

1999 Toyota RAV4

1999-2000 DRIVE AXLES Differentials, Axle Shafts & Drive Shafts -- Rear Integral Housing -- RAV4

1999-2000 DRIVE AXLES

Differentials, Axle Shafts & Drive Shafts -- Rear Integral Housing -- RAV4

AXLE RATIO & IDENTIFICATION

Axle ratio may be determined by dividing number of ring gear teeth by number of teeth on drive pinion.

AXLE RATIO SPECIFICATIONS

Application	Ratio
A/T	4.404:1
M/T	4.933:1

DESCRIPTION & OPERATION

Drive axle assembly is a hypoid gear-type with integral housing. Drive pinion transfers power to the ring gear which provides power to the side gear shafts. Side gear shafts are connected to the axle shafts which transfer the power to the wheels. Drive pinion preload is adjusted using collapsible spacer. Side bearing preload is adjusted using plate washers.

Rear differential may be a Limited Slip Differential (LSD) or a conventional type rear differential. If equipped with LSD, manufacturer does not recommend disassembly of differential case.

LUBRICATION

CAPACITY

DIFFERENTIAL FLUID CAPACITY

Application	⁽¹⁾ Quantity
RAV4	1 Qt. (.9L)
(1) Approximate quantity listed.	

FLUID TYPE

FLUID TYPE SPECIFICATIONS

Application	Fluid Type
Temperature Greater Than 0°F (-18°C)	SAE 90W GL-5 Hypoid Gear Oil
Temperature Less Than 0°F (-18°C)	SAE 80W-90 GL-5 Hypoid Gear Oil

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING article in GENERAL INFORMATION.

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REMOVAL & INSTALLATION

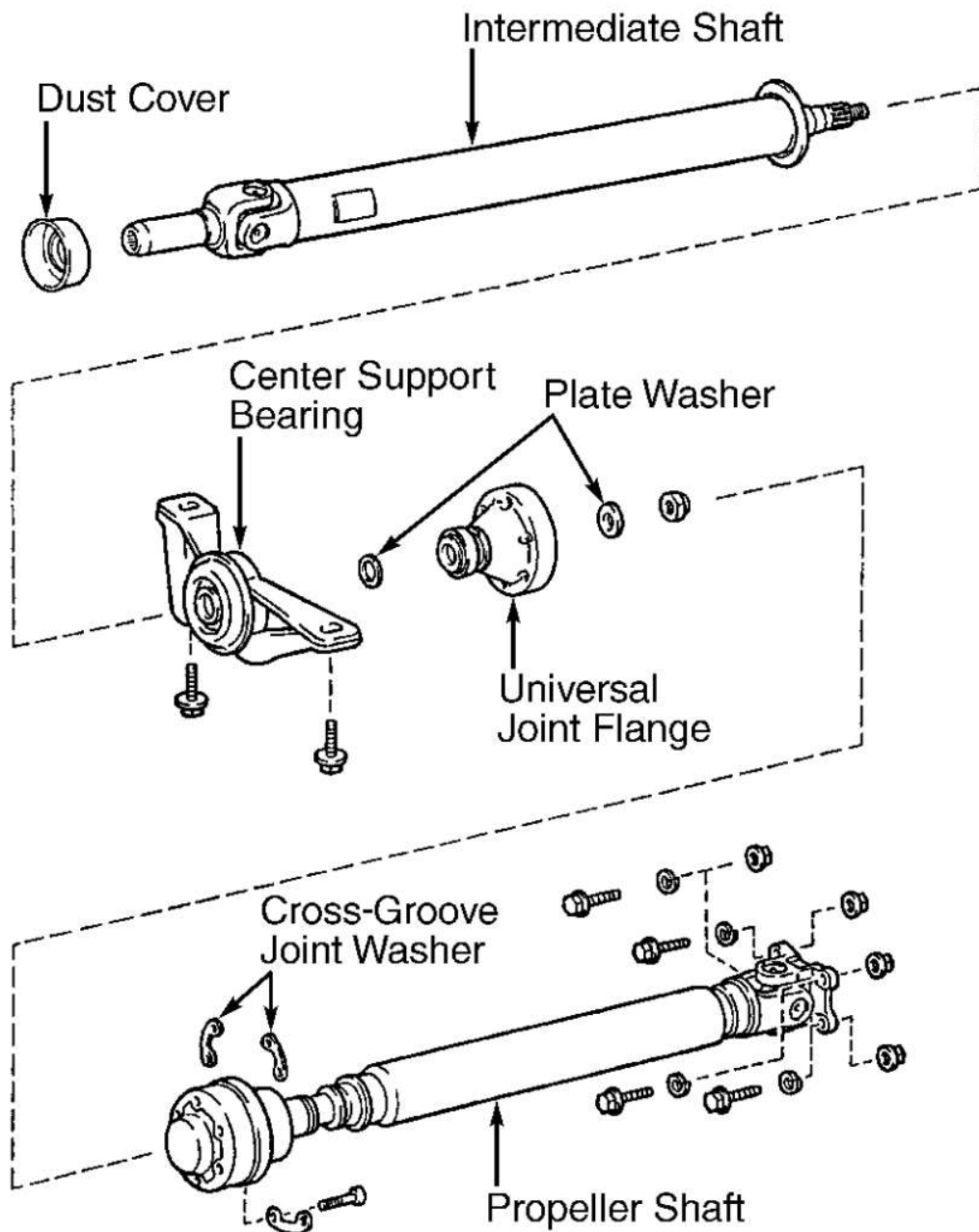
NOTE: For rear axle shaft servicing procedures, see **AWD, FWD & RWD AXLE SHAFTS - MR2 & RAV4** article in **DRIVE AXLES**.

