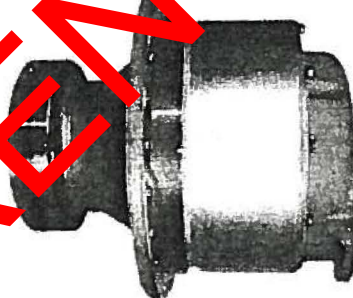
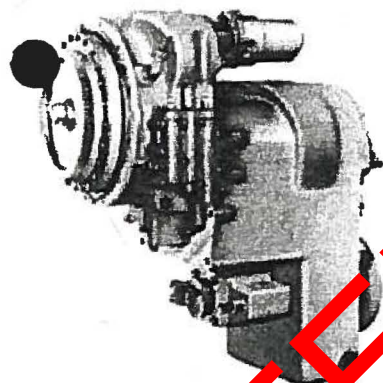
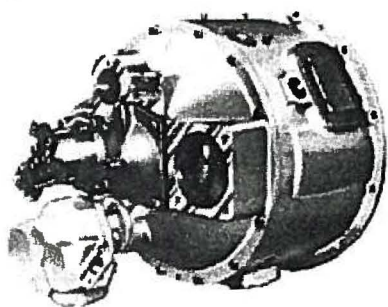


V2

1350 C.A.
0131

236508



SPICER OFF-HIGHWAY COMPONENTS



REFERENCE ONLY

MAINTENANCE MANUAL

Models PS/PR-1350

Carrier Assembly, Pinion Mount Wet Disc Brakes,
NoSPIN Differential Option, Differential Lock Option

CONTENTS

Page

GENERAL INFORMATION

General Precautions for Assembly and Disassembly	2
Lubricant Change Schedule	3
Torque Specifications	3
Axle Identification	3
Gear Set Identification	4

CARRIER SECTION

Carrier Assembly (Illustration)	5
Removal of Carrier from Axle Housing	6
Removal of Differential from Carrier	6
Differential Disassembly	7
Pinion Disassembly	8, 9
Pinion Assembly	10, 11, 12
Pinion Position	13, 14, 15
Differential Assembly	16
Differential Installation	17
Ring Gear and Pinion Tooth Contact Pattern	18, 19
Installation of Carrier Assembly into Axle Housing	20

OPTIONAL EQUIPMENT

Pinion Mount Wet Disc Brake Disassembly	21, 22
Pinion Mount Wet Disc Brake Assembly	23, 24
NoSPIN Differential Disassembly	25, 26
NoSPIN Differential Assembly	27, 28
Installation Test (NoSPIN Differential)	29
Trouble Shooting (NoSPIN Differential)	30
Differential Lock (Illustration)	31
Differential Lock Disassembly	31-33
Differential Lock Assembly	34-37
Inspection and Failure Analysis	38, 39
Diagnosis of Rear Axle Problems	40

IMPORTANT SAFETY NOTICE

Proper service and repair is important to the safe, reliable operation of all motor vehicles or driving axles. 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. Special tools should be used when recommended and in the method described.

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

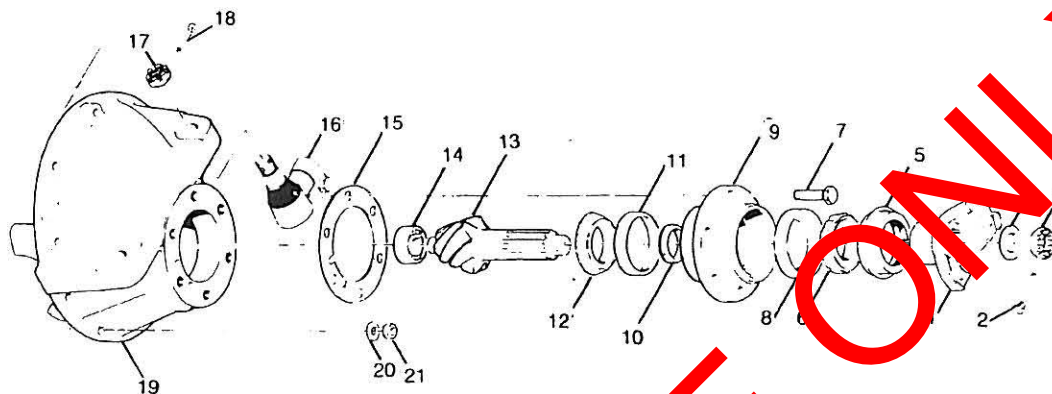
Accordingly, anyone who uses a service procedure or tool which is not recommended must first satisfy himself that neither his safety nor the vehicle safety will be jeopardized by the service methods he selects.

Should an axle assembly require replacement of component parts, it is recommended that "Original Equipment" replacement parts be used. They may be obtained through your service dealer or other original equipment manufacturer parts supplier. The use of non-original equipment replacement parts is not recommended as their use may cause unit failure and affect vehicle safety.

PAGES 2-7 MISSING

REFERENCE ONLY

Pinion Disassembly



- | | |
|---|---|
| 1. Pinion Nut — Slotted (Required Self-Locking with 2-Speed Range Box or Pinion Mount Wet Disc Brake) | 11. Bearing Cap (Pinion Inner) |
| 2. Cotter Pin | 12. Bearing Cone (Pinion Inner) |
| 3. Flat Washer | 13. Pinion |
| 4. End Yoke or Companion Flange | 14. Bearing Assembly (Straight Roller) |
| 5. Oil Seal (Not Req. w/Pinion Wet Brake) | 15. Shim (Pinion Position) |
| 6. Bearing Cone (Pinion Outer) | 16. Steering Cylinder Socket (Optional) |
| 7. Hex Bolt | 17. Slotted Nut |
| 8. Bearing Cup (Pinion Outer) | 18. Cotter Pin |
| 9. Bearing Retainer Cap | 19. Carrier Sub-Assembly (Steering) |
| 10. Pinion Bearing Spacer | 20. Flat Washer |
| | 21. Locknut |



1. Remove pinion cage cap screws which hold pinion assembly to the carrier housing.



2. Remove pinion and cage assembly from carrier housing. If difficulty is encountered in removing pinion assembly from carrier housing, place brass drift on inner end of pinion gear and tap lightly.

NOTE: Retain shims for possible use during reassembly.



3. Mount pinion assembly in a soft jawed vise, holding yoke stationary, and remove cotter pin, nut, and washer.

4. Remove the end yoke using a suitable puller.

5. Remove pinion gear from cage assembly.

NOTE: It may be necessary to tap outer end of pinion gear with a soft hammer. Replace pinion nut, flush with end of pinion, so damage to threads does not occur.



6. Located between pinion bearings is a selective spacer, used for pinion bearing preload. Retain this spacer for possible use in reassembly.

7. Remove old pinion oil seal and discard. Always replace it with a new seal at time of reassembly.

8. Lift out outer pinion bearing cone.



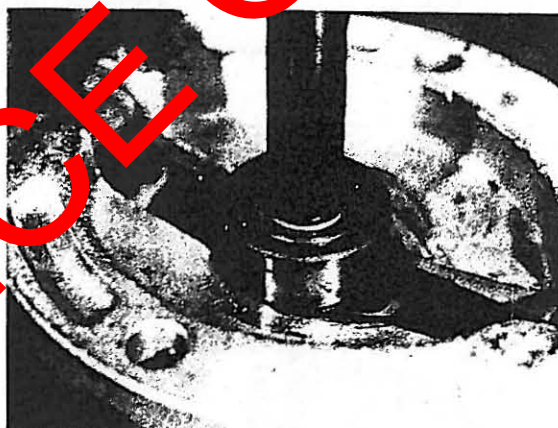
9. Remove inner pinion bearing cup, use a suitable adapter and press or puller.

CAUTION: Do not nick bearing bore.

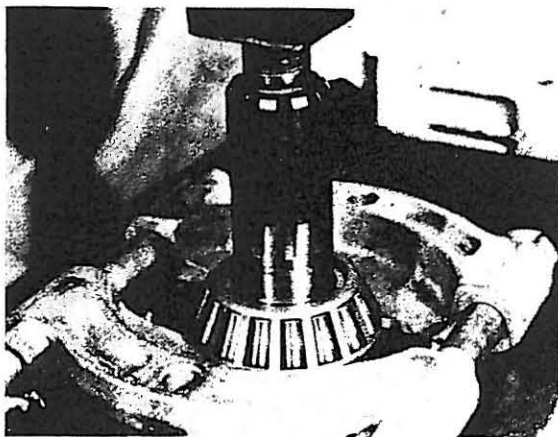


10. Remove outer pinion bearing cup.

CAUTION: Do not nick bearing bore.

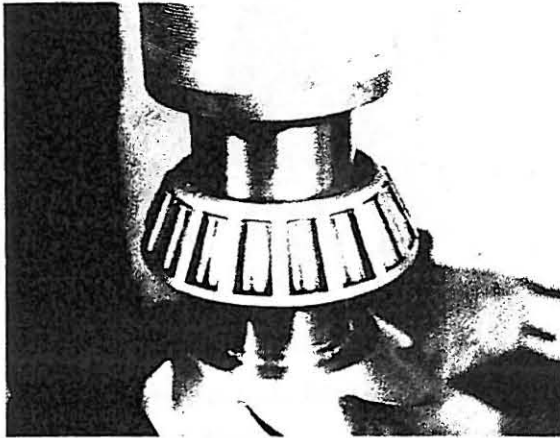


11. Remove pinion roller bearing from end of pinion.



12. Remove inner bearing cone from pinion gear.

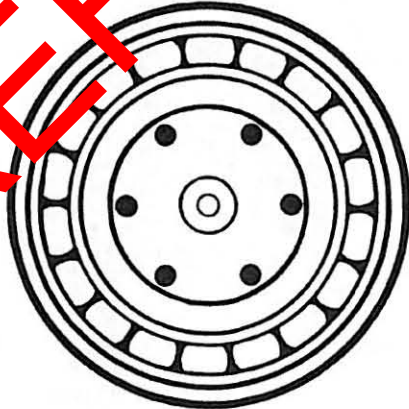
Pinion Assembly



1. Press inner pinion bearing cone onto the pinion gear.



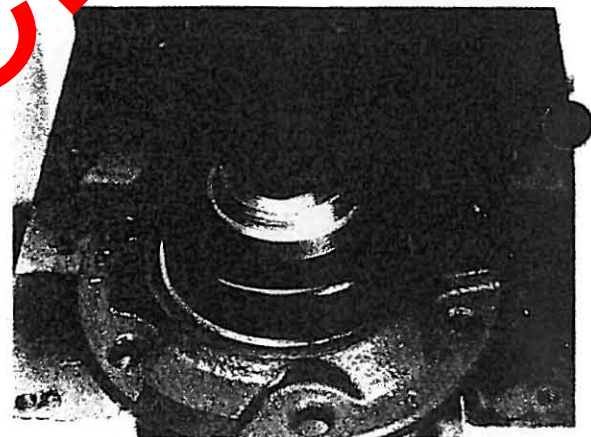
2. Press roller bearing onto the pinion gear.



