

SECTION 4B

REAR AXLE

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SECTION 4B1

7¹/₂ AND 7⁵/₈-INCH RING GEAR AXLES

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DESCRIPTION

The corporate 7¹/₂ and 7⁵/₈-inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers this driving force at a 90 degree angle from the propeller shaft to the drive shafts.

This axle is semi-floating. The axle shafts are supported at the wheel end of the shaft by a roller bearing that is pressed into the housing. The shafts are retained into the housing by retaining clips within the differential. The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.

The ring gear is bolted onto the differential case with 10 left-hand thread bolts.

The differential case is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using se-

lective shims and spacers between the bearing and the axle housing. To move the ring gear, shims are deleted from one side and an equal amount are added to the other side. These shims are also used to preload the bearings which are pressed onto the differential case. Two bearing caps are used to hold the differential into the rear axle housing.

The differential is used to allow the wheels to turn at different rates of speed while the rear axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.

The rear axle is sealed with a pinion seal, a seal at each axle shaft end, and by a gasket between the rear cover and the axle housing.

All corporate rear axles are identified by the part number on the right axle tube near the carrier. The carrier cover does not have a drain plug.

CHECKING THE AXLE BEFORE DISASSEMBLY

Inspect

- Remove the axle cover from the rear axle and drain the axle lubricant into a suitable container.
1. The ring gear backlash. Refer to "Backlash Adjustment" in this section. This information can be used to determine the cause of the axle problem. It will also help when setting up the shim packs for locating and preloading the differential case.
 2. The case for metal chips and shavings. Determine where these chips and shavings come from, such as a broken gear or bearing cage.
- Determine the cause of the axle problem before disassembly if possible.

DISASSEMBLY OF THE REAR AXLE

Remove or Disconnect (Figure 1)

Tools Required:

J 8107-2 Differential Side Bearing Remover Plug

J 22888 Side Bearing Remover

J 8614-01 Pinion Flange Remover

J 25320 Rear Pinion Bearing Remover

- Place the rear axle in a suitable support.
1. The differential cover bolts (35) and the differential cover (34).
 - Drain the gear lubricant into a proper container.
 2. Axle shafts (2). Refer to the proper service manual.
 3. Outer wheel bearings and seals. Refer to the proper service manual.
 4. Pinion shaft lock screw (30).
 5. Pinion shaft (29).
 6. Differential pinion and side gears (26).
 - Roll the pinion gears out of the case with the pinion thrust washers (27).
 - Remove the side gears and the side gear thrust washers (28). Mark the gears and the differential case as left and right.
 7. Differential bearing cap bolts (32).
 8. Differential bearing caps (31).
 - Mark the caps and the housing as left and right.

NOTICE: Be careful when prying the differential case out of the axle housing so as not to damage the cover gasket surface. The differential case must be supported when it is being removed to prevent the case from falling and damaging the case.

9. Differential carrier (24).
 - Pry the case from the axle housing at the differential "window" (figure 2).
10. Bearing outer races (22), shims (21), and spacers (23).

- Mark the races and the shims as left and right, and place them with the bearing caps.

11. Differential side bearings using J 8107-2 and J 22888 (figure 3).

- The jaws of J 22888 must pull from beneath the bearing cone and not the cage.

12. Ring gear bolts (25).

- Ring gear bolts use left-handed threads.

NOTICE: Do not pry the ring gear from the case. This will damage the ring gear and the differential case.

13. Ring gear (20) from the differential.

- Drive the ring gear off with a brass drift if necessary.

Inspect

- Drive pinion bearing preload (figure 4).
- The pinion assembly for looseness by moving it back and forth. (Looseness indicates excessive bearing wear).

14. Pinion flange nut (11) and washer (12) using J 8614-01 to hold the pinion flange.

15. Pinion flange using J 8614-01.

16. Pinion (20) from the axle housing.

- Thread the pinion nut halfway onto the pinion.
- Replace the differential cover (34) with two bolts (35) to keep the pinion from falling to the floor.
- Drive the pinion out of the housing with a hammer and a soft drift.
- Remove the cover (34) and the pinion (20).

17. Collapsible spacer (17) from the pinion (figure 5).

18. Outer seal (14) and outer pinion bearing (15).

19. Inner bearing (18) and shim (19) from the pinion.

- Press the bearing off the pinion using J 25320 (figure 6).
- Remove the shim.

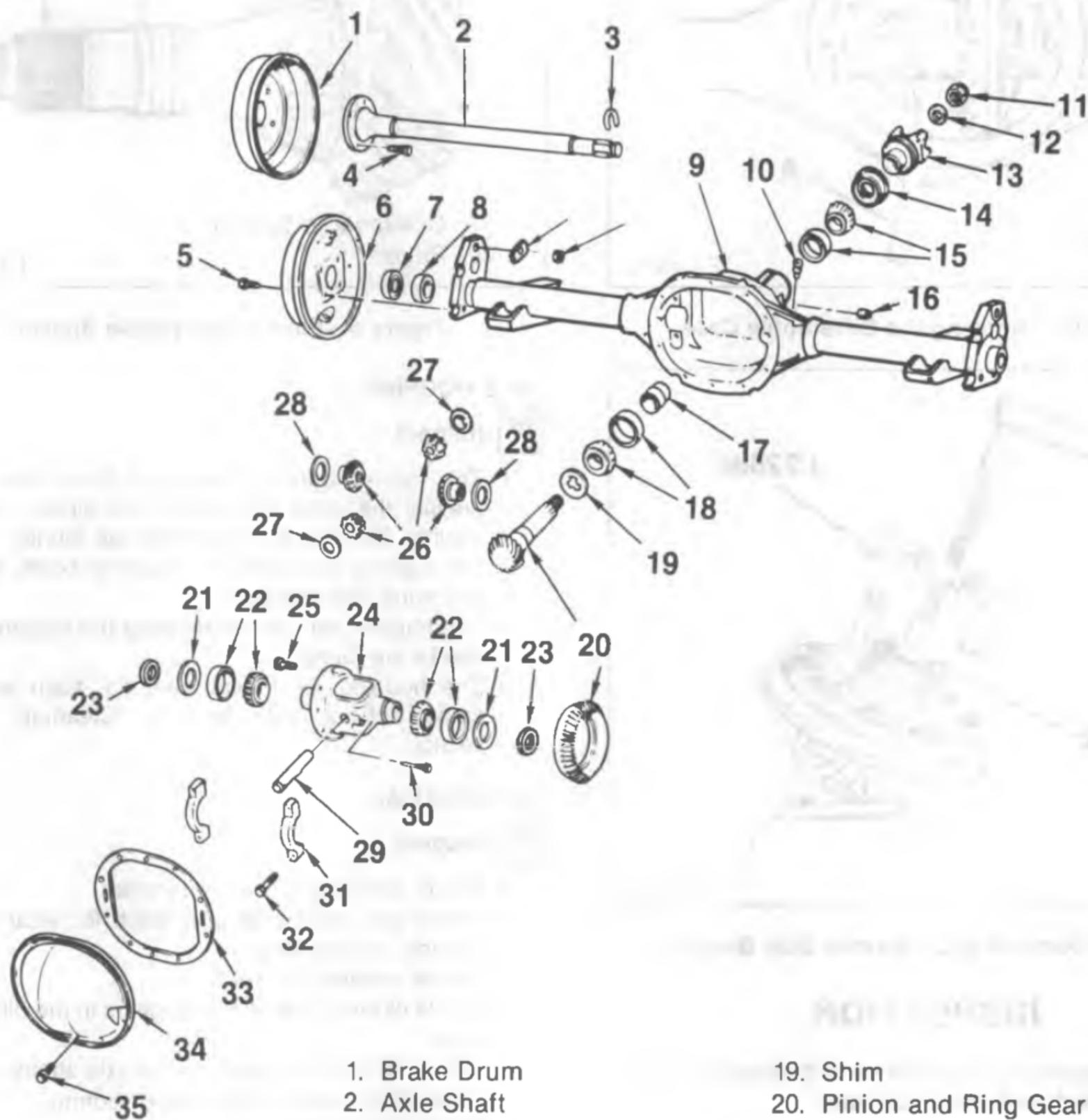
20. Bearing cups (15) and (18) from the axle housing using a hammer and a punch in the slots provided for this purpose.

- Work the cups out of the housing evenly, moving the punch back and forth between one side of the cup and the other.

CLEANING

Do not steam clean drive parts having ground and polished surfaces such as gears, bearings, and shafts. These parts should be cleaned in a suitable solvent. All parts should be disassembled before cleaning.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with compressed air. Do not allow the bearings to spin while drying them with compressed air.



- | | |
|--------------------------|-------------------------------|
| 1. Brake Drum | 19. Shim |
| 2. Axle Shaft | 20. Pinion and Ring Gear Set |
| 3. "C" Lock | 21. Shim |
| 4. Wheel Stud | 22. Differential Side Bearing |
| 5. Backing Plate Bolt | 23. Spacer |
| 6. Brake Assembly | 24. Differential Case |
| 7. Axle Shaft Oil Seal | 25. Ring Gear Bolt |
| 8. Axle Shaft Bearing | 26. Differential Gears |
| 9. Axle Housing | 27. Pinion Thrust Washers |
| 10. Axle Air Vent | 28. Side Gear Thrust Washers |
| 11. Pinion Nut | 29. Pinion Shaft |
| 12. Washer | 30. Pinion Shaft Lock Bolt |
| 13. Pinion Flange | 31. Bearing Cap |
| 14. Pinion Oil Seal | 32. Bolt |
| 15. Pinion Outer Bearing | 33. Gasket |
| 16. Plug | 34. Cover |
| 17. Collapsible Spacer | 35. Bolt |
| 18. Pinion Inner Bearing | |

