SPICER® / THORNTON

POWR-LOK

DIFFERENTIAL

INSTALLATION — MAINTENANCE

INSTRUCTIONS

For Passenger Cars and Light Trucks
Equipped With Spicer Design Axles

BULLETIN No. X-1575

1-65

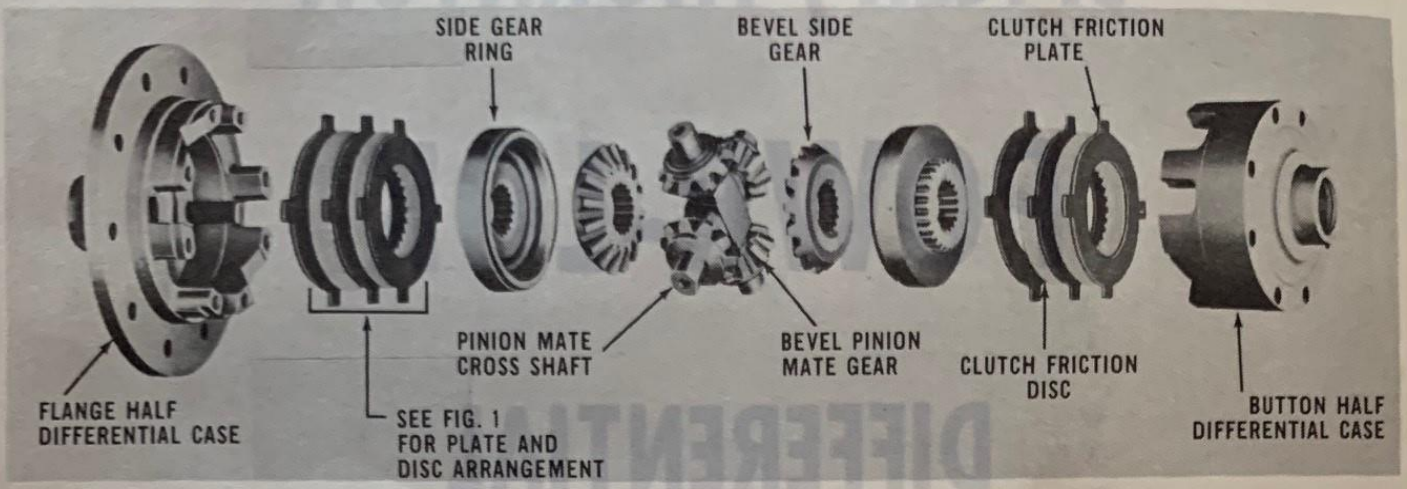
SALISBURY DIVISION
FORT WAYNE, INDIANA 46801

DANA

DANA CORPORATION

Spicer® / Thornton POWR-LOK Differential

For Passenger Cars and Light Trucks Equipped With Spicer Design Axles



Spicer axle models can be identified by the number cast into the carrier (differential housing) through raised pattern letters on the top of the main body.

To further identify Spicer models, the assembly number is stamped on the right hand tube, a ratio tag is attached to the cover assembly, and if a Powr-Lok was originally installed in the unit, a Powr-Lok identification tag will also appear on the cover assembly.

INSTALLATION INSTRUCTIONS

PREPARATION OF REAR AXLE ASSEMBLY

1. Drain the lubricant from the axle.
2. Remove the rear axle assembly from under the car.

   NOTE: Thoroughly clean the outside of the rear axle housing. Remove any dirt and accumulated grease.

3. Remove both of the axle shafts.

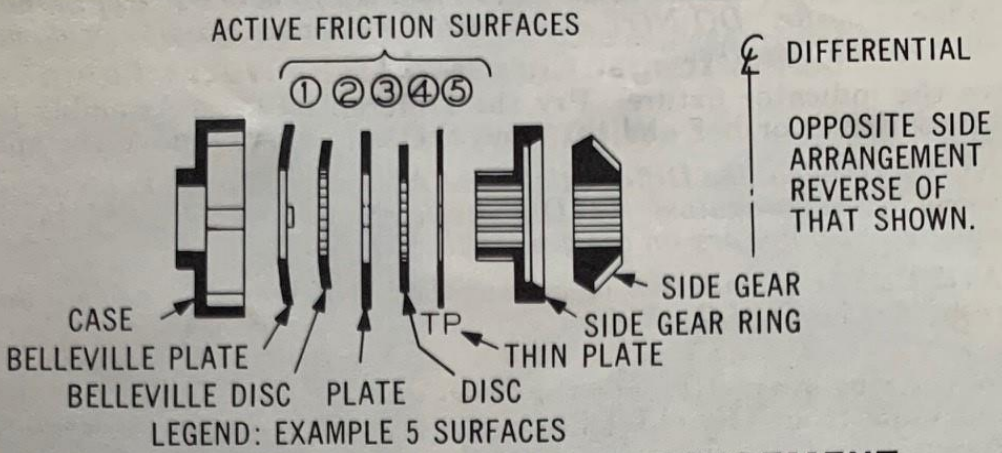
   NOTE: The axle shafts must be removed prior to removal of the Differential Case Assembly. When removing the axle shafts mark the axle shafts and the bearing adjusting shims (right or left) so that they can be returned to the same respective side upon reassembly.

