



400 MAINTENANCE

MAINTENANCE



400 MAINTENANCE

CARRIER MAINTENANCE

Magnetic Strips and Oil Troughs

An oil trough with magnetic strips is attached to the inside of the bevel gear compartment cover. Clean the oil trough and magnetic strips each time the oil is changed or when the cover is removed. Replace the O-ring whenever the cover is removed.

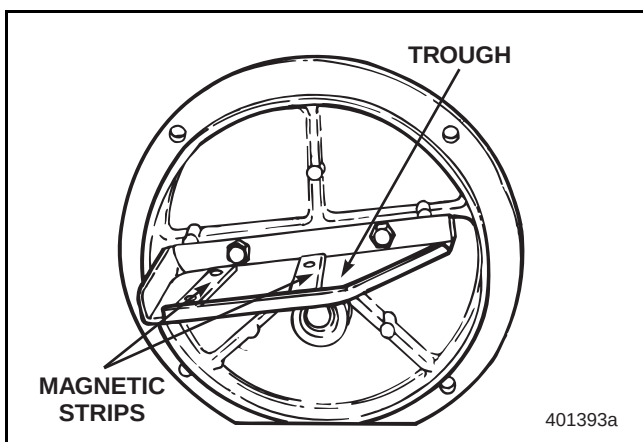


Figure 17 — Magnetic Strips and Oil Trough

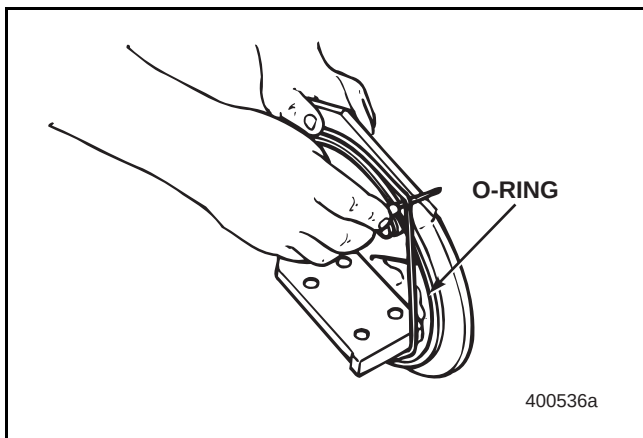


Figure 18 — Bevel Compartment Cover O-Ring

Checking Oil

⚠ WARNING

Be careful not to burn your finger in hot gear oil when checking the oil level in the carrier.

When checking the oil level in the rear axles, check after the vehicle has been operated, make sure the unit is at normal operating temperature and chassis is parked on level ground. Check the oil level by removing the filler plugs from the axle housings and the bevel gear compartments. The level is correct when oil runs out of the filler plug hole in the axle housing, and slightly below the filler plug hole in the bevel gear compartment. If the level in the axle housing is low, add oil to the axle housing and the bevel gear compartment until the oil is level with the bottom of the filler plug holes.

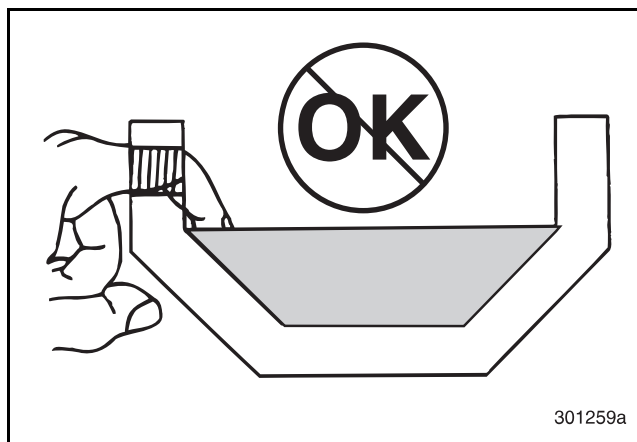


Figure 19 — Incorrect Oil Level

DO NOT add oil if the level in the axle housing is sufficient. Reinstall the plugs and tighten to specifications.

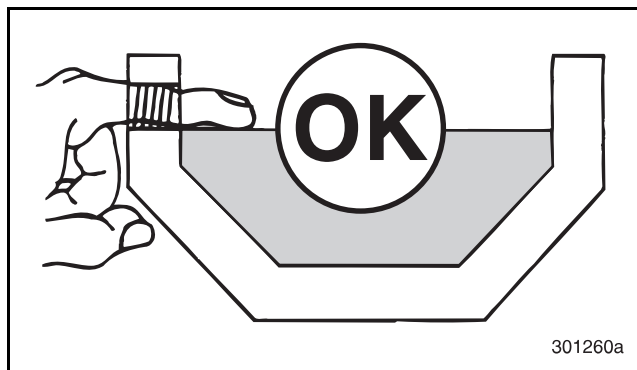


Figure 20 — Correct Oil Level



400 MAINTENANCE

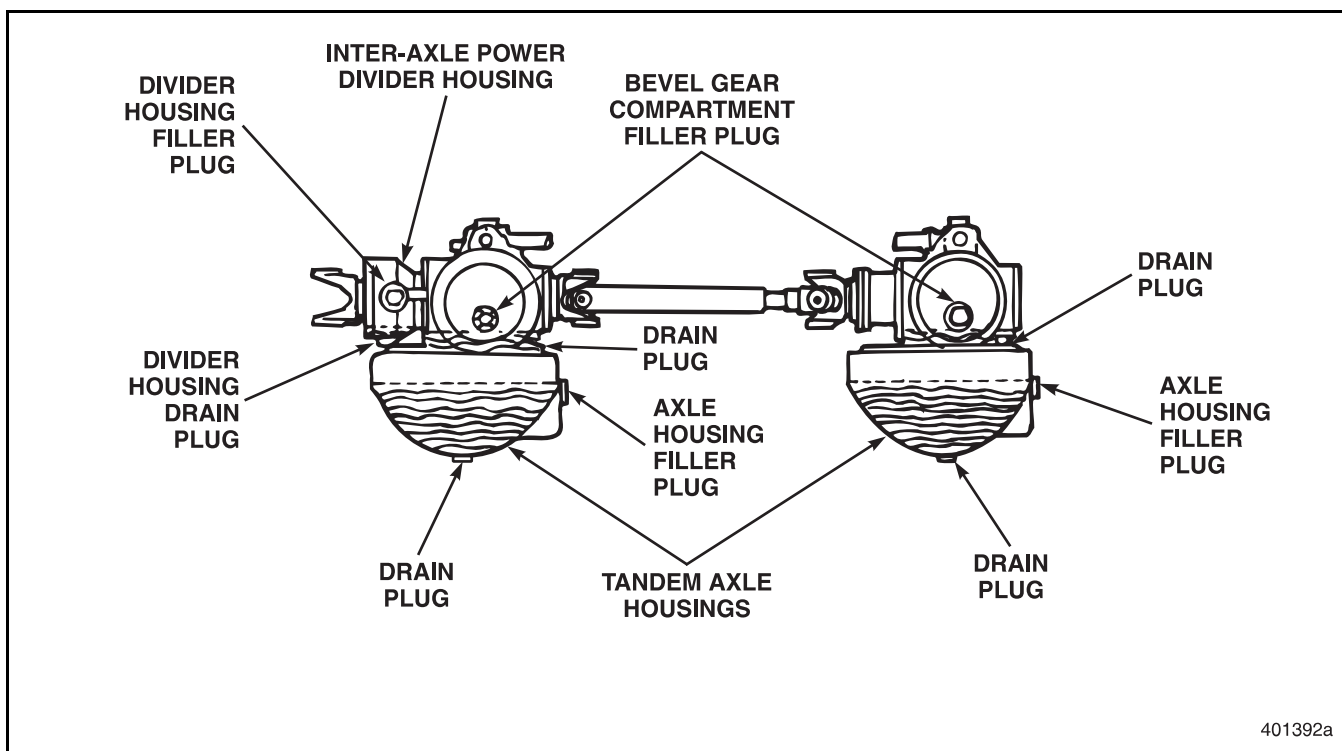


Figure 21 — Filler and Drain Plug Locations

Changing Oil

When changing the oil in the carrier unit, the oil should be at normal operating temperature. Remove the magnetic drain plug from the bottom of the axle housing(s), the drain plug in the bevel gear compartment(s) and the drain plug in the inter-axle power divider housing (if equipped). Then drain the hot oil from the unit into an industry-approved recovery container. Clean and reinstall the magnetic drain plug(s). Then torque to specification.

Remove the filler plug(s) from the axle housing(s), the bevel gear compartment(s) and the inter-axle power divider housing (if equipped). Fill each of the carrier compartments with specified oil to the level of the filler plug hole.

Reinstall and snug the filler plugs in the carrier housing, power divider and bevel pinion compartment. Then tighten each to specified torque. Change the oil at the intervals specified in the Maintenance and Lubrication Manual TS494.

Air Breathers

The 92/93 and 112/113 carriers both have one breather cap located on the uppermost portion of each carrier housing. Remove the carrier housing breather(s) every time the rear axle(s) oil is changed. Clean the breather in a suitable nonflammable solvent and check for damage. Also check to be sure that airflow through the breather is unobstructed. Reinstall the breather onto the carrier housing and tighten until snug.

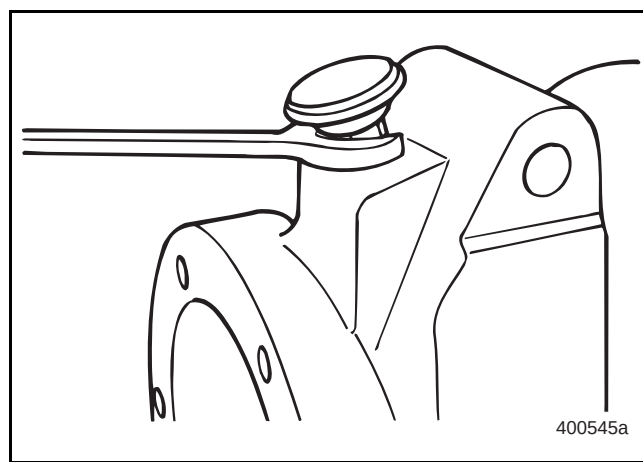


Figure 22 — Installing Breather on Carrier Housing



NOTES



400 CARRIER DISASSEMBLY

CARRIER DISASSEMBLY



400 CARRIER DISASSEMBLY

[465/475] DIFFERENTIAL REMOVAL

NOTE

Set all major components on a clean work surface for later disassembly.

NOTE

This procedure is also used when removing the inter-wheel power divider or the four-pinion type differential.

1. Remove the bevel gear compartment cover and both of the inside carrier mounting bolts.

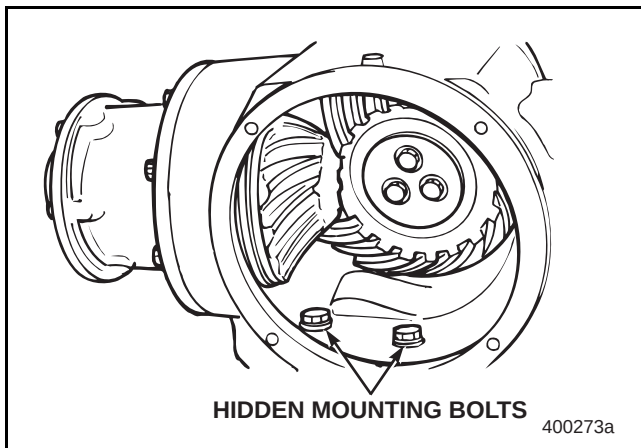


Figure 23 — Bevel Gear Compartment Cover Removed and Hidden Mounting Bolts Accessible

2. Remove the remaining 14 capscrews and washers retaining the carrier housing to the axle housing.
3. Remove the carrier from the vehicle. Note this may require removal of the entire axle housing to access the carrier.
4. Set the carrier in an approved carrier repair stand such as J 3409-D.

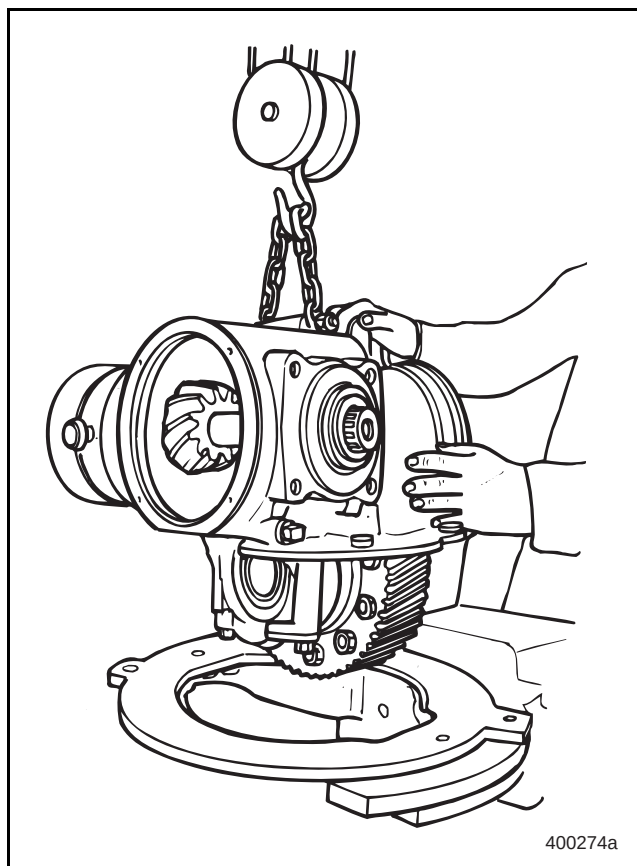


Figure 24 — Mounting Carrier in Stand

5. Secure the carrier to the stand with a minimum of four bolts and tighten securely.
6. Rotate stand holding the carrier housing so the differential assembly is on top.



400 CARRIER DISASSEMBLY

7. Remove the cotter pin and the straight pin in the differential bearing caps.

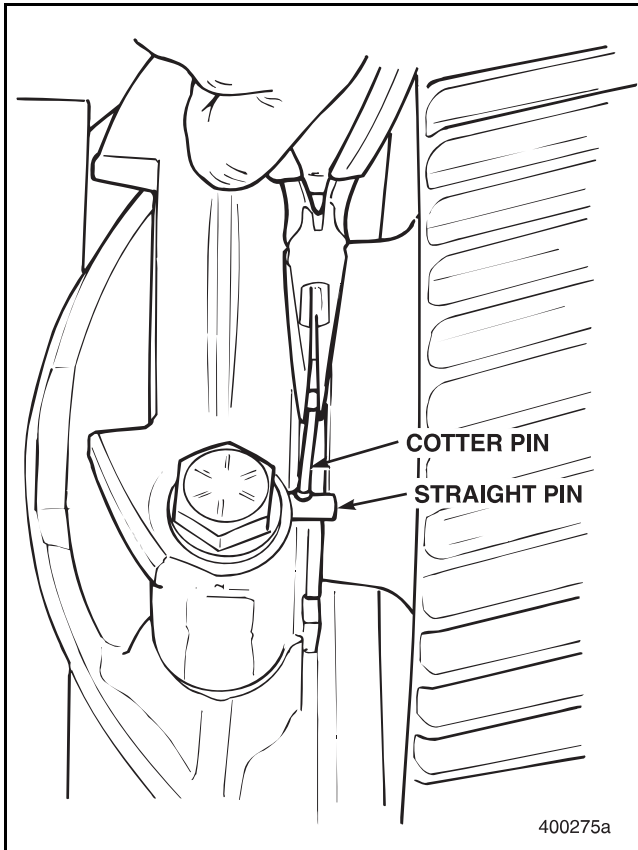


Figure 25 — Removing Cotter Pin

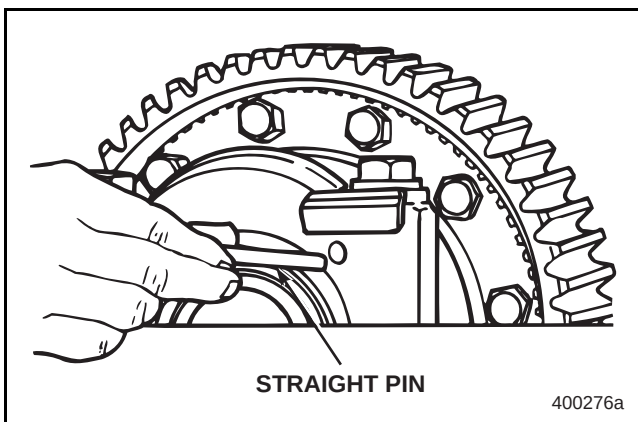


Figure 26 — Removing Straight Pin

8. Punch-mark bearing caps and their mating pedestals to ensure reassembly in their original positions.

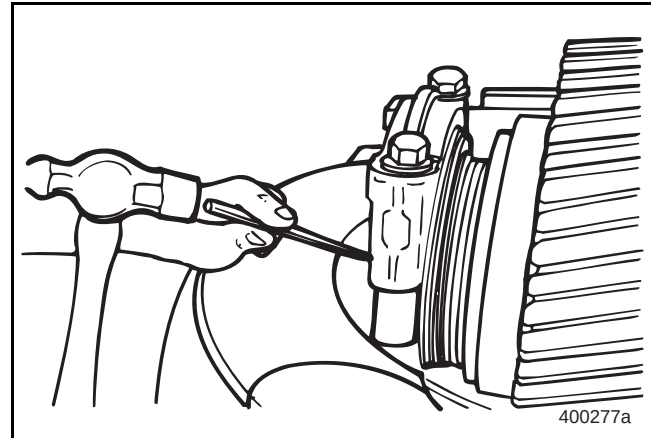


Figure 27 — Marking Bearing Retaining Cap

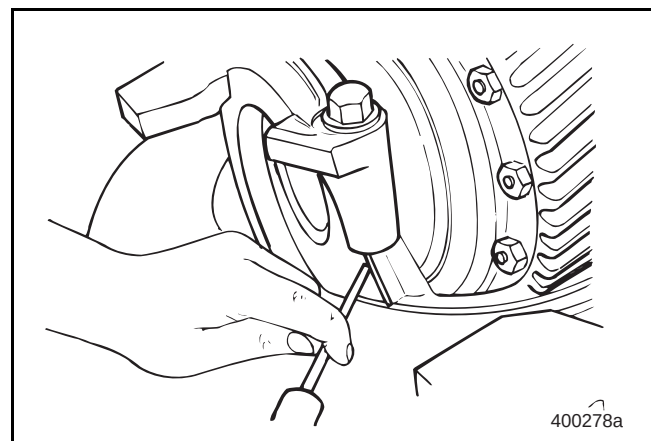


Figure 28 — Marking Bearing Retaining Cap Mated Part (Carrier Housing)



400 CARRIER DISASSEMBLY

- Using differential bearing-nut adjusting wrench J 26437, loosen the bearing adjusting nut approximately one turn.

NOTE

Bearing retainer caps and the carrier housing are machined as a set. Therefore, when bearing retainer caps are lost or broken, the carrier housing and bearing retainer caps must be replaced as a set.

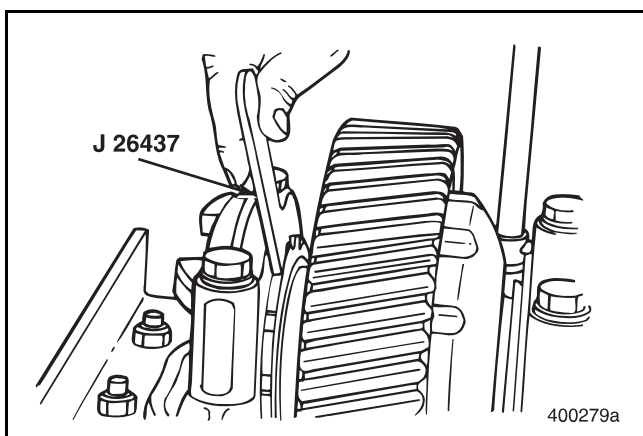


Figure 29 — Loosening Bearing Adjusting Nut

- Remove the bearing retainer capscrews.

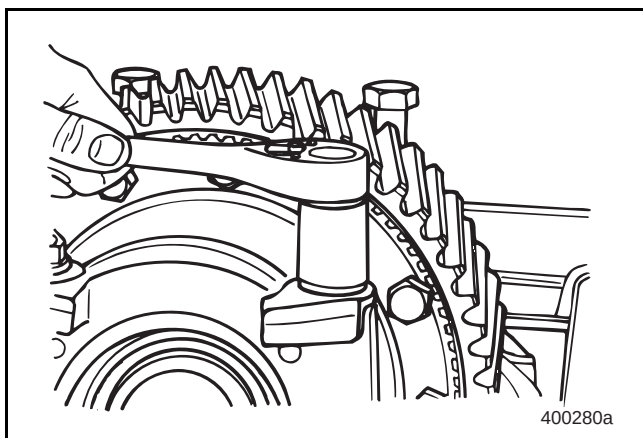


Figure 30 — Removing Bearing Cap Capscrews

- Remove the bearing retainer caps. Be very careful not to lose them.

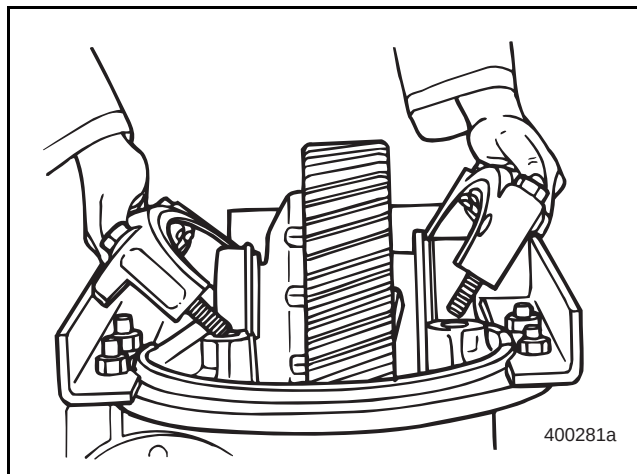


Figure 31 — Removing Bearing Retainer Caps

- Using a hoist, remove the differential/bull gear assembly.

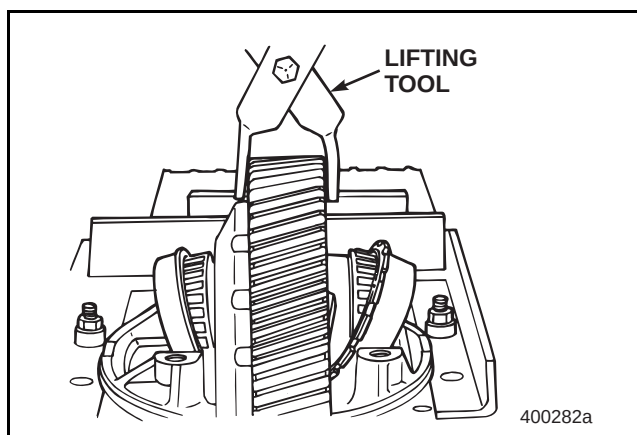


Figure 32 — Removing the Differential Assembly from the Carrier Housing



400 CARRIER DISASSEMBLY

[466] REMOVING THE INTER-AXLE THROUGH SHAFT

13. Remove the capscrews from the inter-axle through-shaft rear bearing cover.

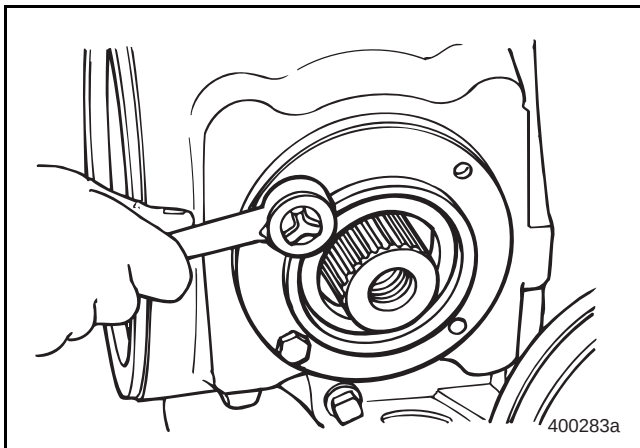


Figure 33 — Removing Capscrews from the Rear Bearing Cover

14. Remove the gasket from the through-shaft rear bearing cover.

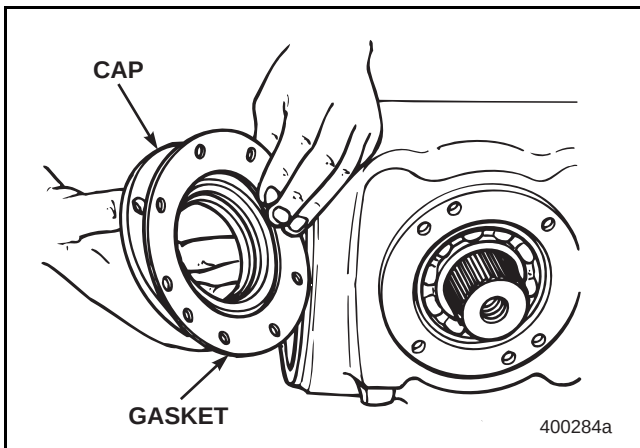


Figure 34 — Removing Rear Bearing Cover and Gasket

15. Pull out the inter-axle through shaft and the inter-axle through-shaft bearing together.

NOTE

The non-current axle through shaft was constructed of a driveshaft combined with a spring to form the oil groove on the through shaft. The current axle through shaft is constructed with a formed, rolled oil groove on the shaft. The two versions are interchangeable.

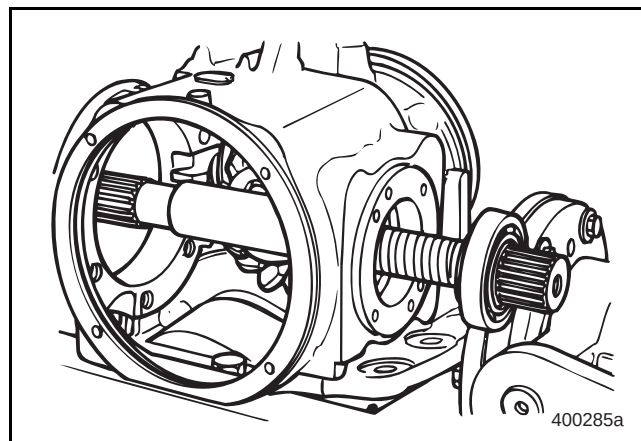


Figure 35 — Removing Through Shaft (Bevel Pinion Removed for Clarity)

16. Install two 3/8-16 jackscrews into the through-shaft housing.

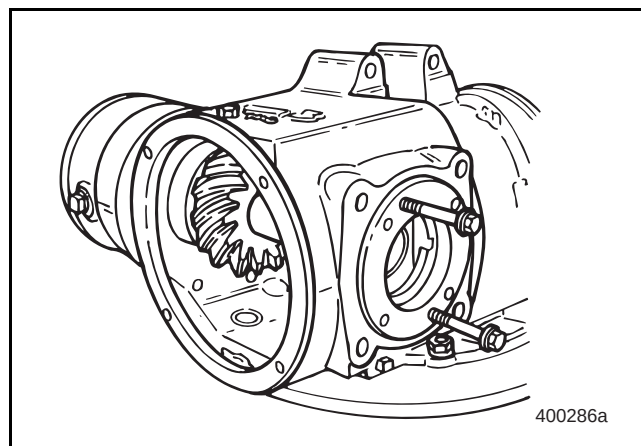


Figure 36 — Installing Jackscrews

17. Back out the bearing retainer by alternately turning the jackscrews. Alternate, even turning of the jackscrews is essential to prevent the retainer from binding or becoming cocked in the bore.

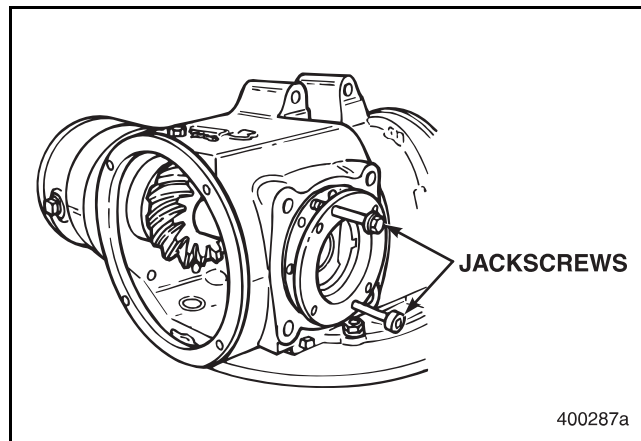


Figure 37 — Removing Through-Shaft Housing



400 CARRIER DISASSEMBLY

NOTE

Before removal, note the position of the inter-axle through-shaft retainer trough so that it can be reinstalled in the proper position.

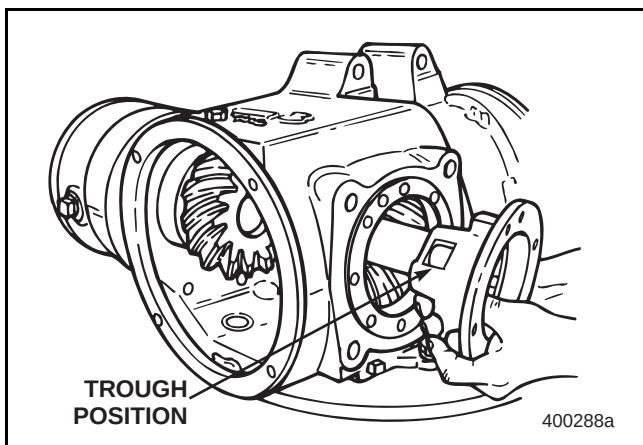


Figure 38 — Trough Position

18. Remove the gasket from the inter-axle through-shaft retainer cap that mounts to the housing surface.

CAUTION

Removing the gasket may require using a gasket scraper. Use caution to prevent damage to the mating surface.

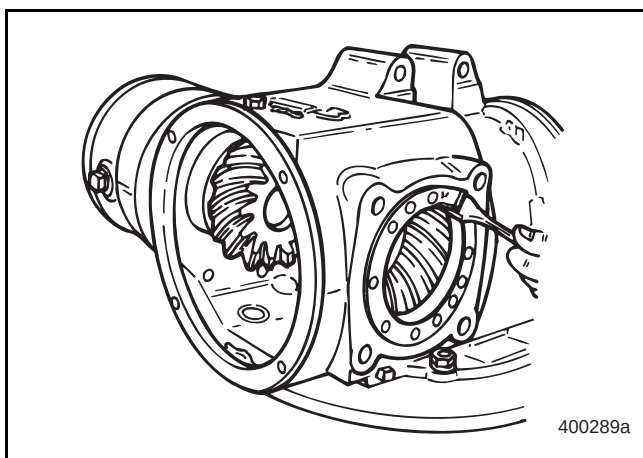


Figure 39 — Removing Gasket from Mating Surface

19. Remove the front power-divider lockout-assembly bevel pinion assembly (if equipped).

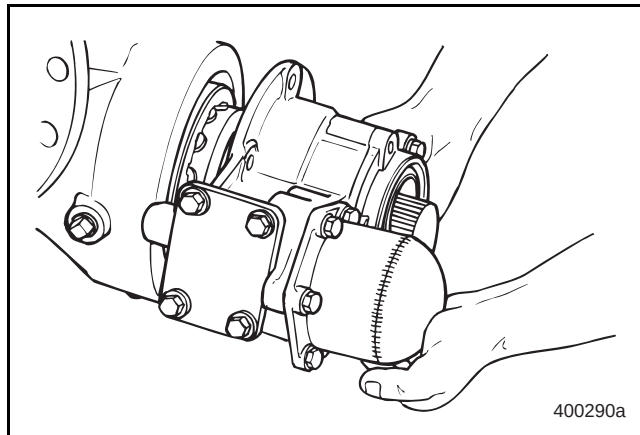


Figure 40 — Front Power-Divider Lockout Removal

[466/476] BEVEL PINION HOUSING REMOVAL (FRONT REAR OR REAR REAR)

SERVICE HINT

This section shows the removal of the front bevel pinion. At the front of the bevel pinion is the Inter-Axle Power Divider (IAPD). Because the IAPD with bevel pinion units are very heavy, you may want to remove the cage assembly first. See the section on the Inter-Axle Power Divider Cage — Disassembly on page 45.

20. Remove the capscrews that retain the front rear or rear rear bevel housing to the carrier housing.

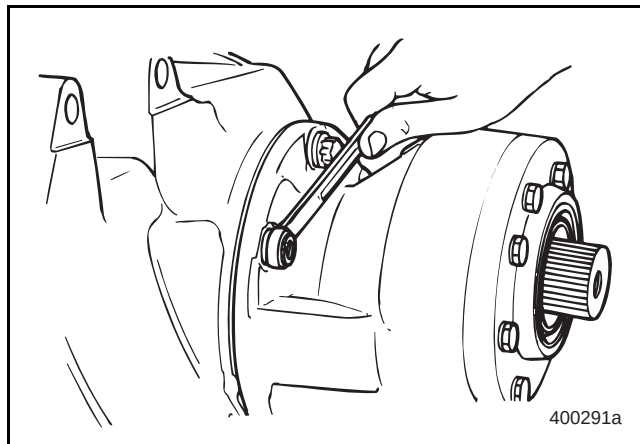


Figure 41 — Remove Bevel Housing Capscrews



400 CARRIER DISASSEMBLY

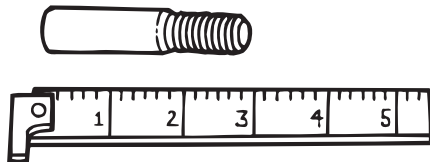
WARNING

If removing the inter-axle power divider as a unit, be extremely careful. It is very heavy. Get help or secure it to a hoist to prevent it from falling and causing personal injury.

21. Install alignment pins in bolt holes at the two-o'clock and ten-o'clock positions to support bevel housing during removal. This is necessary to prevent damage to the shim packs.

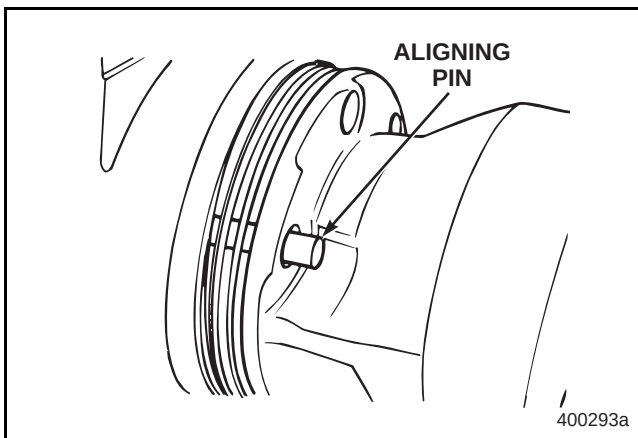
SERVICE HINT

Alignment pins can be manufactured on site from bolts obtained locally. Pins should be about 2-1/2 inches long and with 1/2-inch threads.



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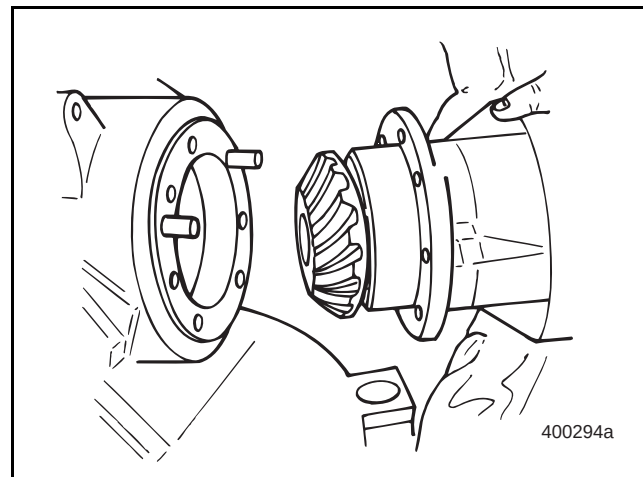
Figure 42 — Making Alignment Pins



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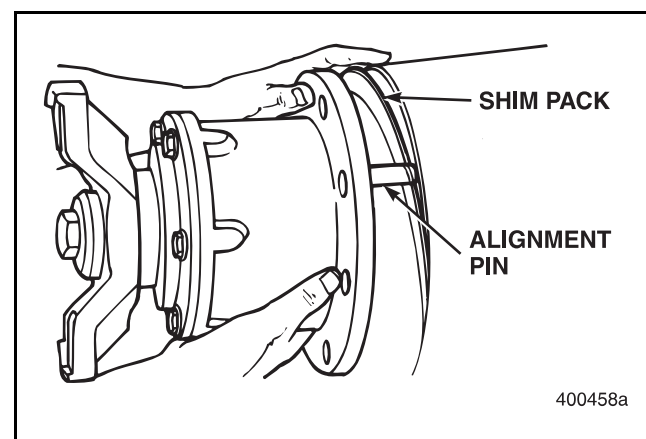
Figure 43 — Housing Supported on Alignment Pins

22. Loosen bevel housing by tapping with a deadblow hammer and then turning slightly. Back assembly out on alignment pins and remove from carrier. Wire shims together and tag for reuse at assembly. Using a micrometer, measure the shim pack for reassembly purposes.



400294a

Figure 44 — Removing Bevel Pinion Housing



400458a

Figure 45 — Removing Rear Rear Bevel-Pinion Housing



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[466] REMOVING THE HELICAL OR SPUR PINION SHAFT

23. Remove the four capscrews retaining the helical pinion-shaft assembly cover.

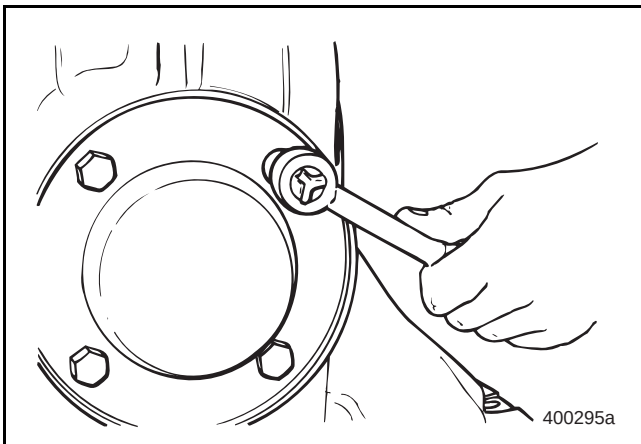


Figure 46 — Removing Pinion Cover Bolts

24. Remove the pinion cover and separate the gasket from the cover. It may be necessary to use a gasket scraper to remove some gaskets from the cover.

NOTE

A steel-core gasket coated on both sides with foam rubber has replaced Silastic sealer which was applied to the pinion shaft cover. Make sure a new steel-core gasket is available for reassembly to eliminate oil leakage in this area.

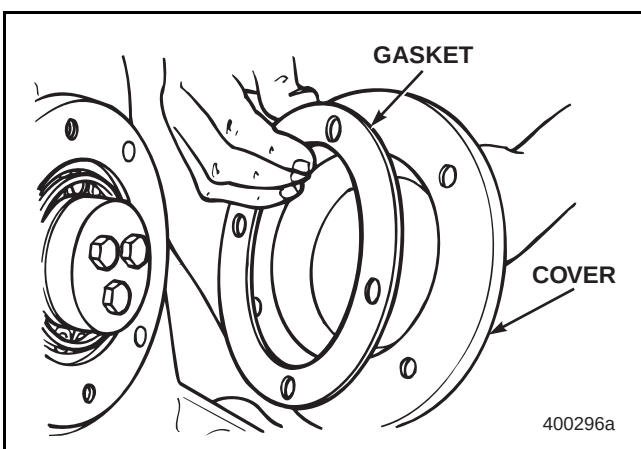


Figure 47 — Removing Pinion Cover and Separating Gasket

25. Remove the clamp plate capscrews and the clamp plate. Replace the clamp plate capscrews with new grade 8 capscrews at final reassembly.

NOTE

Be sure to have new capscrews on hand for final reassembly.

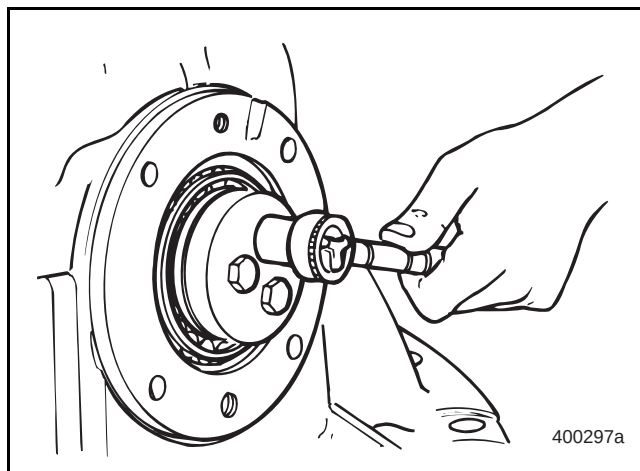


Figure 48 — Removing Clamp Plate Capscrews

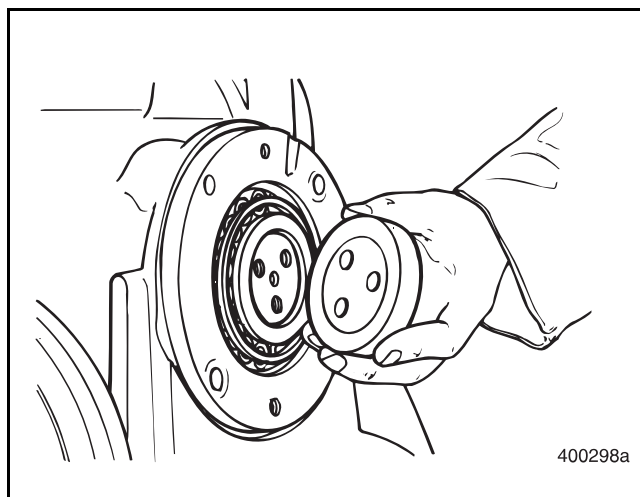


Figure 49 — Removing Clamp Plate

NOTE

The clamp-plate side stamped "OUT" faces outward. This ensures that the clamping force is evenly distributed upon installation.



400 CARRIER DISASSEMBLY

26. Set up a gear puller to push the helical pinion-shaft assembly into the carrier housing. This action will release the helical pinion from the outer bearing cone. Be prepared for the weight of the helical pinion assembly.

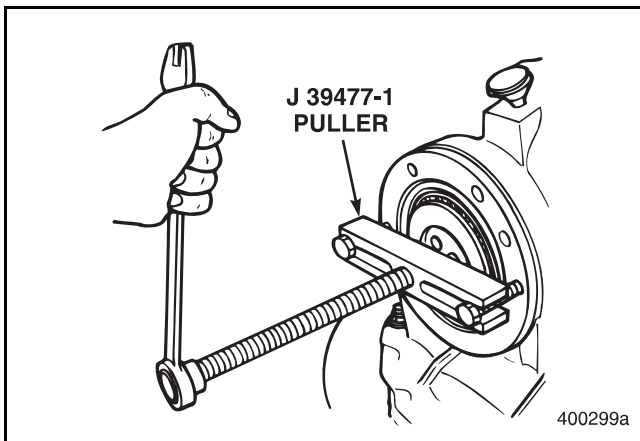


Figure 50 — Gear Puller Installed to Push Helical Pinion

27. Remove the bearing cone.

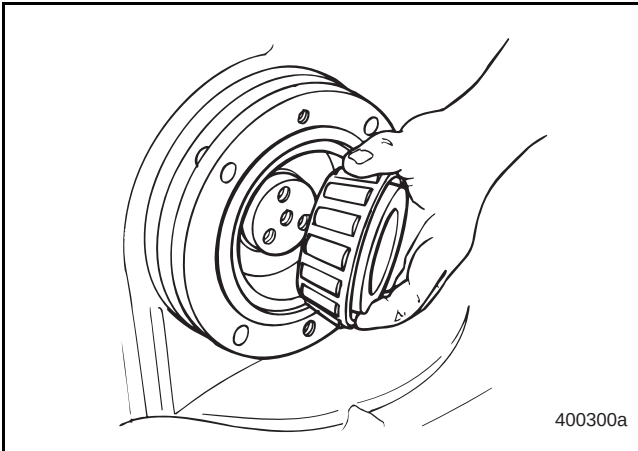


Figure 51 — Removing Bearing Cone

28. Remove the pinion shaft assembly.

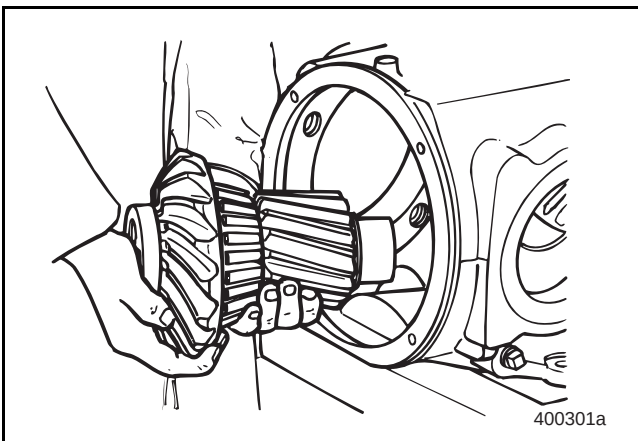


Figure 52 — Removing Pinion Shaft Assembly

29. Using two jackscrews, remove the helical pinion-shaft bearing retainer.

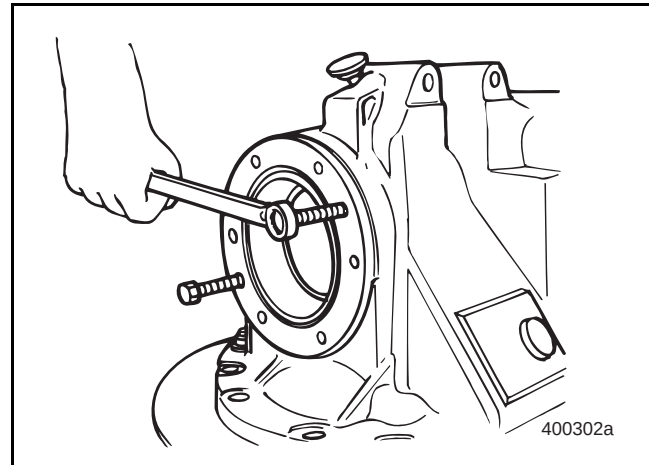


Figure 53 — Using Jackscrews to Remove Retainer

30. Remove the bearing retainer and shim pack. Remove shims, and wire together. Using a micrometer, measure the shim pack. Tag for reuse at reassembly.

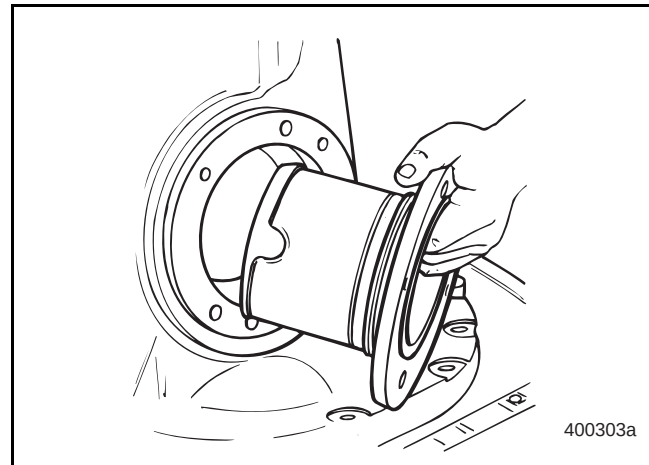


Figure 54 — Removing Bearing Retainer and Shims



NOTES



400 BENCH PROCEDURES

BENCH PROCEDURES — COMPONENT DISASSEMBLY



400 BENCH PROCEDURES

[465/475] FOUR-PINION TYPE DIFFERENTIAL — DISASSEMBLY

Before starting to disassemble the bull gear/differential components, mark the position of each side in relation to the bull gear. These components are line-reamed and turned together. Therefore, it is essential to reassemble them in the same position.

1. Clamp the bull gear/differential assembly in a suitable vise. Loosen the nuts that secure the side casings to the bull gear.

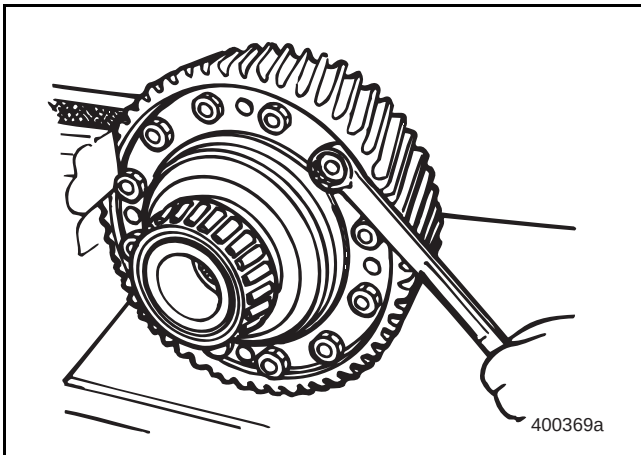


Figure 55 — Loosening Nuts

2. Remove the 12 side-casing nuts.
3. Turn the assembly over and loosen the side-casing capscrews.

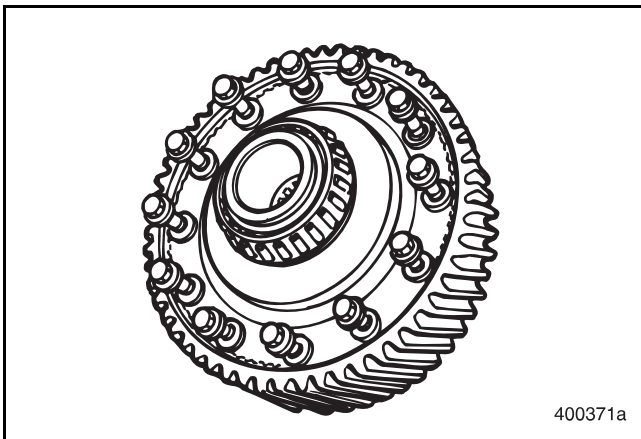


Figure 56 — Bull Gear/Differential Capscrews Loosened

4. Remove the 12 capscrews.

NOTE

During disassembly, mark the bull gear relationship to the casing. Mark both sides of the bull gear for reassembly purposes.

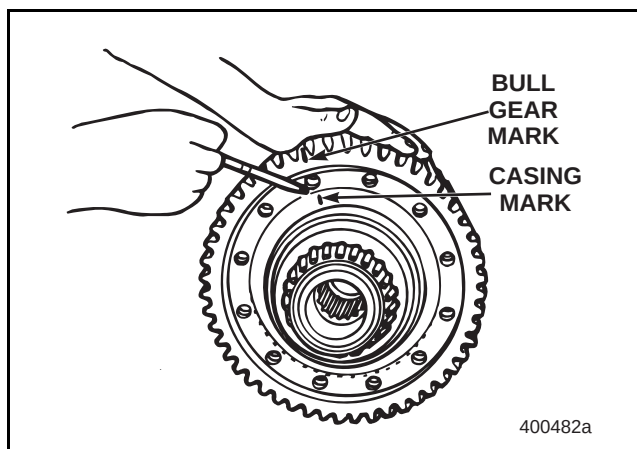


Figure 57 — Marking Both Sides

5. Remove the bull gear from the differential side-casing splined half. Do this by tapping around the bull gear with a deadblow hammer, or by forcing the components apart with a piece of brass bar stock and a machinist's hammer.

