

1999 Toyota RAV4
1999 TRANSFER CASES Toyota A-540H Overhaul

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## APPLICATION

### TRANSFER CASE APPLICATIONS

Vehicle Application	(1) Transfer Case Model Number
RAV4 With A-540H A/T	A-540H
(1) Identifies transmission code. No additional transfer case model number information is available.	

## DESCRIPTION & OPERATION

The A-540H transfer case is an electronically controlled unit which uses a center differential control solenoid with an internal valve body. Transfer control solenoid is operated by duty cycle signals from the Electronic Control Unit (ECU). Duty cycle signals modulate fluid pressure of center differential clutch control valve. For additional information on electronic control components, see TOYOTA A-540H ELECTRONIC CONTROLS article in AUTOMATIC TRANSMISSIONS.

## ELECTRONIC COMPONENT TESTING

### CENTER DIFFERENTIAL CLUTCH CONTROL SOLENOID

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

1. Ensure transmission fluid is at operating temperature. Block wheels. Remove transfer valve body cover plug and install pressure gauge. See **Fig. 1** .
2. Start vehicle and accelerate 50 percent or more in Park. Ensure center differential clutch control pressure is more than 42 psi (3.0 kg/cm<sup>2</sup> ). Release accelerator. Ensure center differential clutch control pressure is 1.4 psi (.1 kg/cm<sup>2</sup> ) or less at idle. If pressure is not as specified, go to next step.
3. Install a 24-watt bulb in jumper wire connected between positive battery terminal and control solenoid terminal No. 1. Connect jumper wire between negative battery terminal and control solenoid terminal No. 3 to activate solenoid. See **Fig. 1** . Measure center differential clutch control pressure at idle. See **CONTROL SOLENOID PRESSURE SPECIFICATIONS** table.

**CAUTION:** DO NOT maintain stall speed RPM for more than 5 seconds.

4. Measure center differential clutch control pressure at stall speed. Connect tachometer to vehicle and ensure it is visible to driver. Apply parking and service brakes. Start engine. Position transmission in "D" range. Fully depress accelerator pedal. Immediately note highest engine RPM. DO NOT perform test

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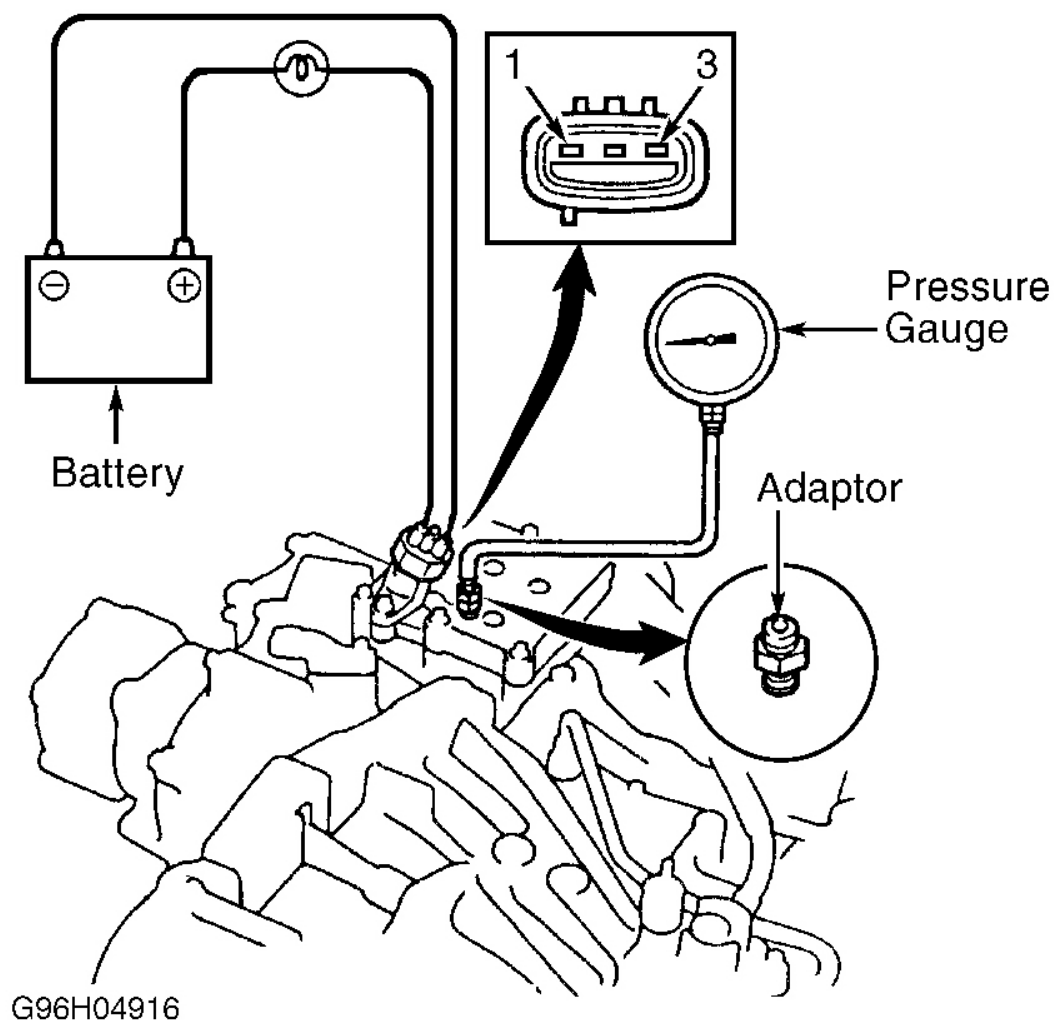
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longer than 5 seconds. Stall speed should be 2250-2550 RPM.

5. If pressures exceed specifications in all ranges, center differential clutch control valve or control solenoid is defective.
6. If pressures are lower than specifications in all ranges, oil pump, differential clutch control valve or control solenoid is defective.
7. If pressure is lower than specifications at stall speed with control solenoid on, control solenoid is defective.
8. If pressure is higher or lower than specifications when jumper wires are connected, differential clutch control valve or control solenoid is defective.

#### CONTROL SOLENOID PRESSURE SPECIFICATIONS

Engine Speed	Pressure psi (kg/cm <sup>2</sup> )
Idle Speed	53-61 (3.7-4.3)
Stall Speed	
With Solenoid On	192-225 (13.5-15.8)
With Solenoid Off	107-125 (7.5-8.8)



**Fig. 1: Checking Center Differential Clutch Control Solenoid Pressure**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

## REMOVAL & INSTALLATION

Transfer case is removed from transmission once complete assembly is removed from vehicle. See appropriate AUTOMATIC TRANSMISSION REMOVAL article in TRANSMISSION SERVICING.

