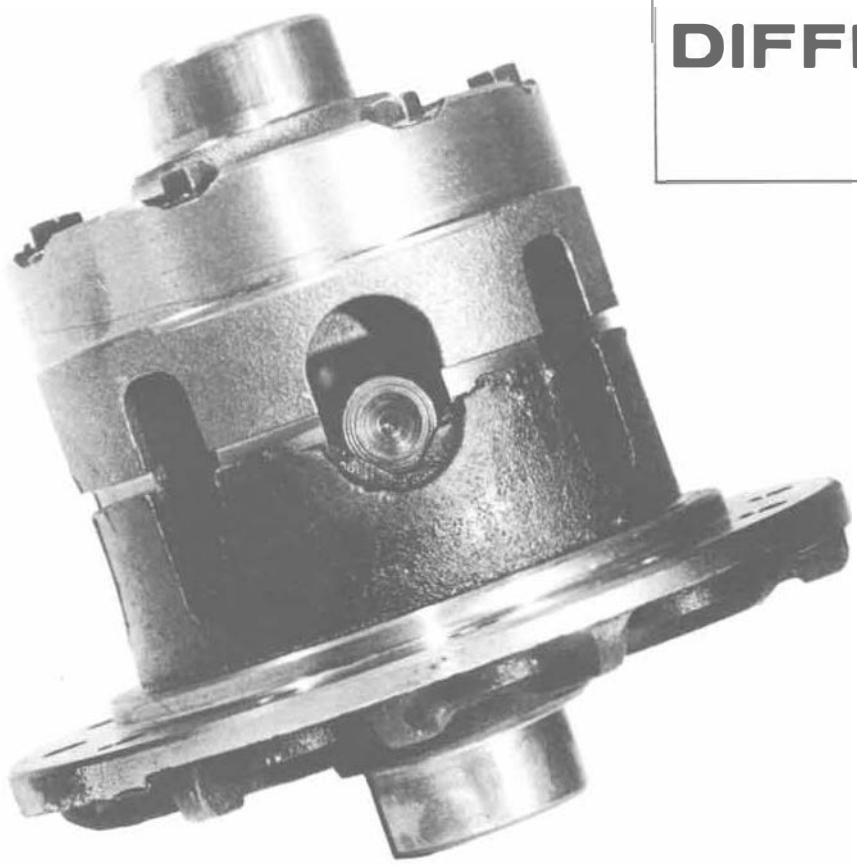
SERVICE MANUAL

SPICER®

MODEL 60

MODEL 70

POWR-LOK LIMITED SLIP DIFFERENTIAL



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IMPORTANT SAFETY NOTICE

Should an axle assembly require component parts replacement, it is recommended that "Original Equipment" replacement parts be used. They may be obtained through your local service dealer or other original equipment manufacturer parts supplier. CAUTION: THE USE OF NON-ORIGINAL EQUIPMENT REPLACEMENT PARTS IS NOT RECOMMENDED AS THEIR USE MAY CAUSE UNIT FAILURE AND/OR AFFECT VEHICLE SAFETY.

Proper service and repair is important to the safe, reliable operation of all motor vehicles or driving axles whether they be front or rear. The service procedures recommended and described in this service manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tool should be used when and as recommended.

It is impossible to know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way.

Accordingly, anyone who uses a service procedure or tool which is not recommended must first satisfy himself thoroughly that neither his safety or vehicle safety will be jeopardized by the service methods he selects.

MODEL 60 AND MODEL 70 POWR-LOK

LUBRICATION

It is not our intent to recommend any particular brand or make of lubricant for Spicer axles. However, a S.A.E. 90 weight multipurpose gear lubricant meeting Mil. Spec. L-2105-B, or 80 W 90 multipurpose gear lubricant meeting Mil. Spec. L-2105-C, and suitable for A.P.I. Service Classification GL-5 is suggested as a minimum requirement.

IMPORTANT

Limited Slip Differentials impose additional requirements on lubricants which cannot be covered by the above specifications. Some otherwise good lubricants produce "chatter" or "bumping" in turning corners with Limited Slip Differentials. Many vehicle manufacturers find it necessary to specify a special lubricant or lubricant additive for use with Limited Slip Differentials. Check the vehicle manufacturer's lubricant recommendations.

COLD WEATHER OPERATION

If the vehicle is operated below 0°F (−18°C), it is advisable to use S.A.E. 80 multipurpose gear lubricant meeting Mil. Spec. L-2105-B and suitable for A.P.I. Service Classification GL-5.

SUBMERSION OR DEEP WATER FORDING

In the event the gear carrier housing should become submerged in water, particularly if over the breathers, it is recommended that the hypoid gear lubricant be drained and internal parts be inspected for water damage and/or contamination.

Clean, examine and replace damaged parts, if necessary, prior to assembling the housing cover and refilling with the specified hypoid lubricant.

NOTE

IT IS RECOMMENDED THAT WHENEVER BEARINGS ARE REMOVED THEY ARE TO BE REPLACED WITH NEW ONES, REGARDLESS OF MILEAGE.

OPERATION

A conventional differential transmits all of the ring gear torque through the differential side gears to the axle shafts. Torque is at all times equal on the axle shafts, and if one wheel slips, the other wheel can only put out as much torque as the slipping wheel.

The Powr-Lok differential has the same power flow as a conventional differential plus a more direct flow which automatically takes effect as driving conditions demand. This more direct power flow is from the differential case to each axle shaft through a clutch plate and disc arrangement.

The most common Model 60 & Model 70 Powr-Lok consists of five steel clutch members on each side of the differential case.

Arrangement of these plates and discs is at the option of the vehicle manufacturer, so care should be taken during disassembly to note the arrangement of these components.

The Powr-Lok construction permits differential action when required for turning corners and transmits equal torque to both wheels when driving straight ahead. However, when one wheel tries to spin due to leaving the ground, a patch of ice, etc., the clutch packs automatically provide more torque to the wheel which is not trying to spin.

The Powr-Lok differential resists wheel spin on bumpy roads and provides more pulling power when one wheel tries to slip. In many cases of differences in traction, pulling power will be automatically provided until both wheels start to slip.

In diagnosis of vehicle operators' complaints, it is important to recognize two things.

1. If, with unequal traction, both wheels slip, the Powr-Lok has done all it can possibly do.
2. In extreme cases of differences in traction, the wheel with least traction may spin after the Powr-Lok has transferred as much torque as possible to the non-slipping wheel.

