30. Install pawl pin and spring to parking lock pawl. Temporarily install parking lock pawl, shaft and spring to transaxle case. See **Fig. 24**. Install underdrive planetary gear assembly into transaxle case. Engage all clutch discs and hub spline of planetary gear assembly firmly and securely. Install parking lock pawl shaft. Install lock pawl clamp and bolt. Tighten bolt to 87 INCH lbs. (9.8 N.m).
31. Using vernier calipers and a straightedge, measure gap between top of differential drive pinion in underdrive planetary gear, and contact surface of transaxle case. See **Fig. 86**. Record measurement as dimension "D".
32. Measure dimension No. 1 and dimension No. 2 of transaxle housing in 2 places. See **Fig. 87**. Subtract dimension No. 2 from dimension No. 1. Record measurement as dimension "E". Install bearing race onto counter drive gear in correct direction. See **Fig. 23**.



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**Fig. 86: Measuring Gap Between Top Of Differential Drive Pinion & Transaxle Case (Dimension "D")**

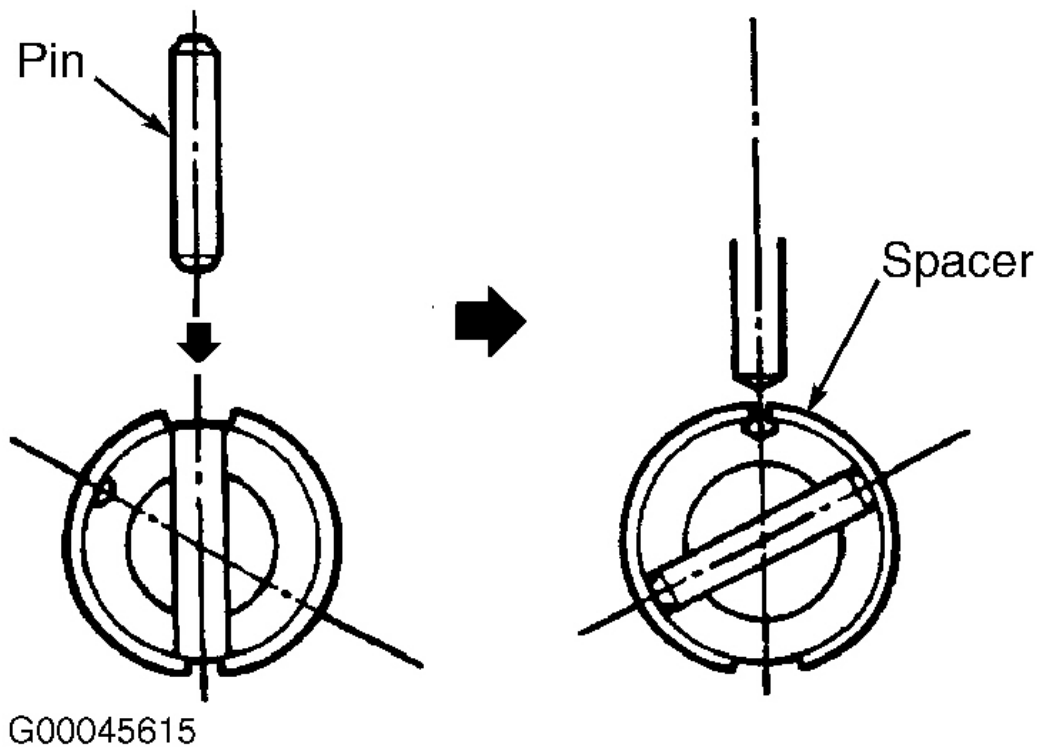
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00011305

**Fig. 87: Measuring Distance Between Transaxle Housing Surfaces (Dimensions No. 1 & 2)**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