DRIVE SHAFT**Removal**

1. Place a piece of cloth around center universal joint boot to protect boot from damage. Depress brake pedal and loosen center universal joint set bolts 1/2 turn. See **Fig. 1** .
2. Loosen center support bearing bracket. Place reference mark on drive shaft companion flange and differential companion flange for reassembly reference. Remove center support bearing and differential companion flange bolts. Pull drive shaft yoke from transaxle and plug transaxle end. Remove drive shaft.
3. If necessary, separate intermediate shaft from rear drive shaft after placing reference marks on joint and flange.

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Fig. 1: Exploded View Of Drive Shaft Assembly
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Inspection

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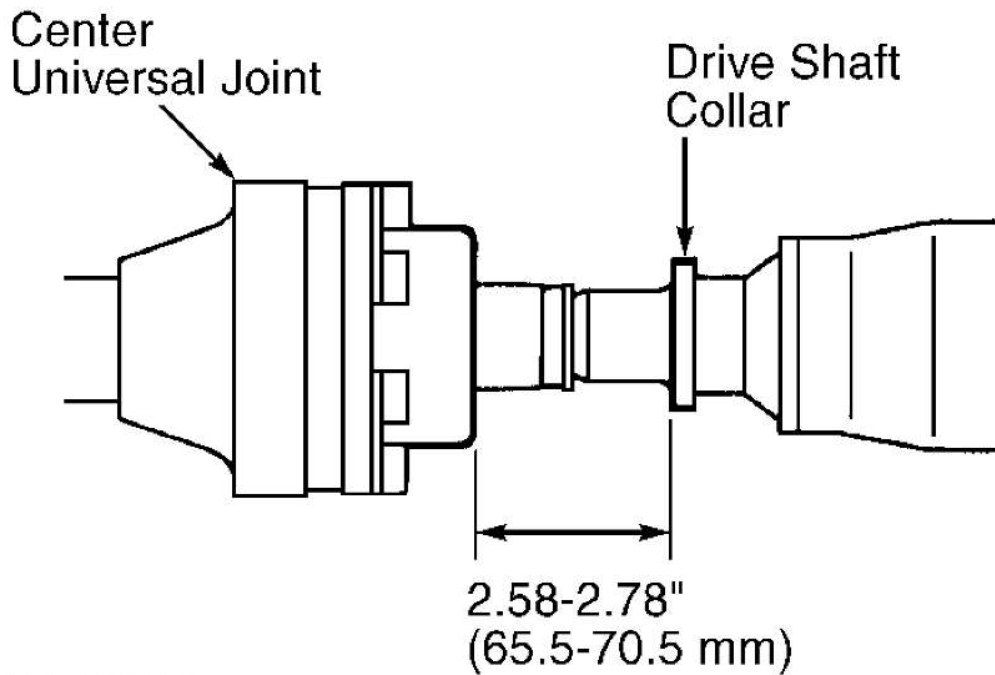
1. Mount drive shaft on wood blocks or other stands. With dial indicator, inspect intermediate shaft and rear drive shaft runout. If runout exceeds .031" (.78 mm), replace shaft.
2. Position dial indicator at end of drive shaft, with tip against inner edge of "U" joint flange. Check horizontal and vertical runout. If runout exceeds .004" (.10 mm), replace "U" joint flange.
3. Hold drive shaft and attempt to move spider bearing to check for axial play. If axial play is excessive, repair or replace spider bearing.
4. Ensure cross groove joint turns smoothly in all directions. Check for damage or grease leakage at boot. If damage is found, replace rear drive shaft.
5. Remove "U" joint flange by loosening stalked part of nut and then removing nut and washer.
6. Turn center support bearing by hand and ensure bearing rotates smoothly. Check condition of seals. If bearing or seals show wear or damage, replace them.
7. With screwdriver and hammer, remove intermediate shaft dust cover.

