



# SERVICE MANUAL

Jeep Grand Cherokee WJ 44-4

X5001-CVSP  
August 2002



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## Axle Teardown and Rebuild

### Getting Started

**WARNING** Under no circumstances should individuals attempt to perform axle service and/or maintenance procedures for which they have not been trained or do not have the proper tools and equipment.

1. **ALWAYS** wear safety glasses that meet OSHA requirements when performing maintenance or service. Failure to wear safety glasses can result in personal injury and/or partial or complete vision loss.
2. **ALWAYS** be careful handling gears or other sharp components, so you do not cut your hands.
3. **ALWAYS** be sure to follow torque specifications carefully. Failure to do so may lead to premature component failure or damage to other vehicle components.

### Introduction



Figure 1

Proper care during the teardown and rebuild of the WJ44-4 (Figure 1) is critical to improved service as well as customer satisfaction.

In addition, failure analysis is an important component of the entire procedure. First, a thorough failure analysis of the axle and axle components must be completed to determine the cause of failure.

This will help determine what parts can be saved and how the axle should be rebuilt.

### Carrier Disassembly

1. Remove the cover bolts and use a rubber mallet to remove the cover plate (Figure 2).

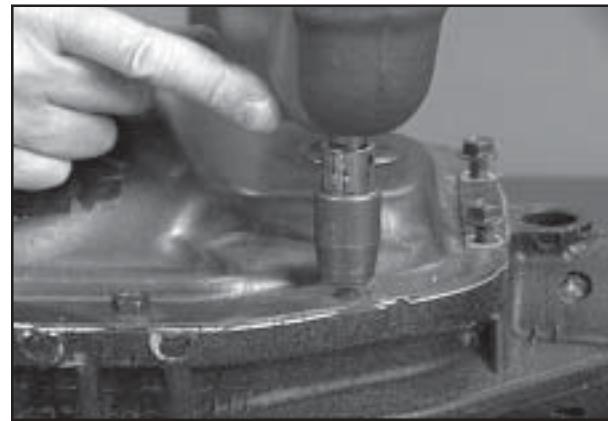


Figure 2

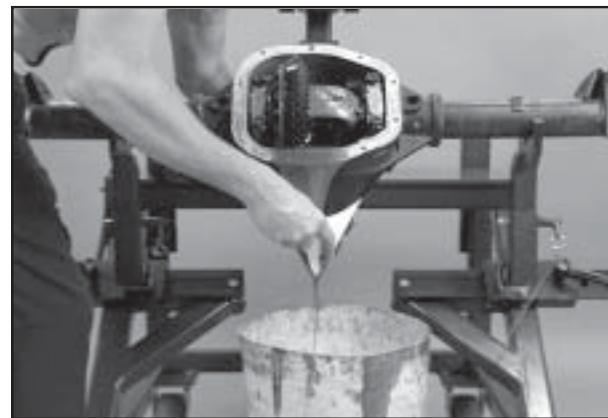
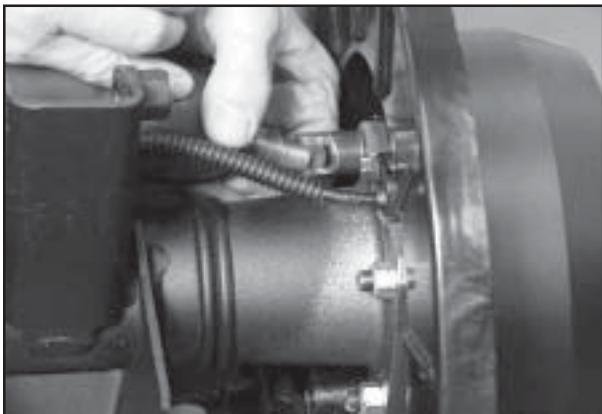
- 2. Turn the axle over and drain the oil.


Figure 3

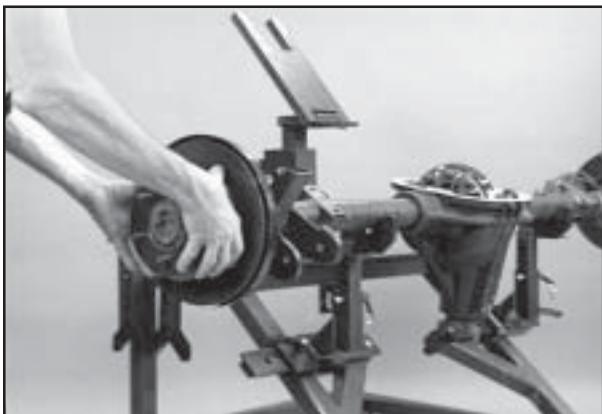
**NOTE:** During drainage, strain the oil to see if it contains metal shavings (Figure 3). Be sure to place a bucket under the stand to catch the oil so it can be disposed of properly. If the axle is being rebuilt because of a major problem such as gear set breakage or excessive bearing wear, a sample of the oil should be sent to a lab for spectral analysis to help determine the root cause of the failure.

3. After the axle is drained, remove the axle shaft retainer nuts, using a swivel adapter (Figure 4).



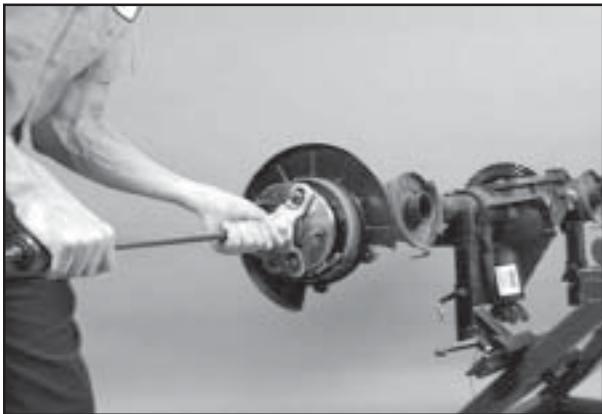
*Figure 4*

4. Remove the brake drum/rotor unit, and pull the axle shafts from the assembly (Figure 5).



*Figure 5*

**NOTE:** It may be necessary to carefully pry them loose using a pry bar or slide hammer (Figure 6).



*Figure 6*

5. Inspect the seal and bearing; then set the shaft aside.
6. Check the total torque to rotate, using a 50 in. lb. torque wrench and a 1-1/8" socket (Figure 7). With the nose of the axle pointing up, turn the end yoke by hand in a clockwise rotation four or five revolutions. Using the torque wrench, turn the pinion nut clockwise, and take a reading while spinning the end yoke. This torque reading will be used only as reference if bearings and cups can be reused.



*Figure 7*

7. Check the backlash, using a .001" dial indicator and a magnetic base, with the plunger set on the ring gear tooth (Figure 8). The dial indicator should be facing towards the O.D. of the ring gear.



*Figure 8*

8. Move the ring gear back and forth in a smooth motion. Look at the indicator and take a reading. Then take three equally spaced readings.

9. Remove the bearing caps using an air gun or hand ratchet with the appropriate socket (Figure 9).

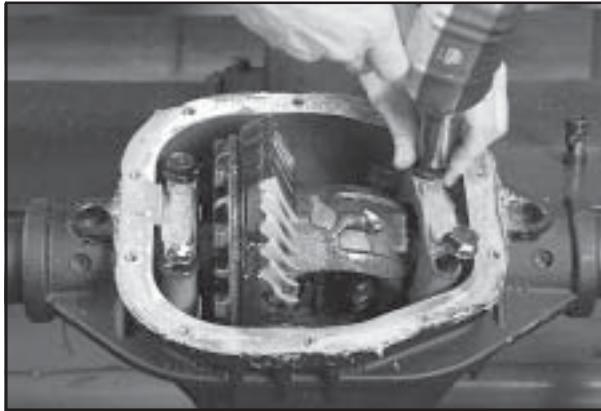


Figure 9

10. Use a pry bar to remove the differential case (Figure 10).



Figure 10

11. Set the outboard spacers by the proper bearing cap.
12. Measure and record both outboard spacers, including the case side or gear side location (Figure 11).

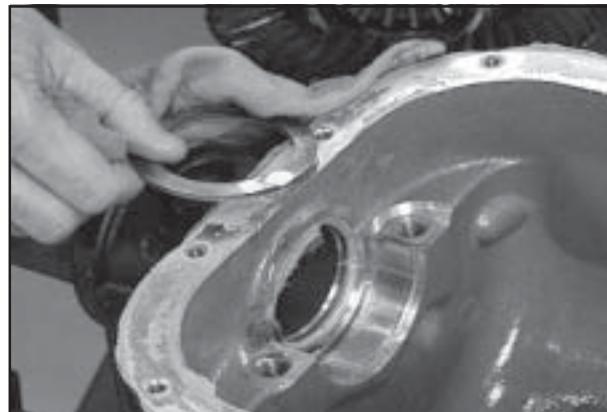


Figure 11

13. Check your pinion torque to rotate. **This must be done.**

14. Remove the pinion nut and use the yoke puller to remove the end yoke. (Figure 12) *Inspect the yoke for signs of damage, such as a groove that is cut into the end yoke by the pinion seal. Deep scratches and nicks are causes to replace the end yoke (Figure 13).*



Figure 12

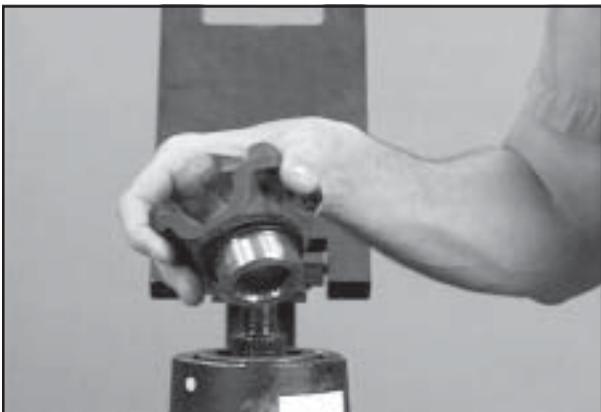


Figure 13



Figure 15

15. After inspecting the end yoke, grab the pinion head and hit the top of the pinion with a soft faced mallet to remove the pinion from the carrier.