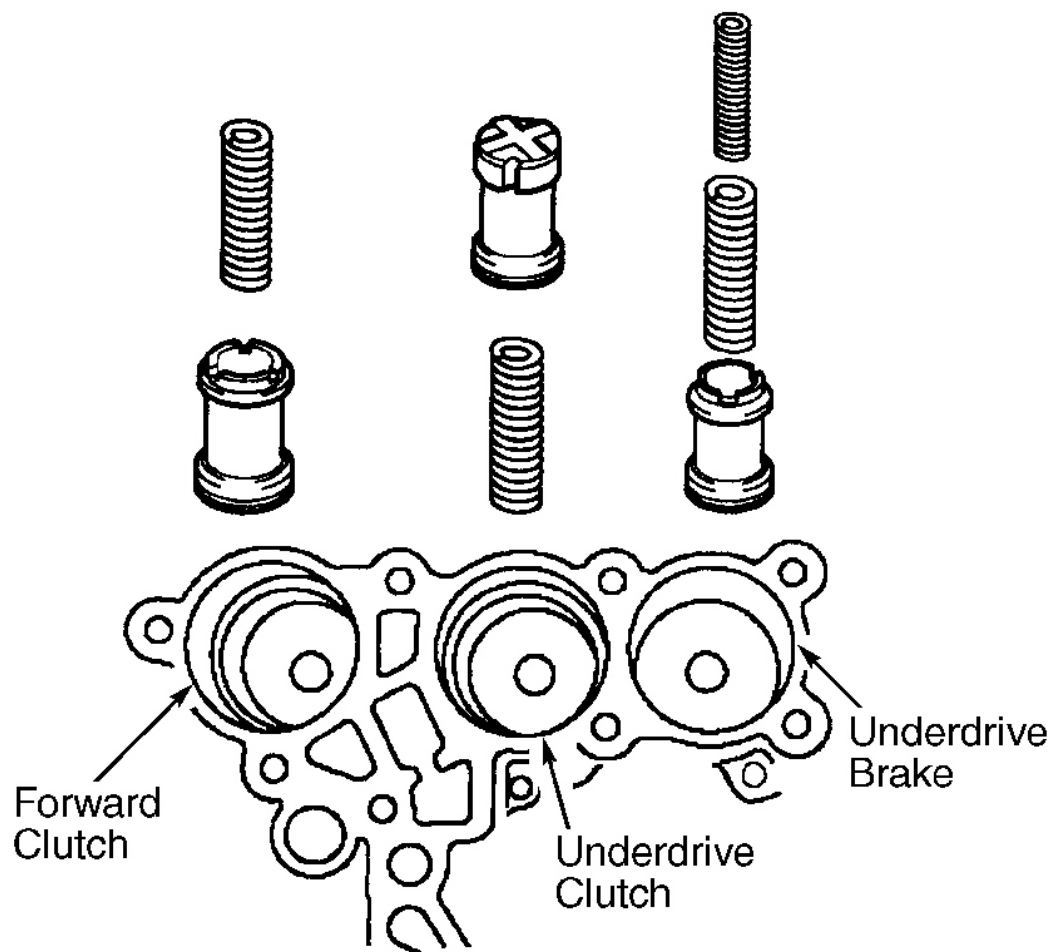
33. Coat needle roller bearing with petroleum jelly and install onto multiple clutch hub (shaft side). Install multiple clutch hub into transaxle case. Install thrust bearing onto multiple clutch hub (forward clutch side). Install forward clutch onto multiple clutch hub. See **Fig. 23**. Align splines of all discs of forward clutch with multiple clutch hub. Install thrust bearing onto forward clutch. Ensure Black side of thrust bearing is visible.
34. Install 2 NEW apply gaskets to front of transaxle case. See **Fig. 22**. Install differential assembly. Calculate transaxle housing-to-underdrive planetary gear assembly end play using the following formula: subtract dimension "D" from dimension "E", performed in steps 31 and 32, minus thrust bearing thickness of .129" (3.28 mm), equals bearing race thickness. End play should be .020-.039" (.50-.99 mm).
35. Select a bearing race to ensure end play is within specification. If dimension "E" minus dimension "D" is less than .301" (7.64 mm), bearing race thickness should be .138" (3.50 mm). If dimension "E" minus dimension "D" is .301" (7.64 mm) or more, bearing race thickness should be .150" (3.80 mm).
36. Install appropriate bearing race onto underdrive planetary gear assembly to ensure end play is within specification. Bearing race outside diameter is 3.268" (83.00 mm). Bearing race inside diameter is 2.220" (56.40 mm). Install appropriate thrust bearing onto bearing race. Thrust bearing outside diameter is 3.345" (84.96 mm). Thrust bearing inside diameter is 2.252" (57.20 mm).
37. Coat oil pump "O" ring with ATF. Install oil pump and 7 bolts. Tighten bolts to 16 ft. lbs. (22 N.m). Ensure transaxle case and transaxle housing surfaces are clean. DO NOT allow oil to contact surfaces. Apply Three Bond (1281) or equivalent gasket sealant about .047" (1.20 mm) wide, to transaxle case around inside edges of bolt holes. Install transaxle housing to transaxle case.
38. Install 16 transaxle housing bolts. Apply thread sealant to 5 lower bolts inside transaxle housing, and tighten these bolts to 16 ft. lbs. (22 N.m) within 10 minutes of installation. Tighten all other bolts to 21 ft. lbs. (29 N.m). Ensure bolts are in correct locations. Longest bolts go inside transaxle housing. See **Fig. 21**.
39. Inspect input shaft end play. Using a dial indicator, measure input shaft end play. See **Fig. 20**. End play should be .010-.049" (.26-1.25 mm). Recheck differential preload. Using appropriate adapter and INCH-lb. torque wrench, measure differential preload. See **Fig. 72**. Preload should be 1.8-6.1 INCH lbs. (.20-.69 N.m) for new bearings and .9-3.1 INCH lbs. (.10-.35 N.m) for used bearings.
40. If preload is not within specification, remove differential assembly from transaxle case and replace shim or plate washer behind transaxle case bearing race. See **Fig. 62** and **Fig. 65**.
41. Place transaxle on 2 blocks of wood, with oil pan surface facing outward. Coat NEW manual valve lever shaft oil seal with ATF. Install oil seal into transaxle case. Install parking lock pawl rod to manual valve lever. Install NEW spacer and manual valve lever shaft into transaxle case. See **Fig. 10**.
42. Using a pin punch and hammer, drive in NEW roll pin. Turn spacer and lever shaft to align small hole for locating staking position in spacer with position mark on lever shaft. See **Fig. 88**. Using a pin punch and hammer, stake spacer through small hole. Ensure spacer does not turn.