Installation

1. Set center support bearing on intermediate shaft. Install plate washer to intermediate shaft. Align reference marks on flange and shaft. Place flange on shaft.
2. With flange held in vise, press bearing into position by tightening NEW flange nut and washer to 134 ft. lbs. (182 N.m). Loosen nut and tighten to 51 ft. lbs. (69 N.m). Stake nut.
3. Install NEW intermediate shaft dust cover by tapping into position evenly.
4. Place piece of protective cloth inside "U" joint cover. Align reference marks on intermediate shaft and rear drive shaft. Install 3 washers and 6 bolts. Temporarily tighten.
5. Insert yoke into "U" joint. Install center support bearing temporarily. Align reference marks on flanges and connect rear drive shaft with 4 bolts, washers and nuts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
6. Depress and hold brake pedal. With hex wrench, tighten cross-groove cover and rear drive shaft. See **TORQUE SPECIFICATIONS** .
7. With vehicle in unladen condition, adjust dimension between rear side of center universal joint and rear drive shaft. See **Fig. 2** .
8. Adjust dimension between rear side of center bearing housing and rear side of bracket to dimension. See **Fig. 3** . Tighten center support bearing bolts to specification. See **TORQUE SPECIFICATIONS** . Ensure centerline of bracket is at right angles to shaft axial line.

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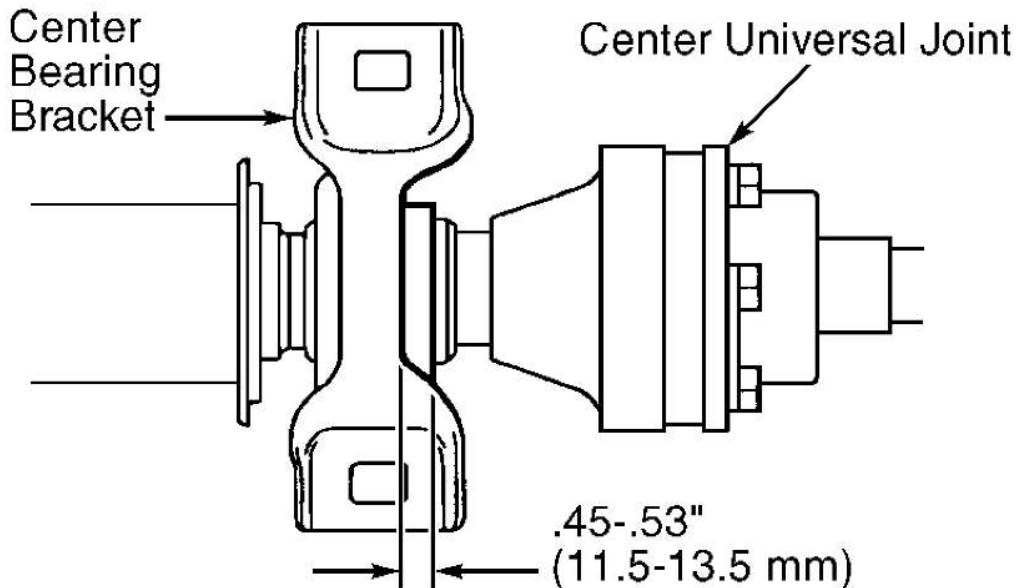


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Fig. 2: Adjusting Dimension Between Rear Side Of Center Universal Joint & Shaft Collar
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Fig. 3: Adjusting Dimension Between Rear Side Of Center Bearing Housing & Rear Side Of Bracket
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REAR DRIVE AXLES

1. Raise and support vehicle. Remove rear wheel. Remove ABS sensor. Remove cotter pin and lock cap. Depress and hold brake pedal and remove hub nut.
2. Place reference marks on rear drive axle and differential side gear shaft. Remove 4 nuts and washers. Disconnect rear drive axle from differential side gear shaft. Remove drive axle from axle carrier.
3. To install, reverse removal procedure. Check operation of axle and ABS sensor.

COMPANION FLANGE & OIL SEAL

Removal

Remove drive shaft. See **DRIVE SHAFT**. Using a chisel and hammer, unstake companion flange nut. Remove nut. Using puller, remove companion flange, oil seal and oil slinger. Discard oil seal. Using puller, remove front bearing and spacer. Discard bearing and spacer.

Installation

1. Install NEW bearing and spacer. Install oil slinger and NEW oil seal. Drive NEW oil seal .08" (2.0 mm) below differential case surface. Apply grease to oil seal lip. To complete installation, reverse removal

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procedure.

2. Apply gear oil to NEW companion flange nut threads. Torque nut to specification. See **TORQUE SPECIFICATIONS** . Adjust drive pinion preload. See **AXLE ASSEMBLY SPECIFICATIONS** . Fill differential. See **LUBRICATION** .

DIFFERENTIAL ASSEMBLY

Removal & Installation

1. Remove drive shaft. See **DRIVE SHAFT** . Remove rear drive axles. See **AWD, FWD & RWD AXLE SHAFTS - MR2 & RAV4** article in DRIVE AXLES.
2. Support differential with jack. Remove 2 rear mounting bolts. Remove 2 front mounting bolts. Remove differential. Remove rear mount cushion from differential.
3. To install, reverse removal procedure. Fill differential.