4. Remove the rear axle housing cover and gasket.

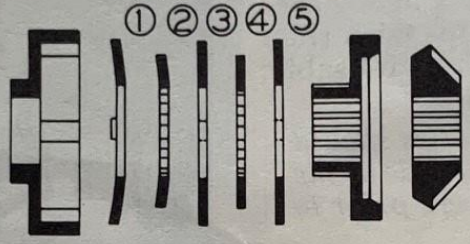
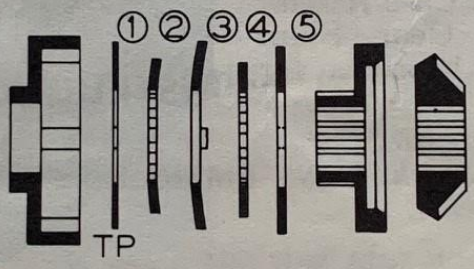
   NOTE: Before any further disassembly, measure the present back-lash between the ring gear and the axle pinion. Use a dial indicator and measure at FOUR equally spaced points around the ring gear. Determine the average back-lash reading and record it for use at reassembly.

5. Remove the Differential Bearing Caps. Note the machined marks on the rear axle housing and the Bearing Caps. These must be reassembled later in the same position they were in prior to disassembly. (See Fig. 2.)
6. Install a Carrier Spreader Tool. (See Fig. 3.)

RECOMMENDED PLATE & DISC ARRANGEMENT



FIVE SURFACE PLATE & DISC ARRANGEMENT

ARRANGEMENT NUMBER	STACK DIAGRAM	MODEL AXLE
I		44, 45, 53, 60, 70
II		23, 25, 27

THREE SURFACE PLATE & DISC ARRANGEMENT

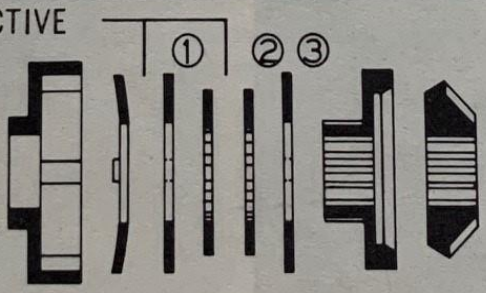
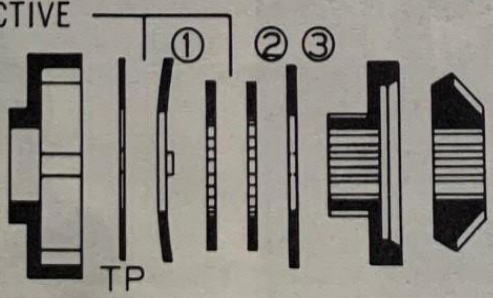
III		44F, 70F
IV		27F

Fig. 1

NOTE: It is necessary to spread the rear axle housing because the differential bearings are pre-loaded. Holes are provided in the housing casting to receive the spreader tool. When spreading the rear axle housing install a Dial Indicator so as to get a reading from one side of the housing to the opposite. DO NOT exceed .020" Indicator Reading or damage to the housing may result.

7. Remove the indicator fixture. Pry the Differential Case Assembly loose with a large screw driver or bar and lift from the housing. Remove the spreader tool.

   NOTE: Pry out the Differential Case Assembly as straight up as possible using leverage against the Differential Case and Housing to prevent damage. Do not pry on the gear teeth.

   NOTE: The installation of a Powr-Lok Differential Assembly does not require removal of the Pinion.

8. Remove the ring gear. Remove the bearings and cups from the old Differential Case Assembly. Care must be taken to insure that the bearing puller is located in the Casting recesses of the case so as not to pull on the Roller Cage. (See Fig. 4.) Keep the bearing cups with their respective cones if they are re-usable; not worn or damaged.

   NOTE: The bearing assemblies should be installed later on the same side of the rear axle housing as they were prior to disassembly.

9. Discard the old Differential Case Assembly but retain the Ring Gear, Shim Packs and the re-usable bearings for reassembly.

   NOTE: Wash out the Differential Carrier Housing using a light machine oil SAE 10 (Do Not Use Solvent).

