

SECTION 9

SINGLE REDUCTION FINAL DRIVE

Applicable to models: 710/710A, S/N 19482 and up
720/720A, S/N 19429, 19431, 19433, 19435 to 19438, 19440, 19442 and up
730/730A, S/N 19425 and up

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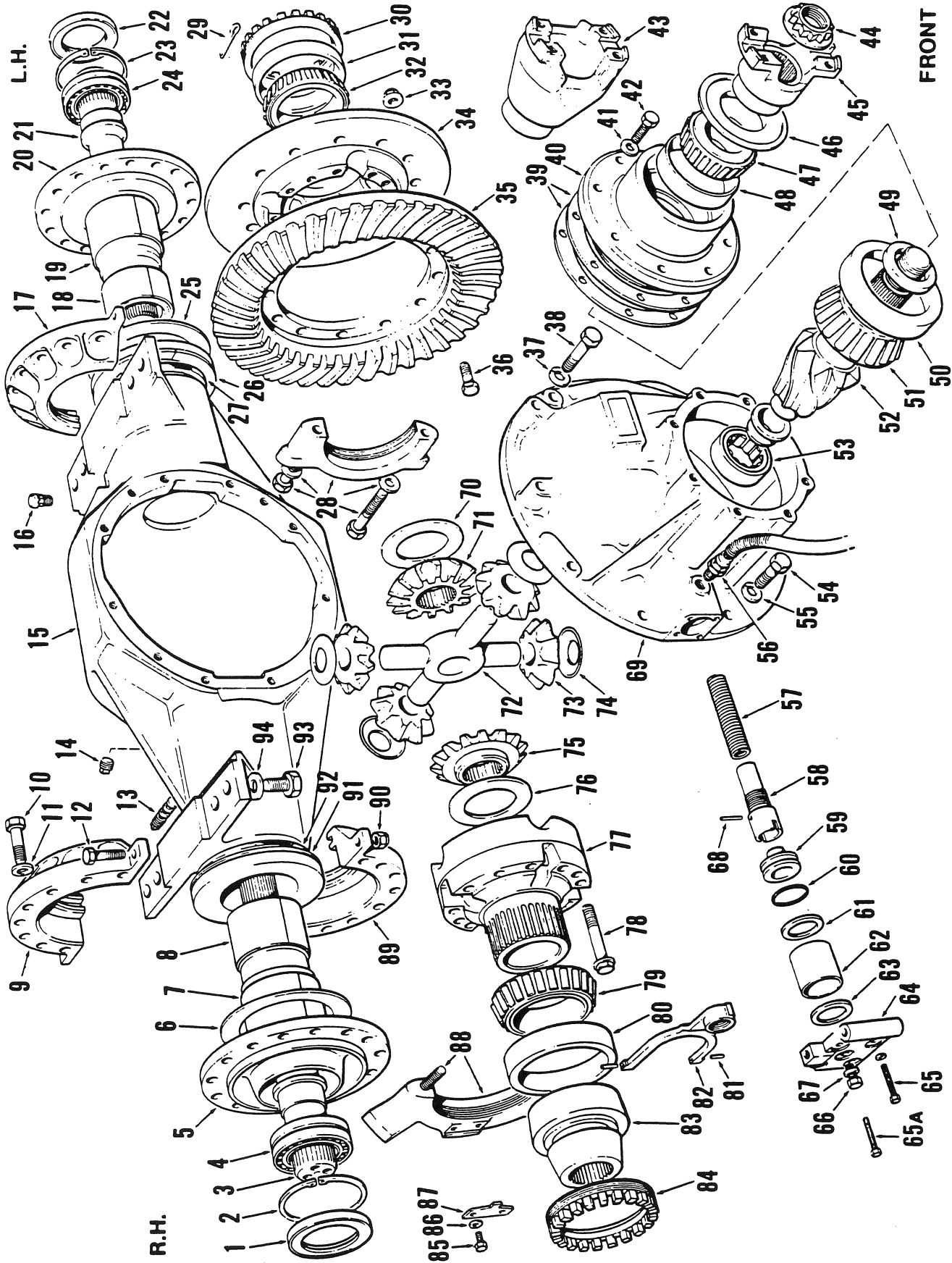


Fig. 1 710/710A, S/N 19482 and up. 720/720A, S/N 19429, 19431, 19433, 19435 to 19438, 19440, 19442 and up

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Item	Description	Item	Description	Item	Description
1	Oil seal	33	Nut	65	Bolt and lockwasher
2	Snap ring	34	Differential case	65A	Bolt (Manual Adjusting)
3	Right-hand axle shaft	35	Ring gear	66	Bolt
4	Bearing	36	Bolt	67	Gasket
5	Flanged sleeve	37	Seal washer	68	Roll pin
6	Outer thrust plate	38	Bolt	69	Differential carrier
7	Outer bushing	39	Shims	70	Thrust washer
8	Inner bushing	40	Drive pinion bearing cage	71	Side gear
9	Split ring half	41	Washer	72	Spider
10	Bolt	42	Bolt	73	Pinion
11	Special washer	43	Yoke for models 720/720A	74	Thrust washer
12	Bolt	44	Nut	75	Side gear
13	Magnetic plug	45	Yoke for models 710/710A	76	Thrust washer
14	Magnetic plug	46	Oil seal	77	Differential case
15	Final drive housing	47	Bearing cone	78	Bolt
16	Breather	48	Bearing cup	79	Bearing cone
17	Split ring half	49	Spacer	80	Bearing cup
18	Inner bushing	50	Bearing cup	81	Roll pin
19	Outer bushing	51	Bearing cone	82	Fork
20	Flanged sleeve	52	Drive pinion	83	Collar
21	Left-hand axle shaft	53	Drive pinion spigot bearing	84	Adjusting ring
22	Oil seal	54	Bolt	85	Bolt
23	Snap ring	55	Seal washer	86	Washer
24	Bearing	56	Sensor switch	87	Lock plate
25	Outer thrust plate	57	Shifter shaft spring	88	Differential bearing cap assembly
26	Inner thrust plate	58	Shifter shaft	89	Split ring half
27	Seal	59	Piston	90	Nut
28	Differential bearing cap assembly	60	O ring	91	Inner thrust plate
29	Cotter pin	61	Washer	92	Seal
30	Adjusting ring	62	Tube	93	Bolt
31	Bearing cup	63	Copper gasket	94	Special washer
32	Bearing cone	64	Cover		

Key to Fig. 1 710/710A, S/N 19482 and up. 720/720A, S/N 19429,19431, 19433, 19435 to 19438, 19440, 19442 and up

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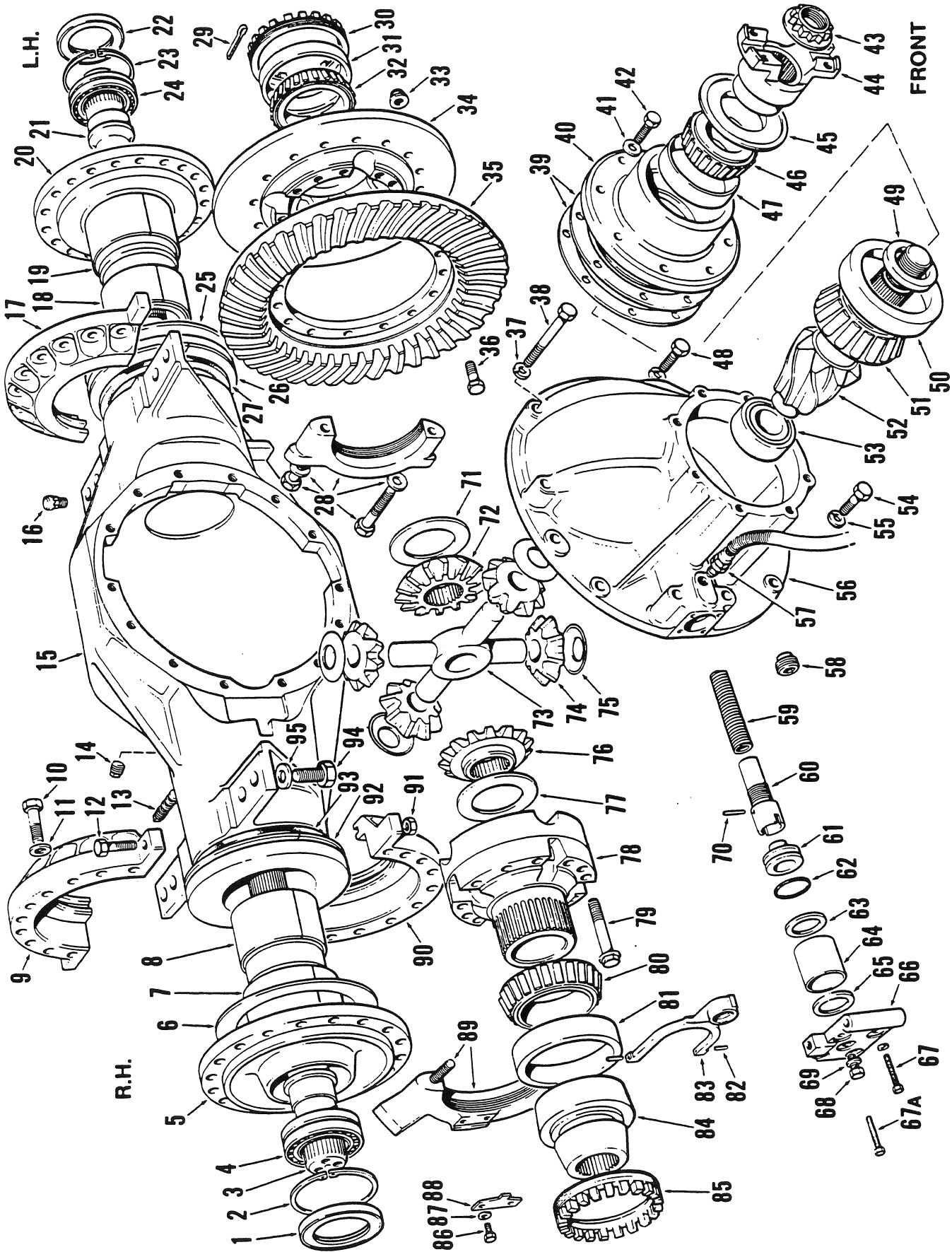


Fig. 2 730/730A, S/N 19425 and up

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Item	Description	Item	Description	Item	Description
1	Oil seal	33	Nut	65	Copper gasket
2	Snap ring	34	Differential case	66	Cover
3	Right-hand axle shaft	35	Ring gear	67	Bolt and Lockwasher
4	Bearing	36	Bolt	67A	Bolt (Manual Adjusting)
5	Flanged sleeve	37	Seal washer	68	Bolt
6	Outer thrust plate	38	Bolt	69	Gasket
7	Outer bushing	39	Shims	70	Roll pin
8	Inner bushing	40	Drive pinion bearing cage	71	Thrust washer
9	Split ring half	41	Washer	72	Side gear
10	Bolt	42	Bolt	73	Spider
11	Special washer	43	Nut	74	Pinion
12	Bolt	44	Yoke for models 730/730A	75	Thrust washer
13	Deep-reach magnetic plug	45	Oil seal	76	Side gear
14	Magnetic plug	46	Bearing cone	77	Thrust washer
15	Final drive housing	47	Bearing cup	78	Differential case
16	Breather	48	Bolt	79	Bolt
17	Split ring half	49	Spacer	80	Bearing cone
18	Inner bushing	50	Bearing cup	81	Bearing cup
19	Outer bushing	51	Bearing cone	82	Roll pin
20	Flanged sleeve	52	Drive pinion	83	Fork
21	Left-hand axle shaft	53	Drive pinion spigot bearing	84	Collar
22	Oil seal	54	Bolt	85	Adjusting ring
23	Snap ring	55	Seal washer	86	Bolt
24	Bearing	56	Differential carrier	87	Washer
25	Outer thrust plate	57	Sensor switch	88	Lock plate
26	Inner thrust plate	58	Plug	89	Differential bearing cap assembly
27	Seal	59	Shifter shaft spring	90	Split ring half
28	Differential bearing cap assembly	60	Shifter shaft	91	Nut
29	Cotter pin	61	Piston	92	Inner thrust plate
30	Adjusting ring	62	O ring	93	Seal
31	Bearing cup	63	Washer	94	Bolt
32	Bearing cone	64	Tube	95	Special washer

Key to Fig. 2 730/730A, S/N 19425 and up

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General

Make sure proper shop tools are available and in good working order. You will need a safe lifting device, blocks or proper stands, a build stand (if available), a hydraulic press and special installation tools.

The differential carrier assembly is manufactured in metric dimensions. When servicing a carrier, it is important to use the correct size metric tool on the fasteners. Refer to the Torque Guide in this section.

Information in this Shop Manual section is made available courtesy of Rockwell International.

Refer to the 700 Series Parts Manual P/N L 3008 for spare parts information.

Service Position Precaution

NOTE: Always place the grader in the SERVICE POSITION before attempting any overhaul, maintenance or inspection procedure. Refer to the SERVICE POSITION procedure on page (ii) in the front of this Shop Manual.

Description

The Gearco family of single reduction final drives combines the best features of the single reduction "No-Spin" and double reduction lock/unlock differential models.

Full floating axle shafts housed in the proven flanged sleeve concept, easily removable differential carrier and operator selectable lock/unlock differential are standard

features on all models. The single reduction final drive uses a hypoid gear set for maximum durability.

The single reduction final drive forms part of the Champion modular powertrain concept. You can quickly and easily remove the tandem/final drive assembly without disturbing the rest of the powertrain.

The differential assembly is locked by transmission lock up pressure and unlocked by spring tension. A switch on the right-hand door post controls a solenoid operated valve. With the switch in the LOCKED (down) position, the solenoid energizes and allows transmission lock up pressure to the differential shift cylinder. In the UNLOCKED (up) position, the deenergized solenoid valve blocks the lock up pressure and spring tension unlocks the differential. The lock/unlock light above the switch on the door post is connected to the differential sensor switch and shows exactly what position the differential is in.

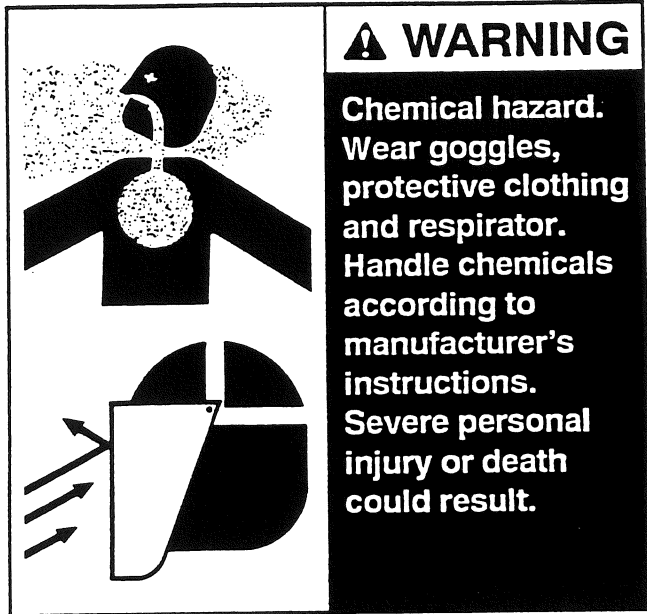
When you operate the differential lock, the shift collar moves along the axle shaft splines toward the differential case. The shift collar splines then engage with the differential case splines. This action locks the axle shaft and differential assembly together. When the carrier operates in the locked position, there is no differential action. Differential action occurs when the carrier operates in the unlocked position.

A small hose between the solenoid valve and the clutch housing vents the shift tube in the unlocked position.

Cleaning and Inspection

Cleaning

Use a cleaning solvent to clean ground or polished parts or surfaces. Kerosene or diesel fuel oil can be used. Do not use gasoline.



Use a flat-bladed tool to remove silicone sealant residue. Take care not to damage the ground surfaces.

Do not clean ground or polished parts in water, steam, alkaline solutions or a hot solution tank. However, rough parts can be cleaned in a hot solution tank with a weak alkaline solution. Parts must remain in the hot solution until completely cleaned and heated. Wash parts with water and remove all alkaline solution.

Steam clean the final drive housing exterior to remove dirt. Before steam cleaning the housing, cover all openings; for example, the air breather.

Immediately dry parts after cleaning and washing. Use soft, clean paper or cloth rags. You can also dry parts - except bearings - using moisture-free compressed air.

NOTE: Do not dry bearings with compressed air. Spinning bearings with compressed air can damage the races and rollers.

Apply system oil to undamaged parts that are ready for assembly. If storing parts for some time, apply a rust inhibitor to all surfaces. Wrap parts in rust inhibitor impregnated paper before storing.

Inspection

Inspect all tapered roller bearing cups and cones. Replace the bearing if you see the following defects.

- a) Center of the large diameter end of the roller worn level with or below the outer surface of the roller.
- b) Radius of the large diameter end of the roller worn to a sharp edge.
- c) Visible roller grooves in the cup or cone inner race surfaces.
- d) Deep cracks in the cup, cone inner race or roller surfaces.
- e) Bright wear marks on the roller cage outer surface.
- f) Etched and pitted rollers or cup and cone inner race surfaces that touch the rollers.
- g) Cup and cone inner race surfaces that touch the rollers damaged by spalling and flaking.

Inspect hypoid drive pinion and ring gear for wear or damage. Replace gears that are worn or damaged. The drive pinion and ring gear are manufactured as a matched set. If either the drive pinion or ring gear needs replacing, you must install a new matched gear set.

Inspect the following differential assembly parts for wear and damage (see Fig. 3). Replace all worn and damaged parts.

- a) Inside surfaces of both differential case halves.
- b) Both sides of all thrust washers.
- c) The ends of the spider (cross) trunnions.
- d) Teeth and splines of both differential side gears.

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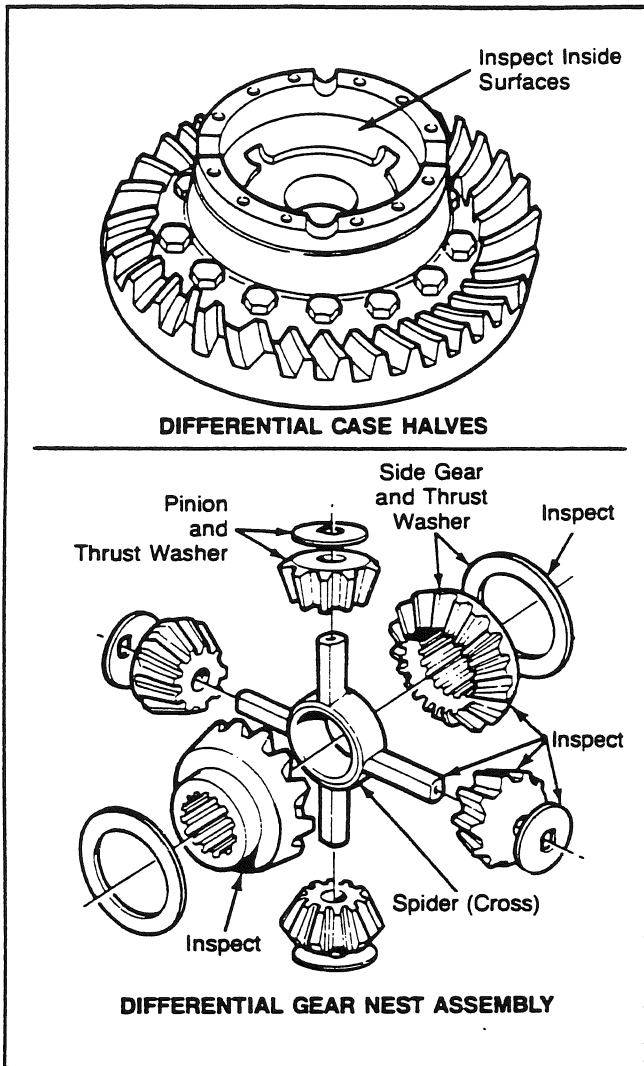


Fig. 3

- e) Teeth and bore of all differential pinions.

NOTE: Always replace thrust washers, differential side gears and pinions in sets. High stress on parts and early failures occur when new parts are used with old or worn parts.

Inspect axle shafts for wear, cracks and worn or twisted splines. Replace any defective axle shaft.

Replace worn or damaged final drive assembly parts. Following are examples of what to check, repair or replace.