**Fig. 88: Staking Spacer To Manual Valve Lever Shaft**

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

43. Using needle nose pliers, install retainer spring. Install parking lock pawl bracket. Install bolts and tighten to 15 ft. lbs. (20 N.m). Install cover, manual detent spring and 2 bolts. Ensure cover and detent spring are installed correctly. See **Fig. 10**.
44. Tighten 1.063" (27.00 mm) bottom bolt to 15 ft. lbs. (20 N.m). Tighten .630" (16.00 mm) top bolt to 106 INCH lbs. (12 N.m). Coat NEW "O" rings with ATF and install them onto accumulator pistons. Coat 4 springs and 3 accumulator pistons with ATF, and install components into transaxle case holes. See **Fig. 89**. See **ACCUMULATOR SPRING FREE LENGTH SPECIFICATIONS** table for spring specifications and identification.



G00011306

**Fig. 89: Identifying Accumulator Piston & Spring Locations**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

#### ACCUMULATOR SPRING FREE LENGTH SPECIFICATIONS

| Application (Color)  | Free Length - In. (mm) | Outer Diameter - In. (mm) |
|----------------------|------------------------|---------------------------|
| Forward Clutch       |                        |                           |
| 4-Cylinder (Pink)    | 3.210 (81.53)          | .728 (18.50)              |
| V6 (Red)             | 3.564 (90.53)          | .728 (18.50)              |
| Underdrive Brake     |                        |                           |
| 4-Cylinder           |                        |                           |
| Inner (Yellow/Green) | 2.372 (60.24)          | .626 (15.90)              |
| Outer (Blue)         | 2.937 (74.61)          | .854 (21.70)              |

## 2001 Toyota Highlander

2001-05 AUTOMATIC TRANSMISSIONS U140E & U140F Overhaul

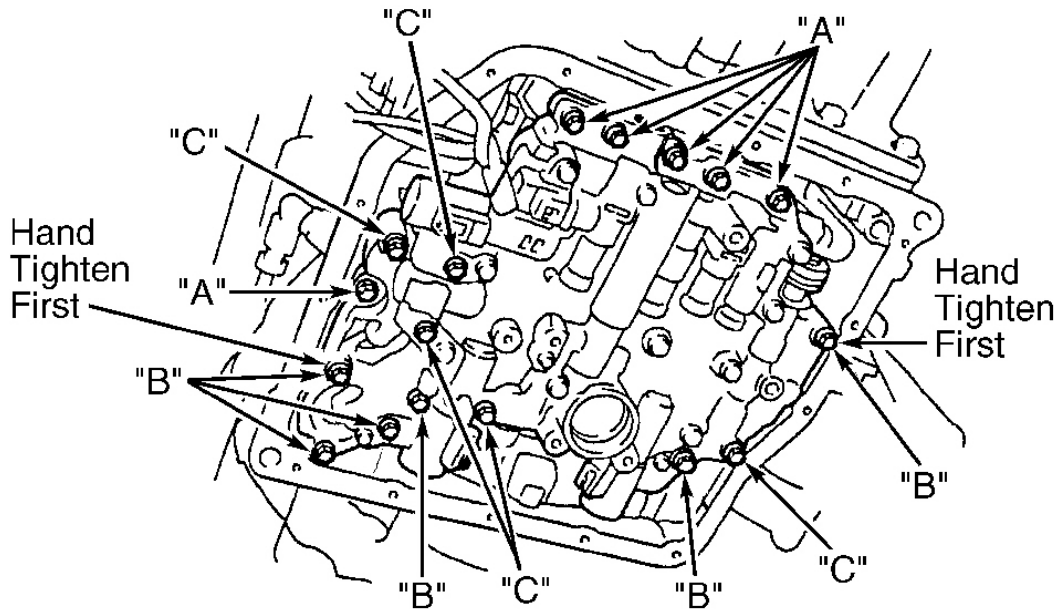
| V6                        |               |              |
|---------------------------|---------------|--------------|
| Inner (Green)             | 2.372 (60.24) | .626 (15.90) |
| Outer (Blue)              | 2.937 (74.61) | .854 (21.70) |
| Underdrive Clutch (White) | 3.563 (90.49) | .756 (19.20) |