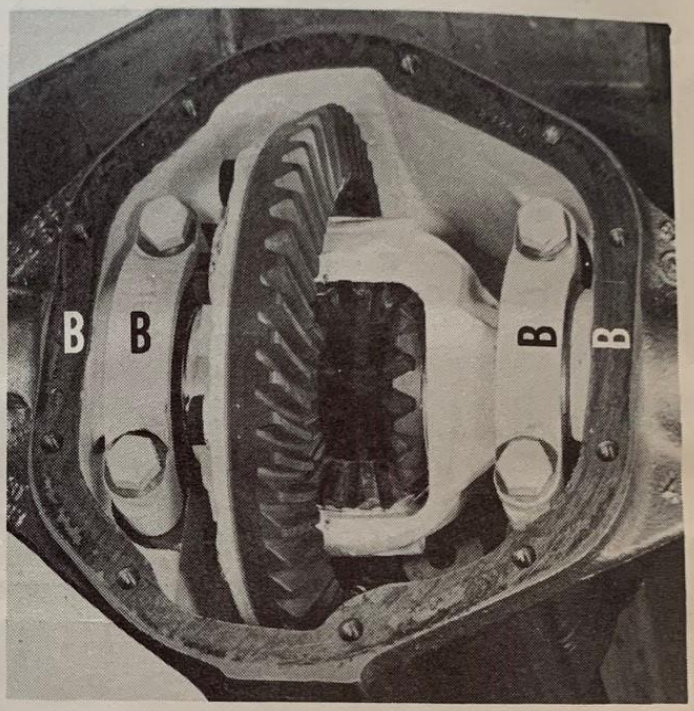


Fig. 2 2441

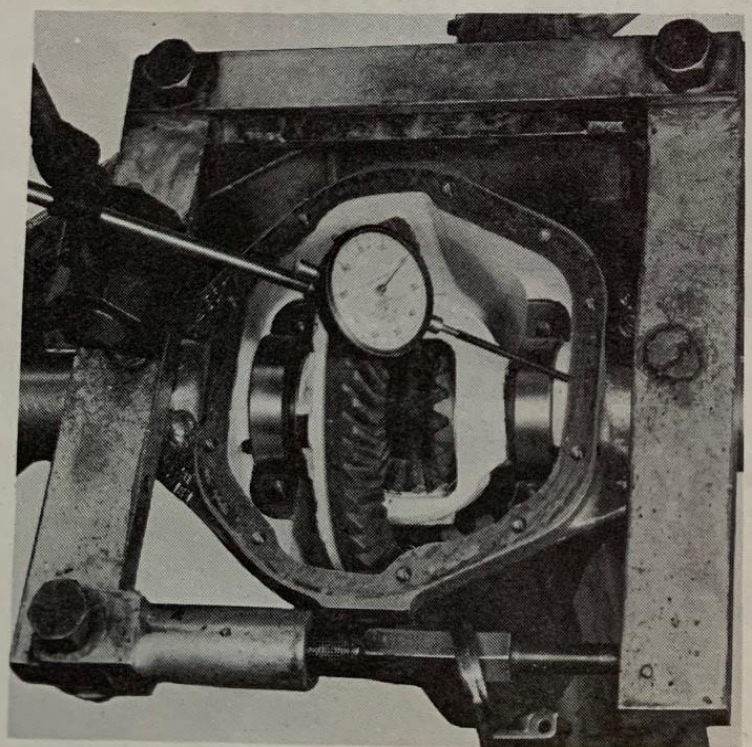


Fig. 3 2441-1

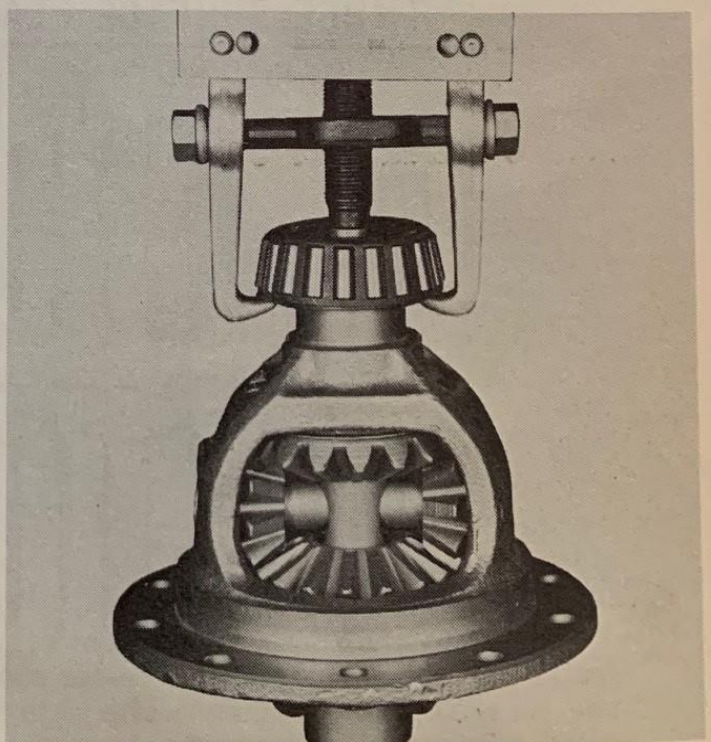


Fig. 4 2441-4

INSTALLATION OF POWR-LOK DIFFERENTIAL

10. Install the ring gear on the Powr-Lok Case Assembly; install new ring gear attaching bolts, tighten and torque to specifications. See Table page 7.

    NOTE: Ring Gear and ring gear screws should be clean—wash in Kerosene oil prior to reassembly, dry thoroughly (DO NOT lubricate).