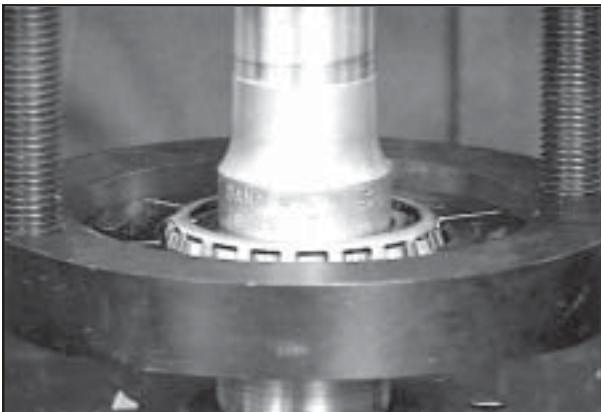


Figure 14

16. Pull the bearing off the pinion, using Miller tool C-293 (Figure 14). Inspect it for signs of damage.

**NOTE:** If there is no oil leakage from the pinion seal during use, there will be no damage now. If there was leakage, look for a cut in the rubber where the seal ran on the end yoke or check to see if the garter spring on the seal fell off. (Figure 15) Other leakage could be the result of a seal that was not properly installed and the sealant on the outside lip did not seal. Following this inspection, remove the seal and discard it.

17. Remove the slinger and outer pinion bearing and set it aside (Figure 16).



Figure 16

18. Remove the inner pinion cup, using a Miller tool C-4307 and handle C-4171 (Figure 17).



Figure 17

**NOTE:** Be careful not to damage the pinion cup bore when removing the cup (Figure 18).



Figure 18

**CAUTION** DO NOT use a punch to pound out the cup. This will damage the bore where the cup sits, making it impossible to reseat the new cup during installation. Eventually, poor seating can lead to improper loading on the seal and bearing, leading to premature axle failure.

**NOTE:** If the axle doesn't have too many miles, the axle shaft bearings may be reused. If the axle has high mileage on it, the bearings and seals should be replaced.

To determine if the seal and bearing should be replaced, inspect the following. At the oil seal, check for:

- signs of leakage prior to teardown
- tears in the rubber at the sealing surface
- the garter spring in the proper location; and
- improper installation that resulted in leakage.

At the wheel bearing, check for:

- complaints dealing with wheel noise
- pitting on the rollers, caused by particles rolling through the bearing; and
- spalling on the rollers, caused by excessive load and poor lubrication.

If there is any doubt whether the seal or bearing can be reused, it is best to be safe and replace these components. Always replace the bearing and seals on both sides of the axle.

## Carrier Inspection and Reassembly

1. Inspect the housing for signs of stress cracks that are the results of overloading the axle (Figure 19).

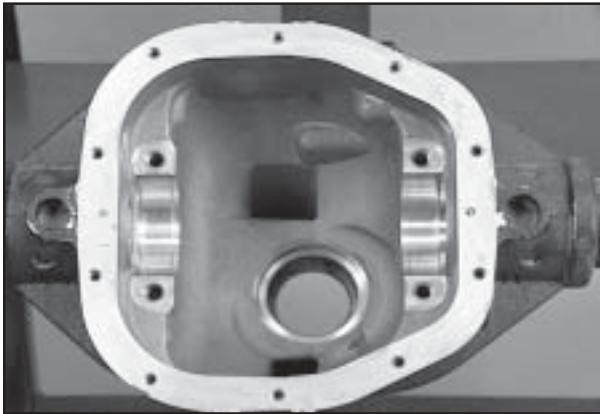


Figure 19

2. Check the axle housing spring seats and shock brackets for cracks or elongated holes (Figure 20).



Figure 20

**CAUTION** If wear is detected, DO NOT reuse the housing. After cleaning the axle, inspect the unit for damage. Look for damage in the pinion bores, the pinion yoke and the differential bores (Figure 21).



Figure 21

**NOTE:** Spicer recommends replacing the yoke any time the pinion and bearings are replaced. Perform a visual inspection inside the housing to check for damage or wear.

3. Apply liquid graphite to the inner and outer pinion cup bores before installing new bearing cups (Figure 22).

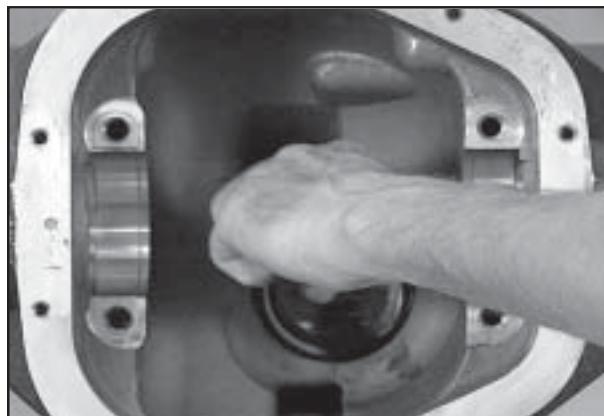


Figure 22

4. Measure pinion position, using the Miller pinion height gauge. To use this tooling, first install both pinion cups using installer D-129 for the outer pinion cup, and C-4308 for the inner pinion cup. Use handle C-4171.

5. To install the pinion height tooling, use the threaded rod 6741 (Figure 23).

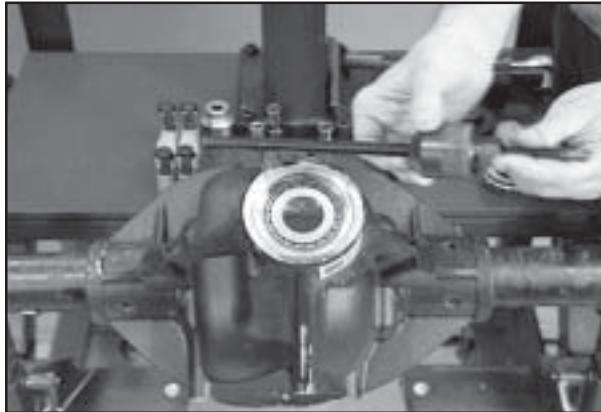


Figure 23

6. With the outer pinion adapter threaded onto the rod, slide the rod through the outer pinion bearing and cup.
7. Turn the carrier and put the inner cone in the cup, and slide the threaded rod through the carrier and through the inner bearing (Figure 24).

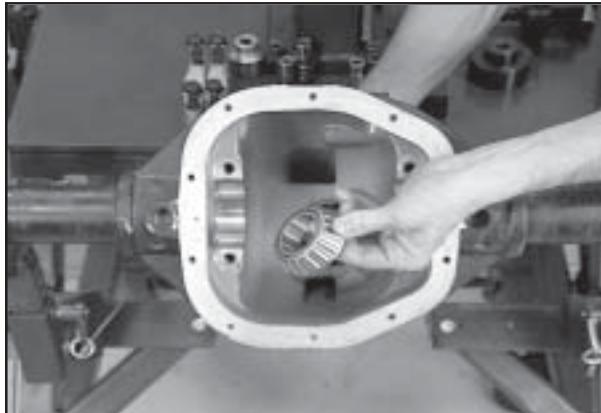


Figure 24

8. Slide the height block 6734 over the threaded rod and position it on top of the bearing. Screw the measuring block 6739 on the threaded rod until it is snug (Figure 25).

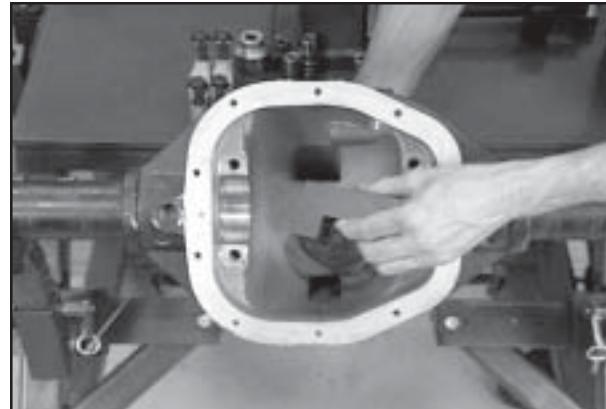


Figure 25

**NOTE:** This set up should rotate freely in the pinion bores.

9. Zero the scooter gauge to the top of the measuring block (Figure 26).

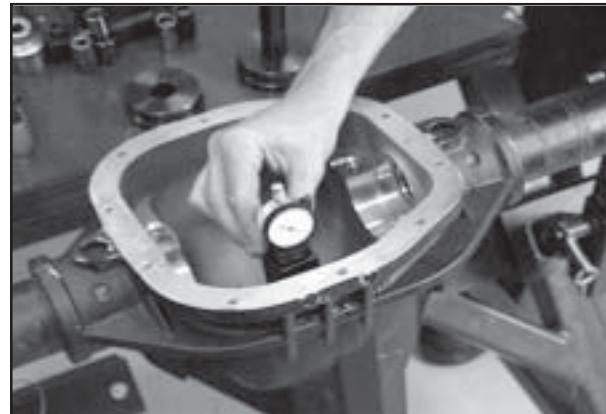


Figure 26

10. Place the metal rod D-115-2 through the arbor disk 6927, and place the assembly in the differential bore. Put the other disk into the bore, and slide the metal rod through the disk. (Figure 27).