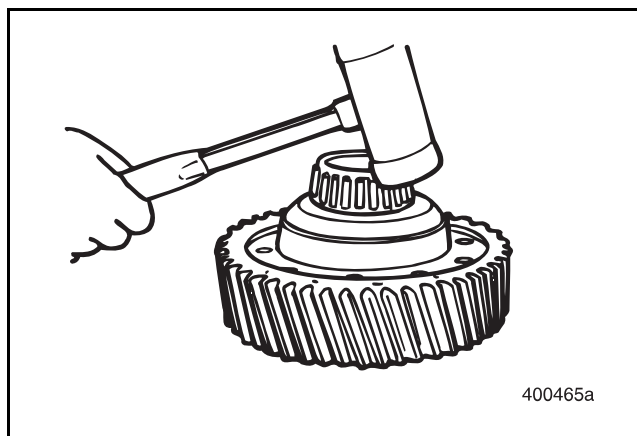


Figure 58 — Using Deadblow Hammer to Separate Differential Half



400 BENCH PROCEDURES

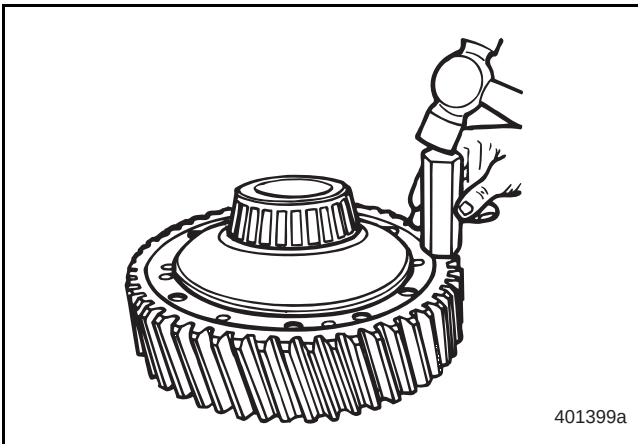


Figure 59 — Separating Bull Gear from Side Casing — Alternate Method

6. Remove the differential half.

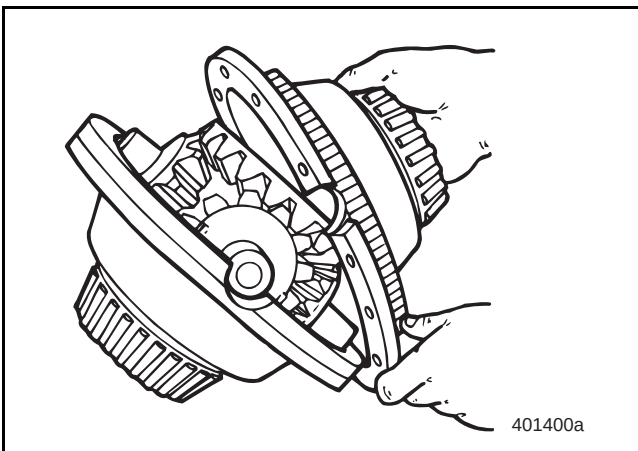


Figure 60 — Differential Half Removed

7. Remove the side-gear thrust washer.

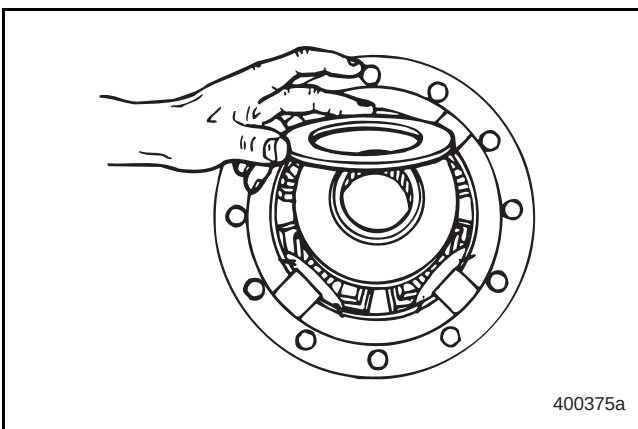


Figure 61 — Removing Side-Gear Thrust Washer

8. Remove the side gear.

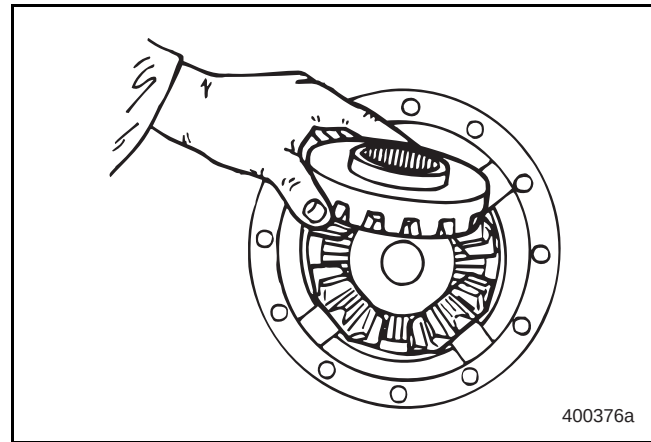


Figure 62 — Removing Side Gear

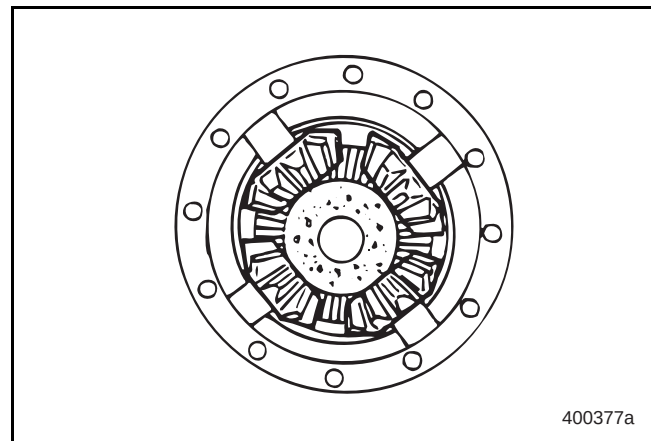


Figure 63 — Side Gear Removed

9. Remove the spider gear assembly. This assembly includes the spider, the four pinion (spider) gears and the four pinion (spider) gear thrust washers.

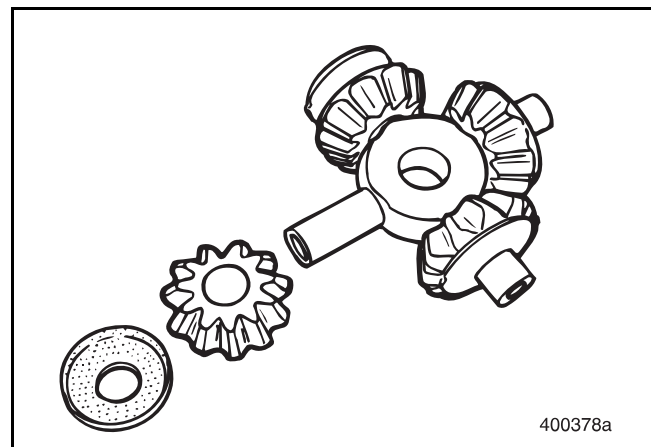


Figure 64 — Spider Gear Assembly



400 BENCH PROCEDURES

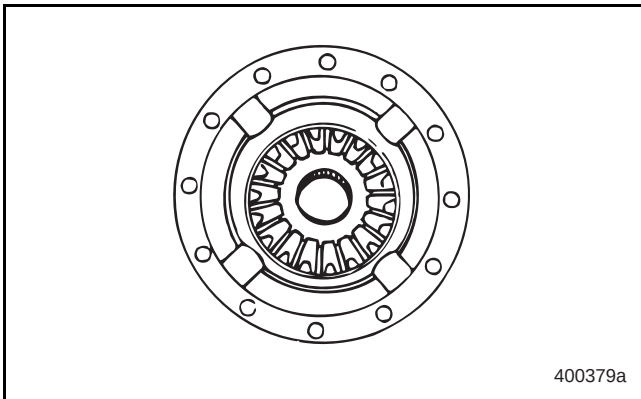


Figure 65 — Differential with Spider Gear Assembly Removed

10. When the spider gears are removed, the other side gear is visible. Remove the remaining side gear and thrust washer.

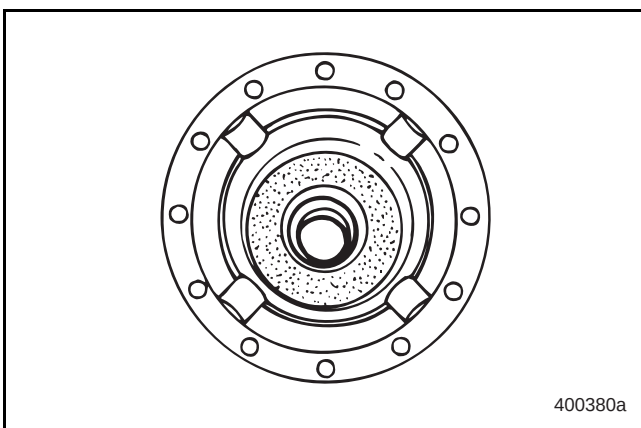


Figure 66 — Side-Gear Thrust Washer

11. If inspection reveals the need to do so, replace the bearings on the differential halves using a hydraulic press and the appropriate segment and adapter rings. Press the bearings off the side casings as shown in Figure 67. Refer to the Special Tools Chart on page 128 for the correct segments and adapter rings.

CAUTION

Exercise extreme caution during the pressing operation, even when using specified tools. The bearing cone may fly apart during removal. Use a scatter shield and be sure to have a new bearing cone ready for installation.

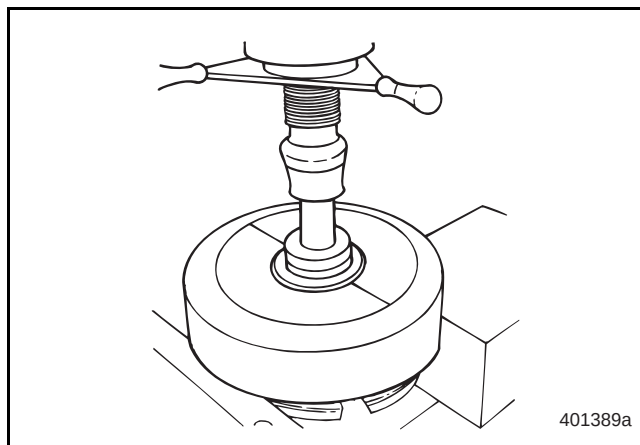


Figure 67 — Removing Bearing Cone from Side Casing

NOTE

Note the timing marks on the bull gear and the splined differential half.

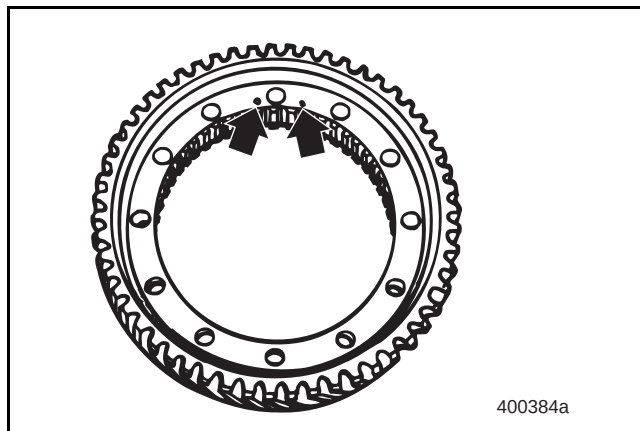


Figure 68 — Bull Gear Timing Marks

12. The two timing marks on the bull gear (twelve o'clock) must fall on each side of the single timing mark on the splined differential half (twelve o'clock).



400 BENCH PROCEDURES

[465/475] INTER-WHEEL POWER DIVIDER DIFFERENTIAL — DISASSEMBLY

1. Remove the capscrews from the splined side of the inter-wheel power divider. It may be helpful to support the assembly in a vise.

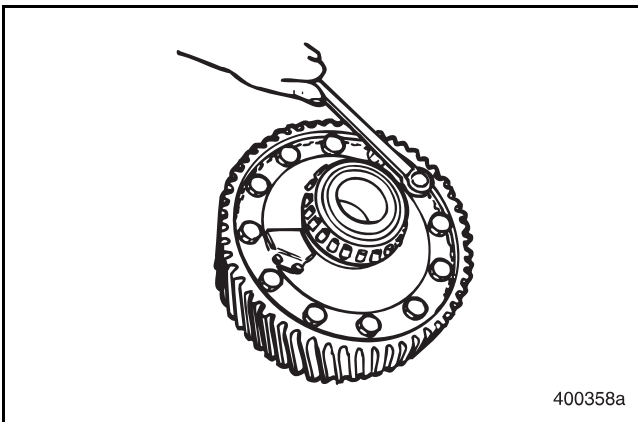


Figure 69 — Removing Capscrews

2. Mark both sides of the unsplined differential half and the bull gear for proper reassembly.
3. Remove the unsplined differential half.

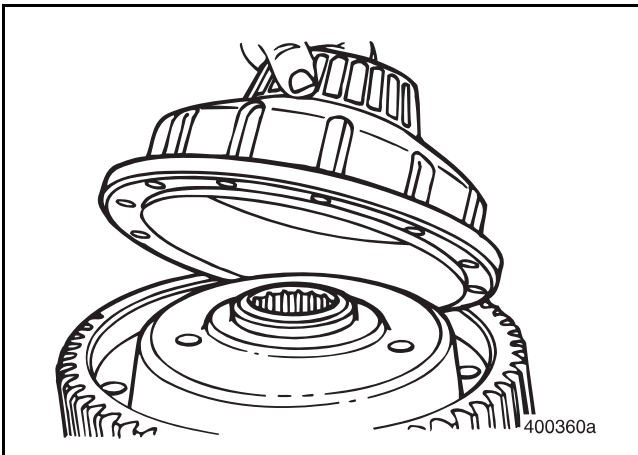


Figure 70 — Removing Unsplined Differential Half

4. Remove the outer cam.

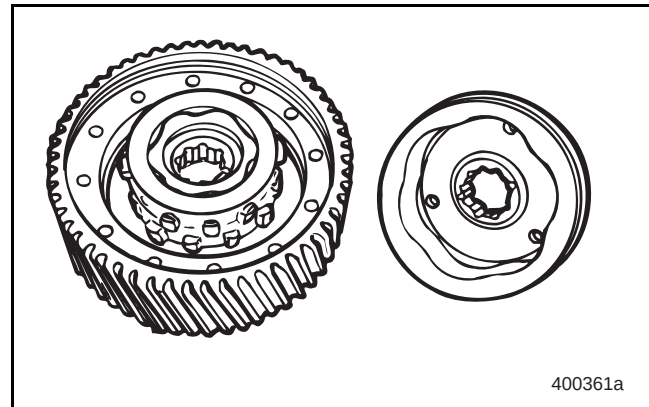


Figure 71 — Outer Cam Removed

5. Remove the inner cam.

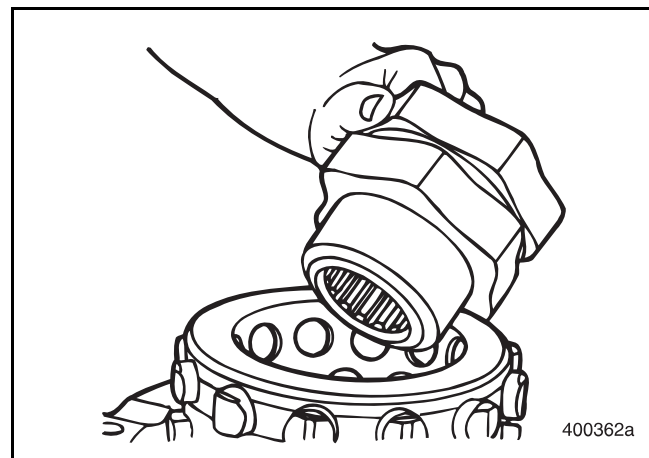


Figure 72 — Removing Inner Cam



400 BENCH PROCEDURES

6. Remove the wedges.

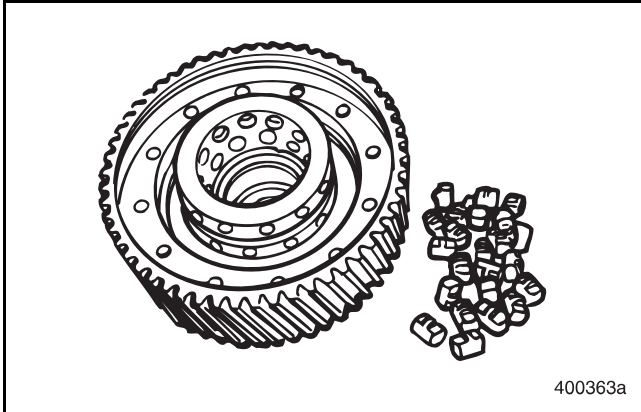


Figure 73 — Wedges Removed

7. Using a suitable hydraulic press, press out the splined inner half of the power divider from the bull gear.

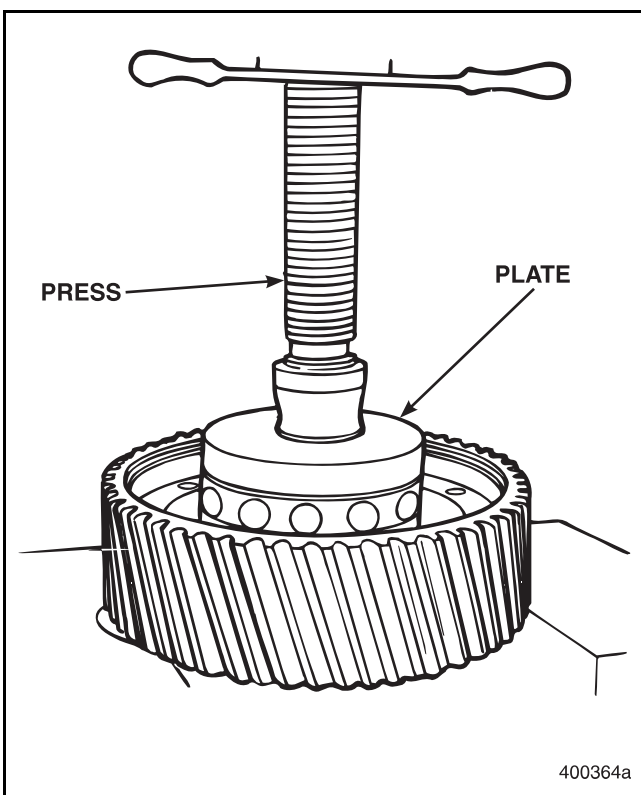


Figure 74 — Pressing Out Splined Differential Half

8. Remove the oil-trough capscrews.

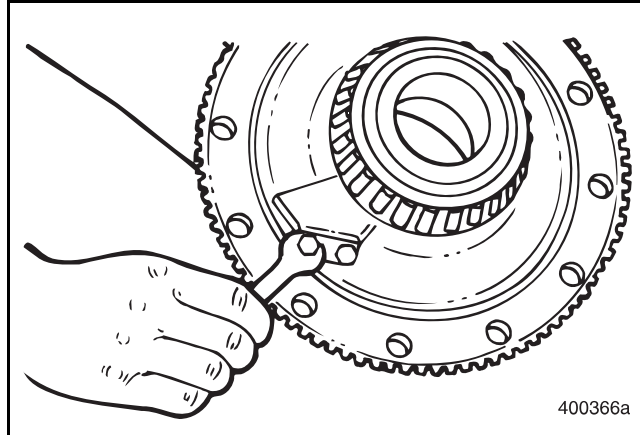


Figure 75 — Removing Oil-Trough Capscrews

9. Remove oil trough.

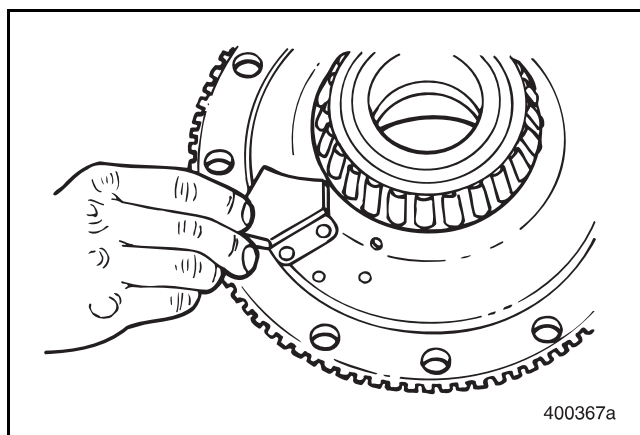


Figure 76 — Removing Oil Trough

10. Remove the outer wedge retaining ring.

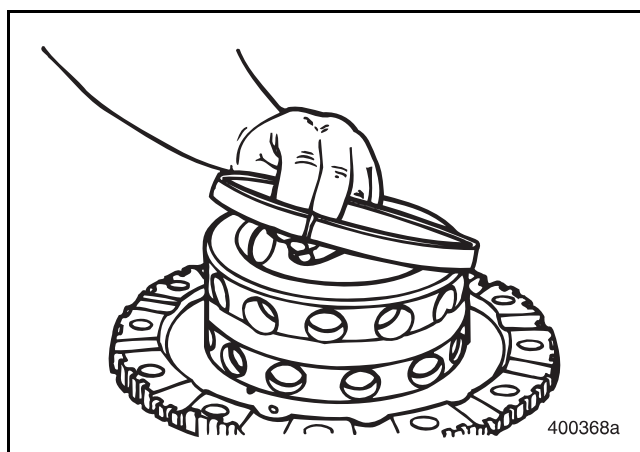


Figure 77 — Removing Retaining Ring



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11. If inspection reveals that the power-divider driving cage bushing must be replaced, remove the bushing.
12. If inspection reveals the need to do so, replace the bearings on the inner wheel power-divider driving cage and side casing using a hydraulic press and the appropriate segment and adapter rings. Press the bearing off the inner wheel power-divider driving cage as shown in Figure 78. Refer to the Special Tools Chart on page 130 for the correct segments and adapter rings.

CAUTION

Exercise extreme caution during the pressing operation, even when using specified tools. The bearing cone may fly apart during removal. Use a scatter shield and be sure to have a new bearing cone ready for installation.

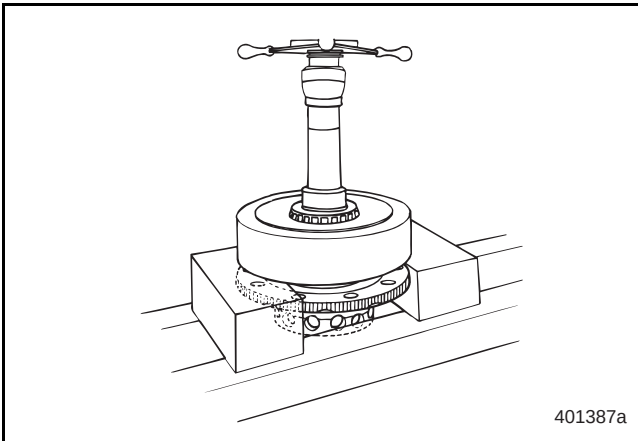


Figure 78 — Removing Bearing Cone from Driving Cage

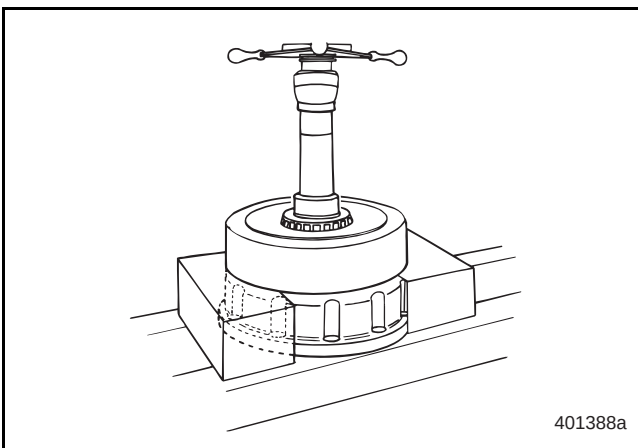


Figure 79 — Removing Bearing Cone from Side Casing

[465] INTER-AXLE POWER DIVIDER CAGE — DISASSEMBLY

1. Remove the capscrews from the inter-axle power-divider cover plate.

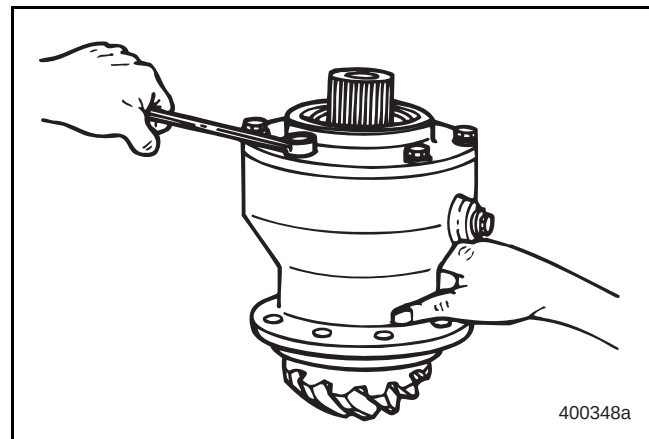


Figure 80 — Removing Capscrews

2. With the cover plate removed, insert two 7/16-14 jackscrews to separate the bearing, housing, cage and wedge assembly from the bevel pinion housing.

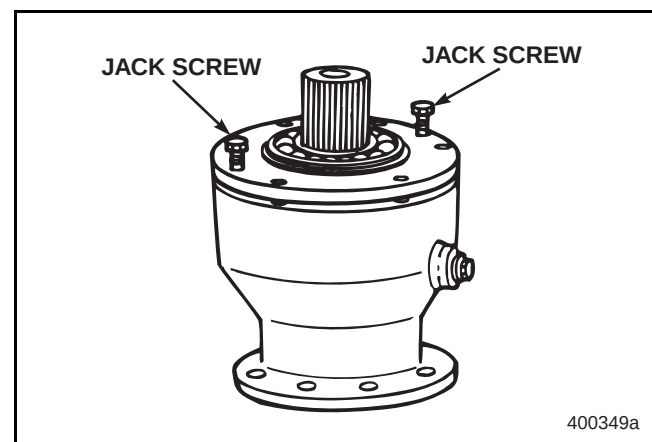


Figure 81 — Jackscrews in Place



400 BENCH PROCEDURES

3. Remove the inner cam, cage and wedge assemblies as a unit.

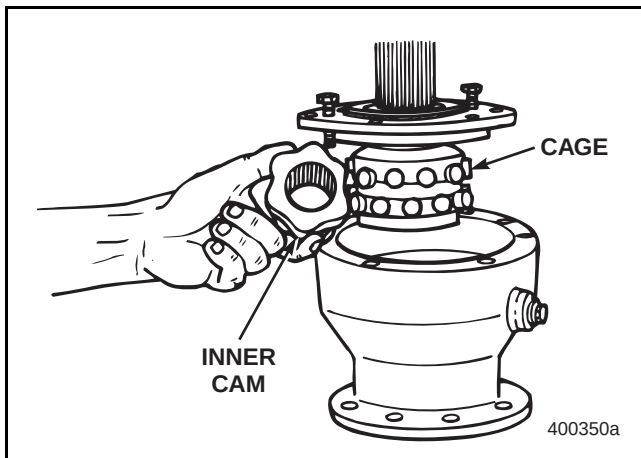


Figure 82 — Removing Inner Cam, Cage and Wedge Assemblies (Inner Cam Held in Hand)

4. Remove the O-ring from the bearing retainer groove of the cage and wedge assembly.

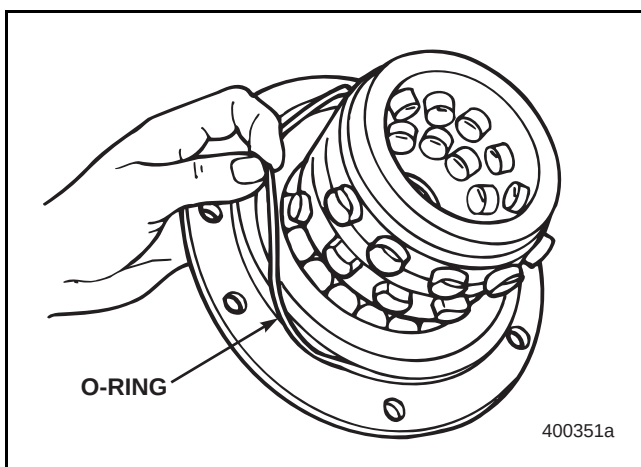


Figure 83 — Removing O-Ring

5. To replace the wedges, the retaining ring must first be removed. Push all upper wedges in as far as possible. Then remove retaining ring with expansion pliers.

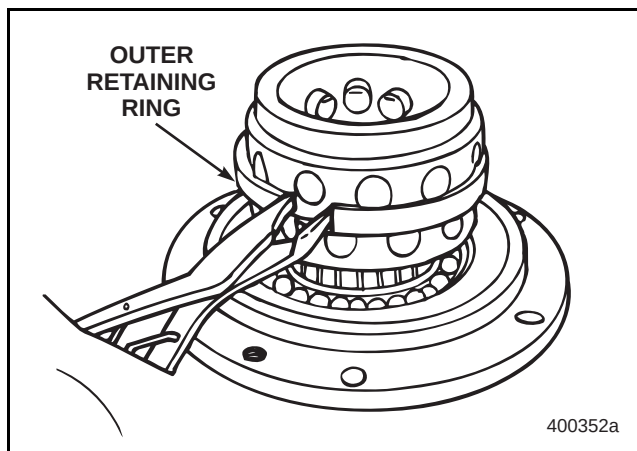


Figure 84 — Removing Retaining Ring

NOTE

Before removing the wedges, note the alpha character (an arrow on early production carriers) on the part of the wedges pointing outward. Reinstall the wedges with the alpha character or arrow pointing outward, as shown in Figure 85.

6. Remove the wedges by pulling straight out with finger pressure.

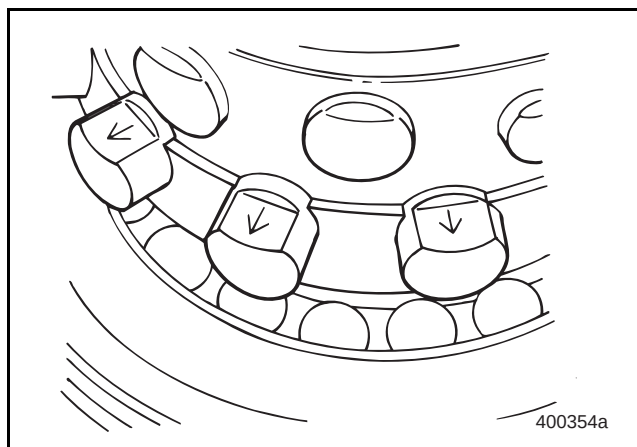


Figure 85 — Arrow on Wedges (May Also Be an Alpha Character)



400 BENCH PROCEDURES

7. The inner ring can now be removed easily. Use two screwdrivers to compress the retaining ring until the ends overlap to allow removal.

WARNING

Be careful when removing the inner ring. It may be sharp and can cause serious personal injury.

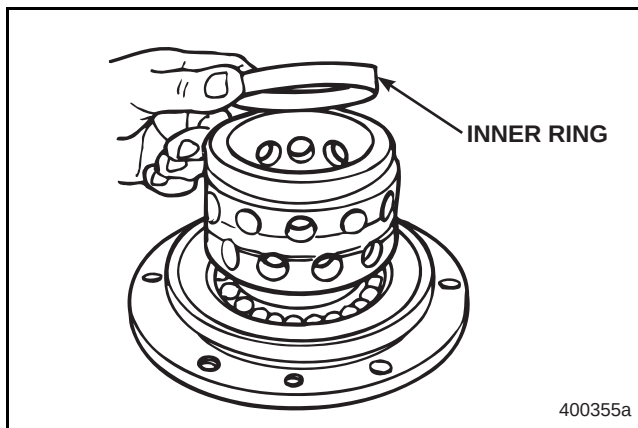


Figure 86 — Inner Ring Removed

8. Use a hydraulic press to separate the cage from the bearing retainer cover. Support the bearing inner race. Do not apply force through the bearings.
9. Remove the O-ring from the cover plate.

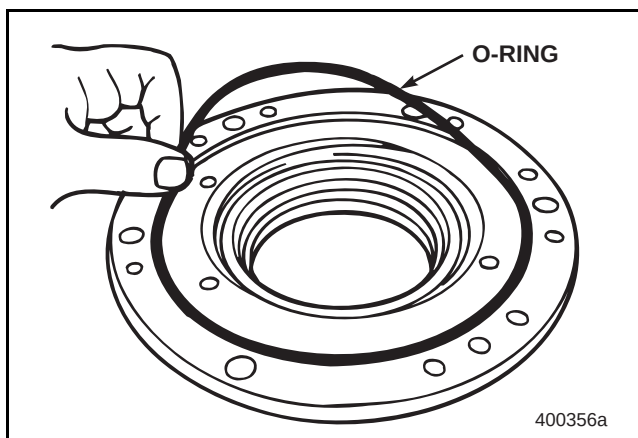


Figure 87 — Removing O-Ring from Cover Plate

10. Remove seal from cover plate using a suitable driver.

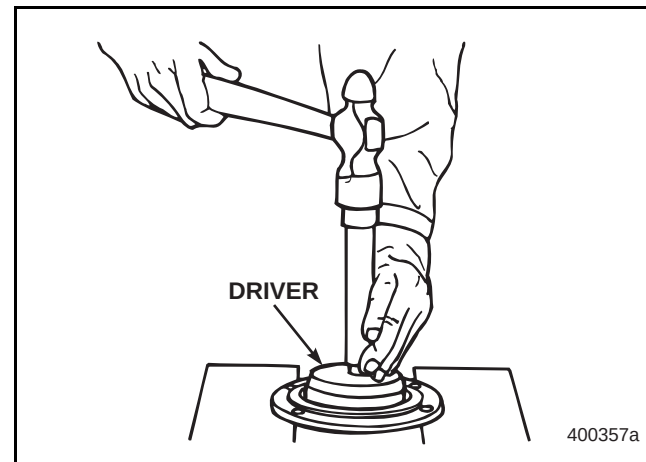


Figure 88 — Removing Seal from Cover Plate

[466] FRONT REAR BEVEL PINION — DISASSEMBLY

1. Using a torque multiplier (OEM 6107) and socket (J 28721-906), loosen and remove the retaining nut on the front bevel pinion. Kent-Moore tool J 33107 is required for holding the outer cam.

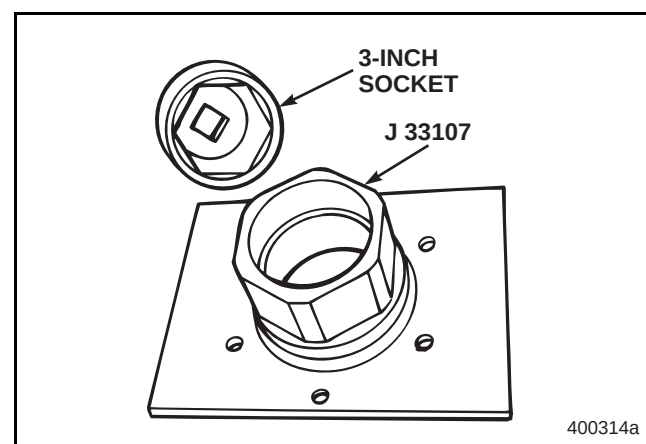


Figure 89 — Outer Cam Holding Fixture and Socket



400 BENCH PROCEDURES

2. Install the holding fixture in a press stand or other stand capable of holding the fixture secure against the 1,300 to 1,500 lb-ft (1762 to 2034 N•m) of torque necessary to release the retaining nut.

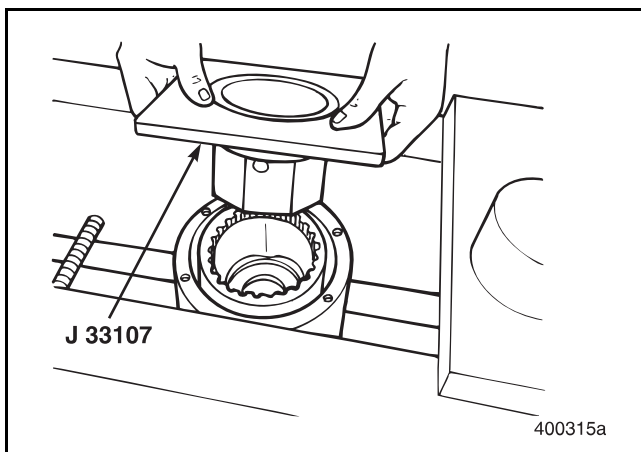


Figure 90 — Installing Holding Fixture

3. Install the socket in the holding fixture.

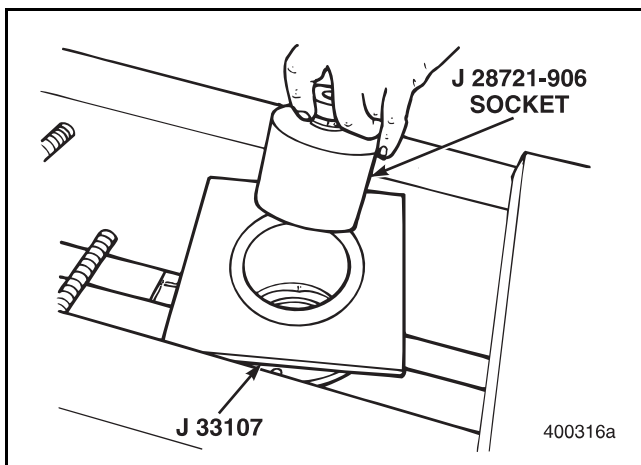


Figure 91 — Installing Socket in Holding Fixture

4. Using a torque multiplier and a press stand or other suitable method, hold the fixture in the power-divider lockout housing and remove the retaining nut.

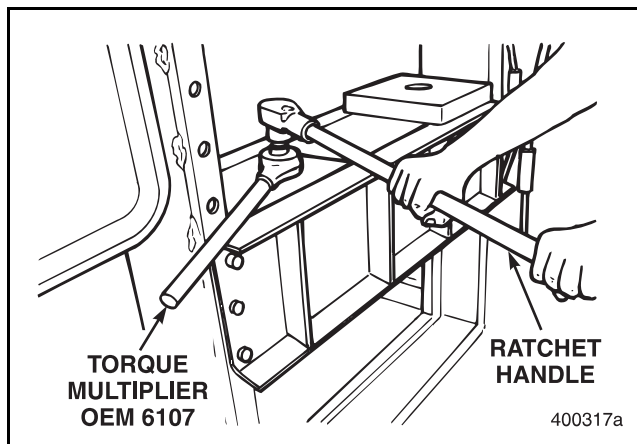


Figure 92 — Using Torque Multiplier to Loosen Nut

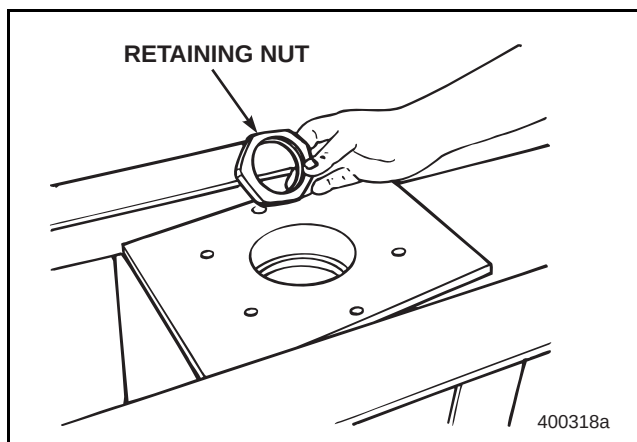


Figure 93 — Retaining Nut Removed

5. Using a hydraulic press, separate the bevel pinion shaft and gear from the bevel housing. Also remove outer cam from bevel housing.

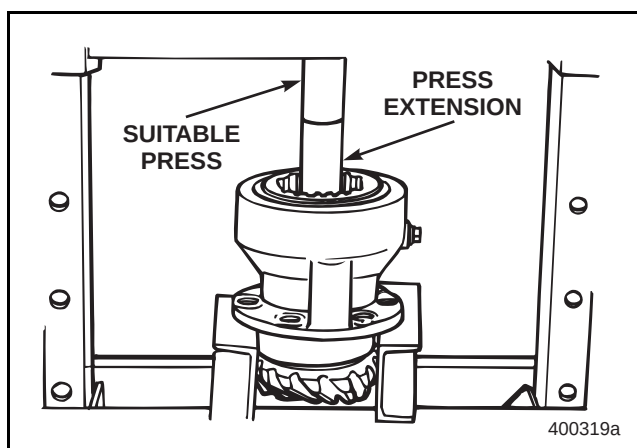


Figure 94 — Pressing out Bevel Pinion Shaft



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6. Using a drift and hammer, remove the inner bearing cup in the housing.

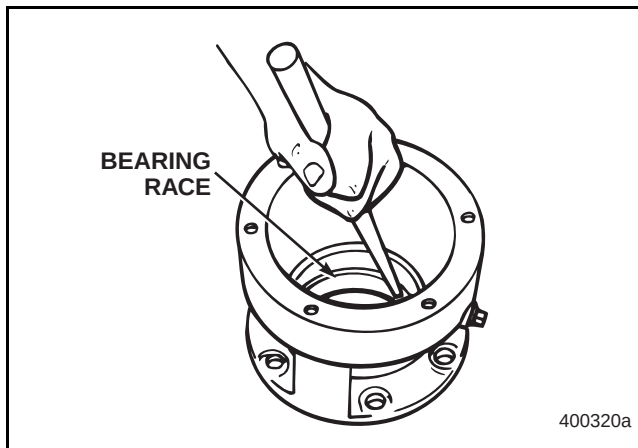


Figure 95 — Removing Inner Cup

7. Turn the housing over. Then use a drift and hammer to remove the outer bearing cup.

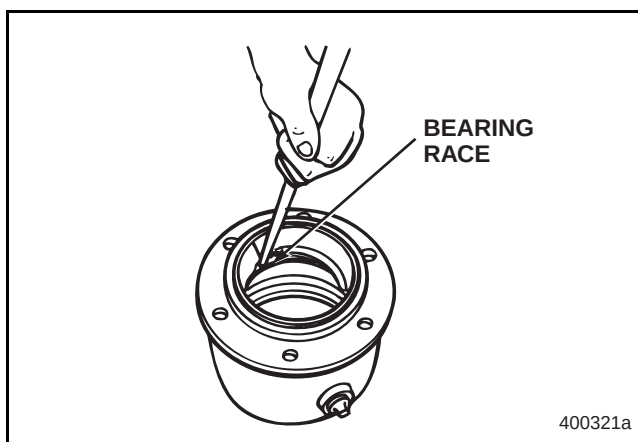


Figure 96 — Removing Outer Cup

8. If the bearings on the bevel pinion must be replaced, remove them using a hydraulic press and the appropriate segment and adapter rings. Press the bearing off the front bevel pinion as shown in Figure 97. Refer to the Special Tools Chart on page 130 for the correct segments and adapter rings.

CAUTION

Exercise extreme caution during the pressing operation, even when using specified tools. The bearing cone may fly apart during removal. Use a scatter shield and be sure to have a new bearing cone ready for installation.

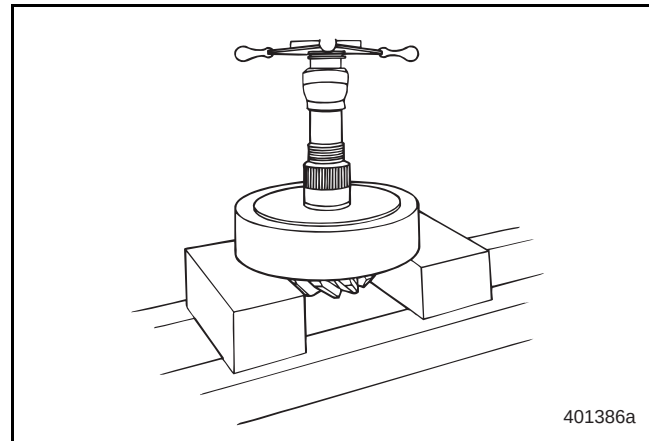


Figure 97 — Pressing Bearing off Bevel Pinion

9. If necessary, remove the outer cam bearing using a hydraulic press and the appropriate segment and adapter rings. Press the bearing off the outer cam as shown in Figure 98. Refer to the Special Tools Chart on page 130 for the correct segments and adapter rings.

CAUTION

Exercise extreme caution during the pressing operation, even when using specified tools. The bearing cone may fly apart during removal. Use a scatter shield and be sure to have a new bearing cone ready for installation.

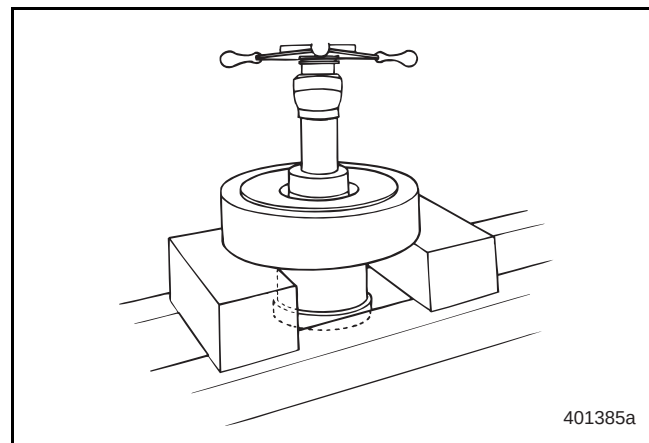


Figure 98 — Pressing Bearing off Outer Cam



400 BENCH PROCEDURES

10. Note and record the numerals stamped into the pinion. They represent the mating number (U337) and the mounting distance (4.135 inches).

NOTE

The actual mating number and mounting distance number will probably differ from U337 and 4.135 inches, which are used here as examples.

The mating numbers on the bevel pinion and the bevel gear will always be the same. These components must always be replaced as a set.

The mounting distance represents the distance from the backface of the head of the bevel pinion to the center line of the bevel gear. This number helps in determining how many shims must be installed to get the proper gear pattern.

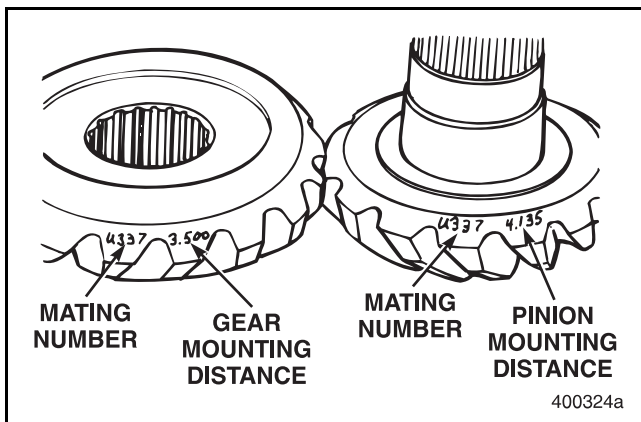


Figure 99 — Mating Number and Mounting Distance Number

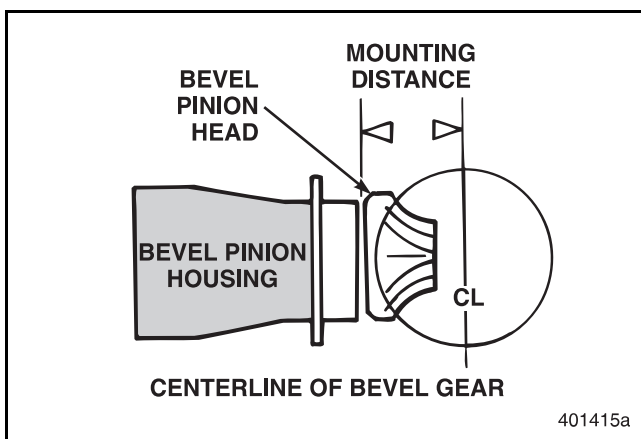


Figure 100 — Determining the Mounting Distance

[476] REAR REAR BEVEL PINION — DISASSEMBLY

1. Remove the capscrews from the rear bevel pinion bearing retainer cover and remove the cover.

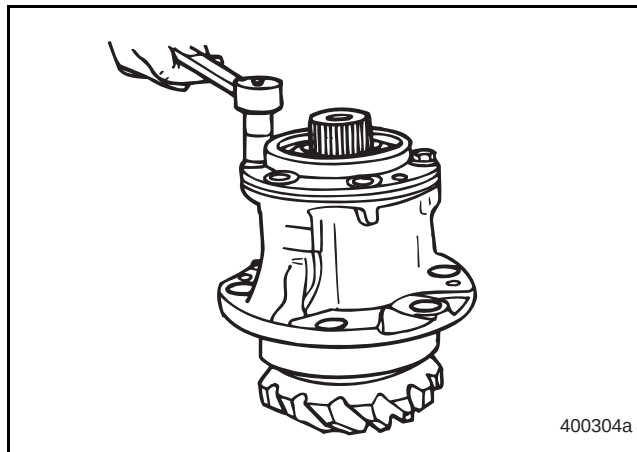


Figure 101 — Removing Capscrews from Bearing Retainer Cover

2. Remove gasket from bearing retainer cover.

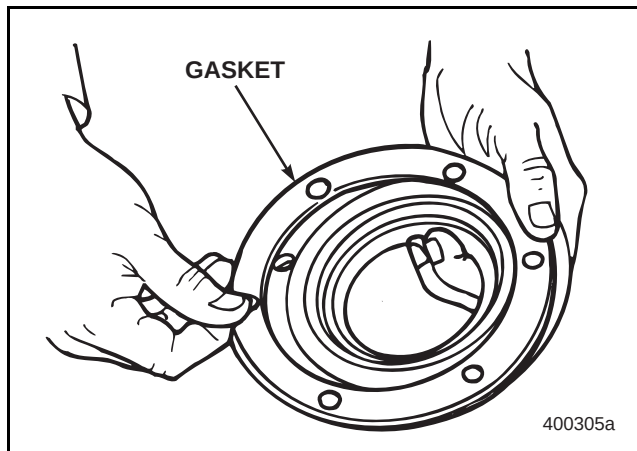


Figure 102 — Removing Gasket from Bearing Retainer



400 BENCH PROCEDURES

3. Remove the seal from the bearing retainer cover using a driver and a hammer.

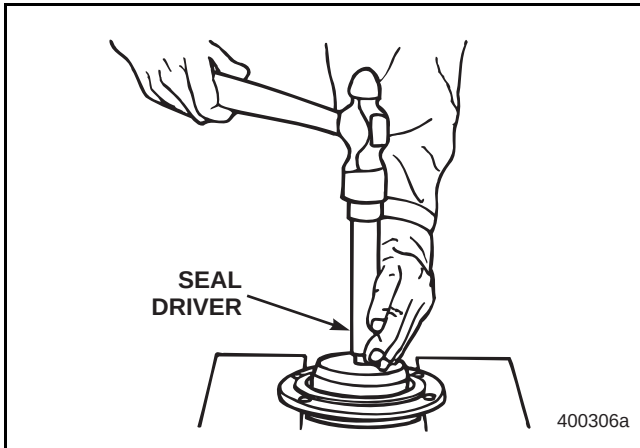


Figure 103 — Removing Cover Seal

4. Using a hydraulic press, separate the bevel pinion shaft, spacer and bearing from the bevel housing. Catch or cushion the bevel pinion shaft during disassembly.