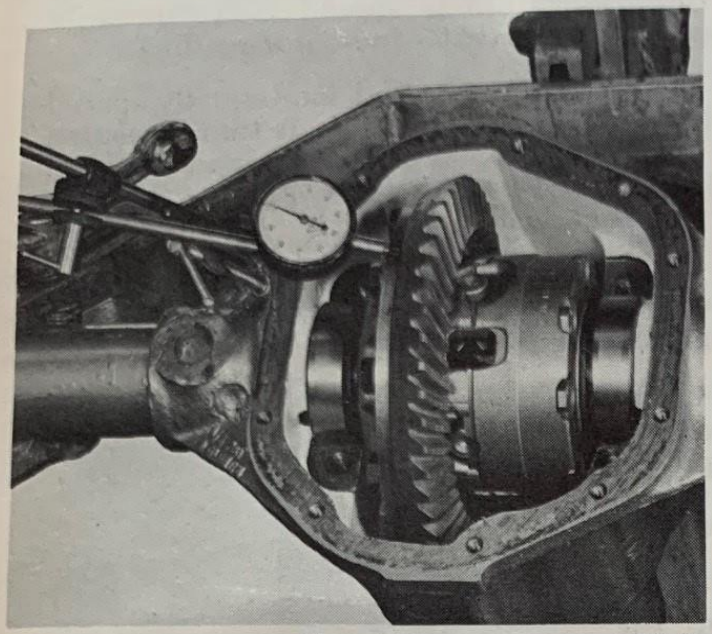


Fig. 5 2441-2

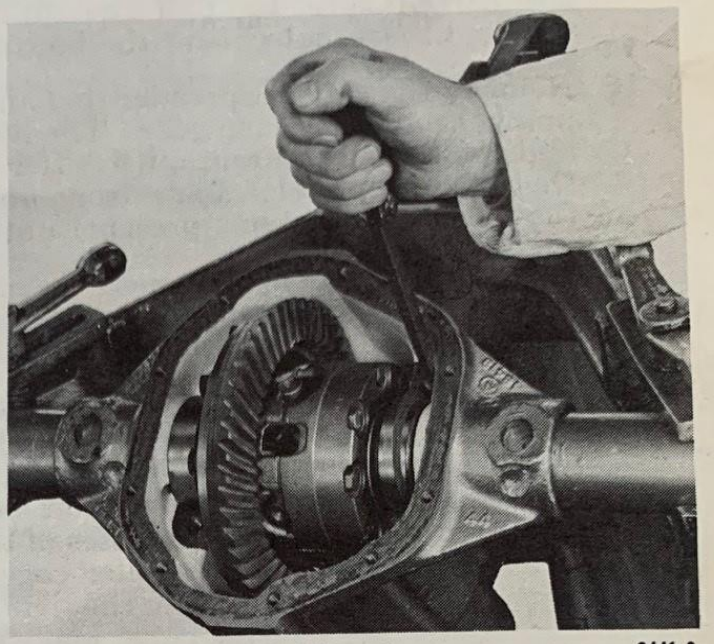


Fig. 6 2441-3

11. Press both of the differential bearing cones on the new Powr-Lok case assembly until they seat against the differential case shoulder.

    NOTE: The bearing assemblies should be installed on the same respective side of the differential case assembly as they were prior to disassembly.

    DO NOT place shims under the bearing cones at this time. Bearings are to be removed and shims installed after the correct amount of bearing pre-load is determined.

12. Install the Differential Case (with the ring gear and differential bearings completely assembled) in the Housing. The assembly will enter the Housing without the use of the spreader. (Do not install the bearing caps at this time.)
13. Set the Dial Indicator Gauge with the contact point on the back face of the ring gear. Use a screw driver placed between the Bearing Cup and the Rear Axle Housing to pry the Differential Case Assembly as far as possible toward the Axle Pinion. Be sure that both bearing cups are properly seated and that the ring gear is fully in mesh with the axle pinion. Set the Dial Indicator to zero, shift the screw driver to the opposite side and pry the Differential Case Assembly as far as possible in the opposite direction again being sure that both bearing cups are properly seated. Repeat this procedure several times until the maximum reading on the indicator is obtained. (See Fig. 5.)
14. With the differential case assembly moved as far as possible away from the axle pinion and against the axle housing at the back side of the ring gear, measure (use feeler stock) the clearance between the rear axle housing and the bearing cup at the opposite side.
15. Temporarily install shims, equal to the maximum indicator reading, between the rear axle housing and the bearing cup at the back side of the ring gear. (See Fig. 6.)
16. Temporarily install shims, equal to the difference between the maximum indicator reading and the amount of feeler stock measured at the opposite side, between the rear axle housing and the bearing cup at the ring gear tooth side of the differential case.

NOTE: At this point there should be no endwise movement of the differential case assembly, the ring gear should have no back-lash with the axle pinion but the axle pinion should rotate with only a slight effort.

17. The proper bearing pre-load and back-lash can now be established by adding .015″ additional Shims to the Shim pack temporarily installed at the Bearing Cup on the Ring Gear Tooth side of the Differential Case. With the aid of the carrier spreader tool the .015″ additional Shims should be temporarily inserted. (Do not spread the housing in excess of .020″ indicator reading.)

18. Remove the carrier spreader tool and check the back-lash at four equally spaced points around the ring gear. The back-lash should be the same as that measured and recorded in paragraph 4. If not, shims should be moved (with the aid of the carrier spreader tool) from one side to the other (without changing the total amount of shims present) until the back-lash is correct.

NOTE: Be sure to remove the carrier spreader tool when measuring back-lash and always measure back-lash at four equally spaced points around the ring gear to assure correct ring gear alignment.

19. Remove the Differential Case Assembly. Keep the shim packs separated. Remove the bearing cones—use a bearing puller. Care must be taken to insure that the puller is located in the casting recesses of the Case so as not to pull on the roller cage. Then place each shim pack on the Differential Case under the bearing cone; make sure the pack with the .015″ additional shims is on the ring gear tooth side. Press bearing cones in place. (*See Fig. 7.*)