TROUBLE SYMPTOMS AND POSSIBLE CAUSES

If noises or roughness, such as chatter, are present in turning corners, the probable cause is incorrect or contaminated lubricant. (See Lubrication).

Before any differential is removed and disassembled for chatter complaints, the correctness of lubricant can and should be determined.

If the vehicle manufacturer recommends a lubricant additive for chatter complaints, add the specified type and amount of additive and recheck for chatter by warming the axle up, and then making a minimum of ten (10) figure eight turns.

If this is unsuccessful, or no lubricant additive is specified, a complete lubricant drain, flush, and refill with the specified Limited Slip differential lubricant will usually correct chatter.

The following procedure is recommended to ensure flushing the system of old lubricant.

1. Warm the lubricant by vehicle road operation or five (5) minutes of operation in gear at 30 m.p.h. with both rear wheels off the ground. Vehicle should be on a *free wheel hoist.*

CAUTION

NEVER PLACE THE TRANSMISSION IN GEAR WITH THE ENGINE RUNNING WHEN ONLY ONE REAR WHEEL OF A LIMITED SLIP DIFFERENTIAL EQUIPPED VEHICLE IS RAISED. THE VEHICLE MIGHT DRIVE ITSELF OFF OF THE JACK AND CAUSE DAMAGE OR INJURY.

2. Drain lubricant while warm. Remove drain plug or cover plate to drain completely. If cover plate is removed it may be necessary to replace the gasket.
3. Refill axle with specified Limited Slip differential lubricant.
4. Operate the vehicle for approximately ten (10) miles, making at least ten (10) figure 8 turns to flush the old lubricant out of the clutch packs.
5. Repeat Steps 2, 3, and 4, making sure to replace the cover gasket, if required, in Step #3.
6. It is possible that slight chatter, requiring additional vehicle operation, may remain after Step 5. If chatter still persists after one hundred (100) miles of vehicle operation, or remains severe after Step 5 above, disassembly and repair will be necessary.

PROPER PROCEDURE FOR CHECKING WHEEL TORQUE

If inadequate or excessive lock-up is suspected, drive the vehicle far enough to warm up the axle lubricant, and exercise the unit by operating the vehicle through at least three (3) figure 8 turns prior to making the following test as described.

With engine shut off, transmission in neutral, and parking brake off, place a block of wood in front and back of both front wheels. Jack up one rear wheel until it is completely off the ground and remove hub cap.

CAUTION

DO NOT JACK UP ONE WHEEL TO CHECK FOR TORQUE WHILE ENGINE IS RUNNING AND TRANSMISSION IS IN GEAR. THIS COULD CAUSE DAMAGE TO THE VEHICLE AND POSSIBLE PERSONAL INJURY IF THE VEHICLE JUMPED OFF THE JACK.

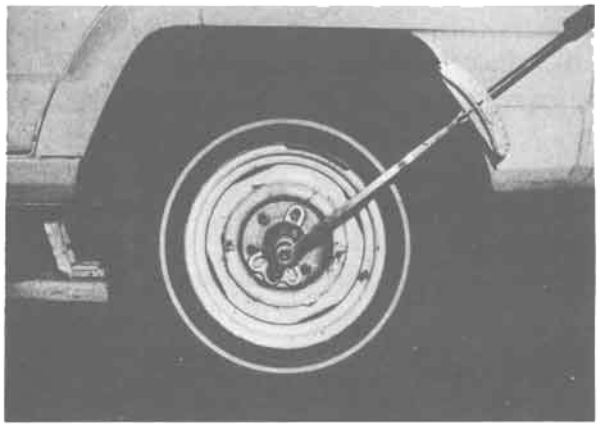

FIGURE 2

1018-2

Apply a torque wrench to the special tool which is bolted to the wheel bolts.

Disregard breakaway torque and observe only the torque required to continuously turn the wheel.

If torque reading is less than 40 lbs. ft. (45.2 N•m) or greater than 200 lbs. ft. (271 N•m) on either wheel (with dished plate and dished disc), the Powr-Lok unit should be disassembled and the necessary repairs made. Powr-Lok units (with dished plate) should require a minimum of 25 lbs. ft. (33.9 N•m) or a maximum of 200 lbs. ft. (271 N•m) to rotate.

DISASSEMBLY
REMOVAL, INSPECTION AND REPAIRS OF POWR-LOK DIFFERENTIAL

On Spicer axles it is recommended that the complete assembly be removed from the vehicle when it becomes necessary to service the Limited Slip differential.

Remove wheels, etc. from vehicle. Refer to vehicle manufacturer's recommendations.

Remove axle shafts.

NOTE

BRAKE BACKING PLATE CAN NORMALLY BE WIRED TO THE FRAME, WITHOUT LOOSENING THE HYDRAULIC BRAKE LINE CONNECTION AT THE WHEEL CYLINDER, IF DESIRED. USE CAUTION TO AVOID DAMAGE TO BRAKE LINE.

NOTE

IF GASKETS ARE ASSEMBLED AT THE WHEEL ENDS, DISCARD OLD GASKETS AND REPLACE WITH NEW ONES AT TIME OF ASSEMBLY.

REMOVE COVER PLATE AND COVER GASKET, IF GASKET IS USED. DRAIN LUBRICANT FROM CARRIER.

REMOVE AXLE ASSEMBLY FROM VEHICLE.

PLACE AXLE ASSEMBLY IN RACK OR STAND TO SERVE AS A HOLDING DEVICE.

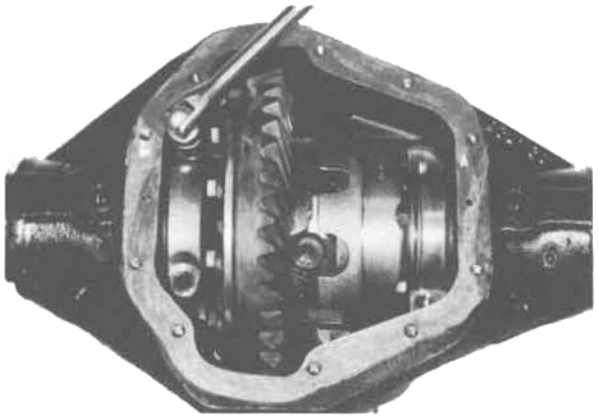

FIGURE 3 1016-3

Remove differential bearing caps. Note letters stamped on both the bearing caps and the cover face of the carrier. Letters are to correspond in horizontal and vertical positions. This is very important at time of assembly.