## OVERHAUL

### DISASSEMBLY & REASSEMBLY

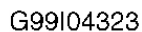
Disassembly (Transfer Case)

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1. Remove mode select lever and rod (if equipped). Remove rear wheel speed sensor. Remove "O" ring from speed sensor. Remove dynamic damper (if equipped). See **Fig. 2**.
2. Remove dust deflector from extension housing. Remove 4 bolts. Remove "O" ring from housing. Remove extension housing oil seal.
3. Remove 5 bolts from right case retainer. Using plastic hammer, remove right case retainer. Remove "O" ring and apply gasket from retainer. Remove 3 bolts and inspection hole cover.
4. Using Lock Nut Wrench (09326-20011) and spring tension gauge, measure driven pinion preload and backlash between driven pinion and ring gear. Driven pinion preload at starting point is 2.0-3.1 lbs. (.9-1.4 kg).
5. Using lock nut wrench and spring gauge, measure total preload. Total preload at starting point is 1.1-2.0 lbs. (.5-.9 kg). Add driven pinion preload. Using dial indicator, measure ring gear backlash. Backlash should be .0051-.0071" (.130-.180 mm).
6. Remove driven pinion bearing cage. Remove "O" ring and shims from bearing cage. Remove transfer right case. Remove center differential assembly. Remove apply gasket from left case.
7. Remove oil pump driven gear and strainer. Remove "O" ring from oil pump strainer. Remove adjusting nut lock plate. Remove "O" ring from bolt.
8. Using Adjusting Nut Wrench (09318-12010), remove adjusting nut and oil reservoir from right case. Remove outer race with a brass bar and hammer. Remove outer race and plate washer. Remove left case oil seal.

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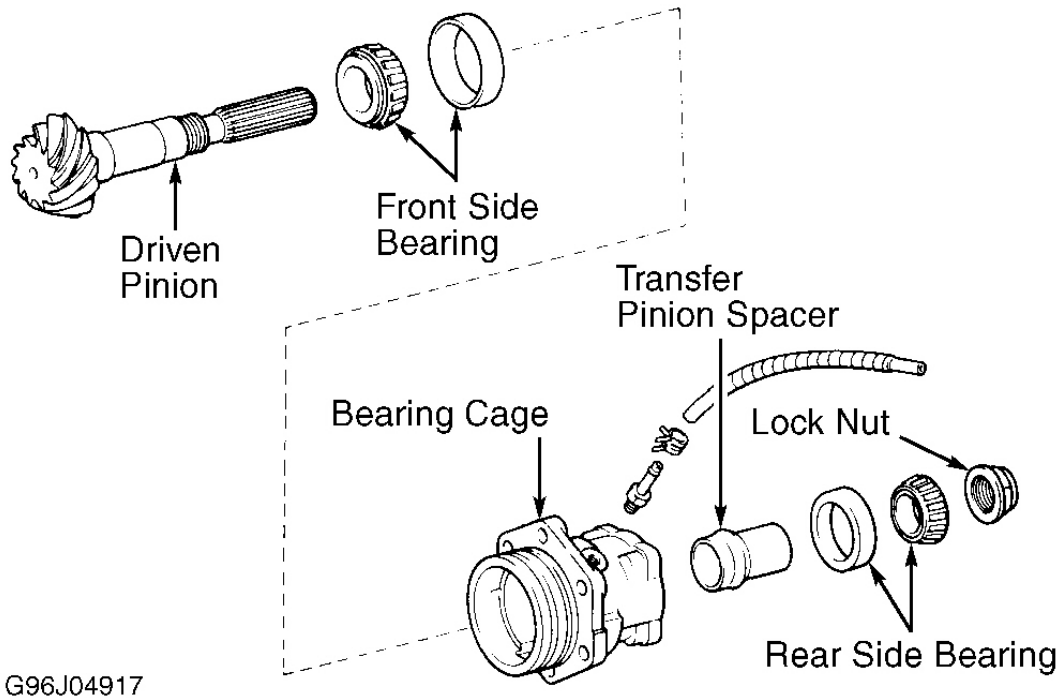


### Disassembly (Transfer Case Driven Pinion Bearing Cage)

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1. Using chisel and hammer, unstake lock nut. Remove lock nut. Use soft jaws to hold driven pinion in vise.
2. Remove driven pinion, rear side bearing and spacer with arbor press. Remove front side bearing. Using brass bar and hammer, remove bearing outer races. See **Fig. 3**.