- a) Replace any fasteners if the corners of the head are worn.
- b) Replace damaged washers.
- c) Replace all oil seals, O rings, cotter pins and snap rings.
- d) Clean parts and apply new silicone sealant P/N 56427 where required when final drive is assembled (see Fig. 4).

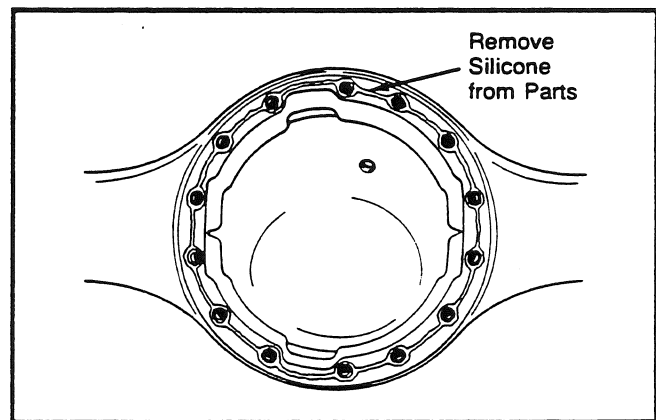


Fig. 4

- e) Remove nicks, scratches and burrs from machined or ground surfaces. Use a fine file, india stone, emery cloth or crocus cloth.
- f) Clean and repair threads. Use a die or tap of the correct size. You can also use a fine file.

NOTE: Threads must be clean and undamaged to ensure correct values when fasteners are torque-tightened; also accurate adjustments.

Lubrication

It is important to check the final drive oil level and add the correct type of lubricant. Refer to your 700 Series Operator's Manual for complete details of capacities, change intervals, fluid types, temperature range and appropriate viscosities.

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Torque Guide

Fig. No.	Application	Torque Value		
		lbf.ft	N.m	kgf.m
39	Nut retaining yoke to drive pinion	996 - 1232	1350 - 1670	138 - 170
50	Bolts retaining drive pinion bearing cage	74 - 92	10 - 13	100 - 125
51	Nut retaining yoke to drive pinion	996 - 1232	1350 - 1670	138 - 170
52	Nuts securing ring gear and flange case half	192 - 214	26 - 30	260 - 290
58	Bolts retaining differential case halves	203 - 251	28 - 35	275 - 340
-	Bolts retaining bearing caps to carrier	479 - 597	66 - 82	650 - 810
88	Bolts retaining adjusting ring lock plate	21 - 26	28 - 35	3 - 3,5
90	Shifter shaft into fork	20 - 25	27 - 34	3 - 3,5
93	Bolts securing differential lock cylinder cover	7.4 - 8.9	10 - 12	1 - 1,2
-	Sensor switch locknut	26 - 33	35 - 45	3,5 - 4,5
96	Bolts retaining carrier to final drive housing	200 - 225	271 - 305	28 - 31
97	Bolt for differential lock in cover	44 - 55	60 - 75	6 - 7,6
97	Manual engaging bolt in cover	22 - 28	30 - 38	3 - 3,8
-	Bolts retaining split rings to tandems	260 - 290	352 - 393	36 - 40
-	Bolts retaining drive sprocket end cap	80 - 100	108 - 136	11 - 14
-	Bolts retaining final drive housing to grader frame	620 - 700	841 - 949	86 - 97
-	Bolts retaining drive shaft to yoke	70 - 80	95 - 108	10 - 11

Removing Final Drive and Tandem Assembly from Grader

1. Park the grader on level ground. Place the transmission mode lever in neutral. Centralize the circle, drawbar and moldboard assembly using the circle shift and blade lift cylinders. Shut down the engine and place the machine in the SERVICE POSITION. Refer to page (ii) in the front of this Shop Manual.
2. Place a container (capacity: 6 U.S. gallons [23 liters]) under the final drive drain plug. Remove the plug and drain the oil. Clean and install the plug.
3. Disconnect all brake lines between the rear frame and tandems. Identify the lines to prevent confusion during assembly. Immediately plug the lines and connectors to prevent dirt and moisture entering the brake fluid system. Remove any spilled brake fluid to prevent paint damage.
4. Disconnect the lower drive shaft universal joint from the final drive yoke. Secure the slip yoke and drive shaft with lockwire.
5. Disconnect the hydraulic hose at the differential lock cylinder cover. Plug the open ports. Disconnect the sensor switch wiring harness from the main wiring harness.
6. Make a visual safety check around the grader. Ensure all personnel are away from the area. Signal your intention and start the engine when it is safe to do so. Position the moldboard at 90° to the frame. Apply down pressure to the moldboard and lift the front wheels about 2 feet (60 cm) off the ground. Shut down the engine. Remove and retain the ignition key. Turn the battery isolation switch to the OFF position. Place a safe, adequate stand under the nose plate.
7. Open the battery box(es) and disconnect the battery cables. Remove one battery and pass the cables through the grommet.
8. Attach a safe lifting device to the rear of the grader frame. Remove the bolts and special washers retaining the final drive assembly to the frame brackets. Remove the nose plate stand. Raise the rear end of the grader clear of the final drive by pivoting on the moldboard. Roll out the final drive and

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tandem assembly from under the grader. Lower the rear end of the grader onto safe, adequate stands (see Fig. 5).

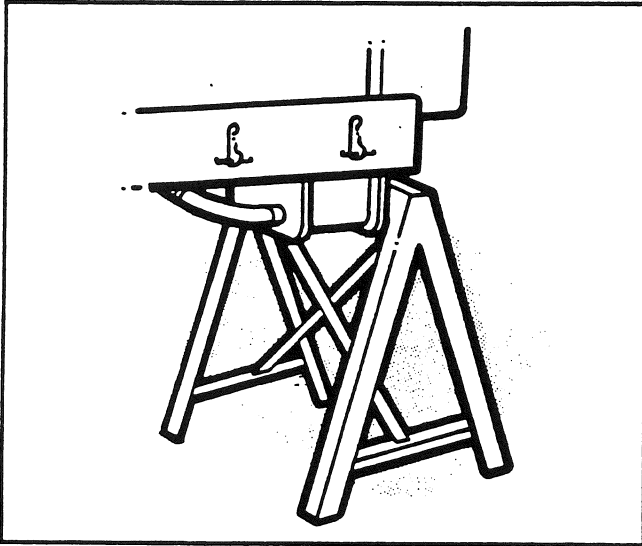


Fig. 5

9. Install chocks in front and behind the tandem tires. Place a container (capacity: 10 U.S. gallons [38 liters], oil disc brakes: 26.5 U.S. gallons [100 liters]) under the tandem drain plug. Remove the plug and drain the oil. Clean and install the drain plug.

NOTE: The differential carrier can be removed without removing the tandems or flanged sleeves.

Manual Lock/Unlock Shift Engagement

1. Before removing or installing the differential carrier or axle shafts, you must shift and hold the differential lock in the locked (engaged) position. The locked position gives enough clearance between the collar and the final drive housing to allow you to remove and install the carrier. Failure to do this can result in component damage.
2. Use the manual engaging method to lock the differential (see Fig. 6).
3. Remove the bolt and gasket from the hole in the center of the cover. Remove the manual engaging

bolt from the top storage hole in the cover. Install the bolt and gasket into the bottom storage hole in the cover.

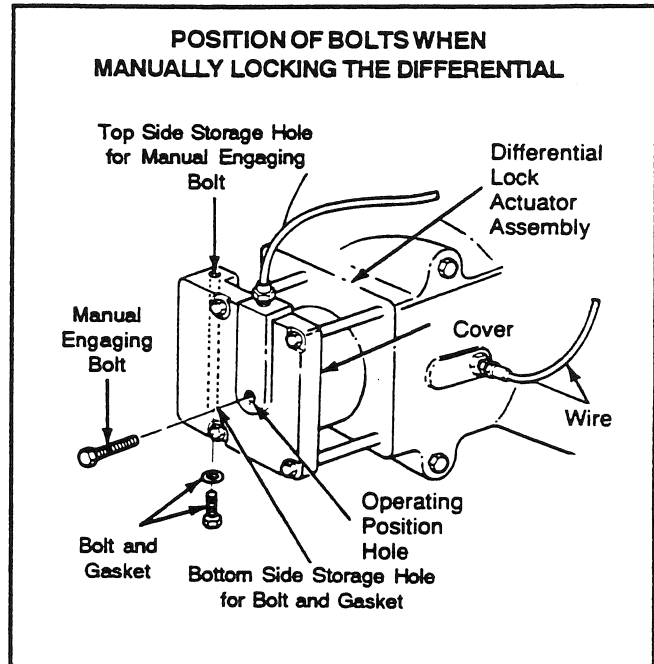


Fig. 6

4. Install the manual engaging bolt into the hole in the center of the cover. Turn the manual engaging bolt to the right until the head is approximately 1/4 inch (6 mm) from the cover. Do not turn the bolt beyond its normal stop. The bolt is now in the service position and the differential lock is completely engaged.
5. You will feel a small amount of spring resistance when turning the manual engaging bolt. If you feel a high resistance before reaching the locked (engaged) position, stop turning the bolt. Otherwise the cover and bolt threads will be damaged.
6. A high resistance to the bolt indicates that the splines of the collar and the differential case half are not aligned or engaged. Align the splines as follows:
 - a) As you turn the manual engaging bolt, rotate the drive pinion to align the splines of the collar and differential case half.

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- b) Reduced spring resistance indicates the splines are engaged. Continue turning the manual engaging bolt until the head is approximately 1/4 inch (6 mm) from the cover.

Removing Tandems

1. Remove, clean and install the deep-reach magnetic plugs. If the oil and magnetic plugs are contaminated with metal particles, completely disassemble the tandem to remove defective parts.
2. If applicable, disconnect and remove the transverse brake line. Immediately plug the line and connector. Remove any spilled brake fluid to avoid paint damage.
3. Remove the bolts securing the tandem side cover plate and remove the plate. Remove all traces of silicone sealant.
4. Remove the bolts, tabwasher and end cap securing the drive sprocket to the axle shaft. Discard the tabwasher.
5. Support the final drive assembly on safe, adequate stands. Attach a safe lifting device to the tandem. Remove the bolts and lockwashers retaining the final drive assembly to the tandem.
6. Carefully remove the tandem. Remove the drive sprocket and chains from the axle shaft using a pry bar. Repeat steps 1 through 6 for the other tandem.

Removing Axle Shafts and Flanged Sleeves

1. Attach a safe lifting device to the final drive assembly and position the assembly with the differential carrier at the top. Remove the drive sprocket spacers. Remove and discard the axle shaft oil seals.

2. Remove and discard the snap rings. Remove the axle shaft and bearing assemblies from the final drive housing. Remove the bearings from the axle shafts using a hydraulic press. Place the bearings and axle shafts to one side for cleaning and inspection.

NOTE: The right-hand axle shaft has two sets of splines. One set engages with the differential side gear. The other set engages with the differential lock collar. When removing the axle shaft, you may have to rotate the shaft slightly to align the side gear and collar splines.

3. Remove the nuts and bolts securing the split ring halves. Separate the split ring halves and remove them from the final drive housing.

NOTE: The split ring halves are a matched pair. Keep them temporarily bolted together during the overhaul procedure. Remove all traces of silicone sealant from the split ring flanges.

4. Install a lifting eye in the flanged sleeve. Remove the flanged sleeve using a safe lifting device (see Fig. 7). Remove and discard the inner and outer thrust plates. Remove and discard the seal. Repeat this step for the other flanged sleeve.

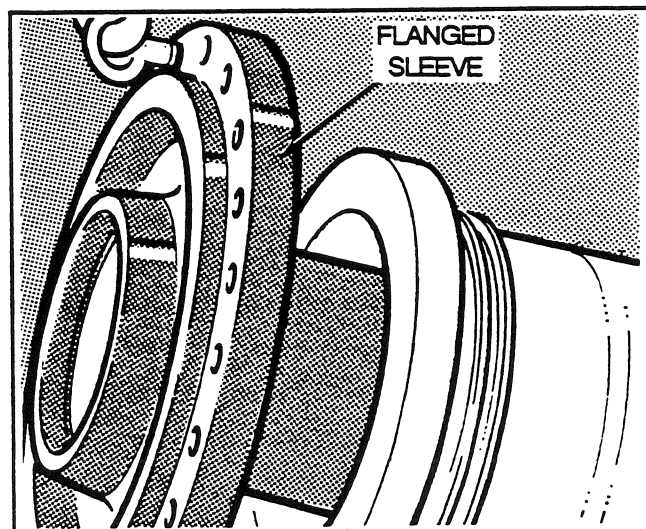


Fig. 7

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Removing Differential Carrier from Final Drive Housing

1. Attach a safe lifting device to the carrier. Remove all except the top two bolts securing the carrier to the final drive housing.
2. Loosen the top two bolts and leave attached to the assembly. The bolts will hold the carrier in the housing.
3. Loosen the carrier in the housing. Use a leather mallet to hit the carrier mounting flange at several points.

NOTE: Model SR 40 carrier housings can be loosened with puller screws. When using puller screws, clean the threaded holes before installing the screws.

4. Remove the top two bolts after loosening the carrier.
5. Using the lifting tackle carefully remove the carrier from the housing. Use a pry bar with a round end to help separate the carrier from the housing.

NOTE: When using a pry bar, take care not to damage the carrier or housing flange. Damage to the flanges can cause oil leaks.

6. Use the lifting tackle and install the carrier into a build stand.

NOTE: Before overhauling the carrier, inspect the ring gear and drive pinion gear set for damage. If the gear set is undamaged, it can be reused. Measure the gear set backlash and record the dimension (see **Checking Ring Gear Backlash** in this section). Adjust the backlash to the same dimension after installing the gear set.

Removing Differential and Ring Gear Assembly from Carrier

1. Tap the two roll pins until they are flush with the inner face of the fork (see Fig. 8). Release the differential lock if it is manually engaged.

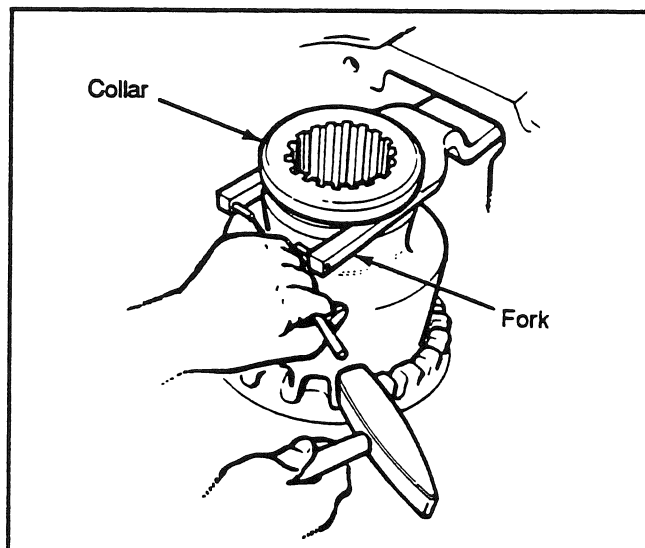


Fig. 8

2. Remove the sensor switch. Remove the four bolts and washers retaining the cover. Remove the cover and copper gasket (see Fig. 9). Remove the tube and piston. Remove and discard the O ring from the piston. Remove the shifter shaft from the fork. Remove the shifter shaft spring and flat washer. Remove the fork.

NOTE: A roll pin installed in the shifter shaft is used to stop the shifter shaft spring. It is not necessary to remove the roll pin.

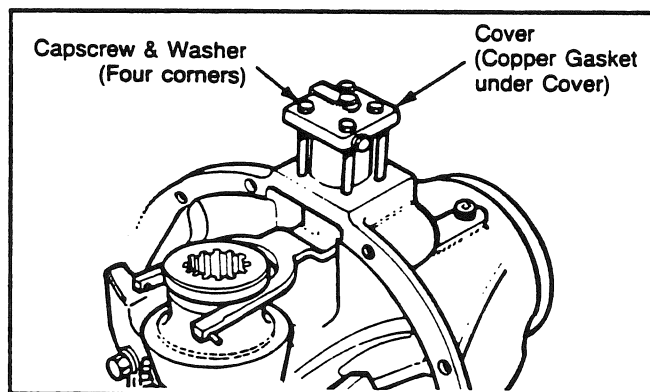


Fig. 9

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3. Mark one carrier leg and differential bearing cap to correctly match the parts during assembly. Use a center punch and hammer to mark the parts (see Fig. 10).

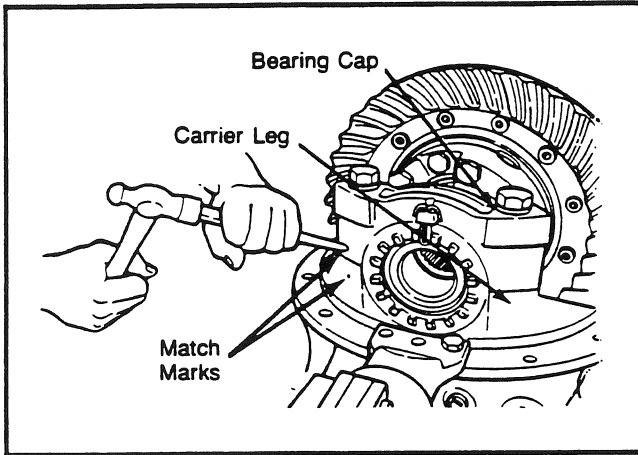


Fig. 10

4. Remove the cotter pin and lock plate retaining the two adjusting rings. Use a hammer and small drift to remove the cotter pin. Two bolts and lockwashers retain the lock plate (see Fig. 11).

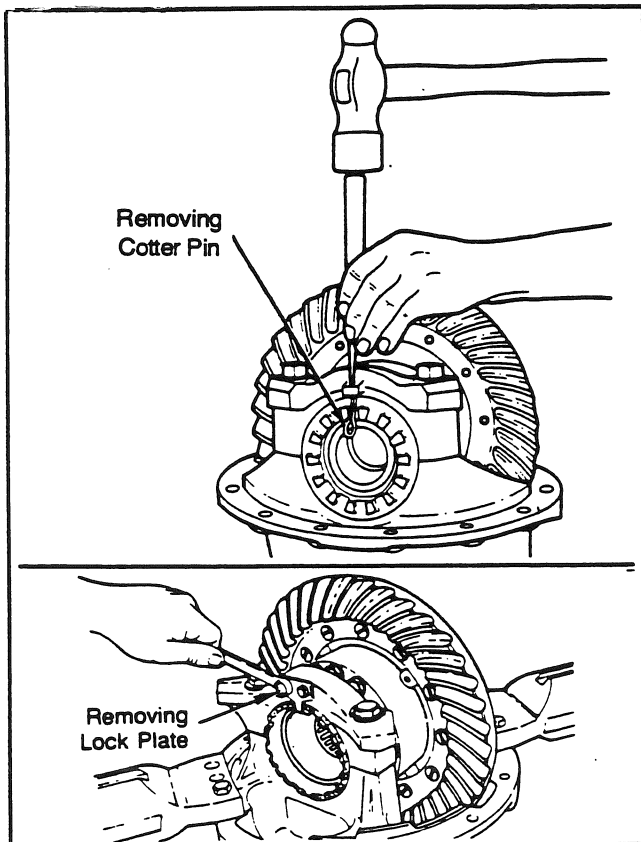


Fig. 11

5. Remove the bolts and washers retaining the two differential bearing caps to the carrier. Remove the bearing caps and adjusting rings from the carrier (see Fig. 12).

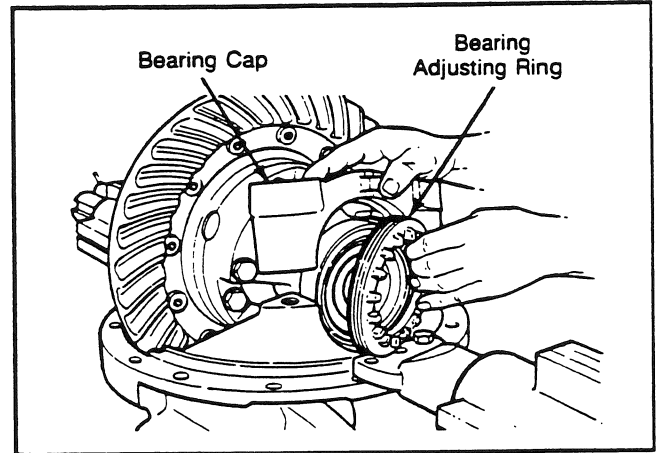


Fig. 12

6. Use safe lifting tackle to remove the differential and ring gear assembly from the carrier (see Fig. 13). Place the assembly on a clean workbench.