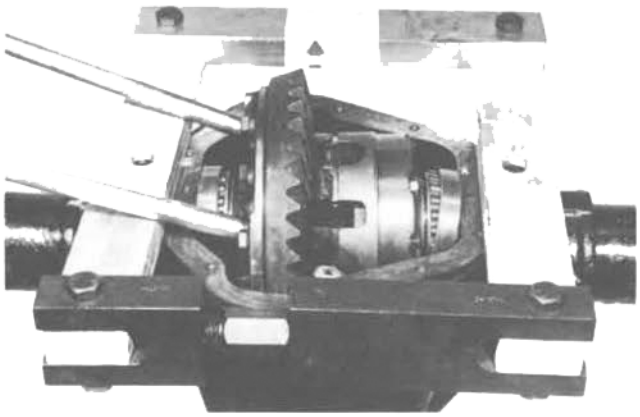

FIGURE 5 1016-5

Remove differential using two pry bars as shown. It will not be necessary to remove the differential bearings at this time, however, the bearing cups should be marked or tagged to indicate which side of the case they were removed.

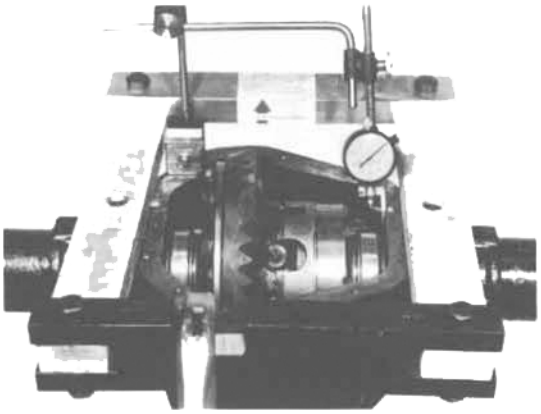

FIGURE 4 1016-4

Mount spreader to housing. Locate dial indicator with a magnetic base and extensions as shown. Allow sufficient travel on dial indicator. Locate dial tip of indicator on carrier as shown.

Set dial indicator at zero ("0"). Turn forcing screw of spreader until indicator records .015" (.38 mm).

CAUTION

DO NOT SPREAD CARRIER IN EXCESS OF .015" (.38 mm).

Remove Indicator

Tools: D-167 Spreader
D-128 Indicator Set

FIGURE 6 1016-6

All Spicer Powr-Loks are identified with a manufacturing date and a complete part number stamped on the button half of the case. If the axle is equipped with a Powr-Lok Limited Slip differential, it will contain a tag specifying the use of Limited Slip lubricant.

In Figure 6, the Powr-Lok is identified with .125" (3.18 mm) high numbers and letters stamped in the case. For example: The number 9-6-77 A is the manufacturing date or build date of the Powr-Lokand is interpreted as follows. The first number is the month; second number is the day of the month; third number is the year; the letter is the shift. For example: September 6, 1977 first shift. The other number stamped beside the manufacturing date is the complete Powr-Lok assembly part number.

MODEL 60 AND MODEL 70 POWR-LOK

NOTE

IT IS ADED THAT WHEN REFERRING TO THE POWR-LOK, OBTAIN THE COMPLETE PART NUMBER AND BUILD DATE. TO DO THIS IT WILL BE NECESSARY TO WIPE THE GEAR LUBRICANT OFF THE CASE.

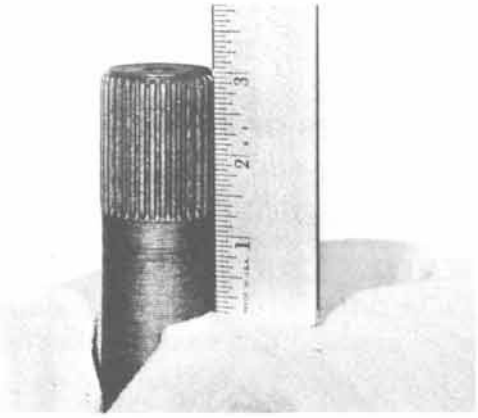

FIGURE 7 1016-7

Place a few shop towels over and between the vise jaws. This will prevent possible damage to the hearing, etc.

Place one of the axle shafts into vise. Tighten shaft in vise with the spline end extending approximately 3 inches (76.2 mm) above the vise. This will be used as a holding device for disassembly and assembly of the Powr-Lok.

FIGURE 8 1016-8

Place the case on the axle shaft as shown. The spline teeth of the side gear will engage those of the axle shaft, the shaft will now serve as a holding device. Use a piece of chalk or paint, scribe a line on one of the cross shaft and both halves of the case, and mark an "0", on the other cross shaft and both case halves as shown. This will permit reassembly (if used) of the shafts and case exactly as they were removed.

Remove case body screws. Remove case from axle shaft and place on bench.

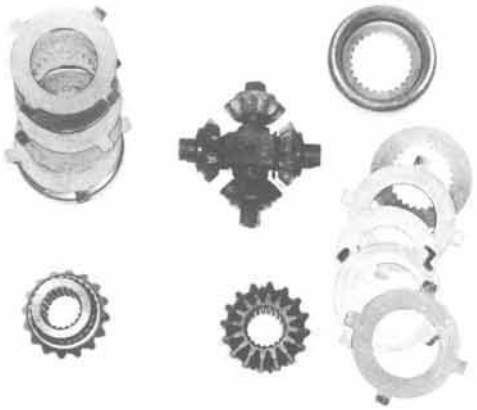

FIGURE 9 1016-9

Disassemble case. Keep the stack of plates and discs in exactly the same order in which they were removed. Inspect plates, discs, clutch rings, side gears, pinion mate gears, and pinion mate shafts for damage, scoring, or wear. If any one of the plates or discs on either stack shows wear or scoring the complete stack is to be replaced on both sides. Clutch rings which show wear or scoring are also to be replaced in sets. The side gears and pinion mate gears that show damage or wear are also to be replaced in sets. If wear is indicated on the cams of the pinion mate shafts, these are also to be replaced in sets.