**Fig. 3: Exploded View Of Transfer Driven Pinion Bearing Cage**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

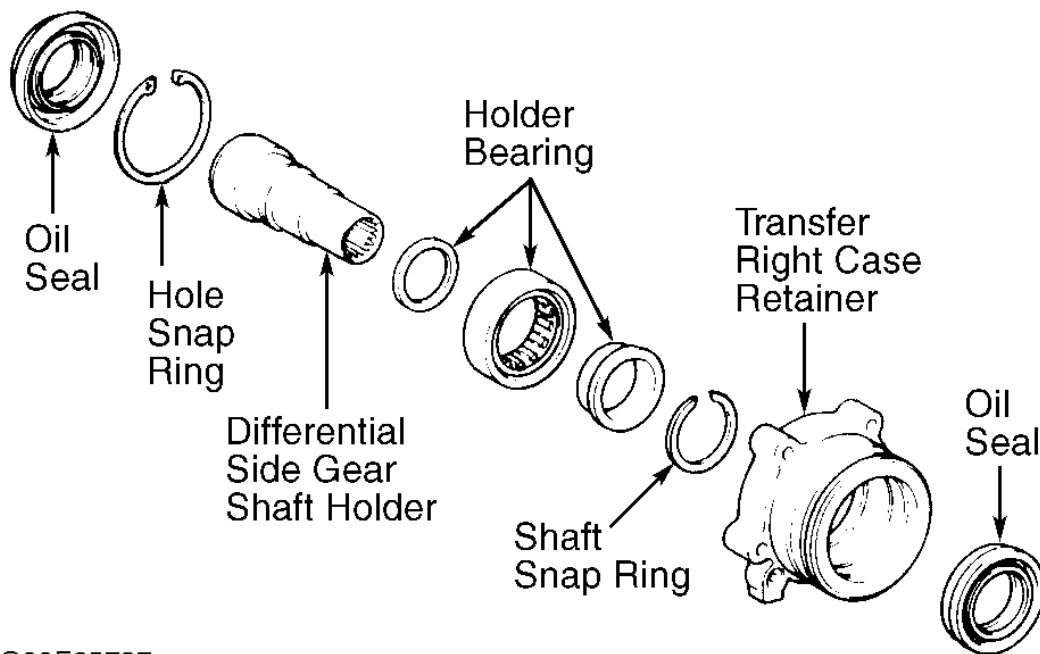
#### Reassembly

1. Install front side bearing outer race to bearing cage. Install rear side bearing outer race. Install front side bearing. Install NEW spacer to driven pinion.
2. Install bearing cage to driven pinion. Using bearing replacer, install rear side bearing to driven pinion. Adjust drive pinion preload. Using Lock Nut Wrench (09326-20011) and torque wrench, tighten nut to 72 ft. lbs. (98 N.m).
3. Using lock nut wrench and spring tension gauge, measure preload. Rotate driven pinion counterclockwise and clockwise several times to allow bearings to settle. Measure preload of driven pinion at starting point. Preload with NEW bearing is 4.0-6.4 lbs. (1.8-2.9 kg). With used bearing, preload should be 2.0-3.1 lbs. (.9-1.4 kg).
4. If preload exceeds specification, replace bearing spacer. If preload is less than specification, retighten nut 5-10 degrees at a time until specified preload is reached.
5. If maximum torque is exceeded by retightening nut, replace bearing spacer. Repeat preload procedure. DO NOT back off pinion nut to reduce preload. Maximum nut torque is 174 ft. lbs. (235 N.m). Stake lock

nut.

#### Disassembly (Transfer Right Case Retainer)

Using a screwdriver, remove oil seal. Remove snap ring. Remove side gear shaft holder with a plastic hammer. Remove snap ring. Using an arbor press, remove holder bearing. Remove oil seal. See **Fig. 4**.



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**Fig. 4: Exploded View Of Transfer Right Case Retainer**

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#### Reassembly

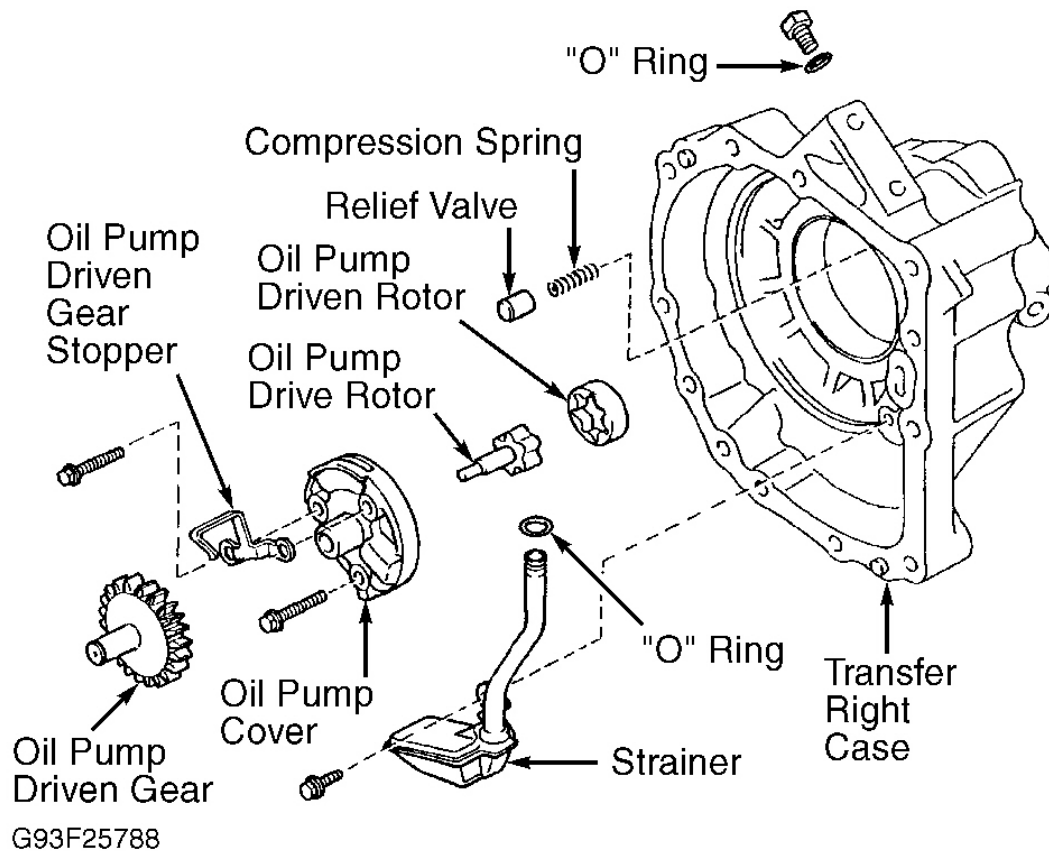
Using press, install holder bearing. Install snap ring. Install side gear shaft holder. Install snap ring. Coat oil seal lip with grease. Install left side oil seal. Install right side oil seal.

#### Disassembly (Transfer Right Case)

Check oil pump operation. Oil pump should turn smoothly with oil pump driven gear. Remove 3 bolts and oil pump driven gear stopper. Remove oil pump cover, drive rotor and driven rotor. Remove relief valve and spring. See **Fig. 5**.

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**Fig. 5: Exploded View Of Transfer Right Case**  
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### Reassembly

Install relief valve and spring. Install oil pump drive rotor and driven rotor. Align match marks on rotors. Install oil pump cover and driven gear stopper. Tighten 3 bolts to 69 INCH lbs. (7.8 N.m). Insert oil pump driven gear to drive rotor. Ensure drive rotor turns smoothly.

### Disassembly (Ring Gear Mounting Case & Center Differential Case)

1. Remove shaft snap ring. Remove oil pump drive gear. Place match marks on differential left and right case. Remove 12 bolts. Remove differential left case upward. See **Fig. 6**.
2. Place match marks on differential left case and ring gear. Using a plastic hammer, tap out ring gear. Remove "O" ring from case. Using press, remove left case bearing.
3. Remove thrust washer. Remove center differential case assembly. Remove shaft snap rings. Remove spacer. Remove following parts from case: 4 pinion shafts, pinion shaft holder, 4 differential pinions, 4 pinion thrust washers, differential side left gear and side gear thrust washer.