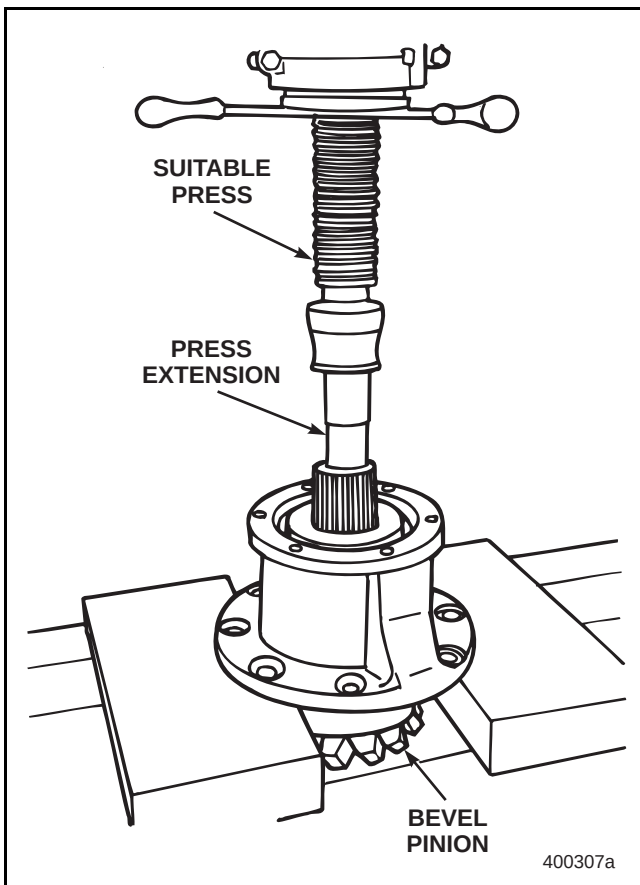


Figure 104 — Pressing out Bevel Pinion Shaft, Spacer and Bearing

5. Remove the spacer from the bevel pinion shaft.

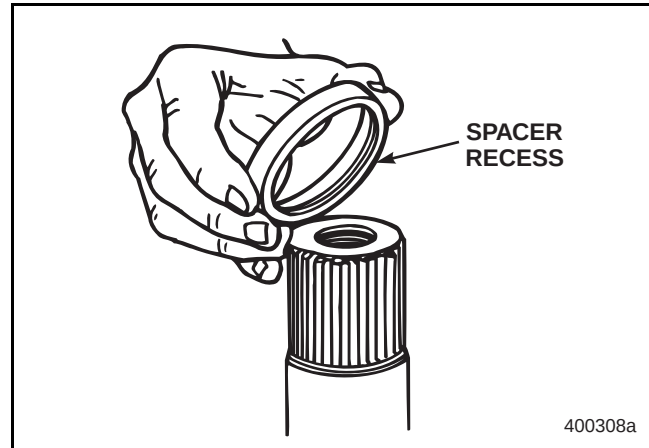


Figure 105 — Removing Spacer

6. Remove the outer bearing from the bevel pinion housing.

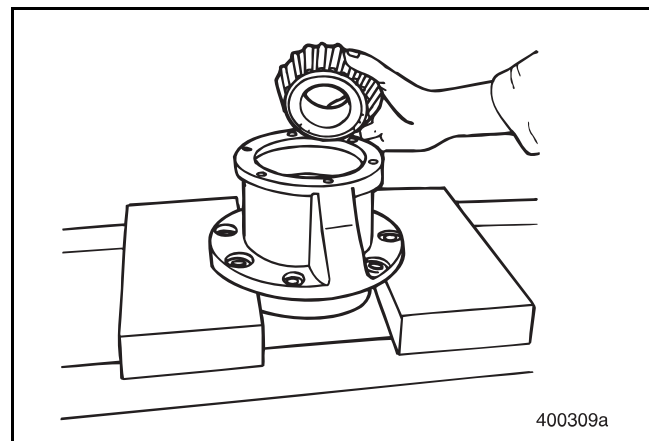


Figure 106 — Removing Outer Bearing from Bevel Pinion Housing



400 BENCH PROCEDURES

7. If the bearings on the bevel pinion must be replaced, position the pinion shaft in a hydraulic press. Use the proper segments and adapter rings to remove the bearing. Refer to Figure 107 for the proper press setup. Refer to the Special Tools Chart on page 130 for the correct segments and adapter rings.

CAUTION

Exercise extreme caution during the pressing operation, even when using specified tools. The bearing cone may fly apart during removal. Use a scatter shield and be sure to have a new bearing cone ready for installation.

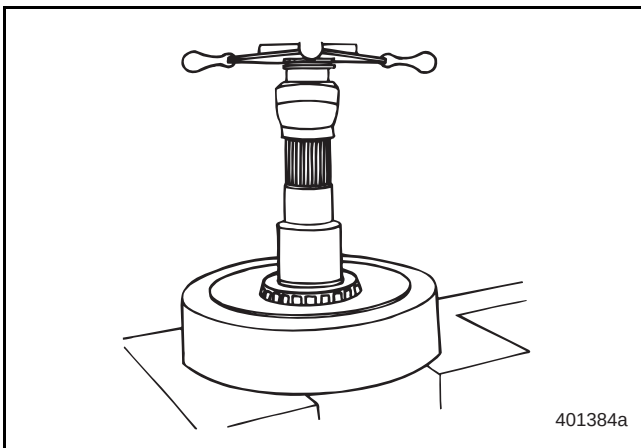


Figure 107 — Removing Inner Bearing Cone

8. Using a hammer and drift, remove the bearing cups (inner and outer) from the bevel pinion housing.

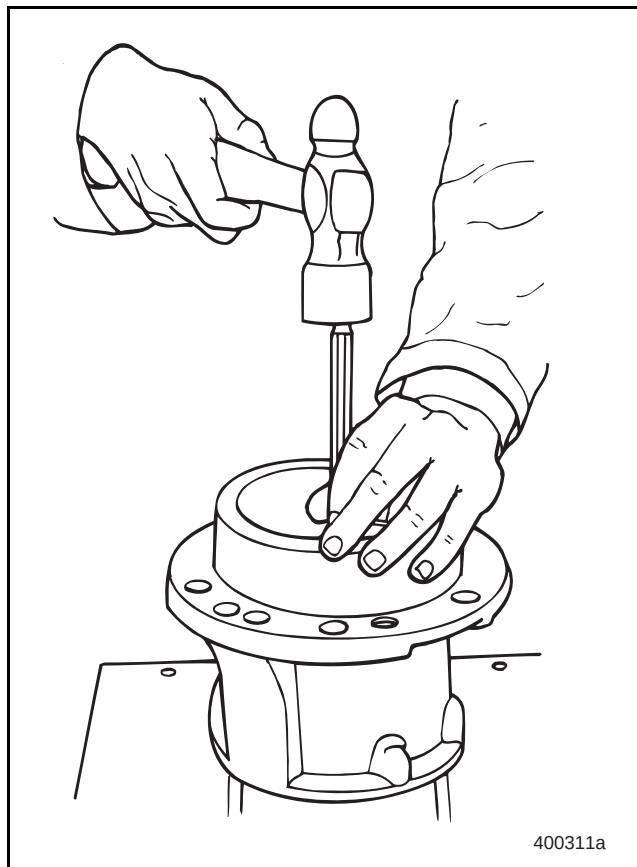


Figure 108 — Removing Bearing Cups from Housing



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9. Note and record the numerals stamped into the pinion. These numerals represent the mating number (A13) and the mounting distance (4.875 inches).

NOTE

The actual mating number and mounting distance number will probably differ from A13 and 4.875 inches, which are used here as examples.

The mating numbers on the bevel pinion and the bevel gear will always be the same. These components must always be replaced as a set.

The mounting distance represents the distance from the backface of the head of the bevel pinion to the center line of the bevel gear. This number helps in determining how many shims must be installed to get the proper gear pattern.

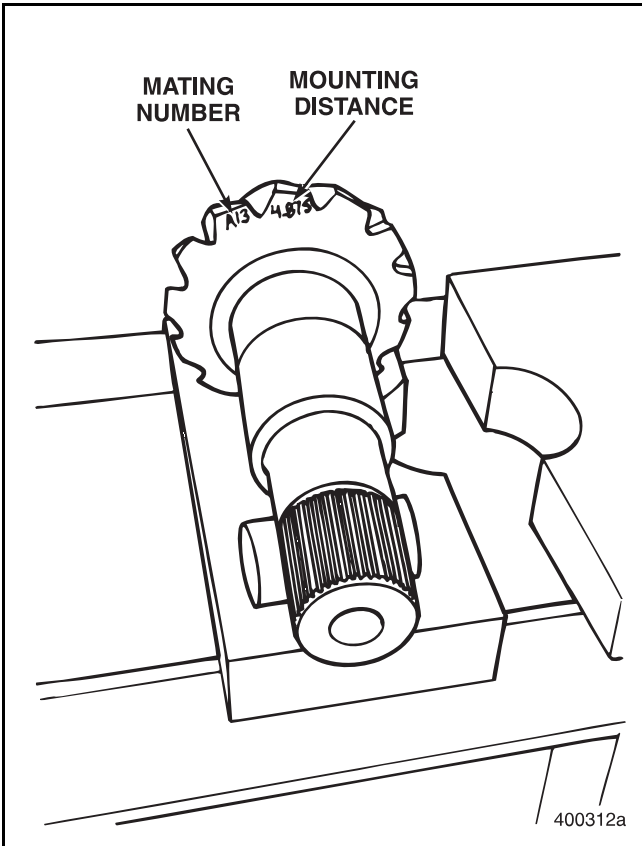


Figure 109 — Mating Number and Mounting Distance Number Location

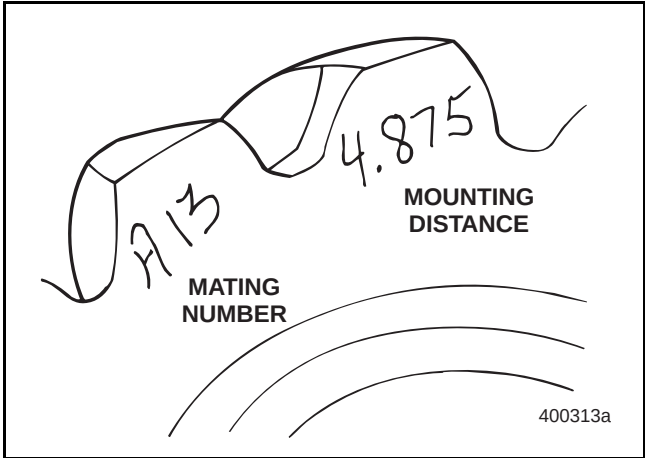


Figure 110 — Mating Number and Mounting Distance Number

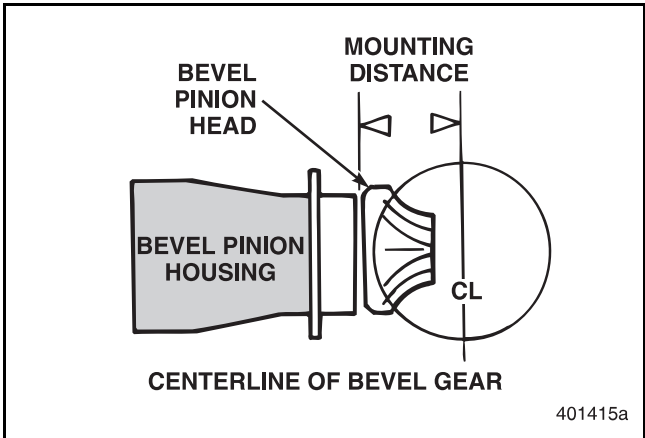


Figure 111 — Determining the Mounting Distance



400 BENCH PROCEDURES

[466/476] HELICAL (SPUR) PINION SHAFT — DISASSEMBLY

1. Secure the helical pinion shaft assembly. Remove and discard the three capscrews that retain the clamp plate. Replace with **new** grade 8 capscrews at reassembly.

NOTE

Be sure to have replacement capscrews for final reassembly.

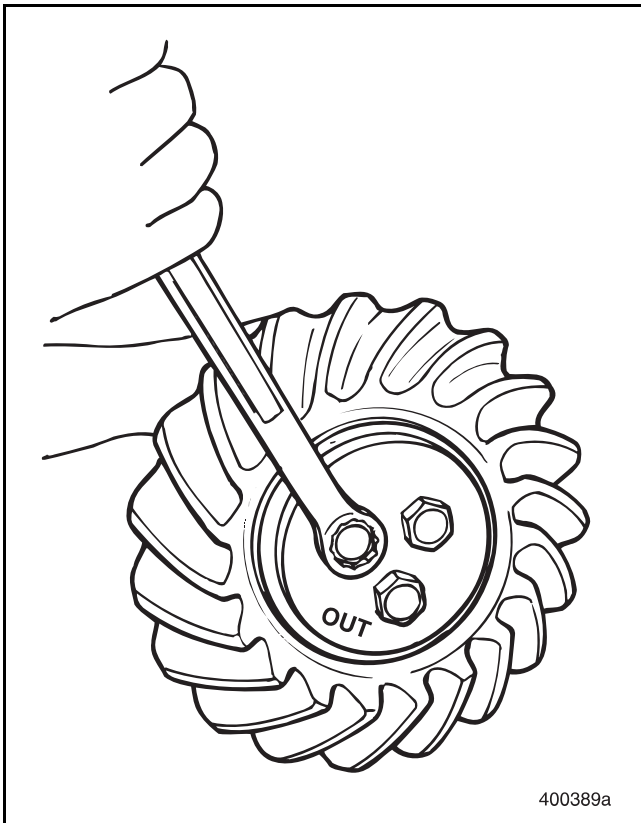


Figure 112 — Removing Clamp-Plate Capscrews

2. Remove the clamp plate.

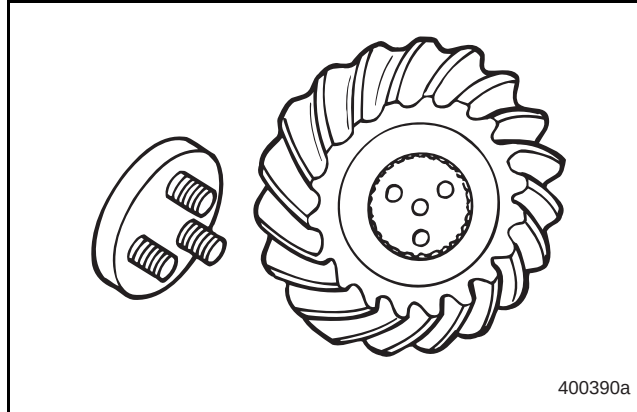


Figure 113 — Clamp Plate Removed

3. Place the pinion shaft into a hydraulic press. Press the helical pinion shaft from the helical gear.

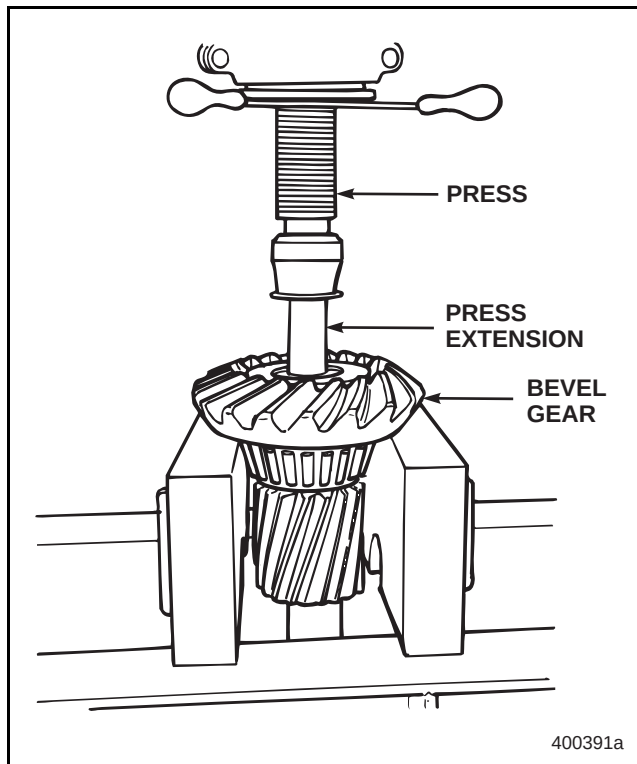


Figure 114 — Pressing Helical Pinion Shaft from Gear



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4. Remove the key from the helical pinion shaft using a pin punch and hammer. Helical pinion shaft key use depends on ratio. Refer to Figure 207 — Examples of Splined and Keyed Pinion Shafts.

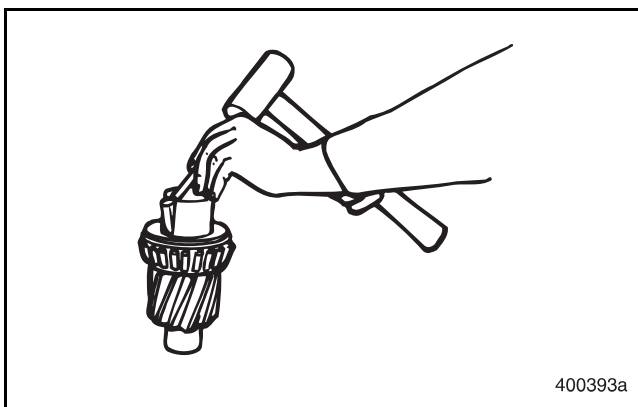


Figure 115 — Removing Key from Shaft

5. Press out the helical shaft from the bearing using the bearing cup for support or suitable puller. This action applies pressing force through the bearing rollers. Refer to Figure 116.

NOTE

Be sure a replacement bearing is available for final reassembly.

CAUTION

*Exercise extreme caution during the pressing operation, even when using specified tools. The bearing cone may fly apart during removal. Use a scatter shield and be sure to have a **new** bearing cone ready for installation.*

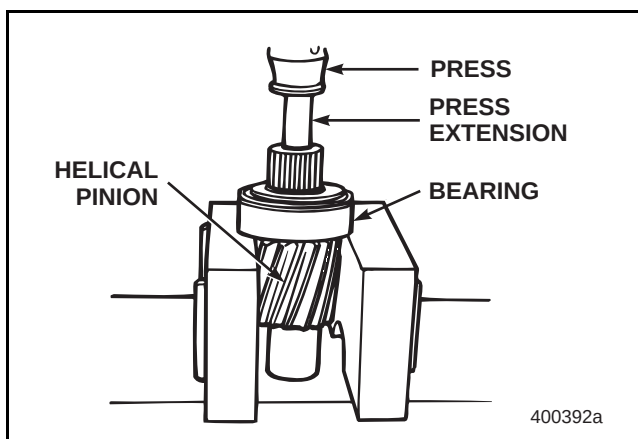


Figure 116 — Pressing Shaft out of Bearing

6. Using a hammer and drift, remove the helical-pinion retainer bearing outer cup.

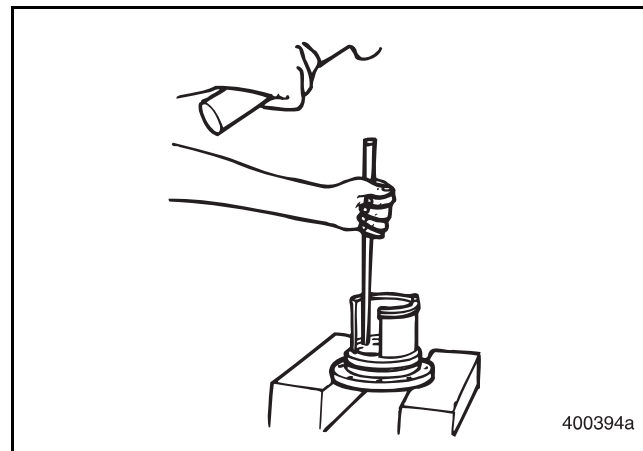


Figure 117 — Removing Helical-Pinion Retainer Bearing Cup

7. Remove the O-ring from the retainer.

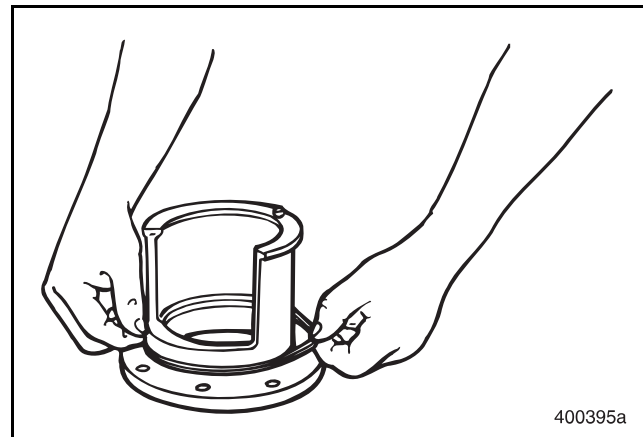


Figure 118 — Removing O-Ring from Retainer

8. Using a hammer and drift, remove the remaining helical-pinion retainer bearing cup from the carrier housing.

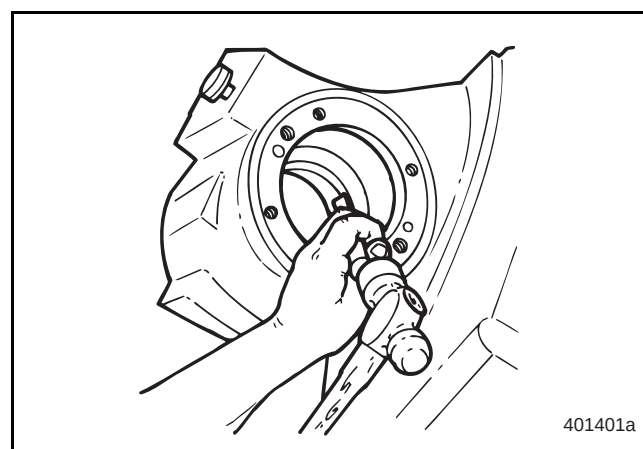


Figure 119 — Removing Inner Bearing Cup



400 BENCH PROCEDURES

[466] POWER DIVIDER LOCKOUT — DISASSEMBLY

⚠ WARNING

Be very careful when removing the power-divider lockout cylinder housing from the unit. It is spring loaded and the spring can release if the nut on the inside is broken or stripped, or the shaft is broken.

1. Remove the capscrews retaining the cylinder housing onto the power-divider lockout housing.

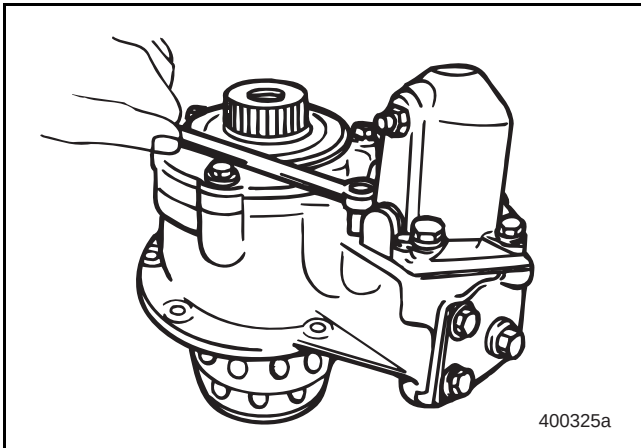


Figure 120 — Removing Capscrews from Cylinder Housing

2. Remove the cylinder housing.

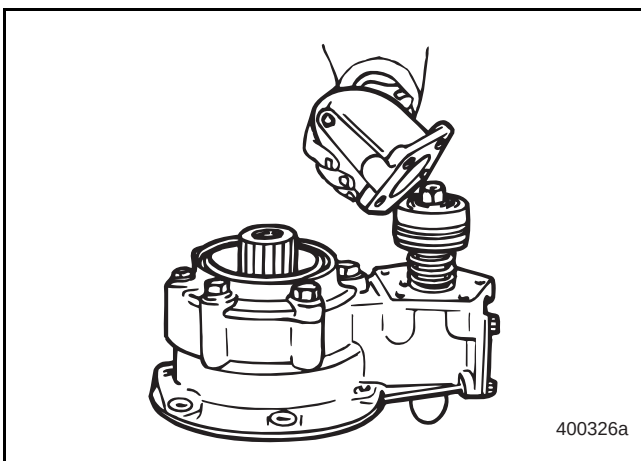


Figure 121 — Removing the Cylinder Housing

3. Remove the nut and washer that hold the piston and spring in place.

⚠ WARNING

Be careful when removing the nut that holds the piston and spring. The piston or spring can suddenly release, causing serious personal injury.

4. Remove the piston from the shaft by sliding it straight off.

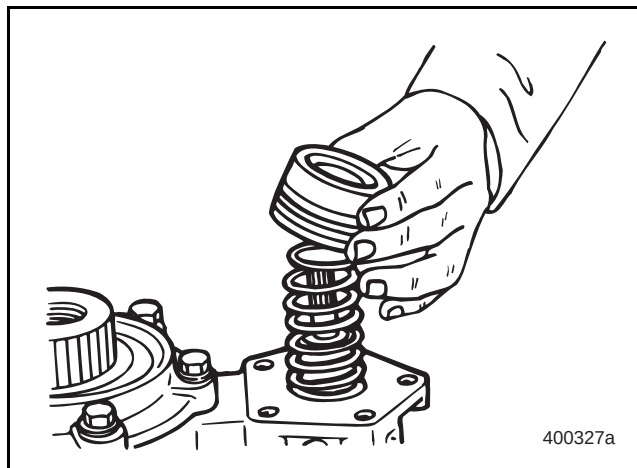


Figure 122 — Removing the Piston from the Shaft

5. Remove the piston return spring.

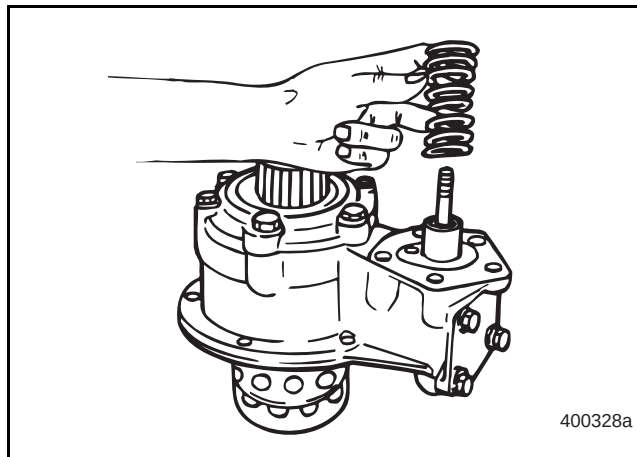


Figure 123 — Removing the Spring



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6. Remove the spacer and remaining washer from the piston shaft.

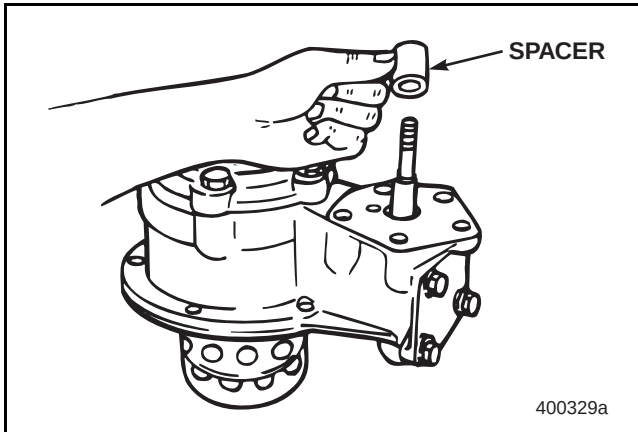


Figure 124 — Removing the Spacer

7. Figure 125 shows the components and assembly order that complete the piston and spring assembly. Ensure all of these components are present. Set them aside for reuse if all are in good condition.

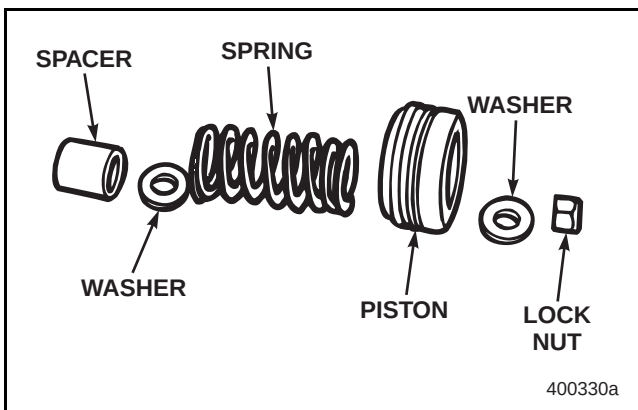


Figure 125 — Spacer, Spring and Piston Assembly

8. Remove the air cylinder gasket.

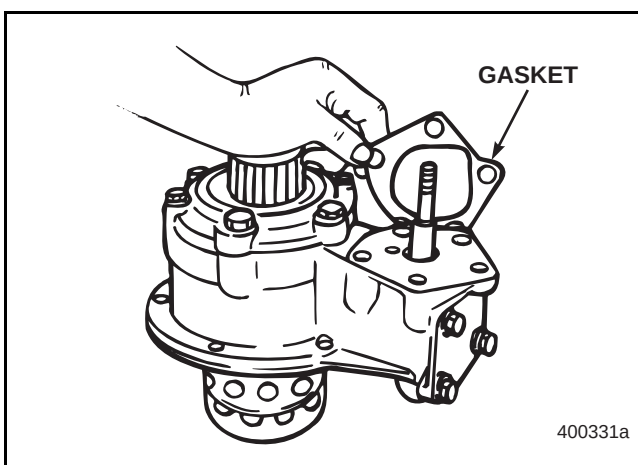


Figure 126 — Removing Gasket

9. Remove the cover plate capscrews from the power divider lockout housing.

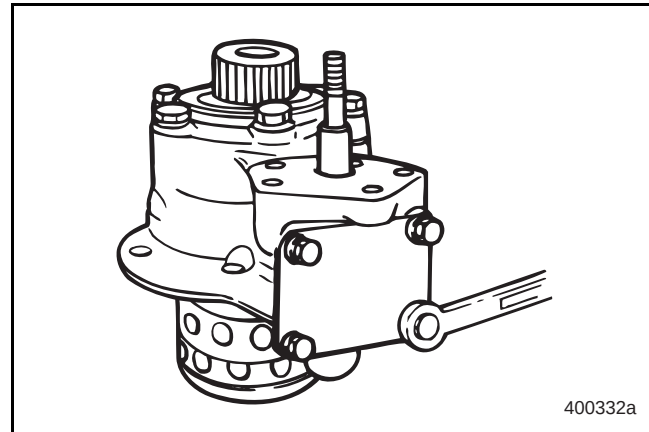


Figure 127 — Remove Capscrews from Cover

10. Remove the cover plate.

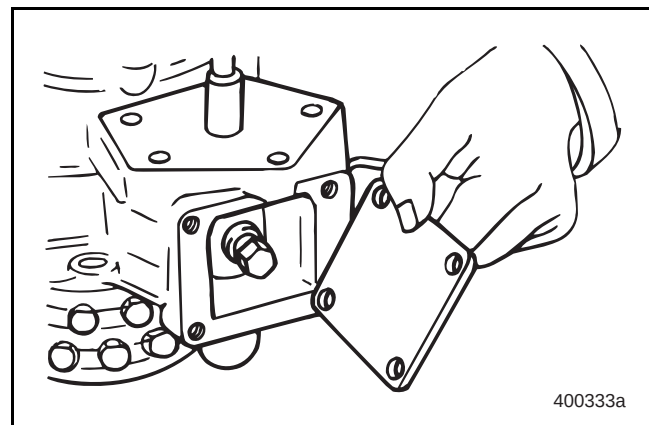


Figure 128 — Removing Cover Plate

11. Remove the cover plate gasket (or Silastic sealer if applicable). Make sure the surface of the cover plate is clean.

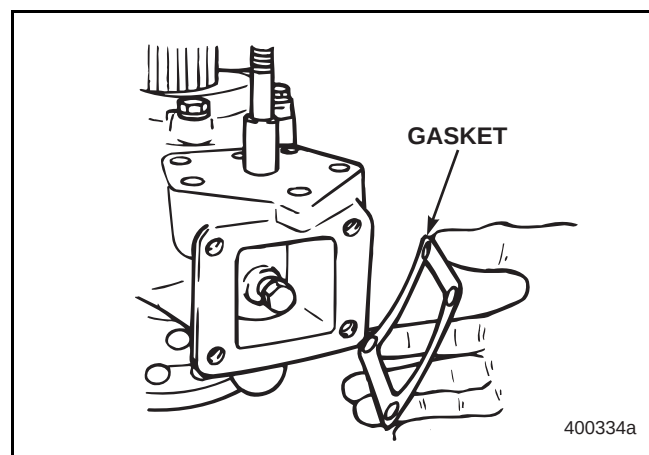


Figure 129 — Removing the Gasket



400 BENCH PROCEDURES

12. Remove the locking capscrew from the shaft and fork.

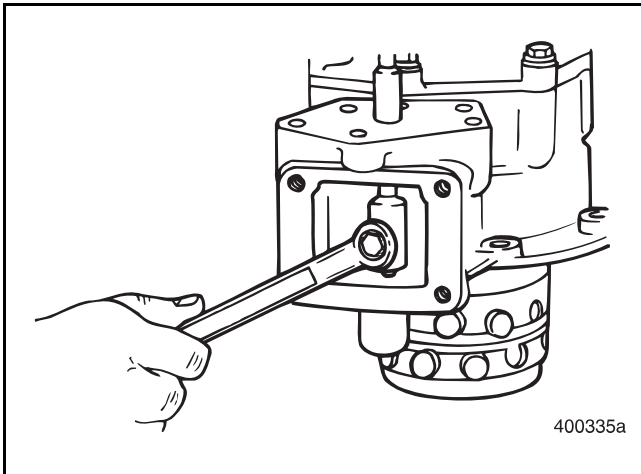


Figure 130 — Removing Locking Capscrew

13. Remove the shift fork shaft.

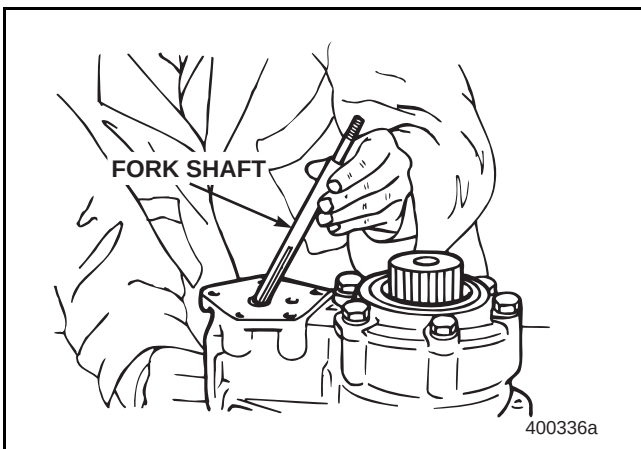


Figure 131 — Removing Fork Shaft

14. Remove the capscrews from the bearing retainer cover.

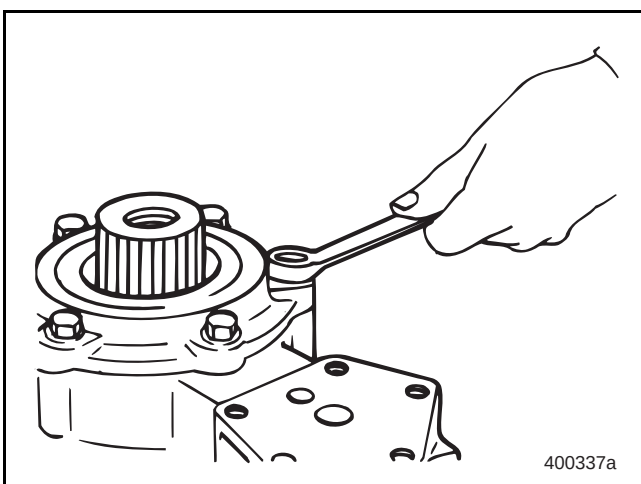


Figure 132 — Removing Capscrews

15. Remove the bearing retainer cover.

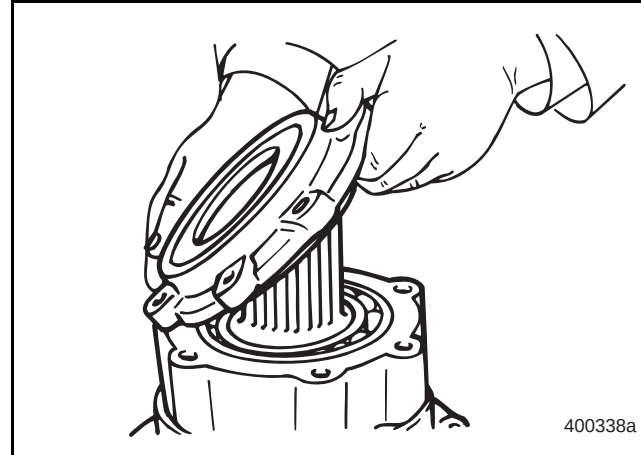


Figure 133 — Removing Bearing Retainer Cover

16. Remove the bearing retainer cover O-ring.

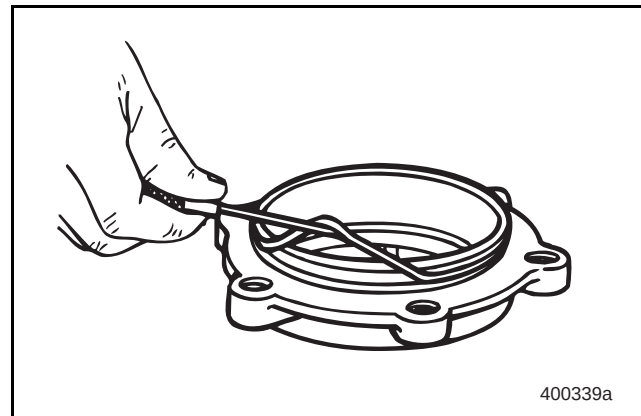


Figure 134 — Removing O-Ring

17. Using a hammer and driver, remove the seal from the bearing retainer.

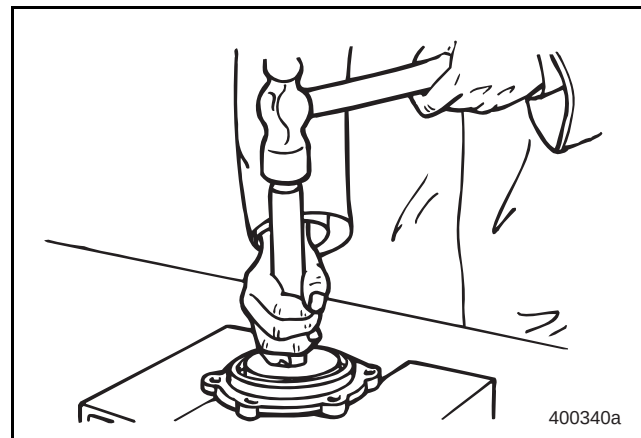


Figure 135 — Removing Seal from Bearing Retainer



400 BENCH PROCEDURES

18. Using a hydraulic press, separate the shaft and cage assembly from the power divider clutch.

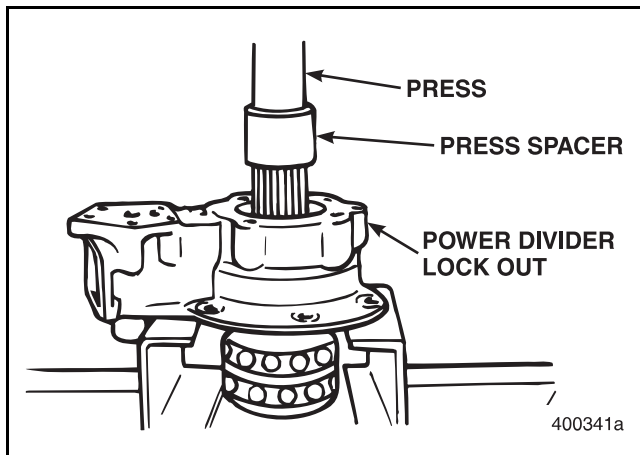


Figure 136 — Pressing out Shaft and Cage Assembly

CAUTION

During the pressing procedure, take special care to avoid binding the fork, which can cause the fork to break.

19. Remove the fork and clutch from the power divider lockout housing.

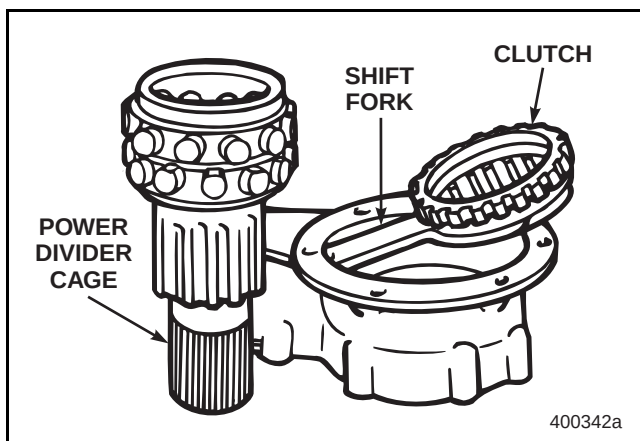


Figure 137 — Fork and Clutch Ready for Removal

20. Using a drift and hammer, remove the ball bearing from the housing. Apply force only to the outer race of the bearing.

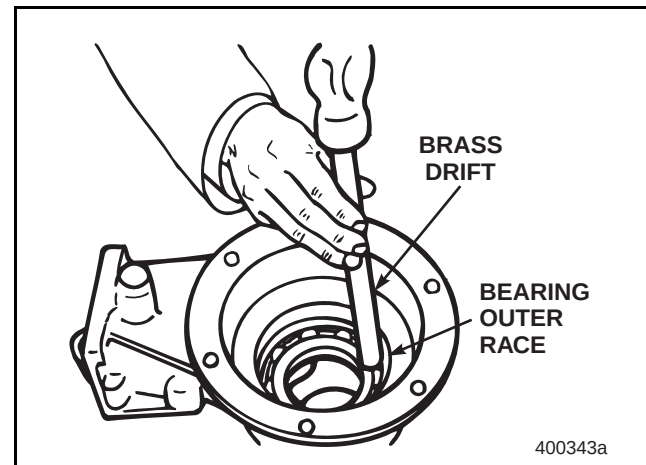


Figure 138 — Removing Bearing from Housing

21. Press all the wedges into the cage as far as possible. Then remove the outer retaining ring from the shaft and cage assembly.

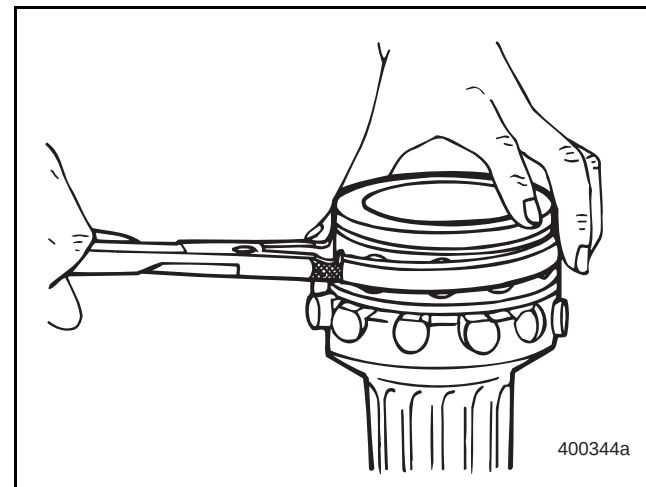


Figure 139 — Removing Outer Retaining Ring

NOTE

Before removing the wedges, note the alpha character (or arrow on early production carriers) on the part of the wedges pointing outward. The wedges must be reinstalled with the alpha character or arrow pointing outward as shown in Figure 140.



400 BENCH PROCEDURES

22. Remove the wedges from the cage.

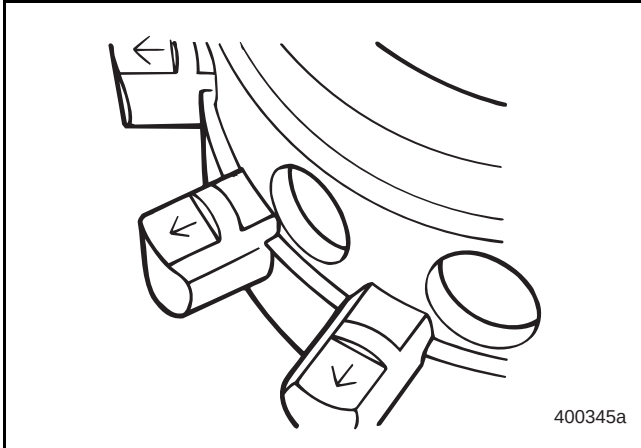


Figure 140 — Removing Wedges

23. Locate the inner ring in the cage.

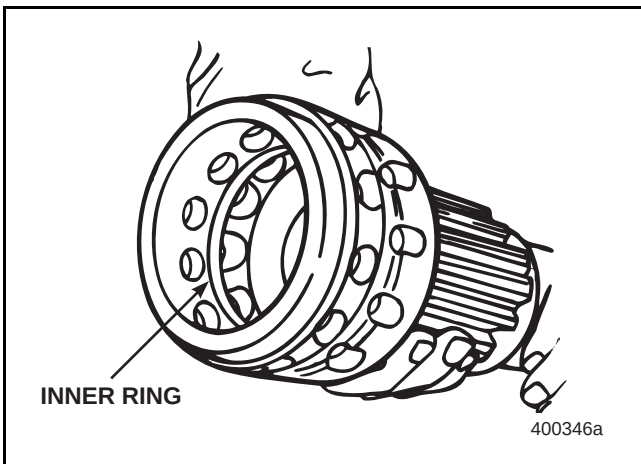


Figure 141 — Inner Ring Location

24. Using two screwdrivers, compress the inner retaining ring until the ends overlap to allow removal. Remove the inner ring.

⚠ WARNING

Be careful when removing the inner ring. It may be sharp and can cause serious personal injury.

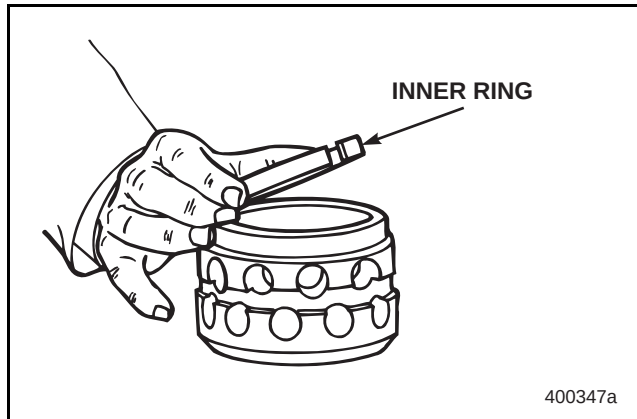


Figure 142 — Removing Inner Ring

[466] INTER-AXLE THROUGH SHAFT — DISASSEMBLY

If the through-shaft bearing must be replaced, remove the bearing using a suitable hydraulic press arrangement as shown in Figure 143.

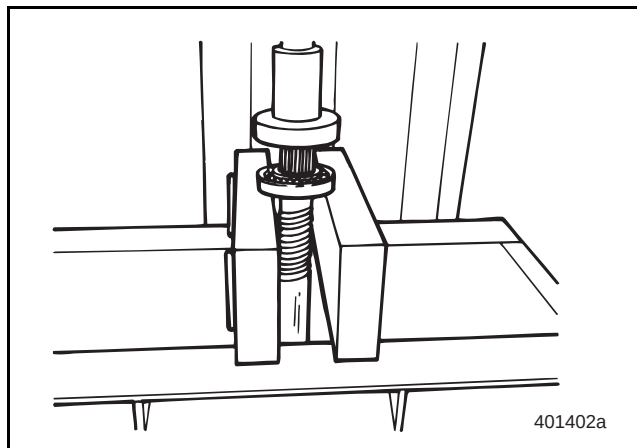


Figure 143 — Removing Inter-Axle Bearing



400 INSPECTION

CARRIER COMPONENT INSPECTION



400 INSPECTION

OVERVIEW

It is very important to carefully and thoroughly inspect drive unit parts before reassembly. Replacement of worn or damaged components will eliminate costly and avoidable drive unit failure.

Whenever possible, use the Magnaflux or similar non-destructive inspection method on all steel parts except ball and roller bearings. This method is especially suited for inspecting ground or highly finished surfaces for wear and cracks, which otherwise would not be visible. It is essential to completely demagnetize the parts before using the Magnaflux method.

PINION SHAFT WEAR LIMITS

Check shafts carefully for cracks or other surface damage that can lead to early failure. Bearing journals must conform to the concentricity requirements. Replace components if the specified wear limit of 0.002 inch (0.05 mm) is exceeded by more than 0.001 inch (0.025 mm). Inspect shaft press fit surfaces to ensure a press fit condition with mating gears and bearings. Splined ends require no less than a tap fit with their mating drive yoke or flange. Make sure that shafts show no signs of twist.

GEAR WEAR LIMITS

Replace gears if teeth show any signs of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in or cracking. Always replace mated spiral bevel gears, and hypoid gears, differential pinion and side gears in sets.

Gear backlash, which may be adjusted by shims (as in the case of spiral bevels), must never exceed 0.018 inch (0.46 mm) relative to a gearset of fixed centers. Bull gears in dual-reduction carriers have no adjustment. Therefore, at this point, the backlash can be as high as 0.030 inch (0.76 mm) before any serious difficulty will be encountered.

DIFFERENTIAL SPIDER WEAR LIMITS

A slightly worn differential spider may be reused if:

- Wear does not exceed 0.005 inch (0.127 mm).
- Spider-to-pinion bore clearance does not exceed 0.007–0.011 inch (0.178–0.279 mm).
- Wear surfaces are not scored, pitted, cracked or otherwise damaged.

Install the spider in the opposite position. This will place the original drive side, which experiences the most wear, on the coast side, which has the lighter load.

BEARINGS, BUSHINGS AND THRUST WASHERS

Check ball and roller bearings for:

- Flaking
- Cracks and fractures
- Cavities and indentations
- Staining
- Measurable wear
- Brinelling
- Fretting
- Corrosion
- Banking
- Seizing
- Galling
- Scoring
- Arching
- Nicking
- Cage failures

Replace bearings if any of these conditions are present.



400 INSPECTION

Tapered roller bearings are set up in a preload condition according to adjustment specifications for each carrier. For reusable or run-in tapered bearings, adjust preload to one half the value specified for new bearings.

If bearings pass inspection, dip them in the recommended differential lubricant. Then wrap bearings in clean cloth or paper until ready to reassemble the axle.

Bushings (inter-wheel power-divider driving cage) and thrust washers be must replaced if they are pitted, scored or show any signs of surface damage or have broken locking tabs. Do not use tabbed thrust washers in a differential casing without the blind hole provision. Latest versions of these differentials are manufactured with thrust washers having tabs. Thrust washers without tabs may be used in old casing halves having the blind hole provision without any adverse effects.

Wear must not exceed 0.010 inch (0.25 mm) maximum. Thrust washers must be replaced in sets. Combining old and new thrust washers can cause premature failure.

POWER DIVIDER

The frictional forces created by loads imposed on the cams and wedges cause moderate scoring on the highly stressed rubbing surfaces of cam tracks. This is a normal condition. Replace the affected cam and wedge items only if working surfaces are badly worn, pitted, scored or cracked. Replace the driving cage member if it is damaged or the wedge hole diameter has worn more than 0.010 inch (0.25 mm) over the original limit.

Never run new wedges against a used inner cam or vice versa. It is permissible, however, to use slightly worn outer cams and driving cages during rebuild. Always replace wedges in matched sets. Do not mix wedges from different sets.

AXLE SHAFTS

Inspect axle shafts for bends, torsional fractures or other conditions that may result in failure. Inspect splines for wear, cracks or distortion. If evidence of any of these conditions is found, install new parts.

Install each axle shaft between lathe centers. Using a dial indicator, check shaft runout at the center and 6 inches (152.4 mm) from each end. Discard shaft if total indicated runout (TIR) exceeds 0.060 inch (1.5 mm) at the center, or 0.030 inch (0.76 mm) at the end locations.

Position the dial indicator so that the indicator shaft contact point contacts the inner surface near the outer edge. Then check flange runout. Discard axle shaft if flange runout exceeds 0.008 inch (0.20 mm).

CLEANING

Clean parts with ground and polished surfaces (e.g., gears, bearings and shafts) in a suitable solvent, such as kerosene or diesel fuel. Do not clean these parts in a hot solution tank or with water and alkaline solutions such as sodium hydroxide, orthosilicates or phosphates.

Do not steam clean assembled drive units after they have been removed from the housing. Steam cleaning traps water in the cored passage of the castings and within close clearances on and between parts. This can cause corrosion (rust) on critical parts of the assembly and rust particles circulating in the lubricant. Steam cleaning can also lead to premature failure of bearings, gears and other parts.

NOTE

Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. For thorough cleaning, the drive unit must be completely disassembled.



400 INSPECTION

Complete Assemblies

Completely assembled axles may be steam cleaned on the outside only, to facilitate initial removal and disassembly. Breathers, vented shift units, and all other openings must be tightly covered or closed to prevent water from entering the assembly.