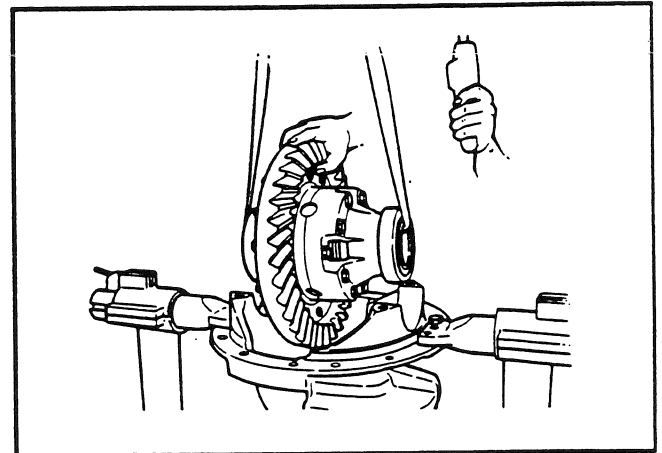


Fig. 13

Disassembly - Differential and Ring Gear Assembly

1. If the matching marks on the differential assembly case halves are not visible, mark each case half using a hammer and center punch (see Fig. 14). The marks show the correct positioning of the plain half and flange half during the assembly procedure. Remove the bolts and washers securing the case halves together.

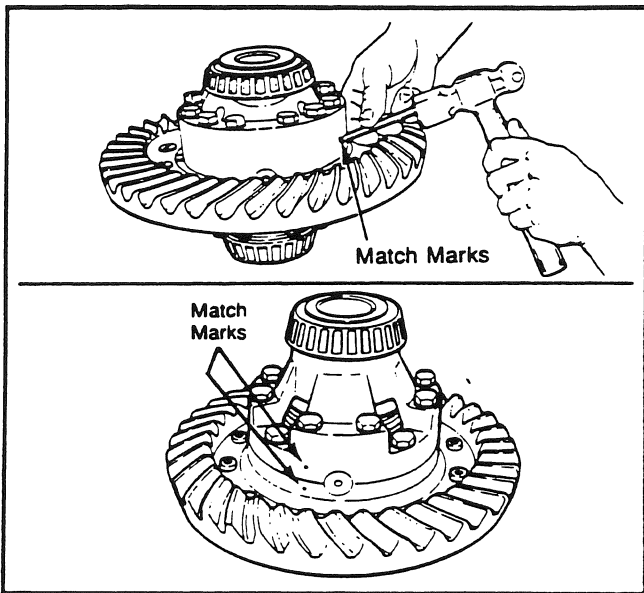


Fig. 14

3. If you are replacing the ring gear, remove the nuts and bolts retaining the gear to the flange case half. Separate the case half and ring gear using a hydraulic press. Support the assembly with wood or metal blocks under the ring gear and press the case half through the gear (see Fig. 16).

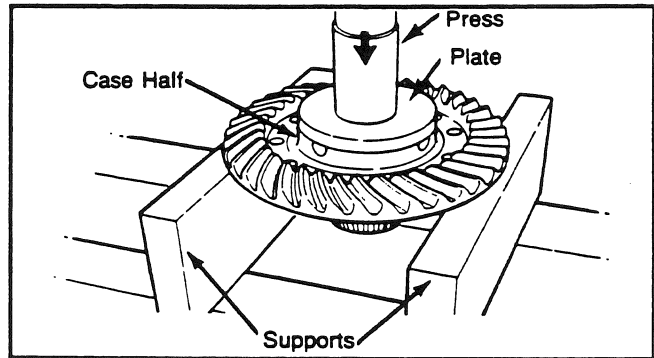


Fig. 16



⚠ WARNING

Do not hit steel parts with a steel hammer. Danger of breaking parts. Flying pieces can cause injury.

2. Separate the case halves. If necessary, use a brass, plastic or leather mallet to loosen the parts. Remove the spider, four pinion gears, two side gears and six thrust washers from inside the case halves (see Fig. 15).

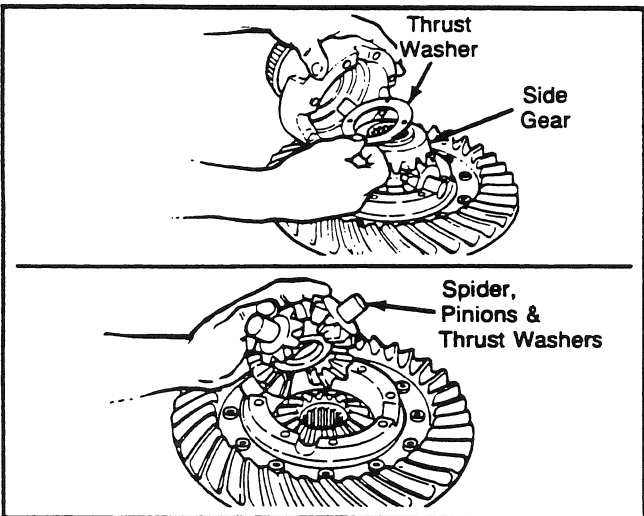


Fig. 15

4. If you are replacing the differential bearings, remove the bearing cones from the case halves. Use a bearing puller or press (see Fig. 17).

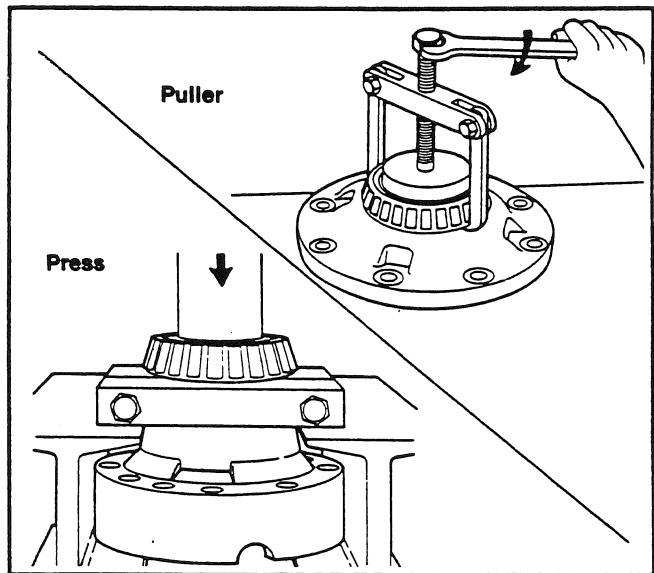


Fig. 17

Disassembly - Drive Pinion and Bearing Cage Assembly

1. Fasten a yoke bar to the input yoke (see Fig. 18). The bar holds the drive pinion in position when you remove the nut. Remove the nut from the drive pinion. Remove the yoke bar. Remove the yoke

from the drive pinion. Use a puller if the yoke is tight on the drive pinion (see Fig. 19).

NOTE: Do not use a hammer or mallet to loosen and remove the yoke. A hammer or mallet can damage parts and cause runout or alignment problems.

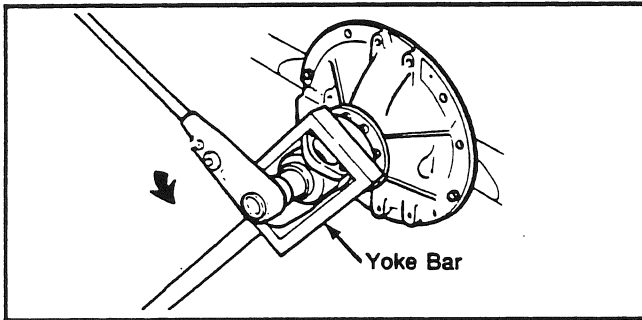


Fig. 18

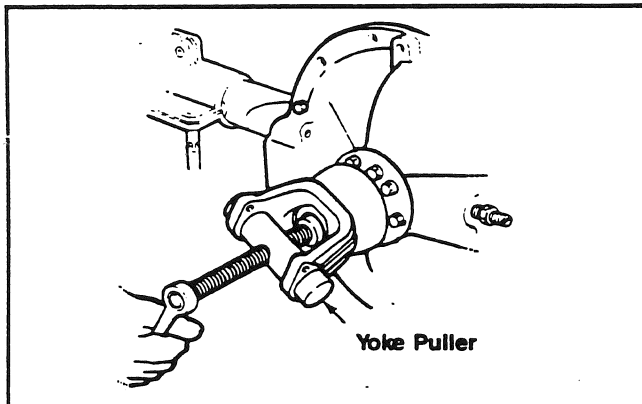


Fig. 19

2. Remove the bolts and washers retaining the bearing cage to the carrier. Remove the drive pinion, bearing cage and shims from the carrier (see Fig. 20).

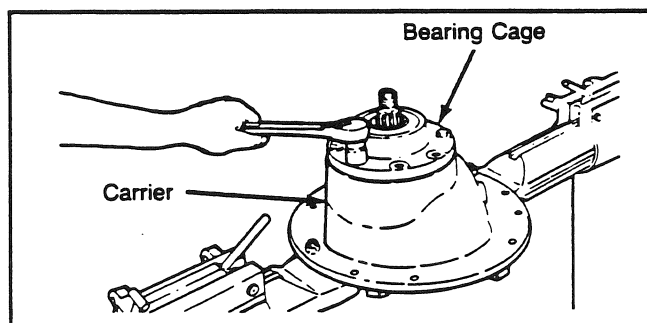
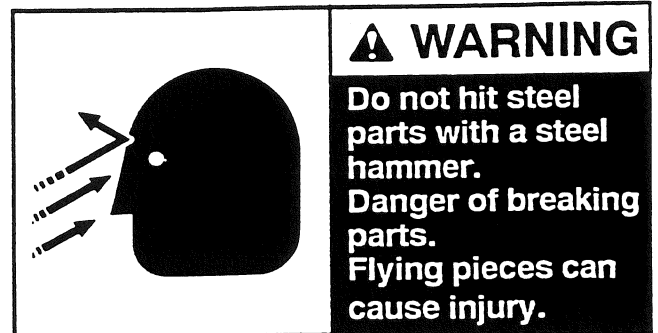


Fig. 20



3. If the bearing cage is tight in the bore, hit the cage at several points around the flange area with a leather, plastic or rubber mallet.

NOTE: Do not use a pry bar to remove the bearing cage from the carrier. A pry bar can damage the bearing cage, shims and carrier.

4. Keep any shims in good condition for use later during the assembly procedure. Before discarding any damaged shims, measure and record the total shim pack thickness. You will need to know this dimension to calculate the depth of the drive pinion when installing the gear set.

5. Place the drive pinion and bearing cage assembly in a press. The pinion shaft must be at the top. Support the bearing cage under the flange area with metal or wood blocks. Press the drive pinion through the bearing cage (see Fig. 21). The inner bearing cone and bearing spacer will remain on the drive pinion shaft.

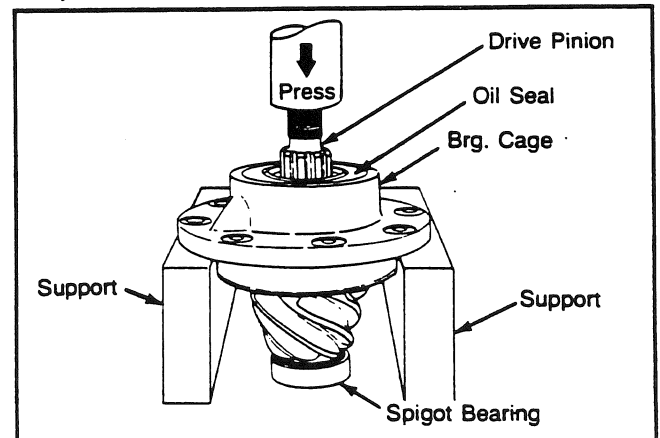


Fig. 21

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6. Remove and discard the pinion oil seal (see Fig. 22). Be careful you do not damage the mounting surfaces or wall of the bore. Damage to the bearing cage bore can cause oil leaks.

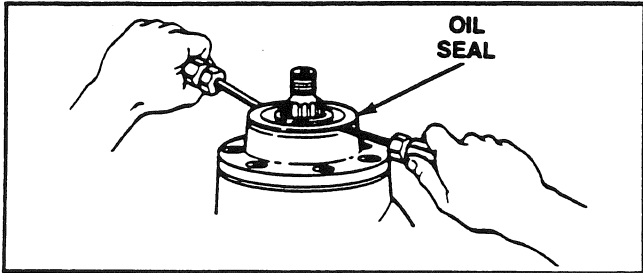


Fig. 22

7. Use a press and sleeve, bearing puller or a hammer and brass drift to remove the drive pinion inner and outer bearing cups (see Fig. 23). When using a press, support the bearing cage under the flange with metal or wood blocks.

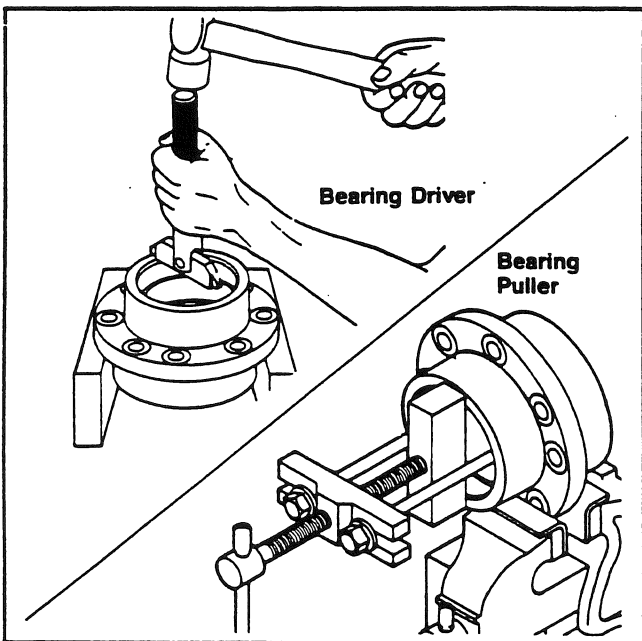


Fig. 23

8. Use a press or bearing puller to remove the drive pinion inner bearing cone. The puller must fit under the inner race of the cone for correct removal (see Fig. 24).

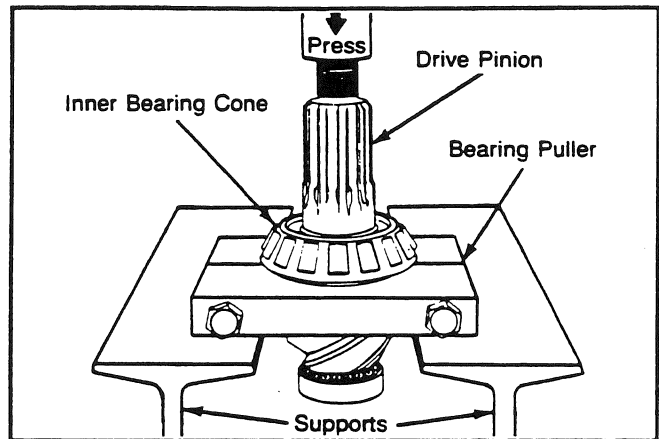


Fig. 24

9. Install the drive pinion in a vise with soft jaws to remove the drive pinion spigot bearing.

NOTE: The spigot bearing design may differ according to your carrier assembly model.

- a) Press fit two-piece design.
- b) Retained to the drive pinion by staking.
- c) Retained to the drive pinion by a snap ring.

10. Remove and discard the snap ring retaining the spigot bearing to the drive pinion (see Fig. 25). Remove the spigot bearing from the drive pinion using a bearing puller (see Fig. 26). For a two-piece bearing, remove the inner race from the drive pinion using a bearing puller. Remove the outer race from the carrier using a press or hammer and brass drift (see Fig. 27).

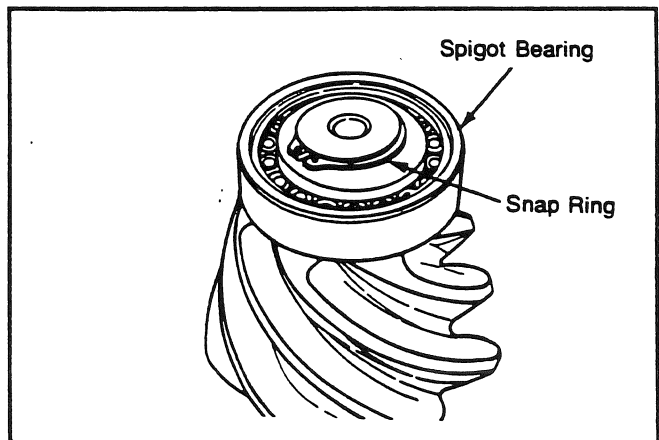


Fig. 25

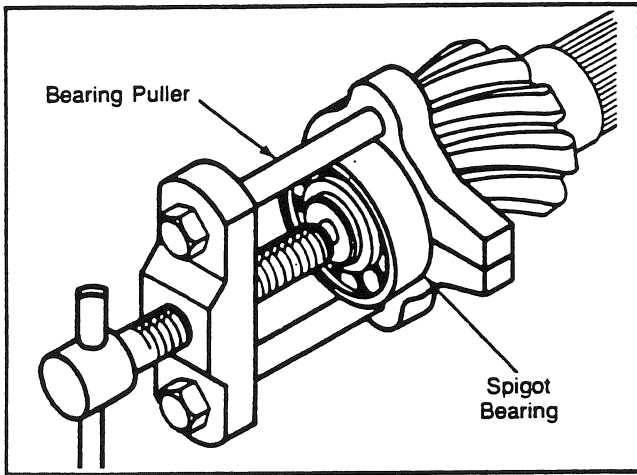


Fig. 26

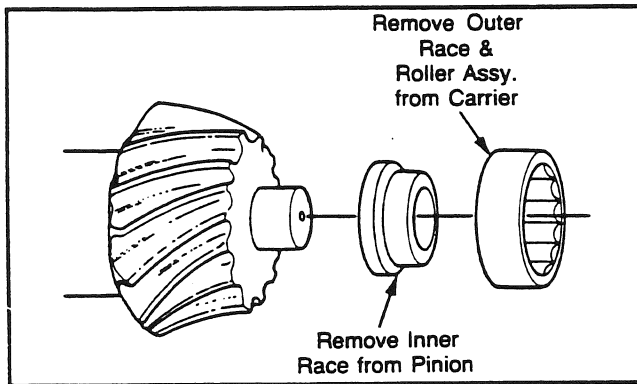


Fig. 27

Disassembly - Final Drive Housing Journal Bushings

1. Remove and discard the inner and outer bushings from the final drive housing journals (see Fig. 28).

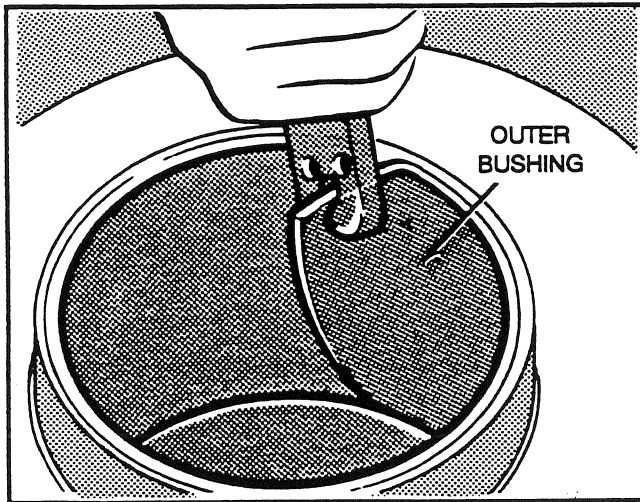


Fig. 28

Assembly - Drive Pinion, Bearings and Bearing Cage

1. Place the bearing cage in a press and support with metal or wood blocks. Lubricate the bearing cup with system oil. Use a sleeve of the correct size and press the bearing cup into the bearing cage until the cup is flat against the bottom of the bore (see Fig. 29). Repeat the procedure for the other bearing cup.