45. Install check ball body and spring. See **Fig. 15**. Coat NEW "O" ring with ATF and install on transaxle solenoid connector. Install connector into transaxle case, above park/neutral position switch, and tighten bolt to 48 INCH lbs. (5.4 N.m). Install NEW brake drum gasket, located near apply gaskets. See **Fig. 14**. Coat NEW 2nd brake gasket and governor apply gasket No. 1 with ATF and install them into transaxle case, below valve body assembly. See **Fig. 13**.
46. Align groove in manual valve with pin in manual valve lever. Push valve body assembly against accumulator piston springs and check ball body to assist in installation. Install valve body bolts. Hand tighten 2 bolts temporarily. See **Fig. 90**. These bolts are positioning bolts.
47. Ensure valve body is aligned. Ensure bolts are installed in correct locations. For bolt length, see **VALVE BODY BOLT IDENTIFICATION** table. Tighten bolts to 97 INCH lbs. (11 N.m). Install NEW gasket on oil strainer. Install oil strainer and tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

### VALVE BODY BOLT IDENTIFICATION

| Bolt Identification | Length - In. (mm) |
|---------------------|-------------------|
| A                   | .98 (25)          |
| B                   | 1.61 (41)         |
| C                   | 1.77 (45)         |





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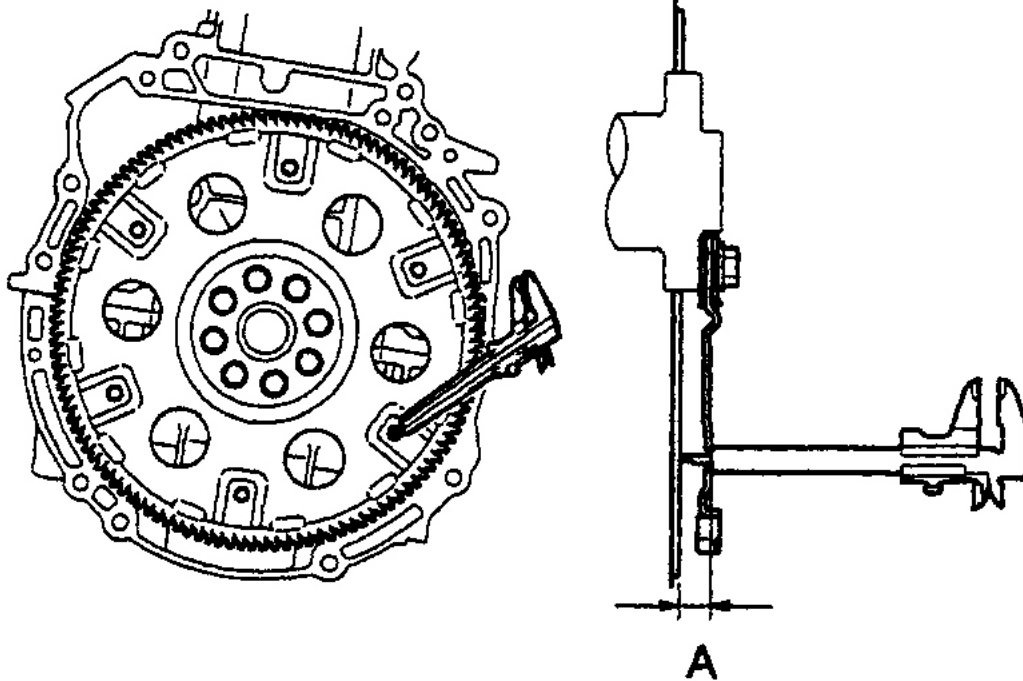
**Fig. 90: Identifying Valve Body Bolt Locations**