Disassembled Parts

Immerse all parts in suitable cleaning fluid and clean parts thoroughly. Use a stiff bristle brush to remove all old lubricant. Remove gasket particles which may adhere to mating faces of axle housing, carrier housing, hubs and axle shaft flanges. Clean out lubricant channels in the pinion cage and carrier housing. Clean the housing breather. Make certain that the interior of the axle housing is thoroughly cleaned.

Bearings

The importance of proper bearing cleaning cannot be overemphasized. Clean bearings separately from other axle parts using the following steps:

1. Soak differential and drive pinion bearings in clean kerosene, diesel fuel oil, or other cleaning solvent. Do not use gasoline.
2. After old lubricant is loosened, hold bearing races so that the bearing cannot rotate. Then brush bearings with a soft-bristled brush until all grit and dirt have been removed.
3. Rinse bearings in clean fluid. Then, while holding races, blow dry with compressed air. Be sure air stream is moisture free. Never spin bearings with compressed air as they may score due to the absence of any lubricant.

Rough Parts

Rough parts, such as differential carrier castings, and cast brackets may be cleaned in hot solution tanks with mild alkali solutions, providing these parts are not ground or polished. The parts must remain in the tank long enough to be thoroughly cleaned and heated throughout. This will aid the evaporation of the rinse water. After cleaning, rinse parts completely to remove all traces of alkali.

CAUTION

Do not clean parts with highly volatile fluids such as gasoline or harmful chemicals such as carbon tetrachloride. Also exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

Drying

Using moisture-free, compressed air, thoroughly dry component parts immediately after cleaning and rinsing. If compressed air is not available, use soft, clean, lintless absorbent paper towels or clean wiping cloths that are free of abrasive material.

Corrosion Prevention

Parts that have been cleaned, dried and inspected and are to be reassembled immediately must be coated with light oil to prevent corrosion. If the parts will be stored for any length of time, treat them with a good rust-preventive agent and wrap in special paper or other material designed to prevent corrosion.



400 INSPECTION

GEARSET UPDATING

To assist field personnel in obtaining the desired bevel gearset tooth contact, all service replacement bevel gear matched sets are furnished with the desired tooth contact pattern indicated on the gear teeth in yellow gear-marking compound.

Before proceeding with the installation of the replacement bevel gearset, lift and transfer the tooth contact pattern onto a piece of paper for reference when "setting up" the replacement gearset in the carrier. Use transparent tape (Scotch® brand or equivalent) to make a transfer of the contact pattern.

Cut off a piece of tape slightly longer than the gear tooth. Place the piece of tape on the gear tooth profile, sticky side down, covering the total tooth length and depth. Rub the back of the tape to ensure good contact between the tape and tooth. Do not permit the tape to slide. Gently lift the tape off the gear tooth and apply it to a piece of paper to transfer the tooth contact pattern.

Repeat the procedure on the opposite side of the gear tooth and identify the tooth patterns as drive side and coast side. If no tape is available, make a sketch of the patterns.

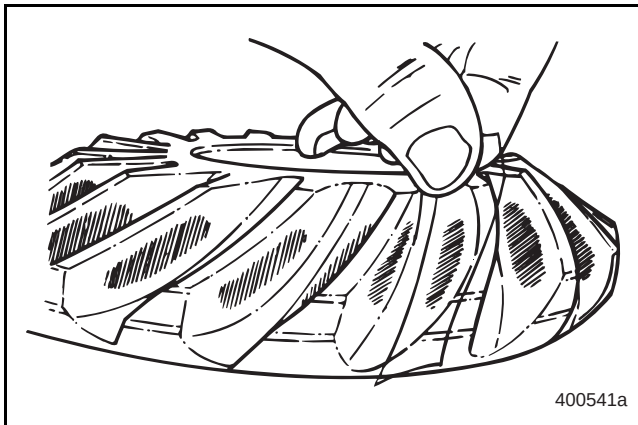
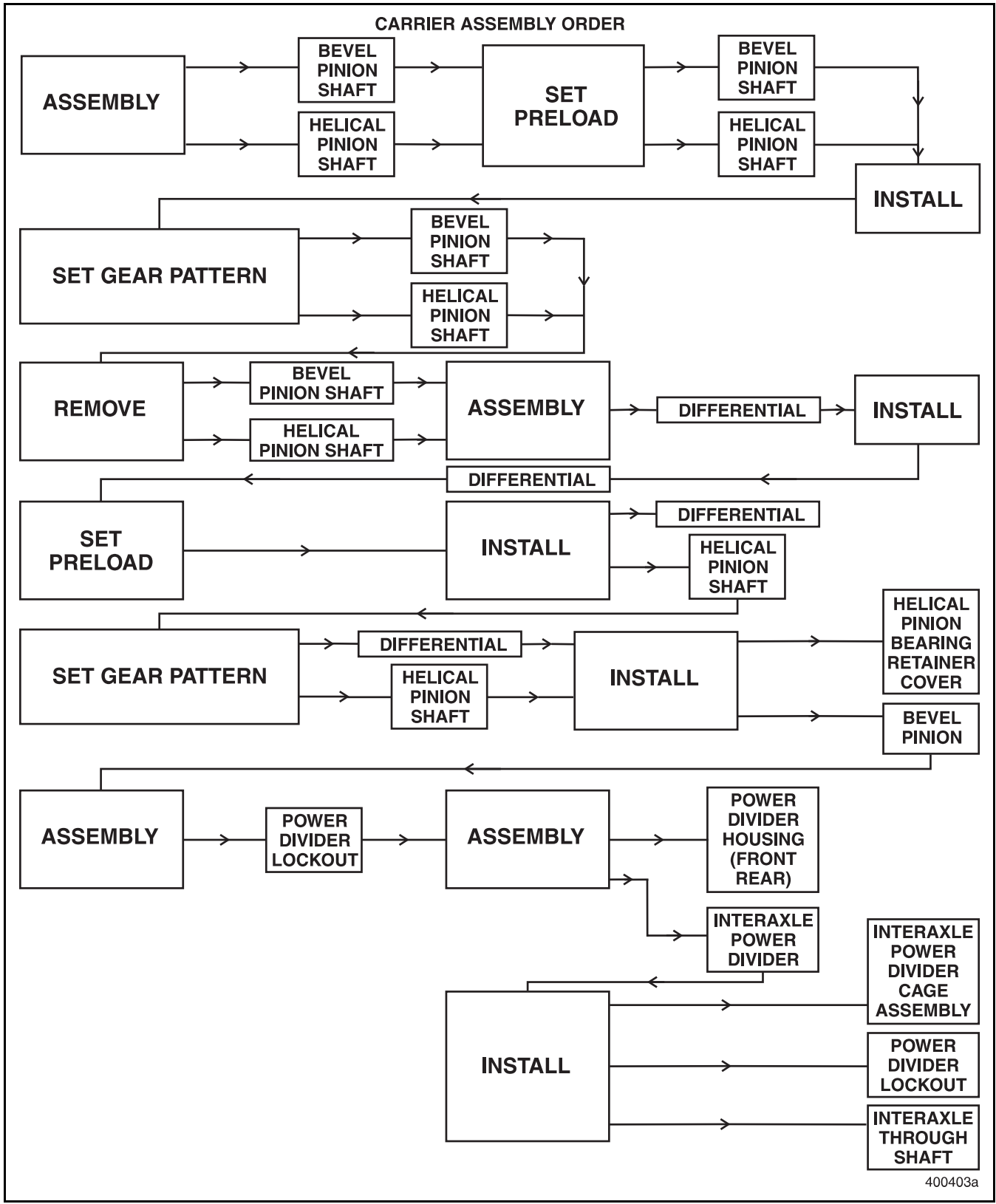


Figure 144 — Lifting Tooth Contact Pattern



400 REASSEMBLY FLOW CHART





400 BENCH PROCEDURES

BENCH PROCEDURES — COMPONENT REASSEMBLY



400 BENCH PROCEDURES

[466] INTER-AXLE THROUGH SHAFT — REASSEMBLY

NOTE

The reassembly procedures in the first part of this section for Inter-axle Through-shaft, Inter-axle Power Divider with/without Lockout and Front Rear Bevel Pinion (pages 68-79) will only be encountered on vehicles with a tandem rear axle.

Install the through-shaft bearing using a suitable hydraulic press arrangement and driver as shown in Figure 145.

WARNING

Ensure that the hydraulic press support blocks are on the flats of the shaft and not on the taper of the shaft. This prevents the blocks from shifting as hydraulic pressure is applied.

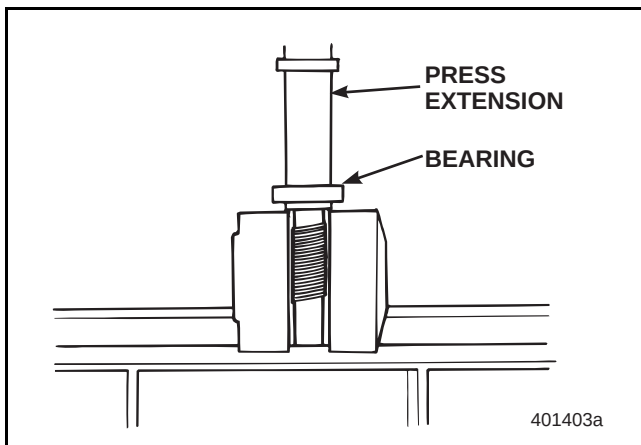


Figure 145 — Installing Inter-Axle Through-Shaft Bearing

[466] POWER DIVIDER LOCKOUT — REASSEMBLY

1. Position a **new** seal on the power-divider bearing retainer cover.

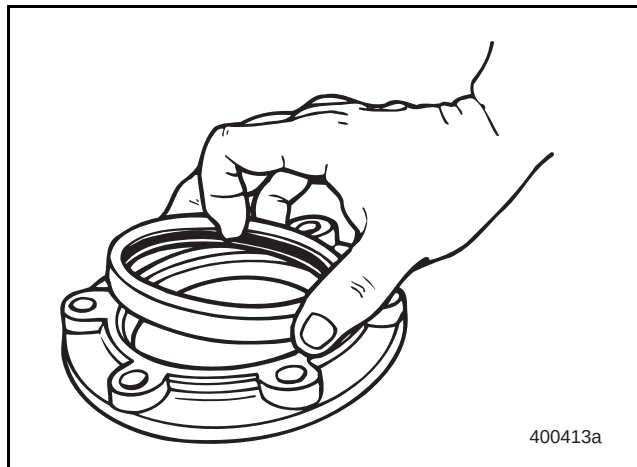


Figure 146 — Position Bearing Retainer Seal

2. Install the seal into the bearing retainer cover using seal driver and a hammer.

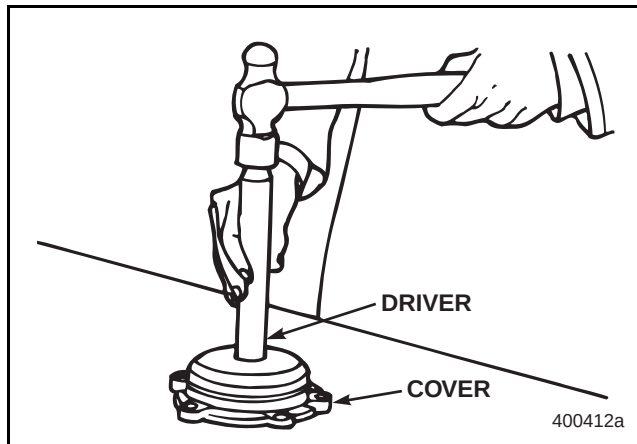


Figure 147 — Install Seal in Cover



400 BENCH PROCEDURES

3. Install the power-divider wedge inner ring into the cage.

WARNING

Be careful when inserting the inner ring, because it may be sharp.

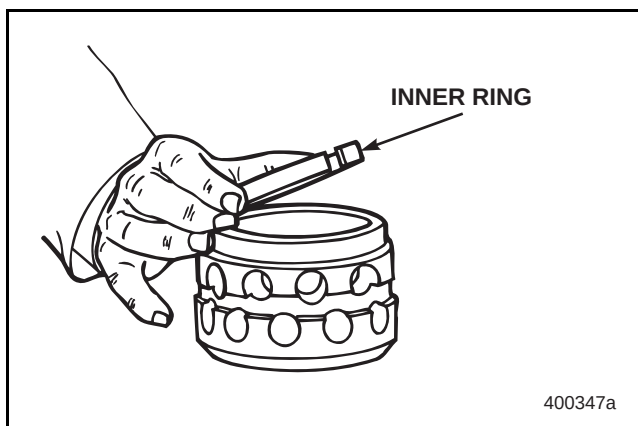


Figure 148 — Installing Inner Ring

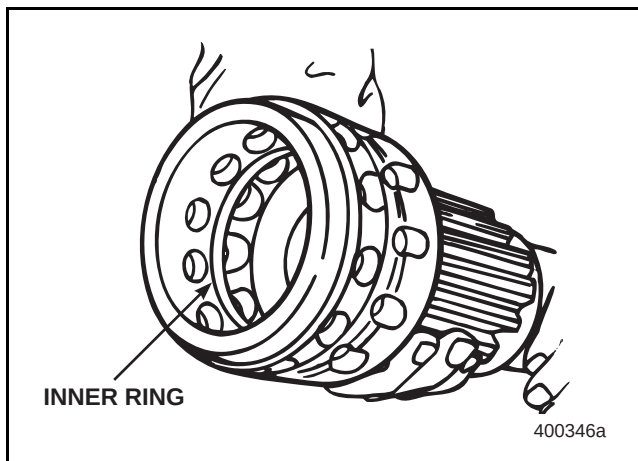


Figure 149 — Inner Ring Installed

4. Install a matched set of 24 wedges from inside the cage, making sure the alpha character (or arrow on early production carriers) is pointing outward as shown in Figure 150. The alpha character or arrow must be visible on each wedge from outside of the cage.

NOTE

The wedges must be reinstalled with the alpha character or arrow pointing outward as shown in the illustration.

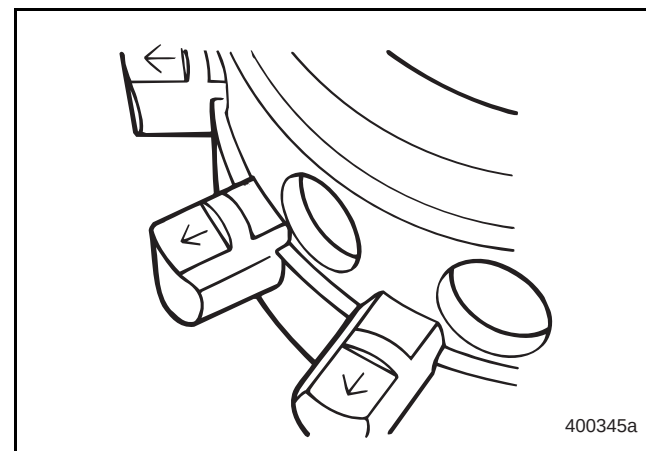


Figure 150 — Install Wedges with Alpha Character or Arrow Pointing Out

5. Push all the wedges in as far as possible and install the outer retaining ring into the slot provided in the cage.

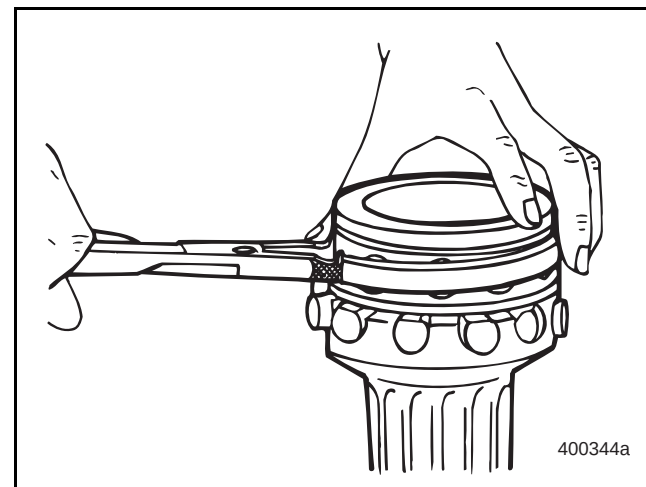


Figure 151 — Install Outer Retainer Ring



400 BENCH PROCEDURES

6. Drive the bearing assembly into the retainer of the inter-axle power-divider shifter housing.

NOTE

Apply driving force only on the bearing outer race during bearing installation.

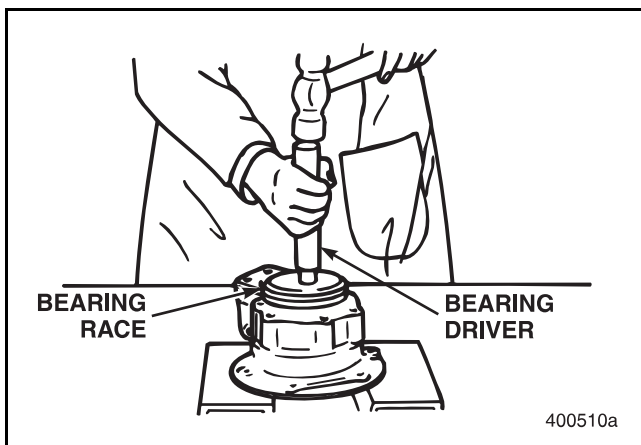


Figure 152 — Driving Bearing into Retainer

7. Insert the fork and clutch into the housing. Do this by installing the fork into the clutch groove and then angling them as a unit into position as shown in Figure 153. Make sure that the flat side of the fork faces the clutching teeth.

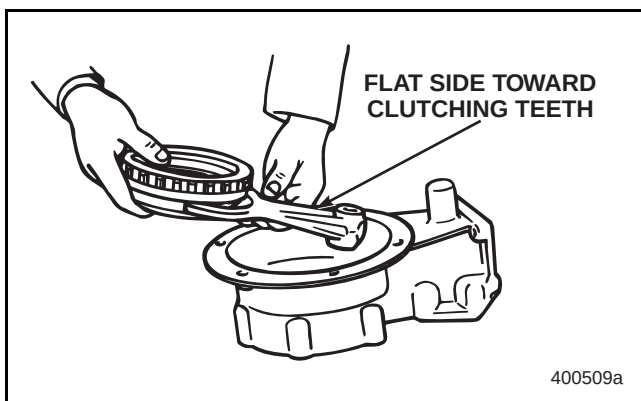


Figure 153 — Inserting the Fork and Clutch

8. Insert the shaft and cage assembly into the sliding clutch.
9. Using a suitable hydraulic press, press the power divider cage into the bearing.

CAUTION

During the pressing procedure, take special care to avoid binding the fork, which can cause the fork to break.

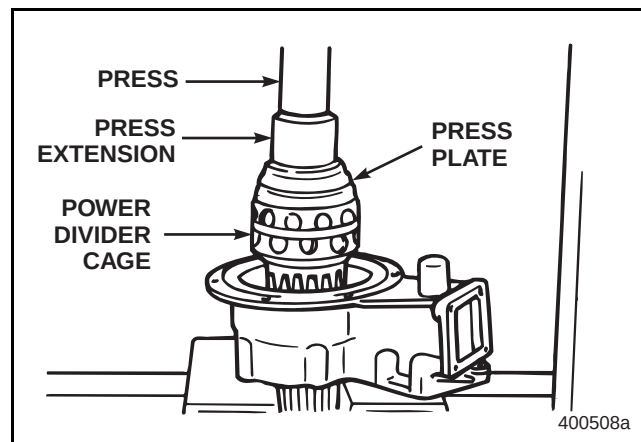


Figure 154 — Pressing Power Divider Cage into Bearing

10. Install a gasket on the power-divider lockout housing face.
11. Lightly lubricate the O-ring and install into the groove in the bearing retainer (oil seal) cover.

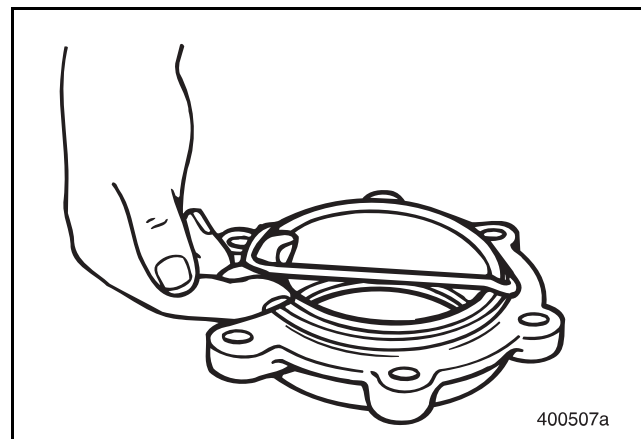


Figure 155 — Installing O-Ring into Bearing Retainer Cover

12. Install the oil seal cover onto the power divider lockout housing with capscrews finger tight. Check the gap between the housing and the cover using a feeler gage. This gap should not exceed 0.010 inch (0.254 mm). If a gap exists and exceeds 0.010 inch (0.254 mm), install a gasket (shim) or gaskets (shims) as required to fill the gap.



400 BENCH PROCEDURES

NOTE

This gasket (shim) will support the bearing retainer and prevent bearing retainer oil seal bore deflection. This deflection causes a bell mouth condition of the seal bore, resulting in a loose oil seal installation.

13. Install the bearing retainer cover onto the power divider lockout housing with gasket (shims), if required.

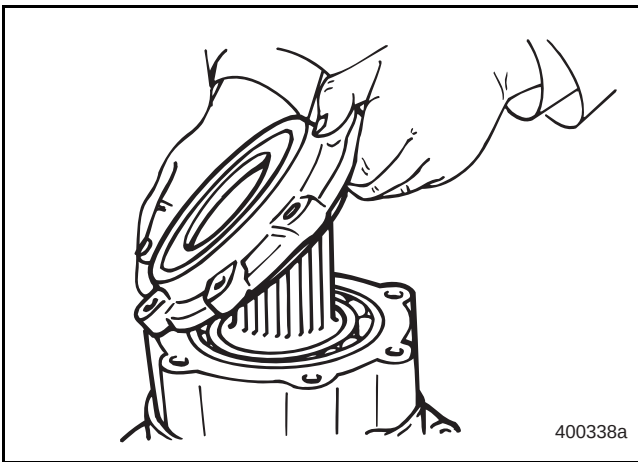


Figure 156 — Install Bearing Retainer Cover

14. Install the capscrews through the bearing retainer cover and into the housing. Torque capscrews to specification.

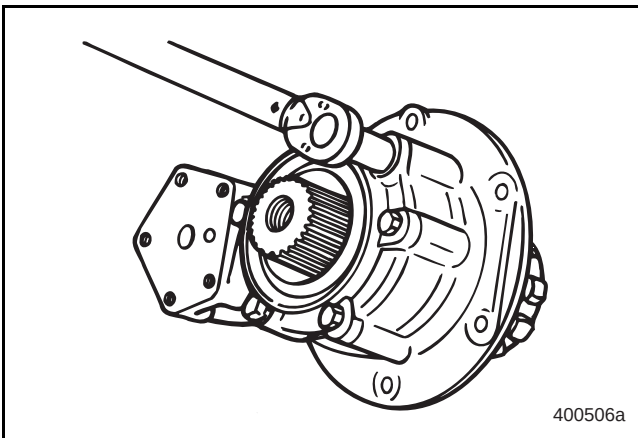


Figure 157 — Torquing Seal Cover Capscrews

15. Install a **new** felt ring and O-ring on the shift piston. Install the O-ring in the top groove and the felt washer in the lower groove. Lubricate the O-ring and the felt ring with GO-J gear oil.

16. Place the shift fork shaft, threaded end up, into a soft-jawed vise. Install the special washer, the piston assembly, an additional special washer and a **new** Nylok nut on the shaft. Tighten nut to specification. Remove the shift fork shaft from the vise.
17. Position the long spacer (sleeve) and the return spring onto the shift fork shaft. Install the shaft assembly into the housing. Align shaft with shift fork opening and insert shaft into fork.
18. Using a hydraulic press, compress the piston spring assembly until the setscrew holes in both the shaft and fork align. Insert the setscrew and tighten to specification.

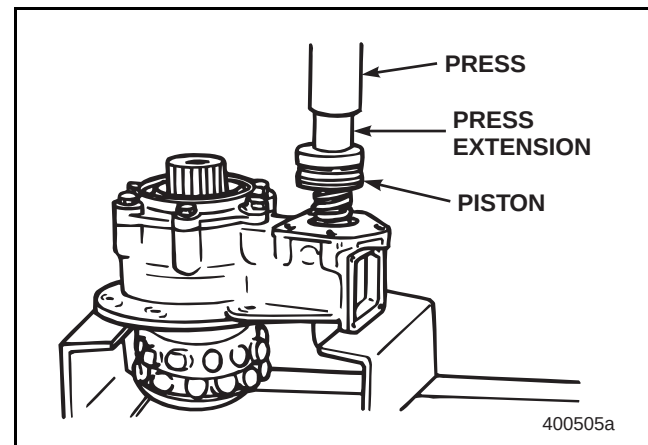


Figure 158 — Press Set Up to Compress Spring

NOTE

Use a screwdriver or wooden wedge to support the shift fork while compressing the spring to avoid binding the fork on the shaft.

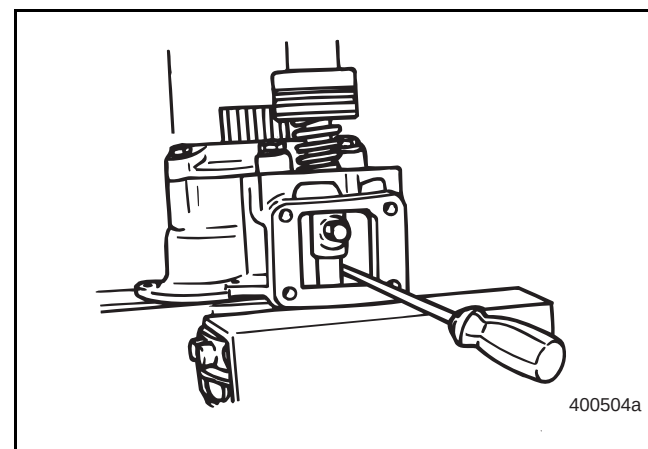


Figure 159 — Aligning Shaft and Fork



400 BENCH PROCEDURES

19. Install the shifter cylinder housing gasket.

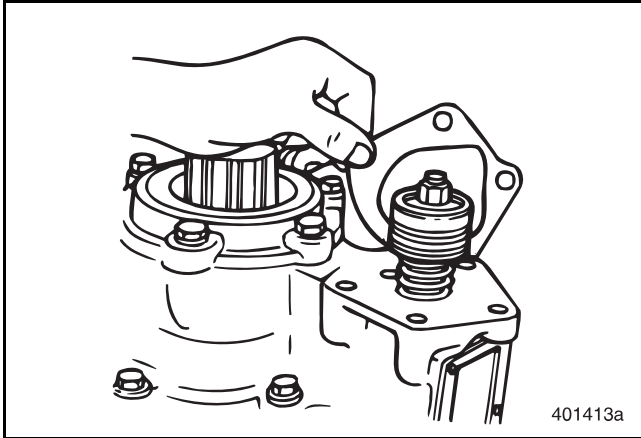


Figure 160 — Installing Gasket

20. Install the cylinder housing and housing capscrews.

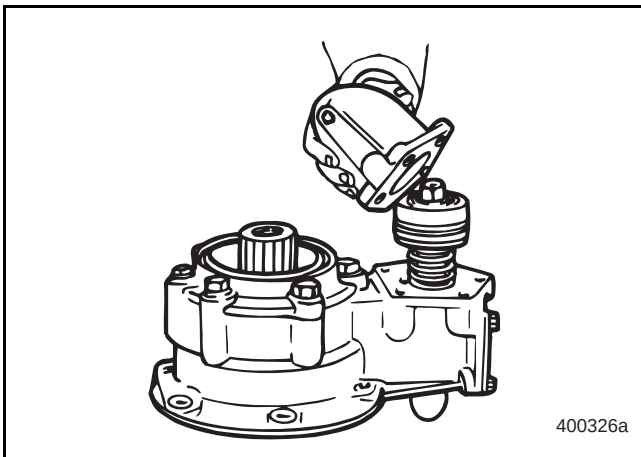


Figure 161 — Install Cylinder Housing

21. Install cover gasket or apply a bead of Silastic or equivalent to the cover plate, completely encircling the screw holes.

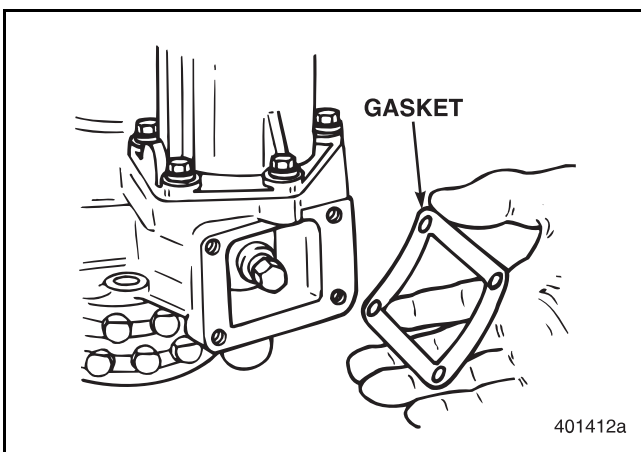


Figure 162 — Install Cover Gasket

22. Install the cover plate.

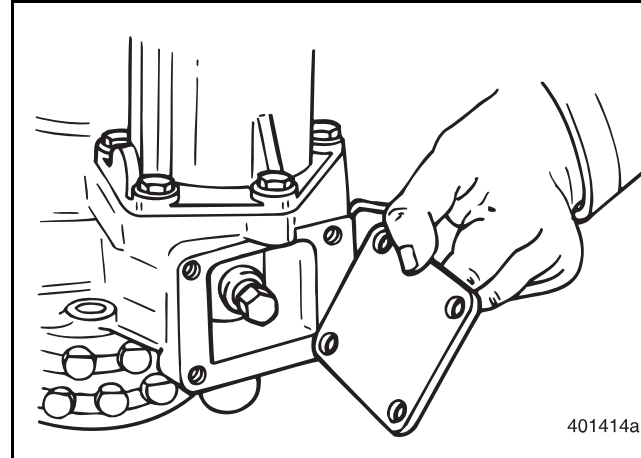


Figure 163 — Install Cover Plate

23. Torque the cover plate capscrews on the power divider lockout to specification.

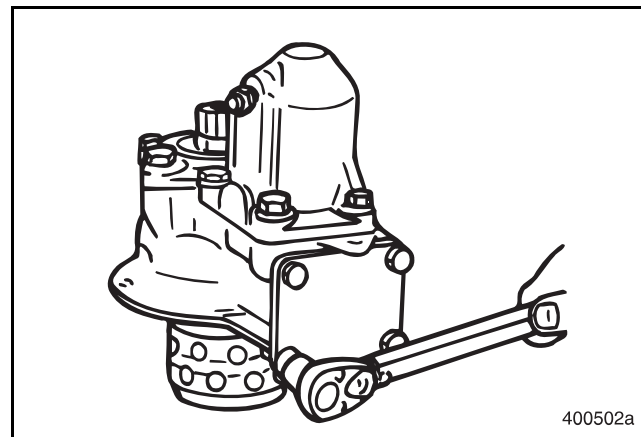


Figure 164 — Torquing Capscrews



400 BENCH PROCEDURES

24. Torque the capscrews on the cylinder housing to specification.

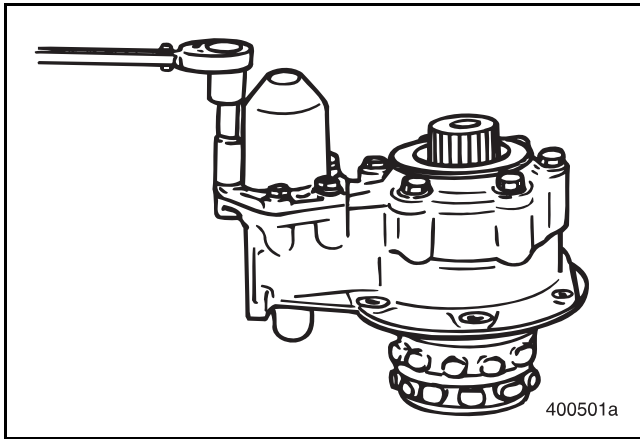


Figure 165 — Torquing Capscrews on Housing

Dip the inner cam in axle lubricant and position it inside the cage. It will fit only one way. Push all the wedges in until they contact the inner cam lobes. Set the assembly on a clean work surface, with the cage up to keep the inner cam from falling out. A coating of heavy grease may be applied to the inner cam face to hold it in place during assembly. This assembly will be installed into the bevel pinion housing at a later time.

[466] INTER-AXLE POWER DIVIDER WITHOUT LOCKOUT — REASSEMBLY

1. Align bearing with the bearing retainer. Then install the ball bearing into the retainer using a plastic hammer. Drive the bearing into the retainer until it is seated. Apply force only to the outer race.

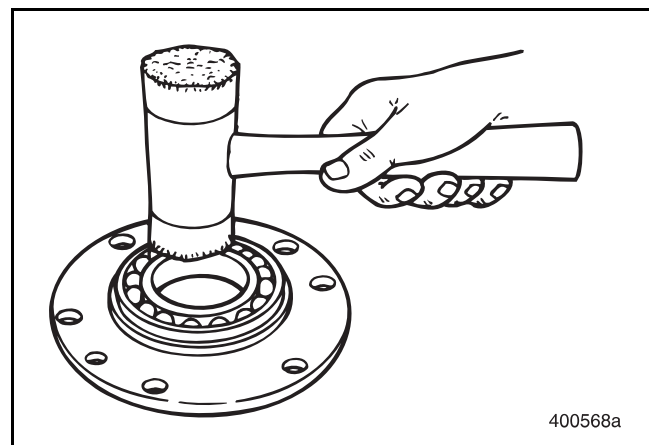


Figure 166 — Installing Bearing

2. Use a press to install the ball bearing and retainer onto the shaft of the power divider cage.

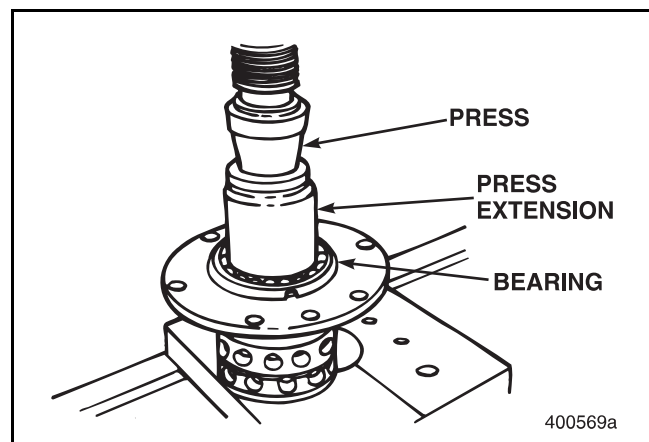


Figure 167 — Installing Retainer Assembly



400 BENCH PROCEDURES

3. Install the inner ring into the center of the power divider cage.

WARNING

Be careful when inserting the inner ring. It may be sharp and capable of causing serious personal injury.

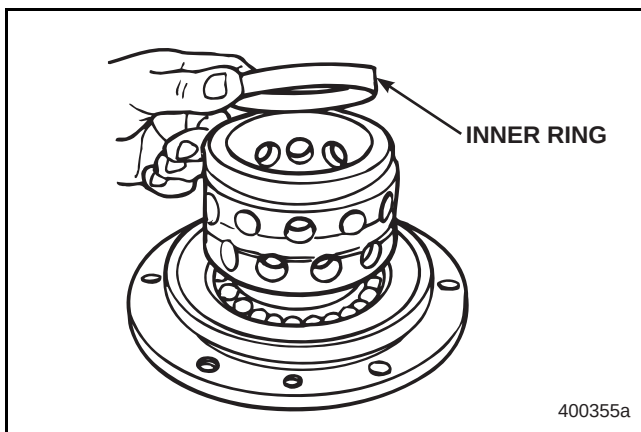


Figure 168 — Install Inner Ring

4. Install the power divider wedges into the cage assembly.

NOTE

Before inserting the wedges, note the arrow or alpha character on the part of the wedges pointing outward. The wedges must be installed with the arrow or alpha character pointing outward.

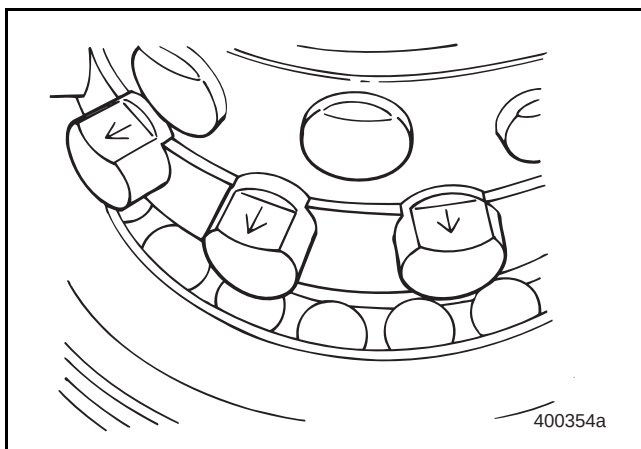


Figure 169 — Install Wedges

5. Push the top row of wedges in even with the cage surface to allow installation of the outer ring.

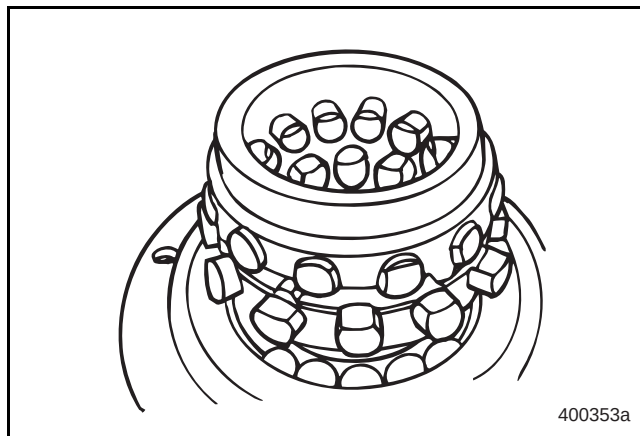


Figure 170 — Wedge Position for Outer Ring Installation

6. Using the proper snap ring pliers, install the power-divider wedge outer retaining ring.

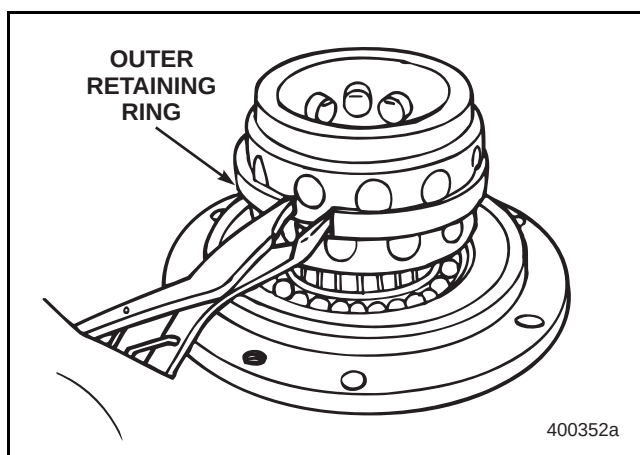


Figure 171 — Install Outer Ring

7. Install the O-ring onto the power-divider bearing retainer plate.

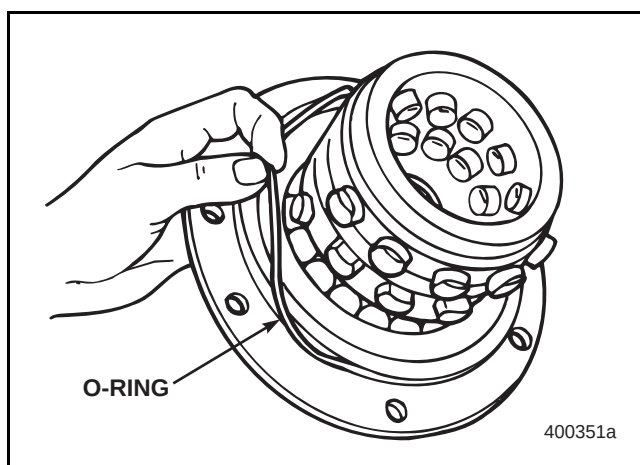


Figure 172 — Install O-Ring



400 BENCH PROCEDURES

NOTE

Lubricate the power divider inner cam and wedge assembly with GO-J before installation.

8. Install the inner cam into the cage and wedge assembly. A coating of heavy grease may be applied to the inner cam face to hold it in place during assembly.

NOTE

Be sure the oil grooves on the face of the inner cam go toward the pinion.

9. Install a **new** seal in the cover plate using a driver and a hammer.

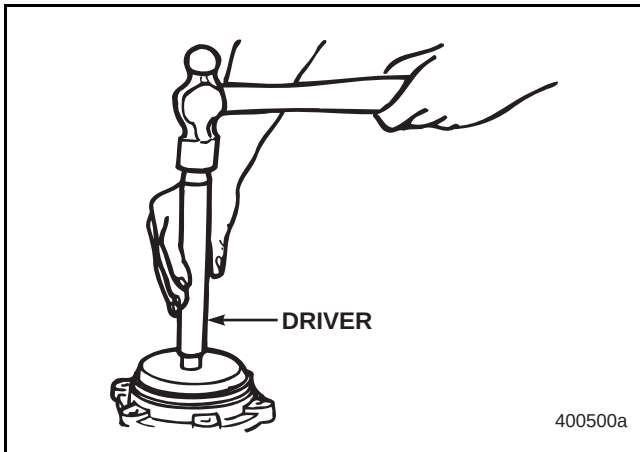


Figure 173 — Driving Seal into Position

10. Lightly lubricate the O-ring and install it into the groove in the oil seal cover.

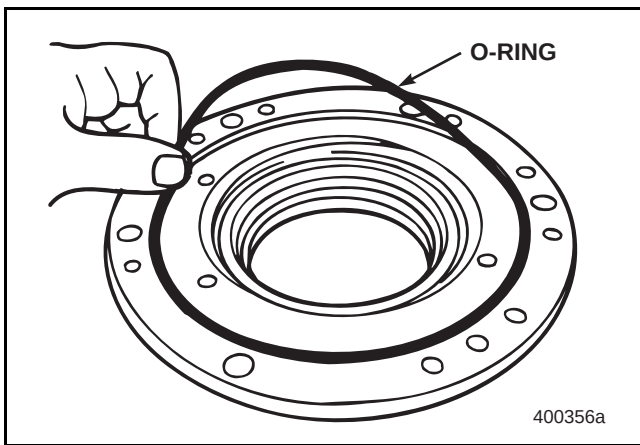


Figure 174 — O-Ring in Oil Seal Cover

11. Loosely install the capscrews through the inter-axle power-divider oil seal cover and bearing retainer. Set the assembly on a clean work surface, with the cage up to keep the inner cam from falling out. This assembly will be installed into the bevel pinion housing at a later time.

[466] FRONT REAR BEVEL PINION — REASSEMBLY

NOTE

The bevel pinion-shaft front rear assembly will only be encountered on vehicles with a tandem rear axle. If the vehicle being worked on has a single rear axle, this section does not apply.

1. Press the inner bearing cup into the bevel pinion housing.

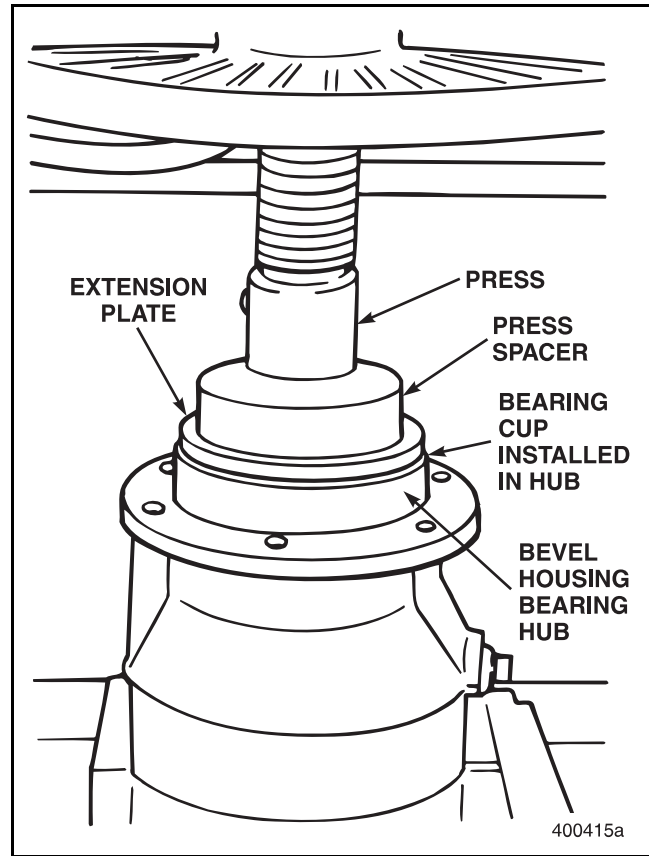


Figure 175 — Pressing Inner Bearing Cup into Bevel Pinion Housing



400 BENCH PROCEDURES

- Turn over the housing and press the outer bearing cup into the bevel pinion housing.

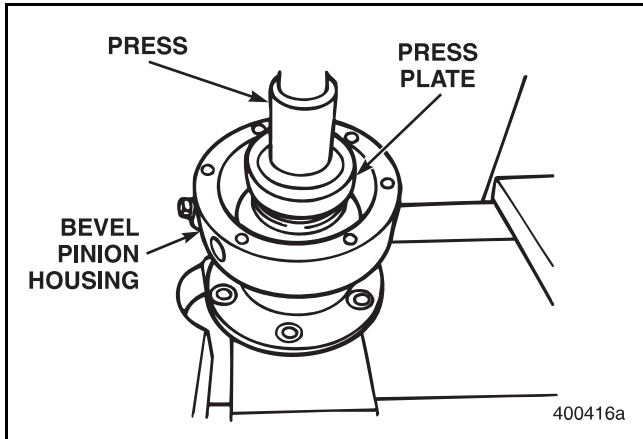


Figure 176 — Pressing Outer Bearing Cup into Bevel Pinion Housing

- The numerals on the back of the bevel pinion gear and the mating bevel gear represent the mating number and the mounting distance.

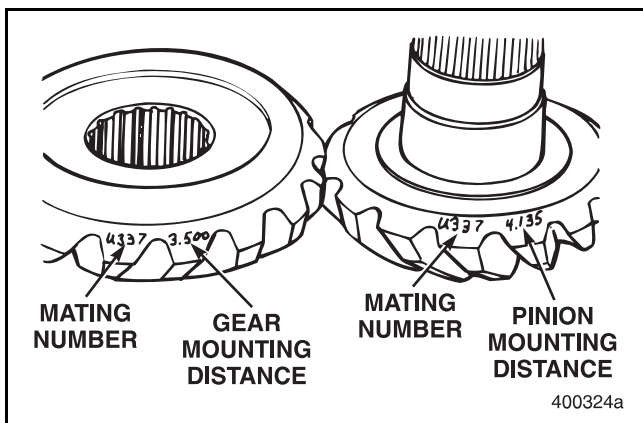


Figure 177 — Mating Number and Mounting Distance

- Note and record the mounting distance. These distances are needed to determine the shim pack thickness.

NOTE

Make sure the bevel pinion and mating bevel gear are identified as a matched set.

- Press the bearing cone onto the bevel pinion shaft.

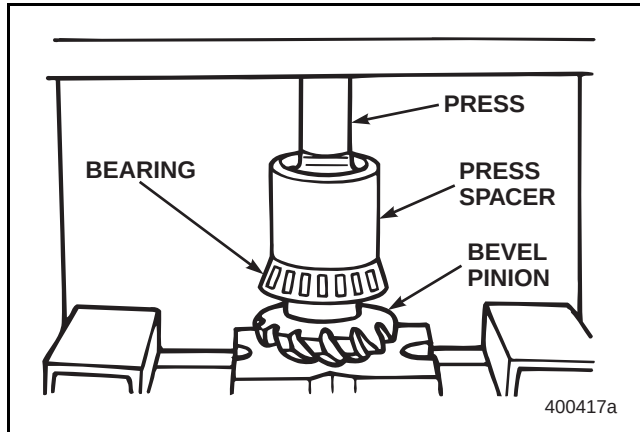


Figure 178 — Pressing Bearing Cone onto Bevel Pinion Shaft

- Press the bearing cone onto the outer cam.

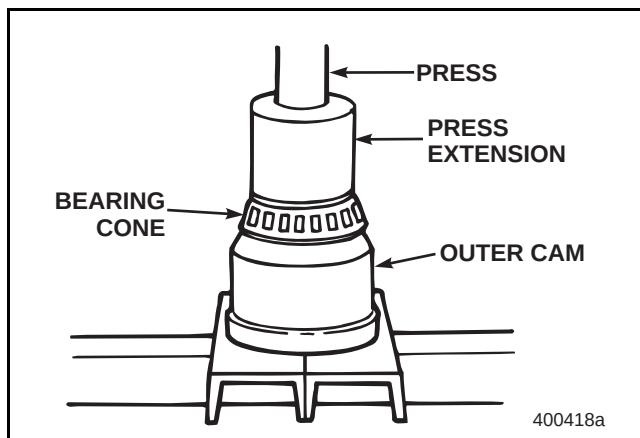


Figure 179 — Pressing Bearing onto Outer Cam

- Place the selective bearing spacer on the pinion, with the chamfer side down.

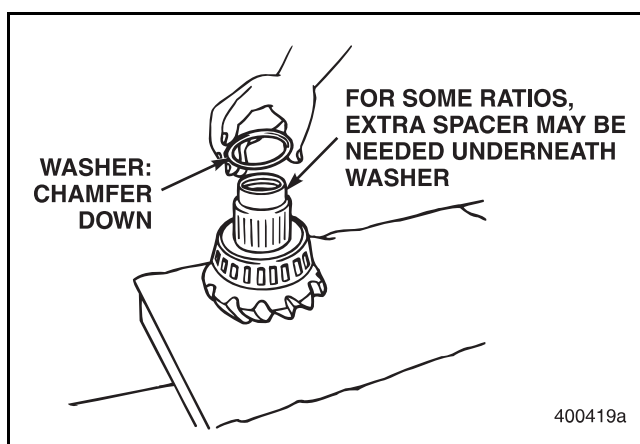


Figure 180 — Placing Selective Bearing Spacer on Pinion



400 BENCH PROCEDURES

8. Install the power divider housing onto the bevel pinion.

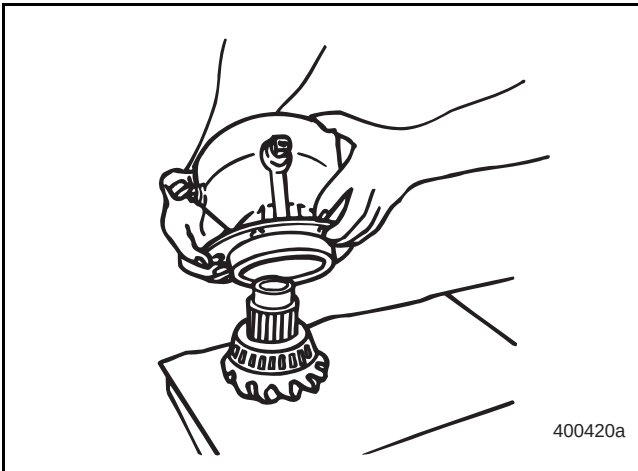


Figure 181 — Installing Housing Assembly

9. Position the power divider outer cam on the bevel pinion shaft.

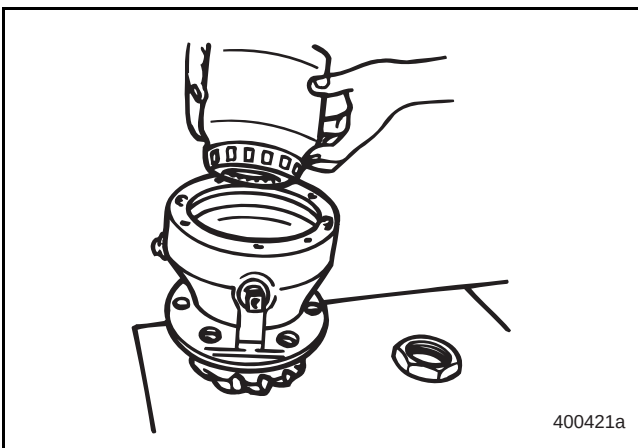


Figure 182 — Installing Power Divider Outer Cam

10. Using a hydraulic press, install the outer cam of the power divider onto the bevel pinion shaft.

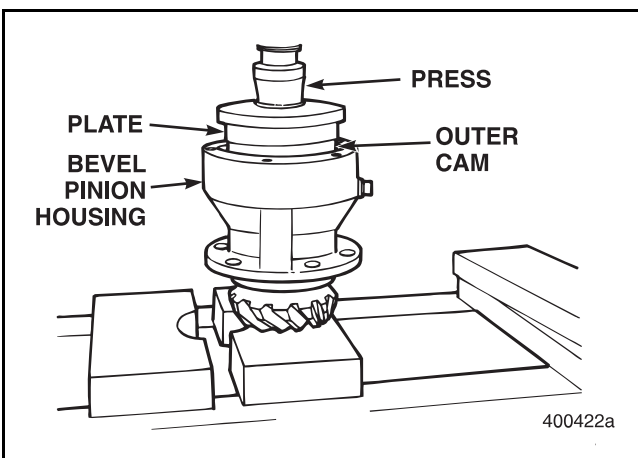


Figure 183 — Installing Outer Cam

Setting the Bevel Pinion Preload

To perform at maximum efficiency, tapered roller bearings must operate under a predetermined preload. This also ensures a rigid mounting for the gears.