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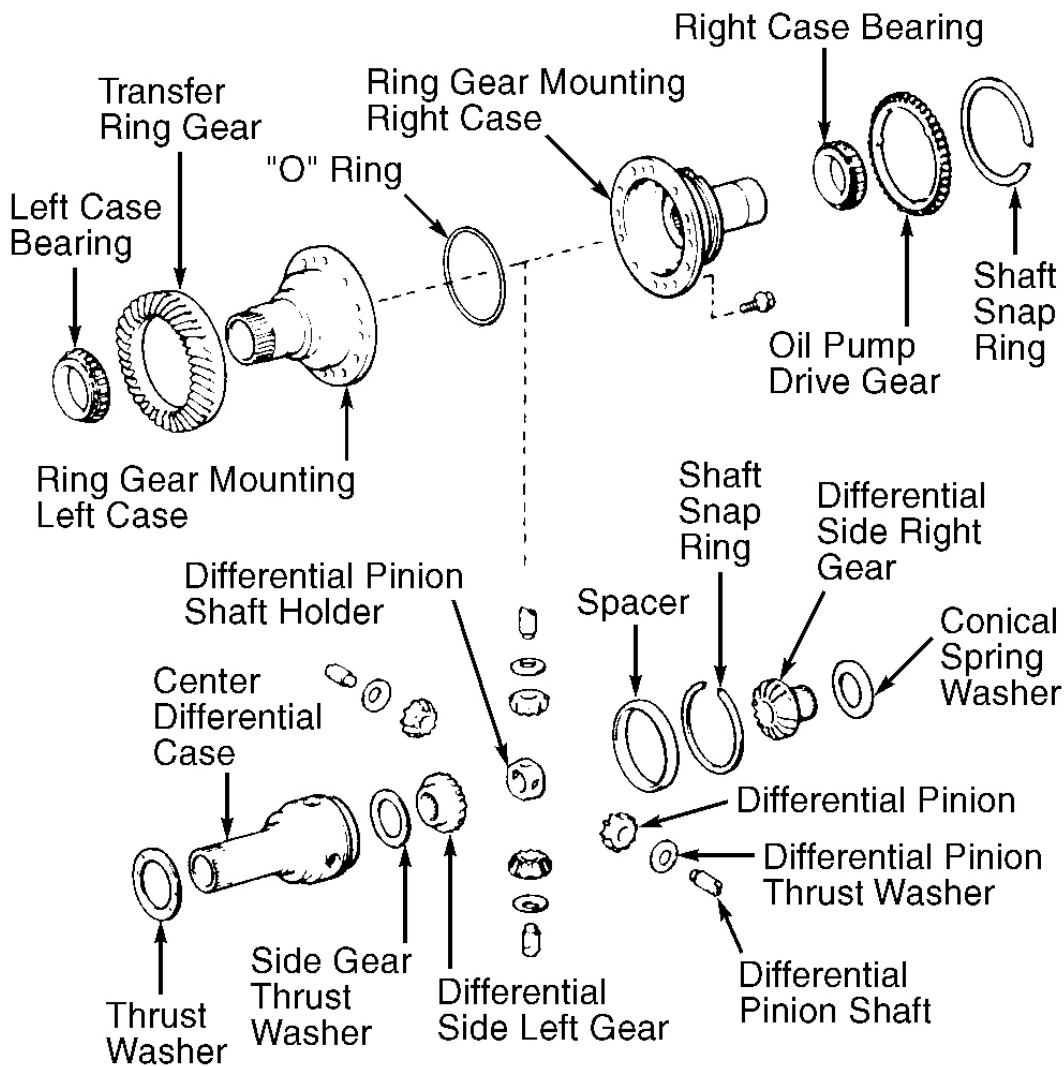
4. Remove differential side right gear and conical spring washer. Note direction of conical spring washer for reassembly reference. Using bearing puller and an arbor press, remove right case bearing.

#### Reassembly

1. Using Bearing Replacer (09316-12010) and Bearing Tool Set (09950-70010), press in right case bearing with an arbor press. Using bearing replacer and bearing tool set, press in left case bearing with an arbor press.
2. Clean contact surface of ring gear mounting left case. Heat ring gear to about 212°F (100°C) in an oil bath. DO NOT heat ring above 230°F (110°C). Clean contact surface of ring gear with cleaning solvent. Quickly install ring gear on ring gear mounting left case.
3. Install following parts to center differential case: side gear thrust washer, differential side left gear, 4 pinion thrust washers, 4 differential pinions, pinion shaft holder and 4 pinion shafts. Install spacer to center differential case. Using a dial indicator, measure side gear backlash while holding one pinion toward case. Backlash is .0020-.0079" (.050-.200 mm). If backlash exceeds specification, install correct thrust washer on side gears. See **SIDE GEAR THRUST WASHER SPECIFICATIONS** table for available thrust washer sizes.
4. Install differential side right gear. DO NOT install conical spring washer. Install center differential case. Install thrust washer. Align match marks on left and right cases. Install 12 bolts. Tighten to 72 ft. lbs. (97 N.m). DO NOT install "O" ring. Using a caliper, measure conical spring washer thickness. Measure thrust clearance of center differential case while holding ring gear mounting case. See **Fig. 7** and **Fig. 8**.
5. See **SIDE GEAR THRUST WASHER SPECIFICATIONS** table. Select thrust washer which will ensure backlash is within specification. Install differential side gear and conical spring washer. Ensure correct direction of conical spring washer.
6. Install center differential case. Install correct thrust washer. Install NEW "O" ring on left case. Align match marks on right and left case. Install 12 bolts. Tighten to 72 ft. lbs. (97 N.m). Install oil pump drive gear. Install shaft snap ring.