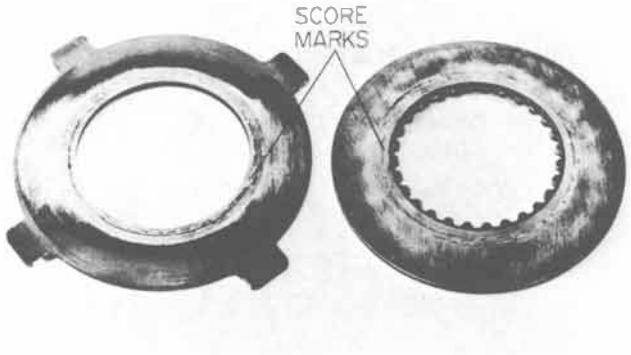

FIGURE 10 1016-10

Figure 10 shows a typical example of scoring and, as mentioned, all plates and discs of the Powr-Lok are to be replaced.

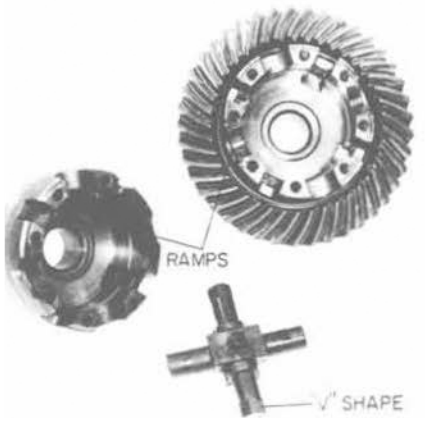

FIGURE 11 1016-11

The pinion mate shafts are unlike the shaft of a conventional differential and, therefore, are not locked to the differential case.

Notice also that at the end of each shaft, they are formed into a "V", and each case half has "V" shaped surfaces. The "V" formation of the case is known as a ramp. If wear is evident on either case half, then both halves must be replaced.

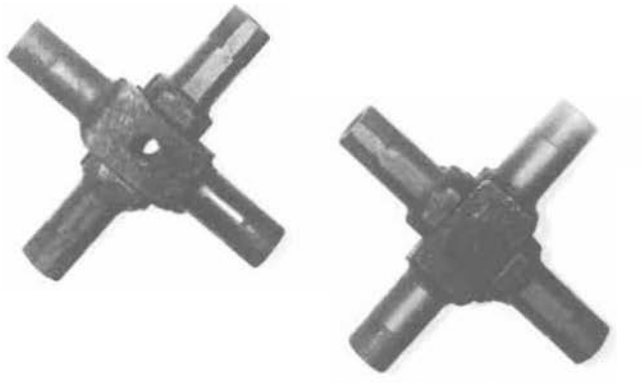

FIGURE 12 1016-12

TWO TYPES OF CROSS PINS

Some semi-float axles require a spacer block to maintain proper end play and transmit thrust forces from one axle shaft to the opposite axle shaft and its wheel bearing. There is one type spacer block and it is known as the roll pin design. Axle shafts which do not require end play have no spacer block in the cross pins.

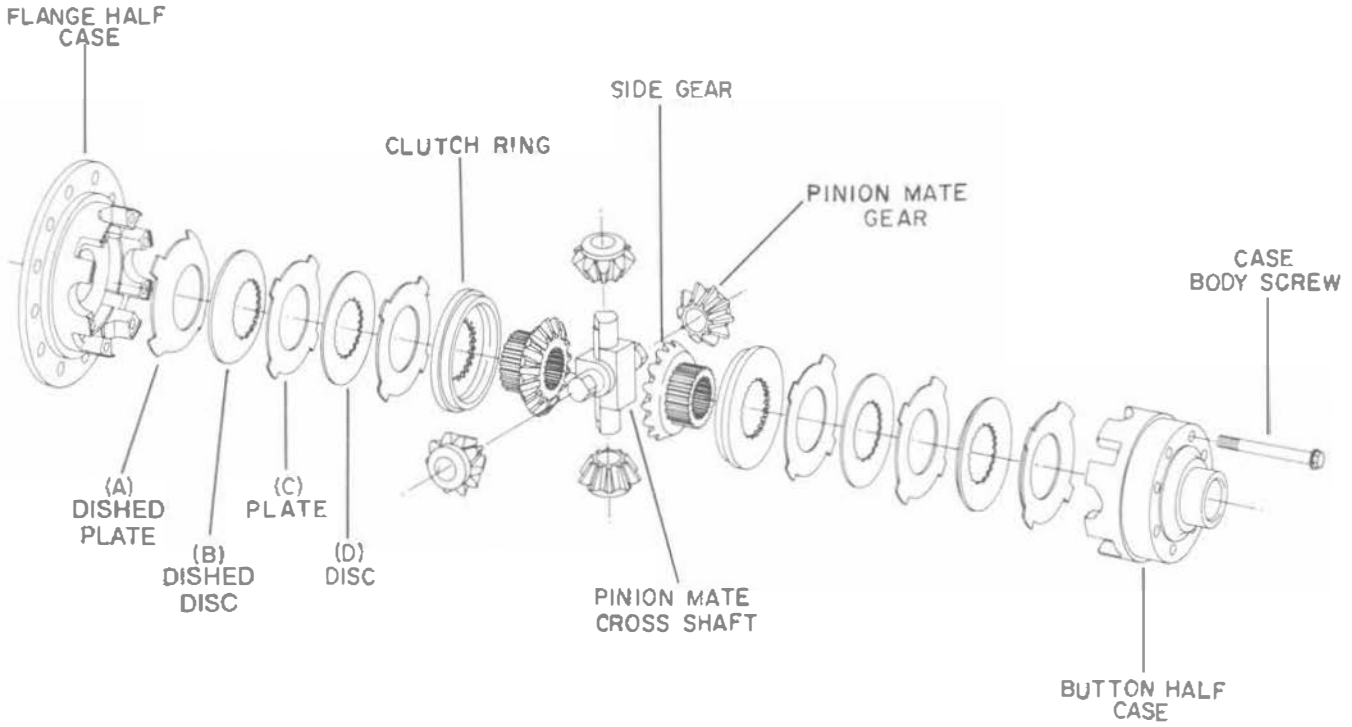

FIGURE 13 1016-13

PARTS IDENTIFICATION.