SETTING THE PRELOAD

Set bearing preload after the bevel pinion is assembled into the housing. Apply 20,000 pounds (10 tons) of pressure to the bearing in a hydraulic press. Rotate the pinion housing (bearings) before applying full pressure to the bearings. This will prevent premature bearing failure.

NOTE

Make sure to lubricate the bearings before performing the bearing preload check.

11. Wrap several turns of cord around the bevel pinion housing at the pilot area. Attach scale J 8129, or equivalent, to the cord and slowly and evenly pull on the scale until the housing rotates. The correct load on the scale should be between 3 and 6 pounds for new bearings, and 2 to 4 pounds for used bearings. If the reading on the scale is not within the correct specifications, it is necessary to replace the original spacer. Use a thinner spacer if it takes less than the specified amount of pull to rotate the housing. Use a thicker spacer if the required load exceeds specification.

NOTE

- A thinner spacer increases preload.
- A thicker spacer reduces preload.

continued on next page...



400 BENCH PROCEDURES

SETTING THE PRELOAD (CONTINUED)

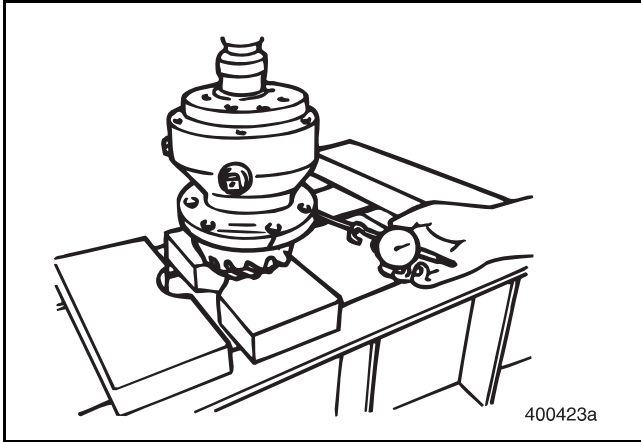


Figure 184 — Checking Bearing Preload

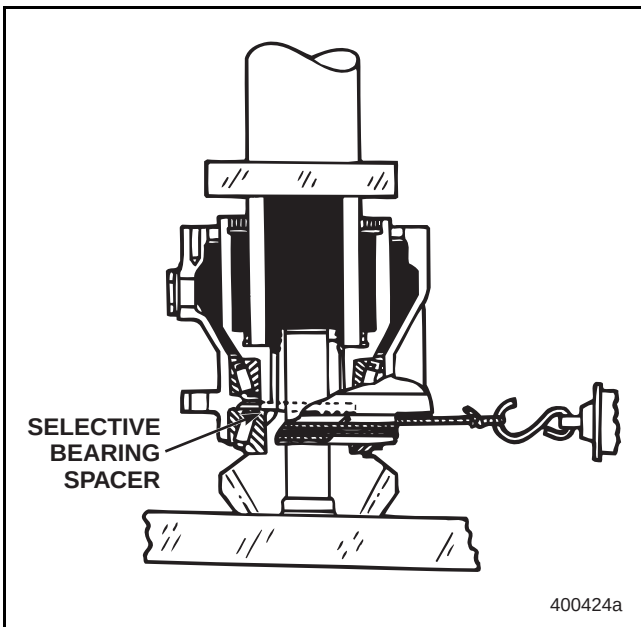


Figure 185 — Selective Spacer Location

SERVICE HINT

If bearings are in good condition, they can be reused for rebuilding a carrier. If used bearings are placed back into a carrier, a good rule of thumb is that the force needed to turn the scale while under 20,000 pounds of preload is about one half the requirement of new bearings. This is why used bearings have a 2–4-pound specification rather than the 3–6 pounds specified for new bearings.

12. After determining the correct bearing preload, install a **new** power divider retaining nut. Coat the threads with Loctite® 262 before installing.

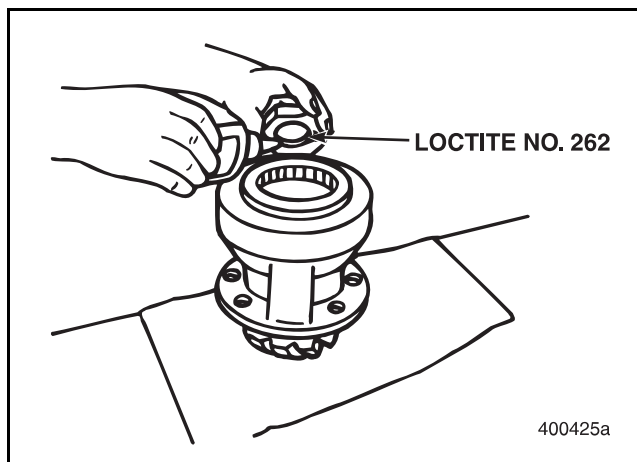


Figure 186 — Installing Retaining Nut

NOTE

In emergency cases, the old nut may be used. In either case (using new or old nut), thoroughly clean and prime the threads of the bevel pinion and the cam nut. The threads must then be coated with Loctite 262.

CAUTION

Do not allow the Loctite 262 to drip into the bearings, as it can cause bearing failure.

13. Install the holding fixture in a stand capable of holding the fixture secure against the 1,300 to 1,500 lb ft (1762 to 2034 N•m) of torque necessary to tighten the retaining nut.

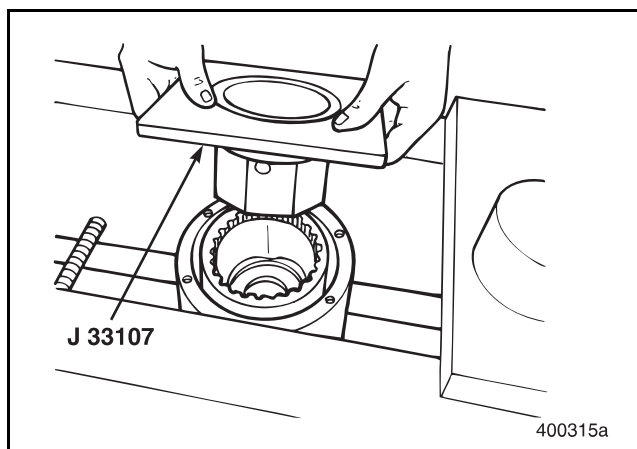


Figure 187 — Installing Holding Fixture



400 BENCH PROCEDURES

14. Install the socket in the holding fixture.
15. Tighten the retaining nut to the specified torque.

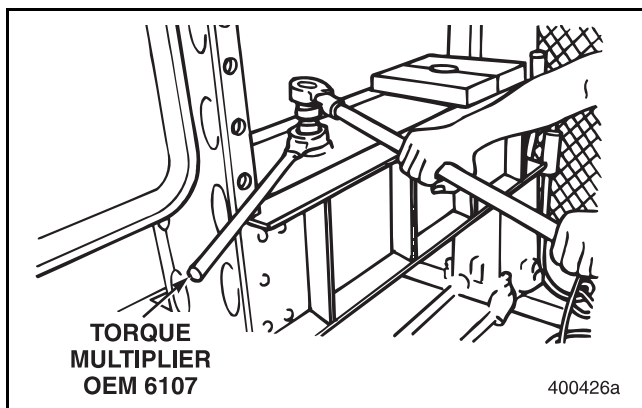


Figure 188 — Tightening the Retaining Nut

16. After tightening the nut to the correct torque, the assembly should look like the illustration in Figure 189.

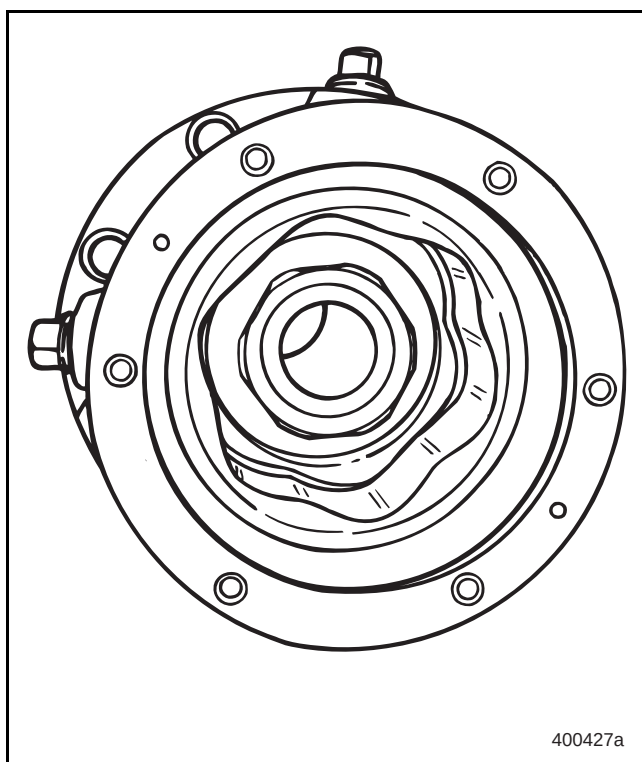


Figure 189 — Correctly Assembled Bevel Pinion

DETERMINING BEVEL PINION TO CARRIER HOUSING SHIM PACK

When reusing the bevel pinion that was removed from the carrier, also use the shim pack that was removed at disassembly upon reassembly and installation of the bevel pinion. When rebuilding a carrier, it is sometimes necessary to use a new bevel pinion. When this occurs, use the following procedure:

- Determine the mounting distance on the disassembled bevel pinion (etched into original pinion) and compare it with the mounting distance on the new bevel pinion (etched into new pinion).
- If the new bevel pinion mounting distance is longer than the old (higher number), this amount of shim will have to be added to the new shim pack.
- If the new bevel pinion mounting distance is shorter than the old (lower number), this amount of shim will have to be removed from the shim pack.

For example:

$$\begin{array}{r} 4.878" \text{ OLD PINION} \\ - 4.875" \text{ NEW PINION} \\ \hline 0.003" \text{ SHIM DIFFERENCE} \end{array}$$

In this case, remove 0.003 inch from the original shim pack.

This procedure provides a good starting point for setting the gear patterns.

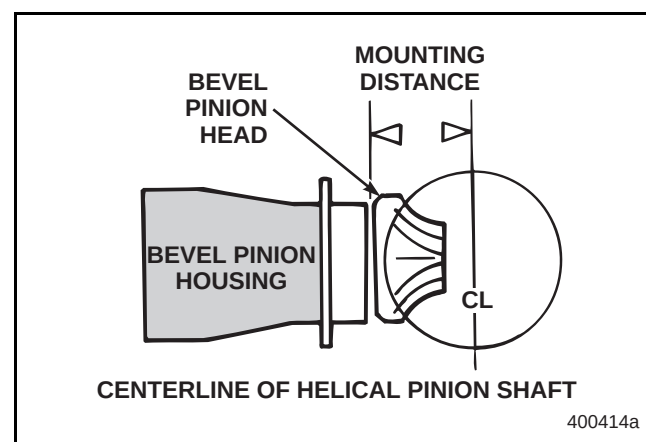


Figure 190 — Determining the Mounting Distance

17. Set the assembly on a clean work surface to be installed into the carrier housing at a later time.



400 BENCH PROCEDURES

[476] REAR REAR BEVEL PINION — REASSEMBLY

The exploded view in Figure 191 shows how the inner and outer bearing cups and the housing fit together.

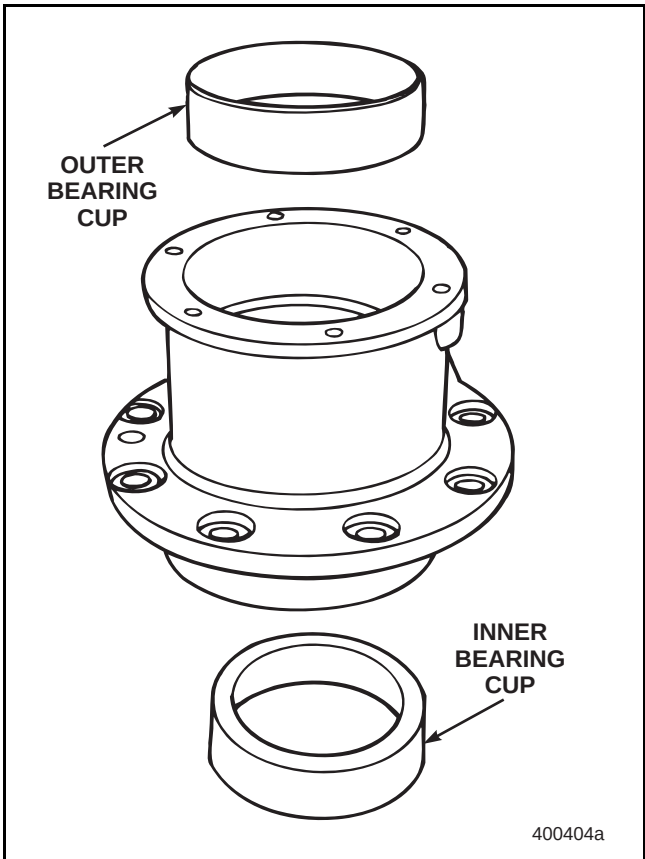


Figure 191 — Bevel Pinion Housing, Inner and Outer Bearing Cups

1. Press the outer bearing cup into the bevel pinion housing.

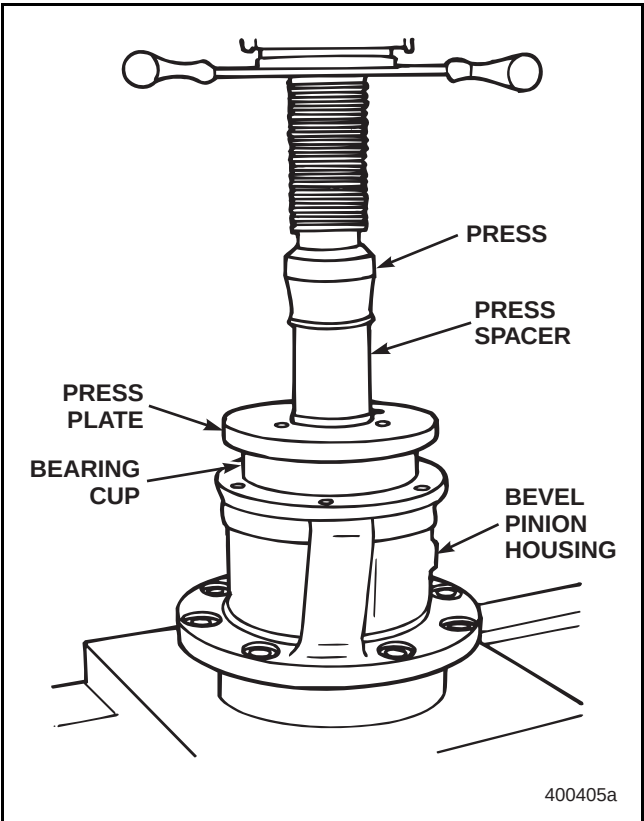


Figure 192 — Pressing the Outer Bearing Cup into the Bevel Pinion Housing



400 BENCH PROCEDURES

2. Press the inner bearing cup into the bevel pinion housing.

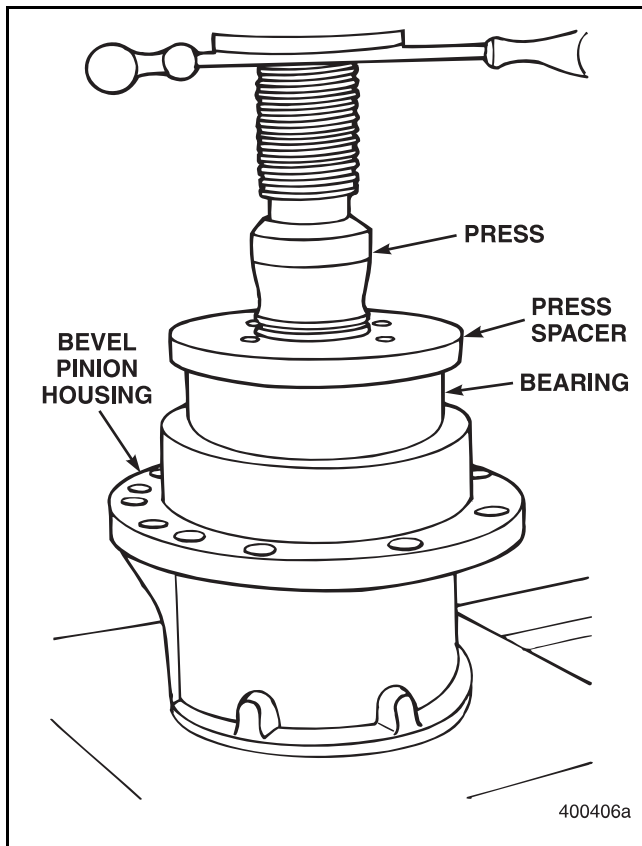


Figure 193 — Pressing the Inner Bearing Cup into the Bevel Pinion Housing

The numbers on the back of the bevel pinion and bevel teeth represent the mating number and mounting distance (Figure 194).

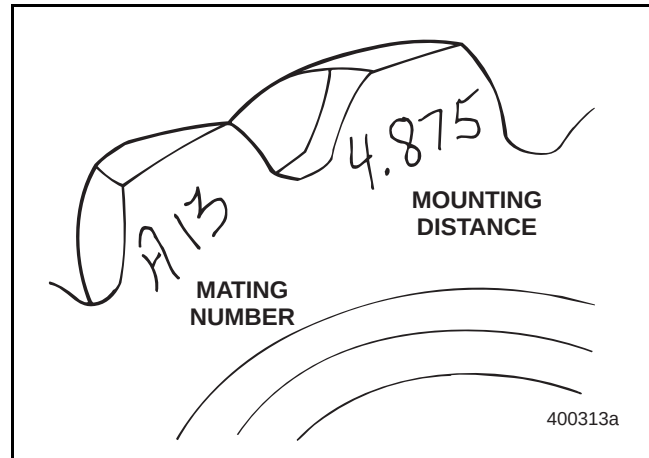


Figure 194 — Mating Number and Mounting Distance Number

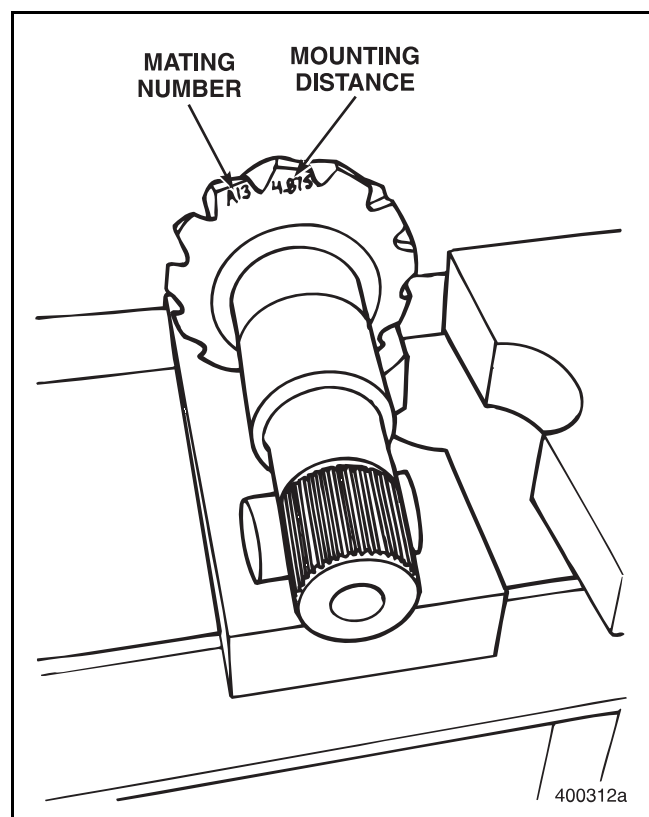


Figure 195 — Mating Number and Mounting Distance Number

3. Record the mounting distance. These distances are needed to determine shim pack thickness. Make sure that the bevel pinion and mating bevel gear are identified as a matched set.



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4. Using a suitable hydraulic press arrangement, press the inner bearing cone onto the bevel pinion shaft.

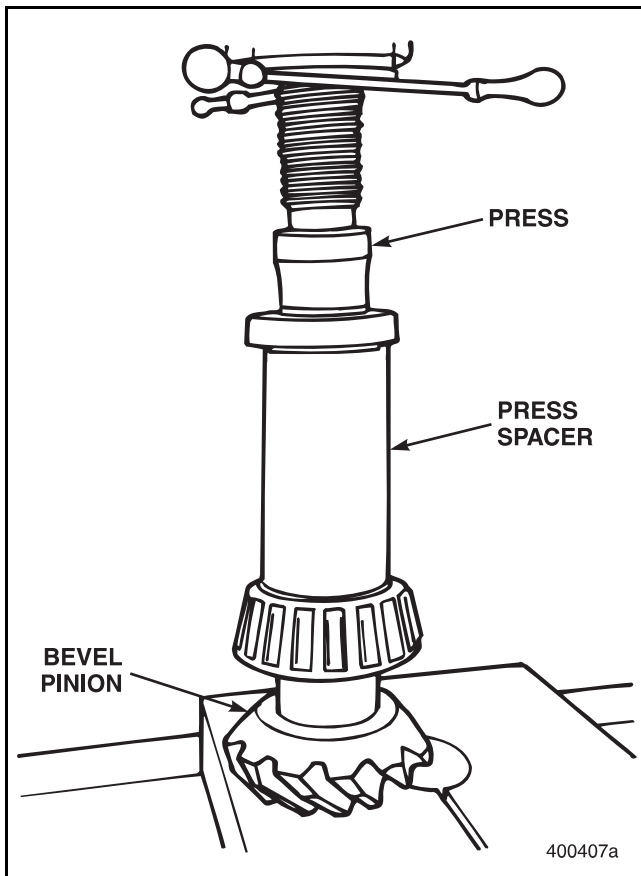


Figure 196 — Pressing Inner Bearing Cone onto the Bevel Pinion Shaft

5. Install the selective spacer with the tapered side toward the bearing.

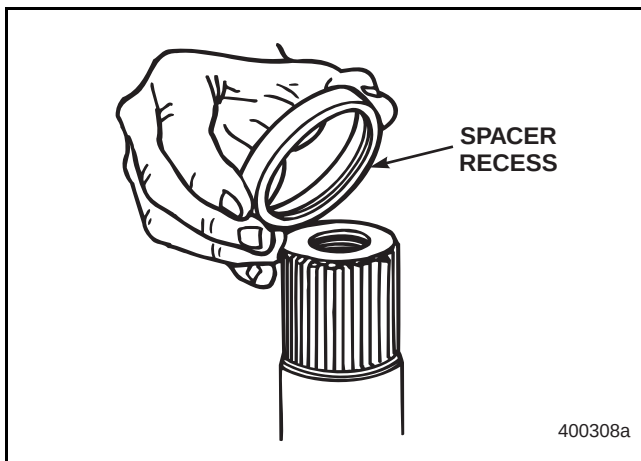


Figure 197 — Installing the Selective Spacer

6. Install the bevel pinion housing over the bevel pinion. Place bevel pinion and housing assembly on a press stand.
7. Position the outer bearing cone onto the bevel pinion shaft and press it into place.

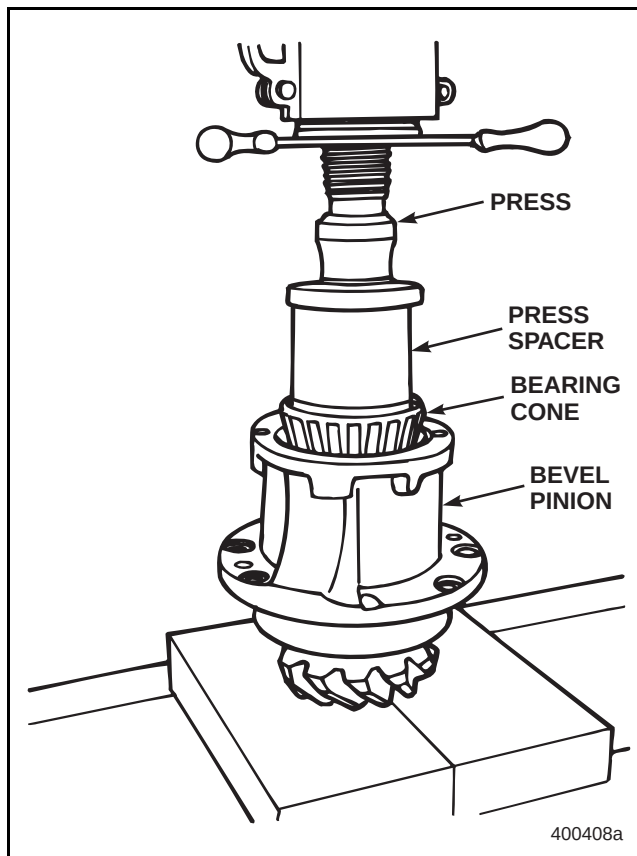


Figure 198 — Pressing Outer Bearing Cone onto the Bevel Pinion Shaft



400 BENCH PROCEDURES

Setting Bevel Pinion Preload

For maximum efficiency, tapered roller bearings must operate under a predetermined preload. This also ensures a rigid mounting for the gears.

SETTING THE PRELOAD

Set bearing preload after the bevel pinion is assembled into the housing. Use a hydraulic press to apply 20,000 pounds (10 tons) of pressure to the bearing. Rotate the pinion housing (bearings) as you apply full pressure to the bearings. This will prevent premature bearing failure.

NOTE

Make sure to lubricate the bearings before performing the bearing preload check.

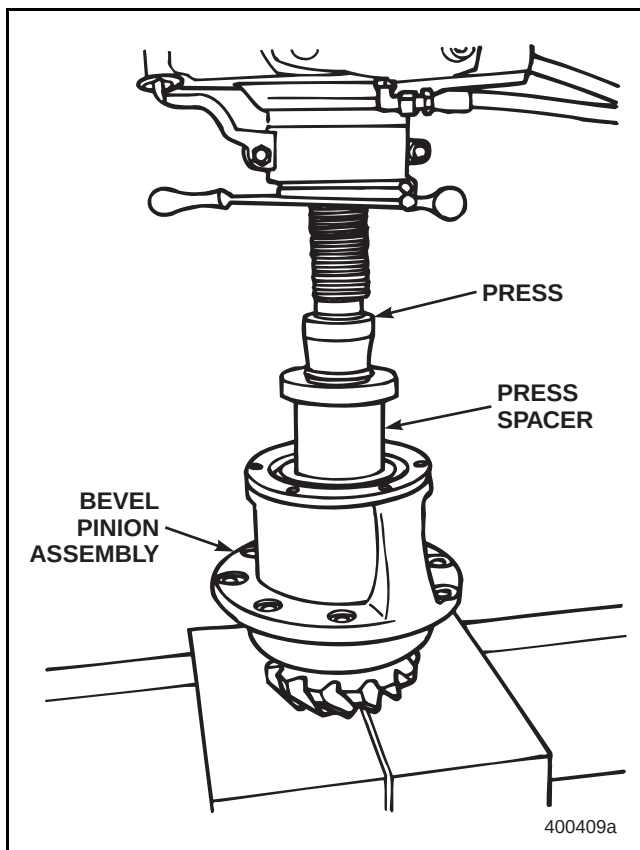


Figure 199 — Bevel Pinion Assembly Loaded with 20,000 Pounds Pressure

8. Wrap a cord around the bevel pinion housing as shown in Figure 200. Then attach scale J 8129, or equivalent, to the cord. Pull on the scale slowly and evenly until the housing rotates.

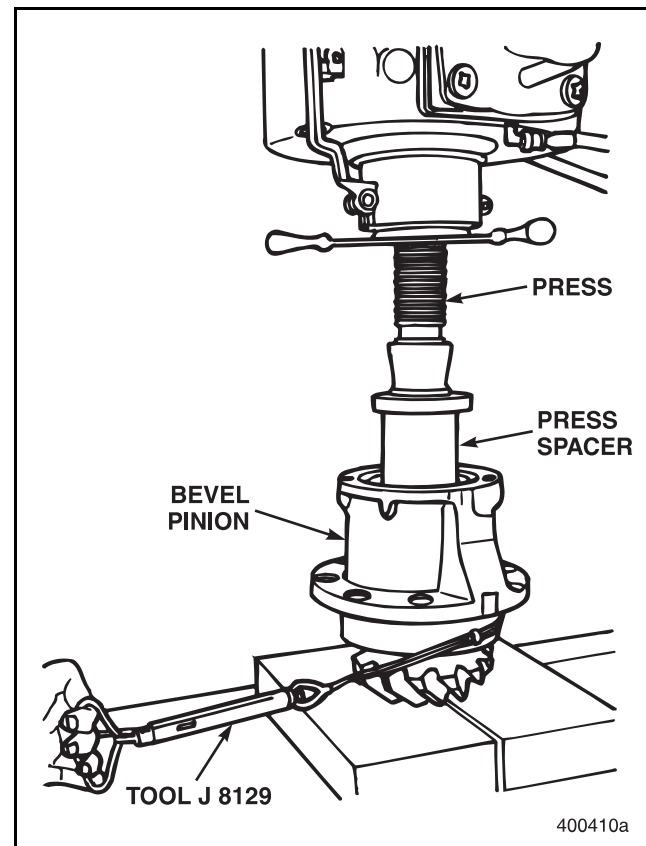


Figure 200 — Checking the Bearing Preload on the Bevel Pinion

9. To keep the housing rotating steadily, the correct load on the scale should read 3 to 6 pounds for new bearings, and 2 to 4 pounds for used bearings. If the reading is not within specifications, replace the original spacer. Use a thinner spacer if it takes less than the specified pounds of pull, or a thicker spacer if it takes more than the specified pounds to rotate the housing.

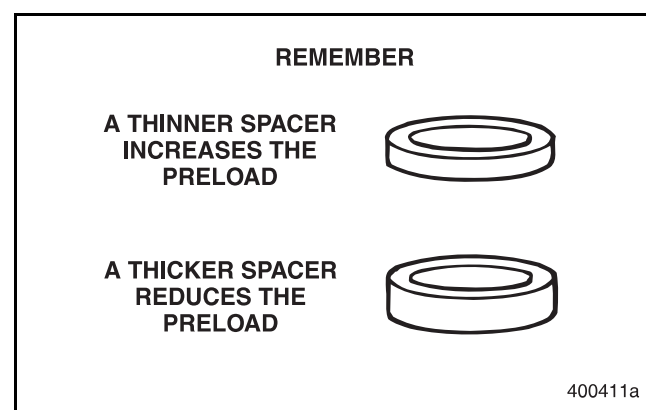


Figure 201 — Spacer Thickness Chart



400 BENCH PROCEDURES

SERVICE HINT

Bearings that are in good condition can be reused to rebuild a carrier. When reusing bearings, remember that the force needed to turn the scale while under 20,000 pounds of preload is about one half the requirement of new bearings. This is why used bearings have a 2–4-pound specification rather than the 3–6 pounds specified for new bearings.

NOTE

Make sure to lubricate the bearings before performing the bearing preload check.

10. After the correct bearing preload has been determined, position the seal in the bearing retainer cover.

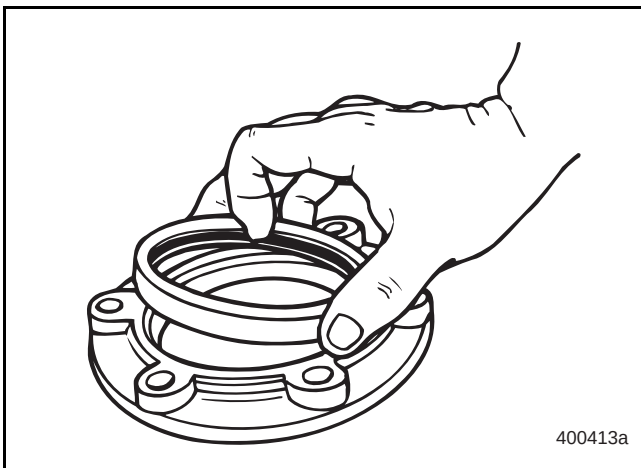


Figure 202 — Positioning Seal in Bearing Retainer

11. Drive the bearing cover seal into position using a seal installation tool.

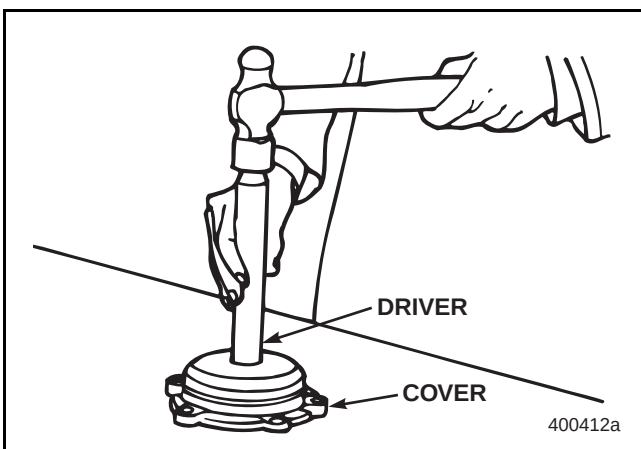


Figure 203 — Installing Seal in Cover

12. Install the bearing cover onto the bevel pinion assembly with a **new** gasket and tighten the cover capscrews to specification.
13. Dip end of drive yoke in GO-J lubricant and position them on the input shaft. Position the clamp plate and install the self-locking capscrew finger tight.
14. Torque the self-locking capscrew to specification.

DETERMINING BEVEL PINION TO CARRIER HOUSING SHIM PACK

When reusing the original bevel pinion, also reuse the shim pack that was removed from the carrier at disassembly.

Sometimes it is necessary to use a new bevel pinion to rebuild the carrier. If so, use the following procedure:

- Determine the mounting distance on the disassembled bevel pinion (etched into original pinion) and compare it with the mounting distance on the new bevel pinion (etched into new pinion).
- If the new bevel pinion mounting distance is longer than the old (higher number), this amount of shim will have to be added to the new shim pack.
- If the new bevel pinion mounting distance is shorter than the old (lower number), this amount of shim will have to be removed from the shim pack.



400 BENCH PROCEDURES

For example:

$$\begin{array}{r} 4.876" \text{ OLD PINION} \\ - 4.874" \text{ NEW PINION} \\ \hline 0.002" \text{ SHIM DIFFERENCE} \end{array}$$

In this case, 0.002 inch must be removed from the original shim pack.

This simple procedure provides a good starting point for setting the gear patterns.

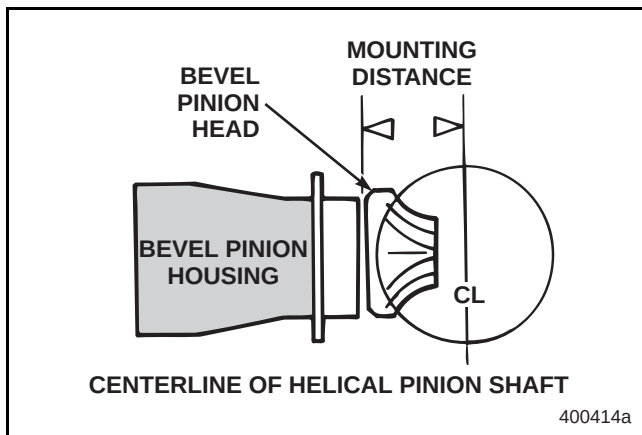


Figure 204 — Determining the Mounting Distance

15. Set the bevel pinion assembly (with the correct shim pack) aside temporarily on a clean work surface.

[466/476] HELICAL (SPUR) PINION SHAFT — REASSEMBLY

The exploded view in Figure 205 shows the parts of the helical pinion shaft assembly.

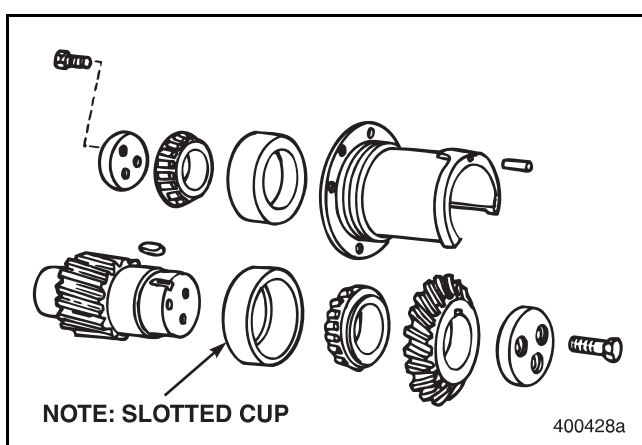


Figure 205 — Helical (Spur) Pinion Shaft Assembly (Exploded View)

1. Using a suitable hydraulic press, install the bearing cone onto the helical pinion shaft. Note the direction of the bearing.

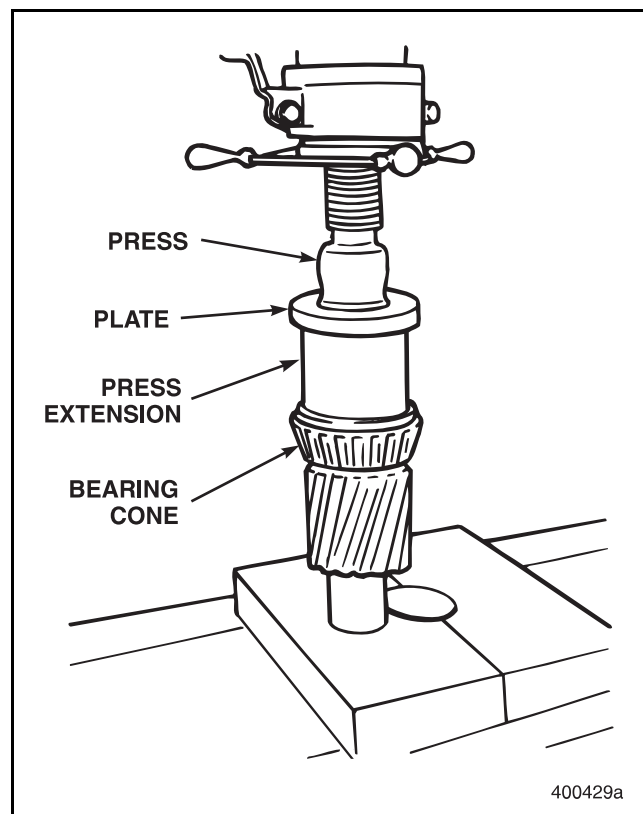


Figure 206 — Pressing Bearing Cone on the Helical Pinion Shaft

2. The pinion shaft will be either splined or keyed, depending on the ratio.

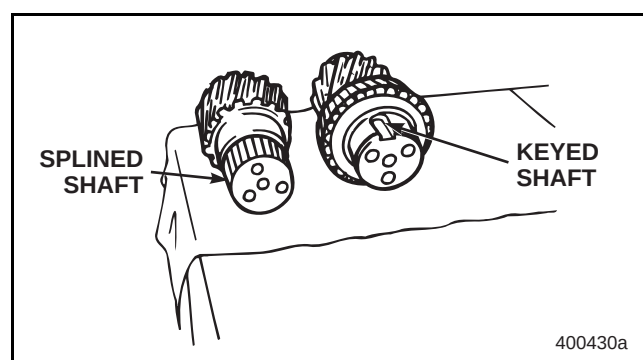


Figure 207 — Examples of Splined and Keyed Pinion Shafts



400 BENCH PROCEDURES

3. Using a machinist's hammer, install the key into the helical pinion shaft (if shaft requires a key).

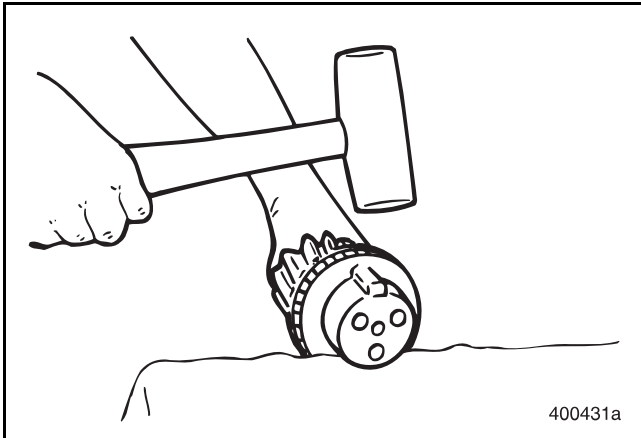


Figure 208 — Installing Key into Helical Pinion Shaft

4. Start the bevel gear onto the helical pinion shaft, making sure that key slot in gear aligns with the shaft.

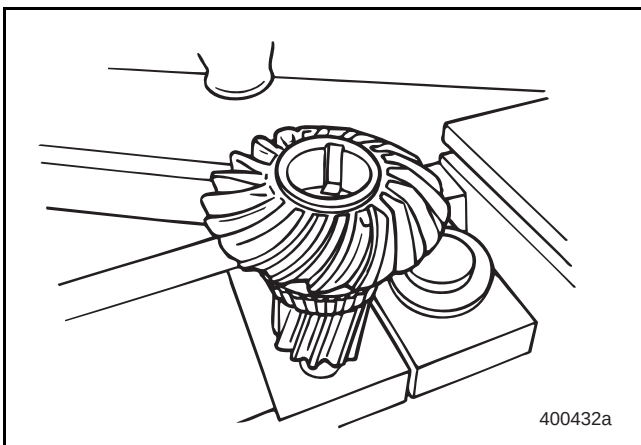


Figure 209 — Starting Bevel Gear on Helical Pinion Shaft

5. Press the bevel gear onto the helical pinion shaft.

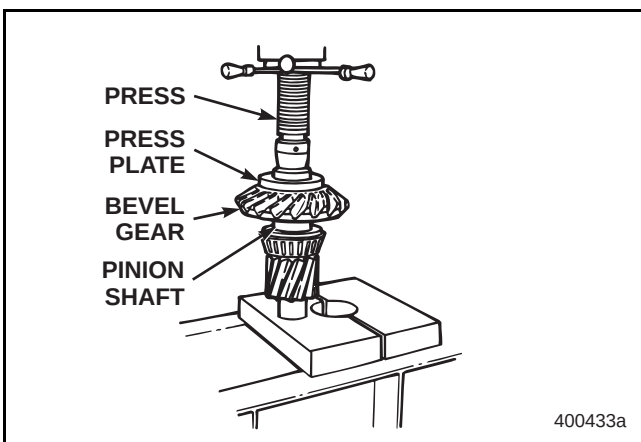


Figure 210 — Pressing Bevel Gear on Helical Pinion Shaft

6. Apply Loctite 262 to the threads of the capscrews that will hold the clamp plate to the helical pinion shaft.



Figure 211 — Applying Loctite 262 to Capscrew Threads

7. Secure the helical pinion shaft assembly in a soft-jawed vise. Insert the capscrews that hold the clamp plate in place.
8. Tighten the capscrews to specification.

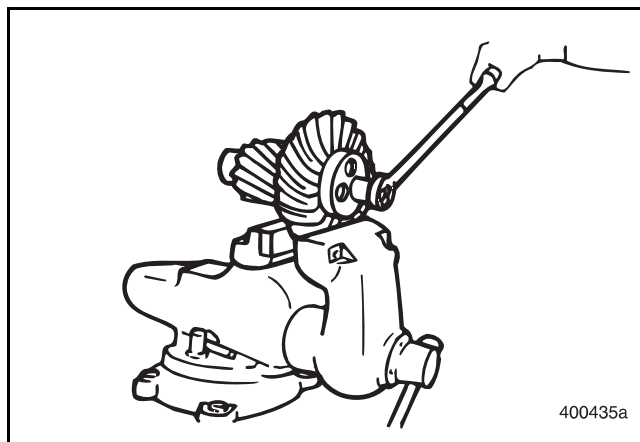


Figure 212 — Torquing Clamp-Plate Capscrews



400 BENCH PROCEDURES

9. Install the slotted inner bearing cup over the pinion and bearing cone.

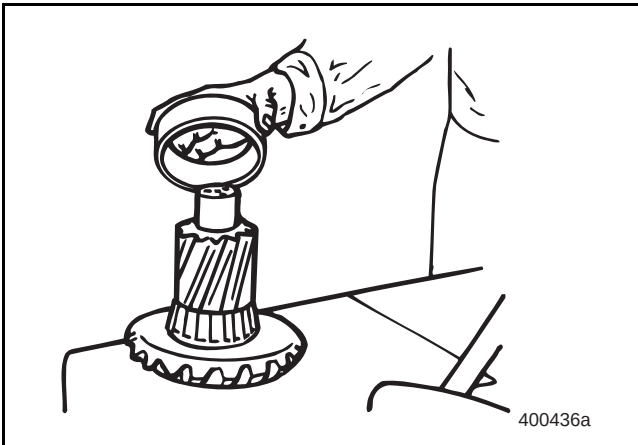


Figure 213 — Installing the Slotted Bearing Cup

10. Install the selective bearing spacer, with the tapered side down toward gear. Note that the thickness of this spacer determines bearing preload.

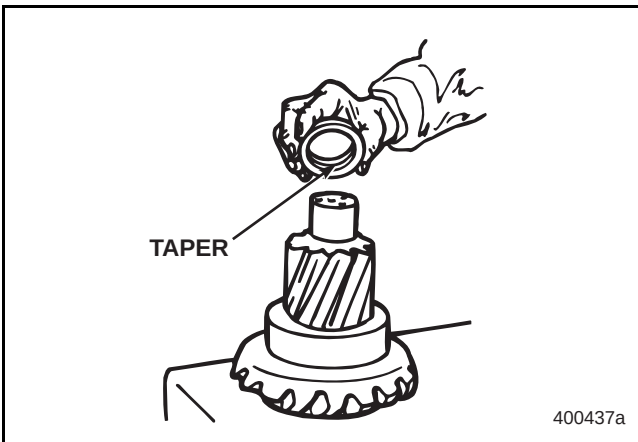


Figure 214 — Installing the Selective Bearing Spacer

11. Press the outer bearing cup into the helical pinion-bearing retainer.

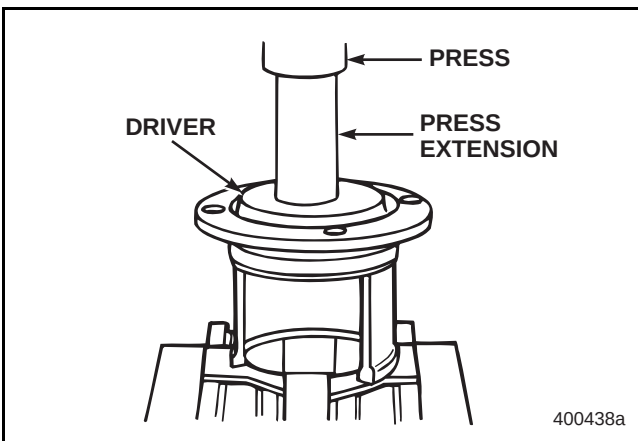


Figure 215 — Pressing Bearing Cup into Bearing Retainer Housing

12. Install a **new** O-ring on the helical pinion bearing retainer.

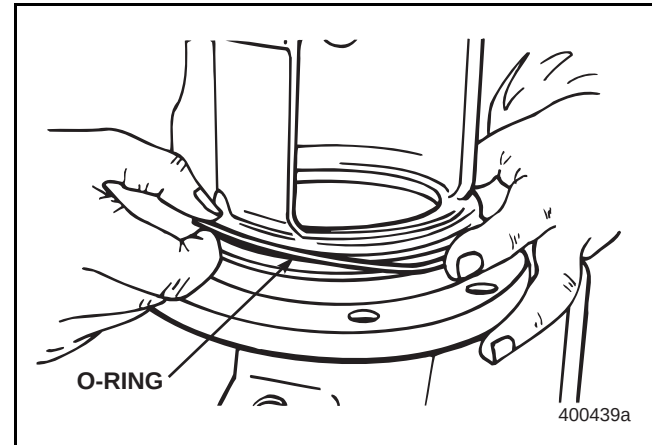


Figure 216 — Installing O-Ring on Helical Pinion Bearing Retainer

13. Install the bearing retainer over the pinion shaft.

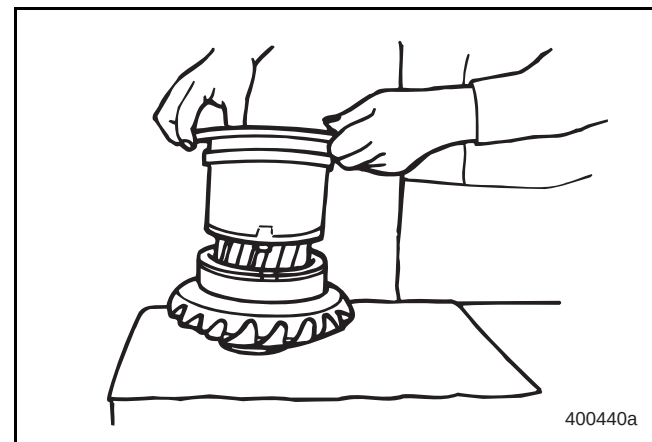


Figure 217 — Installing Bearing Retainer over Pinion Shaft

14. Ensure that the retainer lock pin aligns with the slot in the inner bearing cup.

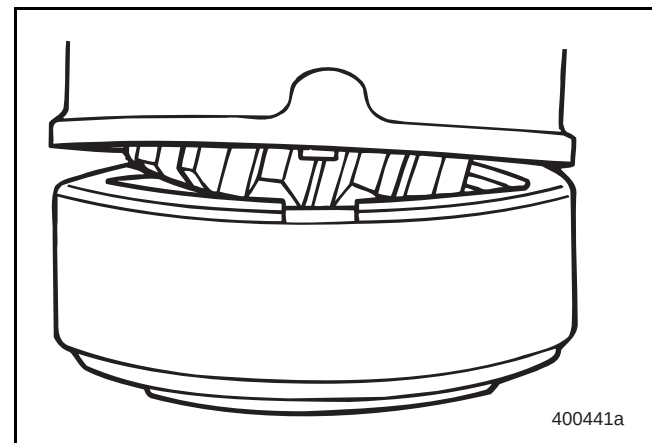


Figure 218 — Align Retainer Lock Pin with Slot in Inner Bearing Cup



400 BENCH PROCEDURES

15. Install the outer bearing cone on the helical pinion shaft.

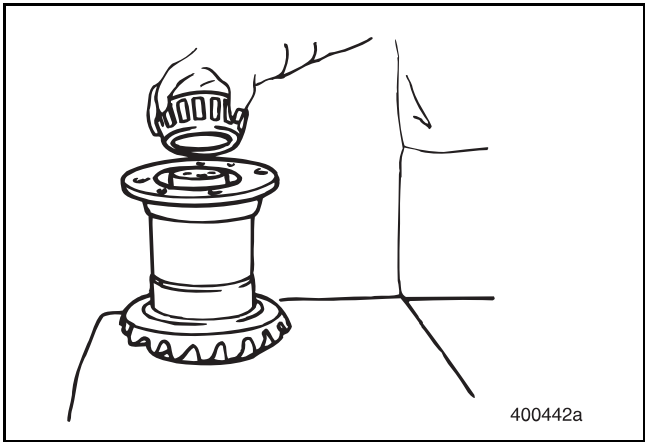


Figure 219 — Installing Outer Bearing Cone on Helical Pinion Shaft

16. Press the outer bearing cone into place.

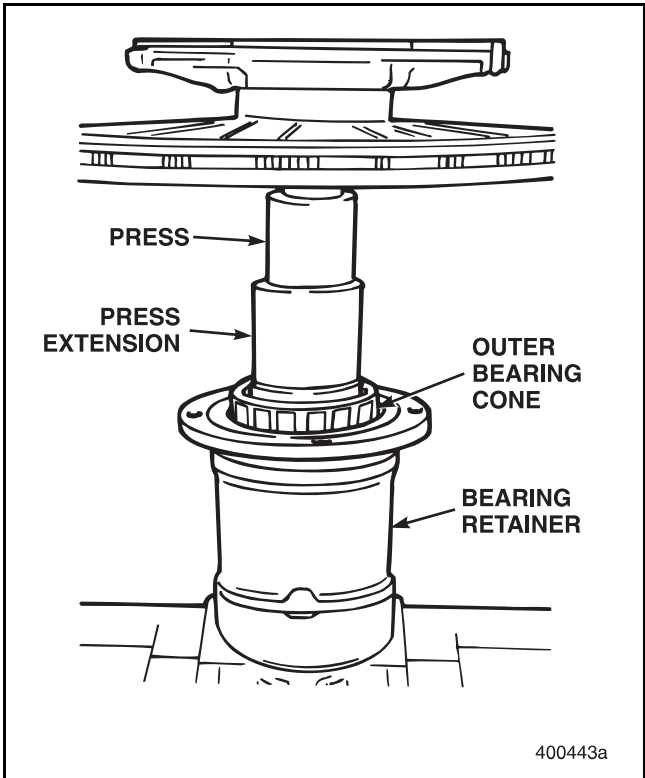


Figure 220 — Pressing Outer Bearing Cone into Position

Setting the Preload

With the helical pinion shaft in the press, apply 20,000 pounds (10 tons) of pressure to the helical pinion shaft assembly. Using a spacer between the bevel gear and press (to prevent damage to the clamp-plate screw heads), wrap a cord around the bearing retainer several times as shown. Attach scale J 8129, or equivalent, to the cord and steadily pull on the scale until the retainer rotates slowly and evenly. Begin rotating the assembly before full pressure is applied to the bearings. This will prevent premature bearing failure.