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

48. Connect 5 shift solenoid connectors. Install fluid temperature sensor, clamps and bolt. Tighten bolt to 58 INCH lbs. (6.6 N.m). See **Fig. 12**. Install magnets into oil pan in original locations. Apply Three Bond (2430) or equivalent to 18 oil pan bolt threads. Install NEW oil pan gasket, oil pan and bolts. Tighten bolts to 69 INCH lbs. (7.8 N.m) within 10 minutes of installation.
49. Coat NEW "O" rings with ATF and install on speed sensors. Install input turbine and counter gear speed sensors into top of transaxle case. Tighten bolts to 97 INCH lbs. (11 N.m). Install NEW "O" rings on oil line union and elbow. Install oil line union and elbow into transaxle case. Tighten to 20 ft. lbs. (27 N.m). See **Fig. 9**.
50. Coat NEW "O" ring with ATF and install on transaxle test plug. Install transaxle test plug into transaxle case. See **Fig. 11**. Install 3 transaxle case plugs located on opposite side of transaxle case from test plug. Install park/neutral position switch onto manual valve lever shaft and temporarily install 2 adjusting bolts. See **Fig. 10**.
51. Install NEW lock tab and nut. Tighten nut to 61 INCH lbs. (6.9 N.m). Temporarily install control shift lever. Turn lever counterclockwise until it stops, then turn it clockwise 2 notches. Remove control shift lever. Align groove in park/neutral position switch to neutral basic line. Tighten 2 adjusting bolts to 48 INCH lbs. (5.4 N.m). Stake lock tab onto nut. Install control shift lever, washer and nut. Tighten nut to 10 ft. lbs. (13 N.m).
52. On U140F transaxle, remove any debris between transfer case and transaxle case contact surfaces. DO NOT allow oil to contact surfaces. Coat NEW round gasket with petroleum jelly and install onto transfer case.
53. Install intermediate shaft into transfer case assembly. See **Fig. 9**. Apply Three Bond (1281) or equivalent

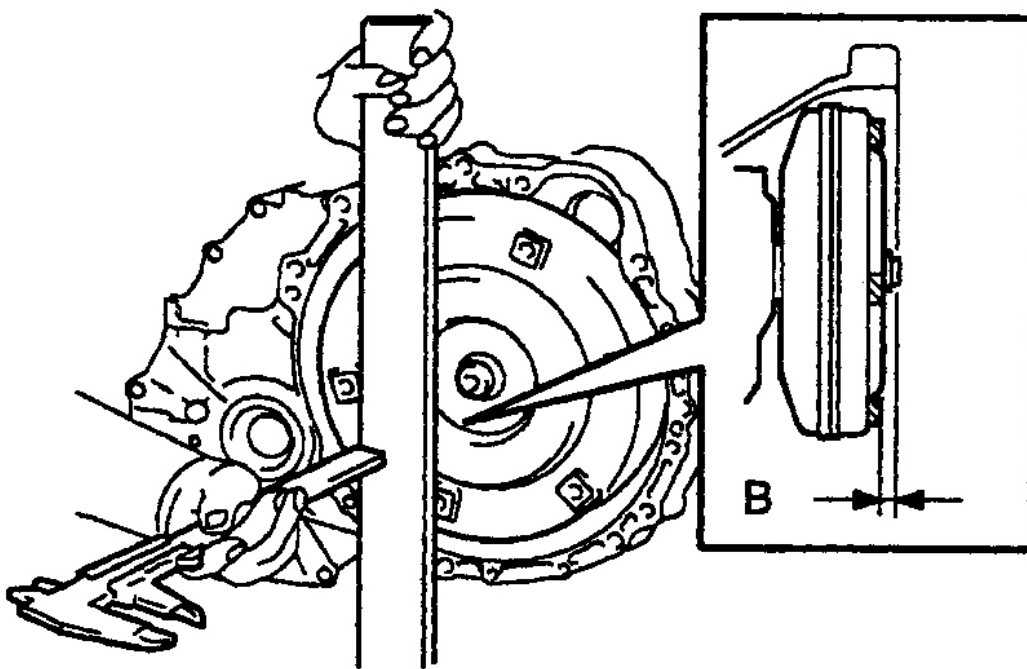
gasket sealant about .047" (1.20 mm) wide, to transfer case contact surface. Install transfer case by pushing straight up and into transaxle. Use care not to damage oil seal lip when installing transfer case. Install 2 bolts and 6 nuts and tighten to 51 ft. lbs. (69 N.m).