OVERHAUL

REAR DRIVE AXLE

Disassembly

1. Check drive axle to ensure there is no play in outboard joint. Ensure inboard joint slides smoothly in thrust direction and that there is no excessive play in radial direction. Check boots for damage.
2. With screwdriver, remove inboard and outboard boot clamps. Paint reference marks on inboard joint tulip and drive axle (DO NOT use punch marks). Remove inboard joint tulip from drive axle.
3. Remove snap ring from tripod. Paint reference marks on end of drive axle and tulip. With brass bar and hammer, remove tripod from drive axle. Use care not to tap roller.
4. Slide out both boots and 4 clamps. DO NOT disassemble outboard joint. With screwdriver and hammer, remove No. 2 dust deflector.

Reassembly

1. Use press and adapters to install NEW No. 2 dust deflector. See **Fig. 4** . Wrap tape around spline of drive axle. Temporarily install NEW outboard and inboard joint boots.
2. Place beveled side of tripod axial spline toward outboard joint. Align reference marks. With brass bar and hammer, tap tripod onto drive axle. Install NEW snap ring.
3. Pack inboard joint and boot with grease. Align reference marks and install inboard joint tulip to drive axle.
4. Pack outboard joint and boot with grease. Ensure both boots and on shaft groove and that boots are not stretched or compressed when drive axle assembly is at standard length. See **Fig. 5** . See **DRIVE AXLE STANDARD LENGTH** table. Install 4 NEW boot clamps. Bend clamp band and lock in place.

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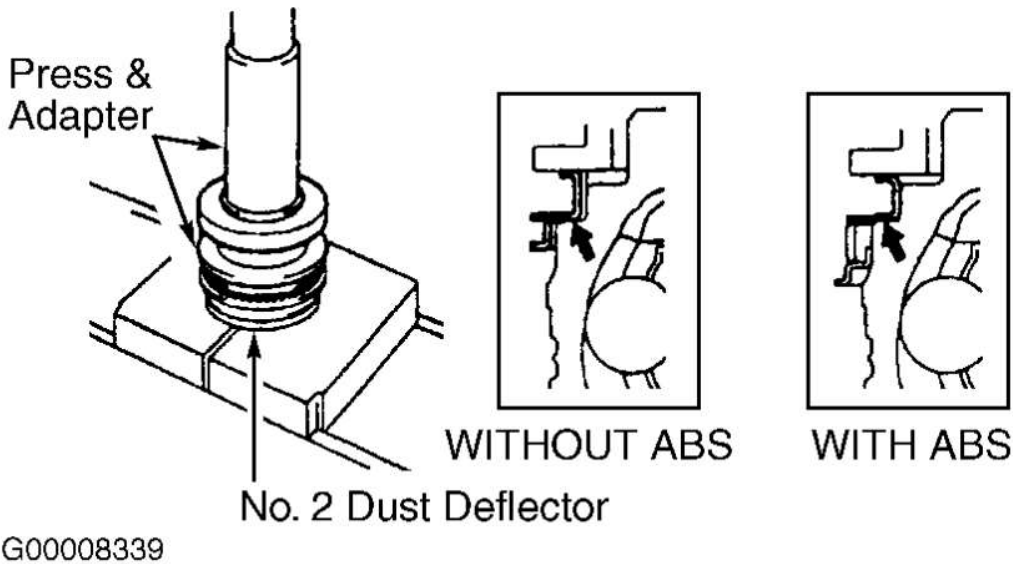


Fig. 4: Installing No. 2 Dust Deflector On Rear Drive Axle
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