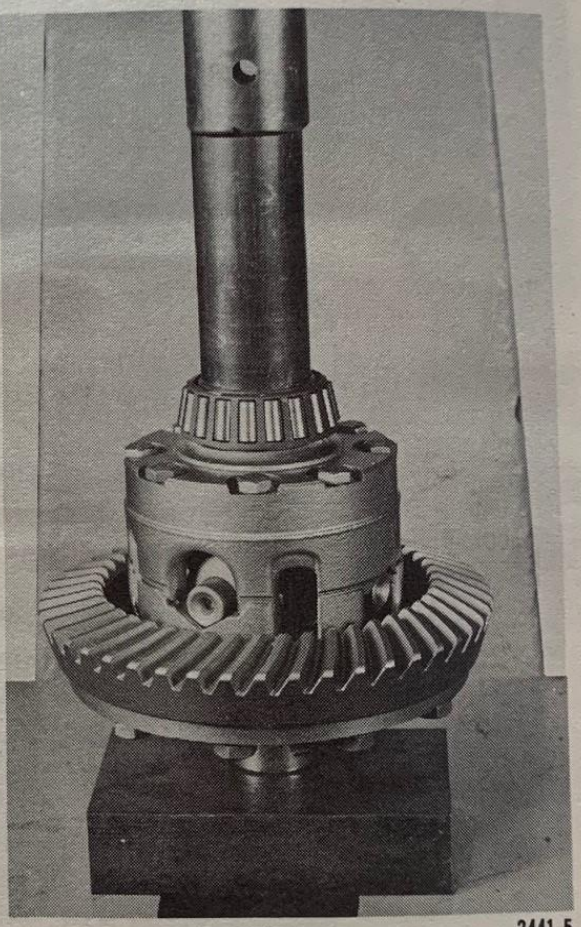


Fig. 7 2441-5

20. Install spreader tool. DO NOT spread in excess of .020″ indicator reading. Proceed as follows: Place the differential assembly in the rear axle housing. Exercise care to prevent damage to the gear teeth. Tap differential assembly into place. Remove spreader tool. Install bearing caps giving attention to the markings on the caps. Coat the bearing cap screws with sealing compound, tighten and torque to specifications. See Table Page 7.

NOTE: After the bearing cap screws are properly installed and tightened a .003″ feeler should not enter between the bottom of the bearing cap and the top of the bearing cup.

21. Use the indicator to recheck back-lash at four points around the ring gear. Back-lash must be the same as that originally measured in paragraph 3. If it is not, shims should be moved from one side to the other (without changing the total amount of shims present) until the desired back-lash is obtained.

22. Grind off filler plug to be flush on the inside. Clean and replace the cover—use new cover gasket; install cover screws, tighten and torque to specifications. See Table Page 7.

23. Install axle shafts. On axles with a taper and key to hold the wheel assembly, it will be necessary to recheck the axle shaft end play specifications .002″ to .008″.

NOTE: Make sure the spline end of the axle shaft does not interfere with the pinion mate shafts. This is best accomplished by measurement. Use a steel tape and with the aid of a flashlight measure from the bottom of the axle shaft bearing bore to the pinion mate cross shaft. Then measure the axle shafts from the corresponding point of the bearing to the end of the spline. The minimum clearance required is ⅛ of an inch. Grind off the spline end if the axle shaft is too long. Check the other axle shaft in the same manner.

CAUTION. If the axle is from a Ford Product, it may be necessary to grind 1/16" from the spline end of the shafts. Shafts must have clearance with the pinion shafts in the differential case.

CAUTION. On some Kaiser (Willys) models with a straight sided spline axle shaft it will be necessary to replace the axle shafts. (See Powr-Lok Catalog X580.)

24. LUBRICATION—Refill axle with correct amount of the proper lubricant.

CAUTION: Consult your authorized car dealer for the recommended Lubricant to be used with Powr-Lok installations. (Lubricants are not available at gasoline service stations.)

AFFIX THE ENCLOSED STICKER TO THE WINDSHIELD

WARNING: DO NOT SPIN WHEEL with one elevated, as it is possible to have sufficient driving load due to friction, etc., to actuate the Powr-Lok unit and cause the car to move.

WARNING: When balancing the rear wheels (in position) on a vehicle equipped with Powr-Lok, always be sure the transmission is in neutral and that both wheels are clear of the floor.

TORQUE RANGE CHART

Axle Model	Ring Gear Screw Size	Ring Gear Screw Torque (Lbs. Ft.)	Differential Bearing Cap Screw Size	Differential Bearing Cap Screw Torque (Lbs. Ft.)	Cover Screw Size	Cover Screw Torque (Lbs. Ft.)	Powr-Lok Case Screw Size	Powr-Lok Case Screw Torque (Lbs. Ft.)
23	3/8 x 24	45 - 65	1/2 x 13	70 - 90	5/16 x 18	15 - 25	3/8 x 24	45 - 55
25	3/8 x 24	45 - 65	1/2 x 13	70 - 90	5/16 x 18	15 - 25	3/8 x 24	45 - 55
27	3/8 x 24	45 - 65	7/16 x 14	35 - 50	5/16 x 18	15 - 25	3/8 x 24	45 55
44	3/8 x 24	45 - 65	1/2 x 13	70 - 90	5/16 x 18	15 - 25	3/8 x 16	45 - 55
45	7/16 x 20	70 - 90	1/2 x 13	70 - 90	5/16 x 18	15 - 25	3/8 x 16	45 - 55
53	7/16 x 20	70 - 90	1/2 x 13	70 - 90	3/8 x 16	15 - 25	3/8 x 16	45 - 55
60	1/2 x 20	100 - 120	1/2 x 13	70 - 90	3/8 x 16	15 - 25	7/16 x 14	55 - 75
70	1/2 x 20	100 - 120	1/2 x 13	70 - 90	3/8 x 16	15 - 25	7/16 x 14	55 - 75

TROUBLE SHOOTING—POWR-LOK

TO ELIMINATE CHATTER FROM POWR-LOK UNIT . . .
Follow instructions below.

1. Drain the axle housing of old lubricant. To do this, we advise heating the axle by operation and draining immediately.

NOTE: To drain thoroughly, it will be necessary to rotate the wheels slowly (by hand) to allow all the lubricant to drain from the internal mechanism.

CAUTION: We do not recommend flushing the unit—especially with solvents, due to the undesirable effect solvents may have on new lubricant.

2. After the axle housing has drained thoroughly, replace the drain plug (if used) and refill with a correct amount of fresh lubricant.

CAUTION: Consult the authorized car dealer for the recommended lubricant to be used with the specific Powr-Lok installation. Lubricants are not generally available at gasoline service stations.

NOTE: In the event the above procedure is not effective after 200 miles of driving, we suggest repeating the heat, drain and refill operation. It has been our experience that this procedure is more effective than the use of a flushing agent, such as light engine oil.