Figure 1—Rear Axle Components

4B1-4 7 1/2 AND 7 5/8-INCH RING GEAR AXLES

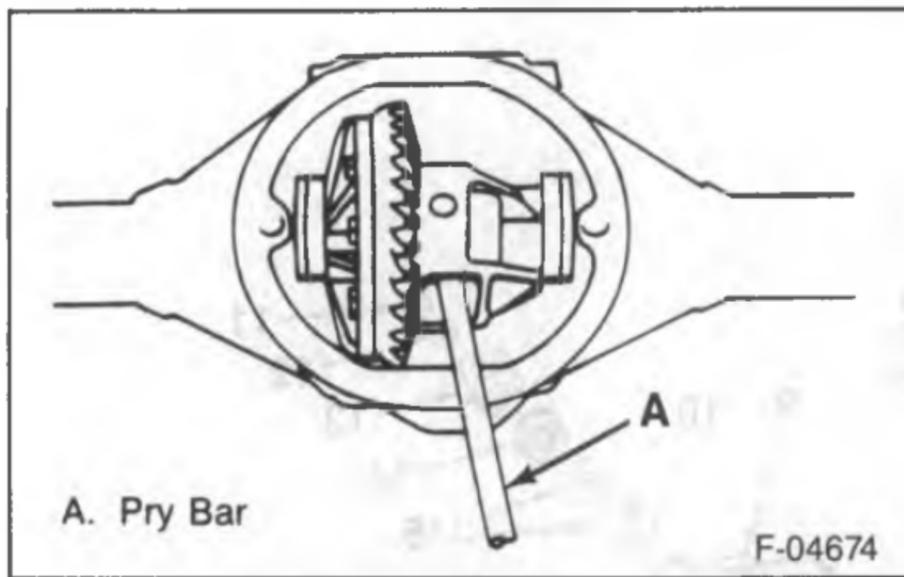


Figure 2—Removing the Differential Case

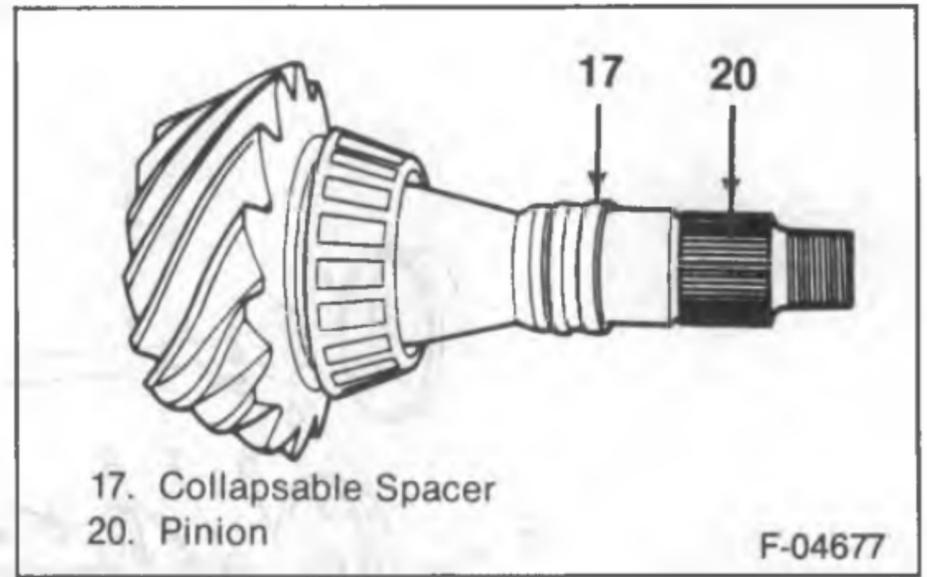


Figure 5—Pinion Collapsible Spacer

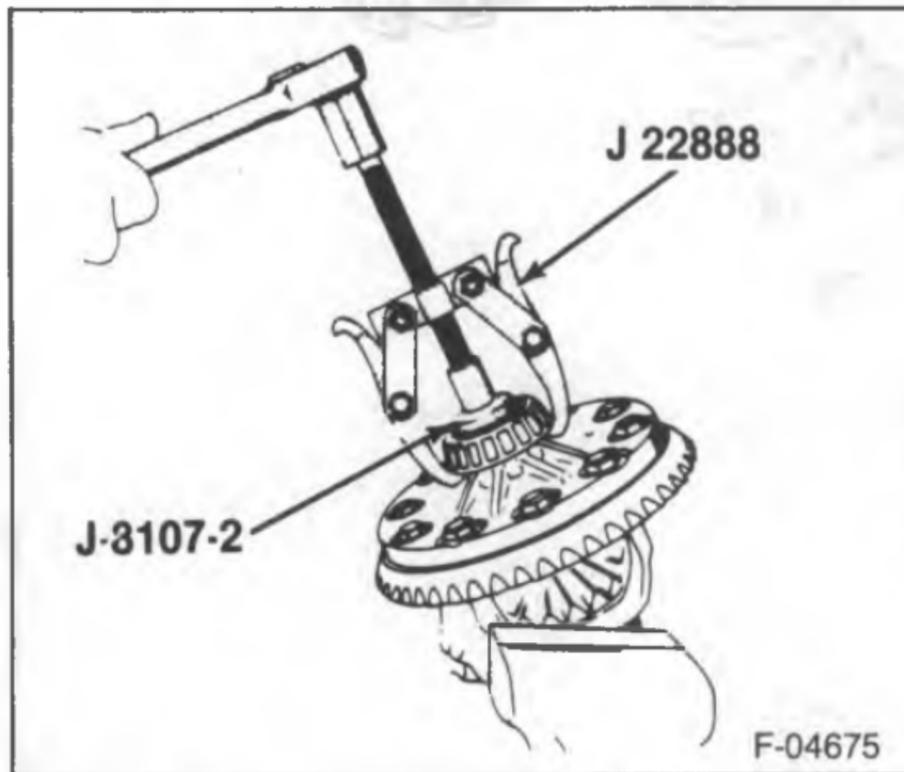


Figure 3—Removing Differential Side Bearings

INSPECTION

It is very important to carefully and thoroughly inspect all drive unit parts before reassembly.

Thorough inspection of the drive parts for wear or stress and subsequent replacement of worn parts will eliminate costly drive component repair after reassembly.

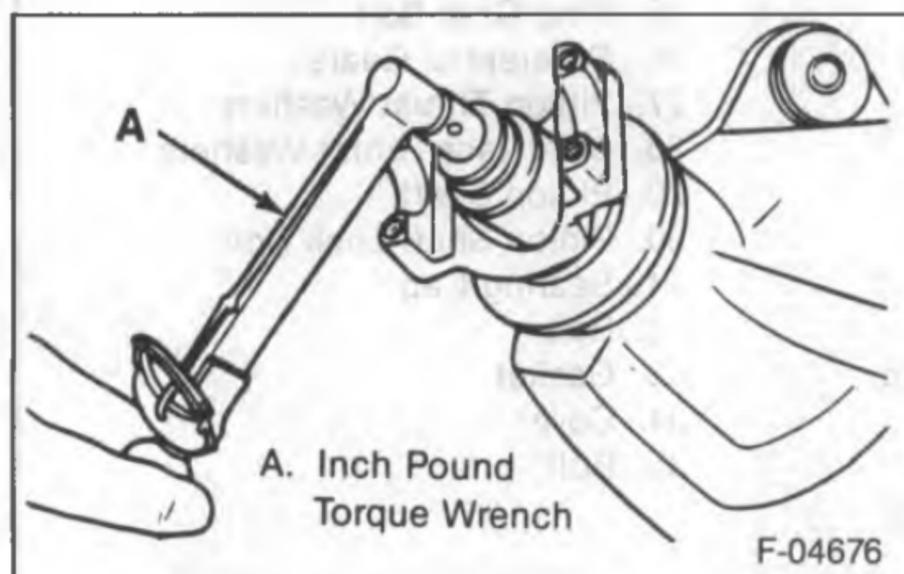


Figure 4—Checking Pinion Preload

AXLE HOUSING

Inspect

- The carrier bore for nicks or burrs that would prevent the outer diameter of the pinion seal from sealing. Remove any burrs that are found.
- The bearing cup bores for nicks or burrs. Remove any burrs that are found.
- The housing for cracks. Replace the housing if any cracks are found.
- The housing for foreign material such as metal chips, dirt, or rust. Refer to "Cleaning" in this section.

DIFFERENTIAL

Inspect

- Pinion gear shaft for unusual wear.
- Pinion gear and side gear teeth for wear, cracks, scoring, and spalling.
- Thrust washers for wear.
- The fit of the differential side gears in the differential case.
- The fit of the side gears on the axle shafts.
- Differential case for cracks and scoring.
- Replace all worn parts.

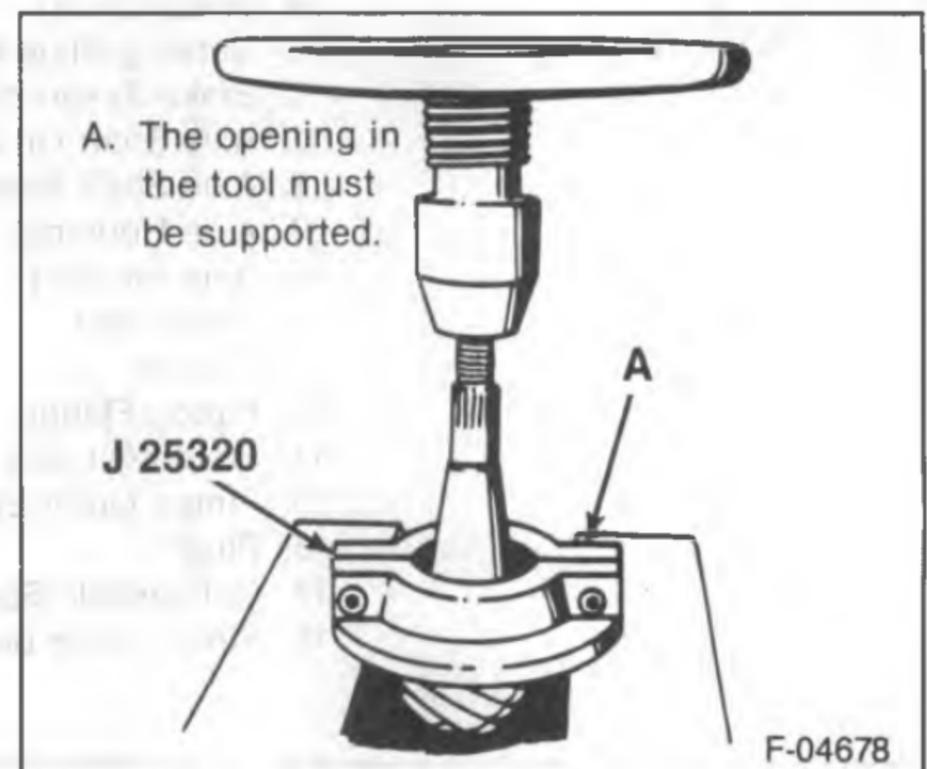


Figure 6—Removing the Pinion Rear Bearing

PINION AND RING GEAR

Inspect

- Pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Pinion splines for wear.
- Pinion flange splines for wear.
- The fit of the pinion on the pinion flange.
- The sealing surface of the pinion flange for nicks, burrs, or rough tool marks which would cause damage to the seals' inside diameter and result in an oil leak.
- Replace all worn or broken parts.
- Ring and pinion gears are matched sets and are both replaced any time a replacement of either is necessary.

BEARINGS

Inspect

- Bearings visually and by feel.
- The bearings should feel smooth when oiled and rotated while applying as much hand pressure as possible.
- The large end of the bearing rollers for wear. This is where tapered roller bearing wear is most evident.
- Bearing cups for wear, cracks, brinelling and scoring.
- Bearings and cups are only replaced as sets.
- If the rear axle was operated for an extended period of time with very loose bearings, the ring gear and drive pinion will also require replacement.
- Low mileage bearings may have minute scratches and pits on the rollers and the bearing cups from the initial pre-load. Do not replace a bearing for this reason.
- Bearing cups for cracks or chips.

SHIMS

Inspect

- Shims for cracks and chips. Damaged shims should be replaced with an equally sized service shim.