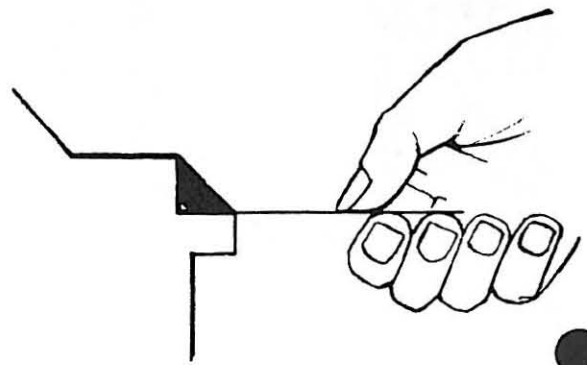
3. Stake roller bearing in six places, using staking tool.
NOTE: Make sure all cage bores are free of nicks, dirt, or any contamination.



4. Install inner pinion bearing cup into pinion cage.



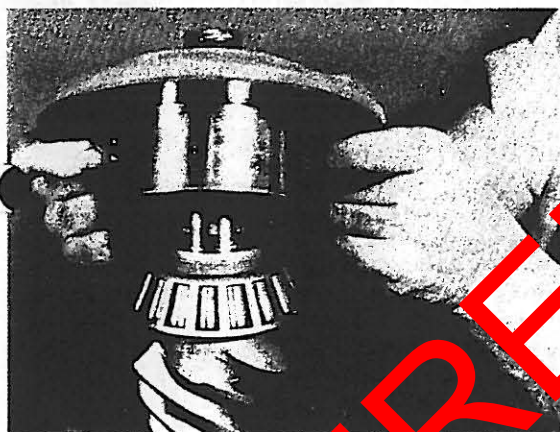
5. Install outer pinion bearing cup into pinion cage.



6. Use a feeler gauge or shim stock (.0015 Approx.) to ensure bearing cups are completely seated in bearing bores. This is necessary for proper pinion position.



7. Place selective preload spacer, that was removed during disassembly, onto pinion.



8. Place pinion cage onto pinion gear inner bearing.



9. Install outer pinion bearing cone onto pinion.

10. Inspect end yoke or flange seal surface for grooves caused by lip of seal. If grooves can be detected with fingernail, it should be replaced.

11. Install end yoke onto pinion, without seal, and torque to 325 ft. lbs. (400 N-M) so bearing preload can be checked.

NOTE: Pinion cage should be rotated while tightening pinion end nut to seat and align the pinion bearings.



12. To measure preload, clamp flange horizontally in a soft jaw vise. Wrap a strong cord around pinion cage. Attach end to spring scale. Read scale only while pinion cage is turning. Scale reading or bearing preload must be between 5-14 lbs.

NOTE: When preload reading does not fall within allowable limits, bearing load can be increased by using a thinner spacer or decreased by using a thicker spacer.

.001" (.025 mm) change in preload spacer thickness, changes scale reading by approximately 10 lbs.

The pinion spacers are available in the following thicknesses. Measure the spacer before assembly to assure correct thickness.

INCHES	M.M.	INCHES	M.M.
.5135	13.04	.5315	13.50
.5165	13.12	.5325	13.52
.5195	13.19	.5335	13.55
.5225	13.27	.5345	13.58
.5245	13.32	.5355	13.60
.5255	13.35	.5375	13.65
.5265	13.37	.5395	13.70
.5275	13.40	.5405	13.73
.5284	13.42	.5435	13.80
.5295	13.45	.5485	13.93
.5305	13.47		

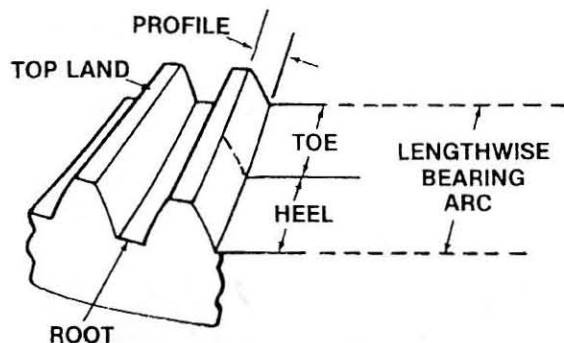
NOTE: Closer adjustment can be made by working next thinner spacer to desired thickness using emery cloth on a flat surface.

CAUTION: Wash spacer thoroughly of emery cuttings before installing on pinion.

PAGES 12-17 MISSING

REFERENCE ONLY

Ring Gear and Pinion Tooth Contact Pattern

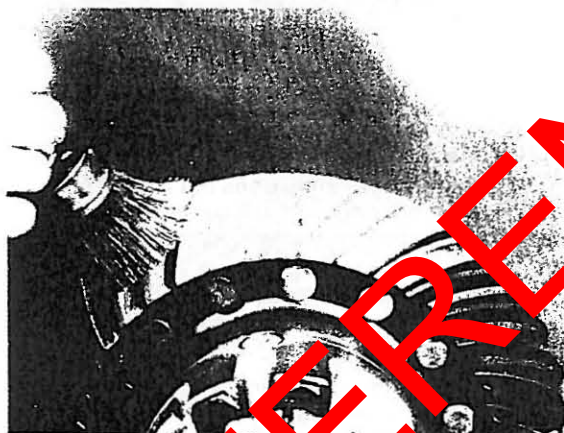


Gear tooth nomenclature

The **toe** of the gear tooth is the portion of the tooth surface at the end towards the center.

The **heel** of the gear tooth is the portion of the tooth surface at the outer end.

The **top land** of a gear tooth is the surface of the top of the tooth.



1. Paint ring gear teeth with marking compound and rotate with pinion to obtain contact pattern.



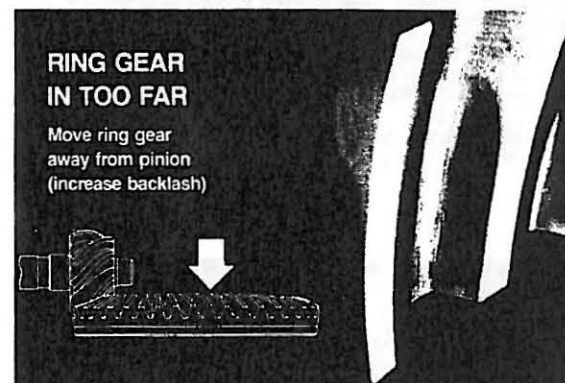
2. The tooth contact patterns should have the same general shape and position as the ring gear teeth shown above.



RING GEAR OUT TOO FAR

Move ring gear toward pinion (decrease backlash)

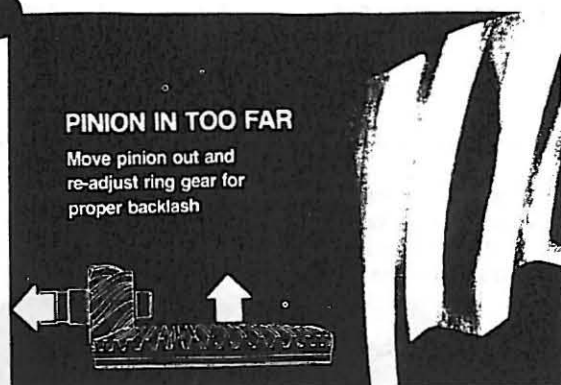
3. If the pattern is concentrated more toward the heel (as shown above), backlash must be reduced. Recheck backlash as described in step 6, page 17. To reduce backlash, loosen the right side adjusting ring until the measured backlash is within specification. The tooth contact pattern should now have the same general shape and location as shown in step 2. If the contact pattern still does not conform, less backlash than normal is required. To avoid reducing differential bearing preload excessively, further loosening of the right hand adjusting ring should be accompanied by equal tightening of the left hand adjusting ring. Place a dial indicator directly on each adjusting ring to measure the exact amount of additional adjustment. Decreasing backlash moves the ring gear toward the pinion.



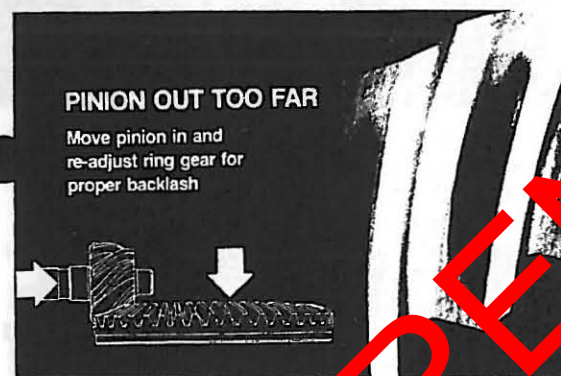
RING GEAR IN TOO FAR

Move ring gear away from pinion (increase backlash)

4. If the pattern is concentrated at the toe (as shown above), more backlash is required. Recheck backlash. To increase backlash, tighten the right side adjusting ring further until the measured backlash is within specification. The tooth contact pattern should now spread across the ring gear tooth as in step 2. If the contact pattern still does not conform, more backlash than normal is required. To avoid increasing differential bearing preload excessively, further tightening of the right hand adjusting ring should be accompanied by equal loosening of the left hand adjusting ring. Place a dial indicator directly on each adjusting ring to measure the exact amount of the additional adjustment. Increasing backlash moves the ring gear away from the pinion.



5. If a pattern is concentrated at the ring gear tooth root as shown above, the pinion is too close to the ring gear. It must be moved out and away to establish its proper mounting distance and contact pattern as shown in step 2, page 18. This is accomplished by choosing a thicker pinion bearing cage shim. Readjust pinion-to-ring gear backlash, as required, once proper pinion mounting distance has been established.