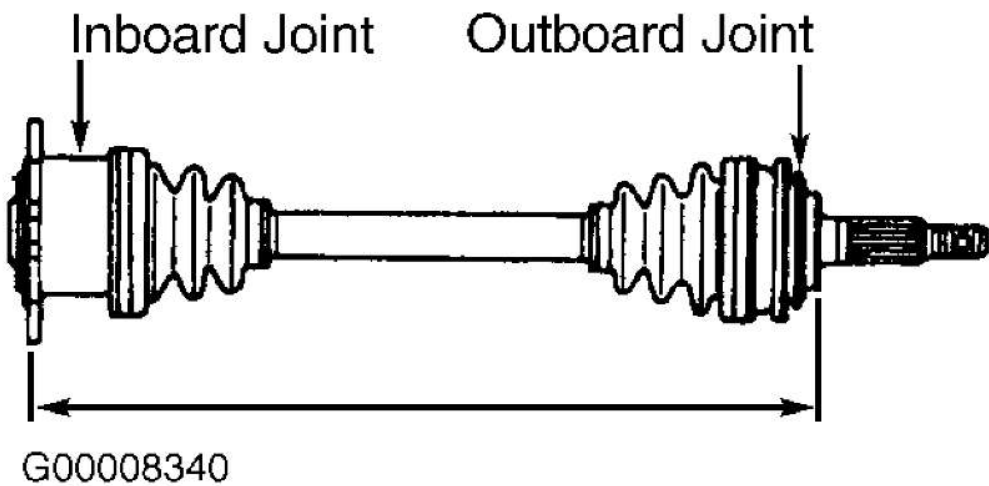


Fig. 5: Showing Standard Length Measurement Of Rear Drive Axle
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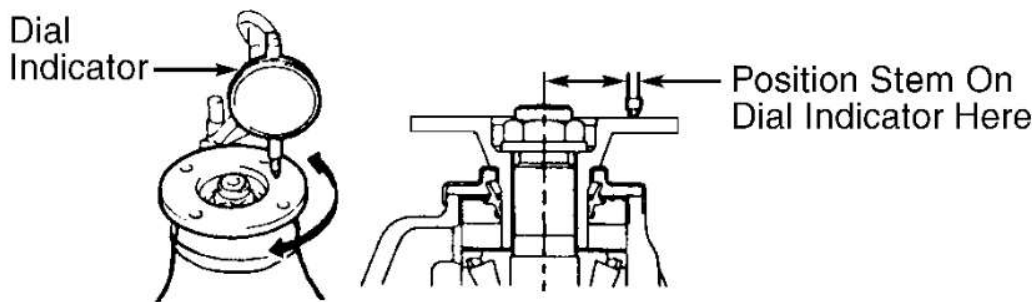
DRIVE AXLE STANDARD LENGTH

Application	In. (mm)
Left Axle	23.401-23.795 (594.38-604.39)
Right Axle	23.401-23.795 (594.38-604.39)

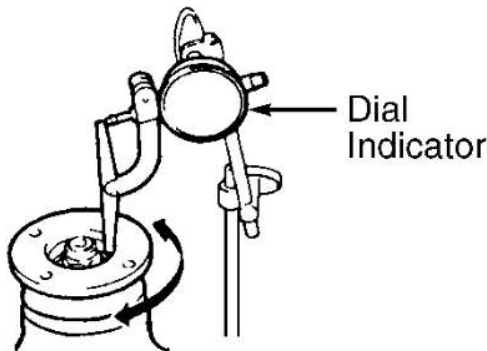
DIFFERENTIAL ASSEMBLY

Disassembly

1. Remove differential carrier cover. Using dial indicator, check companion flange vertical and lateral runout. Runout should not exceed .0039" (.099 mm). See **Fig. 6** .



CHECKING VERTICAL RUNOUT



CHECKING LATERAL RUNOUT

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Fig. 6: Checking Companion Flange Vertical & Lateral Runout
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2. Using INCH-lb. torque wrench installed on drive pinion nut, measure drive pinion rotating torque. This will determine drive pinion bearing preload for reassembly reference. Drive pinion rotating torque should be within specification. See **AXLE ASSEMBLY SPECIFICATIONS** table.

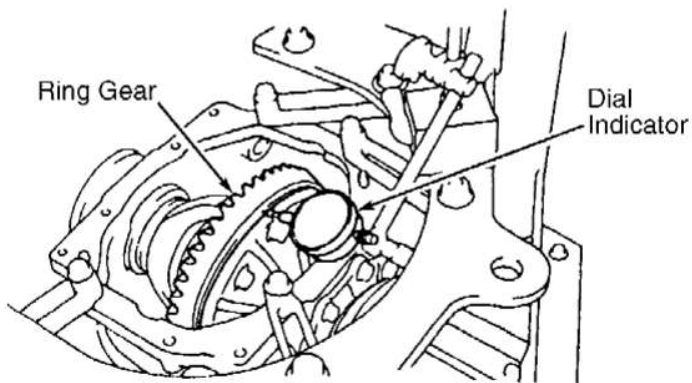
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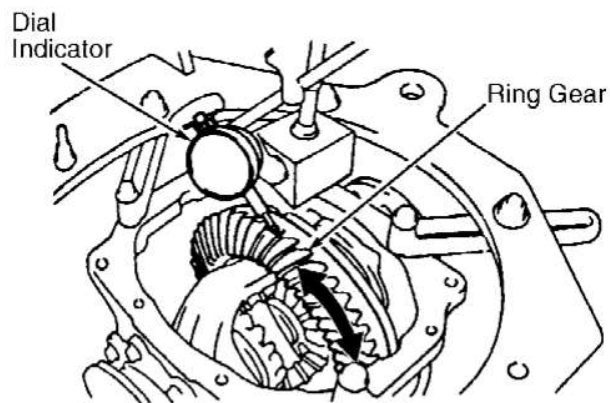
3. Using dial indicator, check ring gear runout at backside of ring gear while rotating ring gear. See **Fig. 7** . Replace ring gear if ring gear runout exceeds .0028" (.071 mm).
4. Using dial indicator, check ring gear backlash while rotating ring gear back and forth, and holding drive pinion from rotating. See **Fig. 7** . Check ring gear backlash at 3 different areas on ring gear. Ring gear backlash should be .0051-.0071" (.129-.180 mm). If not, adjust side bearing preload or replace components as necessary.
5. On all differentials check gear tooth contact pattern. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION.
6. On models equipped with conventional rear differential, use dial indicator to check side gear backlash while holding one side gear against differential case. See **Fig. 7** . Side gear backlash should be .0020-.0079" (.050-.201 mm). If side gear backlash is not within specification, different thickness thrust washers must be installed on side gears.