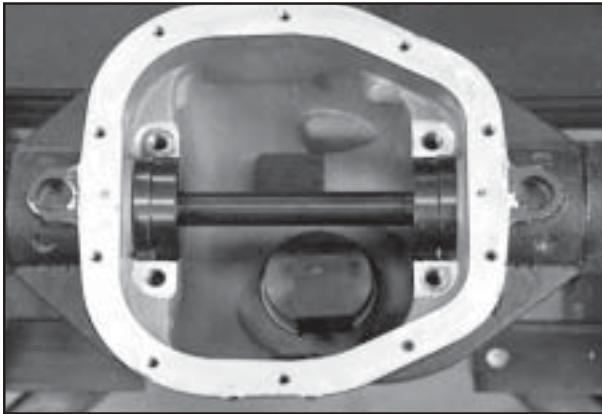


Figure 27

**NOTE:** Be sure the arbor disks are flat against the differential backup to ensure an accurate reading.

11. Place the bearing caps over the disk and tighten the bolts to no more than half of the original torque specification (Figure 28).

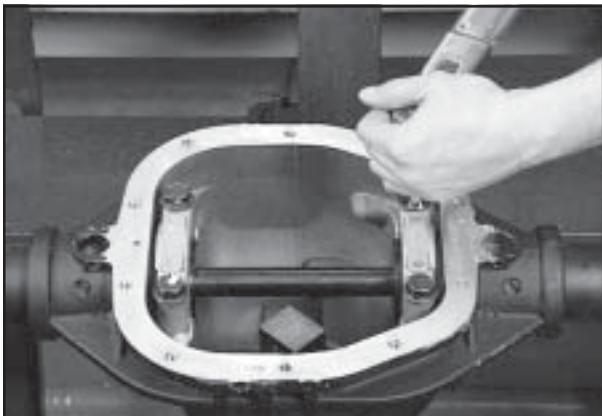


Figure 28

**NOTE:** If the procedure is done correctly, the metal bar should slide freely back and forth inside the disk. If the bar does not move freely, check on the bearing cap to make sure the disks are seated in the bore. Retighten the bearing cap bolts.

12. Snug the threaded rod assembly.

**NOTE:** DO NOT tighten the assembly to the point it cannot be turned, but so it turns with slight resistance. This puts a preload on the pinion bearing for a more accurate reading at the gauge.

13. Slide the gauge to the top of the bar, and look for the lowest reading. This is the first number needed to determine pinion position.

**NOTE:** Check this reading a few times to be sure it is accurate. When the number is confirmed and written down, the setup can be disassembled.

**NOTE:** All Dana gear sets are marked with a set number and an etch number. The etch number may look something like plus 1, minus 3, or 0 for example (Figure 29). This number tells what is required to build the axle at zero; the ideal running position for the gear. If, for example, the etch number is plus 2, it means to subtract .002". If the pinion height gauge measures .040", for example, subtract .002" and install a .038" shim.



Figure 29

14. Place the correct pinion position shim on the pinion stem (Figure 30).

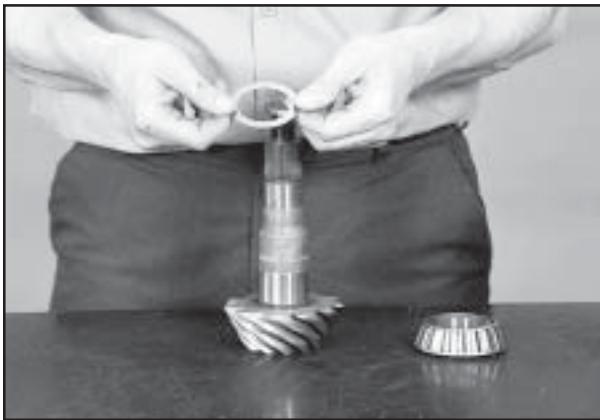


Figure 30

15. Slide the inner pinion bearing cone on the pinion stem, and press the bearing tight to the shim using the bearing installer 6448 (Figure 31).



Figure 31

**NOTE:** This can be done by tapping the installer with a steel hammer until the bearing is seated on the pinion. If a press is available, use it to seat the bearing. To be sure the bearing is seated properly, try to turn the position shim. Also try to slide a .0015" shim between the bearing and the shim. If the shim does not fit , the bearing is properly seated.

16. Rotate the axle unit so that the pinion nose is facing up, and put the outer pinion bearing in the cup (Figure 32). Do not put grease on the bearing.

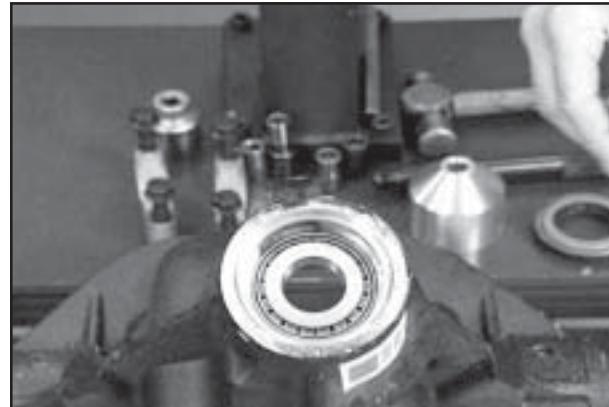


Figure 32

17. Place the slinger on top of the bearing, and place the seal in the bore and use seal driver C-3972-A to install the seal (Figure 33).



Figure 33

18. Tap the driver to install the seal.

**NOTE:** Tap the driver a few times to be sure the seal is seated in the bore, and the sealant flattened in the bore. Look through the pinion seal hole to see if the garter spring on the seal fell off (Figure 34). Installing the seal with a hammer does work, but occasionally the shock from hitting the tooling may knock the spring off the seal. If a press is available, it should be used.

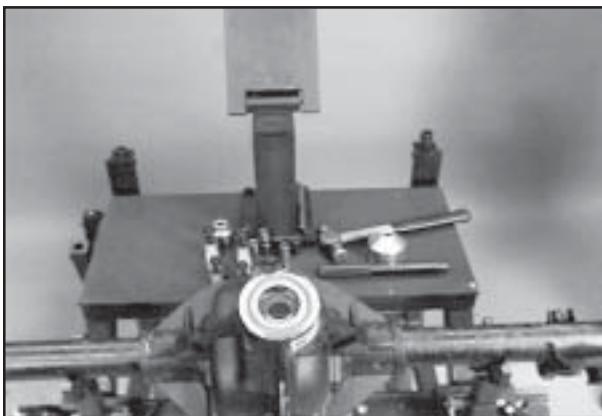


Figure 34

**NOTE:** Do not grease the inner pinion bearing during installation.

19. Slide the collapsible spacer on the pinion stem, and slide the pinion through the carrier (Figure 35).

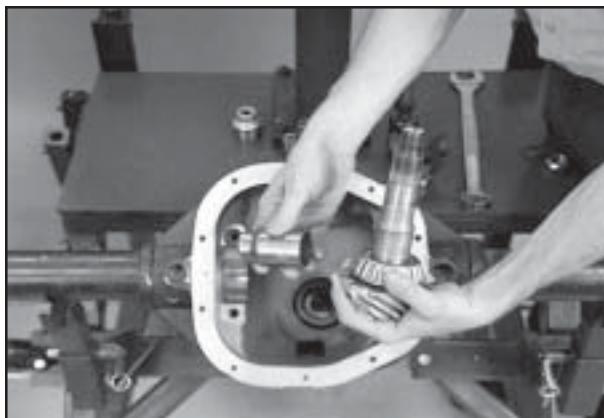


Figure 35

20. Match up the pinion splines with the end yoke.

21. Use the pinion installer C-3718 to pull the end yoke tight to the pinion (Figure 36).



Figure 36

22. Place a pinion nut on the pinion, torque the pinion nut to a minimum of 200 ft. lbs. (Figure 37).



Figure 37

**NOTE:** There is no set maximum torque because each spacer collapses differently. Once the spacer starts to collapse, continue checking for 25 to 35 in. lbs. torque to rotate using a 50 in. lb. wrench.

23. Turn the torque wrench four revolutions, taking a reading while the wrench is moving on the fourth turn.



Figure 38

24. Tighten the pinion nut slowly, checking the torque-to-rotate often (Figure 38).

**NOTE:** It is important that the maximum pinion torque- to- rotate is not exceeded. However, a minimum torque to rotate of 25 in. lbs. must be met. The pinion preload is now set. Be sure to write down this number because it will be needed later.

**NOTE:** If the bearings are being reused, follow the same process as above, except the pinion torque-to-rotate must be set at 1 to 2 in. lbs. over the pinion torque-to-rotate obtained during teardown. The bearings are already broken in, so setting a used bearing to a torque meant for a new bearing will cause the old bearing to fail prematurely.