MODEL 60 AND MODEL 70 POWR-LOK

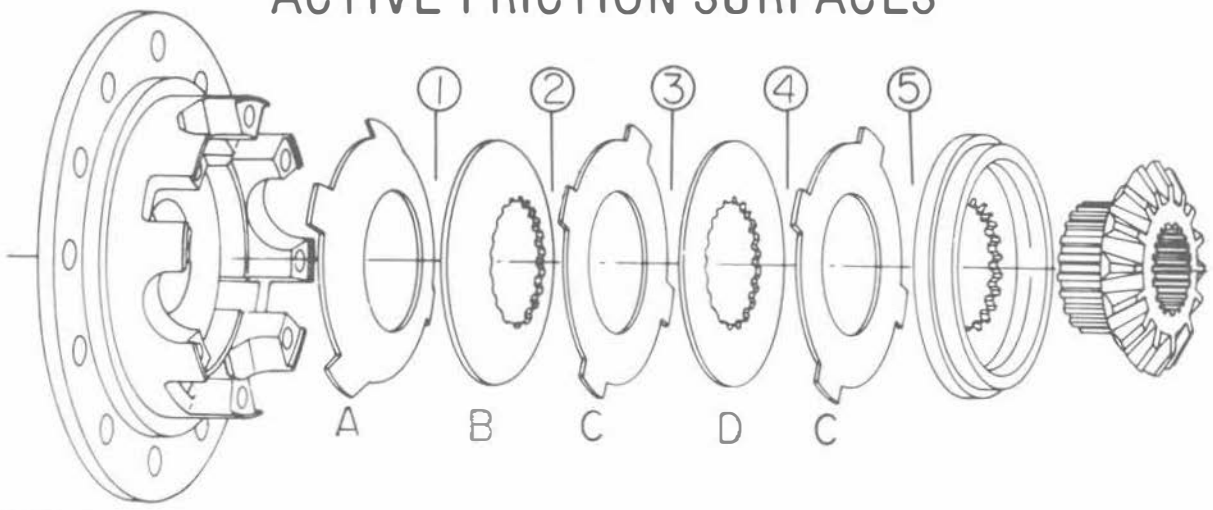

FIGURE 14 1018-14

5 SURFACES DISHED PLATE AND DISHED DISC

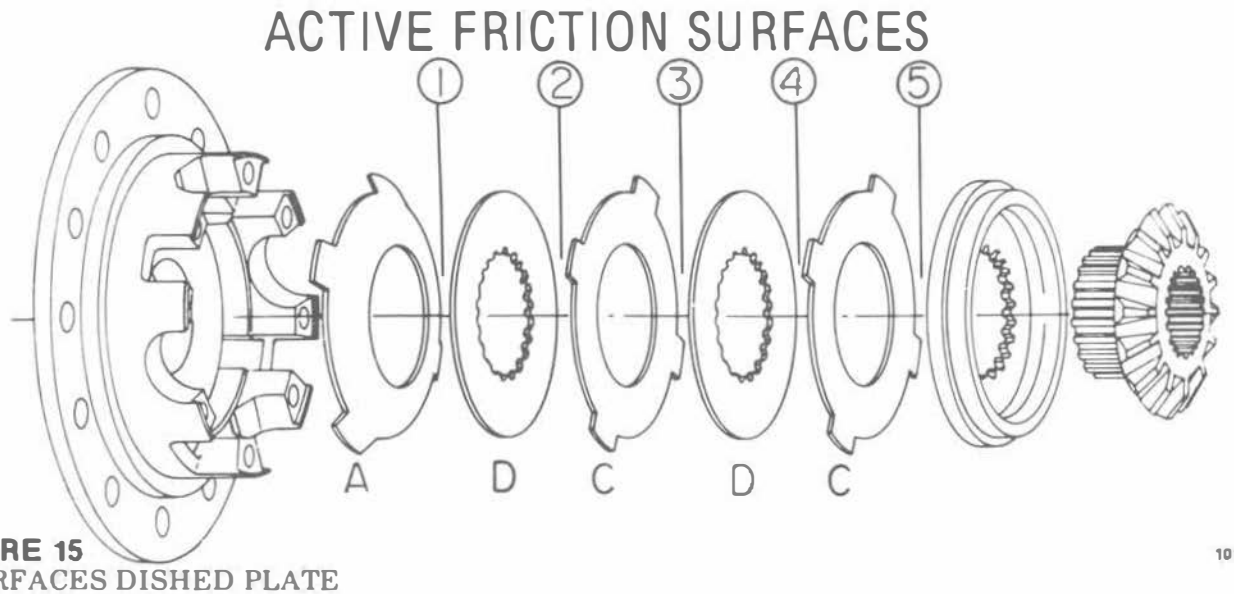

FIGURE 15 1018-15

5 SURFACES DISHED PLATE

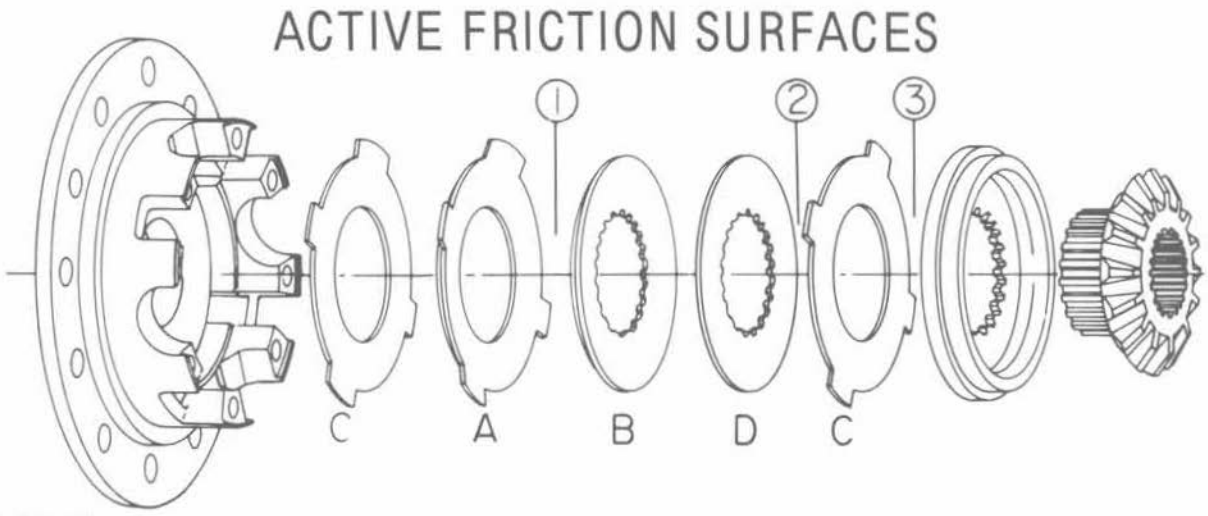

FIGURE 16 1018-16

3 SURFACES DISHED PLATE AND DISHED DISC

MODEL 60 AND MODEL 70 POWR-LOK
ACTIVE FRICTION SURFACES

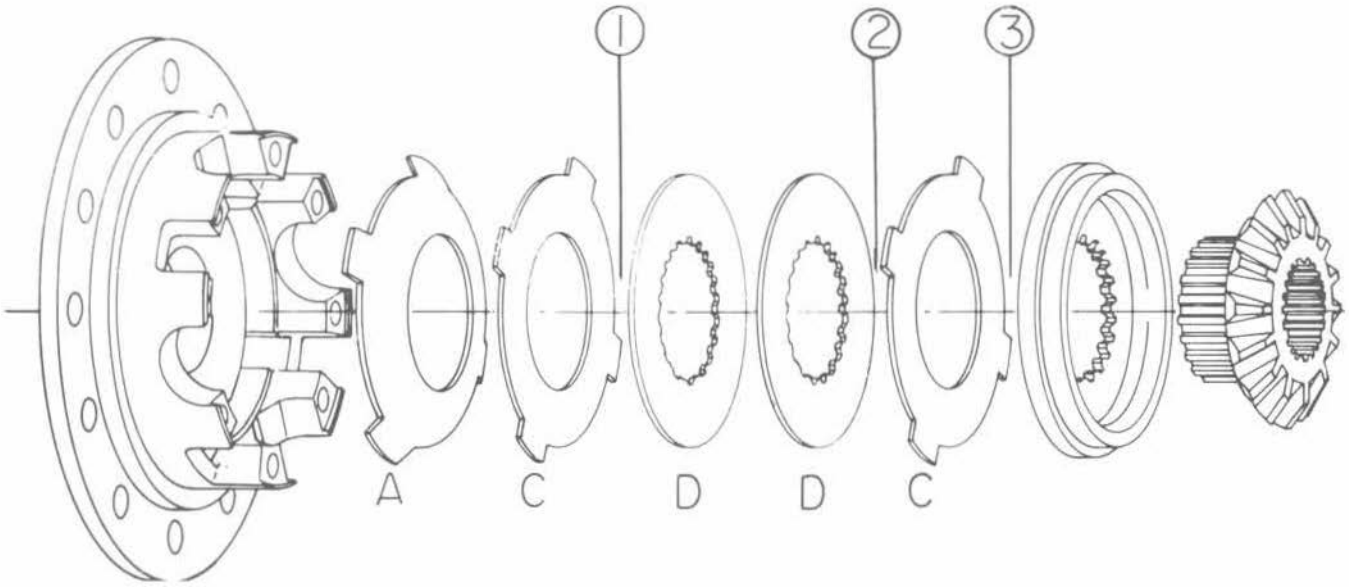

FIGURE 17 1016-17
3 SURFACES DISHED PLATE

CHANGING CLUTCH MEMBERS FROM FIVE FRICTION SURFACES TO THREE FRICTION SURFACES TO DECREASE WHEEL TORQUE:

If the present Limited Slip differential in the vehicle is of the dished plate and dished disc, five friction surface arrangement, and lower wheel end torque is desired by the owner of the vehicle, then these clutch members can be arranged to lower the torque.

FOR EXAMPLE:

The five friction surface dished plate and dished disc arrangement is shown in Figure 14. The stack arrangement as shown in numbers 1 thru 5, which indicate the five friction surfaces. The letters A, B, C, D, and C, identify each part such as, A-Dished Plate; B-Dished Disc; C-Plate; and D-Disc.

To decrease the wheel torque, the clutch member can be rearranged to change from five friction surfaces to three friction surfaces as shown in Figure 16.

NOTE

CLOSE ATTENTION SHOULD BE PAID TO THE DIRECTION AND POSITION OF PARTS A AND B IN FIGURE 16.

With the three surfaces dished plate and dished disc arrangement, as shown in Figure 16, the maximum torque effort to rotate one wheel should be decreased by approximately 40%.