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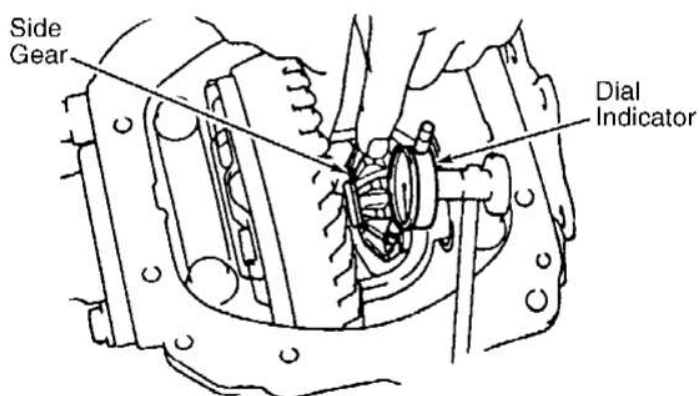
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CHECKING RING GEAR RUNOUT



CHECKING RING GEAR BACKLASH



CHECKING SIDE GEAR BACKLASH

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Fig. 7: Checking Typical Ring Gear Runout, Ring Gear Backlash & Side Gear Backlash
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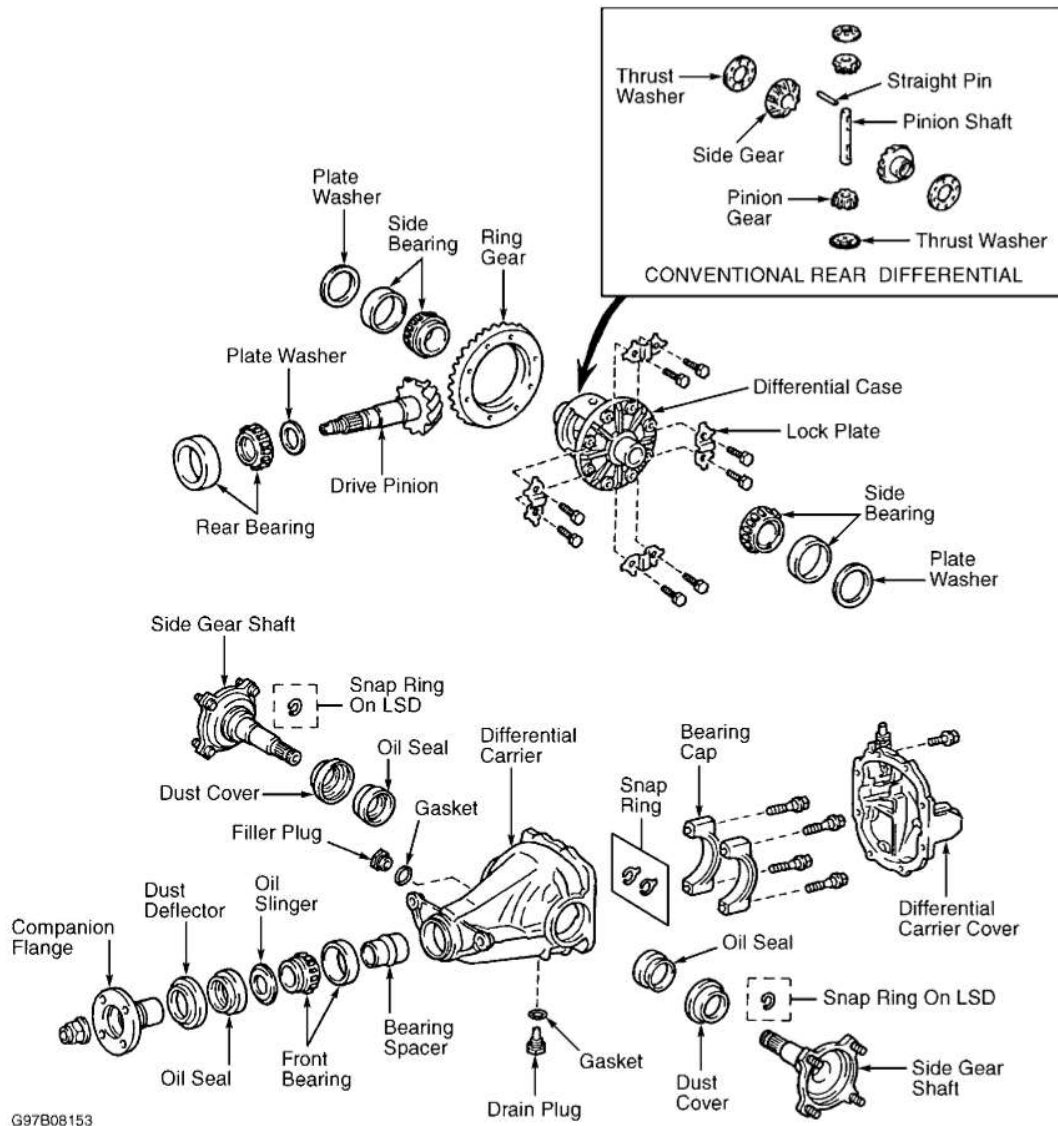


Fig. 8: Exploded View Of Rear Differential Assembly

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7. Measure total assembled preload required to rotate drive pinion and ring gear for reassembly reference. Total assembled preload should be within specification. See **AXLE ASSEMBLY SPECIFICATIONS** table.
8. Remove companion flange and oil seal from differential carrier. See **COMPANION FLANGE & OIL SEAL** under REMOVAL & INSTALLATION. Remove oil slinger from front bearing. Remove spacer from drive pinion.
9. On LSD models, use special puller to remove both side gear shafts from differential. With screwdriver, remove snap rings from both shafts. On conventional rear differential, use needle nose pliers to remove snap rings from inside differential carrier to remove side gear shafts. Remove shafts.