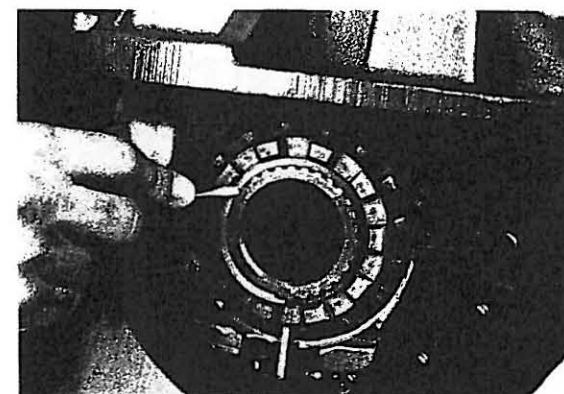
6. If pattern is concentrated at the tooth top land (as shown above), the pinion is too far away from the ring gear and must be moved closer to the ring gear to establish its proper mounting distance and tooth contact pattern. This is accomplished by selecting a thinner pinion bearing cage shim. Readjust pinion-to-ring gear backlash as required once proper mounting distance has been established.



7. After proper ring gear pattern is achieved, again torque the differential bearing cap bolts to 150-160 ft. lbs. (200-220 N-M). Install adjusting ring retainers and new collar keys of proper size.



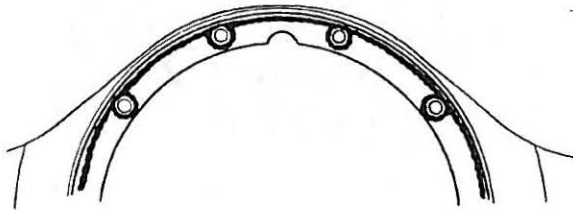
8. On axles equipped with the differential lock option, install the stationary collar onto the splined end (flange half), of the differential support case.



9. Install spiral locking ring into groove on splined end of differential support case.

Installation of Carrier Assembly into Axle Housing

1. Thoroughly clean inside of axle housing. Stone the housing mounting surface if necessary to remove burrs or nicks.



2. Apply Permatex #2 gasket sealer to axle housing at carrier mounting flange. A 1/4 inch bead around the outside of all carrier mounting studs and each stud hole is required.

3A. If studs are used to mount the carrier, apply Loctite #271 or its equivalent to the threads and torque to 30-50 ft. lbs.

3B. If bolts are used to mount the carrier, thread 2 studs 180° apart, into the axle housing as an installation aid.

4. Install carrier assembly into axle housing. Install washers. Torque bolts to 56-62 ft. lbs. or lock nuts to 49-54 ft. lbs. Bolts and locknuts must be cleaned and coated with Loctite #271 or its equivalent.

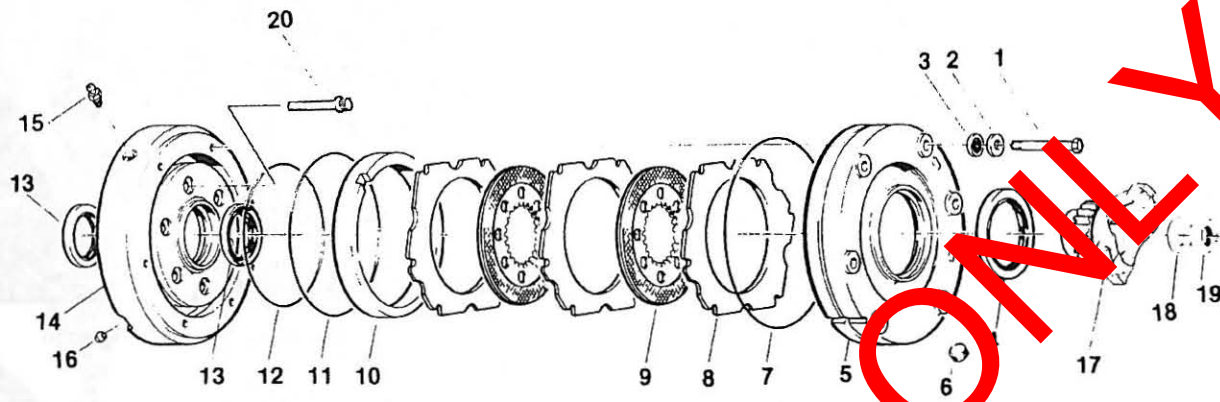


4B. If axle is equipped with differential lock, insert slide collar into axle housing and engage on axle shaft spline prior to carrier assembly installation.

5. Assemble axle shafts, hubs, brakes, and all wheel end parts at this time following procedures outlined in the PS-PR 1350 Wheel End Manual.

6. Clean drain plug and install. Fill unit with proper hypoid gear lubricant to same level as fill hole located in bowl of axle housing.

Pinion Mount Wet Disc Brake Disassembly



- | | | |
|--------------------|--------------------|----------------------------------|
| 1. Hex Head Bolt | 8. Stationary Disc | 15. Bleeder Screw |
| 2. Flat Washer | 9. Rotating Disc | 16. Orifice Insert |
| 3. Sealing Washer | 10. Piston | 17. End Yoke or Companion Flange |
| 4. Oil Seal | 11. O-Ring | 18. Flat Washer |
| 5. Housing | 12. O-Ring | 19. Pinion Nut |
| 6. Hex Socket Plug | 13. Oil Seal | 20. 12 point Cap Screw |
| 7. O-Ring | 14. Power Plate | |

1. Remove drain plug and drain hydraulic oil.



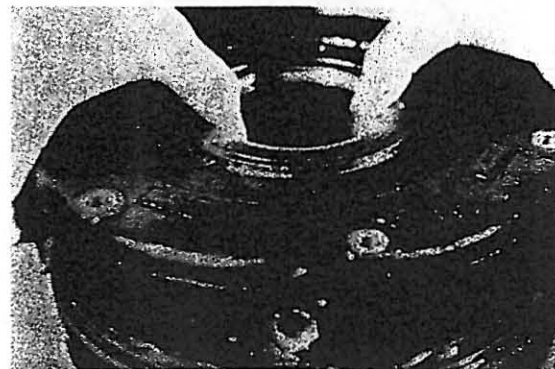
2. Remove pinion nut and washer.



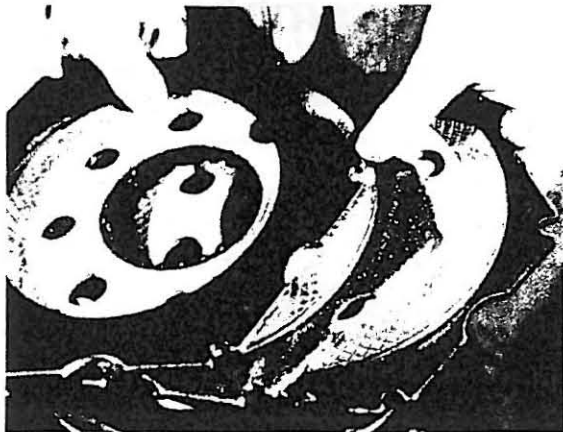
3. Turn assembly to vertical position as shown, and lift pinion yoke or flange out of carrier assembly.



4. Remove housing to power plate bolts.



5. Lift housing off power plate assembly. Inspect outer O-ring seal and replace if damaged.



6. Remove both stationary (steel) and rotating (rounded) brake discs and clean thoroughly with suitable petroleum base solvent. Inspect rotating discs for wear in the involute splines. Replace if worn. If OK, measure thickness of bonded friction material, with 0-1" micrometer. If discs measure less than .240 in. (6.1 mm) they must be replaced. Replace all seals when replacing bonded discs.

Inspect stationary discs for warpage using a straight edge. If warpage is indicated discs must be replaced. Inspect all brake discs for heat damage. Replace if necessary.

NOTE: If brake discs are within specifications, and the assembly was operating, inner hydraulic piston seals do not need replacing. However if discs need replacing, replace piston seals also.

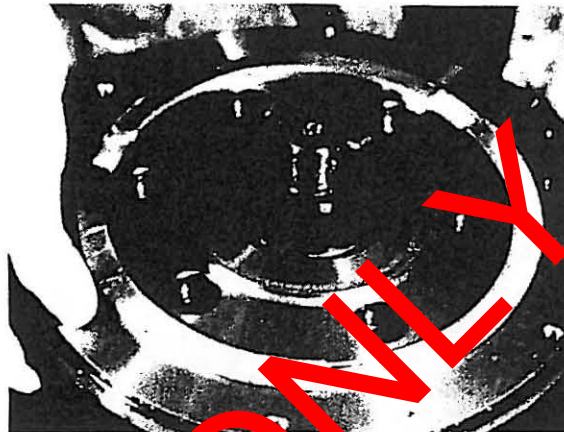
7. To replace piston seal, direct piston away from operator, apply low air pressure (15 lbs. maximum) into hydraulic inlet.

CAUTION: If high pressure is applied, the piston may "pop" out with considerable force. Also avoid spray of hydraulic fluid.

Remove old O-rings. Clean thoroughly and replace with new seals.



8. To replace pinion seal, or repair carrier assembly, it will be necessary to remove power plate. Remove power plate to carrier bolts as shown.

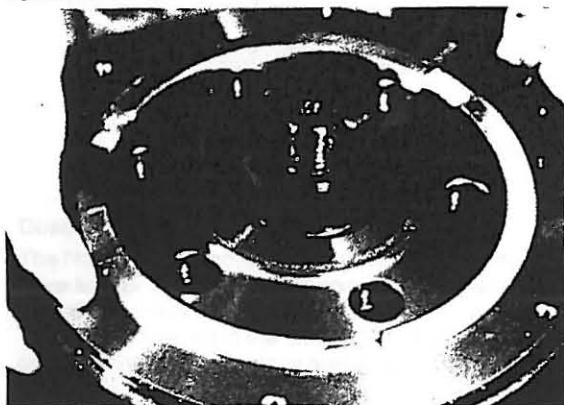


9. Lift power plate away from pinion bearing cage assembly.

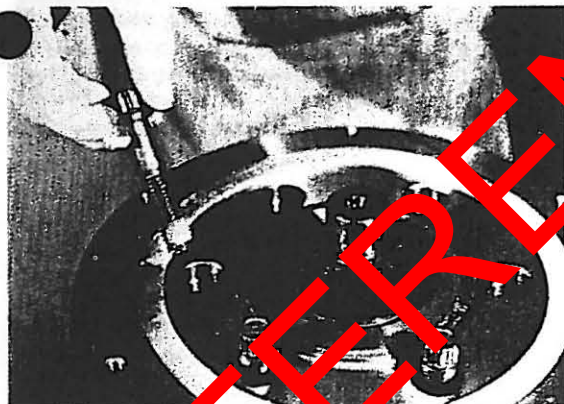
IMPORTANT NOTE: BEFORE INSTALLING REPLACEMENT INPUT YOKE SEALS, THOROUGHLY CLEAN EACH BORE. APPLY A THIN UNIFORM COATING OF #2 PERMATEX TO BORE WALLS. CAREFULLY INSTALL NEW SEALS UNTIL FLUSH, MAKING SURE LIP DIRECTION IS THE SAME AS THE ORIGINAL SEAL.