54. Install torque converter into transaxle housing while rotating. Ensure converter is properly installed by measuring the following dimensions. Using vernier calipers, measure dimension "A" between transaxle fitting part and converter fitting part of drive plate. See **Fig. 91**. Using vernier calipers and a straightedge, measure dimension "B" as shown in **Fig. 92**. Ensure dimension "B" is greater than dimension "A". Do not add thickness of straightedge. Standard measurement is dimension "A" plus .039" (1.00 mm) or more.



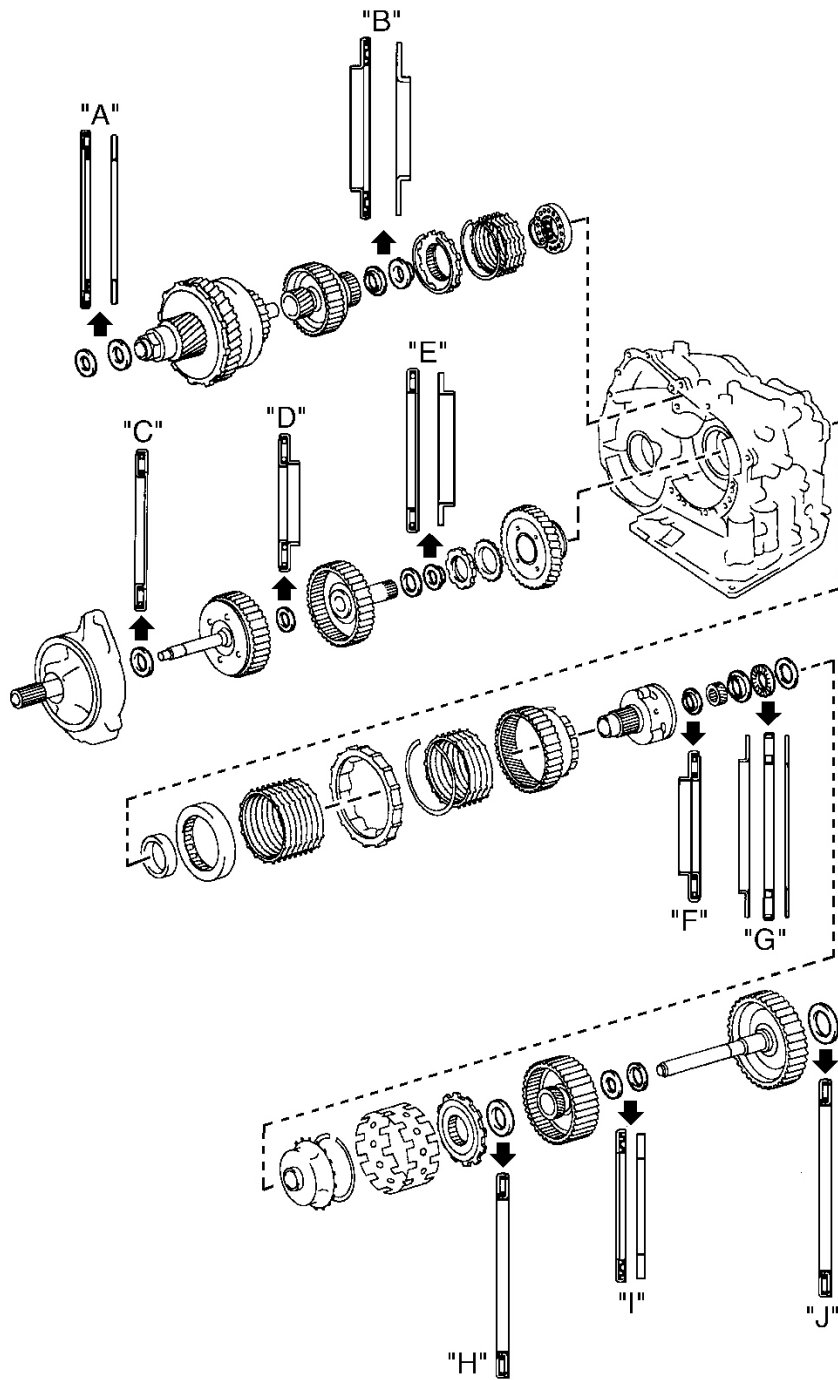
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**Fig. 91: Measuring Dimension "A" Between Transaxle & Drive Plate**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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**Fig. 92: Measuring Dimension "B" Between Torque Converter & Transaxle Housing**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