NOTE

Make sure to lubricate the bearings before performing the bearing preload check.

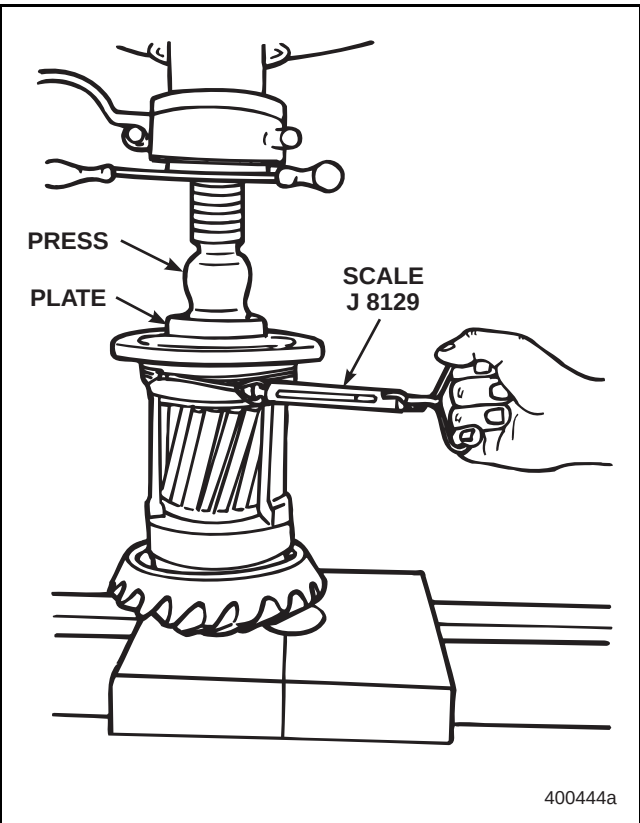


Figure 221 — Checking for Correct Preload of Helical Pinion



400 BENCH PROCEDURES

The correct load on the scale should read about 3–6 pounds for new bearings, and 2–4 pounds for used bearings. If it takes more than the specified amount of pull, use a thicker spacer. If it takes less than the specified amount of pull, use a thinner spacer.

17. After the correct bearing preload has been established, remove the assembly from the press. Disassemble the outer bearing cone, spacer and bearing retainer from the shaft assembly. Remove the inner bearing cup from the shaft assembly.

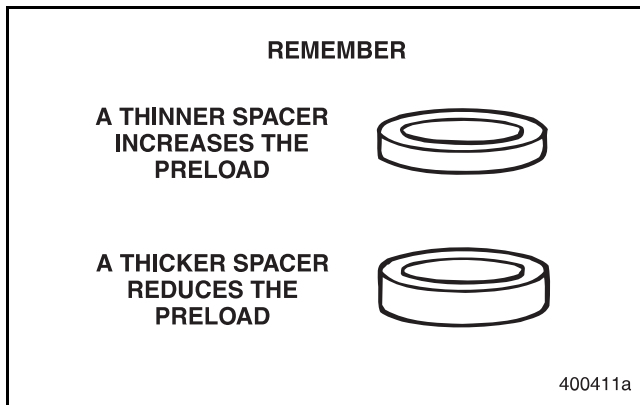


Figure 222 — Spacer Thickness Chart

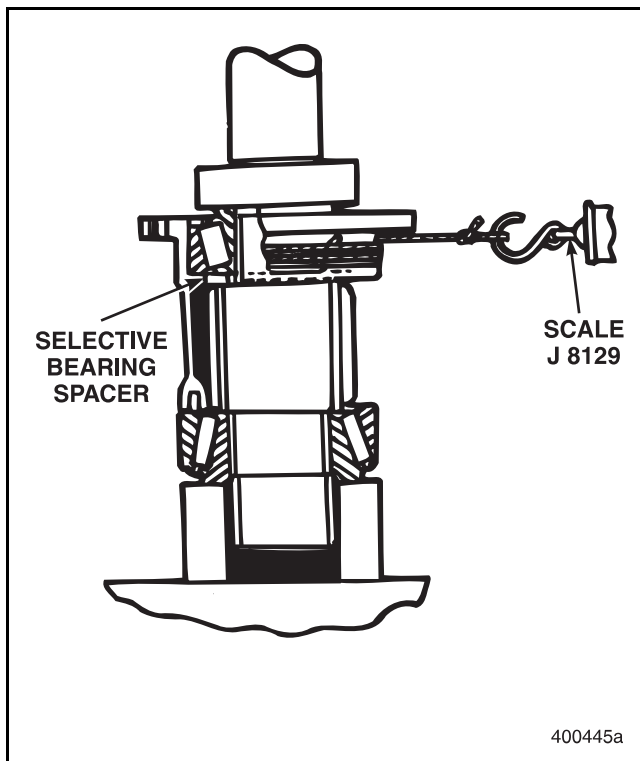


Figure 223 — Selective Spacer Location

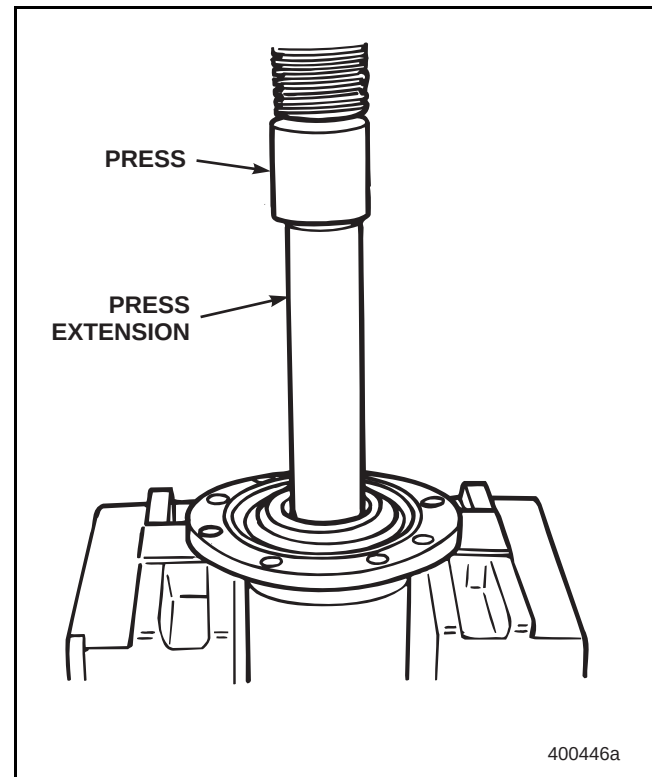


Figure 224 — Pressing Pinion Shaft out of Bearing Cone



400 BENCH PROCEDURES

Setting the Gear Patterns

After setups for the bevel pinion and helical pinion subassemblies have been completed, the gear patterns must be properly set. If the disassembly instructions for these subassemblies have been followed as described, the existing shim pack thickness should have been measured and recorded, providing a basis on which to begin the gear pattern adjustment procedure.

NOTE

The mounting distance stamped on the back of the bevel pinion teeth represents the distance from the backface of the head of the bevel pinion to the centerline of the bevel gear. The mounting distance on the back of the bevel gear teeth represents the distance from the backface of the bevel gear to the centerline of the bevel pinion. This number helps in determining the shims which will have to be installed to achieve the desired gear pattern. Refer to illustration below.

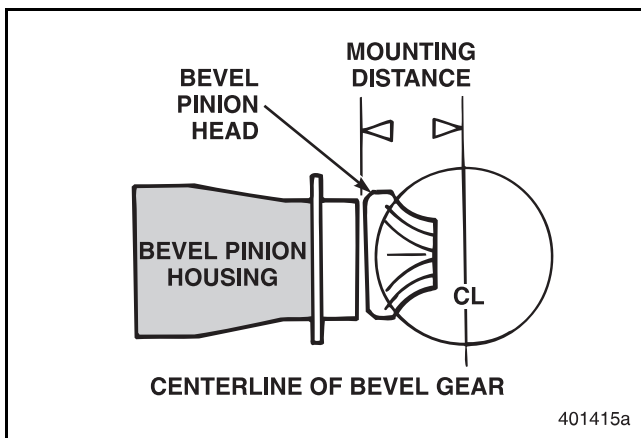


Figure 225 — Determining the Mounting Distance

NOTE

If the dimension number on the new bevel pinion or bevel gear is greater than the old, the shim pack must be increased by the same amount. If the dimension number on the new bevel pinion or bevel gear is less than the old, the shim pack must be decreased by the same amount.

18. Install the established shim pack onto the helical pinion bearing retainer.

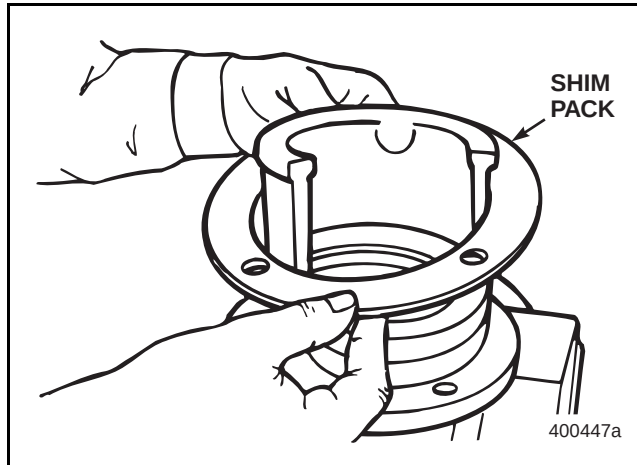


Figure 226 — Installing the Established Shim Pack

19. Using alignment pins, install the bearing retainer into the carrier housing. Position the retainer so that the opening faces the bull gear.

SERVICE HINT

Make alignment pins from bolts obtained locally. Pins should be about 2-1/2 inches long with 1/2 inch of thread.

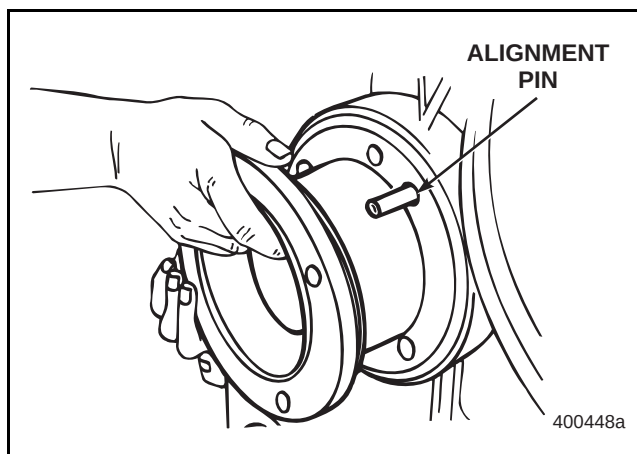


Figure 227 — Aligning and Installing the Bearing Retainer



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20. Install two cover bolts to hold the bearing retainer in the carrier housing for installation of the inner bearing cup.
21. Torque the bearing retainer capscrews to specification.

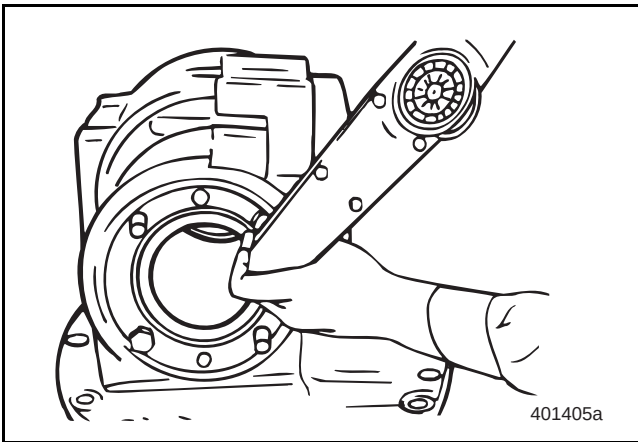


Figure 228 — Torquing Bearing Retainer

22. Mark the carrier housing next to the location of the lock pin.

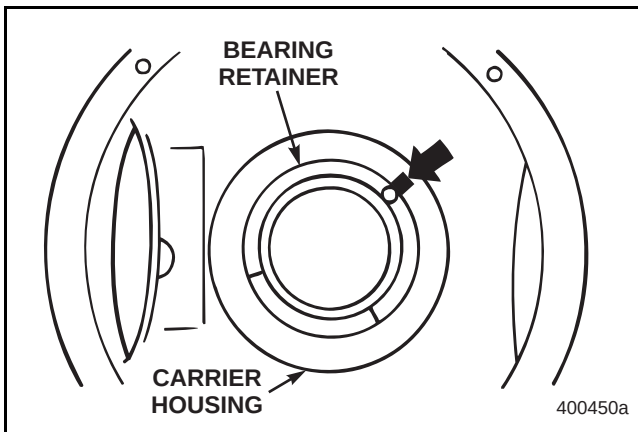


Figure 229 — Marking Case Next to Lock Pin

23. Position the inner bearing cup so that the slot in the cup aligns with the mark.

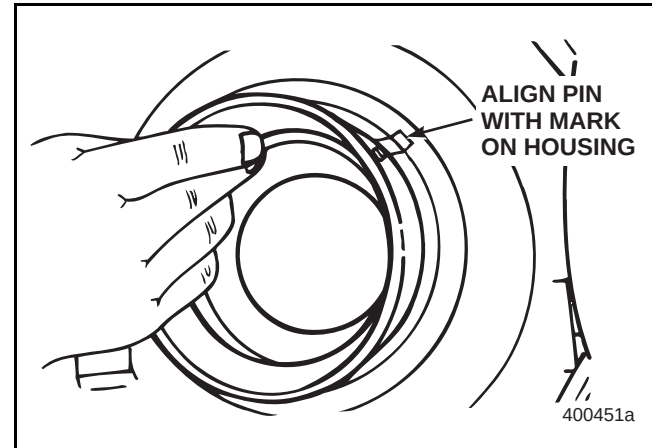


Figure 230 — Aligning Inner Bearing Cup Slot with Mark

24. Install the slotted inner bearing cup into the carrier housing using hand pressure to start, then tapping with a driver and hammer.

NOTE

The inner bearing cup slot must align with the bearing retainer locating pin.

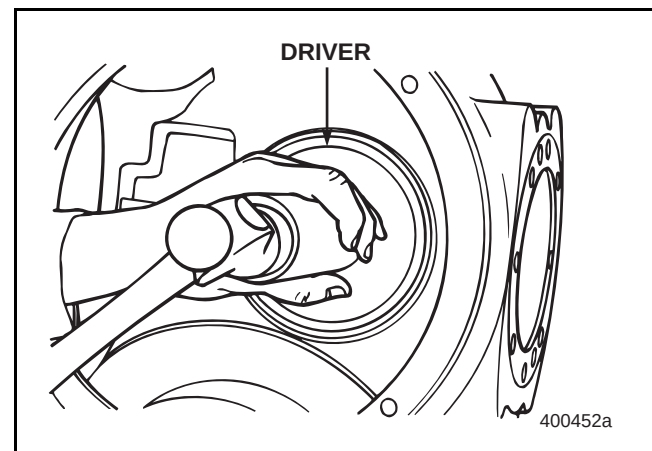


Figure 231 — Installing Inner Bearing Cup into Carrier Housing



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25. Insert the shaft assembly, with the established spacer, into the carrier housing. Position a block of wood in the housing to support the shaft assembly.

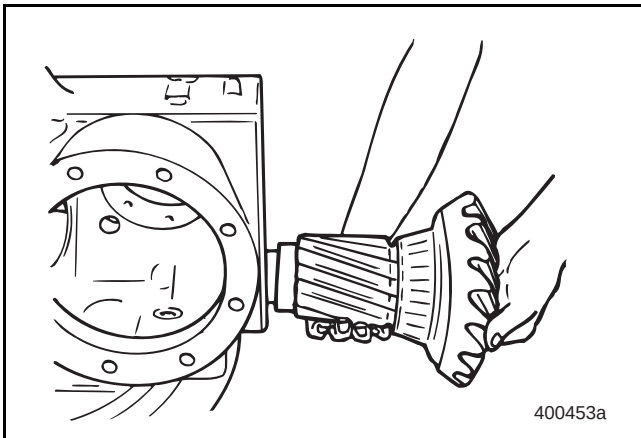


Figure 232 — Installing Shaft with Spacer

26. Install the outer bearing cone onto the end of the pinion shaft.

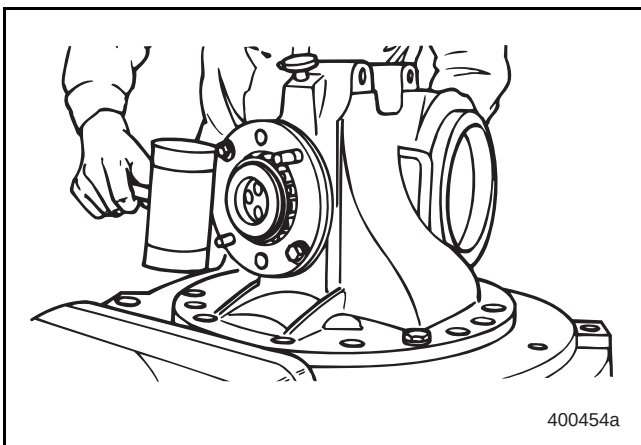


Figure 233 — Installing Outer Bearing Cone onto Pinion Shaft

27. Install the clamp plate and old capscrews. Torque capscrews to specification using a pinch bar or jamming tool between the spiral bevel gear and housing to jam the gear.

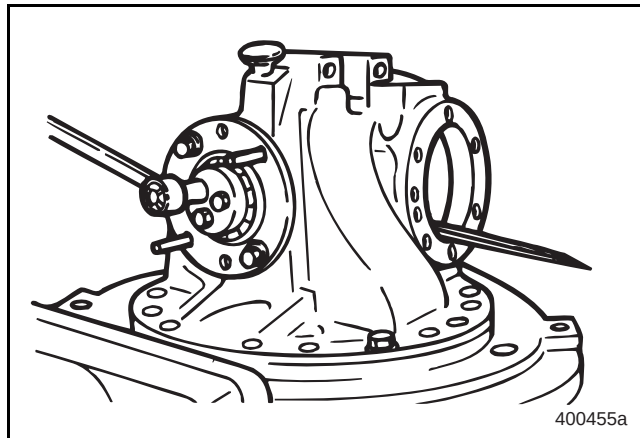


Figure 234 — Torquing Clamp-Plate Capscrews

SERVICE HINT

Tighten the capscrews retaining the clamp plate in stages until the recommended torque is obtained.

28. Rotate the assembly. The unit should turn with some drag. If it will not turn, return to the BENCH PROCEDURES on page 88 and recheck bearing preload.
29. Loosen the three clamp-plate capscrews to relieve the preload. Tap with a hammer to loosen the bearing.
30. Retorque the three clamp-plate capscrews to specification using the pinch bar or jamming tool to jam the gear.



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Bevel Pinion Installation

The bevel pinion (which was preassembled in a previous section) is now ready to be fitted to the carrier housing for backlash and gear pattern checks. The bevel pinion can be installed only after the helical pinion shaft. Make sure the drive yoke is installed and properly tightened before performing the backlash check. Otherwise, a false reading will be obtained.

31. Install the established bevel pinion shim pack over the alignment pins. The alignment pins should be used because they will retain the shim pack while installing the bevel pinion.

SERVICE HINT

Make alignment pins from bolts obtained locally. Pins should be about 2-1/2 inches long with 5/8-inch threads.

CAUTION

Shims must not block oil holes.

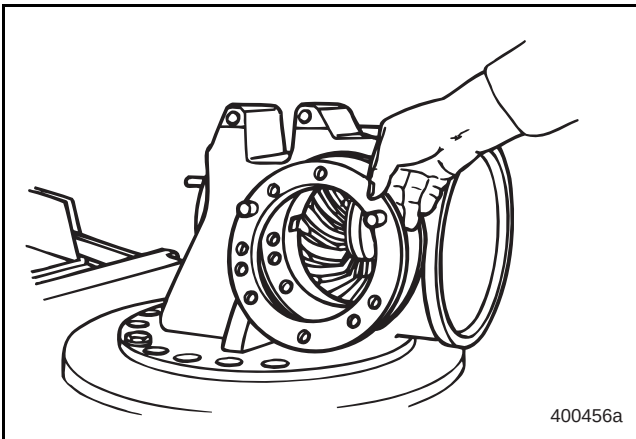


Figure 235 — Installing Established Shim Pack

32. Install the front rear or the rear rear bevel pinion into the carrier housing, positioning to align the oil passages and slide on the alignment pins.

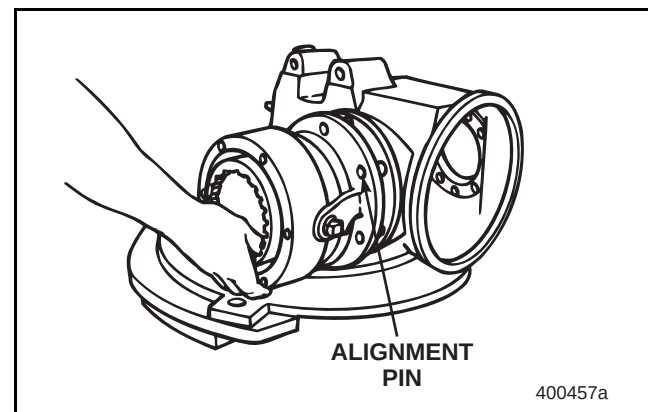


Figure 236 — Installing Front Rear Bevel Pinion (92)

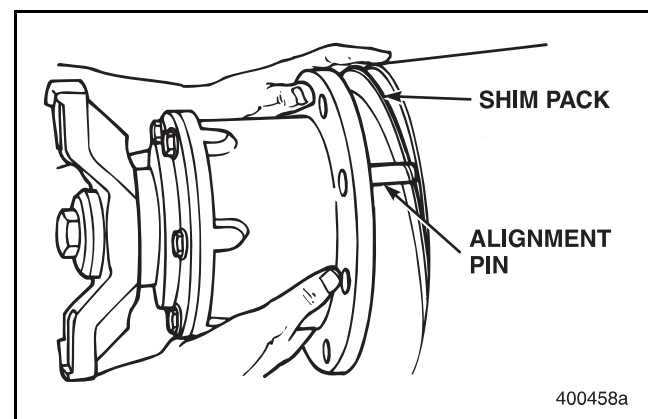


Figure 237 — Installing Rear Rear Bevel Pinion (93)

NOTE

Make sure to install and properly tighten the drive yoke to the rear rear bevel pinion assembly. A false backlash reading will be obtained without a properly torqued drive yoke.



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33. Install some of the capscrews. Remove the alignment pins after the bevel pinion is in position. Install the remaining capscrews.
34. Torque bevel pinion capscrews to specification.

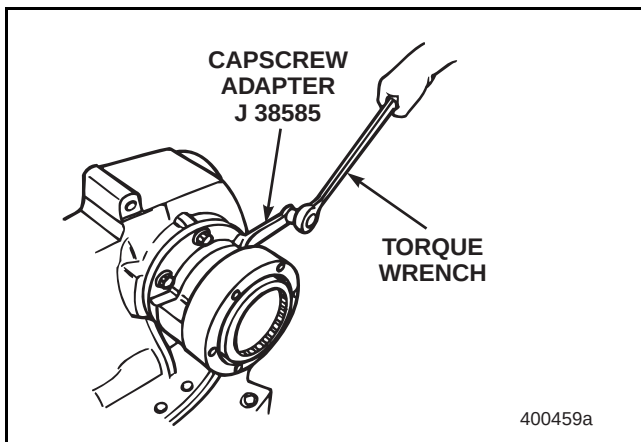


Figure 238 — Torquing the Bevel Pinion Capscrews

Setting the Backlash

35. Set the backlash between the bevel pinion and the bevel gear. The backlash should be 0.006 to 0.018 inch (0.15 to 0.46 mm). Add or remove shims as necessary to attain the correct backlash.
36. A dial indicator with a magnetic or bolt-on type base is used to make the measurement.

NOTE

A bolt-on type base is required on aluminum housings.

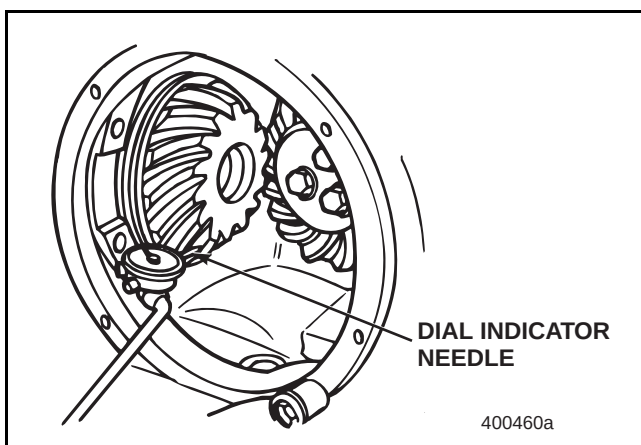


Figure 239 — Checking Backlash

Setting Spiral Bevel Gears

37. Check the gear patterns using marking compound. Mark four of the teeth, approximately 180 degrees apart.

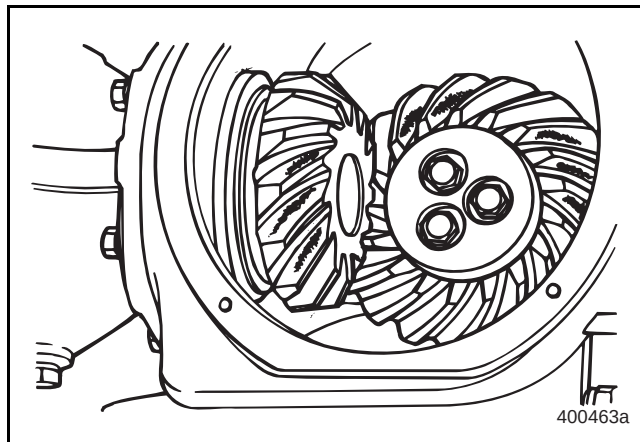


Figure 240 — Coating the Bevel Gear and Pinion with Marking Compound

38. Rotate at least two full turns in both directions while applying braking force to the helical pinion. This will squeeze the gear-marking compound away from the contact areas.
39. Compare the readings from the axle being serviced to those in Figures 241 and 242.

NOTE

In some cases, it may be necessary to slightly readjust the setting made by the dial indicator to obtain the correct tooth contacts. However, make sure that there are no dirt particles under the shim packs and that all fasteners are tightened to the proper torque. Then recheck the tooth contact pattern.

40. After reaching proper tooth contact pattern and gear backlash limits, temporarily remove the bevel pinion and the helical (spur) pinion shaft from the carrier housing. Wire the bevel pinion shims together for use at final assembly. Wire the helical (spur) pinion shaft assembly shims together to use when checking tooth contact pattern between the helical (spur) pinion shaft assembly and the bull gear. Refer to HELICAL (SPUR) PINION SHAFT, FRONT REAR BEVEL PINION or REAR REAR BEVEL PINION sections for removal procedures for these units.

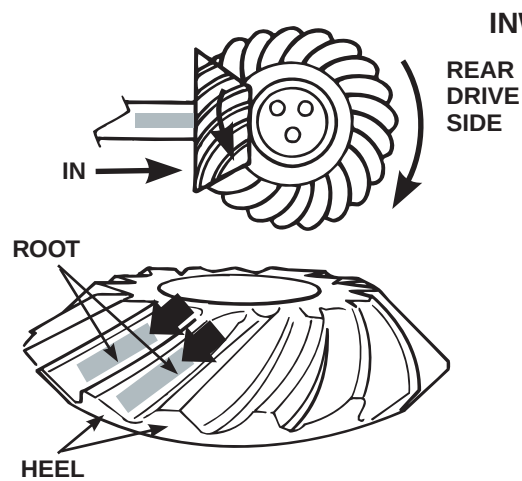


400 BENCH PROCEDURES

SETTING THE GEAR CONTACT PATTERN MATED-GEAR ADJUSTMENT

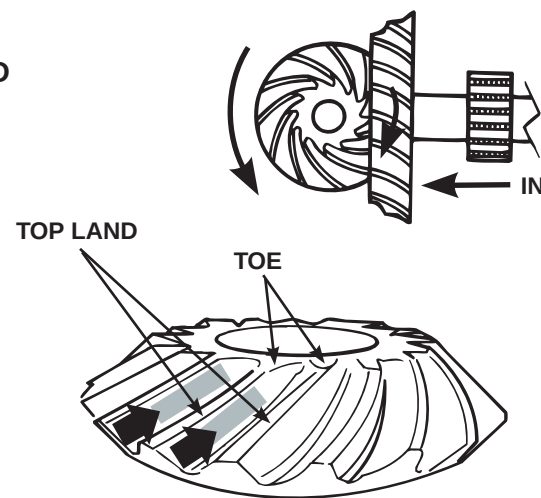
MOVING THE BEVEL PINION . . .

If tooth contact pattern is not correct, it can be adjusted by removing or adding shims. Removing bevel pinion shims moves the bevel pinion inward. This moves the contact area toward the tooth root and slightly toward the heel on the drive side of the gear.



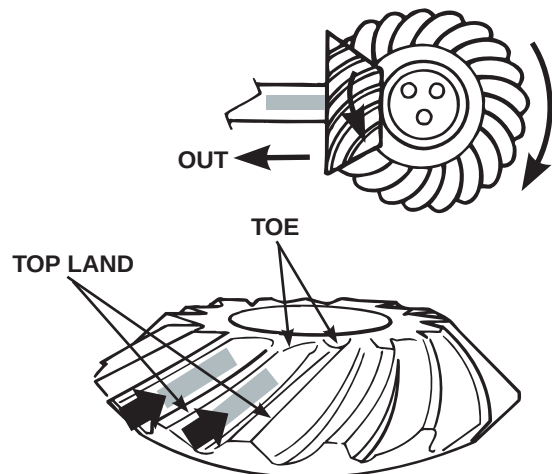
MOVING THE BEVEL GEAR . . .

Removing helical pinion shims moves the bevel gear inward. This moves the contact area nearer to the toe and slightly towards the tooth top land on the drive side of the gear.

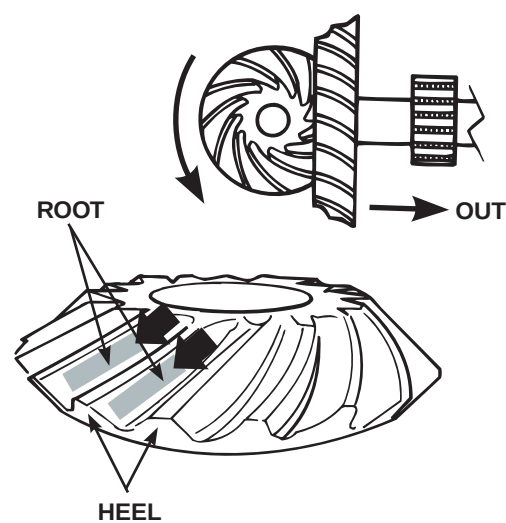


OUTWARD

Adding bevel pinion shims moves the bevel pinion outward. This moves the contact area toward the tooth top land and slightly toward the toe on the drive side of the gear.



Adding helical pinion shims moves the bevel gear outward. This moves the contact area nearer to the tooth heel and slightly toward the tooth root on the drive side of the gear.

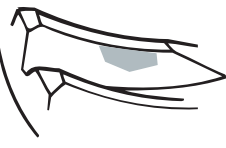
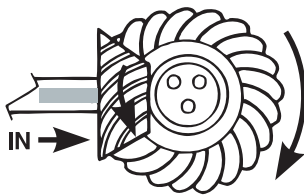
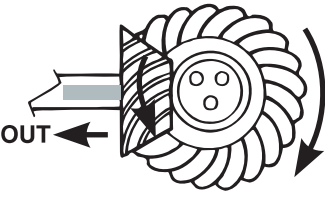
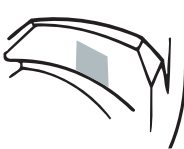
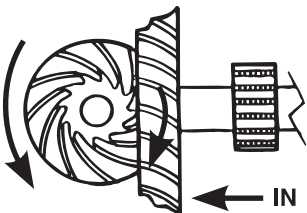
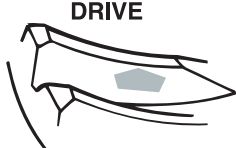
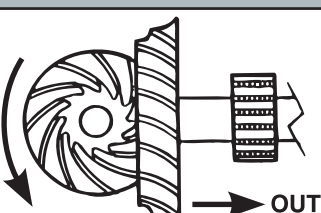


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Figure 241 — Setting Gear Contact Pattern



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PRACTICAL APPLICATIONS			
LISTED BELOW ARE COMMON GEAR CONTACT PATTERNS YOU MAY SEE. WHEN SETTING UP A SET OF MATED GEARS, STRIVE TO ACHIEVE AN IDEAL CONTACT PATTERN ON BOTH DRIVE AND COAST SIDES. IF YOU MUST FAVOR ONE OR THE OTHER, SET THE IDEAL ON THE DRIVE SIDE.			
UNACCEPTABLE BEVEL GEAR PATTERNS		RECOMMENDED ADJUSTMENTS	DESIRED CONTACT PATTERNS
DRIVE  TOE-LOADED TOP LAND	COAST  HEEL-LOADED TOP LAND	 MOVE PINION TOWARD GEAR BY REMOVING BEVEL PINION SHIMS	DRIVE  COAST  IDEAL CONTACT PATTERN WILL ALSO DECREASE BACKLASH
DRIVE  HEEL-LOADED ROOT AREA	COAST  TOE-LOADED ROOT AREA	 MOVE PINION AWAY FROM GEAR BY ADDING BEVEL PINION SHIMS	DRIVE  COAST  IDEAL CONTACT PATTERN WILL ALSO INCREASE BACKLASH
DRIVE  LOADED DEEP IN ROOT AND SLIGHT IN HEEL	COAST  LOADED DEEP IN ROOT AND SLIGHT IN TOE	 MOVE GEAR TOWARD PINION BY REMOVING HELICAL PINION SHIMS	DRIVE  COAST  IDEAL CONTACT PATTERN WILL ALSO DECREASE BACKLASH
DRIVE  LOADED TOP LAND AND SLIGHT IN TOE	COAST  LOADED TOP LAND AND SLIGHT IN HEEL	 MOVE GEAR AWAY FROM PINION BY ADDING HELICAL PINION SHIMS	DRIVE  COAST  IDEAL CONTACT PATTERN WILL ALSO INCREASE BACKLASH

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Figure 242 — Practical Applications



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[465/475] FOUR-PINION TYPE DIFFERENTIAL — REASSEMBLY

1. Using a suitable hydraulic press, press the bearing cones onto the differential halves. Generously lubricate the bearing cones and the internal components with GO-J lubricant.

NOTE

The bearing cones on the two sides of the differential halves are different. The thicker bearing goes on the unsplined half and the thinner bearing goes on the splined differential half.

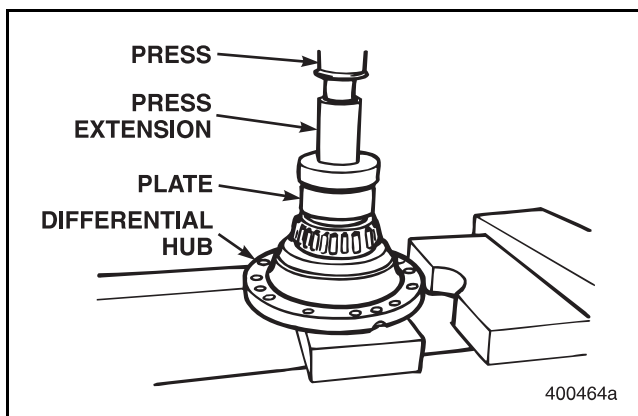


Figure 243 — Pressing the Bearing on the Differential Hub

NOTE

The differential bearing cup which fits the unsplined casing has an external flange which engages a machined surface on the inner side of the bearing pedestal and cap when installed. This arrangement fixes the position of the differential and bull gear and provides for differential bearing preload adjustment. The bull gear position cannot vary.

2. Apply GO-J lubricant to the thrust washer. Install the thrust washer in the unsplined differential casing.

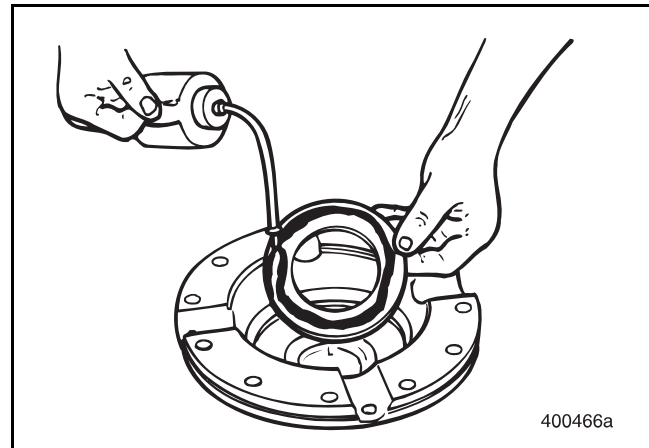


Figure 244 — Applying GO-J Lubricant to Thrust Washer

3. Apply GO-J lubricant to the unsplined differential casing and install the side gear into the casing.

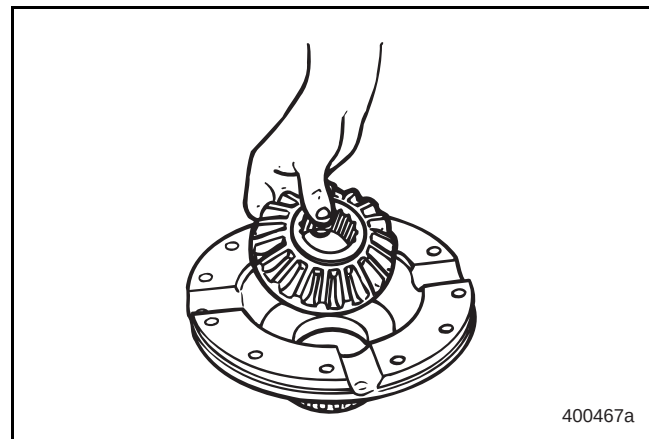


Figure 245 — Installing Side Gear in Differential Casing

4. Assemble the four pinion gears and the four thrust washers onto the differential spider.

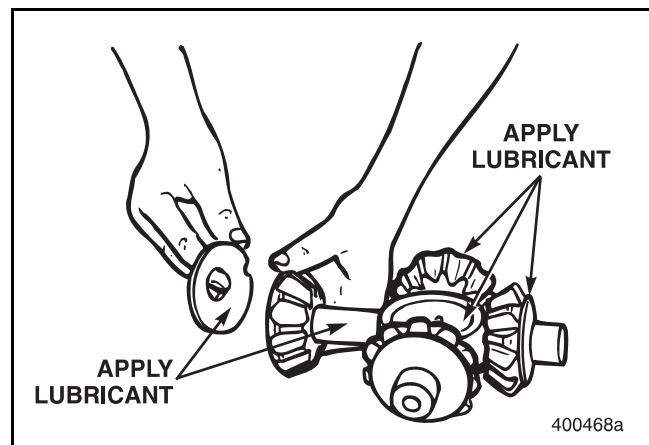


Figure 246 — Installing Pinion Gears and Thrust Washers on Spider



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5. Install the pinion, spider and thrust washer assembly into the unsplined side casing. Apply GO-J lubricant before installation.

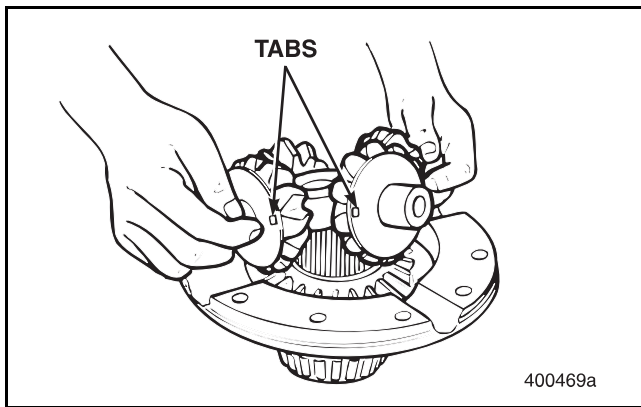


Figure 247 — Installing Assembled Pinion Spider

6. Ensure the gears are properly engaged and that the pinion thrust washer tabs are properly positioned in the casing.

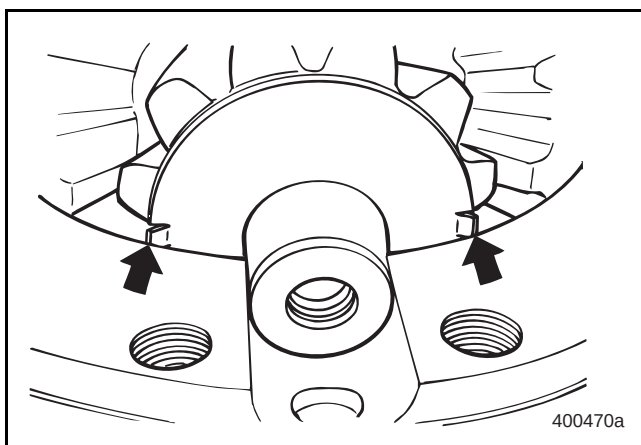


Figure 248 — Position Tabs of Thrust Washers Between Casing Halves

7. Install the other side gear so that it meshes with the pinion and spider assembly, applying GO-J lubricant before installing.

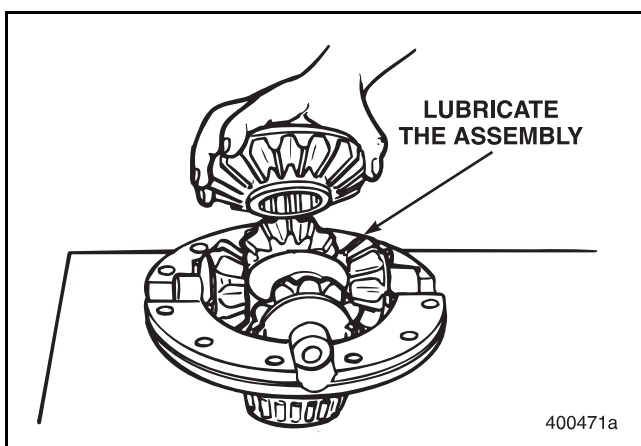


Figure 249 — Installing the Side Gear

8. Install the remaining thrust washer after lubricating it with GO-J lubricant.

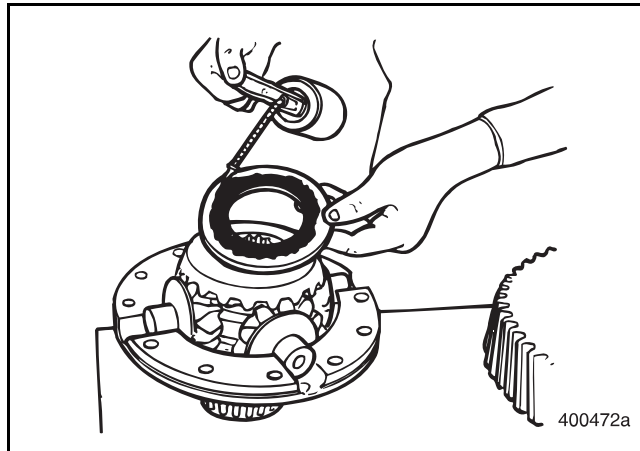


Figure 250 — Lubricating Thrust Washer Prior to Installation

9. Align the side casing halves with the match marks made at disassembly and couple the casing halves together.

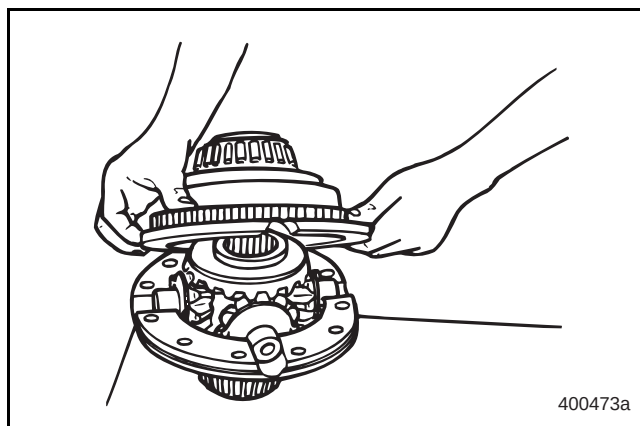


Figure 251 — Aligning Marks Made at Disassembly



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10. Mark the side casing halves with a marking pencil at the "o" marked on the splined half. Mark the tooth between the "oo" marks on the bull gear.

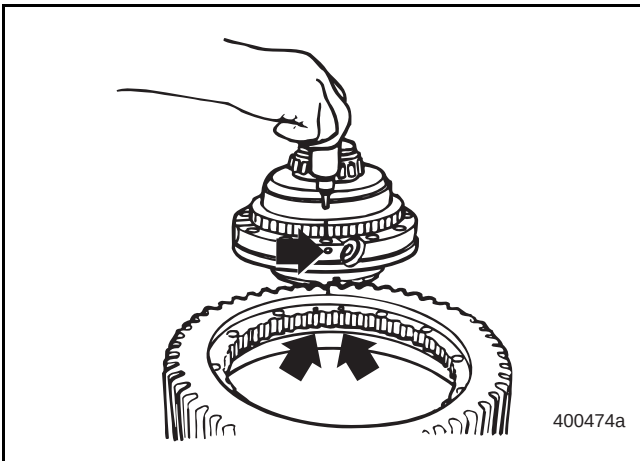


Figure 252 — Marking the Casing Halves

11. Align the match mark on the bull gear with that on the casing halves. Index the bull gear internal splines with the external splines on the differential side casing.

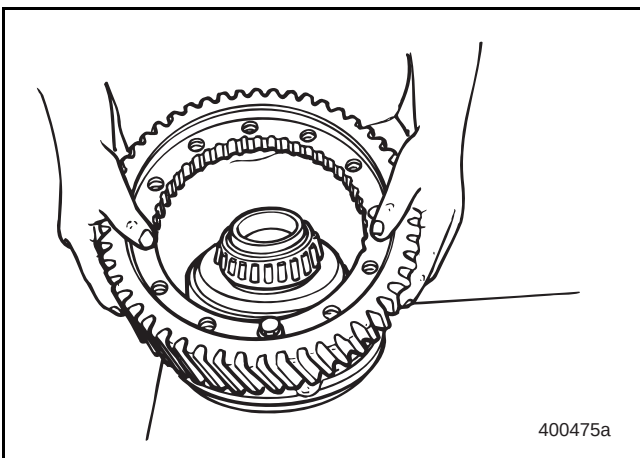


Figure 253 — Aligning Match Marks on Bull Gear and Casings

SERVICE HINT

Install a differential casing bolt in the match-mark hole to help align and install the bull gear.

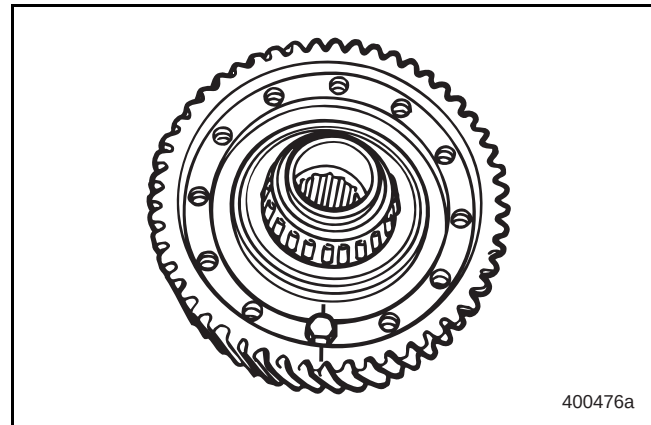


Figure 254 — Match Marks Aligned

12. Apply Loctite 262, or equivalent, to four equally spaced casing capscrew threads. Place Loctite in the middle of the bolts as the bolts extend through the casing.

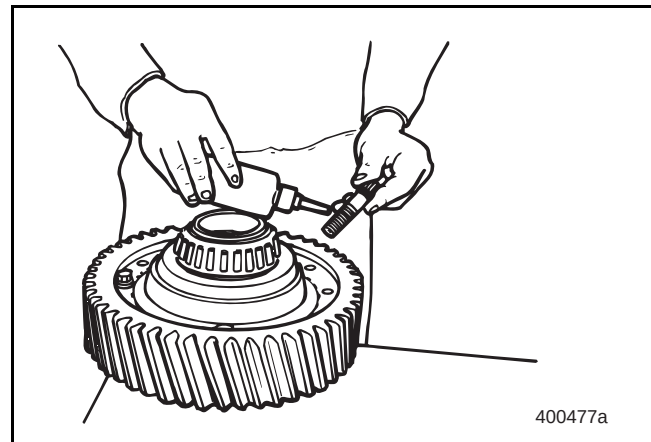


Figure 255 — Applying Loctite 262 to Capscrew Threads

13. Tighten the four equally spaced capscrews evenly to pull the bull gear onto the casing. Turn the bolts equally and evenly to pull gear down before torquing.