Pinion Mount Wet Disc Brake Assembly

NOTE: All parts must be thoroughly cleaned before reassembly. Replace necessary seals and O-rings at this time. Lubricate all seals and O-rings with hydraulic fluid.



1. Set power plate into position on pinion bearing cage assembly. Make certain hydraulic inlet is at proper position.



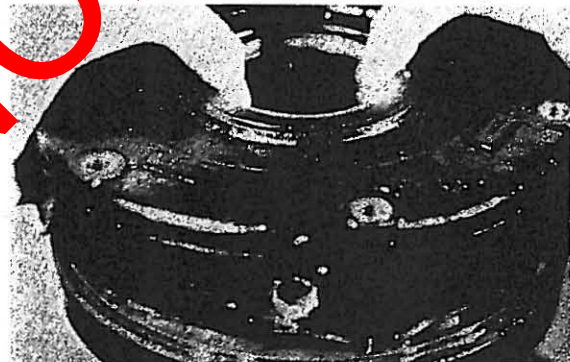
2. Bolts attaching power plate to carrier assembly must be cleaned and coated with #271 Loctite or its equivalent.



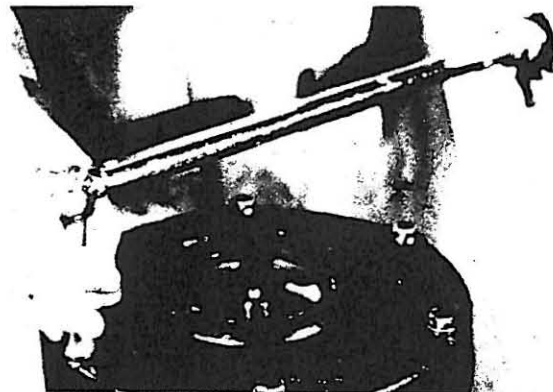
3. Torque bolts to 100-125 ft. lbs. (135-162 N-M).



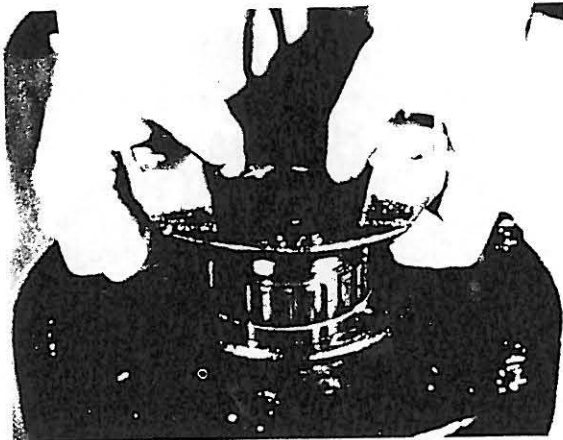
4. Position and align brake discs before installing housing (cover). Position stationary (steel) disc first. Alternate remaining rotating (bonded) discs and stationary discs as shown. Install 2 housing bolts, 180° apart, between stationary discs. Slide yoke (flange) slowly onto pinion splines, rotating from left to right until center spline in rotating discs line up correctly.



5. Remove yoke and install outer O-ring seal onto power plate in seal register. Lube with hydraulic fluid. Install housing as shown. Visually align bolt holes and position drain hole on bottom side of carrier.



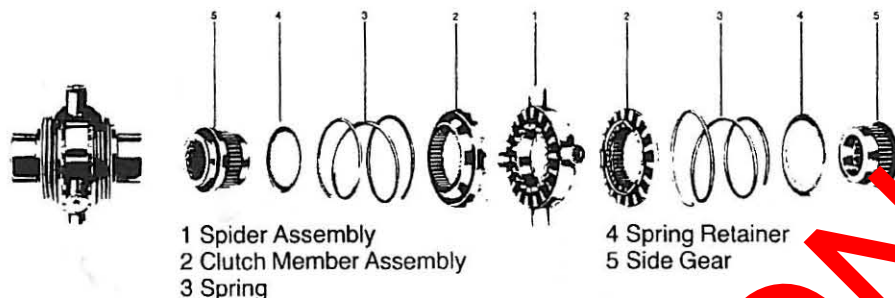
6. Install flat washers and new sealing washers onto housing to power plate bolts. Coat threads with #271 Loctite or its equivalent. Install bolts through housing and alternately torque to 20-25 ft. lbs. (26-32 N-M).



7. Install yoke (flange) and torque pinion nut to 325 ft. lbs. (440 N-M).

8. After assembly has been installed into the vehicle, it will be necessary to bleed hydraulic system, and either fill, or hook up cooling lines to cooling section of wet disc brake. Follow procedures outlined in vehicle maintenance manual.

NoSPIN Differential Disassembly



Description

The NoSPIN differential provides equal amounts of drive line torque to both right and left driving wheels and also permits differential action for turning corners. The unit is installed in the differential case in place of conventional gears, pinions and spider. The action of the unit is the same for both drive and coast loads.

CAUTION: Turn the engine off and raise all driving wheels of a NoSPIN differential equipped axle when servicing wheels, brakes, axles or tires to prevent the vehicle from moving. Axles equipped with NoSPIN differentials deliver power to both wheels — even when only one wheel is on the ground. Failure to observe these cautionary measures may cause the vehicle to move which can result in damage or injury.

Routine Inspection

Carefully follow the recommended lubrication, preventative maintenance and inspection procedures of the vehicle/manufacture as part of NoSPIN differential preventative maintenance except for testing for proper operation, and a possible change in the way brake adjustments are made (as explained below), maintenance inspection and lubrication requirements of NoSPIN differential equipped vehicles are the same as for vehicles with standard differentials.

Check for Proper Operation of NoSPIN Differential

At 90 day intervals, the drive axles should be raised and the NoSPIN differential checked (see page 29) to be sure it is operating properly. This test will also determine if both axle shafts are intact.

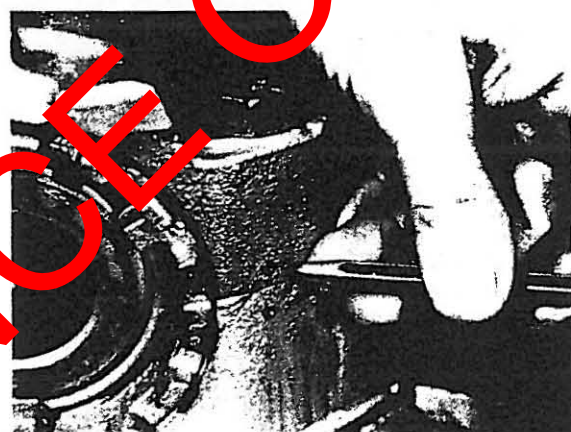
Brake

When making brake adjustments, the wheels on both sides of the vehicle must be raised and the transmission placed in neutral so that the ring gear and opposite wheels are free to rotate with the wheels on the side being adjusted.

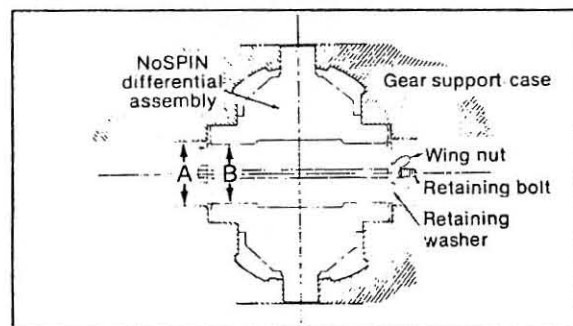
Servicing NoSPIN Differentials

Any decision to disassemble the axle for inspection should be made only after performing the operation tests stated on page 29 and after consulting the trouble shooting guide on page 30 and determining that the NoSPIN differential, or some other axle part, is not working properly.

Differential Removal

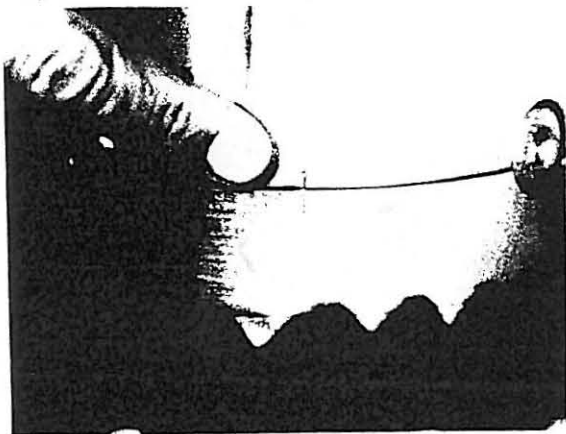


1. With carrier mounted in a holding fixture, remove adjusting nut lock, and mark position of adjusting nut for proper adjustment when reassembling. Bearing saddles must be replaced in original position. Mark as shown above. Remove bearing saddle bolts and lift ring gear and differential clear of carrier.



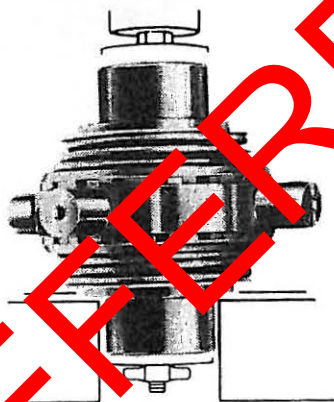
2. A retaining bolt and washers are useful to keep the NoSPIN differential assembly intact when removing it from the differential case and when reinstalling it in the axle housing. You will note that the retaining washers must be small enough to pass through the case ends (dimension "A"), yet large enough to restrain the two side gears (dimension "B") and the balance of the NoSPIN differential assembly when all parts are assembled and the springs are compressed.

CAUTION: Failure to use a retaining bolt or some other restraining means when separating the differential case halves can cause injury. NoSPIN differentials contain compressed springs.



3. Mark the differential case halves so they may be reassembled in their original position, remove differential case bolts and nuts and separate case halves.

CAUTION: If a retaining bolt and washers are not available, hold the differential case firmly as the last bolts are being removed from the case halves to absorb spring pressure and prevent possible injury.