In other words, torque should be approximately 80 lbs. ft. (105.5 N•m) less. For example: If the original unit with five surfaces indicated 200 lbs. ft. (271.2 N•m) to rotate one wheel, the reading should now record in the area of 120 lbs. ft. (162.7 N•m) to rotate one wheel.

NOTE

ALL FRONT DRIVING AXLES THAT ARE EQUIPPED WITH POWR-LOK DIFFERENTIALS ARE TO BE OF THE THREE SURFACE DISHED PLATE ARRANGEMENT, AS SHOWN IN FIGURE 17.

REASSEMBLY
FIGURE 18

1016-18

Replace plates, discs, side gear and clutch ring in exactly the same position as they were removed, (unless rearrangement was required). Apply specified lubricant on each individual part. Refer to Vehicle Service Manual for the specified lubricant.

FIGURE 19

1016-19

With the plates and discs now assembled to the side gear and clutch ring, line up the ears of the plate with the grooves in case so they will easily enter into the ring gear case half.

FIGURE 20

1016-20

Install pinion mate shafts and pinion mate gears. Make sure the shafts correspond with the chalk as marked at time of disassembly. Refer to Figure eight (8). Install the other side gear, clutch ring, plates, and disc exactly as they were removed, (unless rearrangement was required). Prelube each part. Line up ears of plates with grooves of the case.

FIGURE 21

1016-21

Assemble button half of case, making sure chalk marks are lined up. Assemble case body screws finger tight.