EXTREME CASES OF CHATTER OR REPLACEMENT OF FRICTION DISCS OR PLATES

1. As described in the first part of these instructions; remove the Axle Assembly or the Differential Carrier Assembly from under the car, carefully measure and record the average ring gear pinion back-lash reading and remove the Powr-Lok Unit.

   NOTE: Do not remove the ring gear or the bearing cones from the differential case assembly. Be careful not to damage the bearings and mark the bearing cups so they may later be reassembled with the same bearing cones.

   NOTE: The Powr-Lok Differential Case halves should be marked or scribed for correct alignment at reassembly. Each pinion mate cross shaft should also be marked or scribed so that each pin cam surface will match with the same "V" ramp in the case when reassembling. (See Fig. 8.)

2. Separate the case halves and remove the pinion mate cross shafts, bevel pinion mate gears, bevel side gears, side gear rings, clutch friction plates, and clutch friction discs.

   NOTE: Care should be taken to see how the friction plates and friction discs are assembled. (See Fig. 1.) The exact location and orientation of the Belleville Spring Plate used on each side should be noted here.

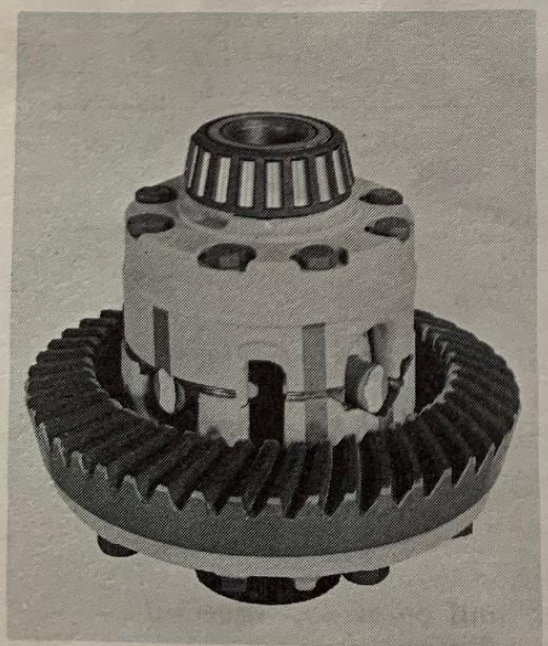


Fig. 8 2166-4

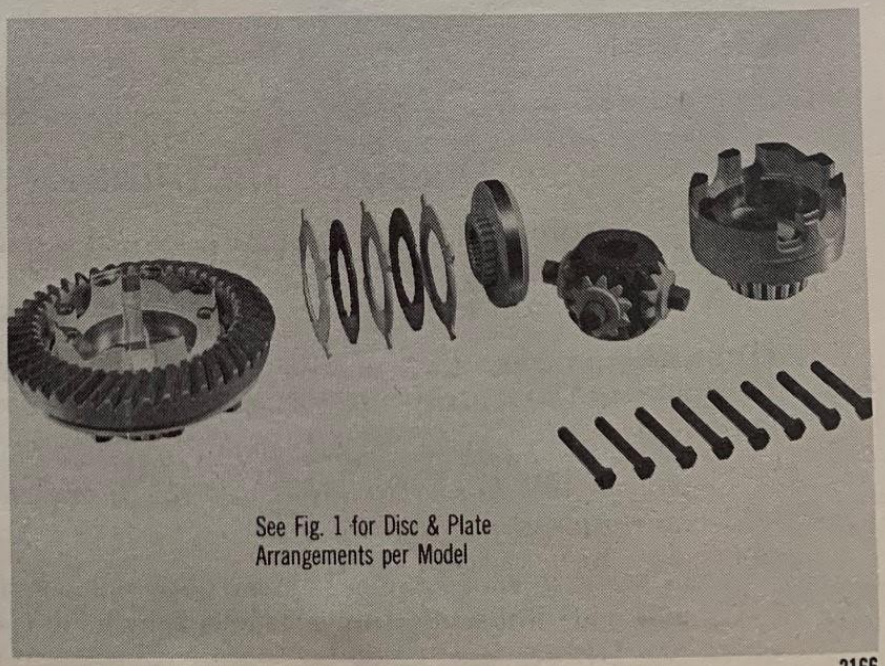


Fig. 9 2166

NOTE: Inspect all parts and replace any items which appear to be worn or damaged. Inspect in particular the plate surfaces of the case halves, the side gear rings and the clutch plates & discs for excessive wear and scoring. (See Fig. 10.)

NOTE: In the event that one or more of the clutch friction plates, discs or spring plates needs replacing, it is suggested that the entire stack of plates, discs & spring plates on each side be replaced. These are supplied in a Kit and can be obtained thru your Powr-Lok parts supplier or car dealer.

NOTE: It is essential that all parts be clean and free of any foreign material before reassembling—wash in kerosene oil prior to reassembly, dry thoroughly.

CAUTION: As each part is reassembled in its proper position it is necessary that it be lightly coated with the correct lubricant.