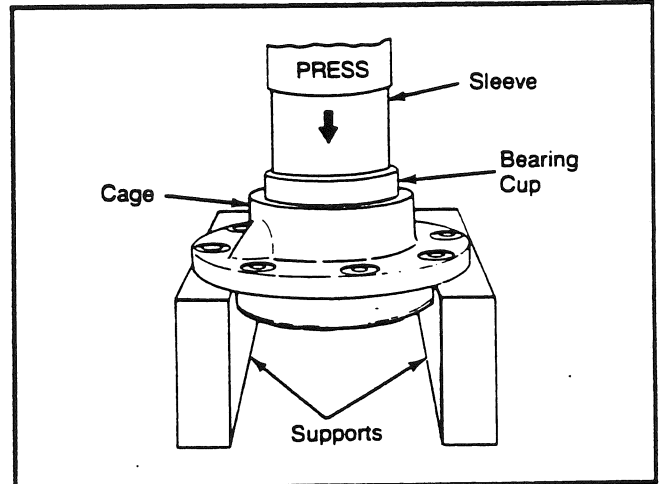


Fig. 29

2. Place the drive pinion in a press, gear head toward the bottom. Lubricate the inner bearing cone. Use a sleeve of the correct size to press the cone on the drive pinion shaft until the cone is flat against the gear head (see Fig. 30).

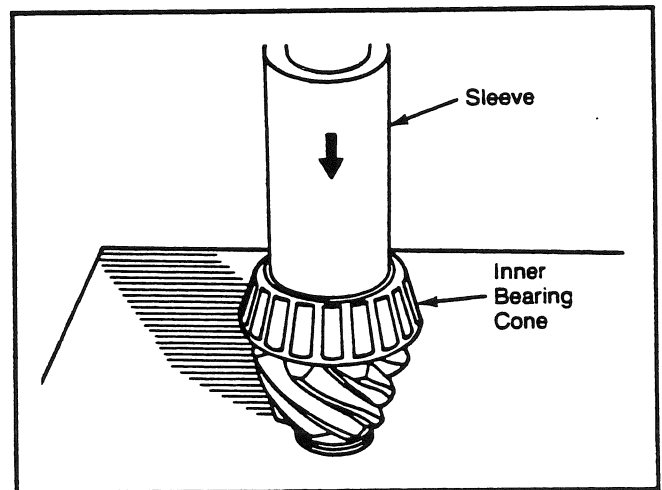


Fig. 30

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- Place the drive pinion in a press, gear head toward the top. Lubricate and install the spigot bearing.

NOTE: The spigot bearing design may differ according to your final drive carrier model.

- Press fit two-piece design.
- Retained to the drive pinion by staking.
- Retained to the drive pinion by a snap ring.

- Use a sleeve of the correct size and press the spigot bearing on the end of the drive pinion until the bearing is flat against the gear head (see Fig. 31). Install a new snap ring.

- For spigot bearings staked to the drive pinion, there should be a minimum of five staking points. Use a two-piece staking tool, consisting of a tube and punch (see Fig. 32). Calculate the staking pressure as follows:

6,614 lb (3000 kg) x number of balls in tool = pounds or kilograms.

Example: 6,614 lb x 3 balls = 19,842 pounds

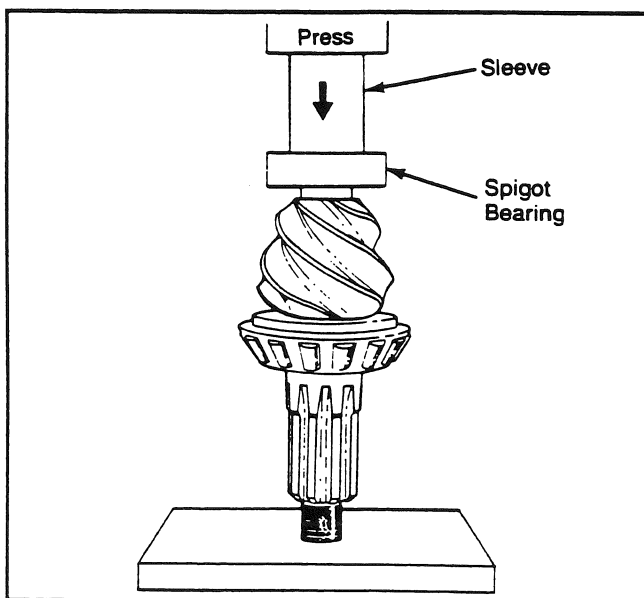


Fig. 31

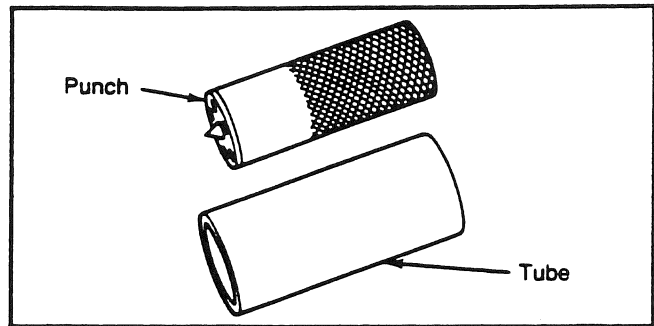


Fig. 32

- Place the drive pinion and the tube into a press. The spigot bearing should be toward the top. Place the punch over the end of the drive pinion and spigot bearing. Apply the staking pressure previously calculated (see Fig. 33).

NOTE: Do not align new staking points with the grooves in the end of the drive pinion or in old points. If the new staking points are put in the wrong areas, the spigot bearing will not be properly retained. If you use a three point punch, rotate the tool 180 degrees.

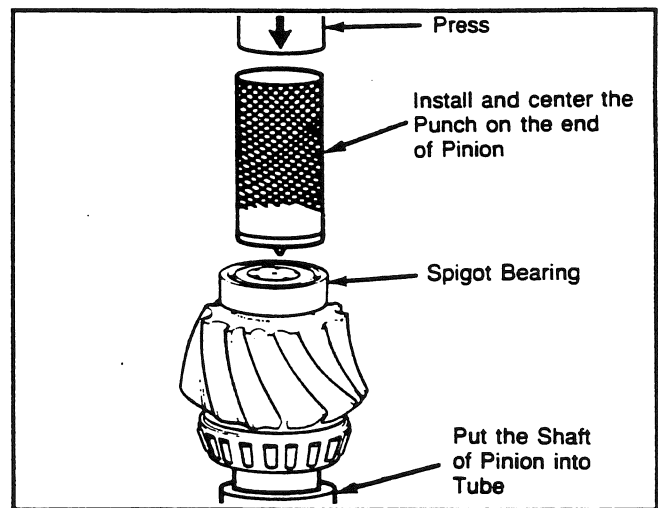


Fig. 33

- Use a press or soft mallet to install two-piece spigot bearings. Lubricate and install the inner race of the spigot bearing onto the nose of the drive pinion. Use a sleeve of the correct size and press the race until it seats squarely against the shoulder on the nose of the drive pinion.

8. Use a press or soft mallet and sleeve of the same size as the outer race to install the race into the carrier bore. Press the race until it seats squarely against the shoulder in the bottom of the bore (see Fig. 34).

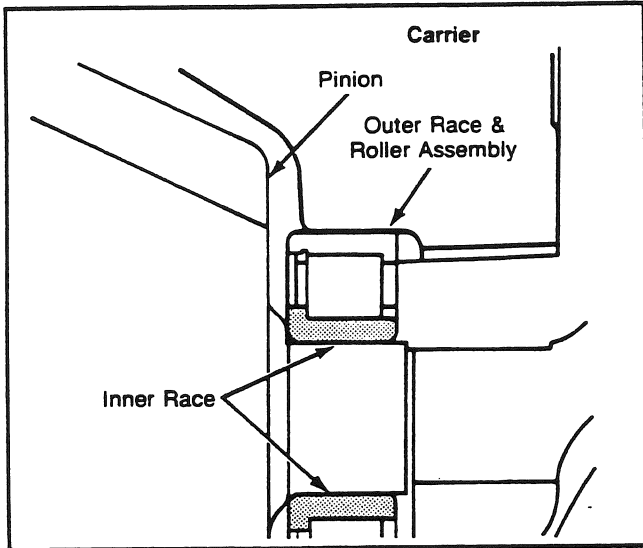


Fig. 34

9. Lubricate the drive pinion bearing cups and cones. Install the drive pinion into the bearing cage. Install the spacer on the pinion shaft against the inner bearing cone. Install the outer bearing cone on the pinion shaft against the spacer (see Fig. 35). Do not install the oil seal. Continue the procedure by adjusting the drive pinion bearing preload.

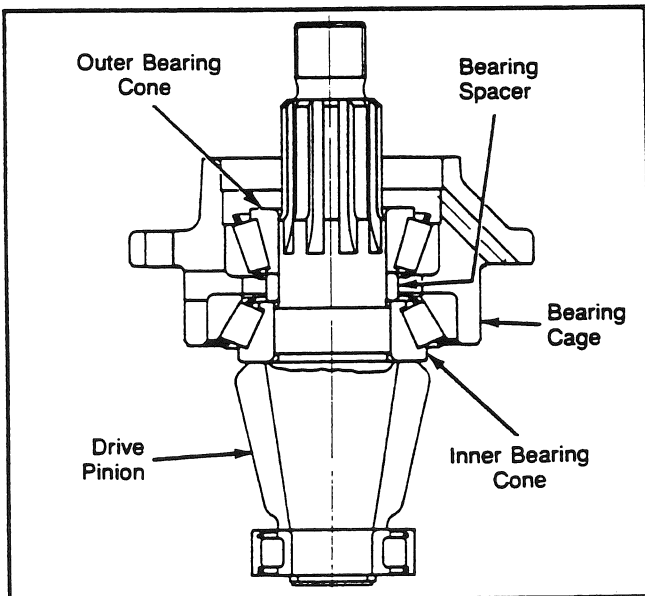


Fig. 35

Adjusting Drive Pinion Bearing Preload

Specifications:

New drive pinion bearings -
5 to 45 lbf-in. (0,06 to 0,52 kgf·m)

Used drive pinion bearings in good condition -
10 to 30 lbf-in. (0,11 to 0,35 kgf·m)

Press Method

NOTE: If a press is not available, or the press does not have a pressure gauge, use the yoke method to adjust the preload.

1. Place the drive pinion and cage assembly in a press, gear head (teeth) toward the bottom. Install a sleeve of the correct size against the outer bearing cone race (see Fig. 36). Apply and hold the following pressure: 50,000 lbs or 25 tons (22 680 kg or 2,7 metric tons). As you apply the pressure, turn the bearing cage several times to ensure normal bearing contact.

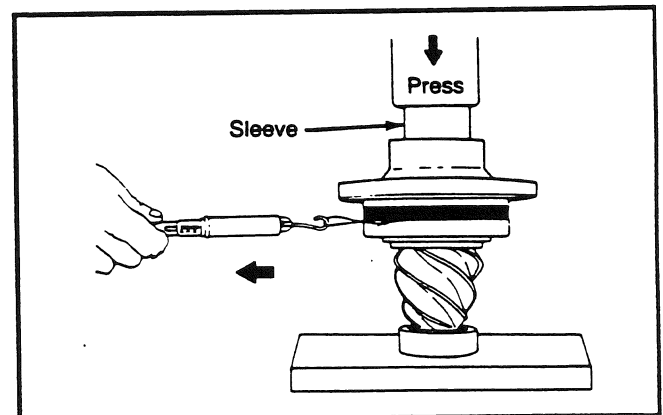


Fig. 36

2. While holding the pressure against the assembly, wind a cord around the bearing cage several times. Attach a spring scale to the end of the cord. Use the scale to pull the cord horizontally. As the bearing cage turns, read the value shown on the scale. Note the reading.

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NOTE: Do not read the starting torque. Read only the torque value after the cage starts to turn. Starting torque will give a false reading.

- See Fig. 37 and note the radius dimension of your model final drive bearing cage.

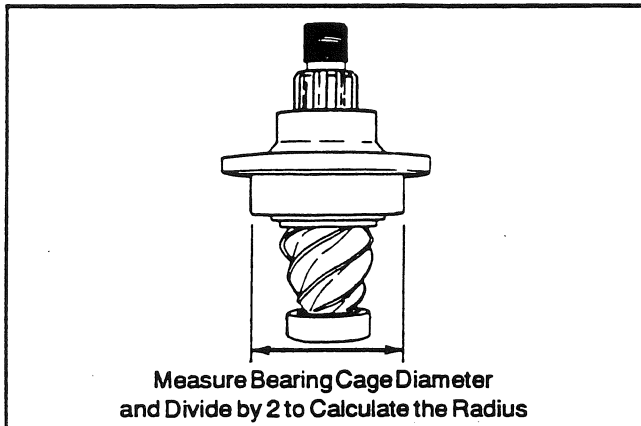


Fig. 37

- Use the following procedure to calculate the bearing preload (torque).

Pounds pulled x Radius (inches) = lbf-in. preload

OR

Kilograms pulled x Radius (centimeters) = kgf-cm preload

Examples:

Reading from spring scale = 7.5 pounds (3,4 kg)

Radius of bearing cage = 3.31 inches (8,4 cm)

7.5 pounds x 3.31 inches = 24.8 lbf-in. preload

OR

3,4 kg x 8,4 centimeters = 28,6 kgf-cm preload

- If the drive pinion bearing preload is not within specifications, complete this step then repeat steps 1 to 4. To increase preload, install a thinner bearing spacer. To decrease preload, install a thicker bearing spacer.

- Check the bearing preload with the drive pinion and bearing cage assembly installed in the carrier. Follow the yoke method procedure to adjust the drive pinion bearing preload.

Yoke Method

Specification:

Torque value needed on pinion nut for correct bearing preload -

900 - 1200 lbf-ft (1220 - 1627 N-m)

- Install the input yoke and nut on the drive pinion. The yoke must fit against the outer bearing cone. You are recommended to use the three-piece pilot tool P/N 58439 when installing the yoke. Refer to the end of this section for pilot tool details. The yoke and pinion splines are an interference fit and the pilot tool helps you correctly install the yoke. Do not use a hammer or mallet to install the yoke. Using a hammer or mallet can damage the yoke.

- Use the three-piece pilot tool as follows (see Fig. 38):

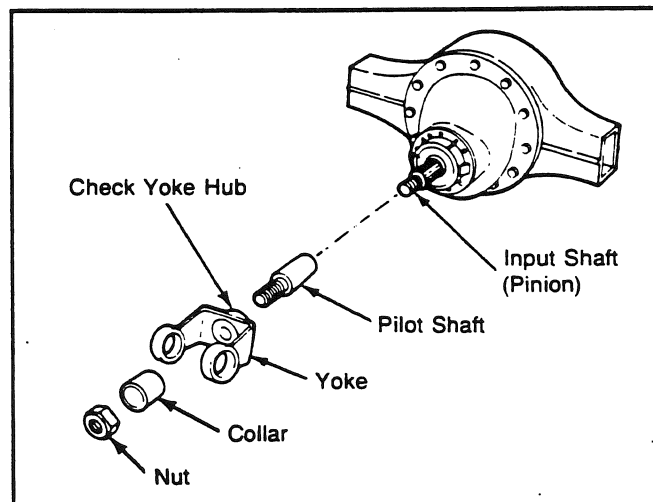


Fig. 38

- Check all surfaces of the yoke hub for damage. Remove damaged surfaces using an india stone, emery cloth or crocus cloth.
- Install the pilot shaft on the drive pinion splines.

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- c) Install the yoke over the pilot shaft. Align the yoke and drive pinion splines.
- d) Install the collar on the pilot shaft and slide it against the yoke.
- e) Install the nut on the pilot shaft and against the collar. Tighten the nut against the collar until the yoke is completely installed on the shaft. Sometimes a torque value of 200 lbf-ft (271 N·m; 28 kgf·m) is required to install the yoke.

NOTE: Use only the nut supplied with the three-piece pilot tool. Do not use the assembly nut.

- f) Remove the nut, collar and pilot shaft from the drive pinion shaft.
 - g) Install the assembly nut onto the drive pinion shaft.
3. Temporarily install the drive pinion and bearing cage assembly in the carrier. Do not install shims under the bearing cage. Install the retaining bolts and tighten hand tight. Washers are not required at this time.
 4. Fasten a yoke bar to the input yoke. The bar retains the drive pinion when you tighten the assembly nut. Tighten the nut to the specified torque (see Fig. 39). Remove the yoke bar.

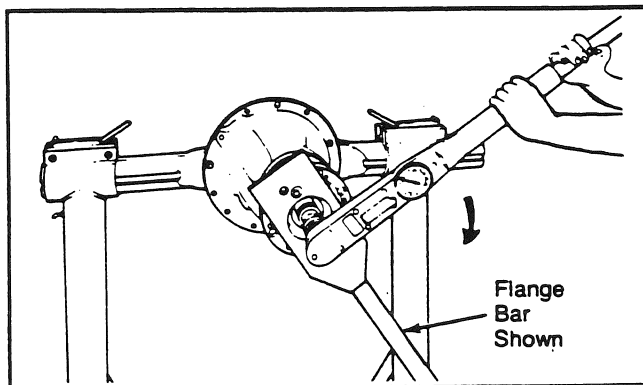


Fig. 39

5. Attach a dial indicator type torque wrench to the drive pinion nut. Turn the drive pinion and read the value shown on the dial (see Fig. 40). This value is the drive pinion bearing preload.

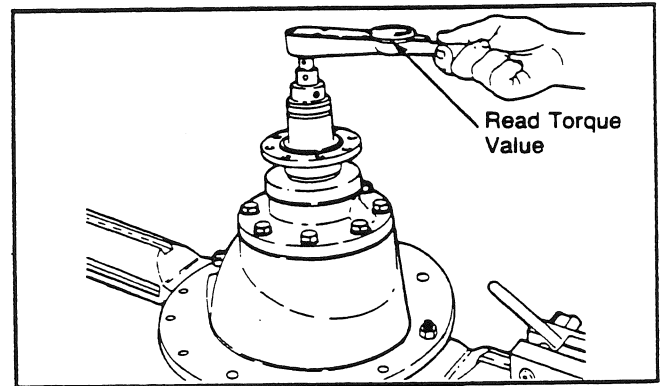


Fig. 40

6. If the drive pinion bearing preload is not within specifications, remove the drive pinion and bearing cage assembly. Complete this step, then repeat steps 1 to 5.
 - a) To increase preload, install a thinner bearing spacer.
 - b) To decrease preload, install a thicker bearing spacer.
7. After adjusting the pinion bearing preload, remove the drive pinion and bearing cage assembly.
8. Apply system oil to the outside diameter of the oil seal and the seal bore in the bearing cage. Install the seal. Make sure the seal lips are clean and free from particles that could cause a leak between the yoke and the seal. Apply wheel bearing grease to the seal lips (see Fig. 41).
9. Place the drive pinion and bearing cage assembly in a press; seal bore toward the top. Use a sleeve or seal driver of the correct size that fits against the metal flange of the seal. The diameter of the sleeve or seal driver must be larger than the diameter of the flange. Install the seal until the flange is flat against the top of the bearing cage (see Fig. 42).

If a press is not available, use a mallet and the sleeve or seal driver (see Fig. 43).

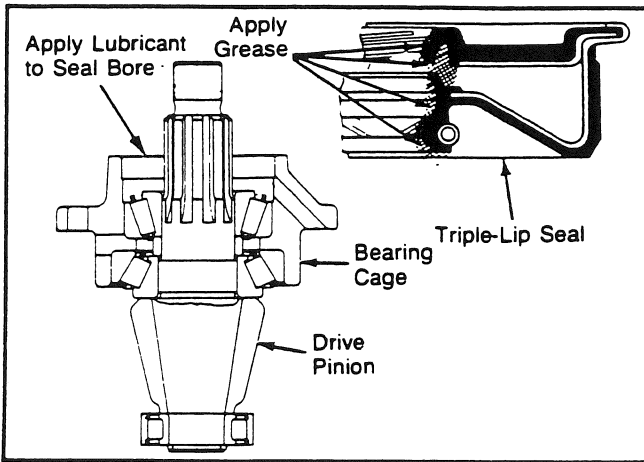


Fig. 41

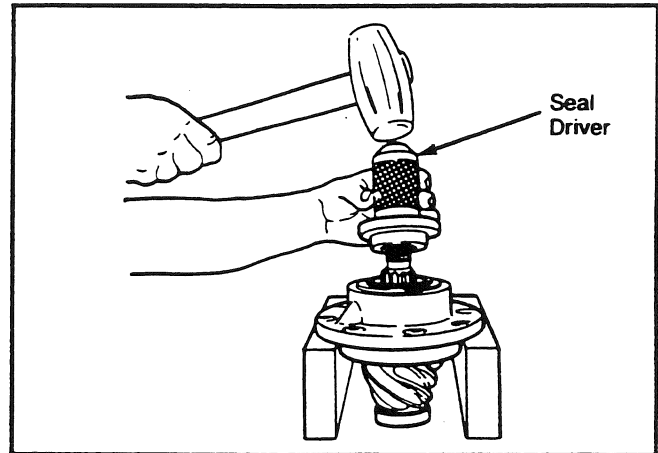


Fig. 43

10. After installing the seal, a gap of approximately 0.015 to 0.030 inch (0,38 to 0,76 mm) between the flange and bearing cage is normal (see Fig. 44). Check the gap with a feeler gauge at several points around the seal. The gap must be within 0.015 to 0.030 inch (0,38 to 0,76 mm). The difference between the largest and smallest gap measurement must not exceed 0.010 inch (0,25 mm).