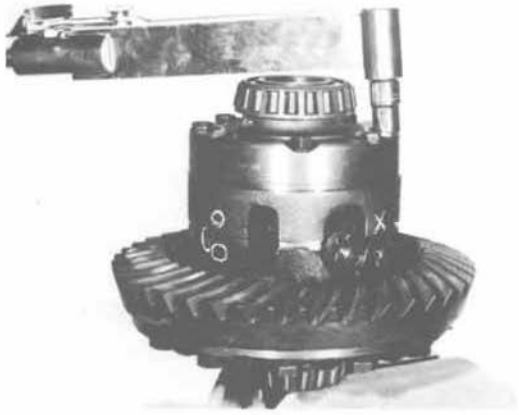

FIGURE 22

1016-22

Place case onto axle shaft as shown. Tighten body screw alternately and evenly. Torque screws to 65-70 lbs. ft. (88-95 N•m).

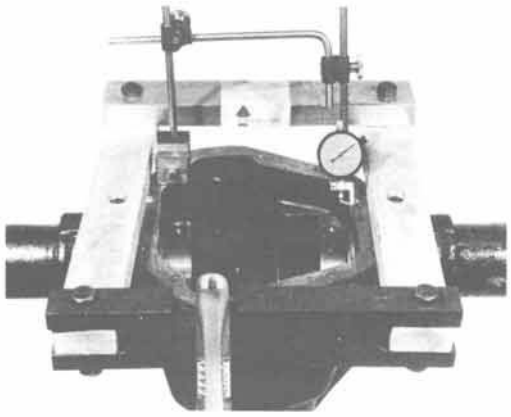

FIGURE 23 1016-23

Mount spreader onto housing. Locate dial indicator with a magnetic base and extensions as shown. Locate tip of indicator on housing as shown. Make sure the indicator has a minimum travel of .030 (.76 mm) for this operation.

Set dial indicator at zero ("0"). Turn forcing screw until indicator records .015" (.38 mm).

CAUTION

DO NOT SPREAD CARRIER IN EXCESS OF .015" (.38 mm).

Remove Indicator

Tools: D-167 Spreader
D-128 Indicator Set

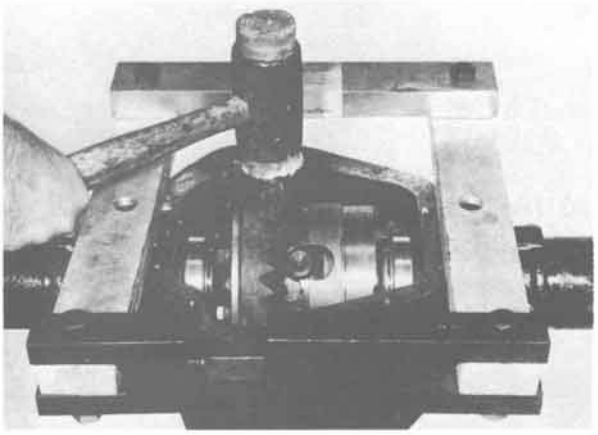

FIGURE 24 1016-24

Prelubricate differential bearing with specified gear lubricant. Assemble differential bearing cups to bearing cones. Assemble differential into carrier housing.

CAUTION

CARE SHOULD BE TAKEN WHEN MESHING THE TEETH OF THE RING GEAR WITH THOSE OF THE PINION TO PREVENT POSSIBLE NICKS, ETC.

Use a rawhide hammer to completely seat the case assembly into carrier crossbore.

Remove Spreader.

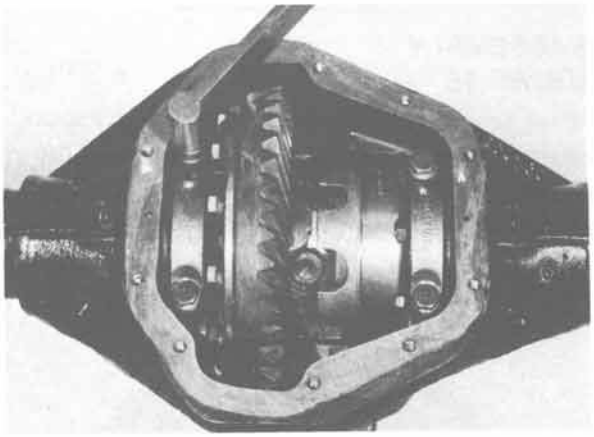

FIGURE 25 1016-25

Assemble bearing caps. Make sure the letters stamped on the bearing caps correspond with those stamped in the cover face of the carrier in both horizontal and vertical positions.

NOTE

IF DANA SPICER AXLE, TORQUE SCREWS TO 70-90 LBS. FT. (96-122 N•m). IF OTHER THAN DANA AXLE, REFER TO VEHICLE SERVICE MANUAL FOR PROPER TORQUE.

NOTE

THERE ARE TWO DIFFERENT DESIGN COVER PLATES. ONE COVER IS OF THE FLAT MOUNTING SURFACE, AND THE OTHER DESIGN IS OF THE RIB BETWEEN SCREW HOLES.

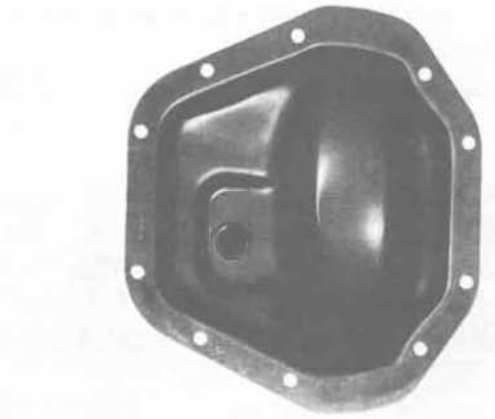

FIGURE 26 1016-26

Figure 26 shows the flat mounting surface cover plate on Dana design axles. This cover requires the use of a silicone rubber sealer material rather than a gasket.

FIGURE 27 1016-27

The cover face of the carrier and the flat surface of the cover plate must be free of any oil film or foreign material.

Sealant must meet specifications of ASTM3, GE303, A19, B37, E16, E36, Z1, Z2 & Z3 sealant.

Apply sealer to cover plate surface. Ensure that the sealer bead is laid on the inside of the cover screw holes. The bead is not to pass through or outside of the holes.

The bead is to be ⅛" to ¼" (3.18-6.35 mm.) high, and ⅛" to ¼" (3.18-6.35 mm.) wide.

Assemble two cover screws into cover at 8 o'clock and 2 o'clock position. Use these two holes to guide cover plate into position on the carrier.

Install remaining screws. Tighten alternately and evenly. Torque screws to 30-40 lbs. ft. (41-54 N•m).

Allow one hour cure time before vehicle operation.