ASSEMBLY OF THE REAR AXLE

Install or Connect (Figures 1, 7 and 8)

Tools Required:

- J 7817 Front Pinion Bearing Cup Installer
- J 7818 Rear Pinion Bearing Cup Installer
- J 8092 Driver Handle

- Pinion bearing cups (15) and (18) using J 7817, J 7818 and J 8092.

PINION DEPTH ADJUSTMENT (Figure 9)

Tools Required:

- J 21777-40 Rear Pilot Washer
- J 21777-42 Front Pilot Washer
- J 21777-43 Stud Assembly — Bolt
- J 21777-45 Side Bearing Discs
- J 23597-1 Arbor
- J 23597-11 Gage Plate
- J 8001 Dial Indicator

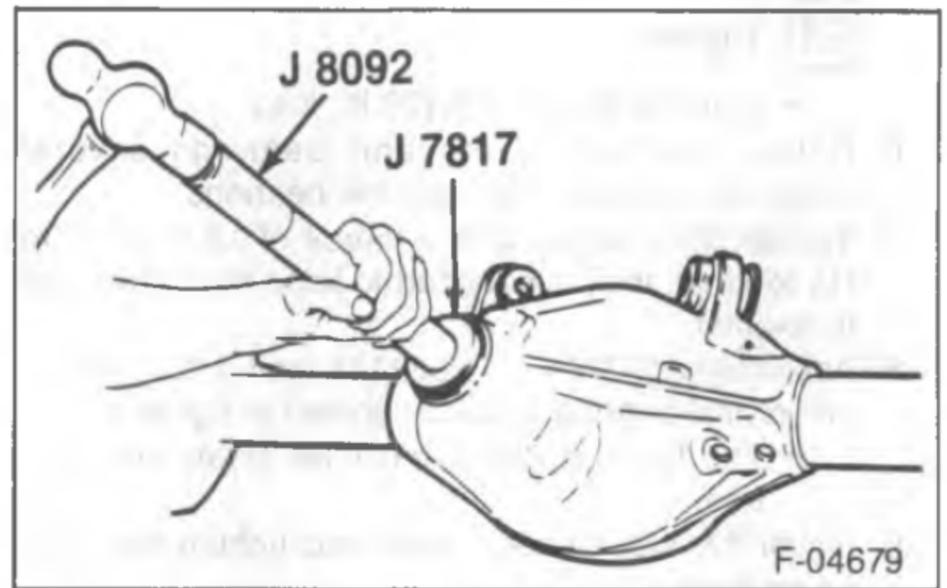


Figure 7—Installing the Front Pinion Bearing Cup

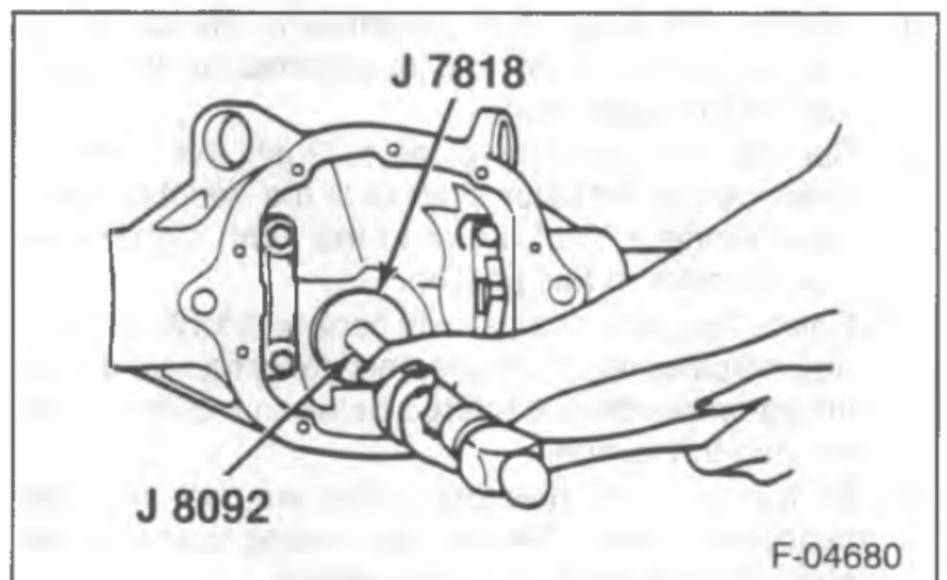


Figure 8—Installing the Rear Pinion Bearing Cup

1. Clean all the gage parts.
2. Lubricate the front and rear pinion bearings with axle lubricant.
3. Place the bearings (15) and (18) into the pinion bearing cups.
4. Install J 21777-40, J 21777-42, J 21777-43 and J 23597-11 to the pinion bore (figure 9).
5. Hold the stud stationary at the flats of the stud.

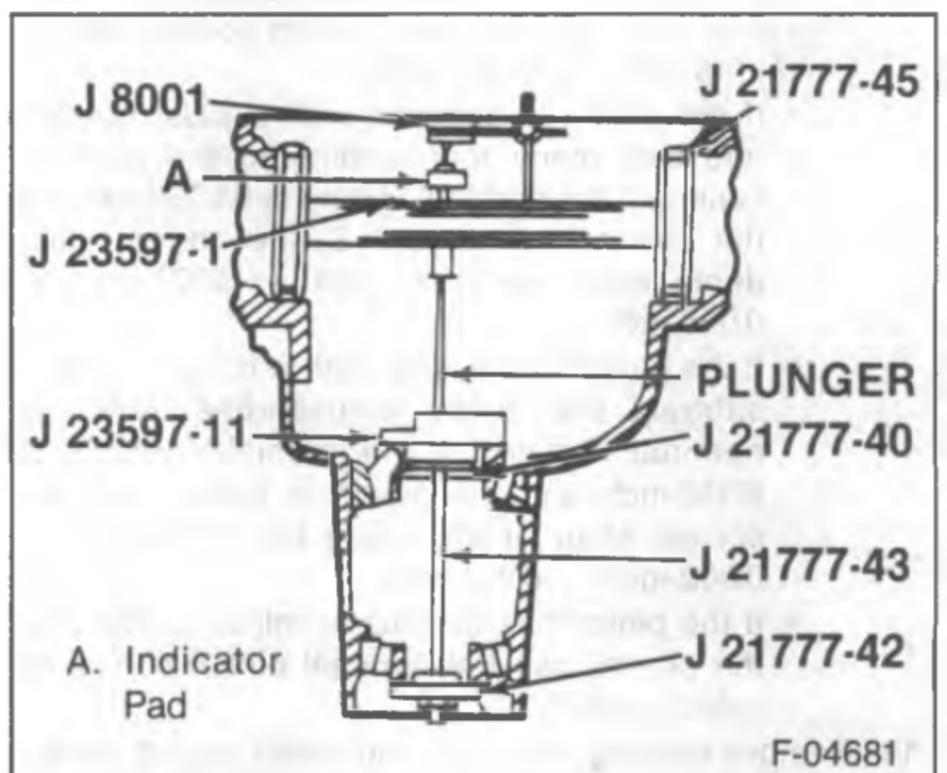


Figure 9—Pinion Depth Tools

**Tighten**

- Stud nut to 2.2 N·m (20 in. lbs.).
6. Rotate the gage plate and bearings several complete revolutions to seat the bearings.
 7. Tighten the stud nut until a torque of 1.6 to 2.2 N·m (15 to 25 in. lbs.) is obtained to keep the gage plate in rotation.
 8. Assemble J 21777-45, J 23597-11, and J 8001 to the differential bearing bores as shown in figure 9.
 - The bearing bores must be clean and burr free.
 9. Install the side bearing caps and tighten the bolts finger tight.
 10. Rotate the gage plate until the gaging areas are parallel with the disks.
 11. Position the gage shaft assembly in the carrier so that the dial indicator rod is centered on the gage area of the gage block.
 12. Set the dial indicator at zero. Push the indicator down on the indicator shaft until the needle rotates approximately $\frac{3}{4}$ of a turn to the right. Tighten the dial indicator in this position.
 13. Rotate the gage shaft slowly back and forth until the dial indicator reads the greatest deflection (when the indicator needle is centered between moving to the left and to the right).
 14. At the point of greatest deflection, set the dial indicator to zero. Repeat the rocking action of the gage shaft to verify the zero setting.
 15. Rotate the gage shaft until the dial indicator rod does not touch the gage block.
 16. Record the actual number on the dial indicator and not the number which represents how far the needle travels. This is the nominal pinion setting.

EXAMPLE: If the indicator needle moved to the left 1.70 mm (0.067-inch) to a dial reading of 0.84 mm (0.033-inch) as shown in figure 10, record the dial reading of 0.84 mm (0.033-inch) not 1.70 mm (0.067-inch).

The dial indicator should be in the 0.50 to the 1.27 mm (0.020 to 0.050-inch) range.
 17. Check the pinion face for a pinion adjustment mark. This mark indicates the best running position for the pinion from the nominal setting.
 - If the pinion is stamped with a plus number, add that many thousandths to the nominal setting. If the nominal setting is 0.033-inch and the pinion is marked +2, the correct shim depth would be 0.033-inch + 0.002-inch = 0.035-inch.
 - If the pinion is stamped with a minus number, subtract that many thousandths from the nominal setting. If the nominal setting is 0.033-inch and the pinion is marked -2, the correct shim depth would be 0.033-inch - 0.002-inch = 0.031-inch.
 - If the pinion has no plus or minus marked on the pinion, use the nominal pinion setting to select a shim.
 18. Remove bearing caps (31) and depth gaging tools.
 19. Install the correct pinion shim (19) according to this procedure to the pinion.

DIFFERENTIAL CASE ASSEMBLY**Install or Connect (Figure 1)****Tools Required:**

- J 25299 Differential Side Bearing Installer
- J 8092 Driver Handle
- J 8107-2 Differential Side Bearing Remover Plug

- Lubricate all parts with rear axle lubricant.
1. Side gear thrust washers (28) to the side gears (26).
 2. Side gears (28) to the differential case (24).
 - Place the side gears in place on the same side as removed.
 3. Pinion gears (28) to the differential without the thrust washers (27).
 - Place one pinion gear onto the side gears and rotate the gears until the pinion is exactly opposite from the differential opening.
 - Place the second pinion gear onto the side gears so that the pinion gear holes line up.
 - Rotate the pinion gears into place, and verify that the pinion gears line up with the pinion shaft holes.
 4. Pinion thrust washers (27).
 - Rotate the pinion gears toward the differential opening just enough to slide in the pinion thrust washers.
 5. Pinion shaft.
 6. Pinion shaft screw.
 - Check that the mating surfaces of the differential case and the ring gear are clean and burr free.
 7. Ring gear (20) to the differential case (24) (figure 11).
 - Thread two left-hand threaded studs into the ring gear on opposite sides.
 - Place the ring gear onto the case, and align the studs with the holes in the case.
 8. New ring gear bolts (25).
 - Tighten the ring gear bolts alternately in stages gradually pulling the ring gear onto the differential case.