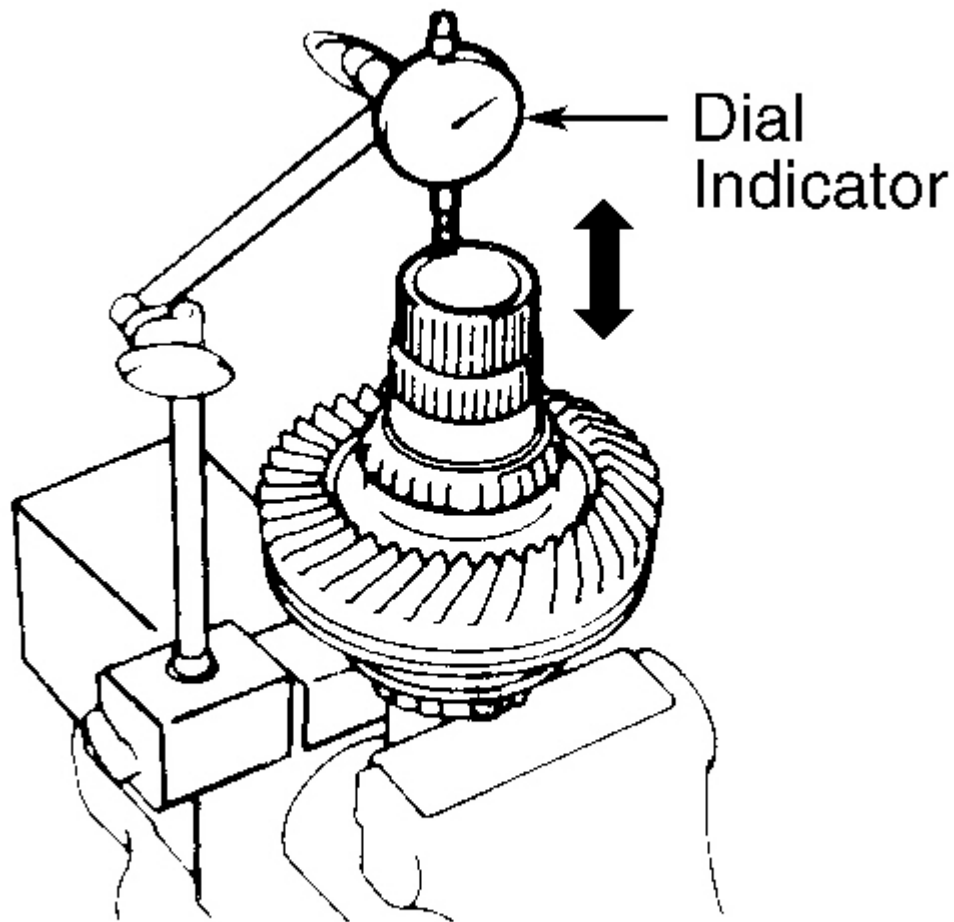
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**Fig. 6: Exploded View Of Ring Gear Mounting & Center Differential Case**  
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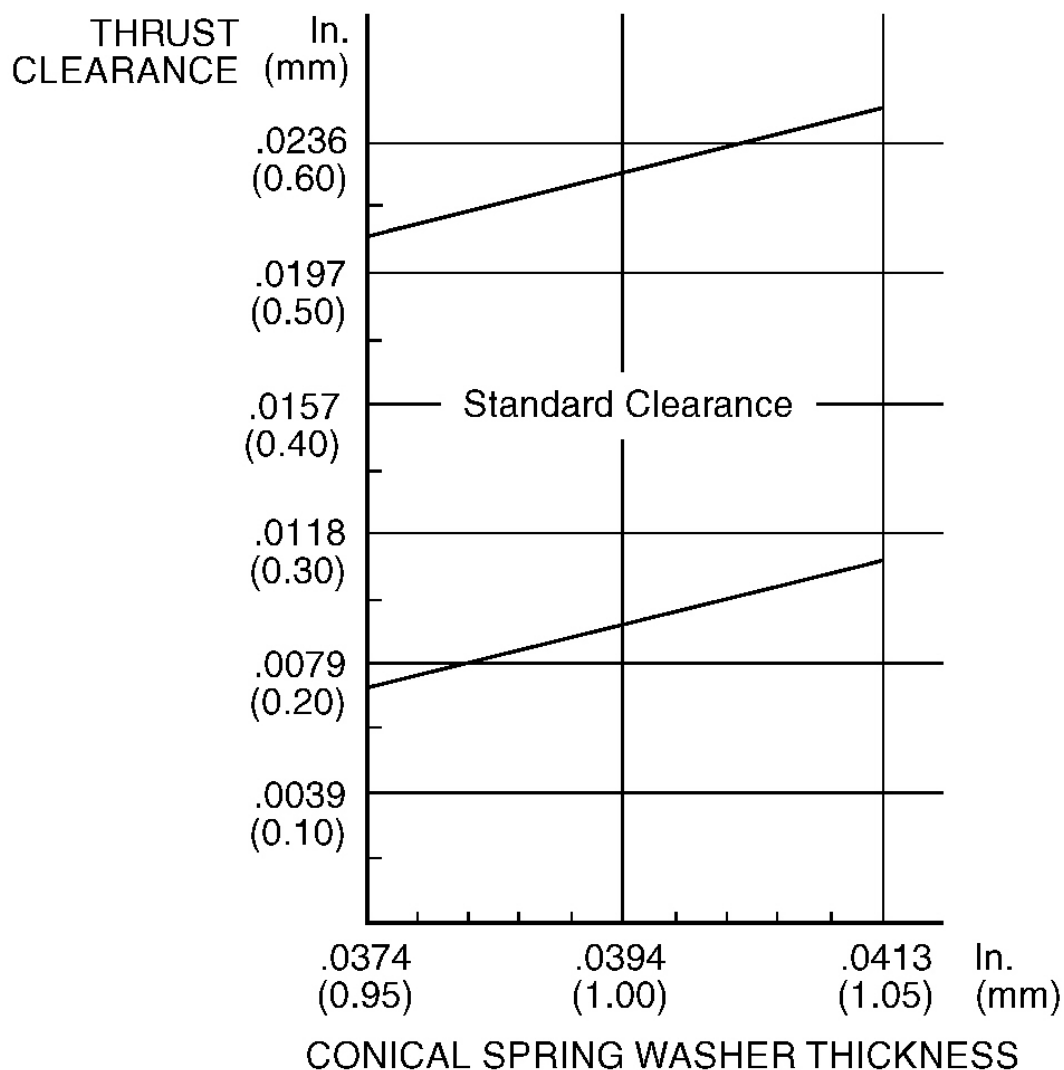


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**Fig. 7: Measuring Center Differential Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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**Fig. 8: Checking Center Differential Side Gear Thrust Clearance**  
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

### SIDE GEAR THRUST WASHER SPECIFICATIONS

ID Mark	Thickness - In. (mm)
A	.0394 (1.000)
B	.0413 (1.050)
C	.0433 (1.100)
D	.0453 (1.150)
E	.0472 (1.200)
F	.0492 (1.250)