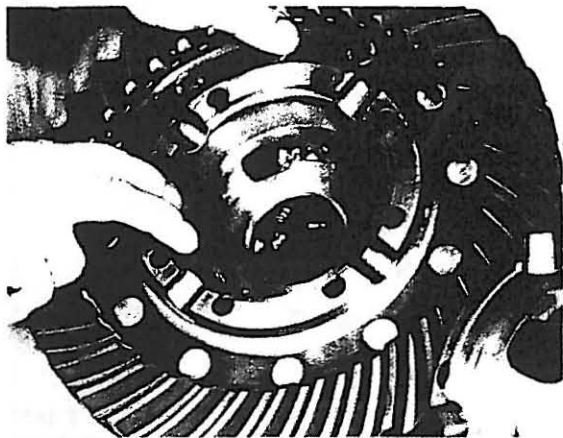
4. If retaining bolts and washers were used, mount unit in a small press as shown and remove nut. Slowly release press until spring pressure is released.

5. Remove side gears, springs, spring retainers, driven clutch assemblies and spider assembly.

Cleaning and Inspection

Wash all parts thoroughly with clean, non-flammable solvent. Inspect all mating surfaces and splines for possible wear or damage. Replace all worn or damaged parts before reassembly. Springs should have a compressed operating height of .620 inch at 88 load pounds $\pm 10\%$. Replace with new springs if not within these specifications.

NoSPIN Differential Assembly



1. Wash the differential case, ring gear, differential case bolts and nuts, and bearing assemblies, in clean, non flammable solvent. Inspect for damage, wear, or corrosion. Replace if necessary.

2. Inspect axle shafts for excessive wear or damage. Fit axle shaft into side gear of NoSPIN to insure smooth, tight fit. If either the axles or side gears are worn they must be replaced.

3. Position the ring gear and differential case half as shown in step one.

NOTE: To protect bearing during the following steps, install bearing cup on bearing cone.

4. Lightly lubricate inside of differential case and install smooth ground hub of side gear into hub of differential case. Be sure the side bearing will rotate freely in case.

5. Assemble spring retainer over the side gear splines with the retaining lip (outside diameter) down.



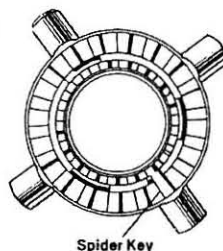
6. Place spring over the side gear spline and against the retainer lip with the smaller diameter of the spring against the retainer.



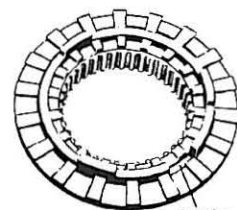
7. Assemble driven clutch assembly over the spring with the teeth up.

NOTE: Verify that the spring is functioning freely by compressing the driven clutch over the side gear splines. Be sure the spring is not binding and that there is good contact between end coil and retainer when driven clutch and side gear splines are fully meshed.

8. Position the spider assembly over the driven clutch assembly.



Spider Key



Slot for Spider Key

IMPORTANT: Be sure the slot in the hold out ring is properly aligned over the long tooth of the spider.

9. Place the remaining driven clutch assembly onto the spider.

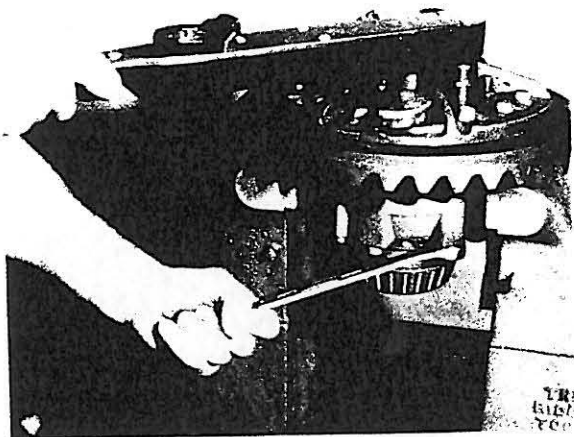
NOTE: Again be sure the slot in the hold out ring is properly positioned over the long tooth of the spider.

10. Assemble the remaining retainer, spring, and side gear as in step #6.

11. Mount the plain case half over the side gear and compress the springs, be sure side gear splines are completely meshed with the driven clutch splines.

12. Hold the case halves firmly together, aligning marks, and start at least 2 case bolts 180° apart. To compress the springs in the NoSPIN, a press can be used to aid assembly.

CAUTION: Do not release pressure until bolts are started and spring pressure has been safely contained. Failure to follow procedure could release case halves under extreme pressure.



13. Install the remaining differential case bolts and torque to 80-90 ft. lbs. (108-122 N-M).

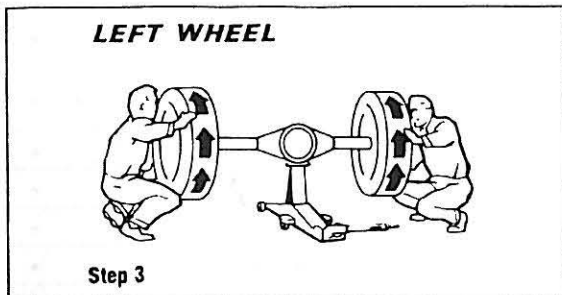
14. Install ring gear, and differential case into carrier following procedure in differential assembly section of this manual.

REFERENCE ONLY

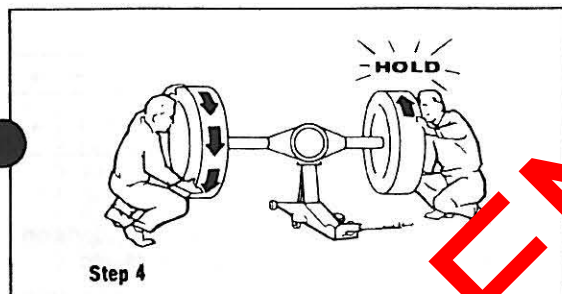
Installation Test

Step 1 With the engine turned off, raise driving axle(s) until all tires are out of contact with any surface.

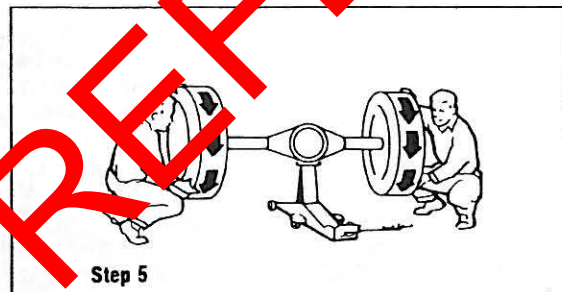
Step 2 Place the transmission in gear.



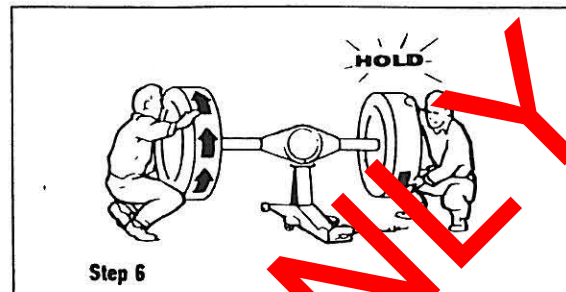
Step 3 With an assistant on the opposite side, start the installation test by rotating both wheels in a **forward** direction as far as possible. (Both wheels should stop after rotating a short distance.)



Step 4 With an assistant **firmly holding the right wheel forward** (against the stop), rotate the **left wheel rearward** while listening for an indexing or clicking sound. (The right wheel must be held firmly against the stop or the left wheel will not disengage freely.) Grasp the left wheel to stop its rotation, and move it slightly **forward** (in the direction of the stop). The NoSPIN differential should lock up.



Step 5 Rotate both wheels **rearward** as far as possible. (Both wheels should stop after rotating a short distance.)



Step 6 With the assistant on the opposite side firmly holding the **right wheel rearward** against the stop), rotate the **left wheel forward** again listening for an indexing or clicking sound. (Again, the right wheel must be held firmly against the stop or the left wheel will not disengage freely.) Grasp the left wheel to stop its rotation, and move it slightly **rearward** (in the direction of the stop). The NoSPIN differential should lock up. **REPEAT STEPS 3, 4, 5 and 6, except hold the left wheel against the stops and rotate the right wheel, in both forward and reverse.**

IF PROPERLY INSTALLED, the rotating (or overrunning) wheel should cam out easily by hand, rotate freely in both directions and produce a soft indexing or clicking sound. The NoSPIN differential should not reengage until the direction of rotation is reversed.

IF YOU HEAR REPEATED LOUD INDEXING OR CLICKING SOUNDS when performing this installation test, one of the driven clutch assemblies may not be properly assembled to the spider. Recheck installation steps on pages 27 and 28.

IF EITHER WHEEL DOES NOT ROTATE FREELY IN BOTH DIRECTIONS, recheck each installation step. Also, check hand and foot brakes for possible drag caused by improper adjustment.

Operation Test

Check to see that both wheels of each NoSPIN differential equipped axle are driving. Make this test under load, so that engine torque is applied through the NoSPIN differential with the wheels on the ground. One way to achieve this load is to drive up against a solid obstruction (on loose dirt or gravel, if possible) and attempt to spin both wheels together. *Perform this test in forward and reverse.

CHECK CAMMING ACTION. On a flat surface, with good traction, drive the vehicle in a tight circle in forward and reverse to be sure that the outside wheel is free to overrun (i.e., that the outside tire does not scuff). A clicking or indexing sound may be heard. The sound of gear reengagement may also be heard upon completion of the turn. This is normal.

*Exercise Caution When Performing This Test.

TROUBLESHOOTING THE NoSPIN DIFFERENTIAL

Potential problems are stated on the left; possible causes for those problems are listed, by number, on

the right. The explanation of these "possible causes" follows below chart.

PROBLEM	POSSIBLE CAUSE(S)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Hub studs shearing; rear tire scuffing; axle shaft breakage	.	.	.	.	.									.
Steering difficulty; vehicle pulls on straight forward driving or tends to go straight when making turns	.	.	.	.	.							.	.	.
No differential action; binding in turns	.			.	.				.				.	.
Excessive driveline noise	.	.	.	.	.		.							.
Excessive tire wear	.	.	.	.	.									.
Grinding noises	.			.	.				.	.	.			.
Continuous "clicking" sound in straight forward driving	.	.	.	.	.									.
Excessive backlash in vehicle drivetrain; engine lug or vehicle surge during turns	.					.		.		.				.
Tendency to side-slip or "fishtail" on icy surface											.			.
Sluggish reengagement of NoSPIN differential clutch assemblies									.		.			.
Difficulty in turning vehicle from standing start	.			.	.								.	.
Erratic operation of NoSPIN differential; premature wear or failure of NoSPIN differential parts		.	.	.	.			.	.	.	.	.	.	.