**Tighten**

- The ring gear bolts in sequence to 120 N·m (90 ft. lbs.).
9. Differential side bearings (22) using J 25299, J 8092, and J 8107-2 (figure 12).
 - Place J 8107-2 into the differential on the side opposite of bearing installation to protect the differential case.
 - Drive the bearing onto the case using J 25299 and J 8092.
 10. Differential case (24) to the axle housing. Refer to "Side Bearing Pre-Load Adjustment" in this section.

SIDE BEARING PRE-LOAD ADJUSTMENT

- The side bearing pre-load adjustment must be made before installing the pinion.
- The case side bearing pre-load is adjusted by changing the thickness of both the left and right shims equally. This will maintain the original backlash.

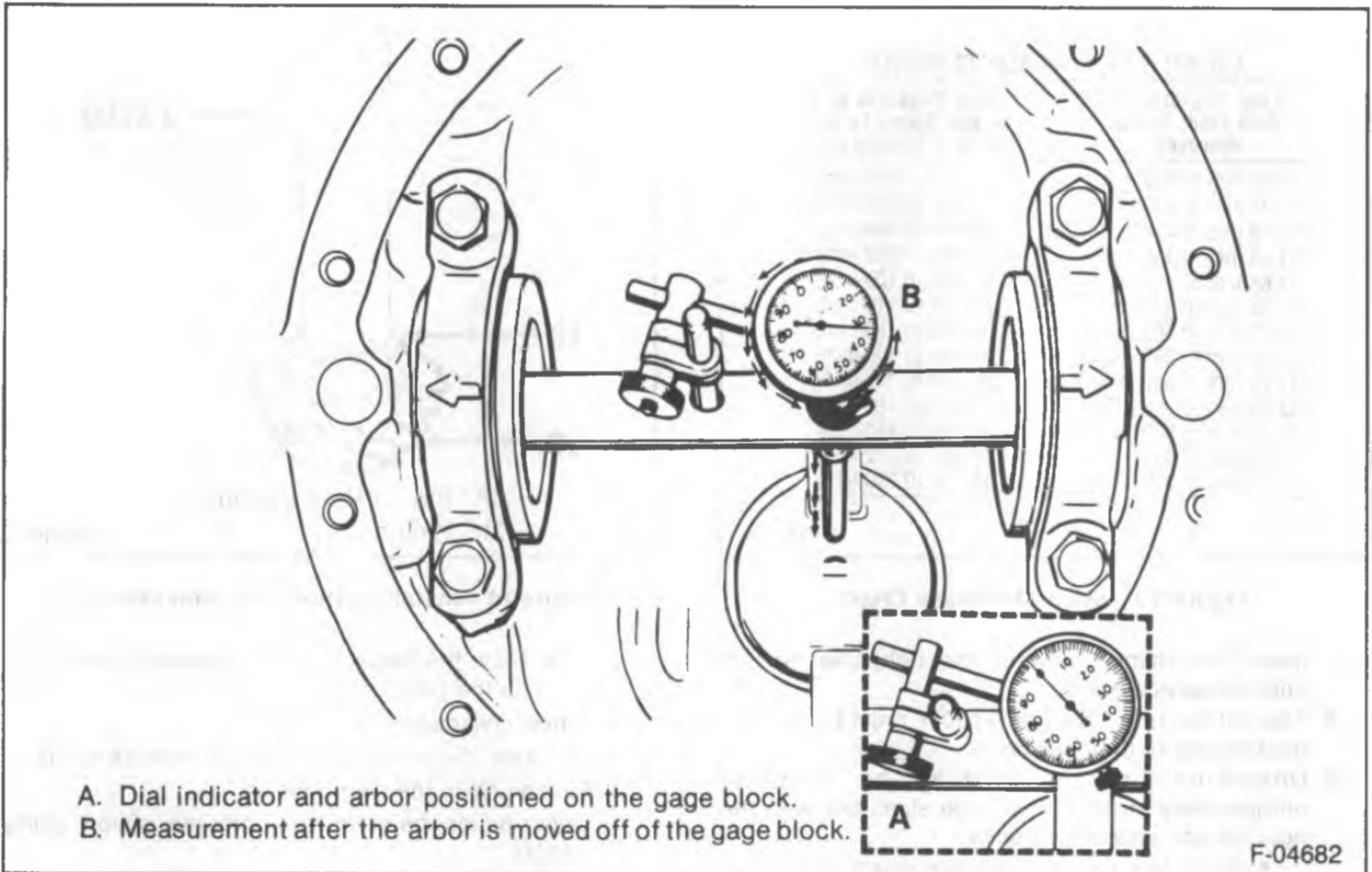


Figure 10—Checking Pinion Depth

- Production shims are cast iron and are not to be reused. Measure the production shims and spacers one at a time, and add the measurements together to obtain the sizes of the left and right shim packs.
- Service spacers are 4.32 to 4.37 mm (0.170 to 0.172-inch) thick.
- Service shims are available from 1.02 mm to 2.54 mm (0.040 to 0.100-inch) in increments of 0.101 mm (0.004-inch).
- Be sure that the side bearing surfaces are clean and free of burrs.

1. Place the case with the bearing cups installed into the axle housing (figure 1).
 - Lubricate the axle bearings with axle lubricant.
2. Insert the service spacer between the bearing cup and the axle housing. Place the chamfered edge against the housing.
3. Install the left bearing cap and bearing cap bolts. Do not tighten the bolts.
4. Select one or two shims totaling the amount needed as shown in figure 13.

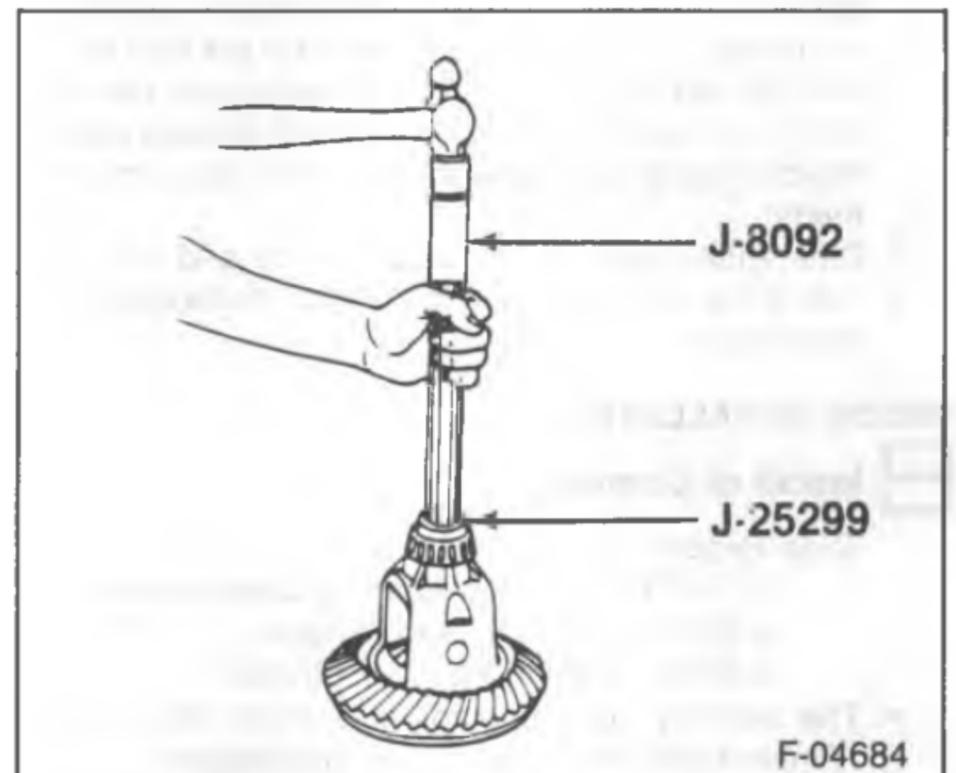
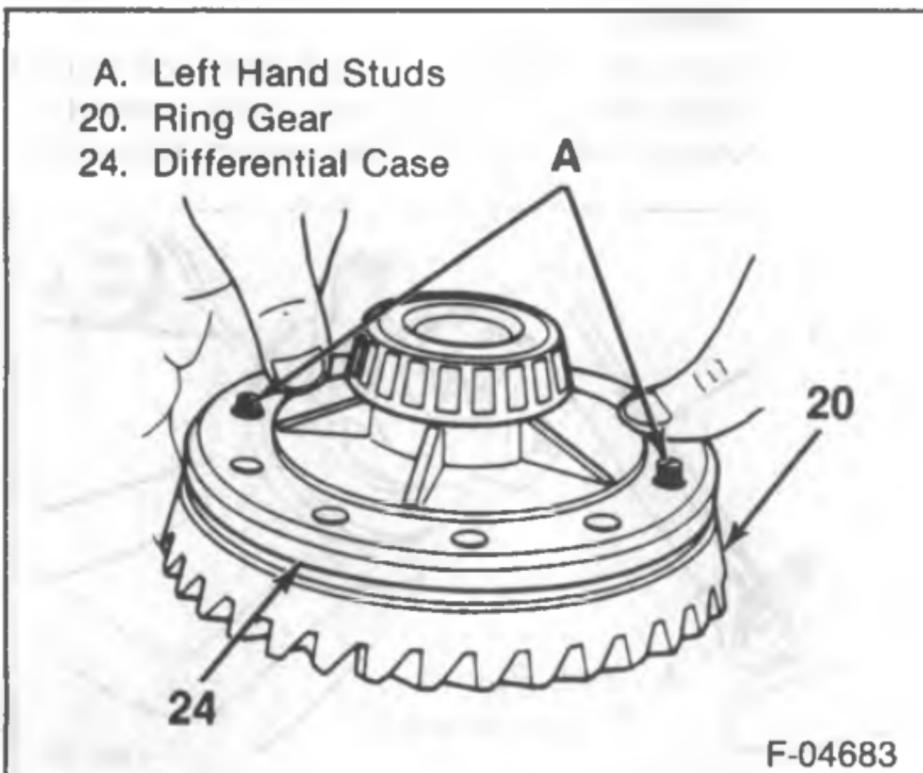


Figure 11—Aligning the Ring Gear Studs

Figure 12—Installing the Side Bearing

4B1-8 7 1/2 AND 7 5/8-INCH RING GEAR AXLES

4.32 MM (0.170-INCH) SERVICE SPACER

Total Thickness of Both Prod. Shims Removed	Total Thickness of Service Shims To Be Used As A Starting Point
10.57 mm (0.420-inch)	1.52 mm (0.060-inch)
10.92 mm (0.430-inch)	1.78 mm (0.070-inch)
11.18 mm (0.440-inch)	2.03 mm (0.080-inch)
11.43 mm (0.450-inch)	2.29 mm (0.090-inch)
11.68 mm (0.460-inch)	2.54 mm (0.100-inch)
11.94 mm (0.470-inch)	2.79 mm (0.110-inch)
12.19 mm (0.480-inch)	3.05 mm (0.120-inch)
12.45 mm (0.490-inch)	3.30 mm (0.130-inch)
12.70 mm (0.500-inch)	3.56 mm (0.140-inch)
12.95 mm (0.510-inch)	3.81 mm (0.150-inch)
13.21 mm (0.520-inch)	4.06 mm (0.160-inch)
13.46 mm (0.530-inch)	4.32 mm (0.170-inch)
13.97 mm (0.550-inch)	4.83 mm (0.190-inch)

F-04685

Figure 13—Shim Thickness Chart

5. Install the shim(s) between the right bearing cup and the service shim.
 - The left bearing race and spacer must be against the left side of the housing.
6. Determine bearing pre-load by inserting progressively larger feeler gage sizes between the right service spacer and shim.
 - Push the feeler gage downward so that it contacts the shim at the top and bottom, and then contacts the axle housing.
 - Rotate the case while using the feeler gage. This will assure an accurate reading.
 - The weight of the case will cause a light drag. Do not mistake this drag for bearing preload.
 - Start with a thin feeler gage to obtain a feel for when preload begins. It will be necessary to work the case in or out and to the left in order to insert the feeler gage.
 - The point just before additional drag begins is the correct feeler gage thickness. This is the zero setting without pre-load.
7. Remove the left bearing cap and shim(s) from the axle housing. Measure the shims using a micrometer. The shim pack needed is the total of the shim(s) and the feeler gage. An additional pre-load of 0.10 mm (0.004-inch) will be added to each side of the differential case after the backlash adjustment is made.
8. Differential case, bearing cups, shims and spacers.
9. Install the pinion. Refer to "Pinion Installation" in this section.