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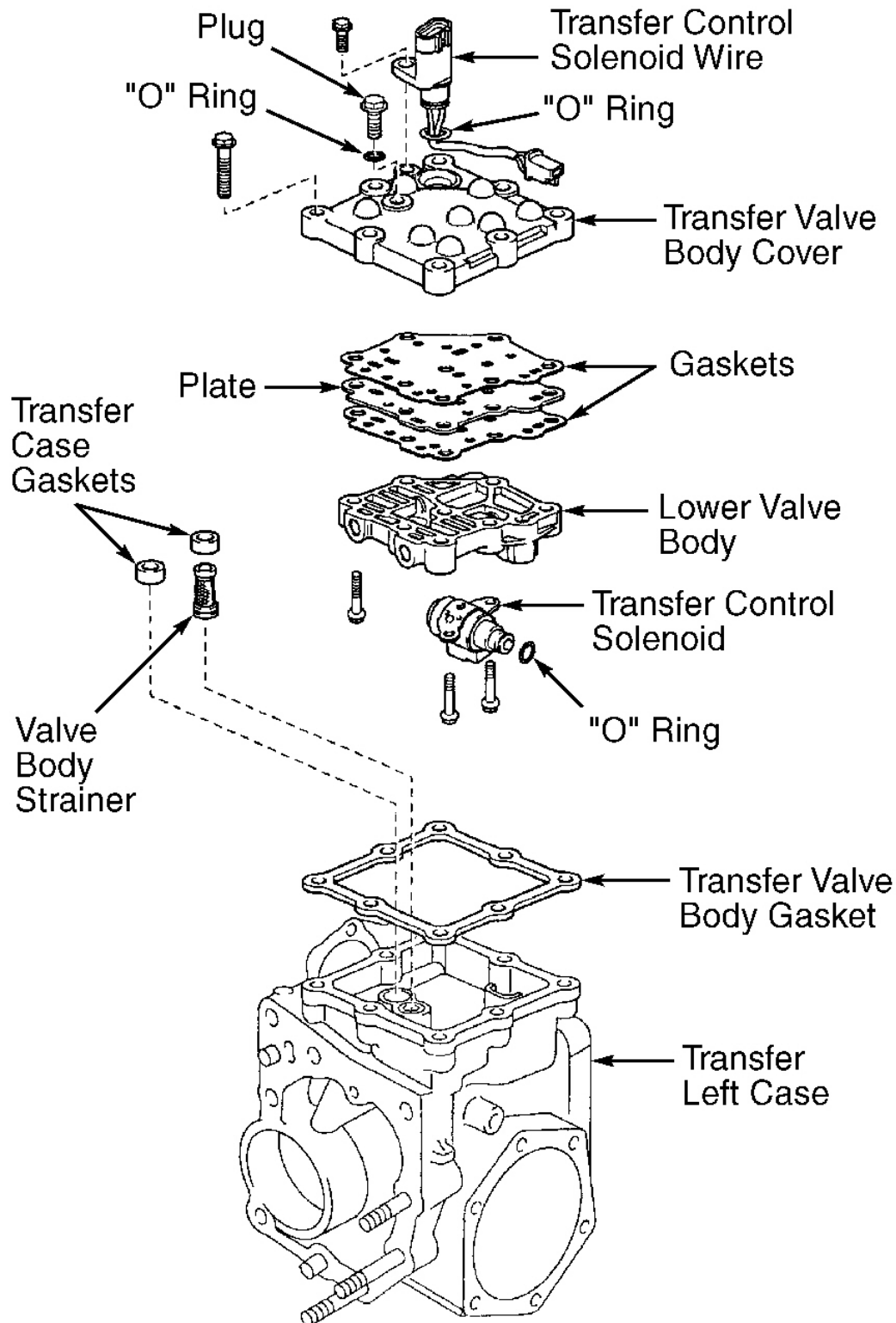
G	.0512 (1.300)
H	.0531 (1.350)
J	.0551 (1.400)
K	.0571 (1.450)
L	.0591 (1.500)

Disassembly (Transfer Left Case & Valve Body)

1. Remove plug. Remove "O" ring from plug. Remove 8 bolts and remove transfer valve body cover. Remove valve body gasket. Remove transfer case gaskets and valve body strainer. See **Fig. 9** .
2. Disconnect control solenoid connector. Remove bolt and solenoid wire. Remove "O" ring from solenoid wire. Remove 2 bolts and control solenoid. Remove "O" ring from solenoid. Remove 6 bolts and transfer lower valve body. Remove 2 gaskets and plate from transfer lower valve body. See **Fig. 9** and **Fig. 10** .

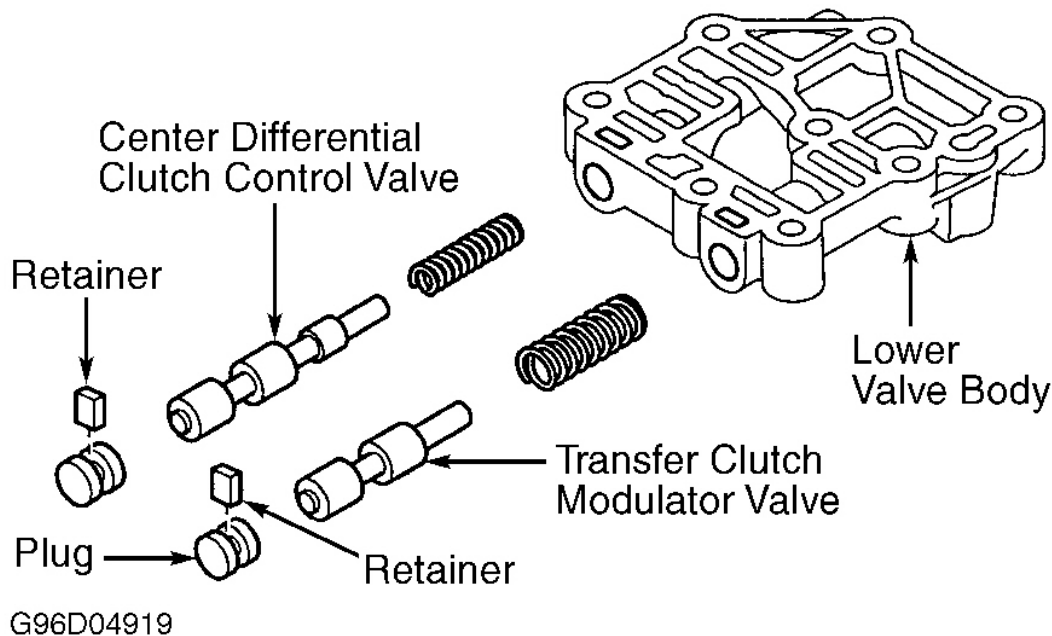
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**Fig. 9: Exploded View Of Transfer Left Case**