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10. Place reference marks on differential carrier and bearing caps. Remove both bearing caps. See **Fig. 8**.
11. Using side bearing replacer and a hammer, remove 2 side bearing plate washers. Measure and record thickness of plate washers. Remove differential case. Mark location of side bearing outer races for reassembly reference. Remove side bearing outer races from carrier.
12. Remove drive pinion from differential carrier. Press front bearing from drive pinion (if necessary). Using hammer and brass drift, remove bearing races from differential carrier.
13. Place reference marks on ring gear and differential case. Unstake and remove ring gear bolts. Using soft-face hammer, tap ring gear from differential case. Using puller, remove side bearings from differential case (if necessary).

NOTE: **On models with Limited Slip Differential (LSD), manufacturer does not recommend disassembly of differential case.**

14. If disassembling differential case on models equipped with conventional rear differential, drive straight pin from ring gear bolt side of differential case. Remove pinion shaft, side gears, pinion gears and thrust washers. On all models, remove dust cover from side gear shafts (if necessary).

Reassembly

NOTE: **Steps 1-4 only apply to conventional rear differential models.**

1. Press NEW dust cover on side gear shafts (if removed). Install side gears and thrust washers. Install pinion gears, thrust washers and pinion shaft in differential case. Ensure hole in pinion shaft aligns with hole for straight pin in differential case.
2. Check side gear backlash with dial indicator. See **Fig. 7**. Ensure side gear backlash is within .0020-.0079" (.050-.201 mm).
3. If side gear backlash is not within specification, install different thickness thrust washers on side gears and recheck side gear backlash.
4. Once correct side gear backlash is obtained, install straight pin in differential case. Using hammer and punch, stake differential case at straight pin area.
5. On all models, heat ring gear in boiling water. Remove ring gear from water and allow moisture to evaporate. Install ring gear on differential case with reference marks aligned. Temporarily install ring gear bolts to ensure correct alignment of ring gear. Allow ring gear to cool.

CAUTION: Ring gear bolts MUST NOT be tightened to specification until ring gear has cooled.

6. Once ring gear has cooled, install and tighten ring gear bolts in a crisscross pattern to specification. See **TORQUE SPECIFICATIONS**. Stake ring gear bolt plates.
7. Using press, press side bearings on differential case (if removed). Install differential case into carrier. Install 2 plate washers to remove all play in bearings. Install bearing caps. Using a dial indicator, measure ring gear runout. runout should be .0028" (.071 mm).
8. Remove bearing caps, plate washers and differential carrier. Press outer races into front and rear of

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differential carrier. Install original washer onto drive pinion. Press rear bearing onto drive pinion.

9. Install drive pinion into carrier and install front drive pinion bearing. Check and adjust gear tooth contact pattern. Assemble and install pinion spacer, oil slinger and NEW oil seal.
10. Press companion flange onto drive pinion. Coat threads of flange nut with grease. Adjusting drive pinion preload by tightening nut, in increments, while holding flange. Tighten nut to reach starting preload of 8.7-13.9 INCH lbs. (1.0-1.6 N.m) if a NEW front bearing was installed, or 4.3-6.9 INCH lbs. (.5-.8 N.m) if original bearing was installed.

CAUTION: When tightening drive pinion nut, DO NOT overtighten nut, as spacer is not installed on drive pinion. Drive pinion nut must be tightened until correct drive pinion rotating torque is obtained.

11. Install differential case with ring gear and outer bearing races in differential carrier.
12. Install plate washer on ring gear back side only. Using a plastic hammer, tap on ring gear to snug down washer and bearing. Using dial indicator, check ring gear backlash while rotating ring gear back and forth, and holding drive pinion from rotating. See **Fig. 7**.
13. Check ring gear backlash at 3 different areas on ring gear and record ring gear backlash. Ring gear backlash should be .0051" (.129 mm).
14. If ring gear backlash is not within specifications, select ring gear back side plate washer to bring backlash within specification. Select ring gear teeth side washer thick enough to eliminate any clearance between outer race and differential case.
15. Remove teeth side plate washer and differential case. Install ring gear back side plate washer. Place outer plate washer onto differential case, together with outer race. Install differential case with outer race into carrier. Tap ring gear with plastic hammer to snug down washer and bearing.
16. With a dial indicator, re-measure ring gear backlash. It should be .0051-.0071" (.13-.18 mm). If not, increase or decrease thickness of washers on both sides of ring gear by equal amount. Clearance should exist between plate washer and case when backlash is within specification.
17. When ring gear backlash is properly adjusted, remove teeth side plate washer. With micrometer, measure thickness of plate washer. Install NEW washer that is .0024-.0035" (.060-.088 mm) thicker than plate washer removed. Washer should press into position about 2/3 way by hand. Use brass bar and hammer to fully seat plate washer.
18. Align reference marks on bearing caps and carrier. Install bearing caps and tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Ensure ring gear backlash is within specified range. If not, increase or decrease thickness of washers on both sides of ring gear by equal amount.