PINION INSTALLATION

Install or Connect

Tools Required:

- J 5590 Rear Pinion Bearing Cone Installer
- J 23911 Pinion Oil Seal Installer
- J 8614-01 Pinion Flange Remover

- The bearing cups should have been installed in "Pinion Depth Adjustment," in this section.
1. The pinion inner bearing (18) using J 5590 (figure 14).

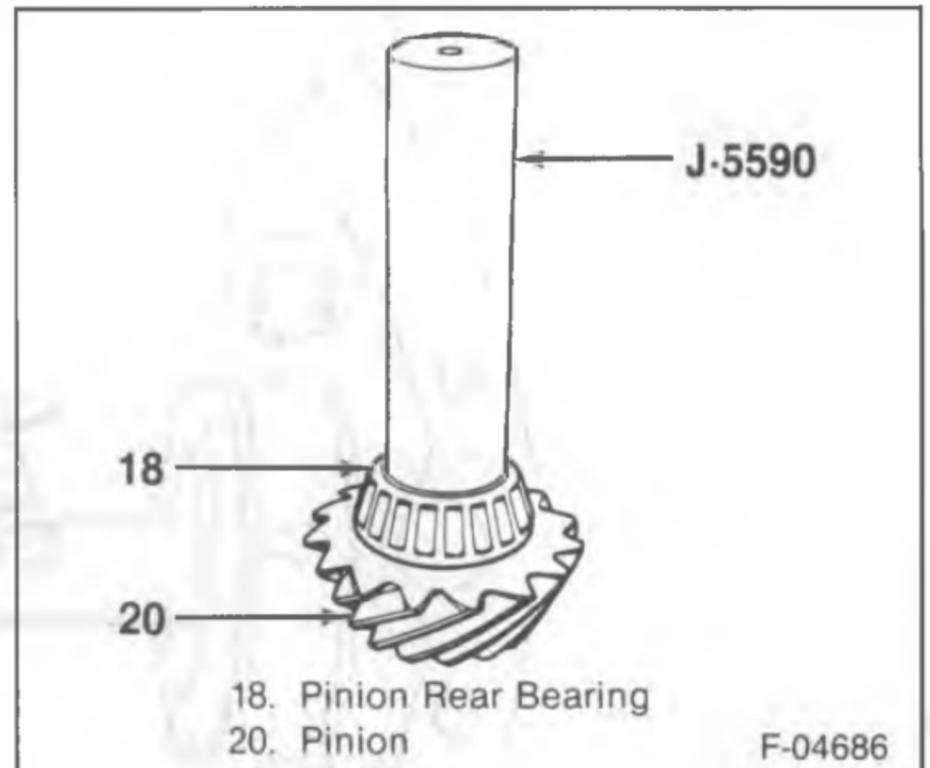


Figure 14—Installing the Pinion Inner Bearing

- Drive the bearing until the bearing cone seats on the pinion shims.
2. A new collapsible spacer (17).
 - Lubricate the pinion bearings with axle lubricant.
 3. Pinion (20) to the axle housing.
 4. Outer pinion bearing (15) onto the pinion using J 5590.
 - Hold the pinion forward from inside the case while driving the bearing onto the pinion.
 5. Pinion oil seal (14) using J 23911.
 6. The pinion flange (13) to the pinion by tapping it with a rawhide hammer until a few threads show through the pinion flange.
 7. The pinion washer (12) and a new nut (11) while holding the pinion flange with J 8614-01.

Tighten

- The nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings. Once there is no end play in the pinion, the preload torque should be checked.
- Remove J 8614-01. Using an inch-pound torque wrench, check the pinion preload by rotating the pinion with the wrench (figure 15).

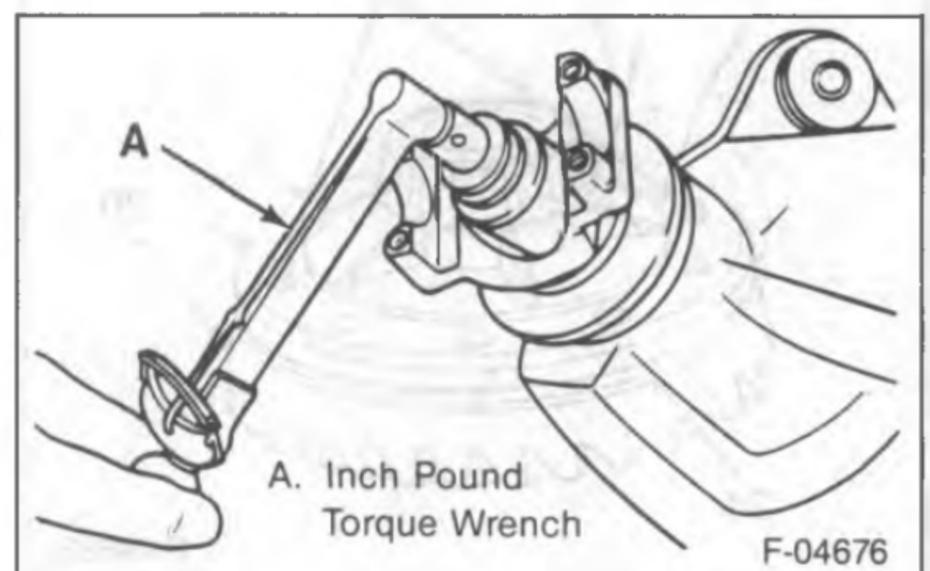


Figure 15—Checking Pinion Preload

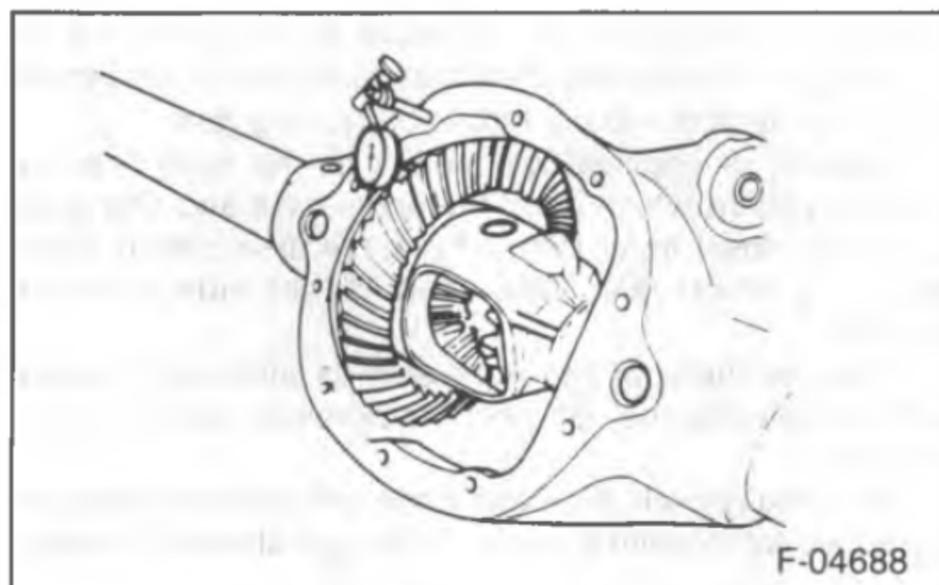


Figure 16—Checking Backlash

Preload should be at or below 2.7 to 3.6 N·m (24 to 32 in. lbs.) on new bearings, or 1.0 to 1.4 N·m (8 to 12 in. lbs.) for used bearings.

- If the preload torque is below the preloads given above, continue torquing the nut in small increments. Check the preload after each tightening. Each tightening increases the bearing preload by several pounds. If the bearing preload is exceeded, the pinion will have to be removed, and a new collapsible spacer installed.
 - Once a preload of 2.7 to 3.6 N·m (24 to 32 in. lbs.) has been obtained, rotate the pinion several times to assure that the bearings have seated. Recheck the preload, and adjust if necessary.
8. Differential case. Refer to "Backlash Adjustment" in this section.

BACKLASH ADJUSTMENT

1. Install the differential case, bearing cups, spacers, and shims as determined from the "Side Bearing Preload Adjustment" earlier in this section.
2. Rotate the case several times to seat the bearings.
3. Install a dial indicator to the case using a magnetic base.
4. Place the indicator stem at the heel end of a tooth (figure 16).
 - Set the dial indicator so that the stem is in line with the gear rotation and perpendicular to the tooth angle.
5. Install the differential bearing caps (31) and bolts (32).

 **Tighten**

- The bolts to 75 N·m (55 ft. lbs.).
6. Check and record the backlash at three or four points around the ring gear.
 - The pinion must be held stationary when checking backlash.
 - The backlash should be the same at each point within 0.05 mm (0.002-inch). If the backlash varies more than 0.05 mm (0.002-inch), check for burrs, a distorted case flange, or uneven bolting conditions.
 7. Backlash at the minimum lash point measured should be between 0.13 and 0.23 mm (0.005 and 0.009-inch) for all new gear sets.