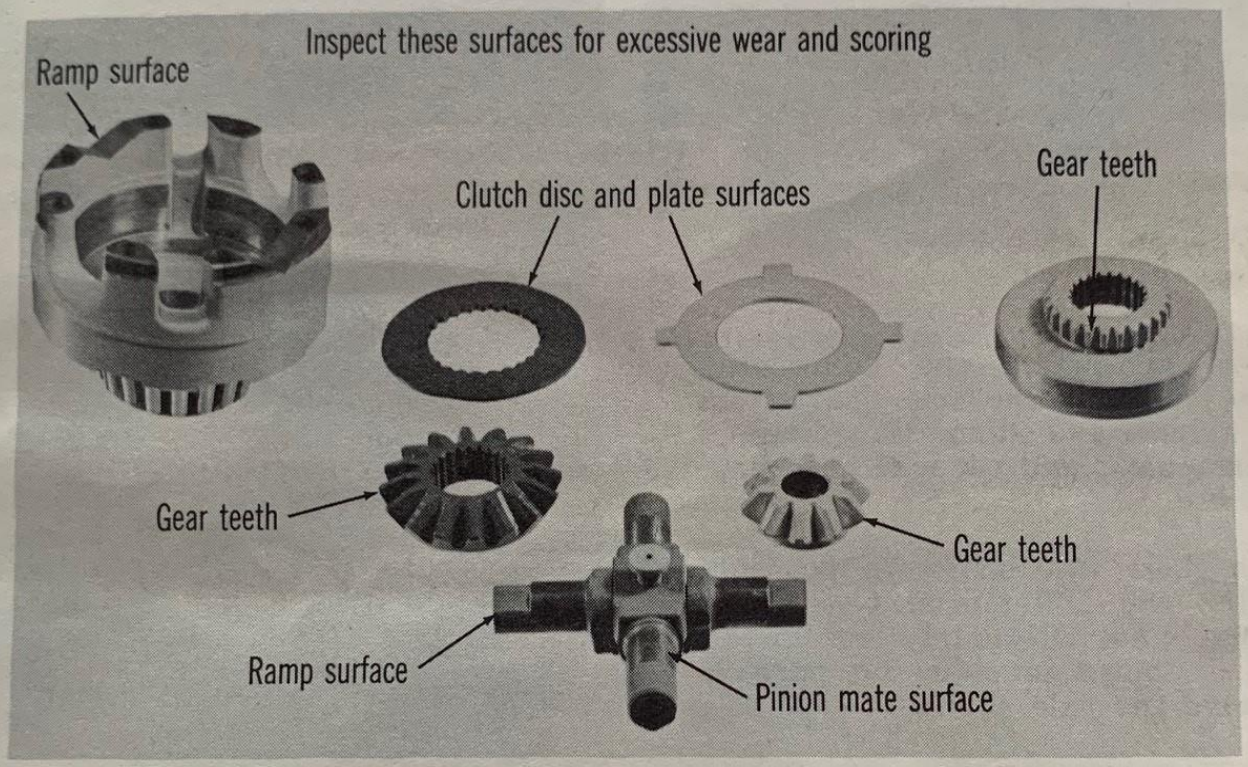


Fig. 10

3. Assemble the proper number of clutch friction plates and clutch friction discs on the splined hub of each bevel side gear. Make sure the plates and discs are arranged correctly. (See Fig. 1.)
4. Hold each Differential Case half on its side, install the side gear rings with the friction plates and friction discs assembled. The side gear ring will rotate with a slight drag when properly located in the case. (See Fig. 11.)
5. With the ring gear flange half of the Differential Case in an upright position, assemble the bevel side gears, pinion mate cross shafts (align the previously made marks on the cross shafts and the case halves), and bevel pinion mate gears. (See Fig. 12.)
6. Hold the remaining case half thru the bearing trunnion and install it on the ring gear flange half. (See Fig. 12.)
7. Make sure the markings on each Differential Case half coincide. (See Fig. 13.) Install the Differential Case bolts and turn them in a few threads.