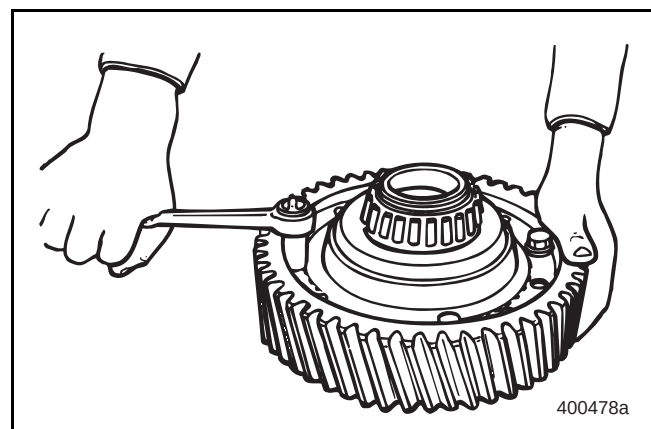


Figure 256 — Tighten Capscrews Evenly



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14. Place the differential in a soft-jawed vise and install the remaining eight capscrews. Torque the capscrews to specification.

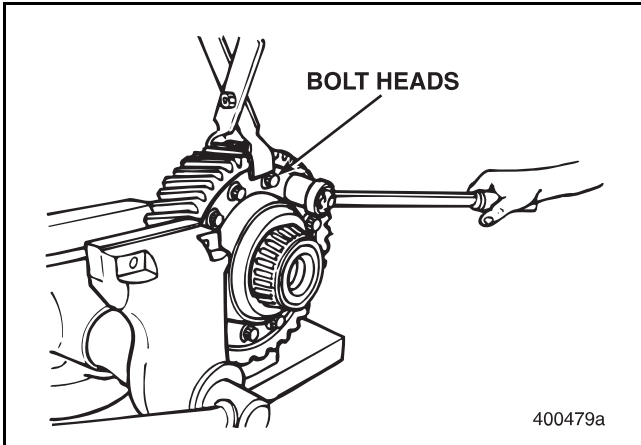


Figure 257 — Torquing Capscrews to Specification

15. Place Loctite 262 on the extended threads of the 12 (previously installed) capscrews and nuts used to retain the bull gear.

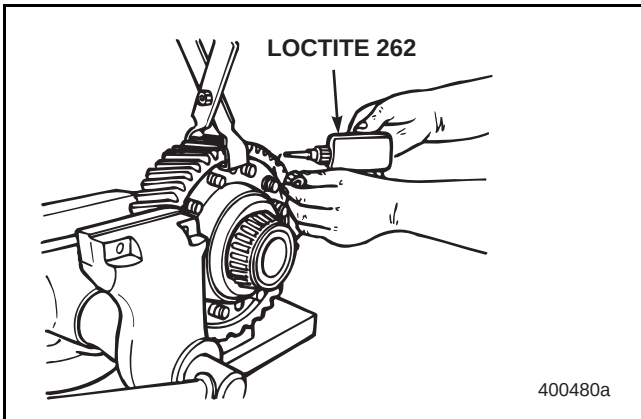


Figure 258 — Applying Loctite 262 to Capscrew and Nut Threads

16. Torque the bull gear retaining nuts to specification.

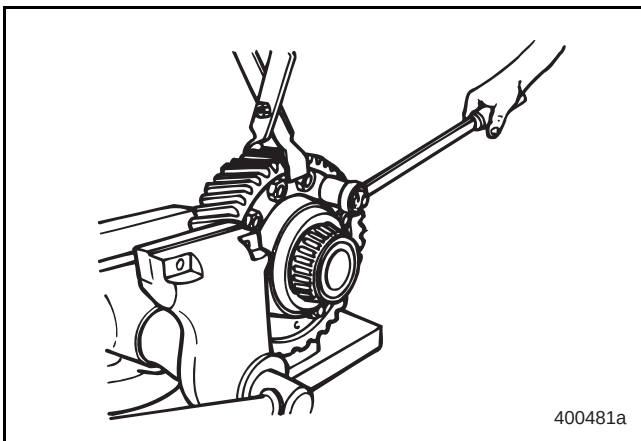


Figure 259 — Torquing Casing Nuts

17. Ensure the differential gears turn freely. If any binding is detected, disassemble the unit and correct the cause.

[465/475] INTER-WHEEL POWER DIVIDER DIFFERENTIAL — REASSEMBLY

1. If removed, insert a **new** presized bushing into the power-divider driving cage until the bushing bottoms. DO NOT OVERDRIVE. A correctly installed bushing must be recessed below the inner-cam thrust surface of the cage as shown in Figure 260.

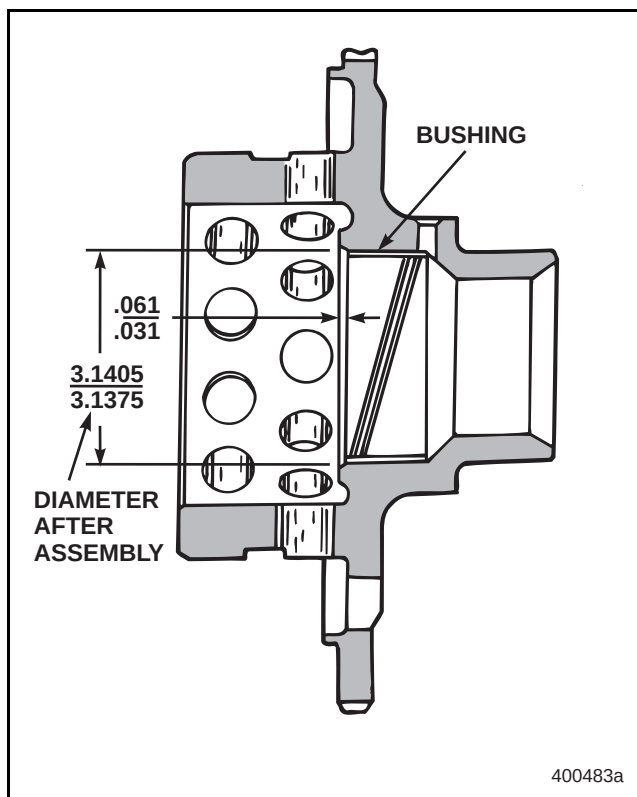


Figure 260 — Driving Cage Bushing Installation

2. Using a hydraulic press, press the thinner bearing cone on the hub of the driving cage.

NOTE

The bearing cones on the two sides of the differential halves are different. The thicker bearing goes on the unsplined half and the thinner bearing goes on the splined differential half.



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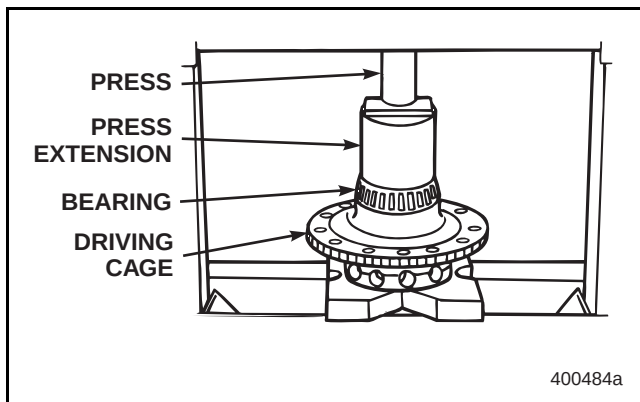


Figure 261 — Pressing Bearing Cone on Hub of Driving Cage

3. Using a hydraulic press, press the thicker bearing cone on the hub of the non-splined power-divider differential side casing.

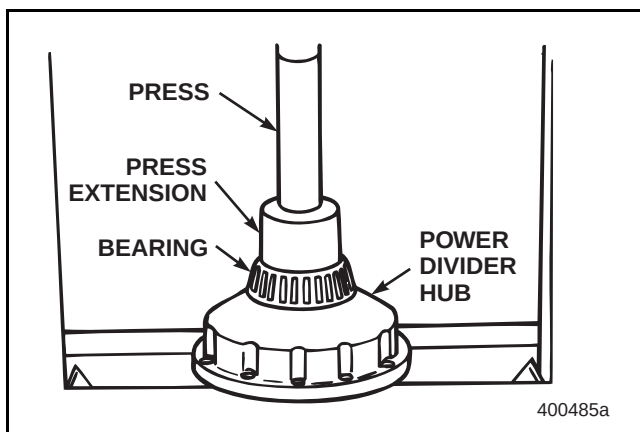


Figure 262 — Pressing Bearing Cone on Power-Divider Differential Side Casing

4. Install the oil trough on the splined differential power divider cage.

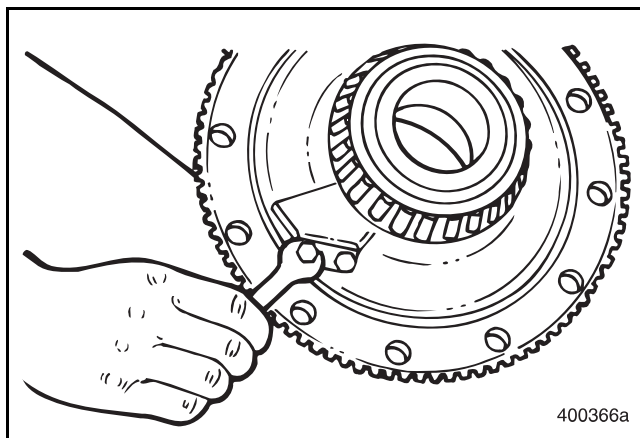


Figure 263 — Attaching Oil Trough

5. Examine the splined half of the power divider differential half. The differential half has one mark (shown at the twelve-o'clock position).

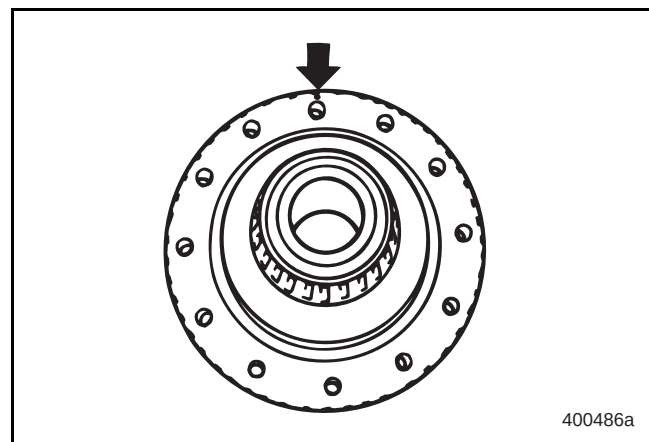


Figure 264 — Power-Divider Splined Differential Half Timing Mark

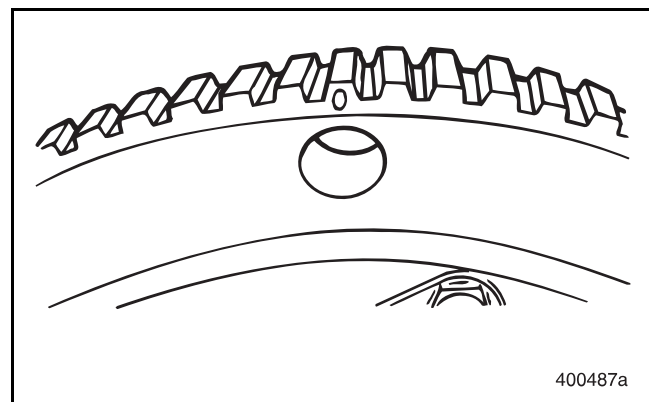


Figure 265 — Closeup of Timing Mark

6. Examine the bull gear. Note that it has two timing marks (shown at the twelve-o'clock position).

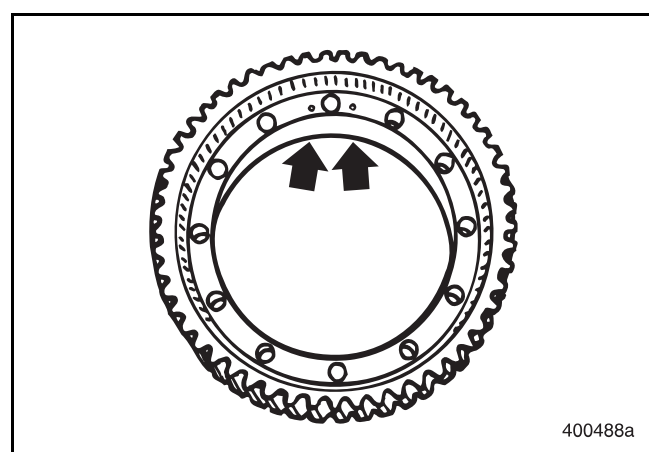


Figure 266 — Bull Gear Timing Marks



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7. Mark the bull gear tooth directly between the timing marks.

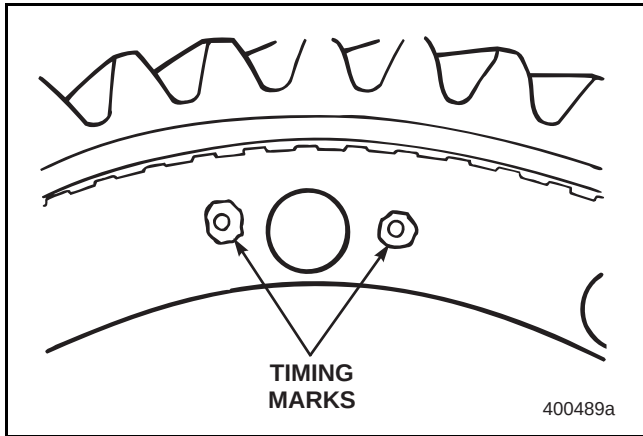


Figure 267 — Closeup of Timing Marks

8. Align the timing marks so the timing mark from the differential half is between the two bull gear timing marks. Press the splined differential power divider cage into the bull gear.

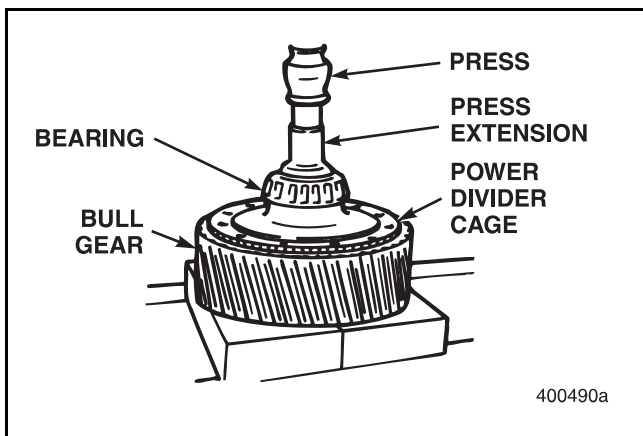


Figure 268 — Pressing Splined Power Divider Cage into Bull Gear

9. Flip over the splined differential power divider cage (now seated into the bull gear) and continue with the assembly.

10. Install the wedges with the arrow or alpha character pointed outward. Lube all parts during assembly.

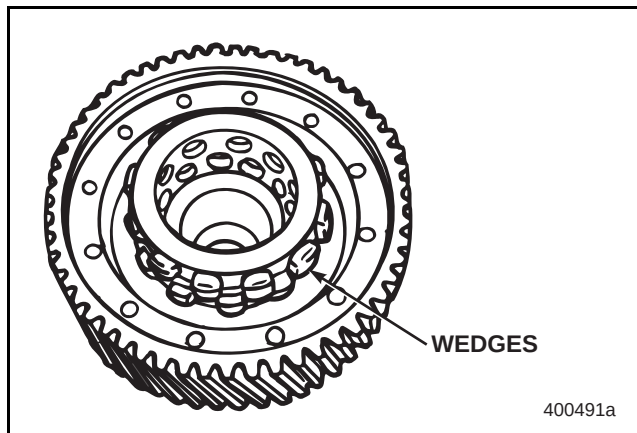


Figure 269 — Wedges Installed

NOTE

Wedges must be replaced only as sets. Never mix wedges of different sets.

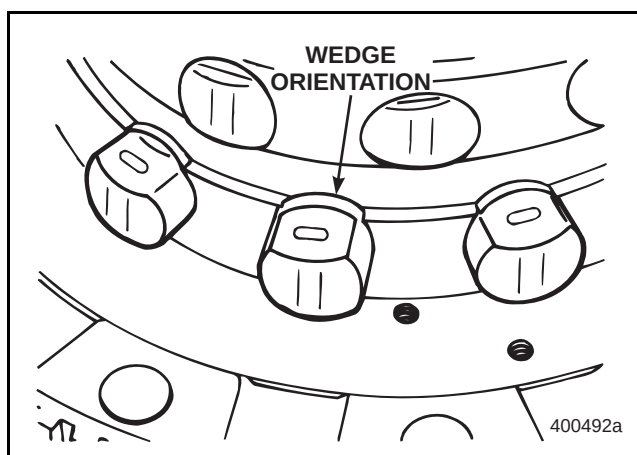


Figure 270 — Alpha Character on the Wedge Pointed Out



400 BENCH PROCEDURES

11. Dip the hub of inner cam in GO-J oil. Install the cam in the cage as shown in Figure 271.

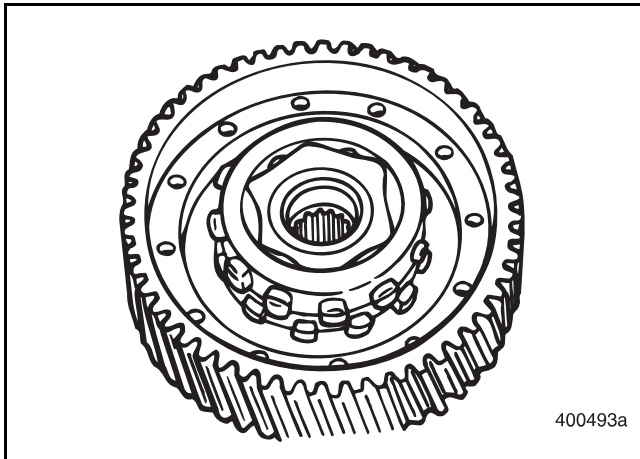


Figure 271 — Inner Cam Installed

12. With the inner cam installed, press all the driving wedges inward so they all contact the inner cam. Align the wedges for outer cam installation.
13. Install the outer cam over the wedges. Turn outer cam back and forth until cam aligns and falls in place.

WARNING

Be careful when installing the outer cam, possible subsequent personal injury can result. The outer cam can drop suddenly into place when all wedges are contacting the inner cam.

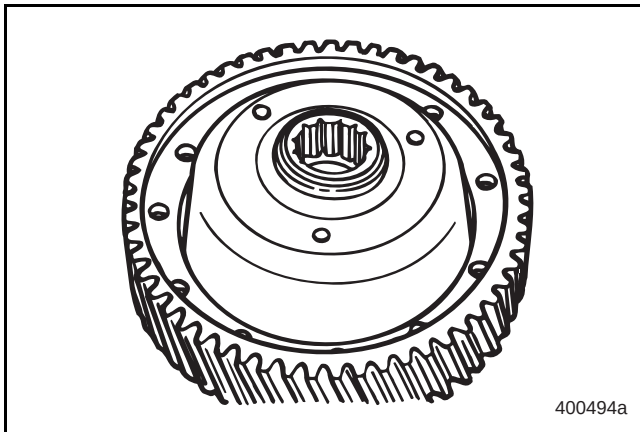


Figure 272 — Outer Cam Installed

14. Align the unsplined differential side casing with the alignment marks made on the bull gear when disassembling the power divider.

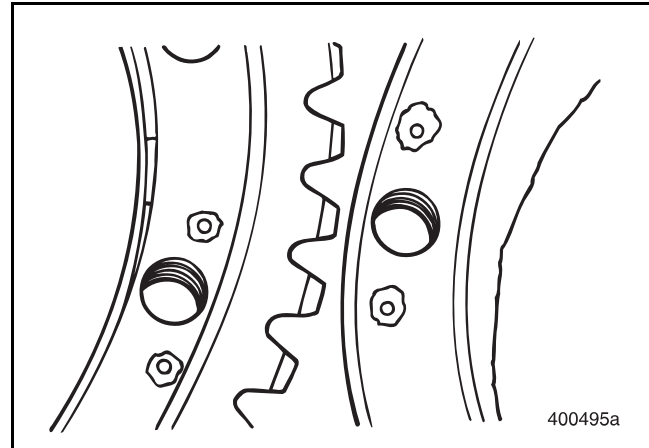


Figure 273 — Alignment Marks

15. Install the unsplined differential side casing.

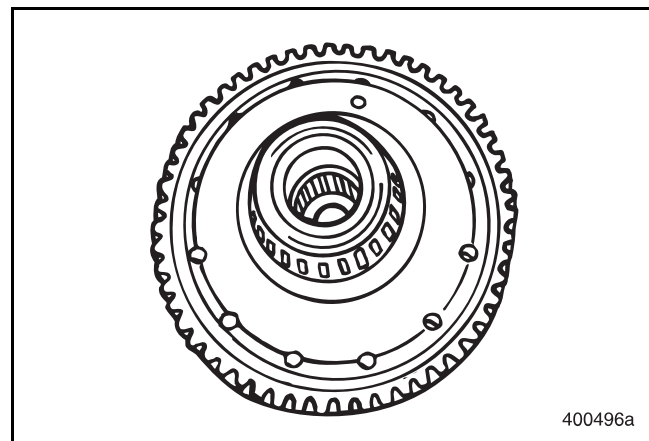


Figure 274 — Installing the Unsplined Differential Side Casing

16. Install and tighten the power-divider differential capscrews that retain the unsplined differential housing.

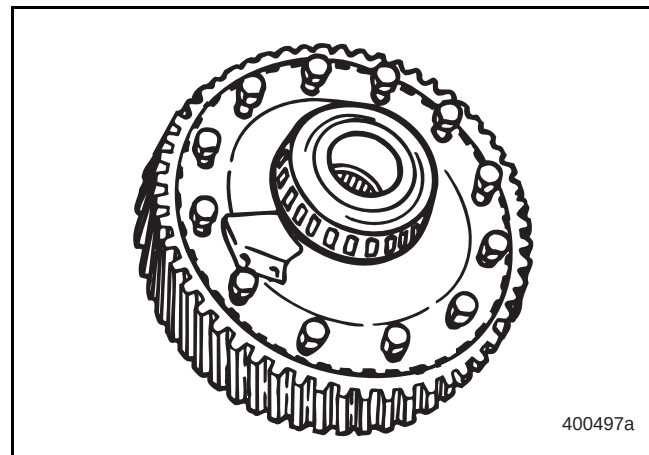


Figure 275 — Installing Capscrews



400 BENCH PROCEDURES

17. Mount the assembly in a soft-jawed vise.
18. Torque capscrews to specification.

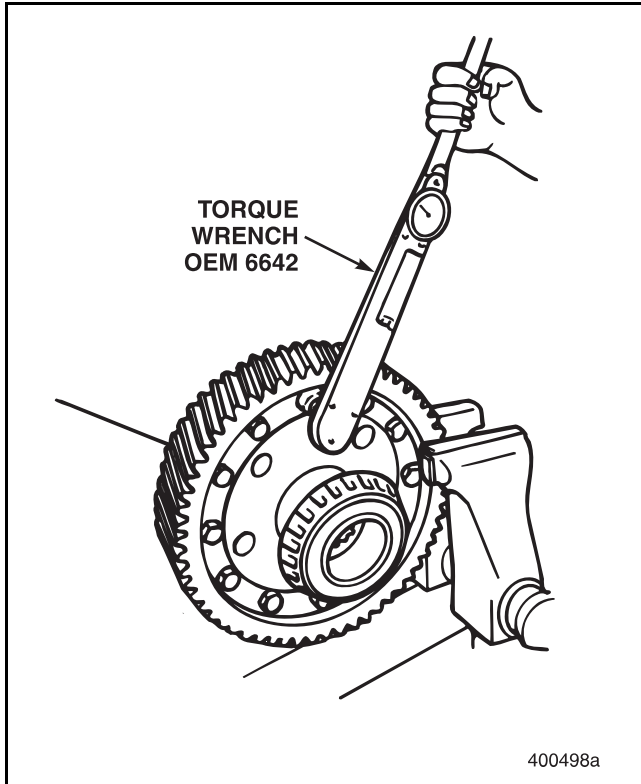


Figure 276 — Torquing Power-Divider Differential Capscrews



400 CARRIER REASSEMBLY

CARRIER REASSEMBLY



400 CARRIER REASSEMBLY

[465/475] DIFFERENTIAL INSTALLATION

NOTE

This same procedure is used when installing the inter-wheel power divider or the four-pinion type differential.

1. Install the bearing adjusting nut onto the threaded bearing cup. Tighten the nut about two turns.

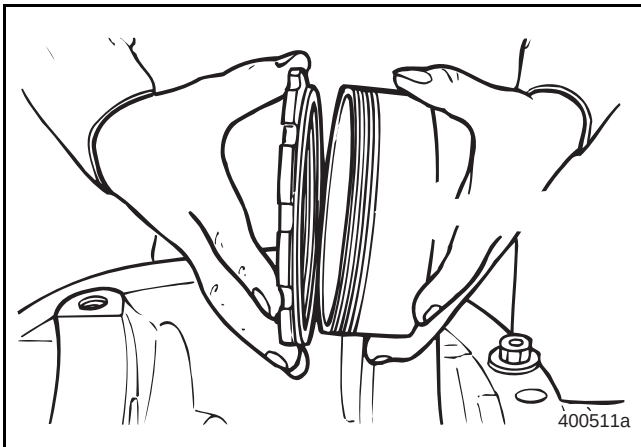


Figure 277 — Installing Adjusting Nut on the Threaded Bearing Cup

2. Use a suitable lifting device to position the differential assembly for installation into the carrier housing.
3. Lubricate the bearings with GO-J lubricant and position the bearing cups on the differential assembly.

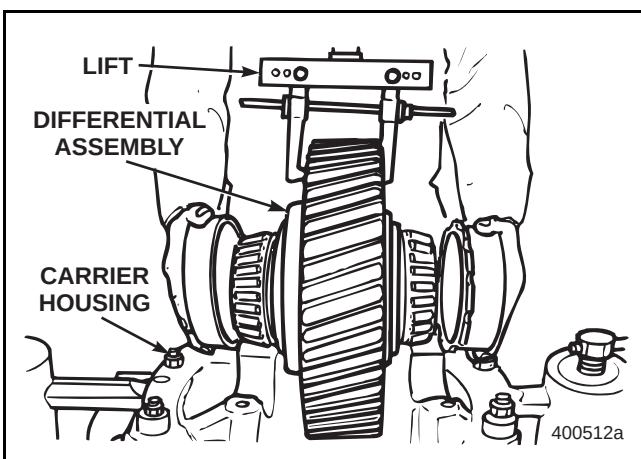


Figure 278 — Positioning Bearing Cups

4. Lower the differential assembly into the housing.
5. Seat the bearing cups on the differential bearing pedestals in the carrier housing.

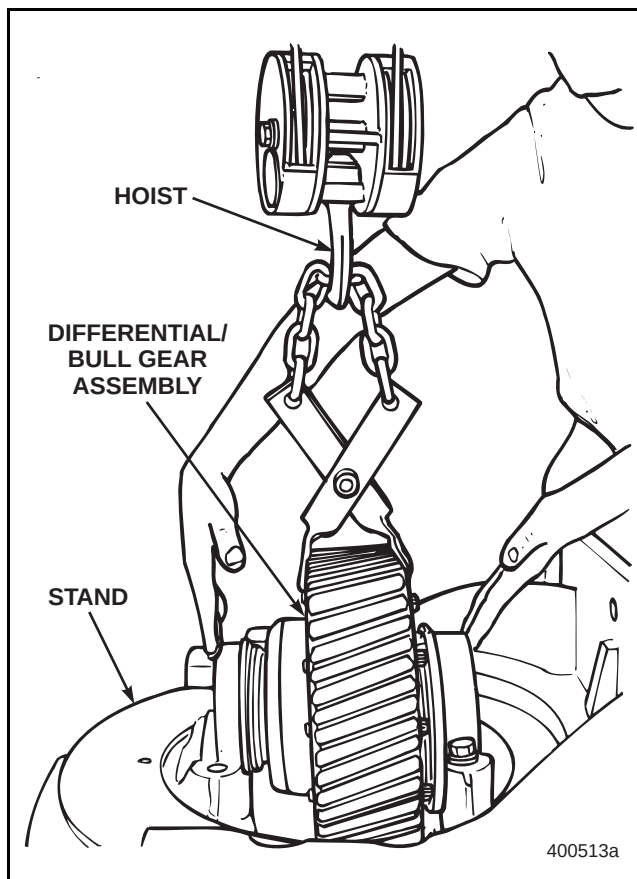


Figure 279 — Installing the Differential Assembly into the Carrier Housing



400 CARRIER REASSEMBLY

6. Align punch marks made at disassembly on the bearing caps with those on the bearing pedestals. Position the bearing caps over the bearing cups.
7. Install the bearing cap capscrew, snugly, but not too tight. This will permit bearing adjustment. Do not apply Loctite at this time.

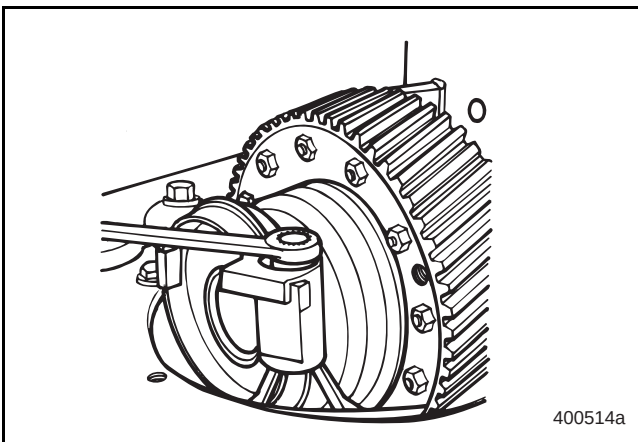


Figure 280 — Installing Bearing Caps

8. Ensure bearing caps are properly aligned.

NOTE

Lost or broken bearing caps must be replaced with a new carrier housing and bearing caps. Bearing caps and the carrier housing are machined as a set and cannot be intermixed.

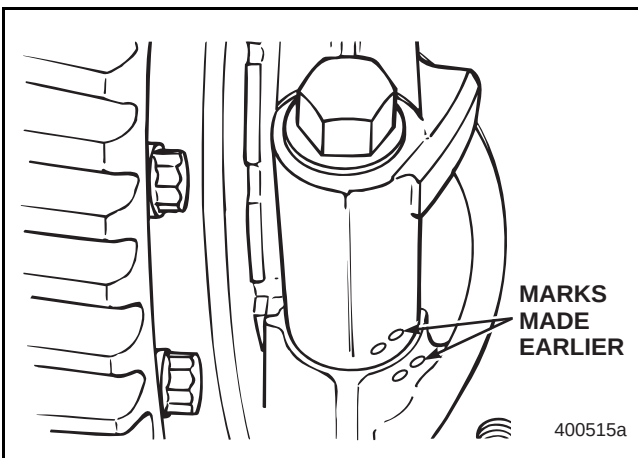


Figure 281 — Ensuring Bearing Caps Align with Mating Parts

9. Position bearing adjustment fixture J 26440 on the carrier housing.

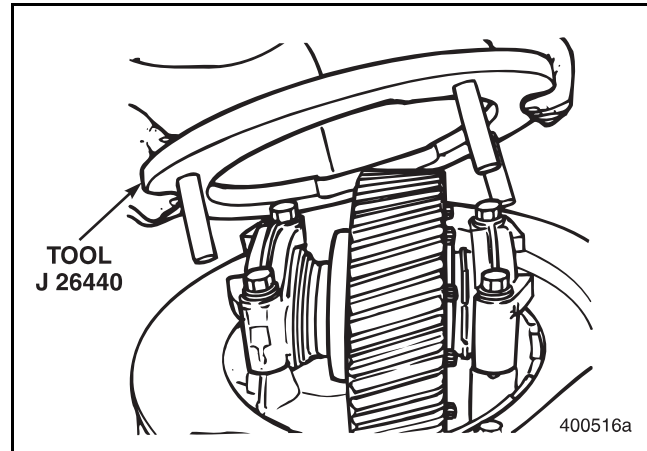


Figure 282 — Positioning the Bearing Adjustment Fixture

10. Lubricate the differential bearings with GO-J gear oil. Then, while turning the differential assembly, adjust the differential bearing nut until the bearings have a slight preload.

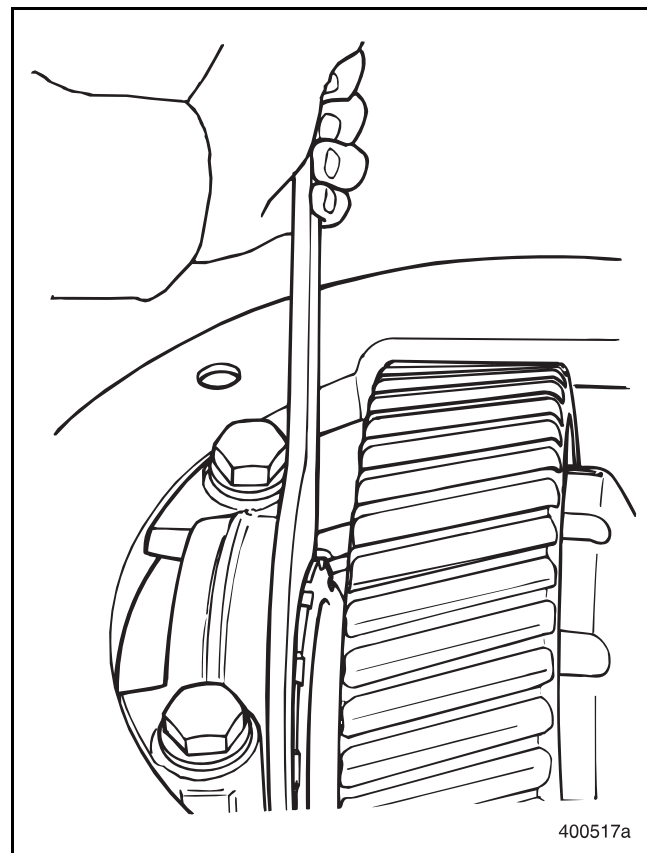


Figure 283 — Adjusting Differential Bearing Preload



400 CARRIER REASSEMBLY

11. Relieve bearing preload by hitting the bearing cap and/or bull gear with a plastic mallet while rotating the differential.

NOTE

To properly measure the bull gear drag, make sure that the helical pinion shaft has been removed. This must be done in order to ensure accurate preload (drag) measurements.

12. Readjust the differential bearing nut to create a slight preload. Repeat the procedure of adjusting preload and hitting the bearing cap and/or bull gear to relieve preload pressure, until a constant preload is maintained.

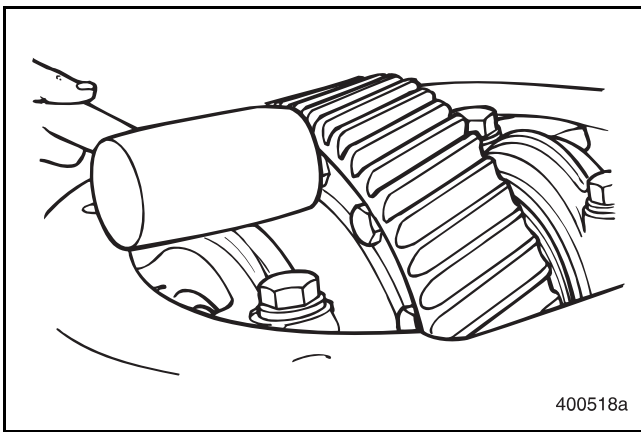


Figure 284 — Striking Bull Gear to Relieve Bearing Preload

13. Torque the bearing-cap retaining capscrews to specification.

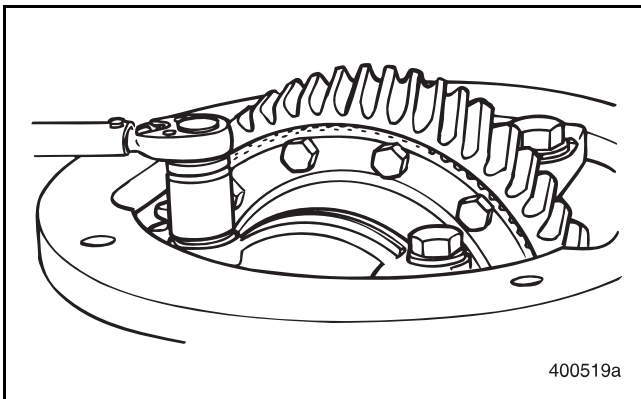


Figure 285 — Torquing Bearing Retaining-Cap Capscrews

14. Wrap a cord around the outside of the diameter of the bull gear several times.

15. Attach scale J 8129 to the cord and steadily pull on the scale until the bull gear rotates slowly and evenly. If correct, the load on the scale will read 2–3 pounds (0.9–1.3 kg).

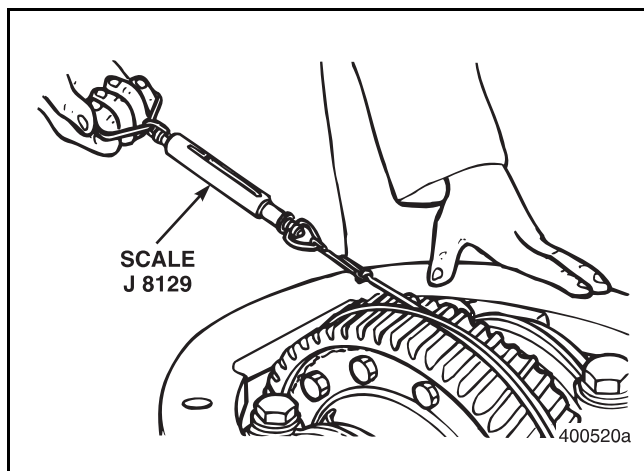


Figure 286 — Setting Differential Bearing Preload

16. If the preload is not within specifications, loosen the capscrews and turn the adjusting nut to attain the proper preload.
17. Once preload is attained, remove the bearing cap capscrews one at a time. Apply Loctite 262 to the threads and retorque to specification.
18. Check for proper alignment of the pin hole in the bearing cap and the adjusting nut. If required, tighten the bearing adjusting nut slightly, until the hole and nut are aligned to provide for installation of the lock pin. Note that it may be necessary to loosen the bearing cap capscrews to allow the adjusting nut to turn. Recheck the torque on the bearing cap capscrews.
19. Recheck the preload on differential bearings by measuring the rolling drag. Adjust as required.
20. Remove the differential adjustment fixture J 26440.
21. Install the lock pin in the bearing cap and secure it with a cotter pin.



400 CARRIER REASSEMBLY

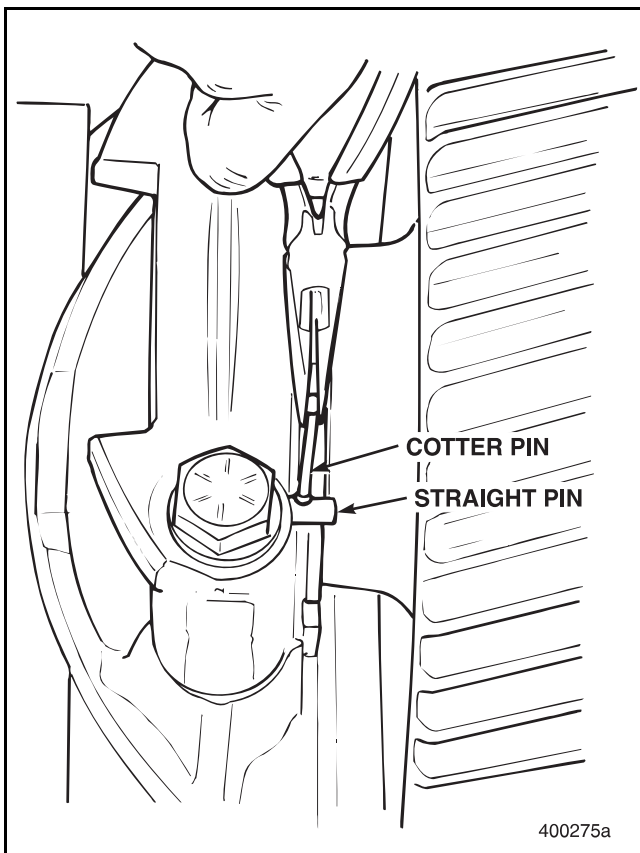


Figure 287 — Installing Cotter Pin

Bull Gear Tooth-Contact Pattern

Earlier in this procedure, the helical pinion shaft was removed and the differential was installed. Now, a measurement must be taken for the bull gear tooth-contact pattern. This requires reinstallation of the helical (spur) pinion shaft. Refer to HELICAL (SPUR) PINION SHAFT — REASSEMBLY. Torque the old capscrews so the clamp plate is tight. This ensures the correct preload on the bearings and an accurate measurement of the gear tooth patterns.

22. Temporarily install the helical (spur) pinion shaft with spacer into the carrier housing as previously outlined. Make certain to engage the helical (spur) pinion with the bull gear.
23. Install the helical-pinion shaft bearing retainer with the predetermined shim pack into the carrier housing.

CAUTION

Shim installation must not block top or bottom oil passageways.

24. Install the bearing cone onto the end of the pinion shaft. The bearing must be seated before attaching the clamp plate.

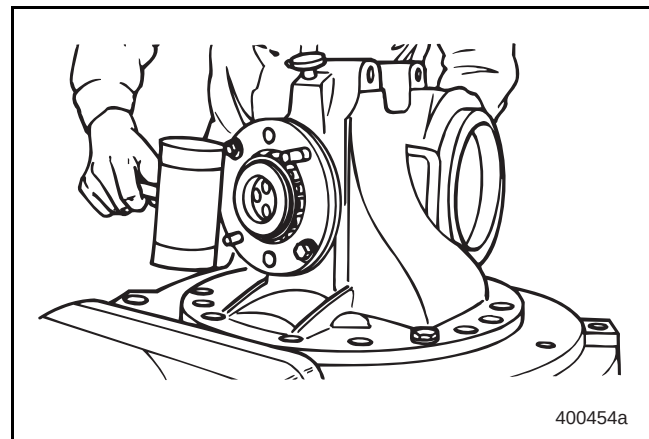


Figure 288 — Installing Bearing Cone onto Pinion Shaft

25. Attach the clamp plate and install the old clamp-plate capscrews (without Loctite). Jam the bevel gear with a pinch bar or jamming bar and torque the clamp-plate capscrews to specification.
26. Coat the bull gear and the helical pinion gear with gear-marking compound.

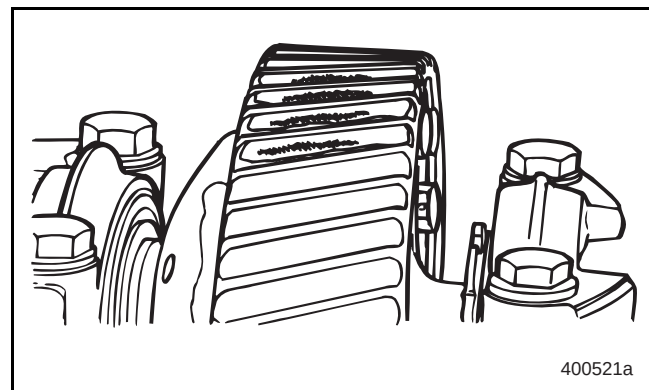


Figure 289 — Bull Gear with Gear-Marking Compound

27. Rotate the bull gear in forward and reverse directions while applying resistance to the helical pinion set to determine the tooth contact pattern. The pattern must be within the limits shown on the following Bull Gear Tooth-Contact Pattern Chart. The contact pattern is either acceptable or unacceptable, because there is no adjustment option. If the gear tooth pattern is unacceptable, replace both the bull gear and the helical pinion with its shaft.



400 CARRIER REASSEMBLY

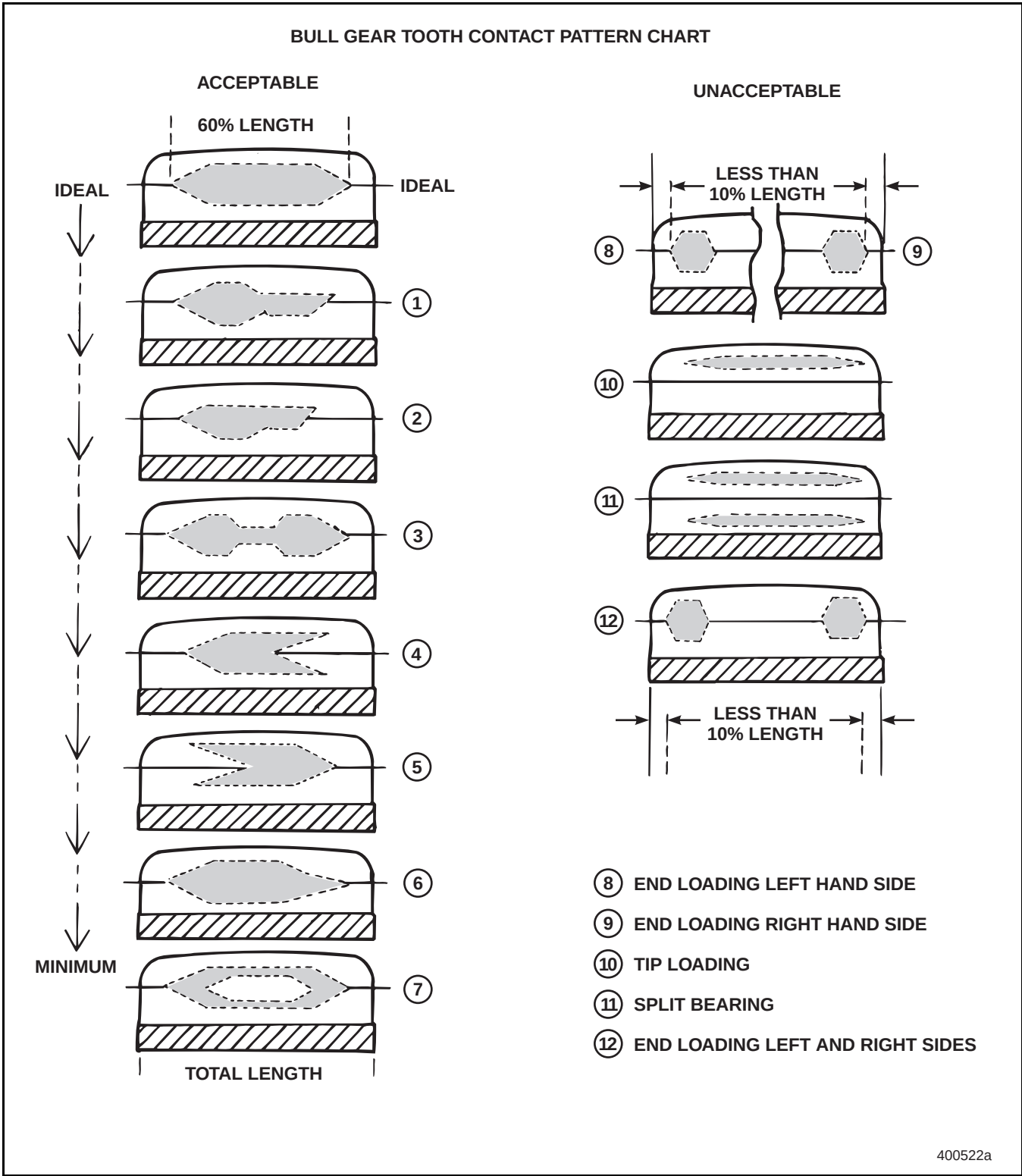


Figure 290 — Bull Gear Tooth-Contact Pattern



400 CARRIER REASSEMBLY

FINAL ASSEMBLY

Provided the instructions of this manual have been followed correctly, the differential assembly is now complete and the helical (spur) pinion shaft has been temporarily installed. The helical (spur) pinion shaft installation must be completed at this point.

28. Remove the three helical (spur) pinion-clamp plate capscrews one at a time and replace using **new** capscrews. Apply Loctite 262 to the threads and install the **new** capscrews. Torque each capscrew to specification while jamming the bevel gear with a pinch bar or jamming tool.
29. Remove the short capscrews used to temporarily retain the helical (spur) pinion-shaft assembly retainer.

NOTE

A steel-core gasket coated on both sides with foam rubber has replaced the Silastic sealer which was applied to the pinion shaft cover formerly. Use a steel-core gasket for reassembly to eliminate oil leakage.

30. Install a **new** steel-core/foam-rubber gasket onto the helical-pinion bearing retainer.

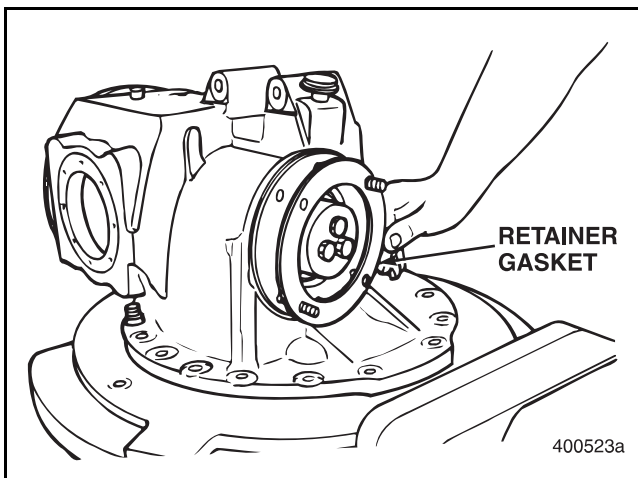


Figure 291 — Installing the Bearing Retainer Gasket

31. Install the helical-pinion bearing retainer cover.

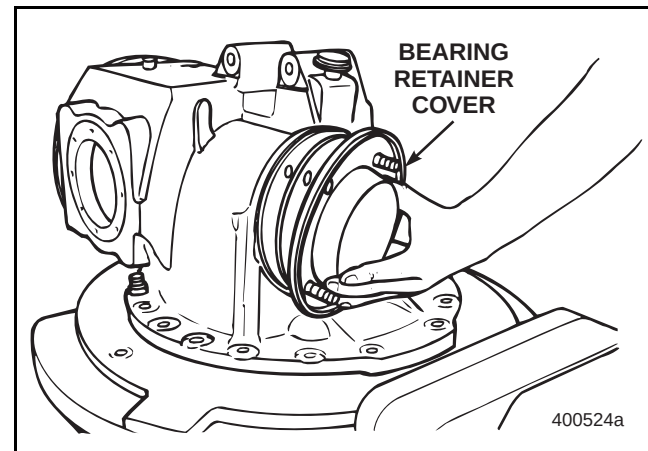


Figure 292 — Installing Helical-Pinion Bearing Retainer Cover

32. Remove the guide pins used to temporarily align the helical (spur) pinion-shaft bearing retainer assembly and use the proper self-locking capscrews to secure the cover.
33. Torque the capscrews retaining the helical pinion-shaft bearing retainer cover to specification.

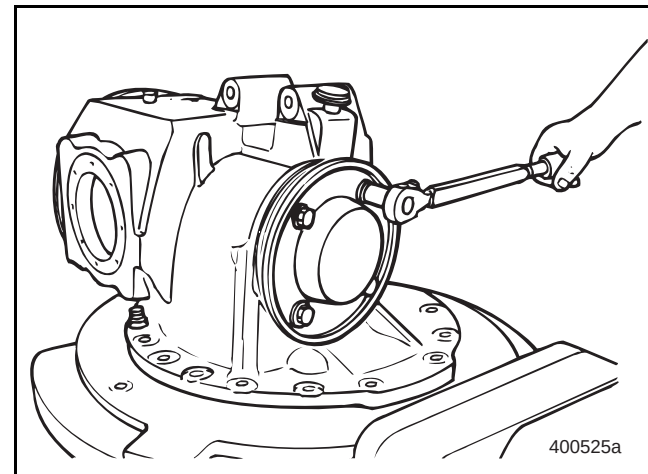


Figure 293 — Torquing Helical Pinion-Shaft Bearing Retainer Cover to Specification



400 CARRIER REASSEMBLY

Front Rear or Rear Rear Bevel Pinion Installation

34. Use the shims as determined while adjusting the bevel pinion assembly for proper tooth contact pattern and proper backlash between the gears.