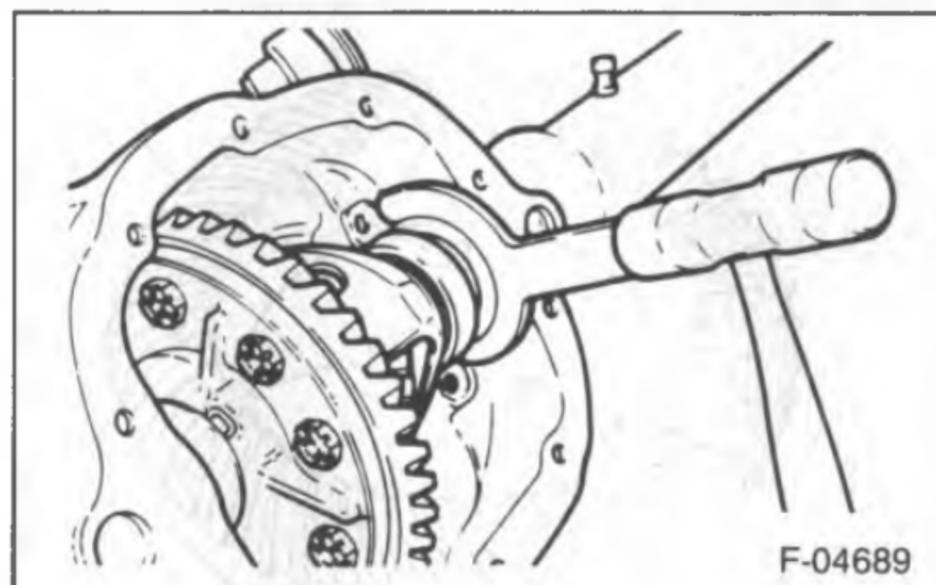


Figure 17—Installing the Differential Bearing Preload Shim

8. If the backlash is not within specifications, move the ring gear in or out from the pinion by increasing the thickness of one shim, and decreasing the thickness of the other shim by the same amount. This will maintain the correct rear axle side bearing preload.
 - Moving 0.05 mm (0.002-inch) worth of shim from one side of the differential to the other will change the backlash adjustment by 0.03 mm (0.001-inch).
9. When the backlash is correctly adjusted, remove the bearing caps and the shim packs.
10. Select a shim 0.10 mm (0.004-inch) thicker than the one removed from the left side. Insert this shim between the spacer and the left bearing race (figure 17).
11. Install the left bearing cap and bolts.
 - Do not tighten.
12. Select a shim 0.10 mm (0.004-inch) thicker than the one removed from the right side. Insert the shim between the spacer and the right bearing race, and drive the shim into place (figure 17).
13. Install the right side bearing cap, and bolts.

 **Tighten**

- All bearing cap bolts to 75 N·m (55 ft. lbs.).
14. Recheck the backlash and correct as necessary.

FINAL ASSEMBLY

 **Install or Connect**

1. Drive axles. Refer to the proper service manual.
2. A new cover gasket and the cover (34).

 **Tighten**

- The cover bolts (35) to 27 N·m (20 ft. lbs.).
3. Axle housing to the vehicle. Refer to the proper service manual.
 4. Lubricant to the rear axle.

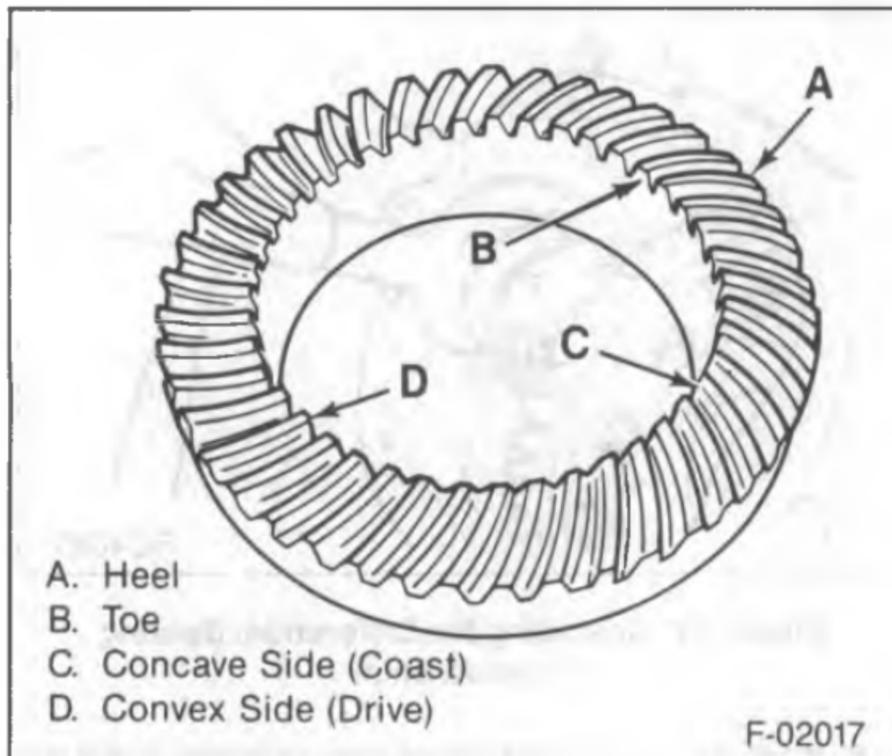


Figure 18—Gear Tooth Nomenclature

GEAR TOOTH PATTERN CHECK

Checking the ring gear to pinion tooth pattern is to be done only after setting up the axle according to the methods in this section. The pattern check is NEVER to be used as an initial check, or instead of checking pinion depth and backlash adjustments. This check is only to be used to verify the correct adjustment of the gear set after setup.

1. Wipe all oil out of the carrier, and carefully clean each tooth of the ring gear (figure 18).
2. Use gear marking compound 1052351 or equivalent and apply this mixture sparingly to all ring gear teeth, using a medium-stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.
3. Tighten the bearing cap bolts to the specified torque.
4. Expand the brake shoes until a torque of 40 to 50 ft. lbs. is required to turn the pinion.

A test made without loading the gears will not give a satisfactory pattern. Turn the pinion flange with a wrench so that the ring gear rotates one full revolution, then reverse the rotation so that the ring gear rotates one revolution in the opposite direction.

5. Observe the pattern on the ring gear teeth and compare this with figure 19.

ADJUSTMENTS AFFECTING TOOTH CONTACT

Two adjustments can be made which will affect tooth contact pattern: backlash, and the position of the drive pinion in the carrier. The effects of bearing preloads are not readily apparent on hand loaded tooth contact pattern tests; however, these adjustments should be within specifications before proceeding with backlash and drive pinion adjustments.

The position of the drive pinion is adjusted by increasing or decreasing the distance between the pinion head and the centerline of the ring gear. Decreasing the

distance will move the pinion closer to the centerline of the ring gear. Increasing the distance will move the pinion farther away from the centerline of the ring gear.

Backlash is adjusted by means of the side bearing adjusting shims which move the entire case and ring gear assembly closer to, or farther from, the drive pinion. (The adjusting shims are also used to set side bearing preload).

If the thickness of the right shim is increased (along with decreasing the left shim thickness), backlash will increase.

The backlash will decrease if the left shim thickness is increased (along with a decrease in right shim thickness).

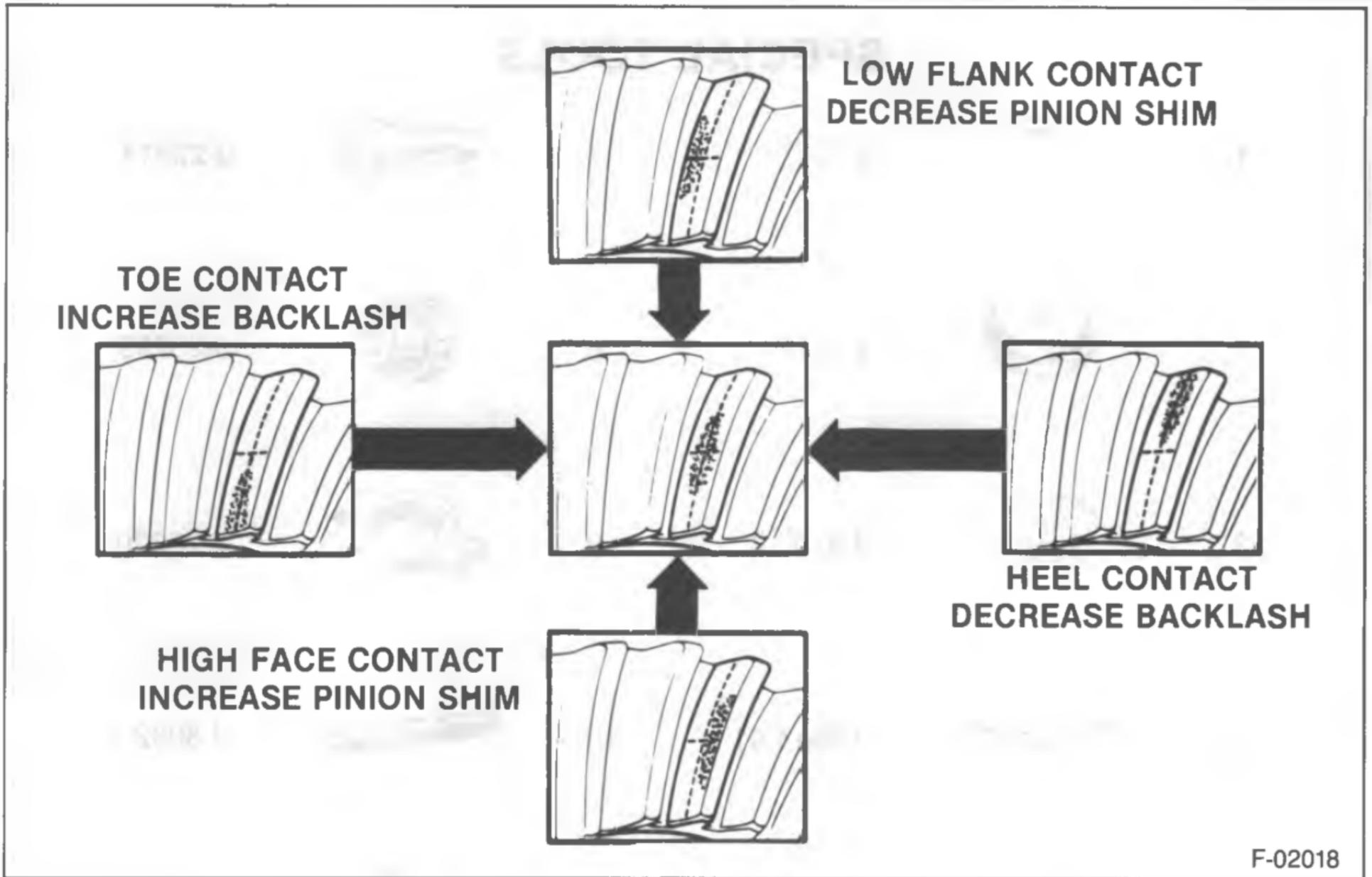


Figure 19—Gear Tooth Pattern

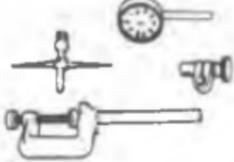
SPECIFICATIONS

7¹/₂ AND 7⁵/₈-INCH RING GEAR AXLE

FASTENER	N·m	FT. LBS.
Ring Gear Bolts.....	120	90
Bearing Cap Bolts.....	75	55
Axle Cover Bolts.....	27	20

SPACER AND SHIM SIZES	SIZE
Differential Side Bearing Spacer.....	.0170-inch
Differential Side Bearing Shim Kits.....	.0040-0.044-inch .046-0.050-inch .052-0.056-inch .058-0.062-inch .064-0.070-inch .072-0.078-inch .080-0.086-inch .088-0.094-inch .096-0.100-inch
Pinion Bearing Shim Kits.....	.0025-0.029-inch .030-0.034-inch .035-0.039-inch .040-0.045-inch
Lubricant.....	.80W-90 GL-5

SPECIAL TOOLS

- | | | | | | |
|----|---|-----------|-----|---|---------|
| 1. |  | J 7817 | 7. |  | J-23911 |
| 2. |  | J 7818 | 8. |  | J-25299 |
| 3. |  | J 8107-2 | 9. |  | J 25320 |
| 4. |  | J 8614-01 | 10. |  | J 8092 |
| 5. |  | J 22888 | 11. |  | J-8001 |
| 6. |  | J 5590 | | | |

1. Front Pinion Bearing Cup Installer
2. Rear Pinion Bearing Cup Installer
3. Differential Side Bearing Remover Plug
4. Pinion Flange Remover
5. Side Bearing Remover
6. Rear Pinion Bearing Cone Installer
7. Pinion Oil Seal Installer
8. Differential Side Bearing Installer
9. Rear Pinion Bearing Remover
10. Driver Handle
11. Dial Indicator

Refer to Figure 9 for these tools:

- | | |
|------------|--------------------|
| J 21777-40 | Rear Pilot Washer |
| J 21777-42 | Front Pilot Washer |
| J 21777-43 | Stud Assembly—Bolt |
| J 21777-45 | Side Bearing Discs |
| J 23597-1 | Arbor |
| J 23597-11 | Gauge Plate |

The gaging area marked "A" on Gage Plate J-21777-21 is used with Discs J-21777-45 and J-21777-1 on 8 1/2 in. ring gears.