### Differential Case Disassembly

1. Remove the differential bearings using a Miller puller set number C-293-PA and inserts 8353 (Figure 39).



Figure 39

**NOTE:** Be sure to inspect the bearings for damage that could cause bearing failure. Also, look at the differential case bearing trunnions for signs of damage (Figure 40).



Figure 40

**CAUTION** If a bearing falls off the trunnion, or if visible damage to the case is noted, the case must be replaced. If a bearing falls off the case, it means that the bearing has spun and either the bearing inside diameter is oversize, or the trunnion is undersize. If a new bearing still slips on the case, the trunnion is undersize and the case must be replaced.

2. Place the case in a vise to remove the ring gear bolts (Figure 41).



Figure 41

3. Use a ball peen hammer and drift punch to knock the gear off the case, being careful not to hit the case (Figure 42).



Figure 42

4. On a standard axle, first remove the pinion mate shaft lock pin (Figure 43).



Figure 43

**NOTE:** This lock pin should be replaced with a new one during the rebuild procedure.

**NOTE:** The pinion mate shaft should slide out of the hole. If it is tight, you may have to use a punch to knock it out. Look for excessive wear or grooves where the pinion mates ride on the shaft (Figure 44). There may be some minor discoloration on the shaft, which is the result of friction and heat. This should not prevent the pinion mate shaft from being reused.



Figure 44

5. Rotate both pinion mate gears so they come to the windows on the case and remove them.

**NOTE:** On the pinion mate gear, look for nicks, chips or visible damage to the gear teeth. Inspect the back gear face for a groove or other visible signs of damage (Figure 45). This is where the pinion mate thrust washer rides. The surface will be shiny and smooth if there is no damage. Check the thrust washers for grooves or damage on both sides of the washer. Also, look to see if the washer is bent or part of the washer is missing at the spot where the pinion mate shaft passes through the washer.



Figure 45

**CAUTION** If the shaft took out part of the washer during assembly, the hole will look distorted and not round. If this is the case, the thrust washer is damaged and must be replaced. If any of these parts look damaged, they should be replaced as well. All damaged parts must be replaced in sets.

6. Take the side gears out of the case and look for nicks, chips, or other signs of damage to the teeth on the side gears. (Figure 46) Check the back face of the side gear for a groove or visible damage.



Figure 46

**NOTE:** This surface will be shiny and smooth if there is no damage. Look at the side gear thrust washer for grooves or visible damage. If any damage to the side gear or thrust washer is noted, they must be replaced.

**NOTE:** Also, be sure to check for damage in the following areas: the ring gear mounting surface for nicks and high spots; the bearing trunnion for grooves or damage caused by the bearing spinning on the trunnion

7. Surface nicks can be stoned or filed off.

**NOTE:** If the bearing fell off the trunnion and did not need to be pressed off, the differential case must be replaced.

8. Check the machined areas where the pinion mate and side gear thrust washers sit (Figure 47).



Figure 47

**CAUTION** Look for grooves or visible damage to these areas. If damage is detected, the differential case must be replaced.

9. Inspect the pinion mate shaft holes. Be sure to check both holes, making sure they are still round.

**CAUTION** If one or both holes are oblong, the case is damaged and must be replaced.

10. Check for grooves caused by metal shavings or contamination in the oil that got into the gears or under the thrust washers.

**NOTE:** If any parts in the differential case are damaged, or if there is any uncertainty regarding the extent of damage to a component, replace the parts or the entire differential case.

#### Differential Case Reassembly: Standard Case

To rebuild the standard differential case, be sure to have the following components available (Figure 48):

- One empty differential case;
- Two side gears;
- Two side gear thrust washers;
- Two pinion mate gears;
- Two pinion mate thrust washers;
- One pinion mate shaft;
- One pinion mate shaft lock pin.



Figure 48

1. Put the side gears and thrust washers in the differential case. Then, hold the top gear with one hand while placing one pinion mate gear and thrust washer in the window with the other hand (Figure 49).



Figure 49

2. Install the other pinion mate gear and thrust washer in the other window directly across from the other gear (Figure 50).



Figure 50

3. Turn the pinion mate gears until they align with the pinion mate shaft hole.

4. Slide the pinion mate shaft through the thrust washers and pinion mate gears (Figure 51).



Figure 51

5. Align the hole in the pinion mate shaft with the hole in the case, and install the lock pin and torque to 8 to 16 foot pounds, or 11 to 22 nm (Figure 52).



Figure 52

6. Spin the side gears to make sure that they spin freely.

#### Differential Case Reassembly: Trac-Lok®

If the unit has no visible damage, check the total torque to rotate before rebuilding the unit. The torque to rotate spec for the 44-4 Jeep Trac-Lok is 320 to 400 ft. lbs. (Figure 53).



Figure 53

1. Put the Trac-Lok in a vise with the windows of the case facing the jaws of the vise. (Figure 54) Tighten the vise until it is snug, making sure that the side gears are not hitting the jaws.



Figure 54

2. Put the splined tooling in the gear (Figure 55).



Figure 55

**NOTE:** You will need a 500 ft. lb. torque wrench. Put the torque wrench in the splined tooling and pull the torque wrench slowly to exercise the case in one direction. After pulling the case five times, a reading can be taken.

3. Pull the torque wrench slowly, looking at the indicator. Check the reading a couple of times to be sure it is accurate (Figure 56).



Figure 56

**NOTE:** Remember that if the assembly was full of metal shavings and contamination, so is the differential case. If all new parts are installed in the rebuilt axle, all new parts should be used when rebuilding the Trac-Lok.

To teardown and rebuild the Trac-Lok differential case, some special tooling will be required. (Figure 57) This includes:

- An OTC splined holder;
- Miller Special Tool Trac-Lok tool set; and
- Drift punch.



Figure 57

4. Put the spline holder tool in a vise. (Figure 58) Set the case on the splined shaft, being careful to align the splines while slipping the case over the shaft.



Figure 58

5. Remove the pinion mate shaft lock pin, and use a punch to remove the pinion mate shaft (Figures 59 and 60).



Figure 59



Figure 60

6. Inspect the holes in the case where the shaft was removed. The two holes must be round and not oblong.

**NOTE:** If they are oblong, the case is damaged and must be replaced. Use the side gear spreader to hold the side gears while the pinion mates and thrust washers are removed. If this is too tight the case will not turn.

7. Install the spreader with a load to hold the side gears in place (Figure 61).

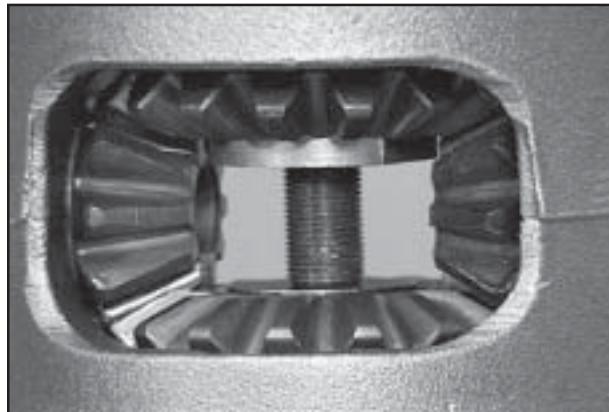


Figure 61

8. Use a yoke holder to turn the case so the pinion mate gears and thrust washers can be removed (Figure 62). Take the case off the splined shaft and remove the side gear spreader. Remove the side gears and thrust washers.

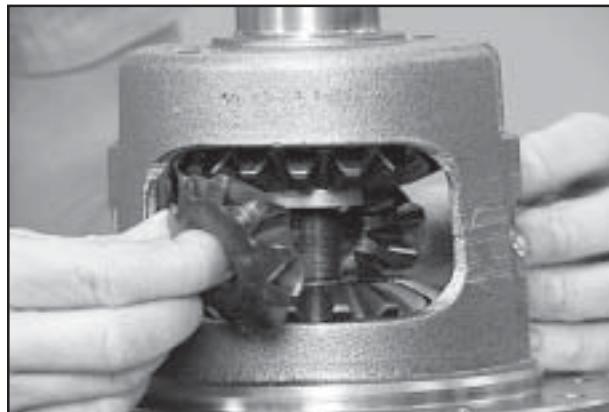


Figure 62



Figure 63

**NOTE:** Be sure to keep track of which side each disc and plate stack is removed from – either the flange or button side (Figure 63).

9. Measure each plate and disc from the flange side gear. Remember that the plate has the “ears”, and the disc is round (Figure 64).



Figure 64

10. Write down the thickness of each plate and disc. Eight numbers should be written down and then added to determine the total stack height.

**NOTE:** Do not measure the Belleville washer, which is the dished plate sitting on the side gear.

11. Repeat the procedure for the button side gear. If all eight plates and discs are measured as a stack, it should be nearly equal to the total of the individual measurements.



Figure 65

**NOTE:** If the stacks are being reused, be sure to keep the plates and discs in the same order, and reinstall them in the same sequence as they were removed. (Figure 65) To help identify the various components, the plates have ears and can be found in three thicknesses - .060", .064", and .068". Discs are round and come in one standard thickness - .060". Each stack contains four plates and four discs.

**NOTE:** The Belleville washer is not measured. It sits on the side gear with the ears up. When the stack is compressed, the bellville flattens out to keep constant pressure on the stack.

**CAUTION** During rebuilding, it is critical that the plates and discs are measured accurately. When measuring, it is important that the new stack height is not less than the original stack height. Spicer offers service kits with the pre-measured stack included. (Figure 66) Be careful not to mix stacks when rebuilding the case.