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

**Fig. 10: Exploded View Of Transfer Lower Valve Body**

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

**Reassembly**

1. Install NEW transfer lower valve body gaskets. Install plate. Ensure transfer lower valve body springs are installed in correct locations. See **TRANSFER LOWER VALVE BODY SPRING SPECIFICATIONS** table. Ensure retainers are same height, width and thickness. Lower transfer lower valve body into place.
2. Install 6 bolts and tighten to 58 INCH lbs. (6.6 N.m). Install NEW "O" ring on control solenoid and coat with ATF. Install 2 bolts and control solenoid. Tighten bolts to 58 INCH lbs. (6.6 N.m).
3. Install NEW "O" ring on control solenoid wiring and coat with ATF. Install solenoid wiring and bolt. Tighten bolt to 58 INCH lbs. (6.6 N.m). Install solenoid connector.
4. Install NEW transfer case gaskets and valve body strainer. Install NEW transfer valve body gasket. Install transfer valve body cover. Tighten 8 bolts to 97 INCH lbs. (11 N.m). Install NEW "O" ring on plug and coat with ATF. Install plug and tighten to 65 INCH lbs. (7.4 N.m).

**TRANSFER LOWER VALVE BODY SPRING SPECIFICATIONS**

Spring	Free Length - In. (mm)	Number Of Coils
Center Differential Clutch Control Valve	1.150 (29.20)	15.5

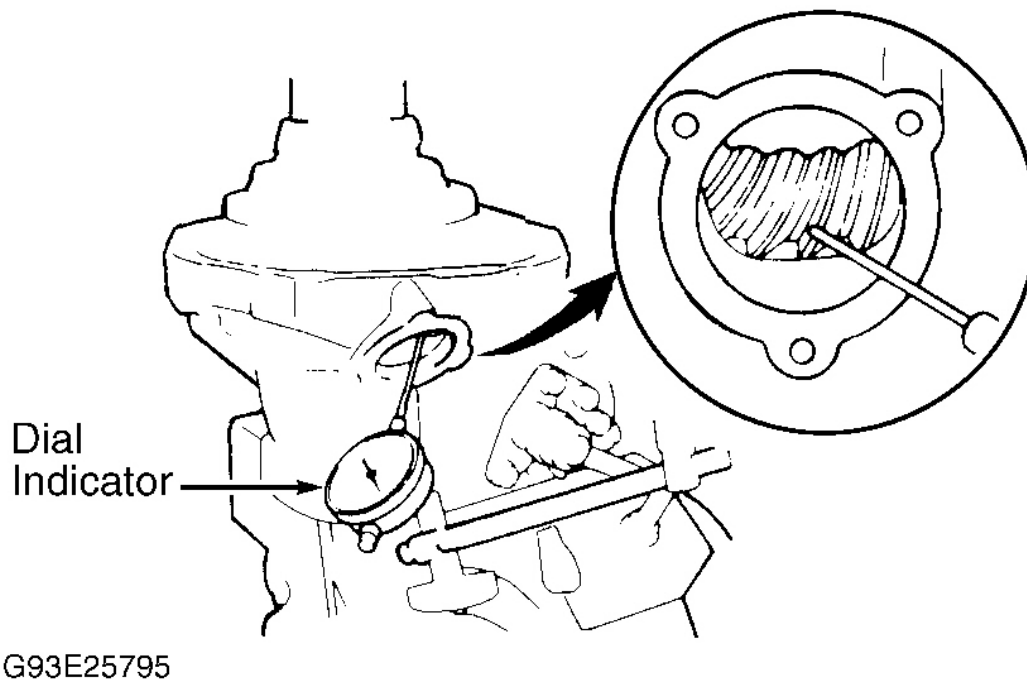
Transfer Clutch Modulator Valve

1.063 (27.00)

14.3

**Reassembly (Transfer Case)**

1. Install case side plate washer. Using press, install case side outer race. Using bearing replacer and an arbor press, install right case side outer race. Install bearing adjusting nut and oil reservoir until nut and reservoir touch outer race. See **Fig. 2**.
2. Install shim(s) to driven pinion bearing cage assembly. Install same thickness shim(s) as removed. Install driven pinion bearing cage. Tighten to 29 ft. lbs. (39 N.m). DO NOT install "O" ring. Install ring gear mounting case and center differential case. Using a dial indicator, measure ring gear backlash. Backlash should be .0051-.0071" (.130-.180 mm). See **Fig. 11**. If backlash exceeds specification, install correct plate washer on ring gears. See **RING GEAR PLATE WASHER SPECIFICATIONS** table.



**Fig. 11: Measuring Ring Gear Backlash**  
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

**RING GEAR PLATE WASHER SPECIFICATIONS**

ID Mark	Thickness - In. (mm)
71	.0839 (2.130)
72	.0850 (2.160)
73	.0862 (2.190)
74	.0874 (2.220)