6. Install the correct Discs on the Gage Shaft, see Fig. 23.
7. Position the Gage Shaft assembly in the carrier so that the Dial Indicator rod is centered on the gaging area of the Gage Block, and the Discs seated fully in the side bearing bores. Install side bearing caps and tighten bolts to 75 N·m (55 lbs. ft.), see Fig. 23. Use Dial Indicator J-8001 or an equivalent indicator reading from 0 mm to 2.5 mm (0 in. to .100 in.).
8. Set Dial Indicator at ZERO. Then position on mounting post of the Gage Shaft with the contact button touching the indicator pad. Push Dial Indicator downward until the needle rotates approximately 3/4 turn clockwise. Tighten the Dial Indicator in this position and recheck.
9. Rotate Gage Shaft slowly back and forth until the Dial Indicator reads the greatest deflection. At the point of greatest deflection, set the Dial Indicator to ZERO. Repeat rocking action of Gage Shaft to verify the ZERO Setting.
10. After the ZERO setting is obtained, rotate Gage Shaft until the Dial Indicator rod does not touch the Gage Block.
11. Record dial reading at pointer position. Example: If pointer moved counterclockwise 1.70 mm (.067 in.) to a dial reading of .84 mm (.033 in.), as shown in Fig. 23, this indicates a shim thickness of .84 mm (.033 in.) except as follows:
Dial Indicator reading should be within the range of .50 mm to 1.27 mm (.020 in. to .050 in.).
12. (Type "O" or "K") Select the correct drive pinion shim to be used during drive pinion reassembly on the following basis:
 - a. If a drive pinion with no marking is being used, the correct shim will have a thickness EQUAL to the indicator gage reading found in Step 12.
 - b. Drive pinions that are marked, "+" (plus), the shim thickness indicated by the Dial Indicator on the Pinion Setting Gage must be INCREASED by the amount on the drive pinion, see Fig. 24.
 - c. If the drive pinion is marked "-" (minus) the shim thickness indicated by the Dial Indicator on the Pinion Setting Gage must be DECREASED by the amount on the drive pinion, see Fig. 24.
 - Shims are available in .03 mm to .94 mm (.001 in. to .037 in.).
 - Each shim has the thickness etched on flat surface for easy identification.
 - "C", "G" or "P" drive pinions will not have any markings, they are nominal gears.
13. Loosen Stud J-21777-43 and remove Gage Plate, washer and both bearings from carrier.
14. Position correct shim on drive pinion and install the drive pinion rear bearing as shown in Fig. 25.

REAR AXLE CASE



Assemble (With Axle Shafts Removed)

Fig. 26 and 27

Before assembling the rear axle case, lubricate all parts with rear axle lubricant.

1. Side gear thrust washers over side gear hubs and install side gears in case. If same parts are reused, install in original sides.
2. Position one pinion (without washer) between side gears and rotate gears until pinion is directly opposite from loading opening in case. Place other pinion between side gears so that pinion shaft holes are in line; then rotate gears to make sure holes in pinions will line up with holes in case.
3. If holes line up, rotate pinions back toward loading opening just enough to permit sliding in pinion thrust washers.
4. Ring gear on case using NEW ring gear attaching bolts just snug, see Fig. 26.
 - NEVER REUSE OLD BOLTS.
 - Tighten bolts alternately in progressive stages to 120 N·m (90 lbs. ft.).
5. Case side bearings as shown in Fig. 27.

SIDE BEARING PRELOAD



Adjust

Fig. 28

The side bearing preload adjustment is to be made before installing the pinion. If the pinion is installed, remove ring gear.

- Case side bearing preload is adjusted by changing the thickness of both the right and left shims by an equal amount.
- By changing the thickness of both shims equally, the original backlash will be maintained.
- Production shims are cast iron and vary in thickness from 5.33 mm to 6.91 mm (.210 in. to .272 in.) in increments of .05 mm (.002 in.)
- Standard service spacers are 4.32 mm (.170 in.) thick and steel service shims are available from 1.02 mm to 2.08 mm (.040 in. to .082 in.) in increments of .05 mm (.002 in.).



Important

- Do not attempt to reinstall the production shims as they may break when tapped into place.
 - If service shims were previously installed, they can be reused, but (whether using new or old bearings) adhere to the following procedure in all cases.
1. Determine the approximate thickness of shims needed by measuring each production shim or each service spacer and shim pack.

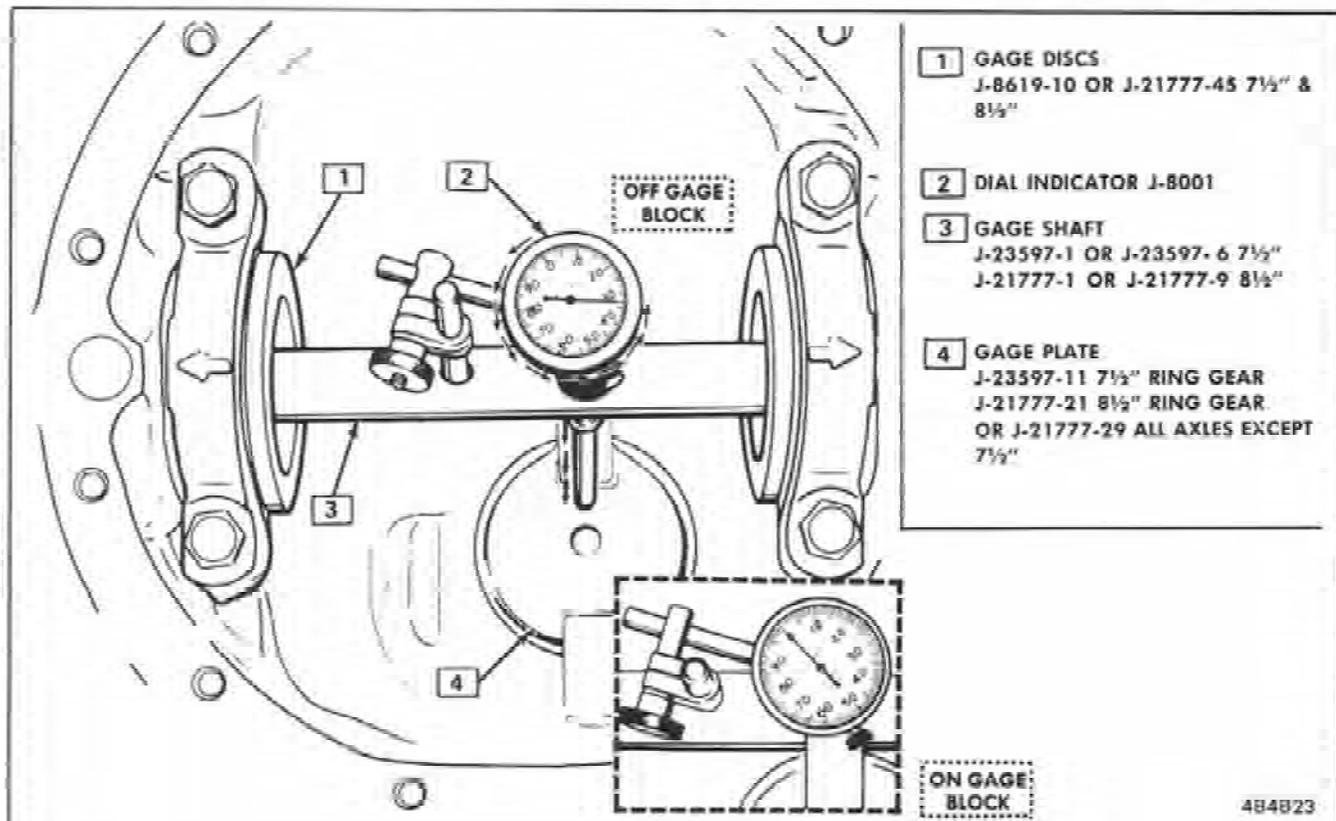


Fig. 23 Checking Pinion Depth

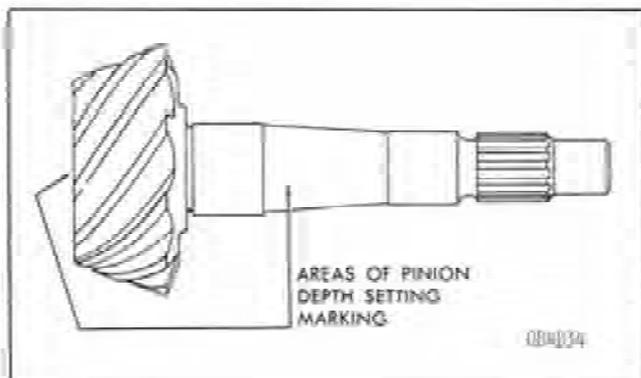


Fig. 24 Pinion Marking All Axles

2. In addition to the service spacer, a service shim will be needed. To select a starting point in service shim thickness, use the following chart: Fig. 28.
3. Place case with bearing outer races in position in carrier.
4. Slip the service spacer between each bearing race and carrier housing with chamfered edge against housing.

Install the left bearing cap loose so that the case may be moved while checking adjustments. Another bearing cap bolt can be added in the lower right bearing cap hole. This will prevent case from dropping while making shim adjustments.