Figure 66

12. To put the first disc and plate stack together, use a side gear with the teeth facing down. Put the Belleville washer over the hub of the side gear with the convex side contacting the side gear (the ears facing up) (Figure 67).

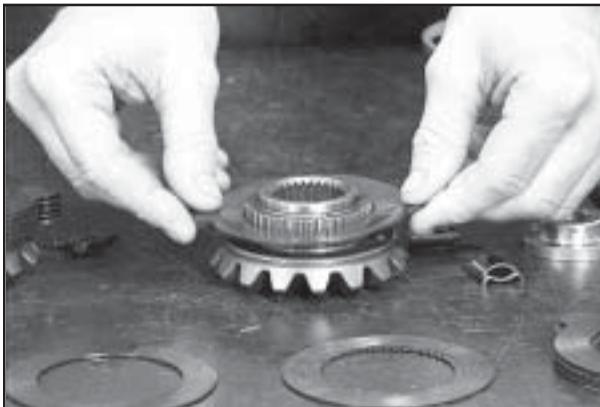


Figure 67

**CAUTION** A friction modifier must be placed on all plates and discs at the time of the assembly. Spicer part number 43161 is recommended.



Figure 68

13. Place a disc on top of the bellville washer, then a plate on the disc, until there are four plates and four discs on the side gear (Figure 68). When the process is finished, a plate should be on the top of the stack.
14. Place one clip over each side of the disc and plate stack to hold the plates together (Figure 69). Repeat this procedure for the other side gear.

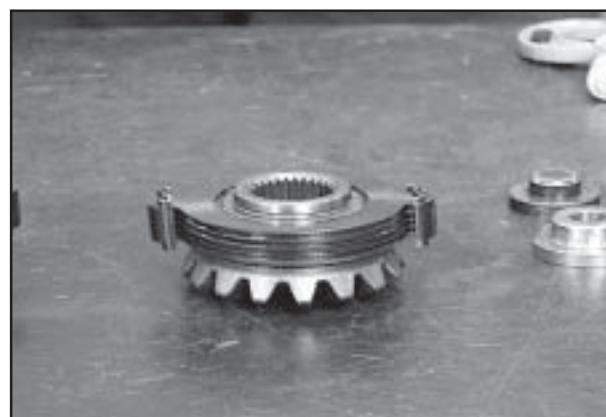


Figure 69

15. Take the differential case and put it on the table with the flange side facing up.

16. Slide the side gear and disc and plate stack assembly through the window of the case, making sure that the clips and ears slide in the grooves in the case (Figure 70). This is the only way the side gear assembly can be put together.

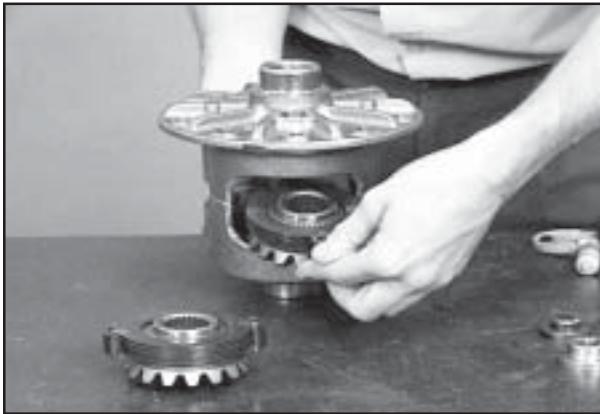


Figure 70

**CAUTION** The flange side must be assembled first or it will be impossible to assemble the case correctly. It is also important that the disc and plate stack and the side gear stay together during assembly. If the top disc separates from the spline on the side gear, further assembly could damage the disc by bending the teeth, and the disc must be replaced.

17. Hold the flange side gear and stack assembly in place, and turn the case over so the button is facing up. Install the other side gear assembly into the case.
18. Hold the assembly with one hand, and use the side gear spreader tool to hold the side gears and stacks in place.

**NOTE:** To use the spreader tooling, place the flat disc in the hole where the axle shaft rides. Take the disc with the hole in it, and put it in the button side gear. Slide the threaded shaft through the button side of the case and through the threaded disc until the flat disc is reached. (Figure 71) If this is tightened too much, it will be difficult to turn the differential case to install the pinion mate gears.



Figure 71

19. Put the splined shaft tooling in the vise and set the differential case on it with the flange side down (Figure 72).

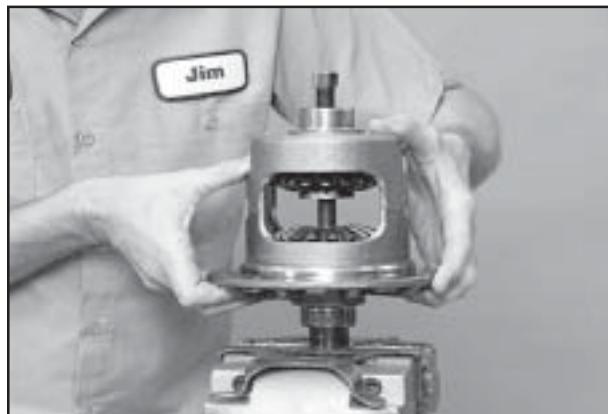


Figure 72

20. Tighten the threaded rod until it is tight, and then back off the threaded rod until the case can be turned using the yoke holder.

21. Put the pinion mate gears in the windows directly across from each other, and use the yoke holder to turn the case (Figure 73). The pinion mate gears should roll into their pockets.



Figure 73

22. Look through the pinion mate shaft hole and make sure the pinion mates are aligned with the holes.
23. Tighten the threaded rod until the bellville washer is collapsed.
24. Take each pinion mate thrust washer, and slide it behind the pinion mate. Align the holes (Figure 74).



Figure 74

25. Loosen the threaded rod, and remove the spreader.
26. Align the parts using a drift punch to line them up.

27. Look in both holes to be sure the thrust washers stayed in place.

**NOTE:** If the washers have moved, and the pinion mate shaft is installed, a side of the washer will get punched out, and it must be replaced.

28. Install the pinion mate shaft, using a hammer to tap it (Figure 75).



Figure 75

29. Make sure that the hole in the pinion mate shaft will align with the hole in the differential case.
30. Install the pinion mate shaft retaining pin, and start a few threads.

**CAUTION** Do not torque until the total torque-to-rotate has been checked.

31. Use the same procedure described earlier to check the total torque-to-rotate.

**NOTE:** If the total is within specification, torque the pinion mate shaft retaining pin to 8 to 16 ft. lbs. or 11 to nm.

### Differential Case Reassembly: Hydra-Lok®

The WJ44-4 axle also may be equipped with the Spicer Hydra-Lok differential assembly. The Hydra-Lok unit itself is not field serviceable (Figure 76). However, care must be taken when removing the differential case and reinstalling it in the carrier to avoid damaging the plenum.

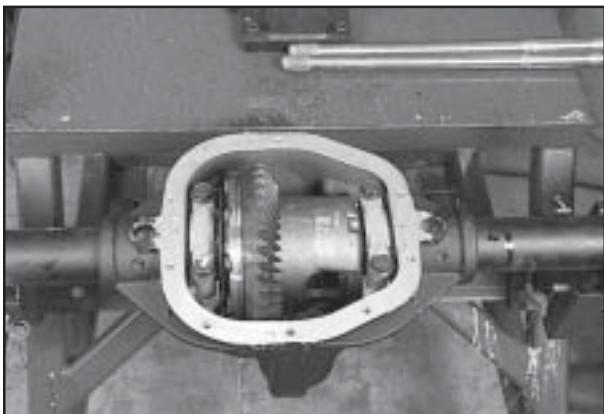


Figure 76

1. Carefully remove the Hydra-Lok differential assembly from the carrier (Figure 77).

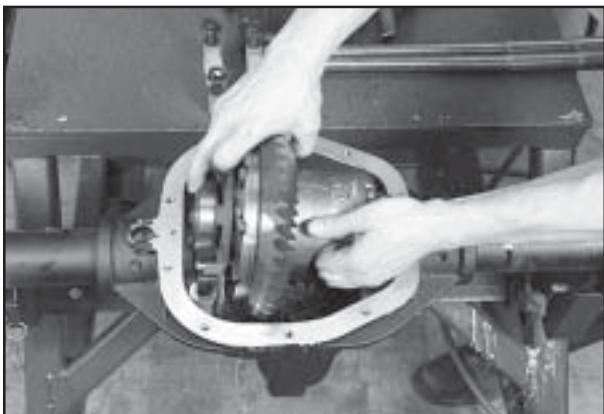


Figure 77

2. Remove the bearing from the case using Miller tool adapters 8353 (Figure 78).



Figure 78

**CAUTION** Be sure the tab on each adapter fits in the plenum windows around the bearing on the flange side.

3. Remove the bearing from the button side of the case using the same tooling.

**NOTE:** To order a new Hydra-Lok differential or other Spicer components, the bill of material number must be checked. This number may be found on a bar code label on the carrier snout behind the pinion flange yoke, on a strip tag between the bolts on the cover plate, or stamped on the right axle tube when looking at the cover plate (Figure 79).