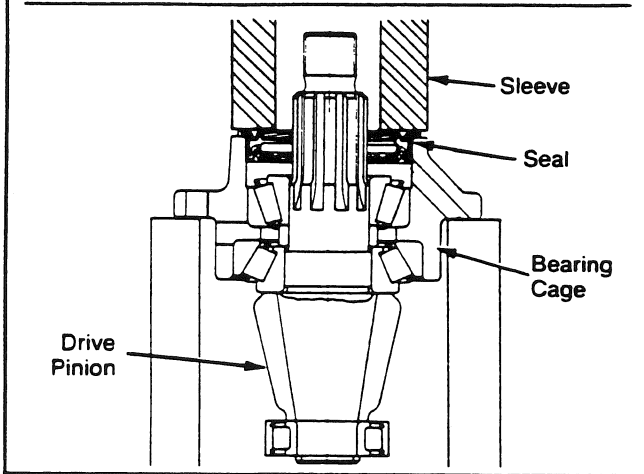
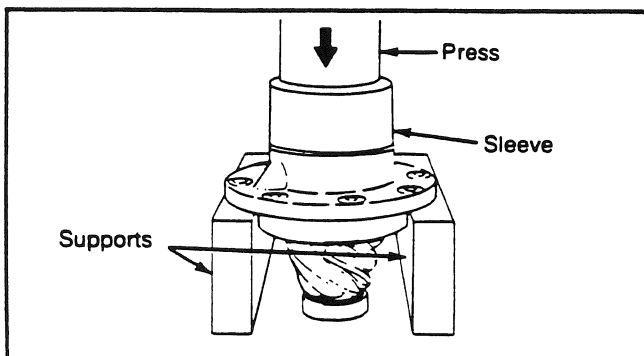


Fig. 42

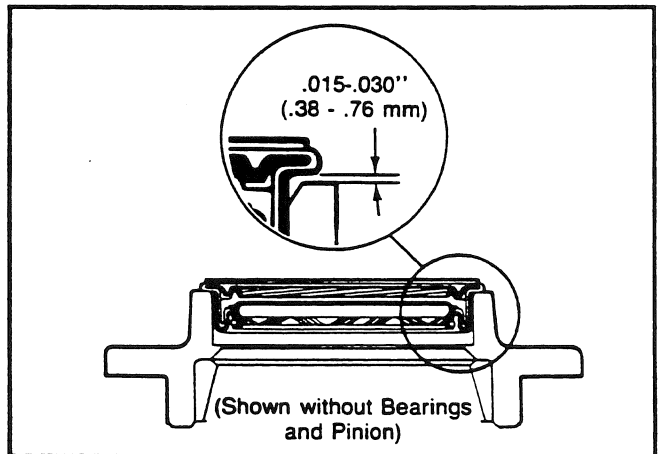
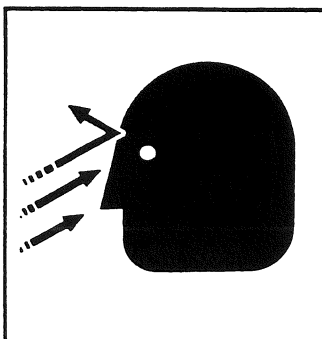


Fig. 44



⚠ WARNING

Do not hit steel parts with a steel hammer. Danger of breaking parts. Flying pieces can cause injury.

Adjusting Pinion Cage Bearing Shim Pack Thickness (Pinion Depth)

NOTE: Use this procedure when installing a new ring gear and drive pinion gear set, or adjusting the drive pinion depth (see Fig. 45).

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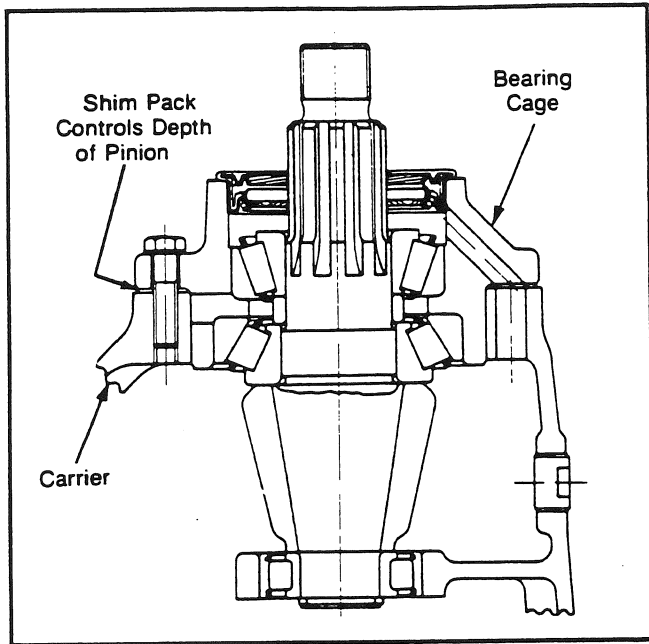


Fig. 45

1. Use a micrometer and measure the thickness of the shim pack that was removed from under the pinion bearing cage. Record the measurement for later use (see Fig. 46).

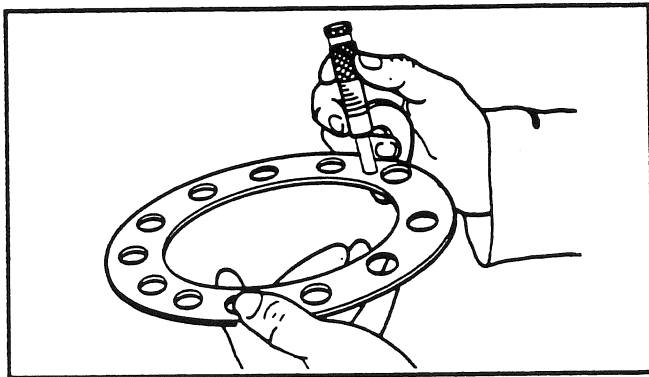


Fig. 46

2. Look at the pinion cone ("PC") variation number on the drive pinion that is being replaced. The location is on the end of the pinion gear head. Record the number for later use (see Fig. 47).

NOTE: Do not use the pinion cone variation number when checking for a matched gear set. Use the number only when adjusting the pinion depth.

NOTE: The pinion cone variation number can be either 1,000ths of an inch or 100ths of a millimeter. See the following examples.

PC+3, PC-3, +3 or -3 represent 0.003 inch

PC+.03, PC-.03 mm, +.03 mm or -.03 mm represent 0.03mm

To change inches to millimeters, multiply inches by 25.40

To change millimeters to inches, multiply millimeters by 0.039

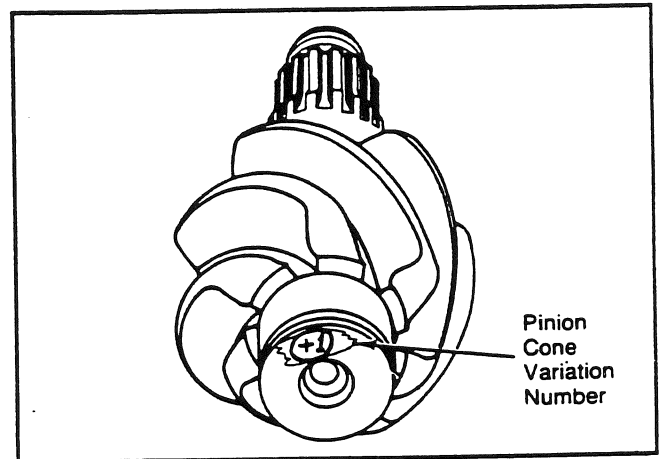


Fig. 47

3. If the old pinion cone variation number is a plus (+), subtract the number from the shim pack thickness measured in step 1. If the old pinion cone variation number is a minus (-), add the number to the shim pack thickness measured in step 1. The value calculated is the thickness of the standard shim pack, without a variation.
4. Look at the pinion cone ("PC") variation number on the new drive pinion to be installed. Record the number for later use.
5. If the new pinion cone variation number is a plus (+), add the number to the standard shim pack thickness calculated in step 3. If the new pinion cone variation number is a minus (-), subtract the number from the standard shim pack thickness calculated in step 3. The value calculated is the thickness of the new shim pack to be installed. See the examples in the following chart.

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Examples:	Inches	mm
1. Old shim pack thickness	0.030	0,76
Old PC number, PC+2	- <u>0.002</u>	- <u>0.05</u>
Standard shim pack thickness	0.028	0,71
New PC number, PC+5	+ <u>0.005</u>	+ <u>0.13</u>
New shim pack thickness	0.033	0,84
2. Old shim pack thickness	0.030	0,76
Old PC number, PC-2	+ <u>0.002</u>	+ <u>0.05</u>
Standard shim pack thickness	0.032	0,81
New PC number, PC-5	+ <u>0.005</u>	+ <u>0.13</u>
New shim pack thickness	0.037	0,94
3. Old shim pack thickness	0.030	0,76
Old PC number, PC+2	- <u>0.002</u>	- <u>0.05</u>
Standard shim pack thickness	0.028	0,71
New PC number, PC-5	- <u>0.005</u>	- <u>0.13</u>
New shim pack thickness	0.023	0,58
4. Old shim pack thickness	0.030	0,76
Old PC number, PC-2	+ <u>0.002</u>	+ <u>0.05</u>
Standard shim pack thickness	0.032	0,81
New PC number, PC-5	- <u>0.005</u>	- <u>0.13</u>
New shim pack thickness	0.027	0,68

Remember: ring gears and drive pinions must be replaced as matched sets.

6. Install the drive pinion, bearing cage and new shim pack into the carrier.

Installing Drive Pinion and Bearing Assembly into Carrier

1. If you are installing a new ring gear and drive pinion or adjusting the drive pinion depth, calculate the shim pack thickness. Refer to the procedure in **Adjusting Pinion Bearing Cage Shim Pack Thickness (Pinion Depth)**.
2. Install the shim pack between the bearing cage and carrier. Align the oil slots in the shims with the oil slots in the bearing cage and carrier. Use guide studs to help align the shims (see Fig. 48). Use a

minimum of three shims in a pack. If the pack is made from different thickness shims, install the thinnest shims on both sides of the pack. This ensures maximum sealing.

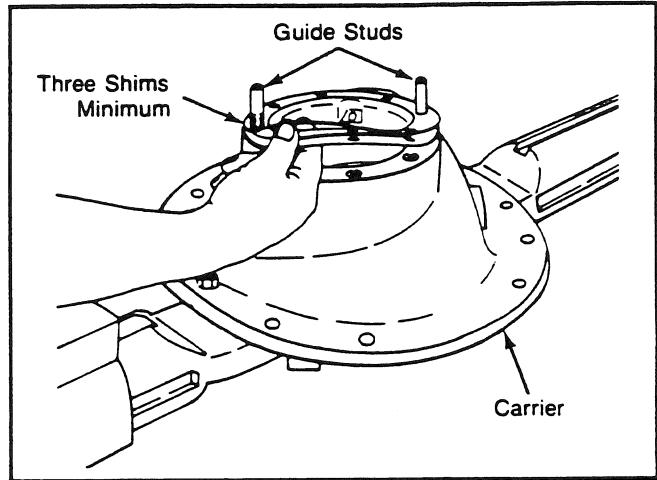


Fig. 48

3. Install the drive pinion and bearing cage assembly into the carrier (see Fig. 49). If necessary, use a rubber, plastic or leather mallet to hit the assembly into position.

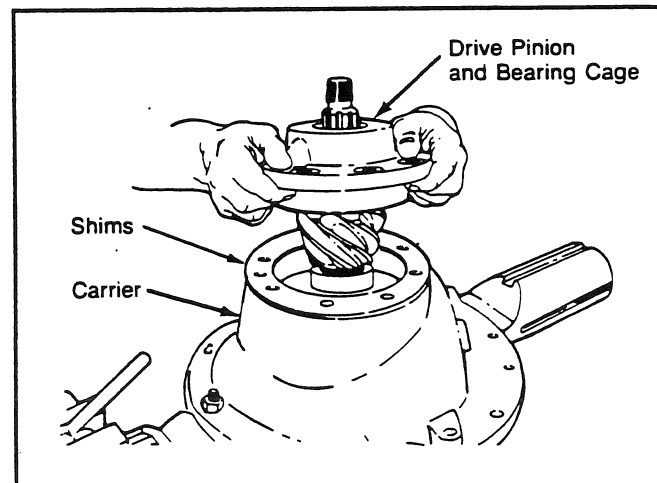
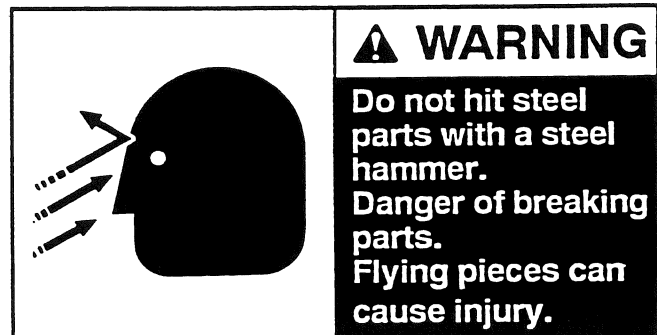


Fig. 49

4. Install the bearing cage retaining bolts and lock-washers. Tighten the bolts to the specified torque (see Fig. 50). Install the input yoke and nut on the drive pinion. The yoke must fit against the outer bearing cone. You are recommended to use the three-piece pilot tool P/N 58439 when installing the yoke. The yoke and pinion splines are an interference fit and the pilot tool helps you correctly install the yoke. Refer to the procedure in **Adjusting Drive Pinion Bearing Preload - Yoke Method**.

NOTE: Do not use a hammer or mallet to install the yoke. Using a hammer or mallet can damage the yoke.

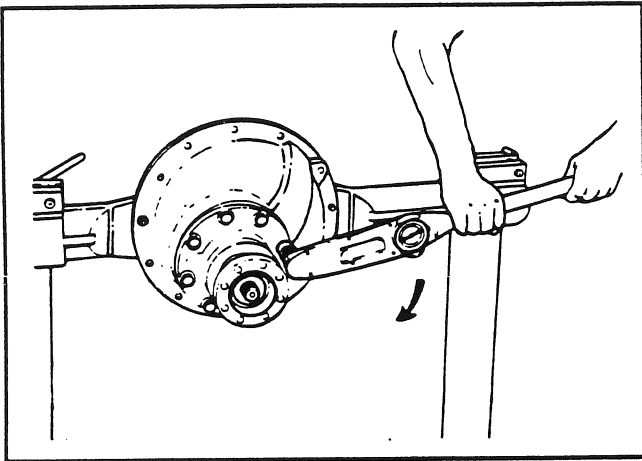


Fig. 50

5. Fasten a yoke bar to the input yoke. The bar retains the drive pinion when you tighten the assembly nut. Tighten the nut to the specified torque (see Fig. 51). Remove the yoke bar.

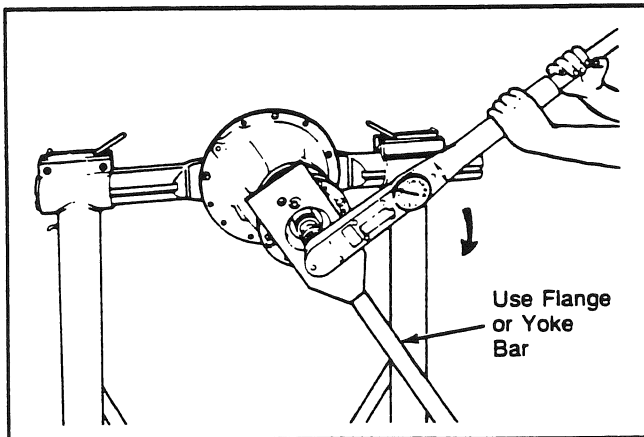


Fig. 51

Assembly - Differential and Ring Gear Assembly



1. Heat the ring gear in a tank of water to a temperature of 160°F - 180°F (71°C - 82°C) for 10 to 15 minutes.

NOTE: Do not press a cold ring gear on the flange case half. Damage to the flange case half can occur. Metal particles between the parts could cause the gear runout to exceed the design specification of 0.008 inch (0,2 mm).

2. Use a safe lifting device and remove the ring gear from the tank of hot water. Install the ring gear on the flange case half immediately after the gear is heated. If the ring gear does not fit easily on the flange case half, reheat the gear.

3. Align the bolt holes of the ring gear and flange case half. Install the bolts and nuts retaining the ring gear to the flange case half. Install the bolts from the gear side of the assembly. The bolt heads must be against the ring gear (see Fig. 52). Tighten the nuts to the specified torque.

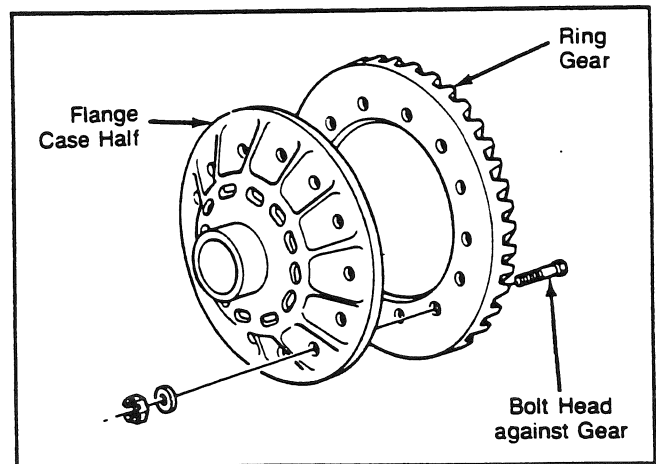


Fig. 52

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4. Install the bearing cones on both of the case halves. Use a press and sleeve of the correct size (see Fig. 53).

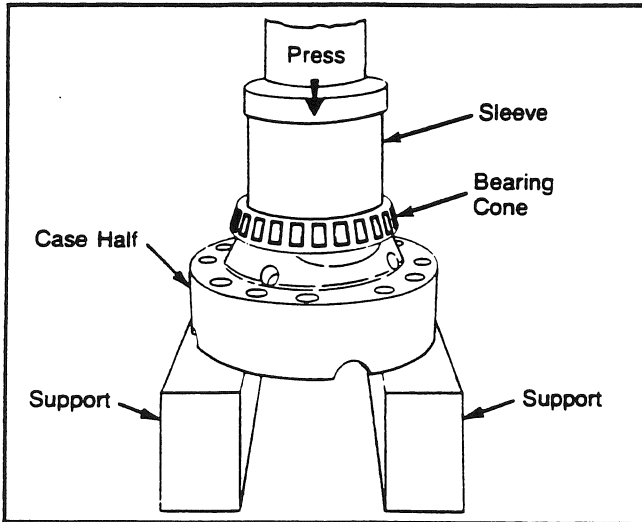


Fig. 53

5. Apply system oil on the inside surfaces of both case halves, spider, thrust washers, side gears and differential pinions.

6. Place the flange case half on a clean workbench, ring gear teeth toward the top. Install one thrust washer and side gear into the flange case half (see Fig. 54).

NOTE: The side gears have different length hubs. Install the correct length side gear into the flange case half.