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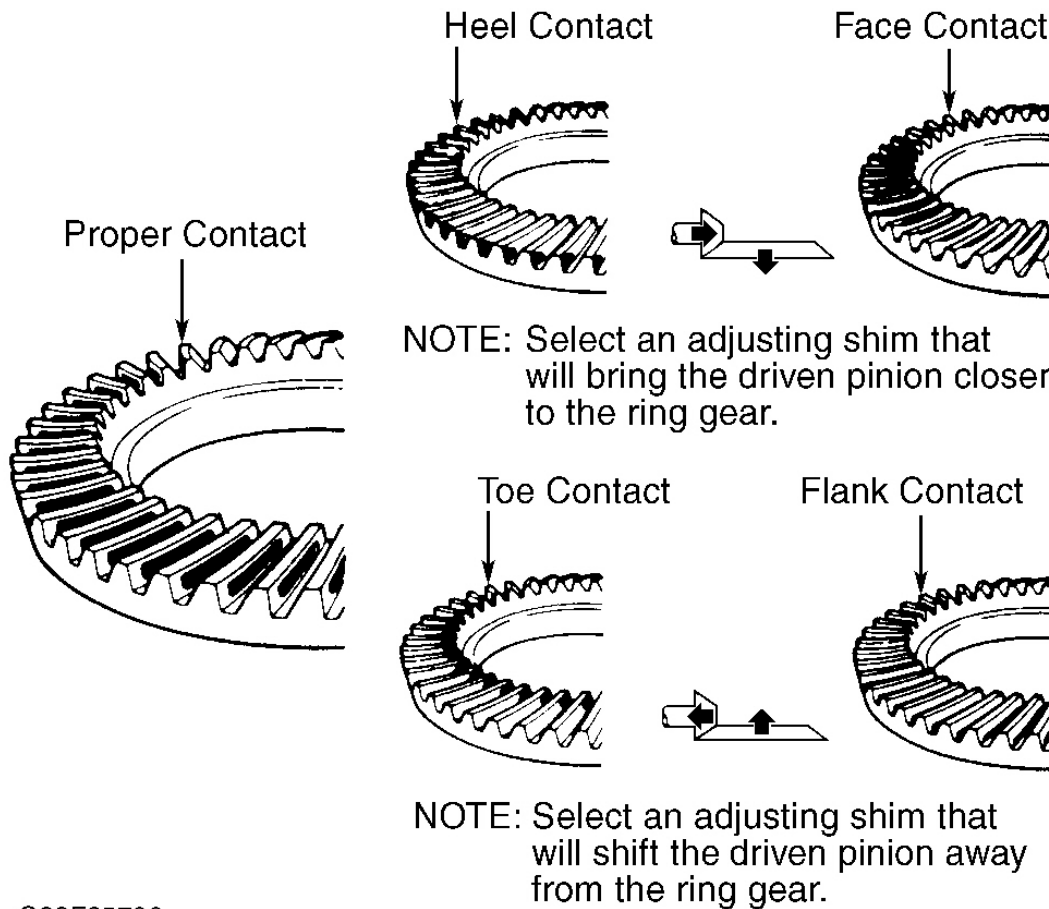
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75	.0886 (2.250)
76	.0898 (2.280)
77	.0909 (2.310)
78	.0921 (2.340)
79	.0933 (2.370)
80	.0945 (2.400)
81	.0957 (2.430)
82	.0969 (2.460)
83	.0980 (2.490)
84	.0992 (2.520)
85	.1004 (2.550)
86	.1016 (2.580)
87	.1028 (2.610)
88	.1039 (2.640)
89	.1051 (2.670)
90	.1063 (2.700)
91	.1075 (2.730)
92	.1087 (2.760)
93	.1098 (2.790)
94	.1110 (2.820)

3. Install right case. DO NOT apply seal packing and gasket. Tighten bolts to 32 ft. lbs. (44 N.m). Using Lock Nut Wrench (09326-20011) and spring tension gauge, measure total preload. Total preload at starting point with new bearing is 2.9-3.1 lbs. (1.3-1.4 kg). With used bearing, preload should be 1.1-2.0 lbs. (.5-.9 kg).
4. Add drive pinion preload to preload from previous step. Rotate drive pinion counterclockwise and clockwise several times. Using Adjusting Nut Wrench (09318-12010), adjust total preload by tightening bearing adjusting nut in small increments. Measure ring gear backlash. Backlash should be .0051-.0071" (.130-180 mm). If backlash exceeds specification, install correct plate washer on ring gear. See **RING GEAR PLATE WASHER SPECIFICATIONS** table.
5. Check tooth contact. Coat 3 or 4 teeth at 4 different positions on ring gear with Red lead. Rotate ring gear, and inspect teeth pattern. See **Fig. 12** . If teeth are not meshing properly, install proper shim and plate washer. See **RING GEAR PLATE WASHER SPECIFICATIONS** and **RING GEAR SHIM SPECIFICATIONS** tables.

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**Fig. 12: Checking Ring Gear Tooth Contact**  
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### RING GEAR SHIM SPECIFICATIONS

ID Mark	Thickness - In. (mm)
A	.0118 (.300)
B	.0130 (.330)
C	.0142 (.360)
D	.0154 (.390)
E	.0165 (.420)
F	.0177 (.450)
G	.0189 (.480)
H	.0201 (.510)
J	.0213 (.540)
K	.0224 (.570)

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6. Remove right case. Remove ring gear mounting case and center differential case. Remove driven pinion bearing cage assembly. Using Oil Seal Puller (09308-00010), remove outer race and plate washer.
7. Using Bearing Replacer (09316-60010), install NEW oil seal. Oil seal depth is .12" (3 mm). Coat lip of oil seal with grease. Install plate washer. Using Bearing Replacer (09316-60010) and an arbor press, install left case bearing outer race.
8. Coat "O" ring with gear oil and install on driven pinion bearing cage assembly. Install driven pinion bearing cage with adjusting shim to transfer left case. Install 6 bolts. Tighten bolts to 29 ft. lbs. (39 N.m). Install ring gear mounting case and center differential case.
9. Install NEW apply gasket to left case. Coat "O" ring with gear oil. Install "O" ring to oil pump strainer. Install strainer to right case. Install bolts. Tighten to 48 INCH lbs. (5.4 N.m) Install oil pump driven gear. Apply Sealant (Three Bond 1281) to left case. Install right case as soon as seal packing is applied. Install right case to left case. Install 10 bolts. Tighten to 32 ft. lbs. (44 N.m). Check total preload as shown in step 3 .
10. Install lock plate so projection from lock plate fits properly into groove of adjusting nut. When lock plate cannot be installed, tighten adjusting nut smallest amount possible. Coat NEW "O" ring with gear oil. Install "O" ring on lock bolt. Install and tighten lock nut to 62 INCH lbs. (7 N.m).
11. Apply Sealant (Three Bond 1281) to left case. Install inspection hole cover as soon as seal packing is applied. Install hole cover to transfer left case. Install 3 bolts. Tighten to 12 ft. lbs. (16 N.m).
12. Coat NEW "O" ring with gear oil. Install "O" ring and NEW apply gasket. Install right case retainer to transfer right case. Install 5 bolts. Tighten bolts to 21 ft. lbs. (29 N.m).
13. Install NEW oil seal in extension housing. Coat lip of oil seal with grease. Install NEW "O" ring in extension housing. Install extension housing to driven pinion bearing cage. Install 4 bolts. Tighten to 18 ft. lbs. (25 N.m). Using a hammer, install dust deflector (if equipped). Install dynamic damper. Tighten to 18 ft. lbs. (25 N.m).
14. Install NEW "O" ring on speed sensor. Install speed sensor to transfer left case. Tighten to 48 INCH lbs. (5.4 N.m). Install transfer mode selector lever, rod and lever guide (if equipped). Tighten 2 lever bolts to 96 INCH lbs. (11 N.m). Tighten guide bolt to 48 INCH lbs. (5.4 N.m).

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Case-To-Case Bolts	33 (44)
Differential Switch	30 (40)
Drain Plug	29 (39)
Dynamic Damper Bolts	18 (25)
Extension Housing Bolts	18 (25)
Inspection Cover Bolts	12 (16)
Pinion Bearing Cage Bolts	29 (39)
Shift Fork Bolt	12 (16)