FIGURE 28 1016-28

On cover plates of the rib design a gasket must be used. Do not use silicone sealer.

NOTE

IF SPICER AXLE, TORQUE COVER SCREWS TO 30-40 LBS. FT. (41-54 N•m).

NOTE

ON ALL FRONT AXLES THE COVER PLATE IS OF A DIFFERENT DESIGN AND REQUIRES THE USE OF A GASKET. DO NOT USE A SILICONE RUBBER SEALER MATERIAL.

Assemble axle in vehicle. Fill axle with the specified lubricant. Refer to vehicle manufacturer's lubricant recommendations.

Assemble brake backing plate, etc., and axle shafts into housing. Refer to Vehicle Service Manual for the specified torques of wheel end components.

Assemble brake drums and wheels.

MODEL 60 AND MODEL 70 POWR-LOK

COMPLETE ASSEMBLY REPLACEMENT

If inspection reveals that replacement of the Powr-Lok as a unit is necessary, the following steps should be followed.

FIGURE 29 1016-29

Place a few shop towels over and between the vise jaws to prevent the teeth of the ring gear from becoming nicked after it is free from the case.

Assemble differential case in vise (Ref. Fig. 29). Remove both differential bearings, cones, and shim packs. Mark or tag each bearing cone and shim pack as they are removed and indicate from which side they were removed. Turn forcing screw to pull bearings off hubs.

Tools: DD-914-P Press
DD-914-7 Extension
DD-914-62 Adapter
DD-914-42 Button
DD-914-8 Adapter Ring

IT IS RECOMMENDED THAT WHENEVER BEARINGS ARE REMOVED, THEY ARE (REGARDLESS OF MILEAGE) TO BE REPLACED WITH NEW ONES.

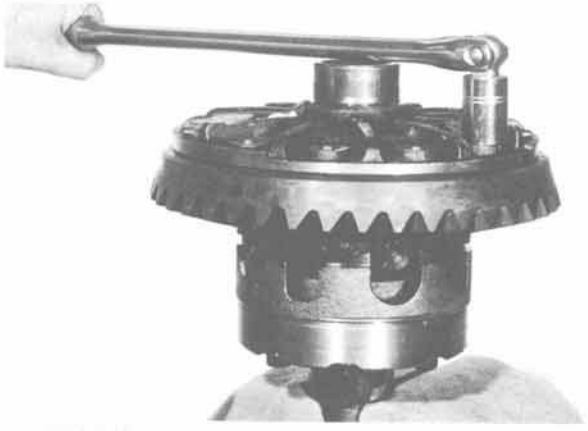

FIGURE 30 1016-30

Remove ring gear screws and ring gear.

Tap ring gear lightly with a rawhide hammer to free it from the case.

Remove Powr-Lok case and ring gear from vise.

NOTE

IT IS RECOMMENDED THAT ON DANA SPICER AXLES WHENEVER RING GEAR SCREWS ARE REMOVED, THEY ARE TO BE REPLACED WITH NEW ONES AT TIME OF ASSEMBLY.

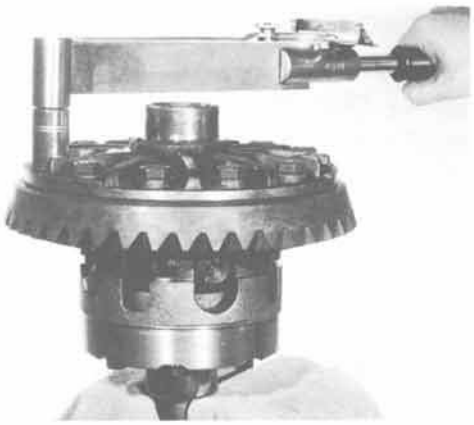

FIGURE 31 1016-31

Assemble ring gear to new Powr-Lok case. Make sure the pilot diameter and flange face of the Powr-Lok case are free of nicks or burrs. Line up the holes of the ring gear with those of the case. Assemble screws finger tight.

Reposition case in vise. Draw screws up alternately and evenly.

NOTE

IF DANA SPICER AXLE, USE NEW RING GEAR SCREWS AND TORQUE TO 100-120 LBS. FT. (135-162 N·m).

FIGURE 32 1016-32

Inspect shim packs and bearings which were removed from the old case. If the shims or bearings show excessive wear or damage, they should be replaced. If used, make sure they are assembled on the same side of the Powr-Lok case from which they were removed. Assemble shims and differential bearing cones. Use hub button as shown to protect the cone from becoming damaged during assembly of the top bearing.

TOOLS: C-4025-A Installer
DD-914-42 Button

Prelubricate differential bearing cones with the specified lubricant.

Assemble case into housing. Follow same procedure, as illustrated in Figures 23 to 25.

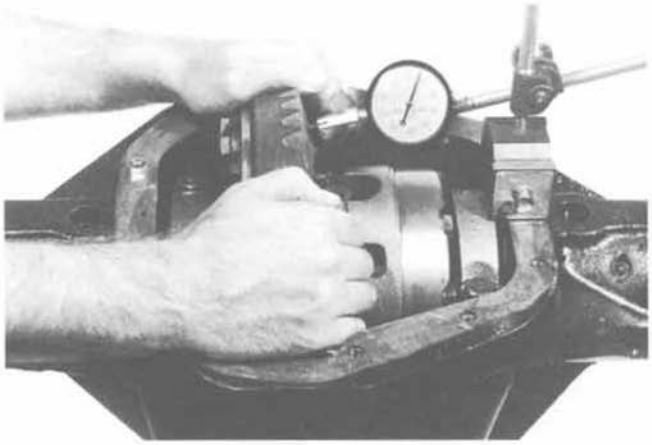

FIGURE 33 1016-33

Check backlash between ring gear and pinion in three equally spaced points with dial indicator and tip of indicator located as shown. Backlash tolerance is .005 to .009 inches (.13-.23 mm) and cannot vary more than .002 inches (.051 mm) beyond points checked.

High backlash is corrected by moving the ring gear closer into the pinion.

Low backlash is corrected by moving the ring gear away from the pinion.

These corrections are made by switching shims from one side of the differential case to the other.

NOTE

FOR CONVERSION FROM STANDARD DIFFERENTIAL TO POWR-LOK DIFFERENTIAL FIGURES 29 THRU 33 SHOULD BE FOLLOWED.