*NOTE: NoSPIN differentials will emit occasional "metallic" sounds due to normal contact into the housing. This is normal!

1. Improper installation; defective NoSPIN differential. Follow test procedures outlined on page 29. Correct installation or repair or replace the NoSPIN differential if the vehicle fails any part of the test procedure.

2. Overloading and/or improper weight distribution. Remove excess weight and redistribute the load from side to side, according to the vehicle manufacturer's instructions.

3. Unequal rolling radii of the drive tires. A smaller radius tire will cause the vehicle to overrun constantly when power is applied. The other tire (with the larger radius) will oversteer the driving. Replace tires or adjust tire pressures until rolling radii are equal.

4. Broken axle shaft. Replace. **NOTE:** It is possible to operate a NoSPIN equipped vehicle on one axle shaft. However, this practice is not recommended in that serious damage can occur to other axle parts.

5. Bent axle shaft or housing; axle shafts on different center lines. Replace bent axle shafts or housing, or realign hub faces and bolt circles in both the differential carrier and axle housing.

6. Larger than normal steering angle; short turning radius. Vehicles designed with high turning angles may surge, have steering difficulty and cause tire wear during sharp turns. Reduce maximum turning angle and have the drive decelerate when engine surge begins.

7. Improper wheel alignment. Correct as required.

8. Worn or defective axle parts. Check the condition of the ring gear, pinion gear, bearings, seals, etc. Replace as required.

9. Foreign matter in axle housing or improper assembly of axle parts. Inspect for contamination. Check assembly of axle parts.

10. Incorrect ring and pinion adjustments; worn driveline parts (transmission gears, U-joints, etc.). Replace or adjust parts as required.

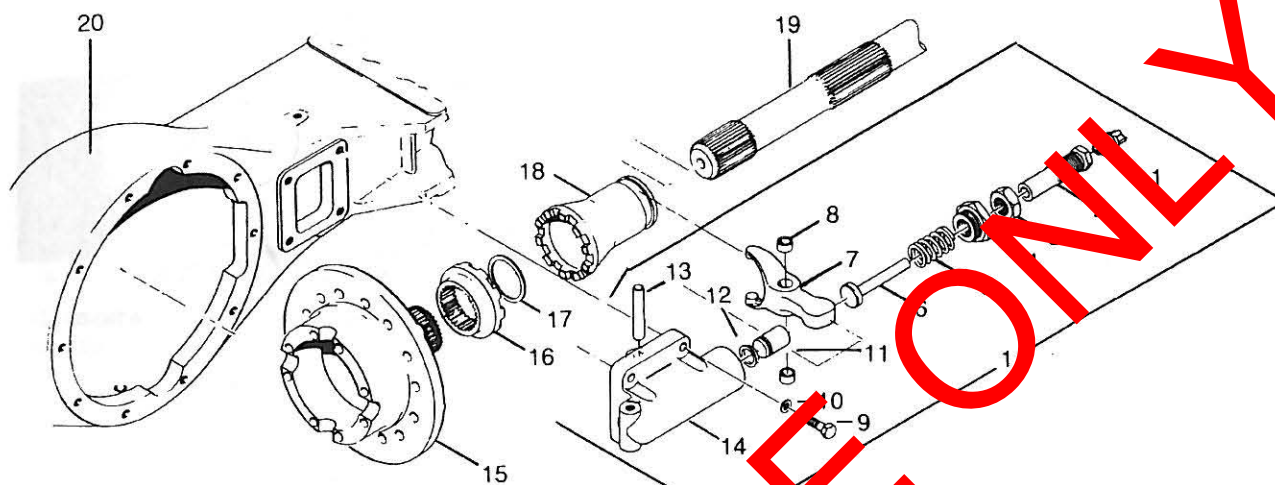
11. High crown in road; poor traction surface under all drive wheels. The tendency to side-slip or "fishtail" on icy surface sloping toward the curb is more pronounced when using a traction differential than when using a conventional differential. Stability can be retained when side-slip occurs by decelerating (letting off the accelerator). **CAUTION: Do not apply brake. To do so may result in loss of vehicle control.**

12. Heavy gear lubricant. In sub-zero temperatures, gear lubricant can thicken and impede the normal function of the NoSPIN differential. Spicer recommends that the axle oil be changed for cold weather operation to the lightest acceptable lubricant. Such as 75W, 75W-90, or 75W-140. Heat control devices, garaging and a warm-up period may also provide relief from this problem.

13. Low cylinder pressure, undersized cylinder, excessive angle of articulation, excessive vehicle weight. Correct as required.

14. Improper application of product. Review application guidelines of vehicle manufacturer.

Differential Lock Disassembly

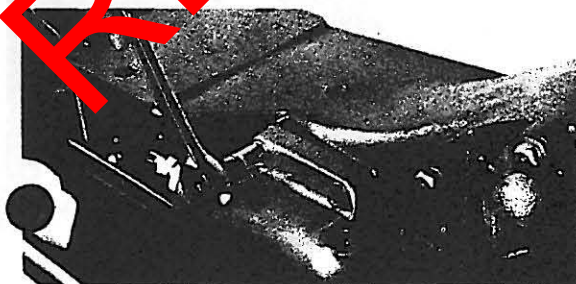


1. Indicator Switch
2. Screw (Guide)
3. Jam Nut
4. Spring Retainer
5. Spring
6. Rod
7. Fork

8. Bushing
9. Hex Bolt
10. Flat Washer
11. Piston
12. Oil Seal
13. Shaft (Pinion)

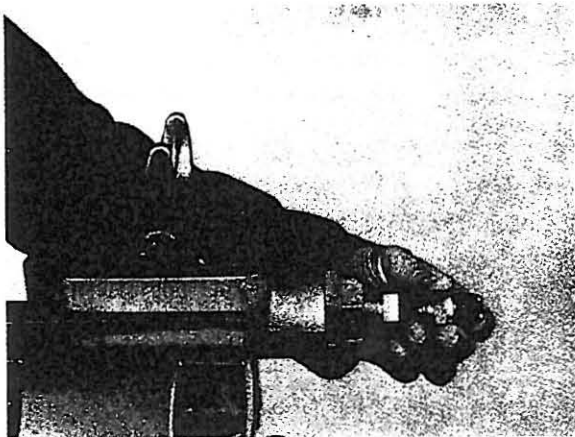
14. Shifter Housing
15. Diff. Case (Flange Half)
16. Collar (Stationary)
17. Retaining Ring (Spiral)
18. Collar (Sliding)
19. Axle Shaft
20. Axle Housing

1. Raise vehicle until wheels of axle with differential lock clear ground. Support with floor stands.
2. Disconnect drive shaft.
3. Drain oil from axle.
4. Remove steering knuckle to gain access to differential lock shifter assembly.
5. Disconnect hydraulic line and indicator switch wires from shifter assembly.



6. Remove mounting bolts from differential lock shifter assembly and remove shifter assembly from axle housing.

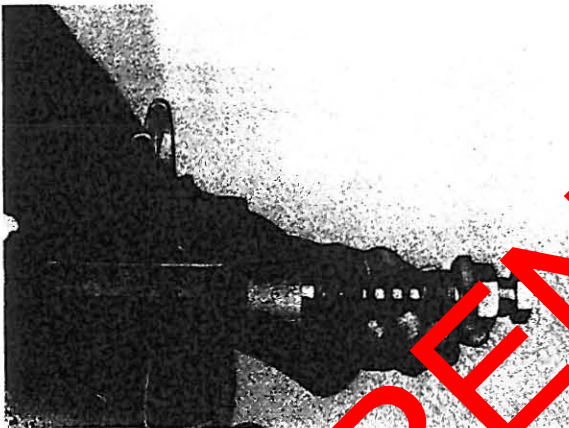
NOTE: Removal of the differential lock stationary and slide collars is covered in the carrier section of this manual.



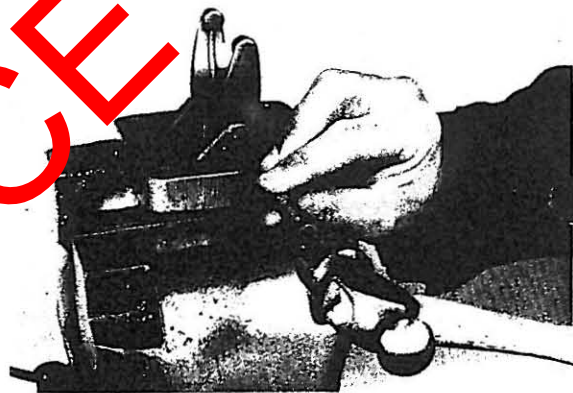
7. Remove indicator switch. Check operation with test light. Replace if defective.



10. Loosen jam nut and remove guide screw from spring retainer.



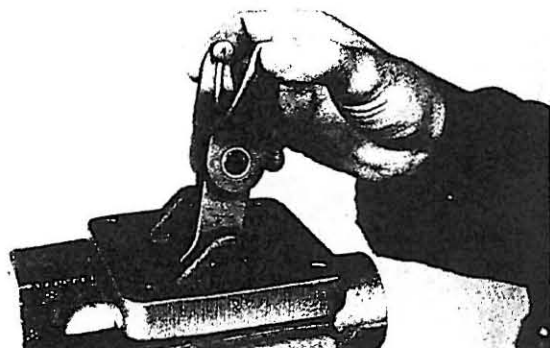
8. Remove complete spring retainer/pilot screw assembly from shifter housing.



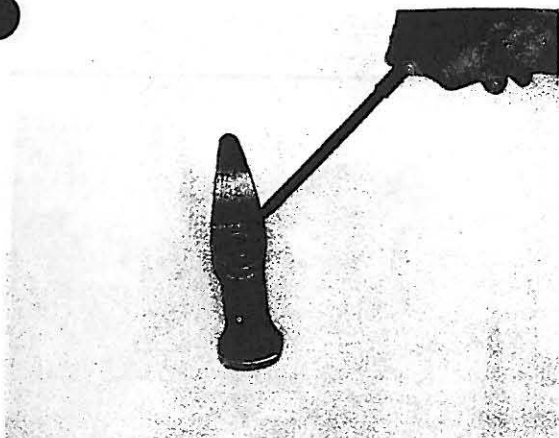
11. Using a small drift punch and hammer, drive pivot shaft out of shifter housing. Inspect for wear or scoring. Replace if necessary.