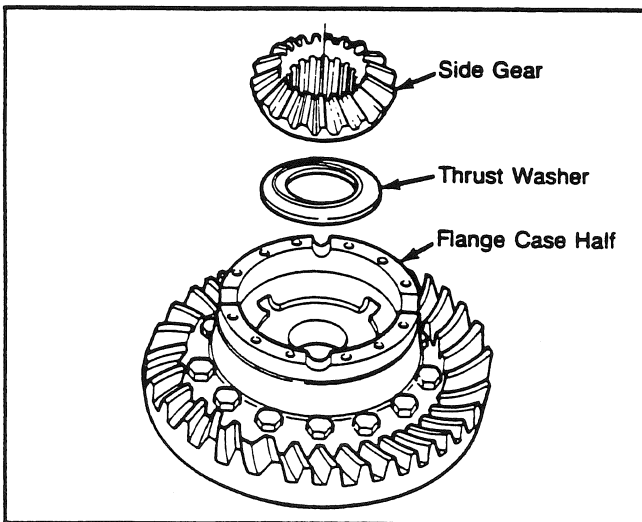


Fig. 54

7. Install the spider, differential pinions and thrust washers into the flange case half (see Fig. 55). Install the second side gear and thrust washer over the spider and differential pinions (see Fig. 56).

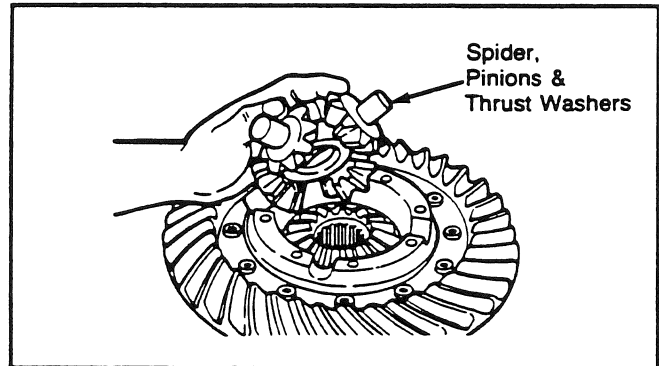


Fig. 55

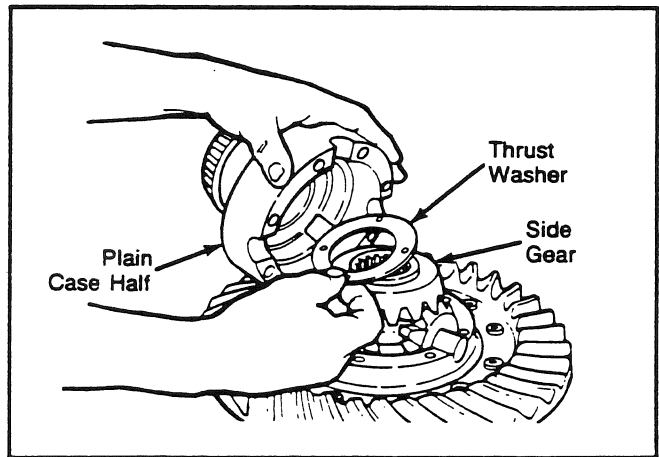


Fig. 56

8. Install the plain half of the differential case over the flange case half and gears. Align the match marks of the two case halves (see Fig. 57).

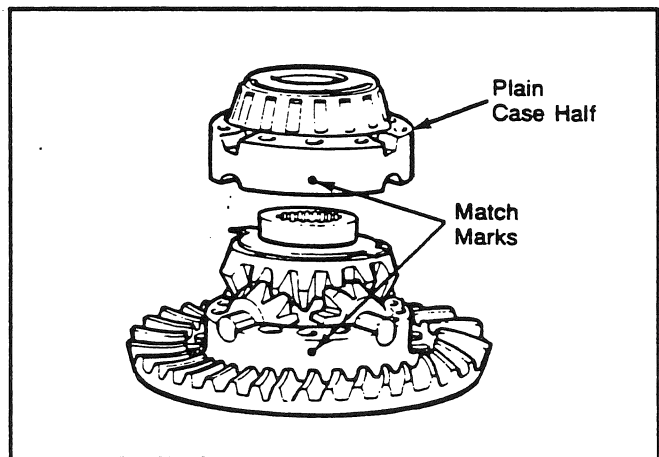


Fig. 57

9. Install four bolts into the case halves. The distance between the bolts must be equal. Tighten the bolts to the specified torque in a diagonal pattern (see Fig. 58). Install the remaining bolts. Tighten the bolts to the specified torque.

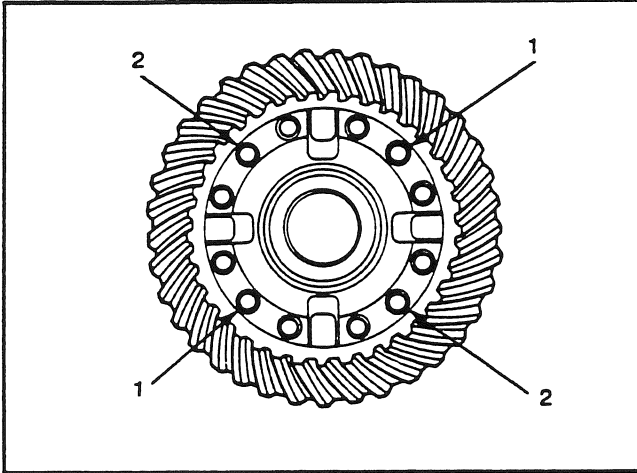


Fig. 58

Checking Differential Side Gear Rotating Resistance

Check the rotating resistance of the differential side gears as follows:

Specification:

50 lbf.ft (67,8 N.m; 6,9 kgf.m) torque (maximum) applied to one side gear.

1. Make a tool for checking the differential side gear rotating resistance. You can make the tool from an axle shaft with splines that match the splines of the differential side gears (see Fig. 59).

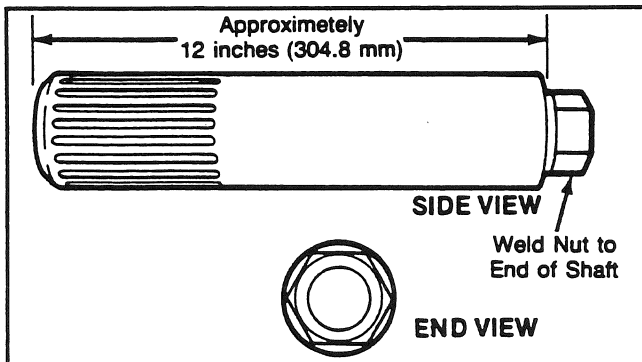


Fig. 59

2. Install the differential and ring gear assembly in a vise with soft jaws. Install the tool into the differential until the splines of the tool and one side gear engage (see Fig. 60).

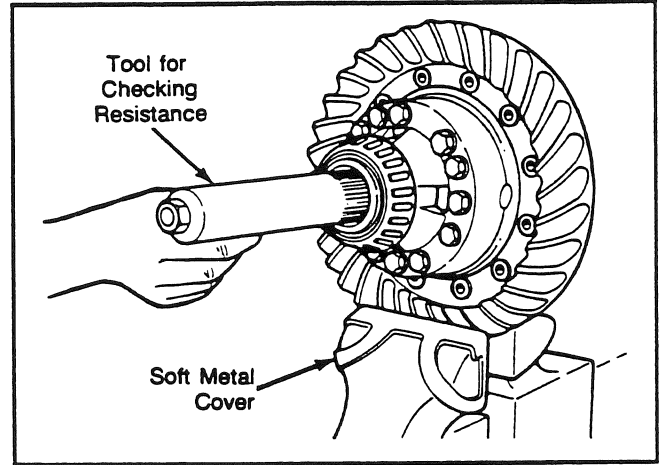


Fig. 60

3. Attach a dial indicator type torque wrench to the nut of the tool and turn the differential gears. As the differential gears turn, read the value indicated on the torque wrench (see Fig. 61). If the torque value exceeds the specification, disassemble the differential case halves.

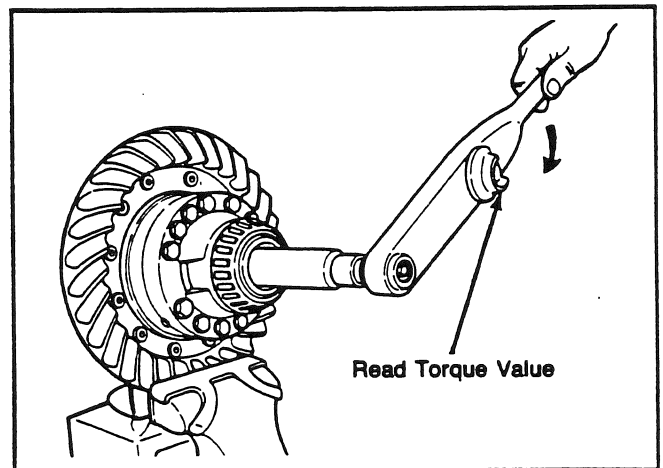


Fig. 61

4. Check the case halves, spider, gears and thrust washers for the problem that causes the torque value to exceed the specification. Repair or replace defective parts; then repeat steps 1 to 4.

Installing Differential and Ring Gear Assembly into Carrier

1. Clean and dry the bearing cups and bores of the carrier legs and bearing caps. Apply system oil on the inner diameter of the bearing cups and on both case half bearing cones. Ensure there is no oil on the outer diameter of the bearing cups or in the bearing bores.
2. Apply a continuous bead of adhesive ('Loctite' RC 635, or equivalent) to the bearing bores in the carrier and bearing caps. Apply the adhesive 360° around the smooth, ground surfaces only. Do not apply adhesive onto the threads (see Fig. 62).

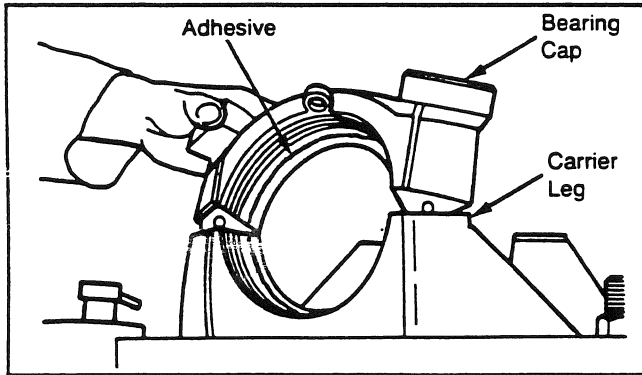


Fig. 62

3. The adhesive becomes hard (dry) in approximately two hours. Perform the differential assembly, bearing preload, backlash and tooth contact pattern procedures within two hours of applying the adhesive. If two hours have passed since the application, clean the parts and apply new adhesive.
4. Install the bearing cups over the case half bearing cones. Use a safe lifting device to install the differential and ring gear assembly into the carrier (see Fig. 63). The bearing caps must sit squarely in the bores between the carrier legs.
5. Install both adjusting rings between the carrier legs. Turn each adjusting ring hand tight against the bearing cup. Install the bearing caps over the

bearings and adjusting rings in the correct position as marked before removal (see Fig. 64).

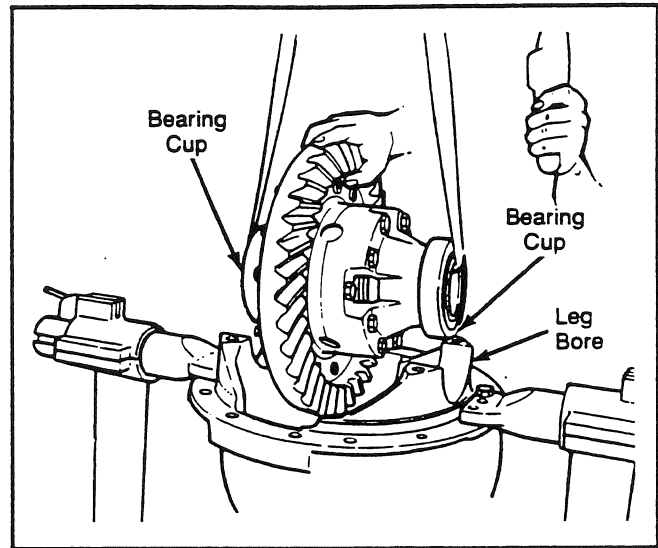


Fig. 63

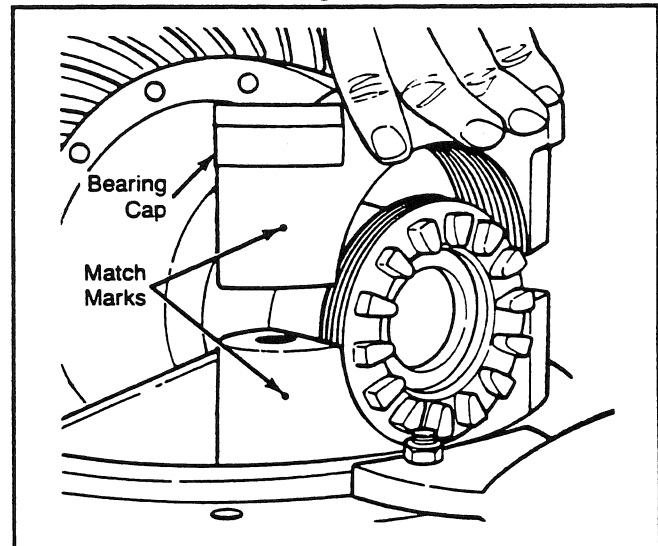


Fig. 64

	WARNING
	<p>Do not hit steel parts with a steel hammer. Danger of breaking parts. Flying pieces can cause injury.</p>

6. Hit each bearing cap into position with a light leather, plastic or rubber mallet. The caps must fit easily against the bearings, adjusting rings and carrier. Do not force the bearing caps into position.

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NOTE: If the bearing caps are not installed correctly, the bores and threads of the caps and carrier will not match. You will have problems installing the caps on the carrier and damage to parts can occur.

7. If the bearing caps do not fit correctly, check the alignment of the match marks on the caps and carrier. Install the bolts and washers retaining the bearing caps to the carrier. Tighten the bolts by hand four to six turns; then tighten the bolts to the specified torque.

8. Do not install the cotter pin and lock plate securing the adjusting rings. Continue the procedure by adjusting the differential bearing preload, ring gear backlash adjustment and tooth contact pattern check.

Adjusting Differential Bearing Preload

Specifications:

Differential bearing preload - 15 to 35 lbf.in. (1,7 to 3,9 N.m; 0,17 to 0,40 kgf.m)

or

Expansion between bearing caps - 0.006 to 0.013 inch (0,15 to 0,33 mm)

Method 1

1. Install a dial indicator on the carrier mounting flange. Adjust the dial indicator plunger against the back surface of the ring gear (see Fig. 65).

NOTE: When turning the adjusting rings, always use a tool that engages two or more opposite notches. A "T" bar wrench is useful for this purpose. The lugs can be damaged if the tool does not correctly fit into the notches (see Fig. 66).

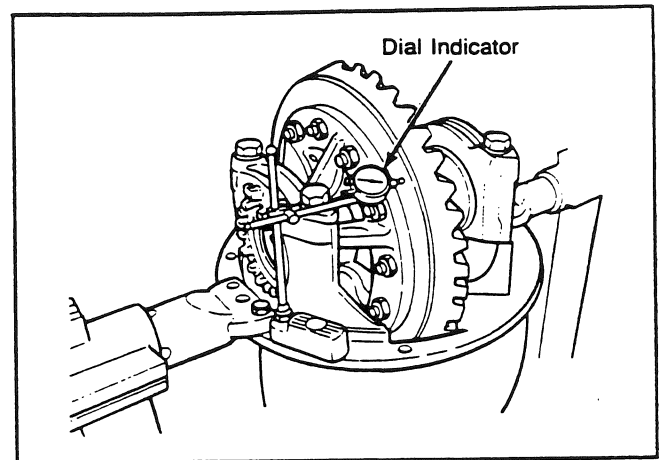


Fig. 65

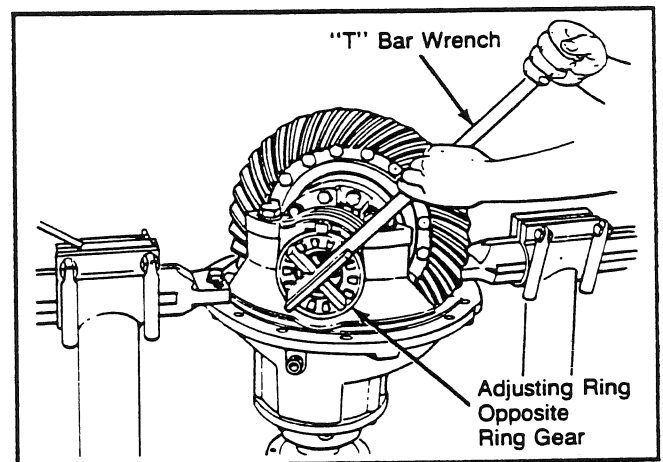


Fig. 66

2. Loosen the adjusting ring opposite the ring gear. Allow a small amount of end play to show on the dial indicator. Move the differential and ring gear assembly to the left and right with pry bars while reading the dial indicator. Use either of the following steps.
 - a) Use two pry bars installed between the adjusting rings and ends of the differential case. The pry bars **must not** touch the differential bearings (see Fig. 67).
 - b) Use two pry bars installed between the differential case or ring gear and the carrier at places other than described in step a). The pry bars **must not** touch the differential bearings (see Fig. 68).

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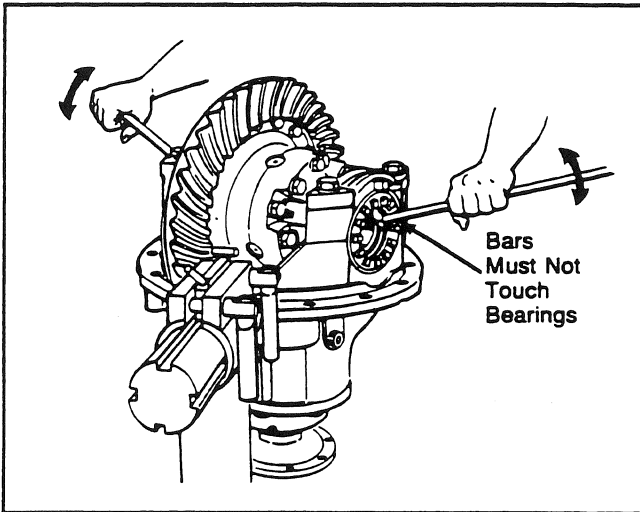


Fig. 67

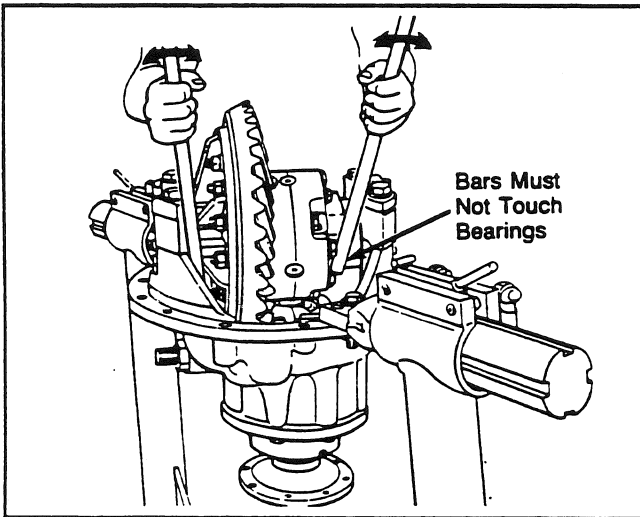


Fig. 68

3. Tighten the same adjusting ring so that no end play (zero end play) shows on the dial indicator. Move the differential and ring gear to the left and right as needed. Repeat step 2 a) or 2 b). Tighten each adjusting ring one notch from the zero end play. Continue the procedure by checking the ring gear runout.

Method 2

1. An alternative method of checking differential bearing preload is to measure the expansion between the bearing caps after you tighten the adjusting rings. Use the following procedure.

- a) Turn both adjusting rings hand tight against the differential bearings.
- b) Measure the distance X or Y between opposite surfaces of the bearing caps. Use a large micrometer of the correct size (see Figs. 69 and 70). Note the measurement.