Figure 79

4. Press the ring gear onto the case (Figure 80).

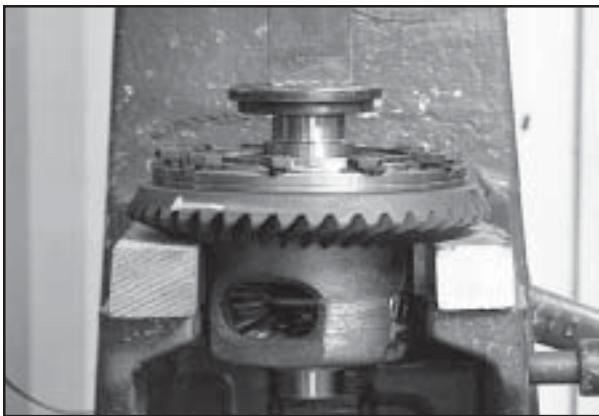


Figure 80

5. Start all of the ring gear bolts, and then press the ring gear onto the case.

**WARNING** Do not use the ring gear bolts to pull the ring gear onto the case. This will stretch the bolt threads and the bolts may not hold their required torque.

6. Tighten the bolts, and torque them to 70 to 90 ft. lbs.
7. Drive the bearing onto the button side of the hub using a Miller tool C-4340 (Figure 81).



Figure 81

8. Turn the case over to install the flange side bearing.

**NOTE:** Be sure to use a plug or other type of support on the button side to prevent the case from being damaged when the second bearing is installed.

9. Lubricate the outer and inner lip seals on the plenum using the same lube as required for filling the unit (Figure 82).



Figure 82

10. Install the plenum by rotating it around the hub (Figure 83). Press downward to seal the plenum against the sealing surfaces on the case and to prevent damaging the seal.



Figure 83

11. Assemble the new differential bearing using the proper tooling, and use a .0015" feeler gauge to check between the bearing and case to be sure that the bearing is properly seated (Figure 84).

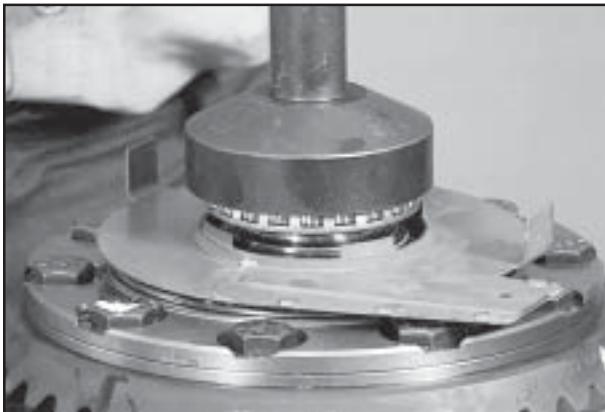


Figure 84

**NOTE:** If the feeler gauge can be inserted, the bearing is not properly seated.

**NOTE:** After completing these steps, the differential case assembly is ready to place in the carrier. Note that the tabs on the plenum are offset and must be installed in the carrier with the oil pick-up pointing to the bottom or sump of the carrier (Figure 85).

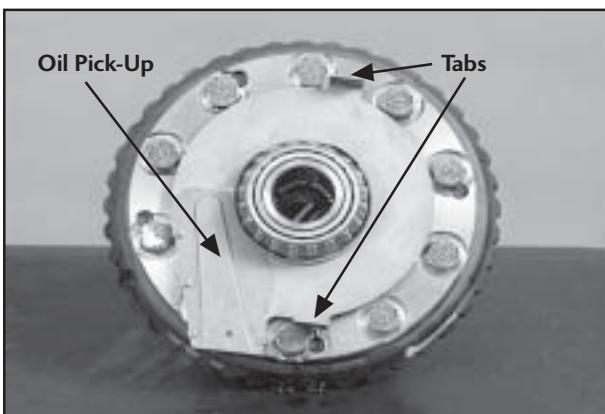


Figure 85

12. Attach the spreader to the carrier and spread the carrier a maximum of .015", or .038 mm. (Figure 86).

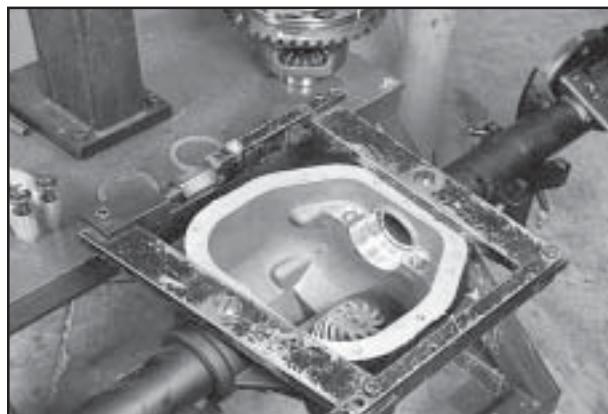


Figure 86

13. Fit the bearing spacers in the carrier bores using a light coating of grease (Figure 87).



Figure 87

14. Install the differential case assembly with the oil pick-up in the proper position (Figure 88).



Figure 88

**CAUTION** Be extremely careful not to bend the ears on the plenum, or the oil will not flow properly to the pump and the bearing caps cannot be installed correctly.

### Carrier and Differential Case Reassembly

To install the differential case into the carrier, two different methods may be used.

One method uses the dummy differential bearing to figure the shim thickness. The other uses the existing differential outboard spacer. Both of these methods will be explained; however, keep in mind that using the existing shims can save a lot of time and reduces the number of times the differential case is installed and then removed from the carrier. The more times the process is repeated, the greater the risk for damaging the carrier, the case, the differential bearings, or the gear set.

**NOTE:** When using dummy bearings, the differential case must not have any bearings or the ring gear attached.

1. Slide the dummy bearing with the deep chamfer towards the case onto the trunnion (Figure 89).

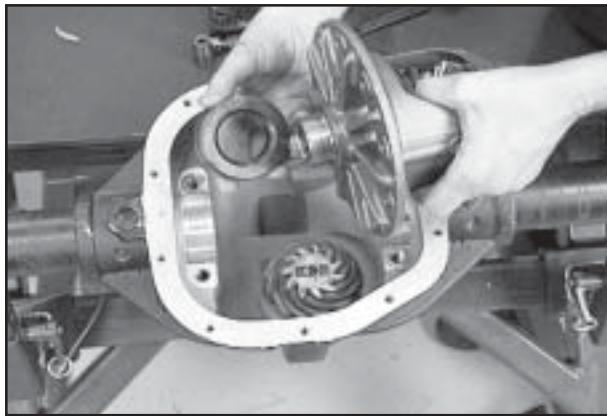


Figure 89

2. Slide the differential case with the dummy bearing into the carrier. The case should slide back and forth.
3. Push the case as far to one side as possible.
4. Attach a dial indicator to the carrier so that the tip of the indicator is against the flange side of the case. Set the dial indicator to zero.

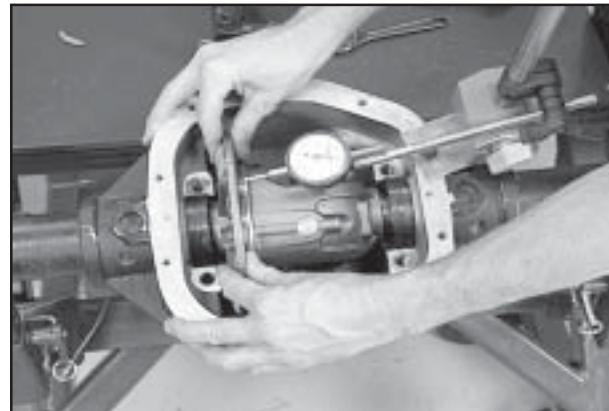


Figure 90

5. Slide the differential case to the right and take a reading (Figure 90). Do this a couple of times to make sure that the same reading, .340" for example, is obtained.

**NOTE:** This is called the total travel of the differential case. Total travel means that the case did not touch the pinion and is measured from shoulder to shoulder of the differential case in the differential bore. Be sure to write down this number for later reference.

6. Pull the case from the carrier and remove the dummy bearings.
8. To install the ring gear on the case, start all of the ring gear bolts.
9. Press the ring gear onto the case (Figure 91).

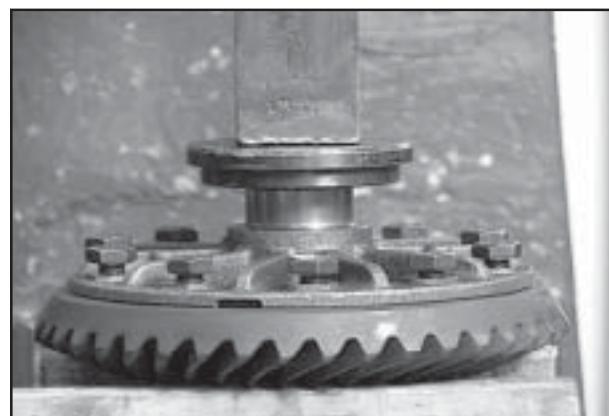


Figure 91

**CAUTION** Do not use the ring gear bolts to pull the ring gear onto the case. This will stretch the bolt threads and the bolts may not hold their required torque.

10. Tighten the bolts and torque them to 70 to 90 ft. lbs. (Figure 92).

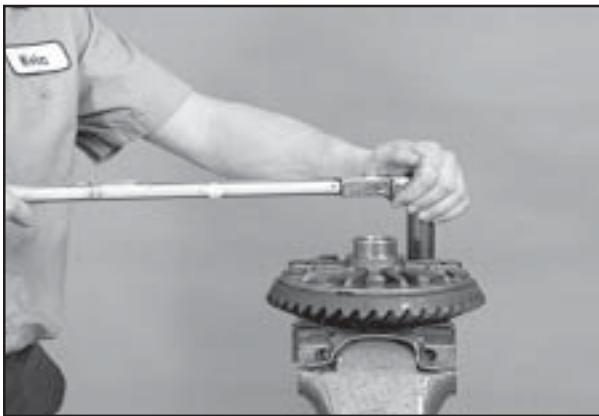


Figure 92

11. Put the dummy bearing back on the case and slide it into the differential bores. Keep the flange side of the case to the left.