CAUTION

Position the shims to align with all oil holes. Blocked oil holes will cause lubrication failure.

35. Install the bevel pinion and housing assembly onto the carrier housing. Align bevel pinion housing with oil passages.
36. Install proper self-locking capscrews into the bevel housing and torque to specification.
37. When assembling a carrier with power divider (with or without lockout), it is necessary to use an offset extension J 28506, or equivalent, with the torque wrench OEM-6642 as shown in the figure below.

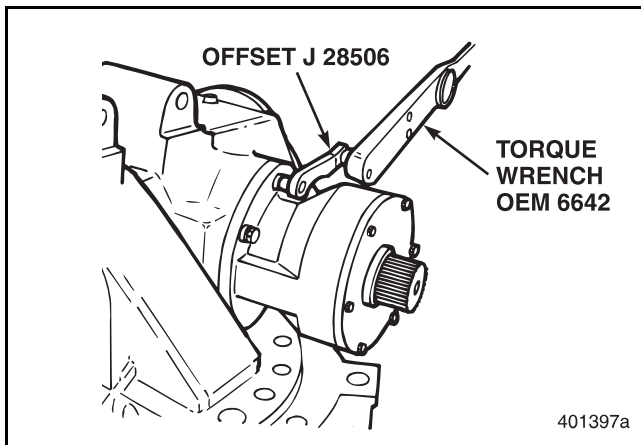


Figure 294 — Torquing Bevel Pinion Capscrews

Inter-Axle Power Divider Installation (With or Without Lockout)

38. Dip the inner cam in GO-J lubricant and position it inside the cage of the power divider. Push all the wedges in until they contact the inner cam lobes and install the inner cam. The cam will fit only one way.

NOTE

Be sure the grooves on the face of the inner cam face in toward the bevel pinion.

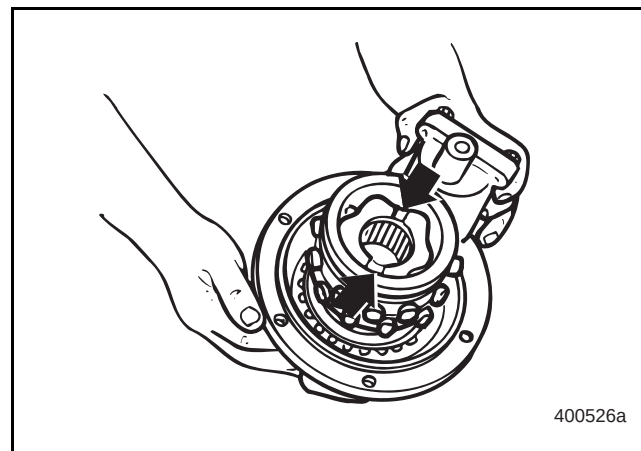


Figure 295 — Installing the Power-Divider Inner Cam

39. Install the power divider housing gasket.

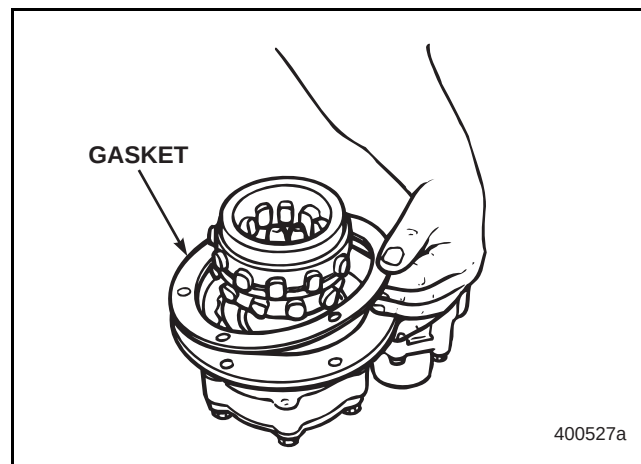


Figure 296 — Installing the Power-Divider Housing Gasket



400 CARRIER REASSEMBLY

40. Position the carrier housing in the stand so the cage assembly may be installed into the outer cam of the bevel pinion. The inner cam will be held in position by the driving wedges.
41. Install the power divider into the housing.

NOTE

The cage assembly must be perfectly centered or the wedges will hang up.

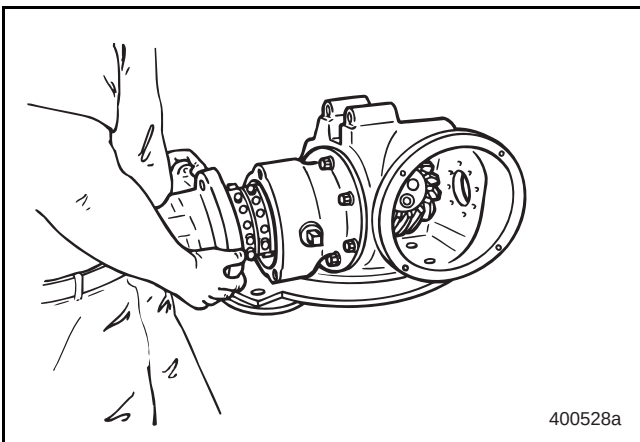


Figure 297 — Installing the Power Divider

INTER-AXLE POWER DIVIDER WITHOUT LOCKOUT ONLY

42. On inter-axle models without lockout, ensure that a new oil seal was installed in the seal cover as outlined in the INTER-AXLE POWER DIVIDER WITHOUT LOCKOUT — REASSEMBLY section.
43. Install a lightly lubricated O-ring into the groove in the oil-seal cover plate.
44. Attach the inter-axle power-divider oil seal cover over the power-divider cage bearing retainer plate.

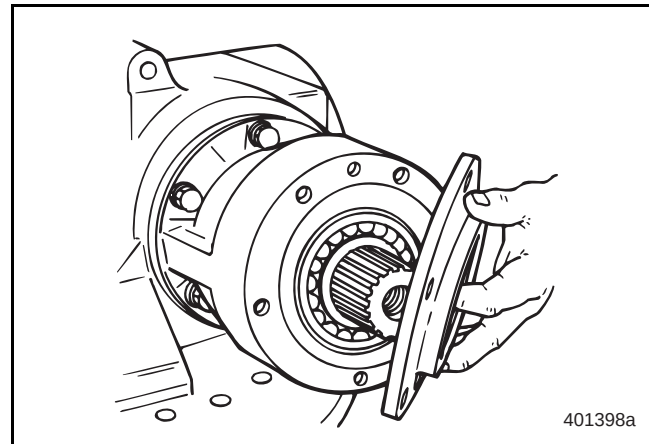


Figure 298 — Installing the Power Divider Seal Cover

45. Install the capscrews through the inter-axle power-divider oil seal cover. Torque to the correct specification.

INTER-AXLE POWER DIVIDER WITH LOCKOUT ONLY

46. Install the capscrews through the inter-axle power divider housing flange. Torque to the correct specification.

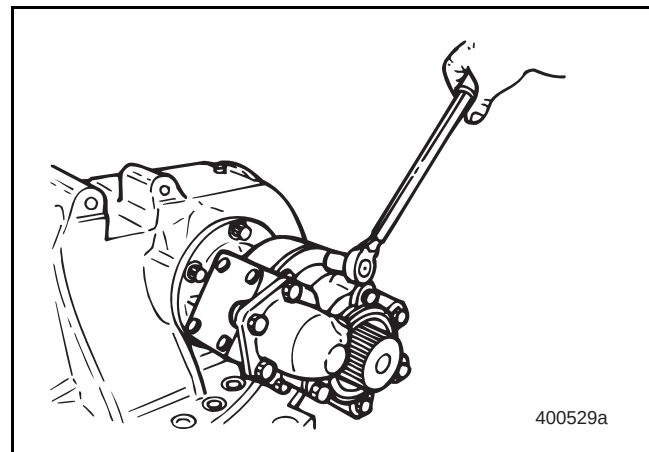


Figure 299 — Torquing Power Divider Capscrews to Specification



400 CARRIER REASSEMBLY

Inter-Axle Through Shaft Installation

47. Position the through-shaft housing gasket onto the surface of the carrier housing.

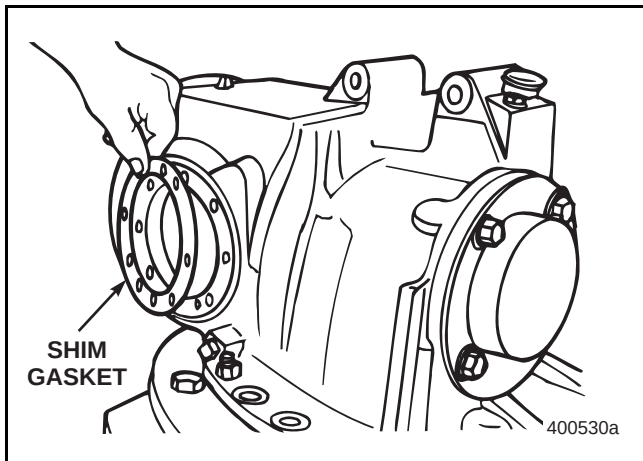


Figure 300 — Installing Through-Shaft Housing Gasket

48. Install the inter-axle through-shaft housing into the carrier housing.

CAUTION

The power divider wedges are lubricated through the through-shaft bearing retainer and the bevel pinion. When the through-shaft bearing retainer is installed, ensure that the oil inlet is on top. If the retainer is rotated so the oil inlet is not in the top position, the inter-axle power divider will be damaged because of a lack of lubricant.

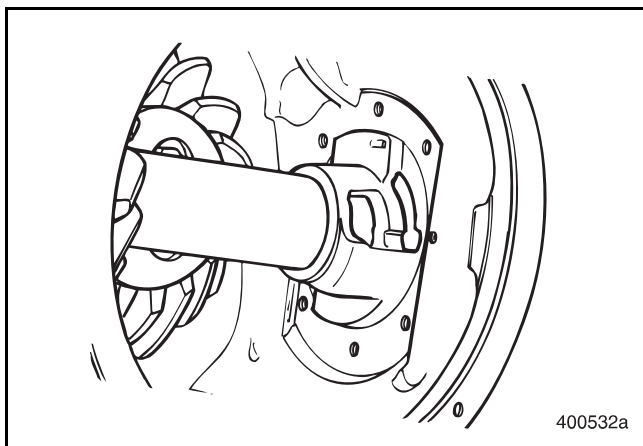


Figure 301 — Installing Inter-Axle Through-Shaft Housing

49. Lubricate the through shaft with GO-J lubricant.
50. Carefully install the through-shaft assembly, aligning the shaft splines with the internal splines of the inter-axle power divider inner cam while making certain that the oil inlet is properly positioned.
51. Ensure the through-shaft bearing is properly seated when the through shaft is installed.

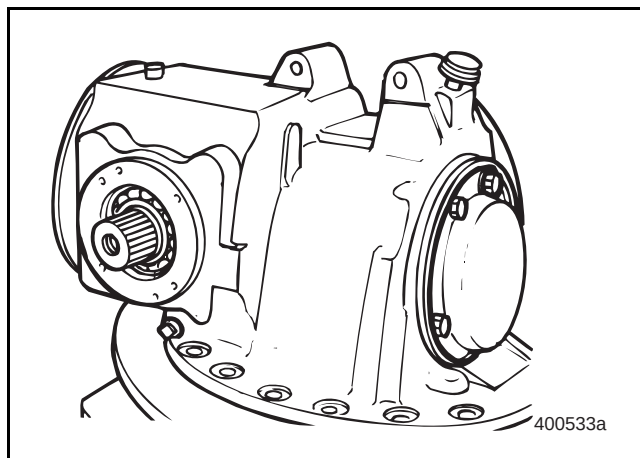


Figure 302 — Install the Through Shaft

52. Determine the proper gasket thickness for the through-shaft bearing retainer.

NOTE

The thickness of this gasket is critical because the gasket seals the joint and determines how much pressure bears on the outer bearing race to keep it from spinning.

- a. Temporarily install the retainer over the through shaft and press on it until the ridge bottoms on the outer bearing race.
- b. Using feeler gauges J 26900-8 or equivalent, measure the gap between the bearing cover and retainer flanges. Add 0.005–0.010 inch to the measured amount for proper gasket thickness. This is done to provide enough clamping force to prevent the bearing from rotating within the bearing retainer, and to provide a seal to prevent oil leakage.



400 CARRIER REASSEMBLY

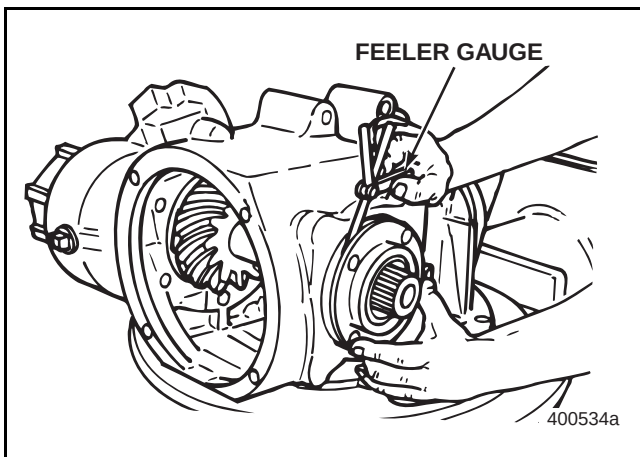


Figure 303 — Measuring Gap Between Bearing Cover and Flange

53. Align the bearing cover and install the capscrews.
54. Torque capscrews to specification.

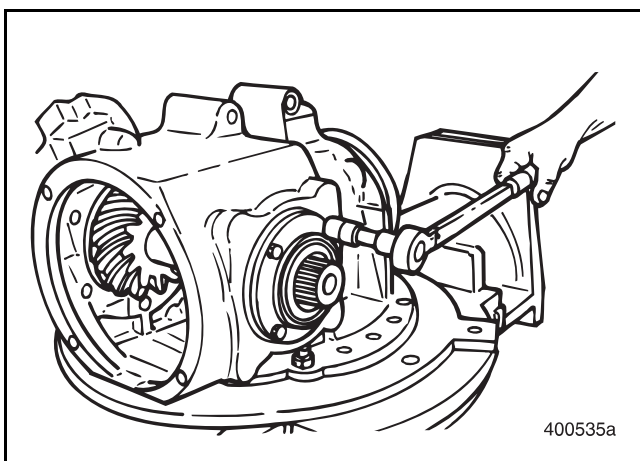


Figure 304 — Torquing Bearing Cover Capscrews to Specification

Carrier Installation into Chassis

55. If not yet installed, dip end of yokes in GO-J lubricant and position them on the input shaft of the input and through-shafts of the front rear carrier. Position the clamp plate and install the self-locking capscrews finger tight.

NOTE

Drive yokes for the 93/113 series carriers were installed in previous steps.

56. Install a holding bar on output yoke and with a socket wrench, tighten yoke self-locking cap screw to the required torque.
57. Check the carrier for free turning and proper operation of working components. If an unusual amount of bind is felt, or noise is heard, correct the cause before proceeding.
58. All units with the four-pinon type differential which are being installed into the axle housing must immediately have the differential filled with one pint of GO-J lubricant before the carrier is installed into the vehicle.
59. Apply a 1/8- to 3/16-inch continuous bead of Silastic 732 RTV sealant, or equivalent, to axle housings without provisions for a large O-ring seal prior to assembly of the carrier onto the axle housing. This includes all CRD 92/93 series carriers. The CRD 112/113 series carrier housings have a large O-ring groove. Install O-ring in the groove. Then mount the carrier. DO NOT use a sealant on carriers using an O-ring.



400 CARRIER REASSEMBLY

60. Install capscrews and washers as shown in Figures 305–307. Torque capscrews to specification.

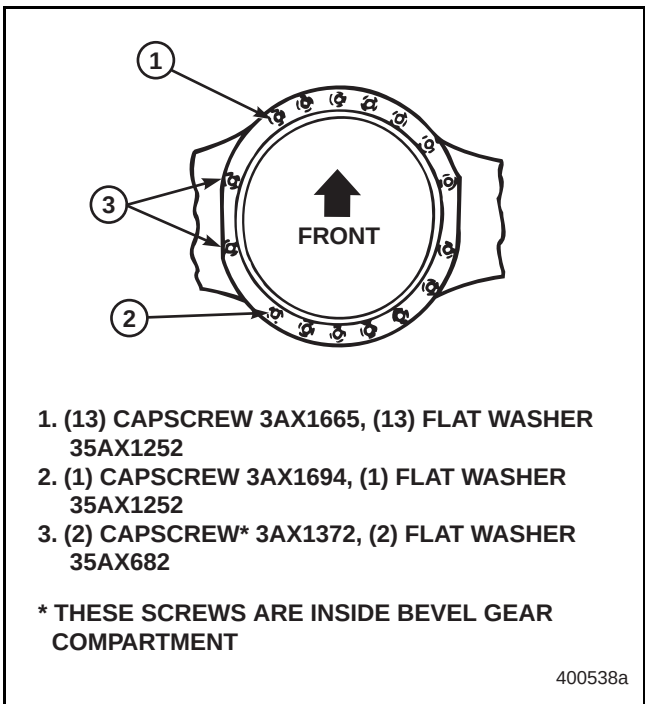


Figure 305 — Carrier Mounting Arrangement CRD 92/93

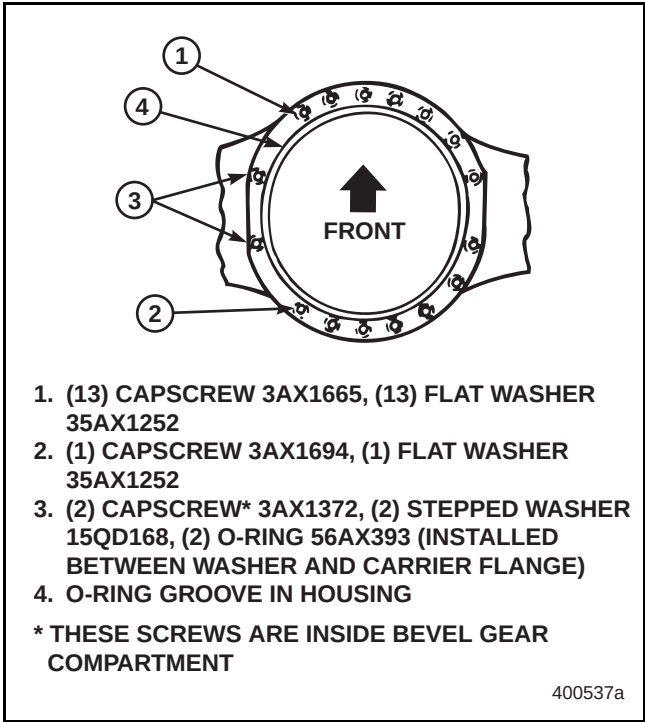


Figure 306 — Carrier Mounting Arrangement CRD 112/113

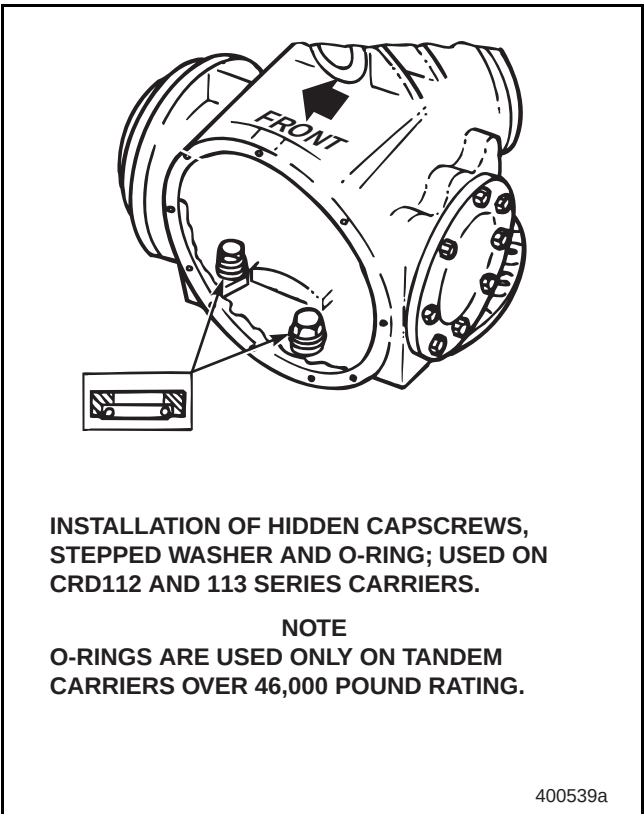


Figure 307 — Stepped Washer and O-Ring Arrangement for CRD 112/113 Series

61. Install the cover assembly. Make sure that a cover containing the oil trough with magnetic strips is used in the front rear carrier.

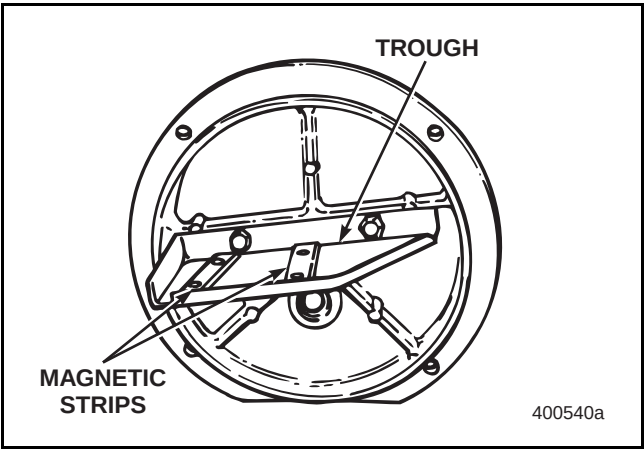


Figure 308 — Oil Trough with Magnetic Strips



400 CARRIER REASSEMBLY

CAUTION

Do not use a plain cover on a front rear axle with power divider provisions. The front rear cover for a carrier with a power divider must have a trough to feed oil to the oil pump (through shaft) to prevent damage to the power divider.

62. Ensure all plugs are installed in the assembly.

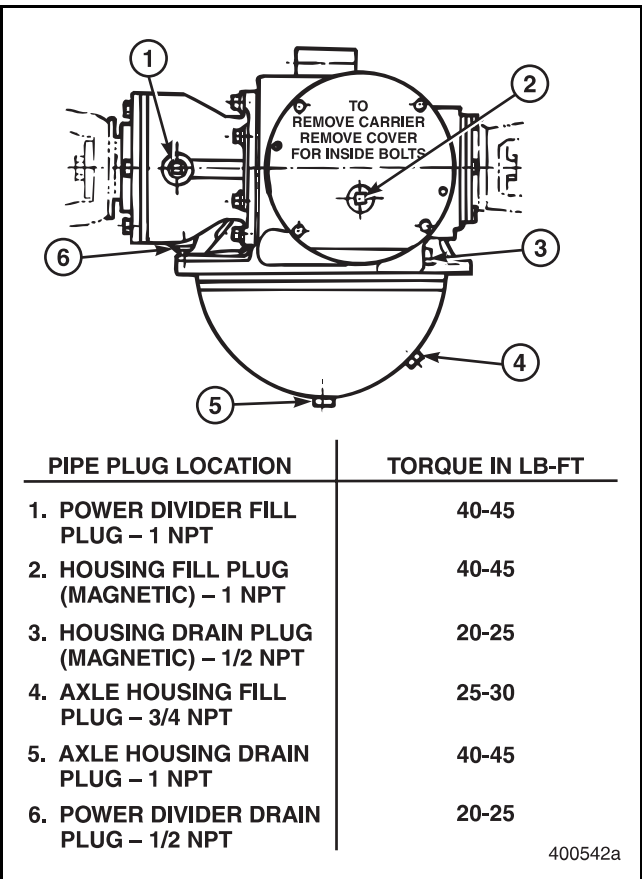


Figure 309 — Carrier and Axle Plugs

63. Torque the bevel compartment cover to specification. Refer to the CARRIER SPECIFICATIONS section.

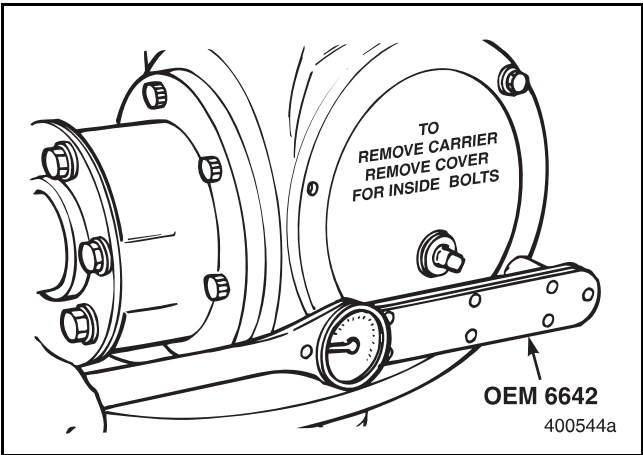


Figure 310 — Torquing Bevel Compartment Cover

64. When the rear axle is completely assembled, it is important to fill the inter-axle power divider (if equipped), and both the carrier and axle housings to their respective proper capacities. Fill the axles with GO-J (or GO-J Plus) lubricant until the oil is level with the filler plug hole. Refer to the CARRIER MAINTENANCE section of this manual.

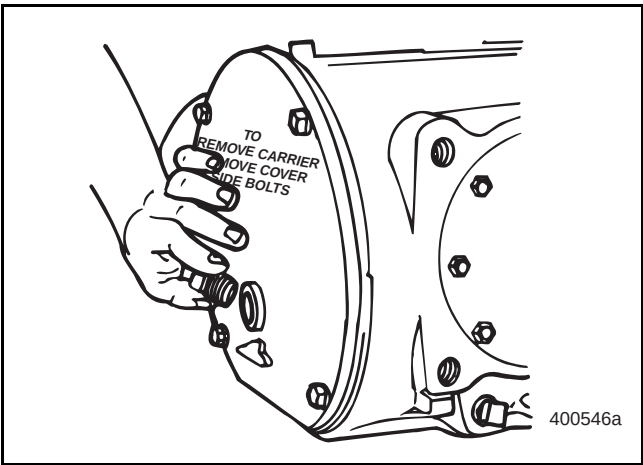
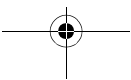
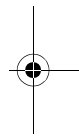
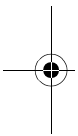


Figure 311 — Carrier Filler Plug



NOTES





400 CARRIER SPECIFICATIONS

CARRIER SPECIFICATIONS



400 CARRIER SPECIFICATIONS

FEATURES AND SPECIFICATIONS 92/93 AND 112/113 CARRIERS

Make	Mack Trucks, Inc.
Type	Dual-Reduction Carrier
Case	Cast Iron or Aluminum
Gears	Durapoid Spiral Bevel Gears, 1st Reduction Coarse-Pitch, Wide-Faced Helical Gears, 2nd Reduction
Lubrication	Splash Lubrication
Drain Plug	Magnetic
Oil Capacity, Pints	Carrier Bowl, each approximately 26 pints (12.3 Liters) Bevel Gear Compartment, each 8 pints (3.8 Liters) Inter-Axle Power Divider, 1 pint (0.5 Liter)
Note: Proper oil level is best determined by checking oil level in reference to the filler plug holes.	
Recommended SAE Grade Gear Oil	
• Mack® GO-J Specification 80W-90, 85W-140 • Mack® GO-J Plus Specification 75W-90 (Synthetic)	

401396a



400 CARRIER SPECIFICATIONS

Tandem Axle Models — With Gear-type Differentials: CRD92, CRDPC92, CRDLP92, CRD93, CRDL93, CRD93, CRDL93, CRDPC112, CRD113	Gearing: 1st Reduction: DURAPOID Spiral Bevel 2nd Reduction: Coarse Pitch Helical		
Tandem Axle Models — With Mack Power Divider Differentials: CRD921, CRDPC921, CRD931	Ratios: 3.65, 3.86, 4.17, 4.42, 4.64, 5.02, 5.32, 5.55, 5.73, 5.88, 6.06, 6.34, 6.56, 7.00, 7.49, 8.27, 9.10		
Single Axle Models — With Gear-type Differentials: CRD93A	Splines, number and type: 17, Involute		
Single Axle Models — With Mack Power Divider Differentials: CRD931A	Side Gear Splines	92/93	112/113
	Root dia. (Mean)	2.243	2.417
	I.D. (Mean)	2.051	2.227
	Axle Shaft Splines		
	O.D. (Mean)	2.186	2.373
	Root dia. (Mean)	2.012	2.166
Type: Top-Mounted, Dual Reduction			
Dimensions and Fits (All dimensions are in inches except where otherwise stated)			
Inter-Axle Power Divider:	Minimum	Maximum	
Wedges Wedges MUST be used in sets of 24 having length within 0.002 inch and within the length dimension, NEVER "BREAK SETS"			
Cams, Male, distance across any two alternate lobes	2.808	2.814	
Female, distance across any two alternate recesses	4.746	4.758	
Air-Actuated Inter-Axle Power Divider Lockout:			
Shifter Fork and Clutch, Side Clearance	0.005	0.020	
Air-Shift Piston Return Spring, free height 3-9/16	—	—	
Test at 2-inch height	180 lb.	220 lb.	
4-Pinion Closed-Type Differential:			
Pinion Bore, finished I.D. (steel-on-steel)	1.256	1.259	
Spider Leg, diameter	1.248	1.249	
Spider-to-Pinion Bore, clearance	0.007	0.011	
Pinion Thrust Washer, thickness	0.064	0.066	
Side Gear Thrust Washer, thickness	0.092	0.094	
Side Gear Hub and Casing, clearance	0.050 nominal		

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NOTES



400 BEARNG ADJUSTMENTS & TORQUE CHART

BEARING ADJUSTMENTS & TORQUE CHART



400 BEARING ADJUSTMENTS & TORQUE CHART

STEP NUMBER 1 — PRELOAD PINION BEARINGS

1. ASSEMBLE PINION AND BEARINGS IN HOUSING OMITTING BEARING COVER AND DRIVE YOKE OR FLANGE.
2. LUBRICATE BEARINGS WITH GO-J OIL AND PLACE ASSEMBLY ON THE PRESS.
3. APPLY 20,000 POUND LOAD TO BEARING CONES.
- X** 4. WRAP STRING AROUND HOUSING AT POINT **(X)**; ATTACH A SCALE TO LOOPED FREE END OF STRING. WITH A STEADY PULL, SLOWLY ROTATE THE HOUSING. AT THE SAME TIME, MEASURE THE ROLLING DRAG. IT MUST BE WITHIN 3-6 POUNDS OF PULL FOR NEW BEARINGS. USED BEARINGS REQUIRE A PULL OF 2-4 POUNDS. IF NECESSARY, ADJUST THE BEARING SPACER **(A)**. CONSULT THE SPACER CHART FOR AVAILABLE SIZES.
5. FINISH THE ASSEMBLY OF THE PINION AND ESTABLISH THE THICKNESS OF THE SHIM PACK **(B)** USING EXISTING SHIM PACK AS A GUIDE. TEMPORARILY REMOVE PINION HOUSING AND SHIMS, THEN PROCEED TO STEP NUMBER 2.

STEP NUMBER 2 — PRELOAD HELICAL PINION SHAFT BEARINGS

1. ASSEMBLE HELICAL PINION WITH BEARINGS IN BEARING RETAINER OMITTING CLAMP PLATES AND BEVEL GEAR.
2. LUBRICATE BEARINGS WITH GO-J OIL AND POSITION ASSEMBLY ON THE PRESS TABLE.
3. APPLY 20,000 POUND LOAD TO BEARING CONES.
- Y** 4. WITH STRING WRAPPED AROUND THE RETAINER PILOT AT POINT **(Y)**, ADJUST THICKNESS OF SPACER **(C)** UNTIL A ROLLING DRAG OF 3 TO 6 POUNDS OF PULL IS OBTAINED FOR NEW BEARINGS. USED BEARINGS REQUIRE A PULL OF 2-4 POUNDS.
5. PRESS THE BEVEL GEAR ON THE PINION SHAFT. INSTALL RETAINER AND PINION ASSEMBLY IN THE CARRIER HOUSING. INSTALL BEVEL PINION IN CARRIER HOUSING AND ADJUST SHIM PACKS **(B)** AND **(D)** AS REQUIRED TO OBTAIN CORRECT GEAR TOOTH CONTACT PATTERN.
6. REMOVE THE BEVEL PINION AND HELICAL PINION FROM THE CARRIER HOUSING FOR STEP NUMBER 3.

STEP NUMBER 3 — PRELOAD DIFFERENTIAL BEARINGS

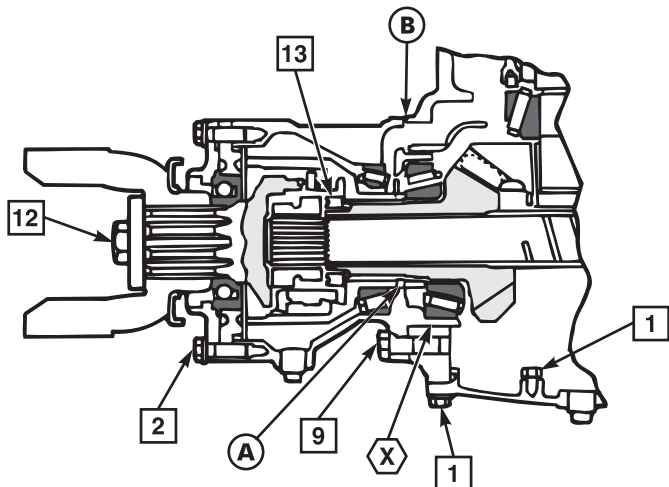
1. ASSEMBLE DIFFERENTIAL COMPLETELY AND INSTALL IN THE CARRIER HOUSING WITH PEDESTAL CAPSCREWS FINGERTIGHT.
2. LUBRICATE BEARINGS **(Z)** WITH GO-J OIL. INSTALL DIFFERENTIAL BEARING ADJUSTMENT FIXTURE, J 26440, ON THE BEARING CAP LUGS.
- Z** 3. WRAP A STRING AROUND THE BULL GEAR TEETH SEVERAL TIMES. ATTACH A SCALE AND SLOWLY ROTATE THE ASSEMBLY. TIGHTEN THE ADJUSTING NUT **(E)** UNTIL A ROLLING DRAG OF 2 TO 3 POUNDS OF PULL IS REQUIRED TO ROTATE THE ASSEMBLY.
4. TIGHTEN PEDESTAL BEARINGS AND CAPSCREW **[11]** TO THE SPECIFIED TORQUE. THEN RECHECK ROLLING DRAG.
5. IF CORRECT, REMOVE ADJUSTMENT FIXTURE AND COMPLETE THE ASSEMBLY OF THE CARRIER.
6. TEMPORARILY INSTALL HELICAL OR SPUR PINION SHAFT. CHECK TOOTH CONTACT PATTERN. IF CORRECT, COMPLETE HELICAL (SPUR) PINION SHAFT ASSEMBLY, INSTALL BEVEL PINION ASSEMBLY AND COMPLETE FINAL ASSEMBLY.

NOTE: NOTATIONS "A-B-C-D" ARE DESCRIBED ON PAGE 125.

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400 BEARING ADJUSTMENTS & TORQUE CHART



CRD 92/112 — FORWARD TANDEM CARRIER WITH INTER-AXLE POWER DIVIDER WITHOUT AIR-ACTUATED LOCKOUT

A TWO (IN COMBINATION) BEARING CONE SPACERS ARE AVAILABLE TO SERVICE SINGLE SPACER FOR THE BEVEL PINION SHAFT.

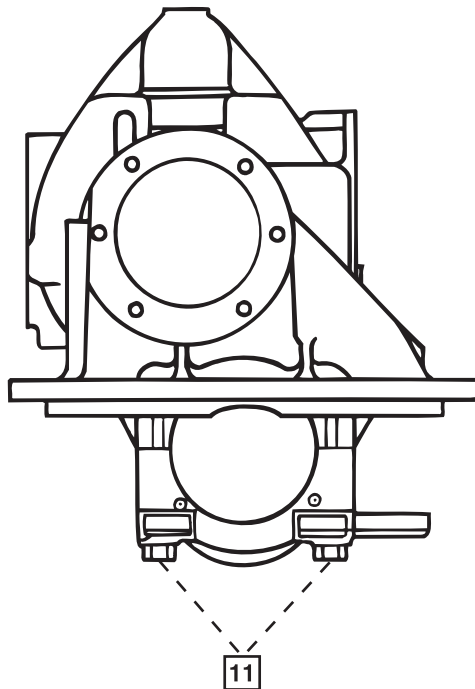
B **GEAR-MOUNTING ADJUSTMENT SHIMS**
51KH 263A P10 (0.010 INCH)
51KH 263A P12 (0.012 INCH)
51KH 263A P15 (0.015 INCH)

USE AS REQUIRED

C TWO (IN COMBINATION) BEARING CONE SPACERS ARE AVAILABLE TO SERVICE SINGLE SPACER FOR THE HELICAL (SPUR) PINION SHAFT.

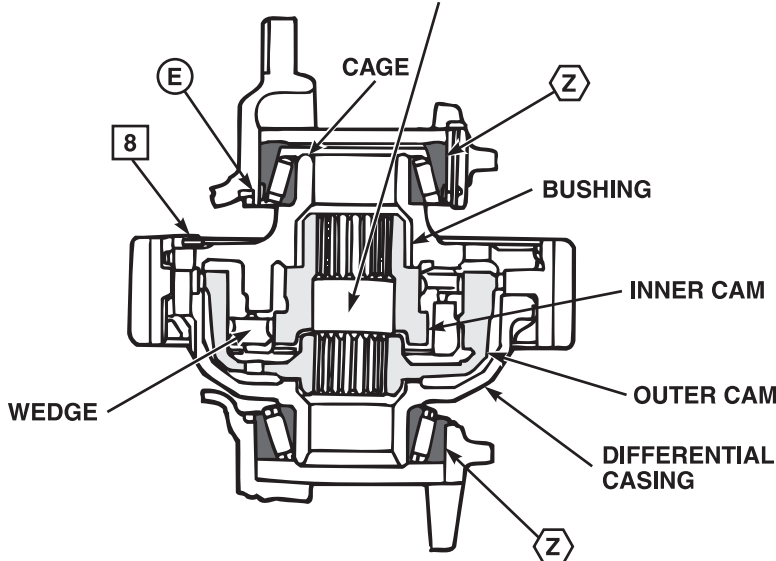
D **PINION-MOUNTING ADJUSTMENT SHIMS**
51 KH 264A P10 (0.010 INCH)
51 KH 264A P12 (0.012 INCH)
51 KH 264A P15 (0.015 INCH)

USE AS REQUIRED



CRD 92/93 AND 112/113 — DIFFERENTIAL BEARING CAP CAPSCREWS

IMPORTANT: NEW AND OVERHAULED DIFFERENTIALS MUST BE FILLED WITH ONE PINT OF GEAR OIL BEFORE ASSEMBLY INTO BANJO.



CRD 92/93 AND 112/113 — DIFFERENTIAL (INTER-WHEEL) POWER DIVIDER

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400 BEARING ADJUSTMENTS & TORQUE CHART

TORQUE LIMIT CHART			
FASTENER			TORQUE IN Lb-ft
LOCATION	SIZE	GRADE	LUBRICATED
1	3/8 – 16UNC	5	23 ± 2
2	7/16 – 14UNC	5	35 ± 4
3	7/16 – 20UNC	5	40 ± 4
4	1/2 – 20UNF	5	65 ± 6
5	1/2 – 20UNF	8	90 ± 9
6	1/2 – 13UNC	5	55 ± 6
7	1/2 – 20UNF	5	65 ± 6
8	9/16 – 18UNF	5	90 ± 9
9	5/8 – 11UNC	8	170 ± 18
10	5/8 – 18UNF	8	180 ± 18
11	3/4 – 10UNC	8	280 ± 30
12	7/8 – 14UNF	8	550 ± 50
13 *	2-3/8 – 12UN	*	1400 ± 100
14	1/2 – NPT	PIPE PLUG	20 – 25
15	1 – NPT	PIPE PLUG	40 – 45
CARRIER-TO-AXLE HOUSING MOUNTING BOLTS			
NOT SHOWN	5/8 – 18	5	155 ± 15

* AFTER ADJUSTMENT OF BEARING PRELOAD SPACER THICKNESS AT (A) TIGHTEN NUT TO 1400 ± 100 LBS-FT TORQUE. USE LOCTITE 262 ON THREADS OF BEVEL PINION GEAR.

NOTE: NOTATIONS “A-B-C-D” ARE DESCRIBED ON PAGE 125. NOTATIONS “X-Y-Z” ARE DESCRIBED ON PAGE 124.

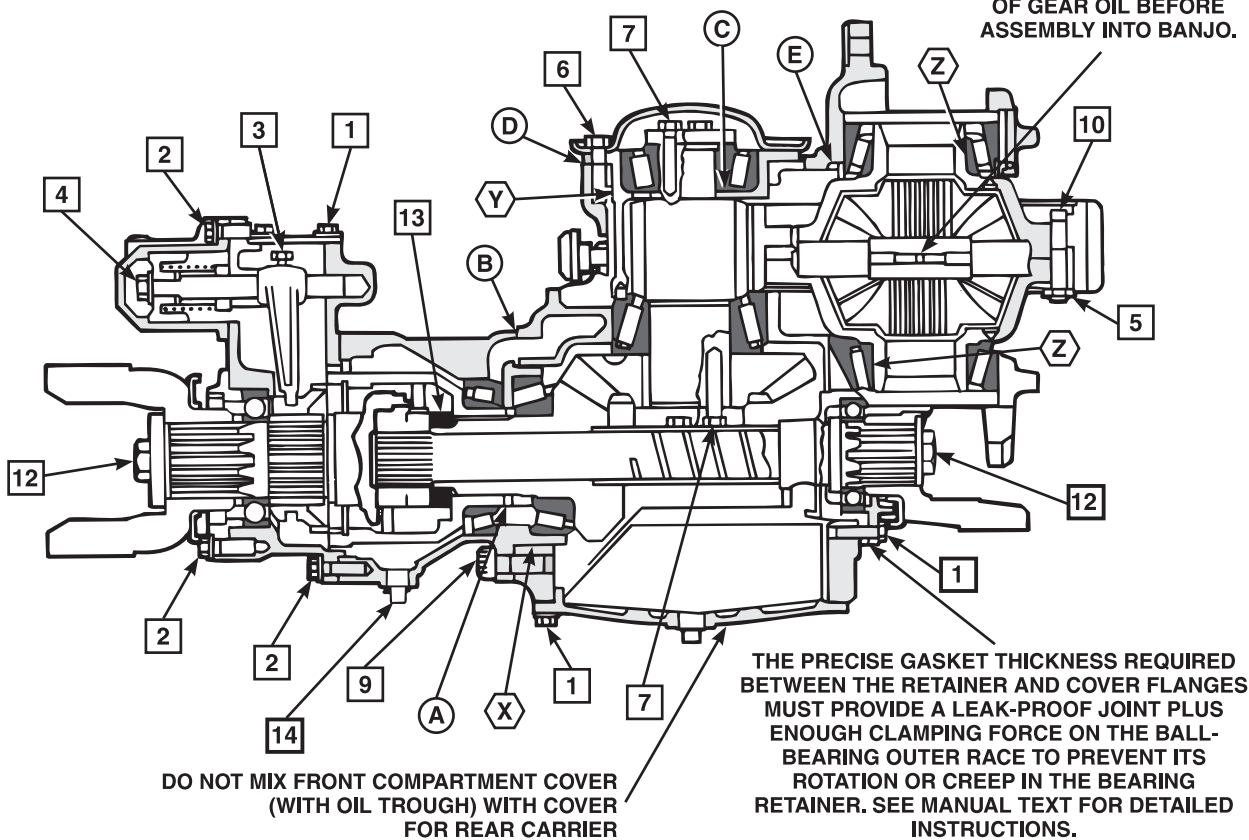
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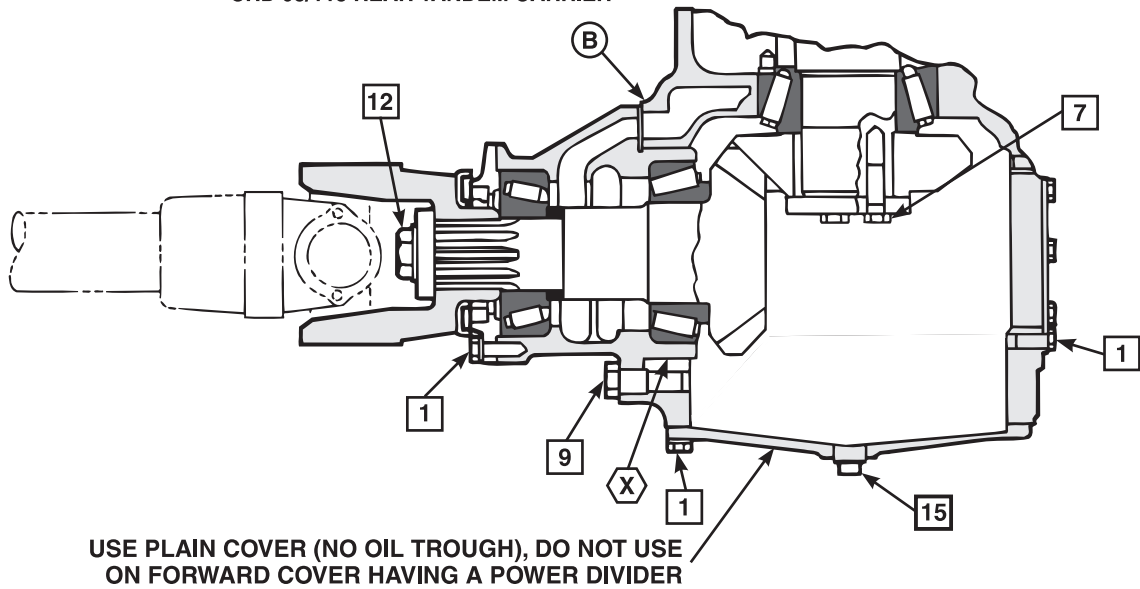
400 BEARING ADJUSTMENTS & TORQUE CHART

CRD 92/112 SERIES FORWARD TANDEM CARRIER WITH
INTER-AXLE POWER DIVIDER AIR-ACTUATED LOCKOUT

IMPORTANT:
NEW AND OVERHAULED
DIFFERENTIALS MUST BE
FILLED WITH ONE PINT
OF GEAR OIL BEFORE
ASSEMBLY INTO BANJO.



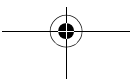
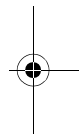
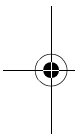
CRD 93/113 REAR TANDEM CARRIER



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NOTES





400 SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS AND EQUIPMENT



400 SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS CHART

Tool Number	Description
J 26437	WRENCH, Differential Bearing Adjusting Nut
J 26440	FIXTURE, Differential Bearing Adjustment
J 8129	SCALE, Spring Tension
J 3409-D	STAND, Carrier Repair
J 29327	ADAPTER, Torque Wrench for torquing capscrew inside carrier housing when mounting to axle housing.
J 28506	ADAPTER, Torque Wrench Bevel Pinion Housing to Carrier Housing
J 33107	FIXTURE, Bevel Pinion Bearing Nut
J 38585	ADAPTER, Capscrew
J 26900-8	SET, Feeler Gauge
J 28721-906	WRENCH, 3" Socket
J 39477-1	PULLER, Bar Type
OEM 6642	WRENCH, Torque (Dial Type)
OEM 6107	MULTIPLIER, Torque
The above listed tools may be obtained from: KENT-MOORE O.E. TOOL AND EQUIPMENT GROUP SPX CORPORATION 28635 Mound Road Warren, Michigan 48092	
S 574	ADAPTER RING, Tapered Roller Bearing Puller
S 573	ADAPTER RING, Tapered Roller Bearing Puller
S 574D	SEGMENT, Adapter Ring, Bevel Pinion Shaft, Rear
S 574E	SEGMENT, Adapter Ring, Pinion Shaft, L.H.
S 573A	SEGMENT, Adapter Ring, Pinion Shaft, R.H.
S 574C	SEGMENT, Adapter Ring, Differential and Differential Power Divider, L.H. and R.H.
The above listed tools may be obtained from: Shel's Supplies and Equipment Company 496 Orange Avenue West Haven, CT 06516	

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400 SPECIAL TOOLS AND EQUIPMENT

Using Adapters/Extensions with Torque Wrenches

Some screws have limited wrench clearance or are otherwise difficult to access. Use Kent-Moore special offset wrench J 29327 for this purpose. This wrench has a 1/2-inch square drive end and a 15/16-inch wrench end. It will service CRD 92, 93, 112, and 113 series carriers.

For accurate torque readings, use a dial-indicator type rather than the click-type torque wrench. Click-type torque wrenches are accurate only when the point or pull remains at the center of the hand grip.

A dial-indicator type torque wrench can be used accurately, with or without an extension, as long as the force is applied anywhere along the handle or the extension. Do not use a handle extension with the click-type torque wrench, unless it is designed and calibrated specifically for that purpose.

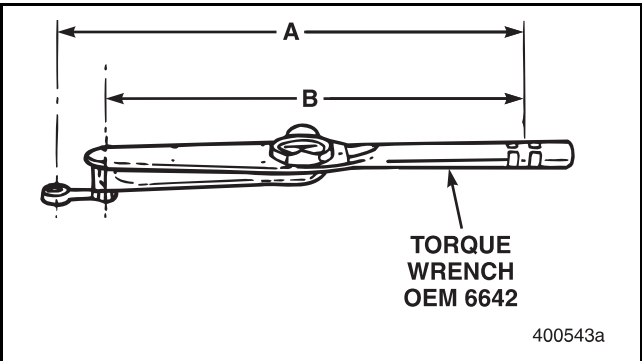


Figure 312 — Dial-Indicator Type Torque Wrench with Adapter

When an adapter is attached to the square drive end of a dial-indicator type torque wrench, the dial reading (compared to the actual torque applied) will be affected if the leverage length of the torque wrench is increased. A correction factor is then needed to achieve an accurate dial reading. Obtain the correction factor as follows:

Divide the total length "A" by the torque wrench length "B":

$$\begin{aligned} \text{Total Length "A"} &= 24" \\ \text{Total Wrench Length "B"} &= 12" \\ A/B &= 24/12 = 2 \text{ (Quotient)} \end{aligned}$$

Multiply the dial reading by the quotient found above to determine the torque at the end of the adapter:

$$\begin{aligned} \text{Dial Reading} &= 50 \text{ lbs.} \\ \text{Quotient} &= 2 \\ \text{Torque at End of Adapter} &= 50 \times 2 = 100 \text{ lbs.} \end{aligned}$$

If the required torque is known, divide by the quotient to determine what the torque reading should be:

$$\begin{aligned} \text{Required Torque} &= 100 \text{ lbs.} \\ \text{Quotient} &= 2 \\ \text{Desired Torque Reading} &= 100/2 = 50 \text{ lbs.} \end{aligned}$$



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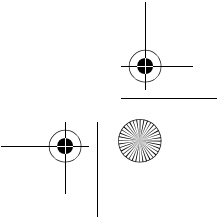
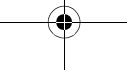
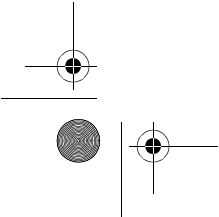
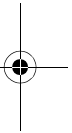
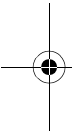
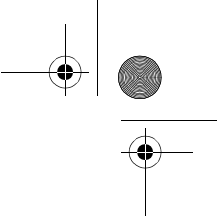
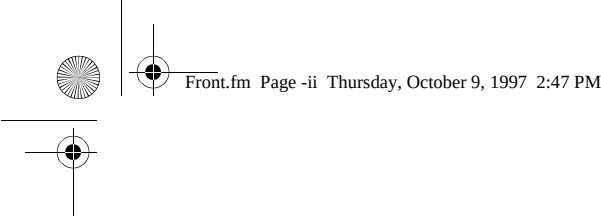


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**MACK DUAL
REDUCTION**

**TANDEM
CARRIER**

92/93 AND 112/113 SERIES

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