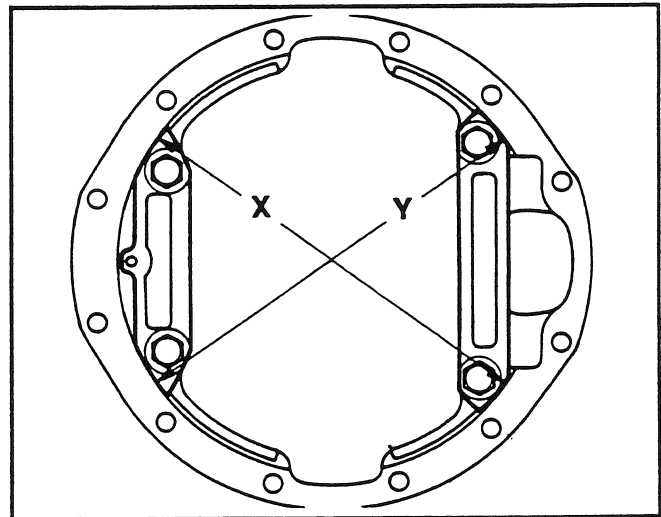


Fig. 69

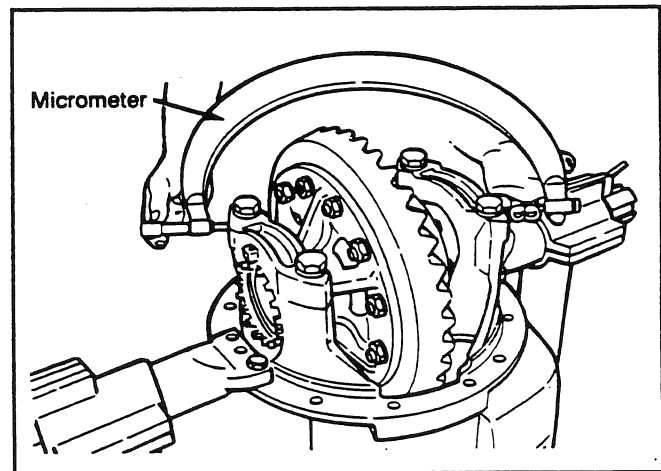


Fig. 70

- c) Tighten each adjusting ring one notch.
- d) Measure the distance X or Y again. Compare this dimension with the measurement noted in step 1 b). The difference between the two dimensions is the amount the bearing caps have expanded.

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Example:

Distance X or Y before tightening adjusting rings
= 15.315 inches (389,00 mm)

Distance X or Y after tightening adjusting rings
= 15.324 inches (389,23 mm)

15.324 inches minus 15.315 inches = 0.009 inch (0,23 mm) difference.

2. If the dimension is within specifications, continue the procedure by checking the ring gear runout. If the dimension is less than the specifications, repeat steps 1 c) and 1 d).

Checking Ring Gear Runout

Specification:

0.008 inch (0,20 mm)

1. Install a dial indicator on the carrier mounting flange. Adjust the dial indicator plunger to touch the back surface of the ring gear (see Fig. 71). Adjust the indicator needle to zero (0).

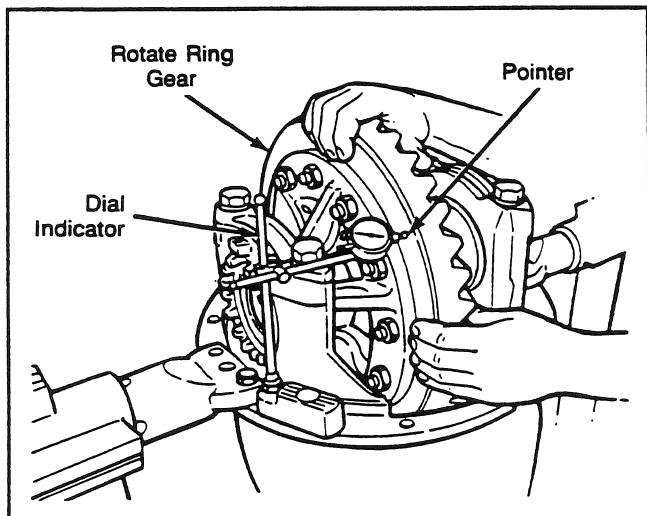


Fig. 71

2. Turn the differential and ring gear assembly while reading the dial indicator. The ring gear runout **must not exceed** 0.008 inch (0,20 mm).

3. If the ring gear runout exceeds specifications, remove the differential and ring gear assembly from the carrier. See **Removing Differential and Ring Gear Assembly from Carrier** in this section and the following steps.

- a) Check the differential parts, including the carrier, for the problem that causes the gear runout to exceed specifications. Repair or replace parts.
- b) After repairing or replacing parts, install the differential and ring gear assembly in the carrier. See **Installing Differential and Ring Gear Assembly into Carrier** in this section.

4. Repeat the differential bearing preload adjustment.

Checking Ring Gear Backlash

Specifications:

Ring gears with a pitch diameter of less than 17 inches (431,8 mm)

Range of backlash setting - 0.008 to 0.018 inch (0,20 - 0,46 mm)

Backlash setting for new gear sets - 0.012 inch (0,30 mm)

Ring gears with a pitch diameter of 17 inches (431,8 mm) or greater than 17 inches

Range of backlash setting - 0.010 - 0.020 inch (0,25 - 0,51 mm)

Backlash setting for new gear sets - 0.015 inch (0,38 mm)

NOTE: Measure the ring gear outside diameter for the approximate pitch diameter (see Fig. 72).

1. If you are installing the old gear set, adjust the backlash to the setting that was measured before the carrier was disassembled. If you are installing a new gear set, adjust the backlash to the correct specification for new gear sets.

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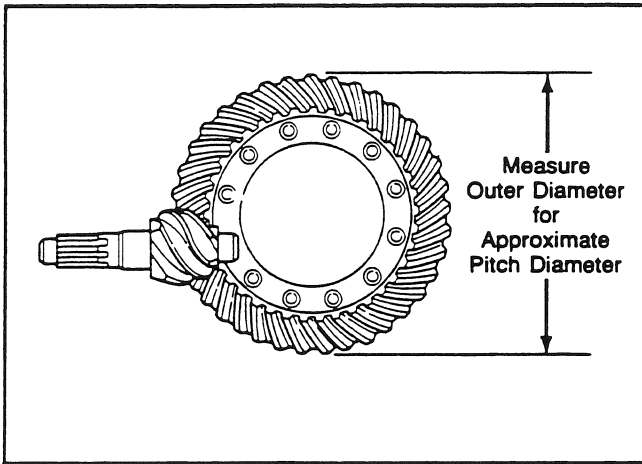


Fig. 72

2. When checking the tooth contact patterns, you can adjust the backlash within the specification limits to change the location of the pattern.

3. Install a dial indicator on the carrier mounting flange. Adjust the dial indicator plunger to touch the tooth surface of the ring gear (see Fig. 73). Adjust the indicator needle to zero (0). Hold the drive pinion in position.

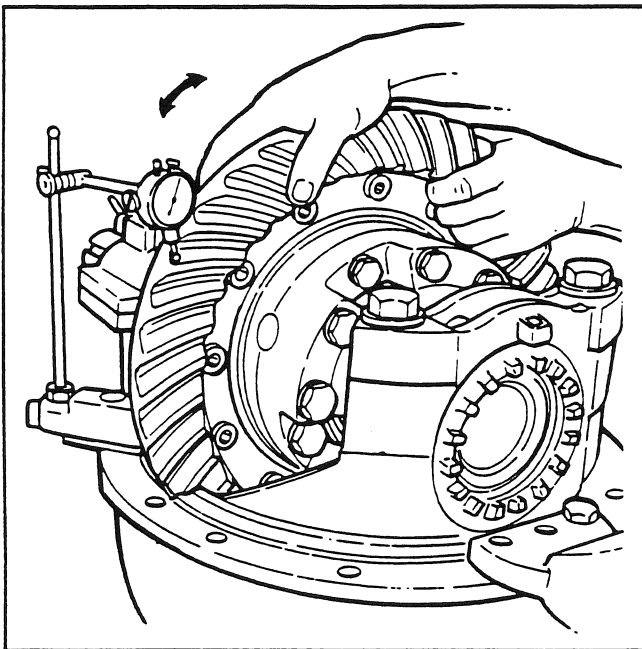


Fig. 73

4. Turn the differential and ring gear assembly a small amount in both directions against the drive pinion teeth and read the dial indicator. If the backlash

reading is within specification, continue the procedure by checking tooth contact patterns. If the backlash reading is not within specification, adjust backlash as follows.

- a) Increase backlash by moving the ring gear away from the drive pinion (see Fig. 74).
- b) Decrease backlash by moving the ring gear toward the drive pinion (see Fig. 75).

5. Loosen one adjusting ring by one notch. Tighten the opposite ring by the same amount (see Figs. 74 and 75). When adjusting backlash, move the ring gear only. Do not move the drive pinion. Repeat steps 3 to 5 until the backlash is within specifications.

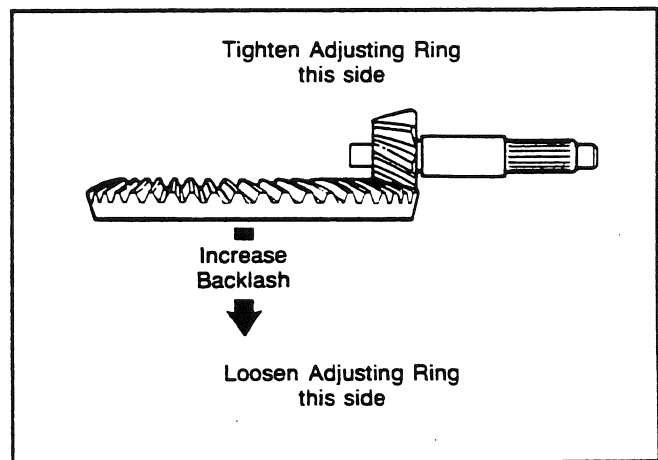


Fig. 74

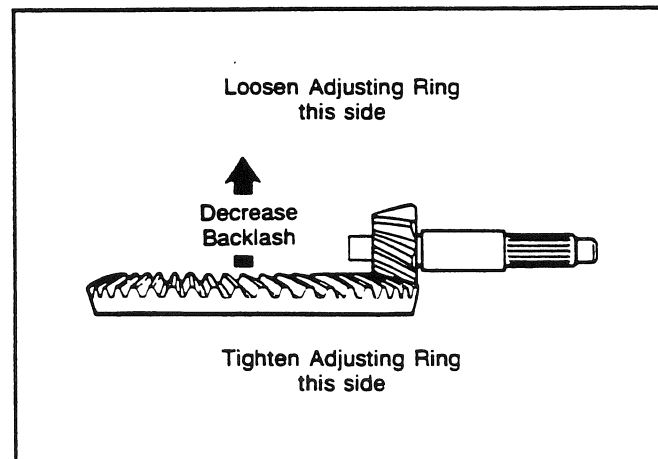


Fig. 75

Checking Tooth Contact Patterns

Look at the gear set part numbers (See Fig. 76). Examples of part numbers are:

36786-K for the ring gear

36787-K for the drive pinion

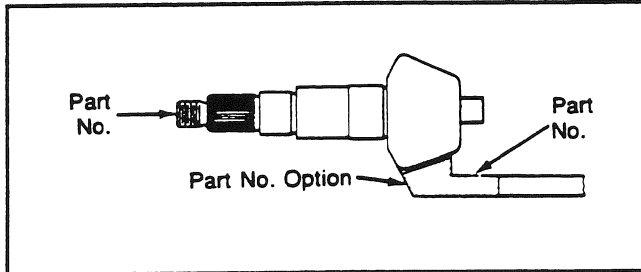


Fig. 76

1. In the following procedure, the contact pattern movement in the length of the tooth is shown as toward the "heel" or "toe" of the ring gear (see Fig. 77). Always check tooth contact patterns on the drive side of the gear teeth (see Fig. 78).

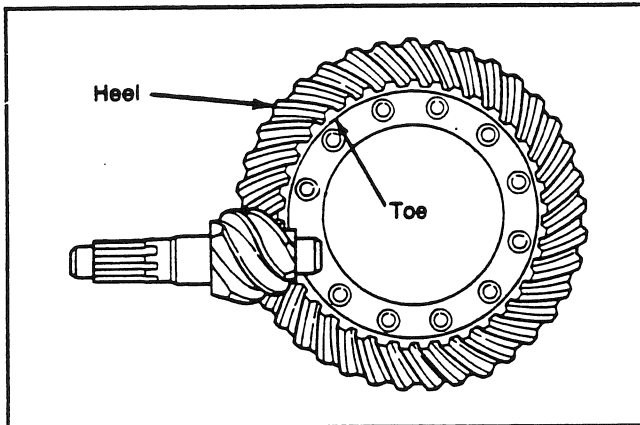


Fig. 77

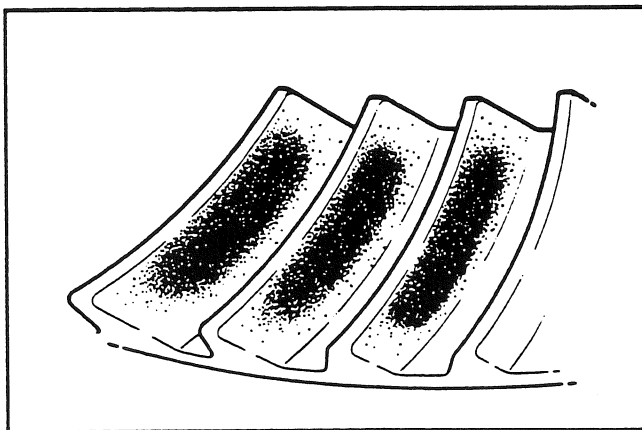


Fig. 78

2. Adjust the backlash of a new gear set to either 0.012 inch (0,30 mm) or 0.015 inch (0,38 mm). Adjust the backlash of an old gear set to the figure that was measured before the carrier was disassembled.

3. Apply marking compound to twelve teeth of the ring gear (see Fig. 79). Turn the ring gear so that the twelve teeth are next to the drive pinion. Move the ring gear forward and backward past the drive pinion six times to make the contact patterns on the twelve teeth. Repeat if needed for a clearer pattern.

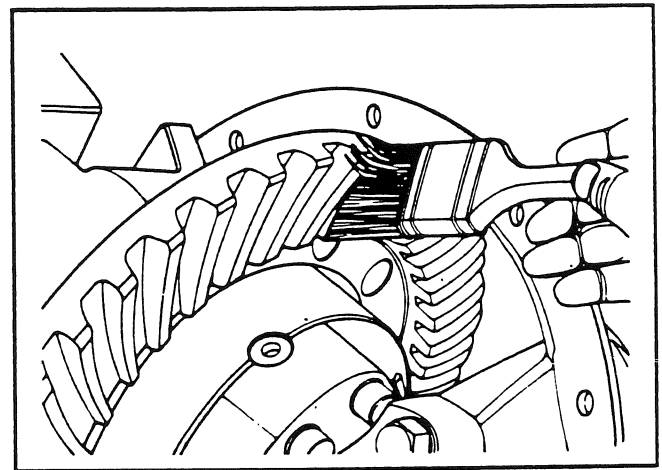


Fig. 79

4. Look at the contact patterns on the ring gear teeth. Compare the patterns to Figs. 80, 81 and 82.
5. For a new gear set, the location of a good hand rolled contact pattern is between the center and toe of the tooth, and in the center between the top and bottom of the tooth (see Fig. 80).
6. During operation, a good pattern extends approximately the full length of the gear tooth. The top of the pattern is near the top of the gear tooth (see Fig. 83).
7. The location of a good, hand rolled *contact pattern* for an old gear set must match the *wear pattern* in the ring gear. The contact pattern is smaller in area than the wear pattern.

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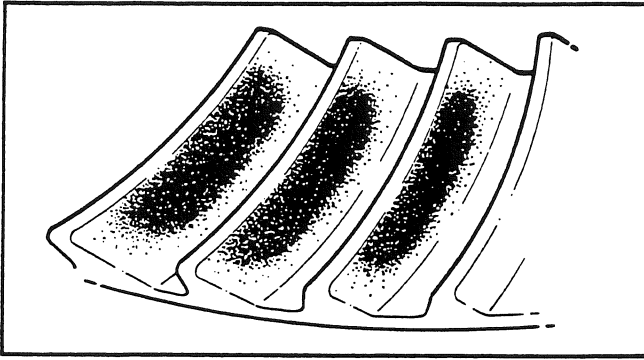


Fig. 80



Fig. 81

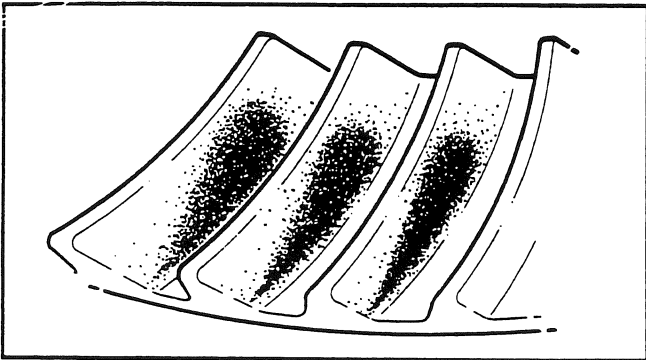


Fig. 82

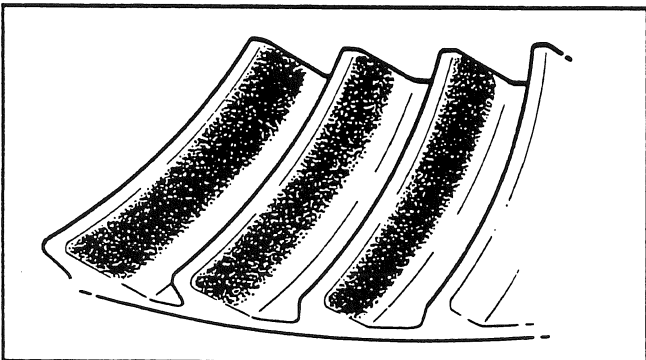


Fig. 83

8. If the contact patterns need adjusting, continue with step 9 and move the contact patterns between the top and bottom of the gear teeth. If the contact patterns are in the center of the gear teeth, continue with step 10.

9. Change the shim pack thickness under the bearing cage to move the contact patterns between the top and bottom of the gear teeth. A high contact pattern shows that the drive pinion is not installed deep enough into the carrier. A low contact pattern shows that the drive pinion is installed too deep in the carrier.

a) Remove the drive pinion and bearing cage from the carrier. See **Disassembly - Drive Pinion and Bearing Cage Assembly** in this section.

b) To correct a high contact pattern (see Fig. 81), decrease the shim pack thickness under the bearing cage. When you decrease the shim pack thickness, the drive pinion moves toward the ring gear (see Fig. 84).

c) To correct a low contact pattern (see Fig. 82), increase the shim pack thickness under the bearing cage. When you increase the shim pack thickness, the drive pinion moves away from the ring gear (see Fig. 85).

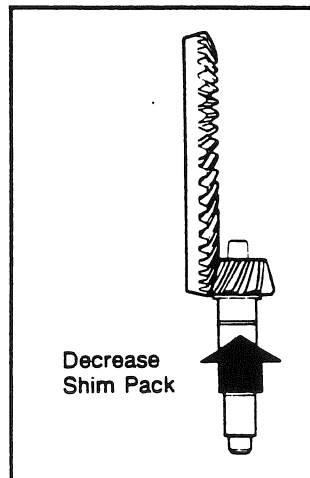


Fig. 84

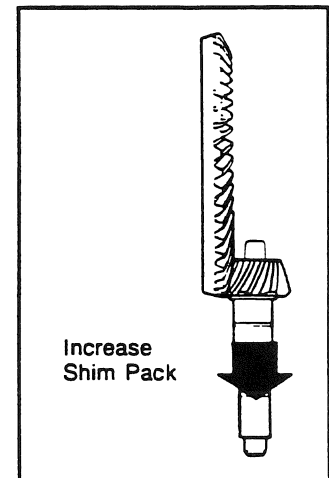


Fig. 85

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- d) Install the drive pinion, bearing cage and shims into the carrier. See **Installing Drive Pinion and Bearing Assembly into Carrier** in this section.
- e) Repeat steps 3 to 8 until the contact patterns are in the center between the top and bottom of the gear teeth.
10. Adjust the ring gear backlash within specifications to move the tooth contact patterns to the correct location in the length of the gear teeth. See **Checking Ring Gear Backlash** in this section.

- a) Decrease backlash to move the tooth contact patterns toward the toe of the ring gear teeth (see Fig. 86).