**CAUTION** Do not drop the case and ring gear into the carrier, because it could damage the ring gear or pinion.

12. Attach a dial indicator to the carrier again, and put the tip of the indicator on the top edge of the ring gear tooth (Figure 93).

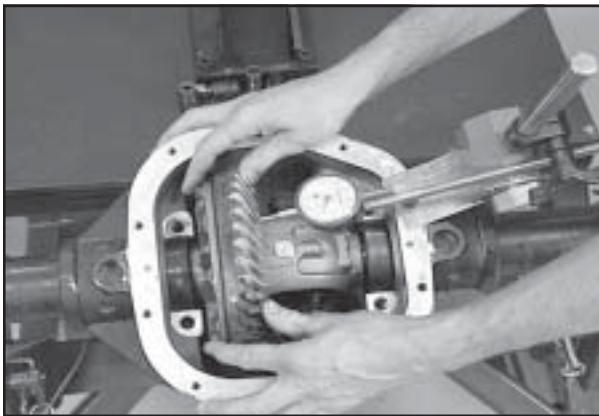


Figure 93

13. Set the dial indicator to zero. Slide the case to the right so that the root of the ring gear tooth meets with the root of the pinion tooth.
14. Repeat this procedure one or two times to be sure the reading is correct, .180" for example.

**NOTE:** This is the root-to-root reading. Write this number under the total travel number. With the total travel and the root-to-root reading, the starting differential spacers can be determined.

The root-to-root reading is always the flange side differential spacer. The remainder is always the button side spacer. To calculate this number, subtract the root-to-root travel from the total travel taken earlier. Using the previous examples:  $.340" - .180" = .160"$ .

The flange side spacer is  $.180"$  and the button side spacer is  $.160"$ . With these starting numbers, there should be zero backlash and zero differential preload.

#### Existing Spacers

15. Measure the spacers before installing them in the carrier. Write down the numbers for later reference.
16. Drive the bearing onto the button side of the hub using a Miller tool C-4340 (Figure 94).



Figure 94

17. Turn the case over to install the flange side bearing. Be sure to use a plug or other type of support on the button side to prevent the case from being damaged when the second bearing is being installed (Figure 95).



Figure 95

18. Place the spreader on the carrier, and spread the carrier to no more than .015" (Figure 96).

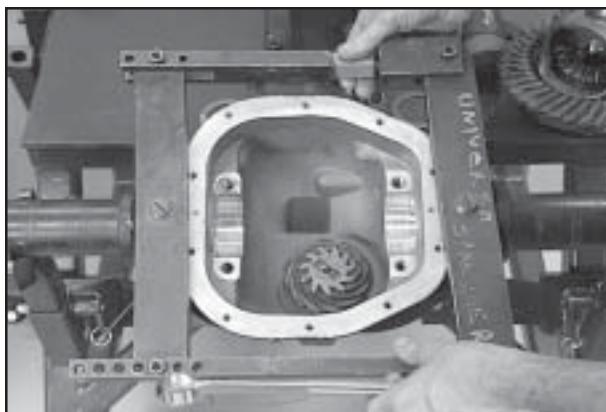


Figure 96

**CAUTION** If the carrier is spread past this limit, the carrier will yield and the axle housing will have to be replaced.

19. Fit the bearing spacers in the carrier bores using a light coating of grease.

20. Tap the case into the bore, using a rubber mallet.

21. Remove the spreader. Once the differential case is seated, the bearing caps may be installed.

22. Verify that the letters stamped on the bearing cap are stamped on the cover face. One will be horizontal while the other will be vertical (Figure 97).

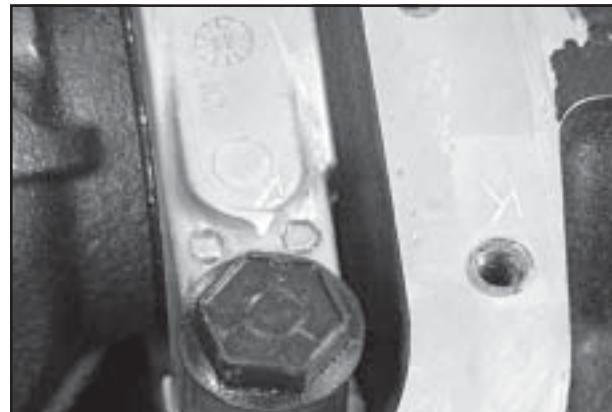


Figure 97

23. Snug the bearing cap bolts and torque to 55 to 70 ft. lbs. (Figure 98).

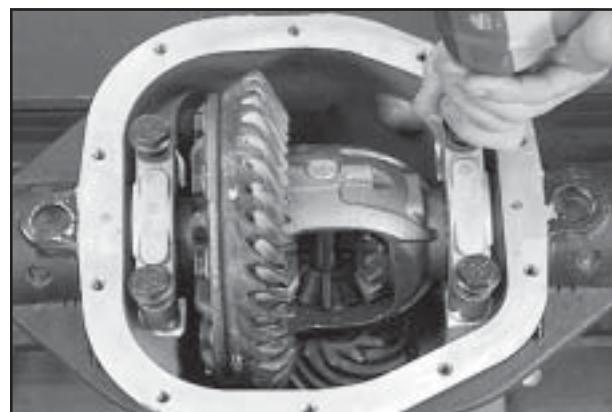


Figure 98

### Setting Backlash

Backlash is the measurement of movement between the pinion and ring gear. With this axle, backlash must be .004" to .006". To adjust backlash, it must be measured first, using a dial indicator attached to the cover face of the carrier.

24. Align the dial indicator plunger with the ring tooth that is parallel to the cover face to measure backlash (Figure 99).



Figure 99

**NOTE:** If the measurement is over .006", it is too high.

25. To tighten backlash, subtract shims from the button side, and place them on the flange side.

**NOTE:** For example, the flange shim may be .180" and the button shim .160", with an .008" backlash. To achieve .004" backlash, take .004" from the button shim, making it .156". Then add .004" to the flange shim, making it .184". To move the shims, follow the same steps used for removing the differential case and installing it.

$$\begin{array}{r}
 .160" \\
 - .004" \\
 \hline
 .156"
 \end{array}
 \qquad
 \begin{array}{r}
 .180" \\
 + .004" \\
 \hline
 .186"
 \end{array}$$

26. Change shims, and check backlash again.

**NOTE:** It should be .004" - .005", which is within the specification for backlash on the WJ44-4 aluminum axle.

### Setting Differential Preload

Differential preload is the amount of pressure that we put on the bearing with the cup. For this axle, an increase of 5 to 13 in. lbs. over the pinion torque-to-rotate is required.

27. To measure preload, use a 50 or 100 in. lb. torque wrench. With the end yoke up, turn the end yoke in one direction about four or five revolutions. This will help seat all of the bearings in the cups.
28. Turn the wrench the same direction that the yoke was turned to seat the bearings. Be sure the turn is steady and not too fast, or a false reading may occur. Take a reading while the wrench is moving (Figure 100).



Figure 100

**NOTE:** If the pinion torque-to-rotate is 30 in. lbs., and the total torque-to-rotate is 34 in. lbs., there is not enough preload on the differential bearings.

29. To adjust the preload, disassemble the differential case as described previously, and add a slight thickness to the outboard spacers.

**NOTE:** The current flange side is .184", and the button side is .156". By adding .002" to each shim, they will change to .186" and .158" respectively. This small adjustment should not effect backlash.

$$\begin{array}{r}
 .184" \\
 - .002" \\
 \hline
 .186"
 \end{array}
 \qquad
 \begin{array}{r}
 .156" \\
 + .002" \\
 \hline
 .158"
 \end{array}$$

30. Reassemble the differential case to the carrier as described earlier, and take another backlash and total torque-to-rotate reading. The backlash and the preload should both be within specification.

#### *Checking Gear Pattern*

Checking the gear pattern will help determine if the pinion position and backlash are correct (Figure 101).

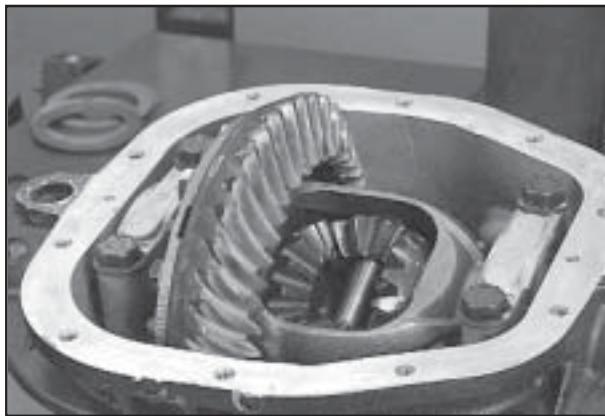


Figure 101

1. Coat the entire ring gear with a thin coat of gear paint (Figure 102).

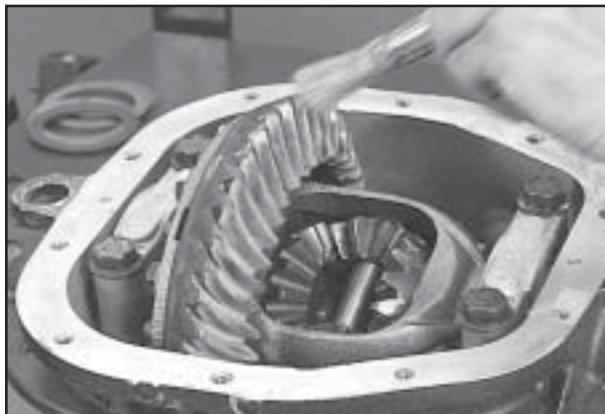


Figure 102

**NOTE:** Be sure not to use too much paint, or the gears will show a false reading of interference.

2. Apply a load to the ring gear while the pinion is turning (Figure 103). The ring gear must spin in both directions to get patterns on the coast and drive sides of the gear.