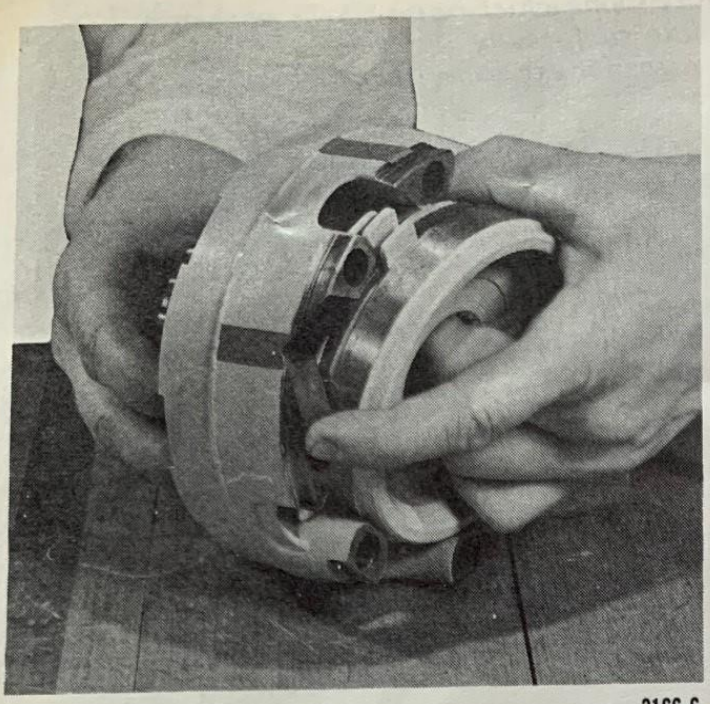


Fig. 11 2166-6

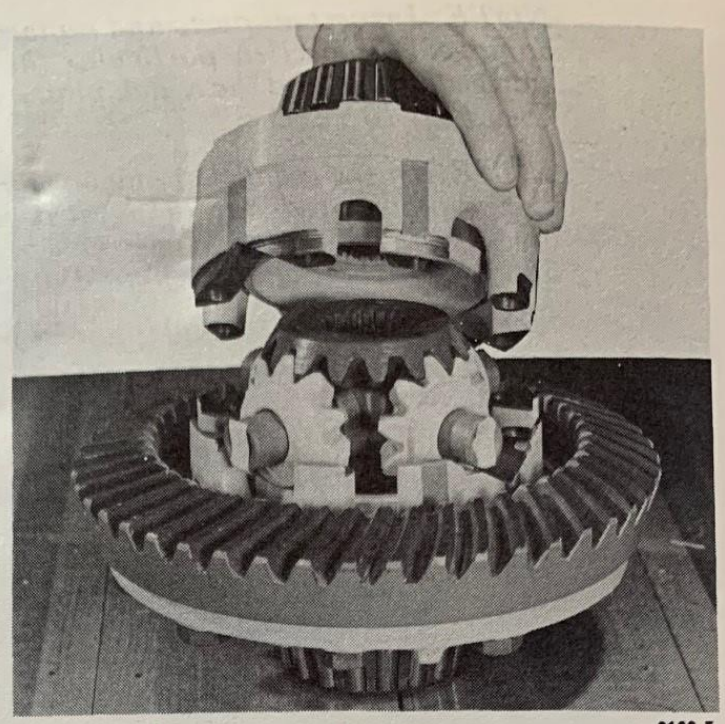


Fig. 12 2166-5

Fig. 13 2166-1

8. Before tightening the Differential Case bolts, use the axle shafts from the vehicle and align the splines of the side gear and the side gear ring. (See Fig. 13.)

9. With these axle shafts in position, tighten the Differential Case bolts evenly, and alternately torque to ft. lbs. shown in chart on page 7. Remove the axle shafts.

NOTE: A check can be made here to determine whether or not the Powr-Lok components have been assembled properly. Each pinion mate cross shaft can be tight on its ramp or in the event there is clearance between the cross shaft and the ramp it should not be more than .010". It should be equal at all four cross shaft ends.

10. Reinstall the assembled Powr-Lok Unit in the axle as outlined (paragraph 19 thru 23) in the first part of these instructions.

CAUTION: If the ring gear or the bearings have not been replaced, it is only necessary to recheck the back-lash to the amount recorded in paragraph 1. This recheck will assure that all of the components are properly located. In the event that the ring gear or the bearings have been replaced, follow previous instructions for re-setting back-lash and bearing pre-load.

A SIMPLE PROCEDURE FOR TESTING YOUR POWR-LOK

Operation under immobile conditions

When one wheel slips, the Powr-Lok will automatically increase the power to the gripping wheel. This increased power, of varying ratio, is a multiple of that required to drive the slipping wheel. The multiple ratio varies automatically to suit the road conditions and ranges from 5:1 to 1.5:1. However, there may be times when the spinning wheel is on an excessively slippery surface and does not provide enough resistance to transfer sufficient power to the gripping wheel. Under these conditions, the Powr-Lok offers an additional advantage for cars equipped with the parking brake at the rear wheels. By lightly applying the brake (usually three or four notches), enough additional resistance can be applied to the slipping wheel to greatly increase the power to the wheel with the better traction.

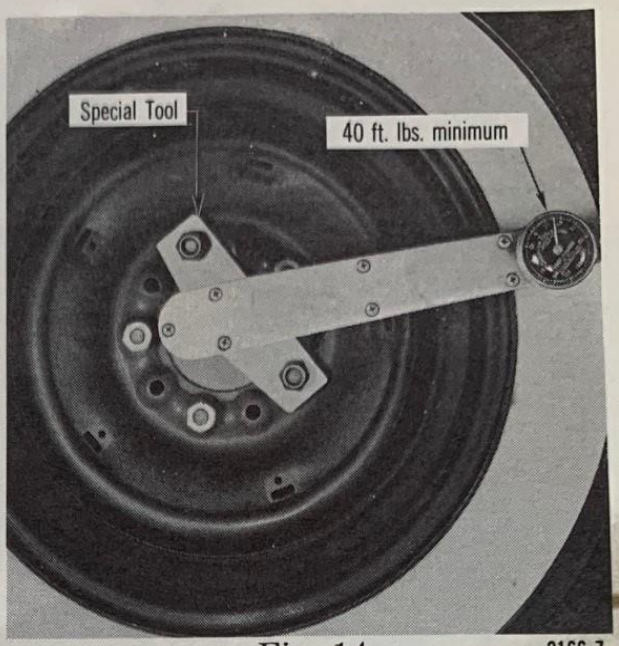


Fig. 14 2166-7

Testing for correct operation

The Powr-Lok can be effectively tested for correct operation by placing one rear wheel on good dry pavement and the other on ice, snow, mud, or gravel.

It can easily be determined whether or not the non-slipping wheel is providing pulling power. The procedure should then be repeated with the opposite wheels on the dry and slippery surfaces.

CAUTION: Do not attempt to test the Powr-Lok while one wheel is on a jack. Under certain conditions, the unit could possibly cause the vehicle to jump off the jack.

The above testing procedure is a rough test that can be made by the owner of the vehicle. However, if it is suspicioned that the unit is not operating properly, it can be checked at the vehicle dealer service department by the following procedure.

Be sure the transmission is in neutral. Raise one wheel off the floor and placê a block in the front & rear of the opposite wheel. Remove the hub cap and install a special tool across two wheel studs if the axle shaft is the flanged type. Apply a torque wrench to special tool. Disregard breakaway torque and observe only the torque required to continuously turn the wheel smoothly. (See Fig. 14)

For a taper type axle shaft having a nut to secure the wheel onto the shaft, the torque wrench can be applied to this nut.

If the torque reading is less than 40 ft. lbs., the unit should be disassembled and the necessary repairs made.