 Measure

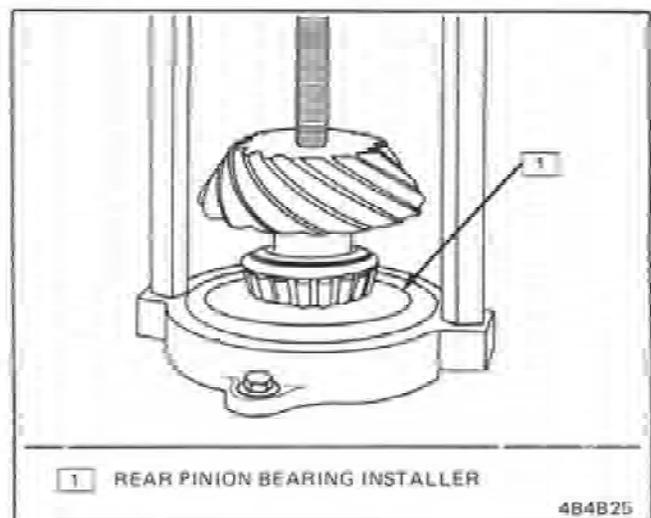


Fig. 25 Installing Rear Pinion Bearing

- Select one or two shims totalling the amount shown in the R.H. column and position between the right bearing race and the service spacer.
 - Be sure left bearing race and spacer are against left side of housing.
1. Insert progressively larger feeler gage sizes .25 mm, .30 mm, .36 mm, etc. (.010 in., .012 in., .014 in., etc.) between the right shim and service spacer until there is noticeable increase in drag.
 2. Push the feeler gage downward until the end of the gage makes contact with the carrier bore so as to obtain a correct reading.

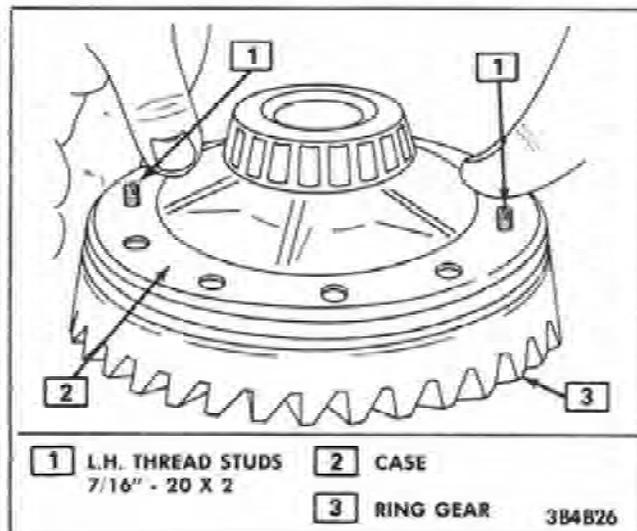


Fig. 26 Installing Ring Gear on Case Assembly

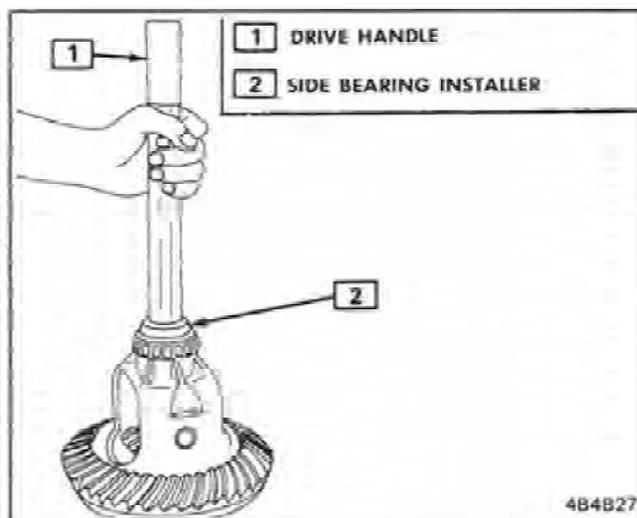


Fig. 27 Installing Case Side Bearings

4.32mm (.170") SERVICE SPACER

TOTAL THICKNESS OF BOTH PROD. SHIMS REMOVED	TOTAL THICKNESS OF SERVICE SHIMS TO BE USED AS A STARTING POINT
10.57mm .420"	1.52mm .060"
10.92mm .430"	1.78mm .070"
11.18mm .440"	2.03mm .080"
11.43mm .450"	2.29mm .090"
11.68mm .460"	2.54mm .100"
11.94mm .470"	2.79mm .110"
12.19mm .480"	3.05mm .120"
12.45mm .490"	3.30mm .130"
12.70mm .500"	3.56mm .140"
12.95mm .510"	3.81mm .150"
13.21mm .520"	4.06mm .160"
13.46mm .530"	4.32mm .170"
13.97mm .550"	4.83mm .190"

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Fig. 28 Shim Thickness

3. The point just before additional drag begins is correct feeler gage thickness.
4. Rotate case while using feeler gage to assure an even reading.
 - The original light drag is caused by weight of the case against the carrier while additional drag is caused by side bearing preload.
 - By starting with a thin feeler gage, a sense of "feel" is obtained so that the beginning of preload can be recognized to obtain ZERO clearance.
 - It will be necessary to work case in and out and to the left in order to insert the feeler gage.
5. Remove left bearing cap and shim from carrier.
6. The total shim pack needed (with no preload on side bearings) is the feeler gage reading found in Step 1 plus thickness of shims installed in Step 3.
7. Select two shims of approximately equal size whose total thickness is equal to the value obtained in Step 1.
 - These shims will be installed between each side bearing race and service spacer when the case is installed in the carrier.
 - The preload will not be added until the final step.
8. If the pinion is in position, install the ring gear, then proceed to Rear Axle Backlash Adjustment.

DRIVE PINION, BEARING AND RACES

→→ Install or Connect

Fig. 29

1. NEW collapsible spacer on pinion and position lubricated assembly in carrier, see Fig. 29.
2. Hold forward on pinion into carrier assembly.
3. Front bearing on pinion and drive bearing on pinion shaft until seated in race.

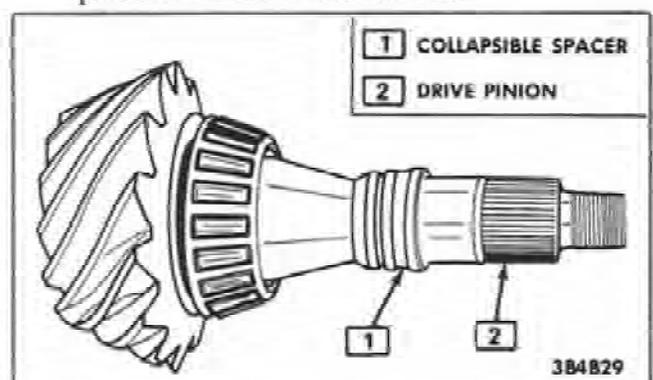


Fig. 29 Collapsible Spacer on Drive Pinion

4. Oil seal in carrier.
5. Coat lips of pinion oil seal and seal surface of pinion flange with Lubricant, No. 1050169 or equivalent.
6. Pinion flange on pinion by tapping with a soft hammer until a few pinion threads project through flange.
7. Install pinion washer and nut.

- Hold pinion flange.
- While intermittently rotating pinion to seat pinion bearings, tighten pinion flange nut until end play begins to be taken up.

⚠ Important

- When no further end play is detectable and when holder will no longer pivot freely as pinion is rotated, preload specifications are being approached.
 - No further tightening should be attempted until the preload has been checked.
8. Check preload by using a pound inch torque wrench.
 - After preload has been checked, final tightening should be done very carefully.
 - Additional tightening of the pinion nut can add many additional pounds inch of torque.
 - The pinion nut should be further tightened only slightly and the preload should be checked after each tightening.
 - Exceeding preload specifications will compress the collapsible spacer too far and require the installation of a new collapsible spacer.
 9. Set preload at 2.26 to 2.82 N·m (20 to 25 lbs. in.) on new bearings or 1.13 to 1.69 N·m (10 to 15 lbs. in.) on used bearings.
 10. Rotate pinion several times to assure that bearings have been seated.
 - Check preload again.
 - If preload has been reduced by rotating pinion, reset preload to specifications.

REAR AXLE BACKLASH

⚙ Adjust

Tool Required:

J-8001 Dial Indicator Assembly

1. Install rear axle case into carrier, using shims as determined by the side bearing preload adjustment.
2. Rotate rear axle case several times to seat bearings, then mount J-8001.
 - Use a small button on the indicator stem so that contact can be made near heel end of tooth.
 - Set Dial Indicator so that stem is in line with gear rotation and perpendicular to tooth angle for accurate backlash reading.
3. Check backlash at three or four points around ring gear.
 - Lash must not vary over .05 mm (.002 in.) around ring gear.
 - Pinion must be held stationary when checking backlash.

⚠ Important

- If variation is over .05 mm (.002 in.) check for burrs, uneven bolting conditions or

distorted case flange and make corrections as necessary.

4. Backlash at the point of minimum lash should be between .13 mm and .23 mm (.005 in. and .009 in.) for all new gears.
5. Backlash by increasing thickness of one shim and decreasing thickness of other shim the same amount.
 - For each .03 mm (.001 in.) change in backlash desired, transfer .05 mm (.002 in.) in shim thickness.
 - To decrease backlash .03 mm (.001 in.), decrease thickness of right shim .05 mm (.002 in.) and increase thickness of left shim .05 mm (.002 in.). To increase backlash .05 mm (.002 in.), increase thickness of right shim .10 mm (.004 in.) and decrease thickness of left shim .10 mm (.004 in.).

CASE SIDE BEARING PRELOAD

⚙ Adjust

Fig. 30

Tool Required:

J-25588 Side Bearing Shim Installer

1. Keep packs in their respective position, right or left side.
2. Select a shim .10 mm (.004 in.) thicker than one removed from left side, then insert left side shim pack between the spacer and the left bearing race.
3. Loosely install bearing cap.
4. Select a shim .10 mm (.004 in.) thicker than the one removed from right side and insert between the spacer and the right bearing race.
5. It will be necessary to drive the right shim into position using J-25588.
6. Tighten to 75 N·m (55 lbs. ft.).
7. Recheck side bearing caps backlash and correct if necessary.
8. Install axles, see Rear Axle Installation.
9. Install new cover gasket.
10. Install cover and tighten cover bolts to 27 N·m (20 lbs. ft.).
11. Fill Rear axle to proper level with the specified lubricant. Refer to Section OB.

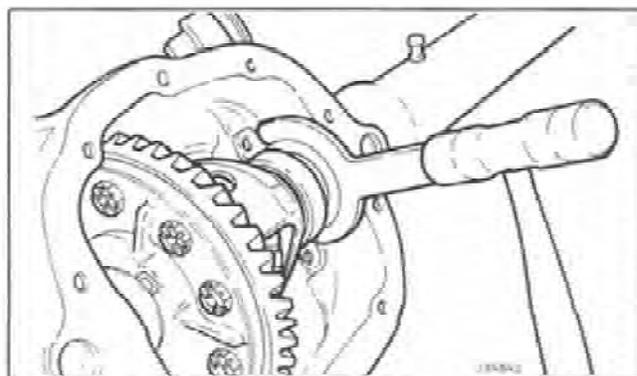


Fig. 30 Installing Case Preload Adjusting Shim