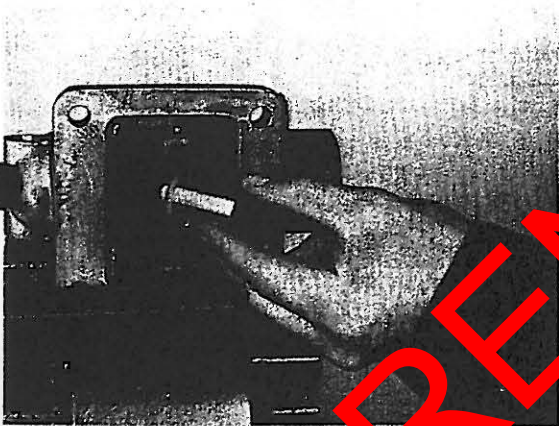
9. Remove rod and spring from guide screw.



12. Remove fork from shifter housing. Inspect fork ends for wear. Replace if necessary.



13. Inspect bronze pivot bushings in fork. If worn, replace.



14. Remove piston from shifter housing.

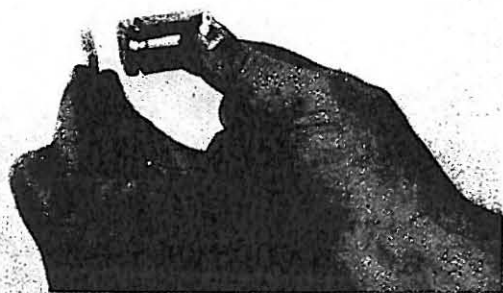
NOTE: It may be necessary to apply compressed air through the hydraulic port to aid piston removal.

CAUTION: Stay clear from inside area of shifter housing when applying compressed air to avoid personal injury. Place a shop towel inside the shifter housing to restrict piston travel and prevent damage to the piston. **USE ONLY 15 PSI MAX. AIR PRESSURE.**

15. Inspect oil seal on piston. Replace if necessary.

16. Inspect piston and piston bore in shifter housing. If either is pitted or scored, replace.

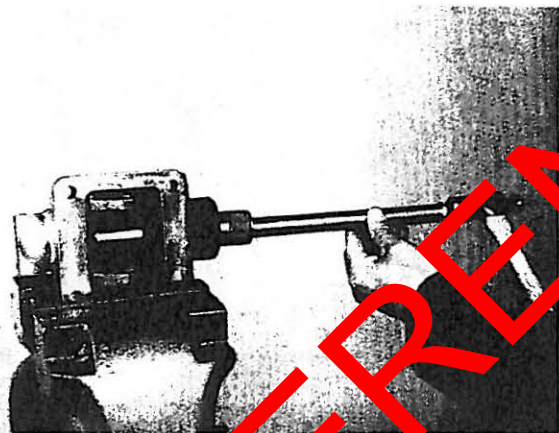
Differential Lock Assembly



1. Install seal on piston.
2. Thoroughly clean shifter housing and apply a light coat of hydraulic oil to piston bore and piston.



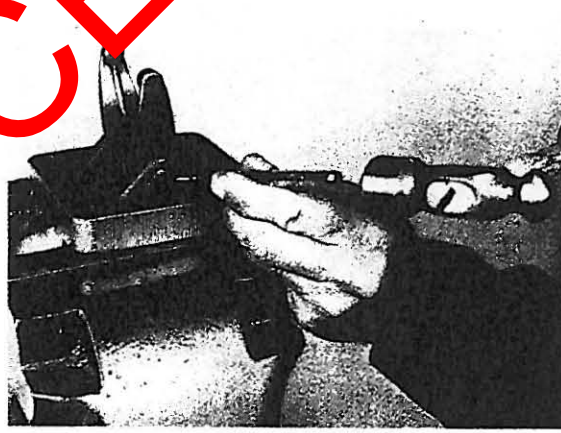
5. Insert shift fork in shifter housing and install pivot pin.



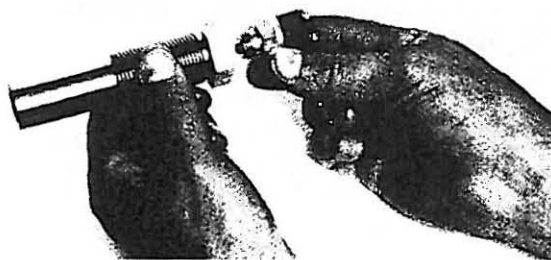
3. Install piston into shifter housing until recessed approx. 1/8".

NOTE: Use of a piston installing tool (Dana tool #451063) is recommended to prevent damage to the oil seal.

4. Install bushing into shift fork if required.



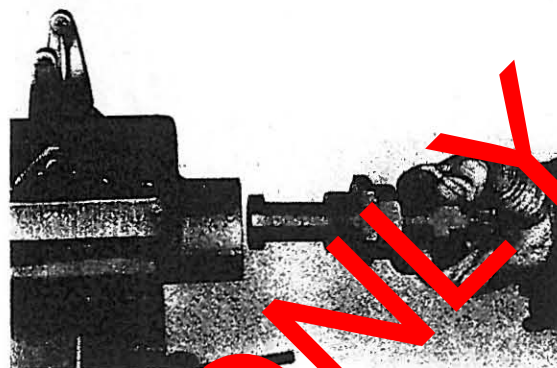
6. Stake area around both ends of pivot pin.
- NOTE:** The following steps outlined the procedure for setting-up the proper differential lock engagement. It is important that these steps be closely followed in order to avoid possible damage to the differential lock during operation.



7. Install indicator switch into guide screw and tighten.



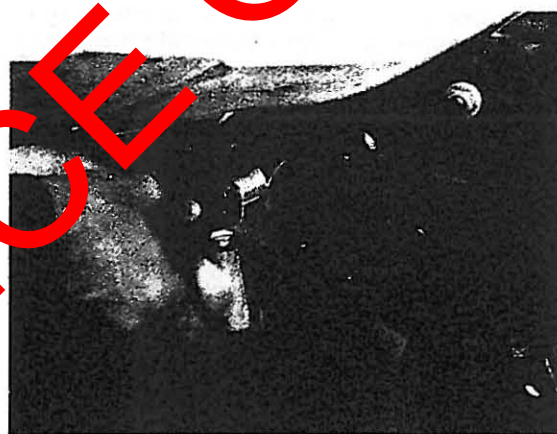
8. Thread jam nut onto guide screw until bottomed against screw head.



11. Install spring retainer/guide screw assembly into shifter housing and tighten.

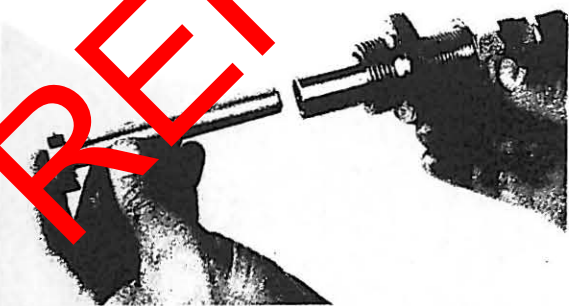


9. Thread guide screw into spring retainer approx. three turns.

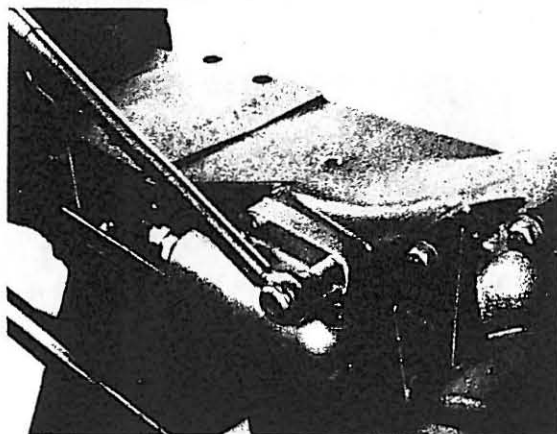


12. Apply #2 Permatex to shifter housing flange. Install shifter assembly on axle housing. Make sure fork engages groove in slide collar.

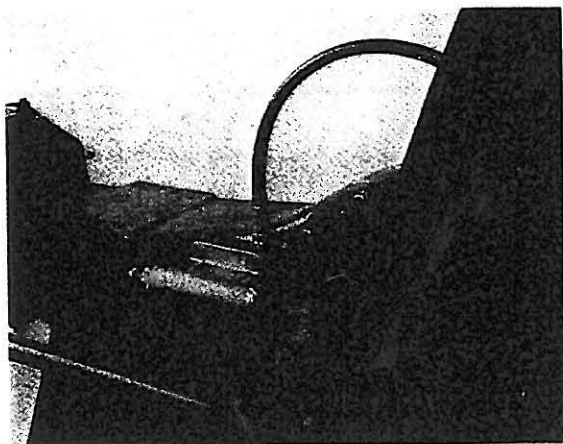
NOTE: The installation of the differential lock stationary and slide collars is covered in the carrier section of this manual.



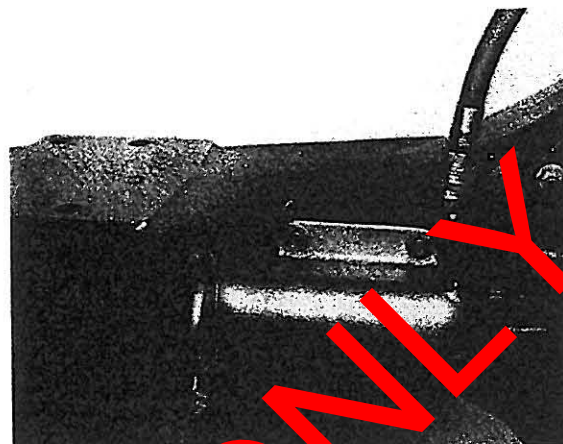
Insert rod into guide screw. DO NOT INSTALL SPRING AT THIS TIME.



13. Install flat washers and mounting bolts. Torque to 44-48 ft. lbs.

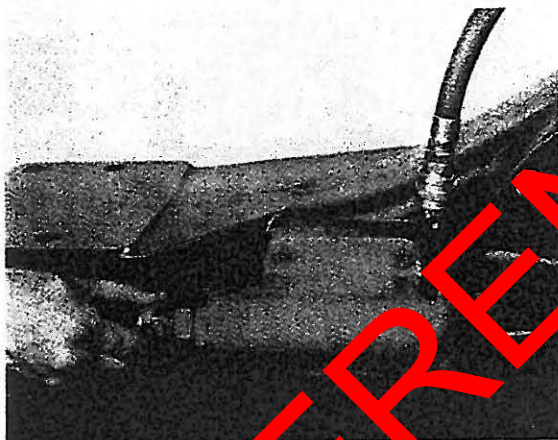


14. While rotating pinion, apply approx. 50 PSI air pressure through hydraulic inlet in shifter housing to completely engage mating differential lock collars.
NOTE: Check individual wheel rotation to be sure collars are engaged and differential action has been lost.