NOTE: Backlash will change about .0008" (.020 mm) for every .0012" (.030 mm) change in plate washer thickness.

19. Using INCH-lb. torque wrench installed on drive pinion nut, measure total assembled preload required to rotate drive pinion and ring gear. Total assembled preload should equal amount of starting preload plus 2.6-4.3 INCH lbs. (.3-.5 N.m).
20. Check gear tooth contact pattern. See GEAR TOOTH CONTACT PATTERNS article in GENERAL INFORMATION. If gear tooth contact pattern is incorrect, install different thickness adjusting washer located in differential carrier, behind race for front bearing. Recheck gear tooth contact pattern. Adjusting

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washers are available in various thicknesses.

21. Remove companion flange and front bearing. Install NEW spacer on drive pinion. Install NEW front bearing. Install oil slinger on drive pinion. Install drive pinion in differential carrier.
22. Apply grease to lip of NEW oil seal for drive pinion. Install oil seal in differential carrier until surface of oil seal is .079" (2.01 mm) below surface of differential carrier.
23. Press companion flange onto drive pinion. Coat threads on drive pinion and NEW drive pinion nut with gear oil. Install drive pinion nut. Hold companion flange and tighten nut to 80 ft. lbs. (108 N.m).

CAUTION: When tightening drive pinion nut, DO NOT overtighten nut. Drive pinion nut must be tightened until correct drive pinion rotating torque is obtained.

24. Measure preload of backlash between drive pinion and ring gear. Starting preload should be 8.7-13.9 INCH lbs. (1.0-1.6 N.m) with a NEW front bearing, or 4.3-6.9 INCH lbs. (.5-.8 N.m) with a reused bearing.
25. If drive pinion starting preload exceeds specified range, replace bearing spacer and repeat procedure. If starting preload is less than specified range, tighten drive pinion nut, in small increments, until specified preload is reached. DO NOT exceed 174 ft. lbs. (236 N.m) torque on drive pinion nut. If torque is exceeded, replace spacer and repeat procedure. DO NOT back off nut if torque is exceeded.
26. Once correct starting preload is obtained, recheck total preload, ring gear backlash, tooth contact pattern between ring gear and drive pinion, and companion flange runout. When okay, stake drive pinion nut. Install NEW side gear oil seals until flush with carrier end surface.
27. On models equipped with LSD, install NEW snap ring on end of side gear shafts. Coat snap rings with grease. Using slide hammer, install side gear shafts until pinion shaft is contacted.
28. On models equipped with conventional rear differential, install side gear shafts. Install 2 NEW snap rings into the inside of differential.
29. Clean carrier and cover contact surfaces. Apply sealant on differential carrier cover and install. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

AXLE ASSEMBLY SPECIFICATIONS

AXLE ASSEMBLY SPECIFICATIONS

Application	Specification
Drive Pinion Rotating Torque	
New Bearings	8.7-13.9 INCH lbs. (1.0-1.6 N.m)
Used Bearings	4.3-6.9 INCH lbs. (.5-.8 N.m)
Ring Gear Backlash	.0051-.0071" (.129-.180 mm)
Ring Gear Runout	.0028" (.071 mm)
Side Gear Backlash	.0020-.0079" (.050-.201 mm)
Total Assembled Preload ⁽¹⁾	2.6-4.3 INCH lbs. (.3-.5 N.m)
(1) Add this amount to drive pinion rotating torque to obtain total preload.	

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TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Axle Shaft Flange-To-Side Gear Shaft Nut	41 (56)
Bearing Cap Bolt	58 (79)
Center Support Bearing Bolts	27 (37)
Differential Assembly Mounting Bolt	
Front Mount-To-Carrier Bolt	98 (133)
Rear Mount-To-Carrier Bolt	101 (137)
Rear Mount-To-Frame Bolt	48 (65)
Differential Carrier Cover Bolt	34 (46)
Drain & Filler Plugs	36 (49)
Drive Pinion Nut ⁽¹⁾	80 (108)
Drive Shaft Companion Flange Bolt/Nut	54 (73)
Hub Nut	159 (216)
Lower Control Arm-To-Strut Bolt/Nut	94 (127)
Ring Gear Bolt	71 (96)
Stabilizer Bar Link Bolt/Nut	
2-Door	33 (45)
4-Door	54 (73)
(1) Tighten to 174 ft. lbs. (236 N.m) when setting drive pinion preload.	