G00011307

**Fig. 93: Identifying Thrust Bearing & Race Locations**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**THRUST BEARING & RACE SPECIFICATIONS <sup>(1)</sup>**

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| Application                                                             | Inner Diameter - In. (mm) | Outer Diameter - In. (mm)      |
|-------------------------------------------------------------------------|---------------------------|--------------------------------|
| <b>A</b>                                                                |                           |                                |
| Bearing                                                                 | 2.252 (57.20)             | 3.345 (84.96)                  |
| Rear Race                                                               | 2.220 (56.40)             | 3.268 (83.00)                  |
| <b>B</b>                                                                |                           |                                |
| Bearing                                                                 | 1.485 (37.73)             | 2.283 (58.00)                  |
| Rear Race                                                               | 1.177 (29.90)             | 2.185 (55.50)                  |
| <b>C</b>                                                                |                           |                                |
| Bearing                                                                 | 1.333 (33.85)             | 2.055 (52.20)                  |
| <b>D</b>                                                                |                           |                                |
| Bearing                                                                 | .925 (23.50)              | 1.732 (44.00)                  |
| <b>E</b>                                                                |                           |                                |
| Bearing                                                                 | 1.429 (36.30)             | 2.055 (52.20)                  |
| Rear Race                                                               | 1.358 (34.50)             | 1.909 (48.50)                  |
| <b>F</b>                                                                |                           |                                |
| Bearing                                                                 | 1.362 (34.60)             | 2.055 (52.20)                  |
| <b>G</b>                                                                |                           |                                |
| Front Race                                                              | 1.587 (40.30)             | 2.283 (58.00)                  |
| Bearing                                                                 | 1.520 (38.60)             | 2.362 (60.00)                  |
| Rear Race                                                               | 1.520 (38.60)             | 2.283 (58.00)                  |
| <b>H</b>                                                                |                           |                                |
| Bearing                                                                 | 2.110 (53.60)             | 2.740 (69.60)                  |
| <b>I</b>                                                                |                           |                                |
| Bearing                                                                 | 1.331 (33.80)             | 1.898 (48.20)                  |
| Rear Race                                                               | 1.193 (30.30)             | 1.811 (46.00)                  |
| <b>J</b>                                                                |                           |                                |
| Bearing                                                                 | 2.110 (53.60)             | 2.740 (69.60) Or 2.763 (70.18) |
| (1) Refer to illustration for component locations. See <b>Fig. 93</b> . |                           |                                |

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS

| Application                   | Ft. Lbs. (N.m) |
|-------------------------------|----------------|
| Control Shift Lever Nut       | 10 (13)        |
| Converter-To-Drive Plate Bolt | 30 (41)        |

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|                                                                     |           |
|---------------------------------------------------------------------|-----------|
| Counter Drive Gear Nut                                              | 207 (280) |
| Differential Ring Gear Bolt                                         | 70 (95)   |
| Drive Plate Bolt                                                    |           |
| 4-Cylinder                                                          | 72 (98)   |
| V6                                                                  | 61 (83)   |
| Elbow                                                               | 20 (27)   |
| Manual Detent Spring Bottom Bolt                                    | 15 (20)   |
| Oil Pan Drain Plug                                                  | 36 (49)   |
| Oil Pump Bolt                                                       | 16 (22)   |
| Parking Lock Pawl Bracket Bolt                                      | 15 (20)   |
| Right Side Differential Case-To-Differential Intermediate Case Bolt | 46 (63)   |
| Transaxle Housing-To-Transaxle Case Bolt                            |           |
| Lower Bolts (5)                                                     | 16 (22)   |
| All Other Bolts                                                     | 21 (29)   |
| Transaxle Rear Cover Bolt                                           |           |
| Lower Bolts (3)                                                     | 14 (19)   |
| All Other Bolts                                                     | 18 (24)   |
| Transfer Case-To-Transaxle Bolt                                     | 51 (69)   |
| Underdrive Planetary Gear Lock Nut                                  | 207 (280) |
| Union                                                               | 20 (27)   |
| <b>INCH Lbs. (N.m)</b>                                              |           |
| Apply Pipe Clamp Bolt                                               |           |
| Transaxle Case                                                      | 48 (5.4)  |
| Transaxle Housing                                                   | 87 (9.8)  |
| Control Shift Lever Lock Tab Nut                                    | 61 (6.9)  |
| Manual Detent Spring Top Bolt                                       | 106 (12)  |
| Oil Deflector Bolt                                                  | 87 (9.8)  |
| Oil Pan Bolt                                                        | 69 (7.8)  |
| Oil Strainer Bolt                                                   | 97 (11)   |
| Parking Lock Pawl Clamp Bolt                                        | 87 (9.8)  |
| Park/Neutral Position Switch                                        |           |
| Nut                                                                 | 61 (6.9)  |
| Bolt                                                                | 48 (5.4)  |
| Shift Solenoid Valve Bolt                                           | 97 (11)   |
| Solenoid Connector Bolt                                             | 48 (5.4)  |
| Speed Sensor Bolt                                                   | 97 (11)   |
| Stator Shaft-To-Oil Pump Bolt                                       | 87 (9.8)  |
| Temperature Sensor Clamp Bolt                                       | 58 (6.6)  |
| Transaxle Case Plug                                                 | 65 (7.4)  |
| Transaxle Rear Cover Plate Screw                                    | 66 (7.5)  |
| Upper Valve Body Cover Bolt                                         | 58 (6.6)  |
| Upper & Lower Valve Body Bolt                                       |           |