17. Thread jam nut against spring retainer and torque to 100 ft. lbs. DO NOT allow guide screw to rotate.

18. Remove air pressure.

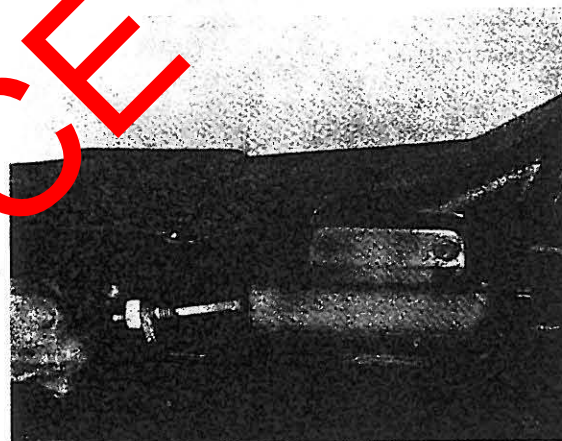


15. While continuing to apply air pressure, thread guide screw in until it stops, indicating rod contact with fork.

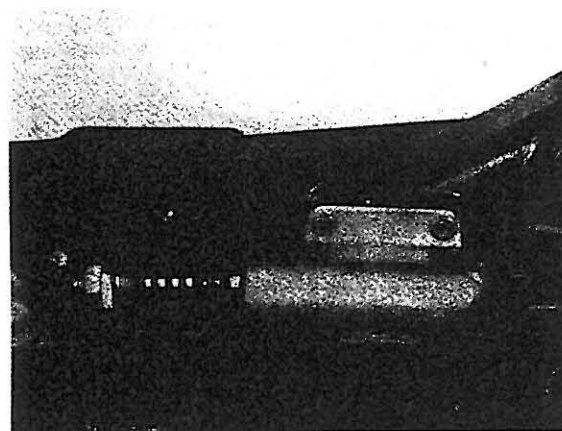
15A. Attach test light to indicator switch terminals to verify rod is contacting fork.



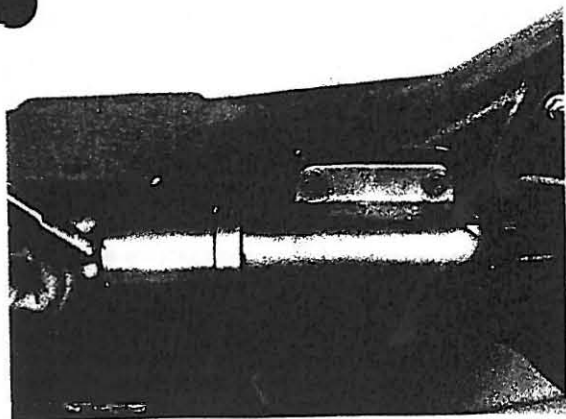
16. Turn screw in an additional 1/6 turn.



19. Remove spring retainer/guide screw assembly from shifter housing.



20. Remove rod from guide screw. Install spring over guide screw and re-install rod.



21. Install complete spring retainer/guide screw assembly into shifter housing and torque to 100 ft. lbs.

22. Loosely connect hydraulic line to shifter housing and bleed air from line.

23. Tighten hydraulic line and connect wires to indicator switch.

24. Actuate differential lock from cab of vehicle and verify engagement with indicator light.

25. Install steering cylinder.

26. Connect drive shaft and lower vehicle.

27. Refill axle to correct level with proper lubricant. (Refer to lubricant section of this manual).

REFERENCE ONLY

Inspection and Failure Analysis

This section is intended to serve as a guide for describing and explaining commonly encountered axle problems or failures, and for recommending appropriate repair procedures.

FAILURE MODE	PROBABLE CAUSE	RECOMMENDED REPAIR
Fracture of ring gear teeth at the tooth heel.	1. Excessive loading of the gear beyond design intent. 2. Incorrect gear adjustment (excessive backlash).	Replace ring gear and pinion as matched set. Carefully follow the recommended procedures for adjusting ring gear and pinion backlash and tooth pattern.
Fracture of ring gear teeth at the tooth toe.	1. Shock impact loading. 2. Incorrect gear adjustment (insufficient backlash).	Replace ring gear and pinion as matched set. Carefully follow the recommended procedures for adjusting ring gear and pinion backlash tooth pattern.
Scored and/or scuffed ring and pinion gear teeth.	1. Insufficient lubrication. 2. Contaminated lubricant. 3. Wrong lubricant or lubricant with depleted additive. 4. Worn pinion bearings which result in pinion end play and incorrect ring and pinion tooth contact.	Replace ring gear and pinion as a matched set. Replace pinion bearings taking care to set ring and pinion position and bearing preloads properly. Use correct lubricant, fill to proper level and change at recommended intervals.
Overheated ring and pinion gear teeth. Look for discoloration of the gear teeth.	1. Prolonged operation at excessive temperatures. 2. Incorrect lubricant. 3. Low oil level. 4. Contaminated lubricant. All of the above can result in inadequate lubricant film between tooth surfaces which causes surfaces to overheat due to excessive friction.	Replace ring and pinion as a matched set. Use correct lubricant, fill to specified level and change at recommended intervals.
Pitted drive pinion teeth.	1. Extremely severe service. 2. Insufficient lubrication.	Replace ring gear and pinion as a matched set. Use correct lubricant, fill to proper level and change at recommended intervals.
Bent axle housing.	1. Vehicle overloading. 2. Vehicle accident. 3. Shock loading.	Replace axle housing.
Worn or pitted bearings.	1. Insufficient lubrication. 2. Contaminated lubricant. 3. Very severe service. 4. Normal wear.	Replace bearing cups and cones in matched sets. Check roller ends for excessive wear by comparing used rollers with a new bearing. Use correct lubricant, fill to proper level and change at recommended levels.
Leaking oil seal.	1. Prolonged operation at excessive oil temperatures. 2. Scored or dented yoke wear surface. 3. Improperly installed oil seal. 4. Nicked or cut seal lip. 5. Contaminated lubricant.	Replace the oil seal and mating surface if damaged. Use correct lubricant, fill to proper level and change at the recommended intervals.

(continued on next page)

Inspection and Failure Analysis

FAILURE MODE	PROBABLE CAUSE	RECOMMENDED REPAIR
Excessive end yoke spline looseness.	1. Severe service. 2. Loose pinion nut. 3. Pinion endplay.	Replace the end yoke. Check the pinion spline for excessive wear. Replace the ring gear and pinion as a matched set if necessary.
Fatigue fracture of the pinion gear teeth. Look for clear-cut, wavy fracture lines (beachmarks).	Severe service.	Replace the ring gear and pinion as a matched set.
Fracture of differential side gears and pinion mates.	Shock loading of differential components.	Replace differential side gears, pinion mates, and cross shaft as a set.
Scoring and/or seizure of cross shaft arms and pinion mate gears.	1. Excessive wheel spinning. 2. Inadequate lubrication. 3. Extremely severe service. 4. Unequal tire pressures.	Replace differential side gears, pinion mates, cross shaft and thrust washers as a set. Use correct lubricant, fill to proper level and change at recommended intervals.
Worn side gear splines. Excessive backlash).	Severe service.	Replace differential side gears and pinion mates as a set. Replace worn axle shafts.
Scored or worn thrust washer surfaces.	1. Insufficient lubrication. 2. Improper lubrication. 3. Contaminated lubricant.	Replace any scored washer and any washer that is .005 inch thinner than a new one. Use correct lubricant, fill to proper level and change at recommended intervals.
Worn pinion roller bearing retainer bore.	1. Severe service. 2. Excessive pinion end play. 3. Inadequate lubrication. 4. Contaminated lubricant.	Replace carrier housing. Check pinion for excessive endplay. Use correct lubricant, fill to proper level and change at recommended intervals.
Twisted or broken axle shaft.	Severe vehicle operation.	Replace the shaft.
Fractured axle shaft in the flange.	1. Loose wheel bearing. 2. Bent axle housing. 3. Loose shaft to wheel hub bolts.	Replace the shaft. Check housing distortion. Make certain that wheel bearings are not worn or misadjusted.

Diagnosis of Rear Axle Problems

FAILURE MODE	PROBABLE CAUSE	RECOMMENDED REPAIR
Noise on Drive	1. Excessive pinion to ring gear backlash. 2. Worn pinion and ring gear. 3. Worn pinion bearings. 4. Loose pinion bearings. 5. Excessive pinion end play. 6. Worn differential bearings. 7. Loose differential bearings. 8. Excessive ring gear run-out. 9. Low lubricant level. 10. Wrong or poor grade lubricant. 11. Bent axle housing.	1. Adjust 2. Replace 3. Replace 4. Adjust 5. Adjust 6. Replace 7. Adjust 8. Replace 9. Replenish 10. Replace 11. Replace
Noise on Coast	1. Axle noises heard on drive will usually be heard on coast, although not as loud. 2. Pinion and ring gear too tight (audible when decelerating and disappears when driving).	1. Adjust or replace (See above) 2. Adjust
Intermittent Noise	1. Warped ring gear. 2. Loose differential case bolts.	1. Replace 2. Tighten
Constant Noise	1. Flat spot on pinion or gear teeth. 2. Flat spot on bearings. 3. Worn pinion splines. 4. Worn axle shaft down holes. 5. Worn hub shafts. 6. Bent axle shaft.	1. Replace 2. Replace 3. Replace 4. Replace 5. Replace 6. Replace
Noisy on Turns	1. Worn differential side gears and pinions. 2. Worn differential spider. 3. Worn differential thrust washer. 4. Worn axle shaft splines.	1. Replace 2. Replace 3. Replace 4. Replace

REFERENCE ONLY

APPLICATION POLICY

Capability, ratings, features and specifications vary depending upon the model and type of service. Applications approvals must be obtained from Spicer Off-Highway Products Division. We reserve the right to change or modify our product specifications, configurations, or dimensions at any time without notice.



SPICER OFF-HIGHWAY PRODUCTS DIVISION

1293 Glenway Drive
Statesville, NC 28625
Tel: 704.878.5801 Fax: 704.878.5860