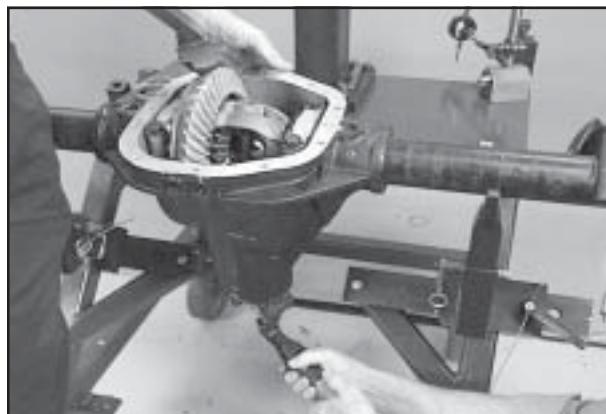


Figure 103

3. Look for a centered toe pattern on both the drive and the coast sides (Figure 104).



Figure 104

**NOTE:** It is very important that the gear pattern on the drive side of the ring gear is in the correct position. There are a few terms that must be understood to determine if the gear pattern is correct.

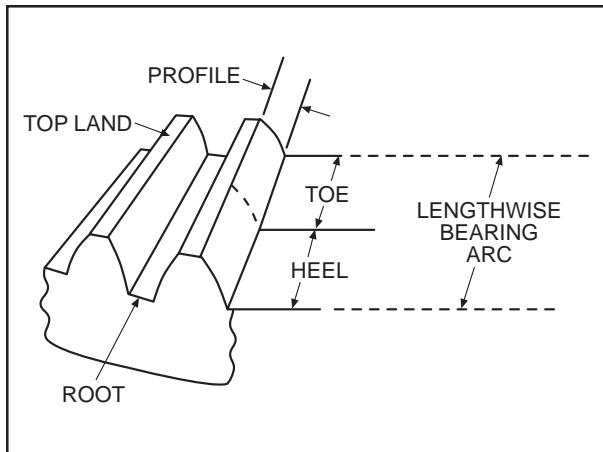


Figure 105

These terms include the following (Figure 105):

- “Root” is the inside radius of the tooth.
- “Top Land” refers to the outside edge of the tooth.
- “Toe” is the bottom of the ring gear I.D.
- “Heel” is the top of the ring gear tooth closest to the carrier O.D.

The “Central” portion is the middle of the tooth. “Flank In” means the gear pattern is close to the root of the tooth and the picture starts at the toe. “Flank Out” means the gear pattern is close to the top land of the gear tooth. The picture will be central to heel.

“Backlash” is the amount of movement between the ring gear and the pinion, and the amount of backlash can move the gear pattern from toe to heel and heel to toe. With a tight backlash, the pattern will shift toward the toe. With a looser backlash, the more the pattern will shift toward the heel.

Once the gear pattern is set, and backlash and preload are within specification, the axle shafts and wheel ends can be installed (Figure 106).



Figure 106

### Axle Reassembly

Before installing the axle shafts into the carrier, be sure to check for damage to the splines and wheel studs. Check the spline for nicks and dings that could prevent the axle shaft from sliding into the side gear. Also look for threads on the studs that are bent and could cause the nut to cross-thread. The studs should be replaced if the studs are bad. The shaft must be replaced as well if the spline is bad.

1. Slide the axle shaft through the backing plate and into the tube (Figure 107).

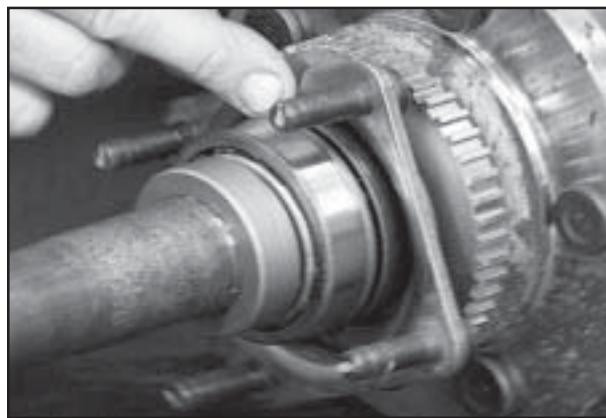


Figure 107

- Line up the splines of the differential case and the axle shaft, and slide the shaft into place (Figure 108).

**CAUTION** Do not force the axle shaft into the side gear. This could cause damage to the splines on the axle shaft or in the side gear.



Figure 108

**NOTE:** Be sure that the correct shaft is in the correct tube. An easy trick is to remember that the long axle shaft goes in the left-hand tube - remember left is long, right is short (Figure 109). It is important to always use new nuts when putting the assembly together. Then, torque the nuts to 35 to 55 ft. lbs.



Figure 109

- Install the rotor assembly on each axle shaft (Figure 110).



Figure 110

- Install the cover plate on the carrier.

**CAUTION** Before installing the cover plate, be sure to inspect both mating surfaces for nicks or dings on either part. If either part is damaged, the cover plate may leak oil, leading to premature failure of the ring and pinion.

**CAUTION** It is also important that both surfaces are cleaned with a solvent to remove any oil film remaining on the surfaces. If oil is not removed, the sealant will not adhere and may cause oil to leak from the cover plate and carrier.

- Apply a thin line of RTV silicone to the carrier (Figure 111). Use a continuous line around the carrier surface, connecting the end point to the starting point.

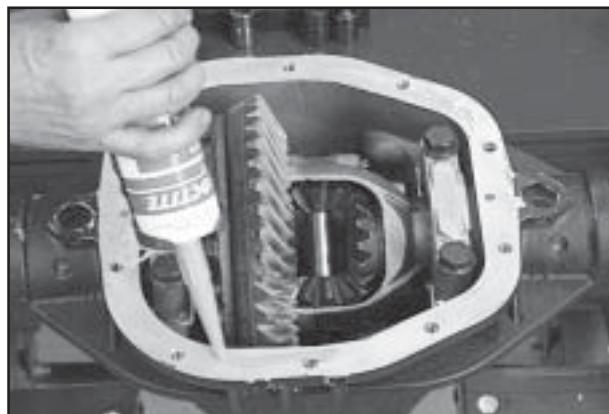
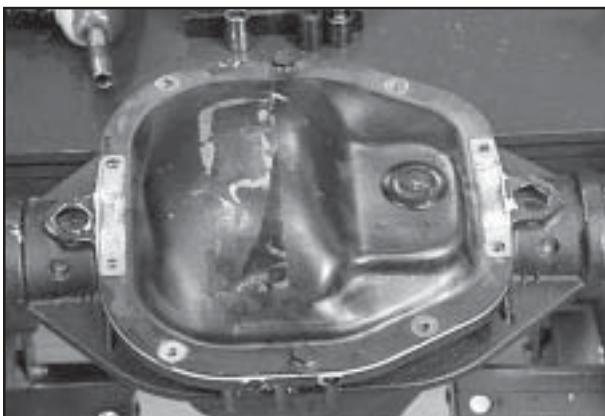


Figure 111

**NOTE:** The Traction Technologies Group recommends using RTV Silicone gasket maker – Spicer part number 38615 in a 70 milliliter tube.

6. Lay the cover plate on top of the carrier, being careful not to slide the cover against the other surface (Figure 112).



*Figure 112*

7. Install the cover bolts, and tighten to 28 to 33 ft. lbs.

## Lubrication

**Option 1:** Use this method before installing the axle in the vehicle.

1. Measure the correct amount of oil.
2. Remove the fill plug in the cover plate and pour the oil into the axle using a funnel (Figure 113).



*Figure 113*

3. Install a new fill plug.

**Option 2:** Use this method if the axle is already installed in the vehicle.

1. Remove the fill plug.
2. Pour the correct amount of oil into the axle using a hose (Figure 114).



*Figure 114*

**NOTE:** If the correct amount has been used, oil should be at the bottom of the fill hole.

3. Install a new fill plug.

**NOTE:** The type and amount of lubricant required depends upon the type of the axle. See specifications below.

## Lube Specs

**Standard differential case:** Use 80W90 thermal stable lube. For a standard differential, use 76 ounces of lubricant for the best protection.

**Trac-Lok differential:** Use 80W90 thermal stable lube. For this axle, use 72 ounces of lubricant plus four ounces of friction modifier. This is Dana part number 43161. The total amount of lubricant used should equal 76 ounces.

**Hydra-Lok differential:** Use a synthetic lubricant. Again use 72 ounces of lube, plus four ounces of friction modifier, which is Spicer part number 43161.

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