**2001 Toyota Highlander**

2001-05 AUTOMATIC TRANSMISSIONS U140E &amp; U140F Overhaul

|                 |         |
|-----------------|---------|
|                 | 97 (11) |
| Valve Body Bolt | 97 (11) |

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

| <b>Application</b>                          | <b>In. (mm)</b>         |
|---------------------------------------------|-------------------------|
| <b>Bushing Inside Diameter (Maximum)</b>    |                         |
| Multiple Clutch Hub                         | .909 (23.09)            |
| Oil Pump Body                               | 1.503 (38.18)           |
| Oil Pump Stator Shaft                       | .849 (21.57)            |
| Underdrive Clutch Drum                      | 1.462 (37.13)           |
| Direct Clutch End Play                      | .008-.037 (.20-.94)     |
| Input Shaft End Play                        | .010-.049 (.26-1.25)    |
| Underdrive Planetary Gear Assembly End Play | .020-.039 (.50-.99)     |
| <b>Oil Pump</b>                             |                         |
| Driven Gear-To-Body Clearance               | .0039-.0067 (.010-.170) |
| Driven Gear-To-Drive Gear Tooth Clearance   | .0028-.0059 (.070-.150) |
| Gear Side Clearance                         | .0008-.0020 (.020-.050) |
| <b>Piston Stroke</b>                        |                         |
| Direct Clutch                               | .024-.033 (.61-.83)     |
| <b>Forward Clutch</b>                       |                         |
| 4-Cylinder                                  | .069-.082 (1.74-2.08)   |
| V6                                          | .082-.095 (2.08-2.42)   |
| Underdrive Brake                            | .071-.087 (1.81-2.20)   |
| Underdrive Clutch                           | .059-.075 (1.51-1.90)   |
| <b>1st/Reverse Brake</b>                    |                         |
| 4-Cylinder                                  | .040-.048 (1.02-1.21)   |
| V6                                          | .043-.051 (1.10-1.29)   |
| 2nd Brake                                   | .024-.036 (.62-.91)     |
| Side Gear Backlash                          | .002-.008 (.05-.20)     |
| <b>Torque Converter Runout (Maximum)</b>    |                         |
| Drive Plate                                 | .008 (.20)              |
| Sleeve                                      | .012 (.30)              |

**CLUTCH DISC & PLATE QUANTITY**

| <b>Component</b>      | <b>Discs</b> | <b>Plates</b> |
|-----------------------|--------------|---------------|
| <b>Direct Clutch</b>  |              |               |
| 4-Cylinder            | 3            | 3             |
| V6                    | 4            | 4             |
| <b>Forward Clutch</b> |              |               |
|                       |              |               |

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|                   |   |   |
|-------------------|---|---|
| 4-Cylinder        | 5 | 5 |
| V6                | 6 | 6 |
| Underdrive Brake  |   |   |
| 4-Cylinder        | 3 | 3 |
| V6                | 4 | 4 |
| Underdrive Clutch |   |   |
| 4-Cylinder        | 3 | 3 |
| V6                | 4 | 4 |
| 1st/Reverse Brake |   |   |
| 4-Cylinder        | 5 | 5 |
| V6                | 7 | 7 |
| 2nd Brake         |   |   |
| 4-Cylinder        | 3 | 3 |
| V6                | 4 | 4 |