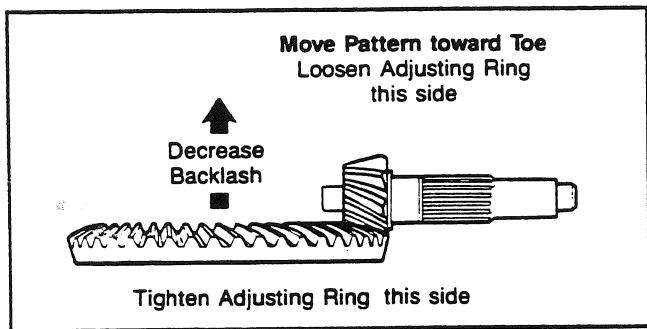


Fig. 86

- b) Increase backlash to move the tooth contact patterns toward the heel of the ring gear teeth (see Fig. 87).

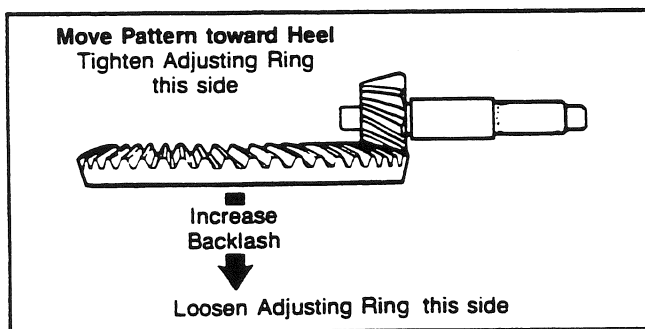


Fig. 87

- c) Repeat steps 3 to 8 and 10 until the contact patterns are at the correct location in the length of the gear teeth.

11. Install the cotter pin and lock plate securing the two adjusting rings. Use the following procedures.

- a) Install the cotter pin between the adjusting ring lugs and through the bearing cap boss. Bend the two ends of the cotter pin around the boss (see Fig. 88).

- b) Install the lock plate on the bearing cap so that the tab is between the adjusting ring lugs. Install the two bolts retaining the lock plate to the bearing cap (see Fig. 88). Tighten the bolts to the specified torque.

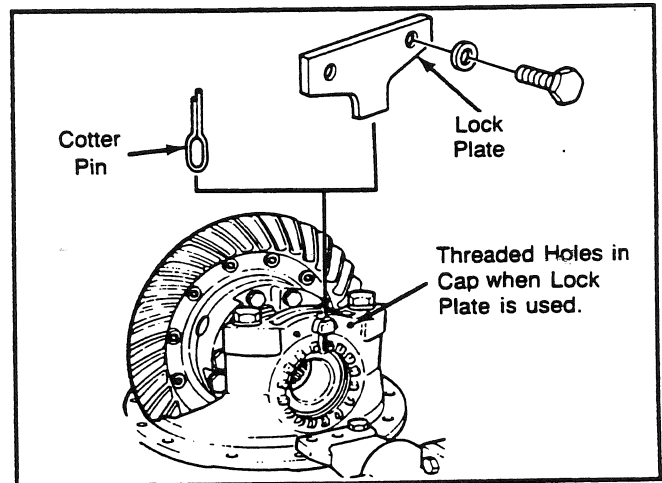


Fig. 88

Installing Differential Shift Assembly

1. Apply threadlocking compound P/N 40945 to the threads of the shifter shaft. Install the fork into its correct position in the carrier case (see Fig. 89).
2. Hold the fork in position. Install the shifter shaft spring into the shifter shaft opening, through the fork bore and into the bore for the shifter shaft spring. Slide the shifter shaft over the spring. Install the shifter shaft into the fork and tighten to the specified torque (see Fig. 90).

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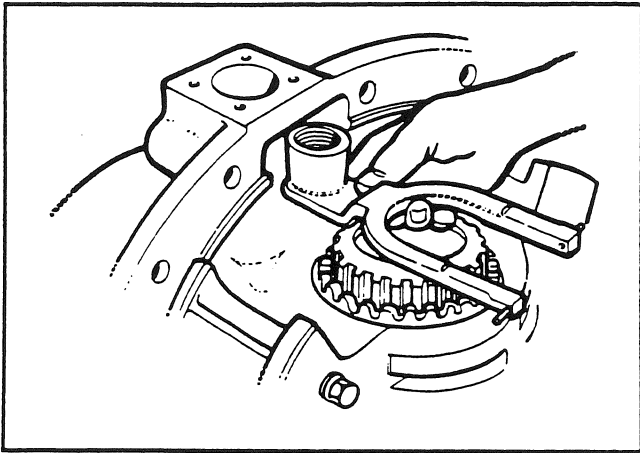


Fig. 89

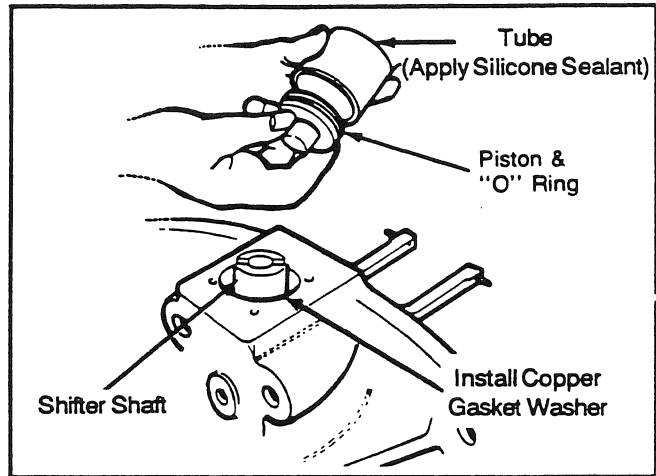


Fig. 91

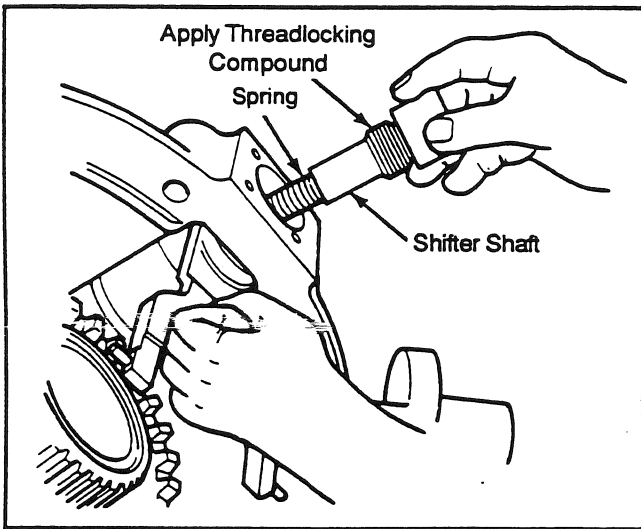


Fig. 90

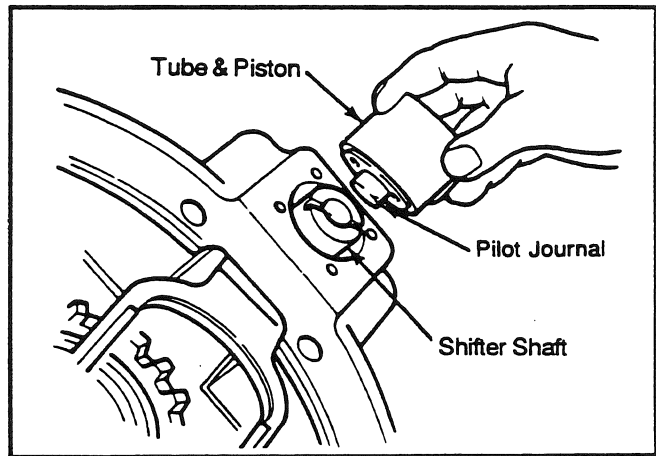


Fig. 92

3. Lubricate the piston O ring with system oil. Install the O ring into its groove on the piston. Apply a bead of silicone sealant P/N 32338 onto the washer end of the tube. Install the piston into the tube (see Fig. 91). Install the washer and tube into the housing bore. Make sure the pilot journal on the piston engages in its bore on the shifter shaft (see Fig. 92).

4. Install the copper gasket into its bore on the inside of the cover. Place the cover over the tube so that the hydraulic port points up when the carrier is installed into the final drive housing. Secure the cover with four bolts and lockwashers. Tighten the bolts to the specified torque (see Fig. 93).

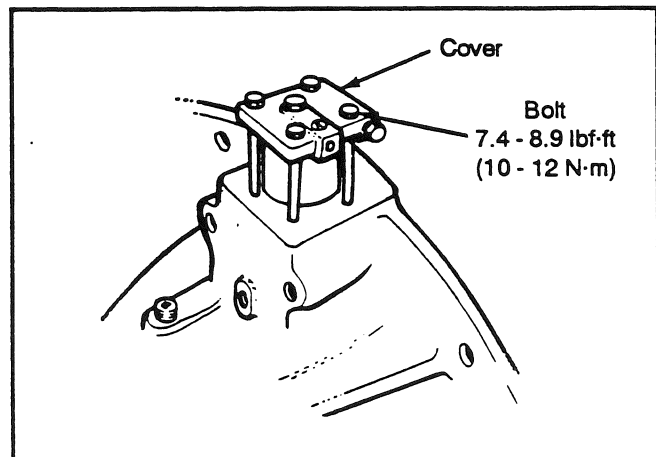


Fig. 93

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5. Slide the collar into the fork. Engage the collar splines with the differential case splines. Use the manual engaging bolt to help engage the collar and differential case splines.

6. Before installing the carrier, you must shift and hold the differential lock in the locked (engaged) position. Install the manual engaging bolt into the hole in the center of the cover. Turn the manual engaging bolt to the right until the head is approximately 1/4 inch (6 mm) from the cover. Do not turn the bolt beyond its normal stop. The bolt is now in the service position and the differential lock is completely engaged.

7. You will feel a small amount of spring resistance when turning the manual engaging bolt. If you feel a high resistance before reaching the locked (engaged) position, stop turning the bolt. Otherwise the cover and bolt threads will be damaged.

8. A high resistance to the bolt indicates that the splines of the collar and the differential case half are not aligned or engaged. Align the splines as follows:

- a) As you turn the manual engaging bolt, rotate the drive pinion to align the splines of the collar and differential case half.
- b) Reduced spring resistance indicates the splines are engaged. Continue turning the manual engaging bolt until the head is approximately 1/4 inch (6 mm) from the cover.

9. Hold the collar in the locked (engaged) position. Tap the two roll pins in the fork ends until they are level with the outer faces of the yoke (see Fig. 94).

10. While the collar is still in the locked position, install the sensor switch. Connect a battery/bulb tester to the sensor switch and turn the switch into its hole until contact with the fork causes the tester light to energize. Turn the switch one additional revolution and tighten the lock nut to the specified torque.

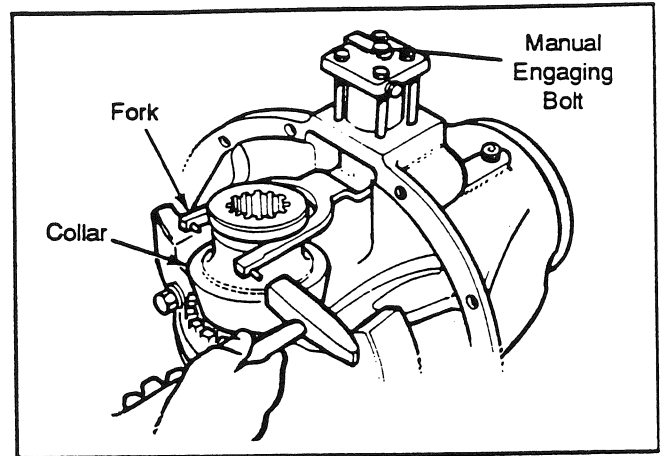


Fig. 94

Installing Carrier to Final Drive Housing

A black and white warning icon. The top part shows a silhouette of a person wearing safety goggles and a respirator mask. The bottom part shows a silhouette of a person's torso with a large, dark, irregular shape on the chest, representing a chemical spill or hazard.	<p>⚠ WARNING</p> <p>Chemical hazard. Wear goggles, protective clothing and respirator. Handle chemicals according to manufacturer's instructions. Severe personal injury or death could result.</p>
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1. Clean the final drive housing and carrier mounting surfaces. Use a cleaning solvent and rags to remove dirt. Blow dry the cleaned areas with moisture free compressed air. Inspect the housing for damage.
2. Apply a uniform bead of silicone sealant P/N 56247 to the housing mounting surface (see Fig. 95). Use a safe lifting device and install the carrier into the housing.

NOTE: Do not use a hammer or mallet to install the carrier. Using a hammer or mallet can damage the carrier mounting flange and cause oil leaks.

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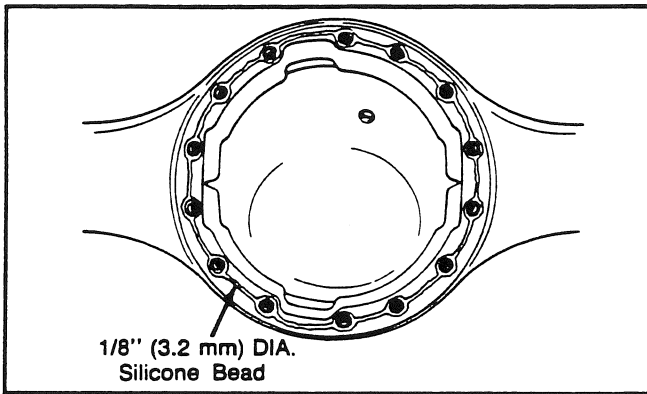


Fig. 95

- Install bolts and washers in the four corner locations around the carrier and housing (see Fig. 96). Tighten the bolts hand tight. Carefully push the carrier into position. Tighten the four bolts two or three turns each in a diagonal sequence. Repeat this procedure until the four bolts are tightened to the specified torque.

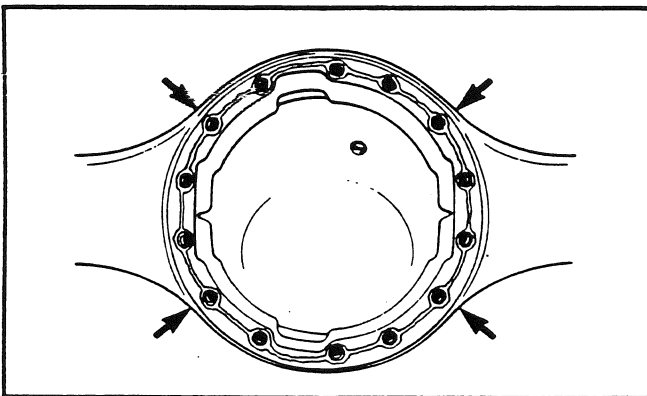


Fig. 96

- Install the other bolts and lockwashers securing the carrier to the housing. Tighten the bolts to the specified torque.
- Remove the bolt and gasket from the storage position in the differential lock cover. Remove the manual engaging bolt from the service position. Removing the manual engaging bolt disengages the differential lock.
- Clean the bolt, gasket, cover and threaded hole in the center of the cover. Install the bolt and gasket into

the operating position in the cover. Install the manual engaging bolt into the storage position (see Fig. 97). Tighten the bolt and manual engaging bolt to the specified torques.

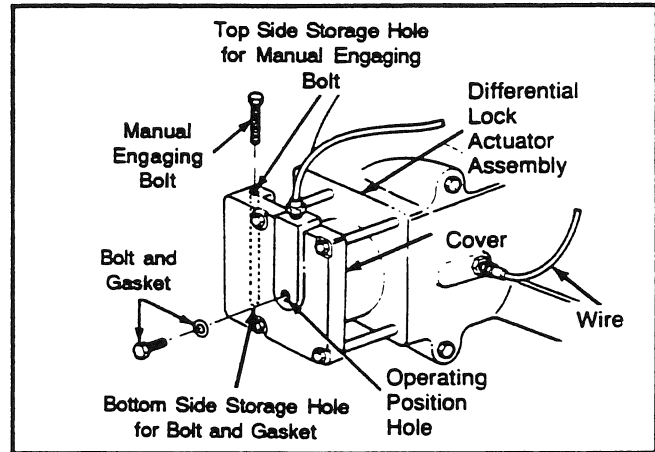


Fig. 97

Installing Inner and Outer Bushings

- You should install the inner and outer bushings using a stepped mandrel, preferably made from case-hardened mild steel. To make an appropriate stepped mandrel, refer to the following chart and Fig. 98.
- Take care to insert the bushings squarely into the final drive housing journals to avoid damage to the lining material. Apply a smear of system oil to the outside surface of the bushings before installation.

Model	P/N	Nominal Bushing Bore (Inches)	Installed Bushing I.D. (Inches)	Bushing Length (Inches)
710/710A 720/720A	37583	5	4.9988 5.0056	3.5
710/710A 720/720A	37582	5.25	5.2502 5.2570	4
730/730A	12638	6.25	6.2502 6.2570	3.725
730/730A	37626	6.75	6.7502 6.7570	4

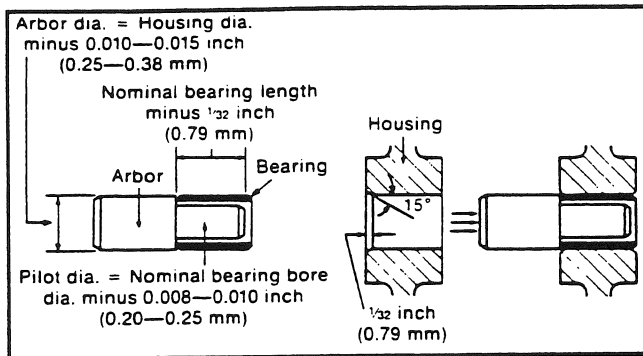


Fig. 98

Installing Flanged Sleeves and Axle Shafts

1. Lubricate and install the seal. Lubricate and install new inner and outer thrust plates. Install a lifting eye in the flanged sleeve. Install the flanged sleeve using a safe lifting device (see Fig. 99). Remove the lifting eye.

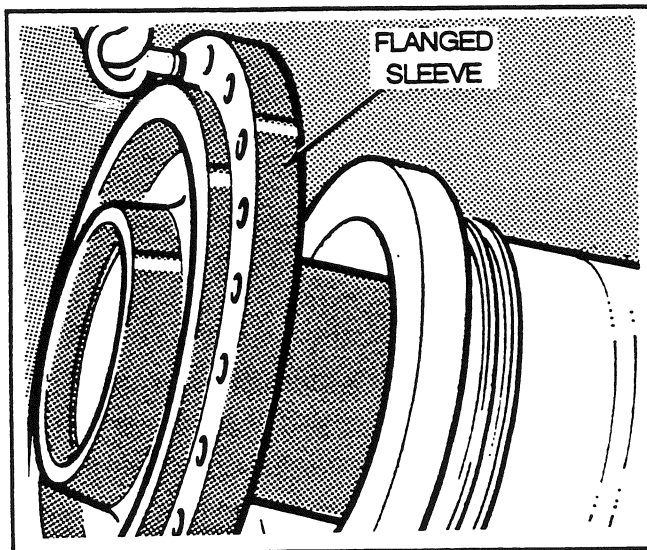


Fig. 99

2. Apply a uniform bead of silicone sealant P/N 56247 to the split ring surface that contacts the flanged sleeve, and the surfaces where the split rings contact each other. Carefully install the split rings over the seal. Secure the two halves with the nuts and bolts. Install nuts and bolts to temporarily secure the split rings to the flanged sleeve. Repeat steps 1 and 2 for the other split rings and flanged sleeve.

3. Lubricate the bearings with system oil. Install the bearings onto the axle shafts using a hydraulic press. Do not apply heat to the bearings.

4. Install the right-hand axle shaft as follows:

- a) Install the axle shaft into the final drive housing until it stops against the differential lock collar.
- b) Turn the axle shaft until the splines of the shaft and the collar engage.
- c) Push the axle shaft further into the housing until it stops against the differential side gear.
- d) Turn the axle shaft until the splines of the shaft and the side gear engage.
- e) Push the axle shaft completely into the housing until fully installed.

5. Install the left-hand axle shaft. Retain the axle shaft bearings with new snap rings. Lubricate the oil seal lips with tandem oil. Use a soft metal drift to install the seals.

Installing Final Drive Assembly to Grader

1. Apply a uniform bead of silicone sealant P/N 56427 to the tandem mounting surface and the drive sprocket bearing surface.
2. Attach a safe lifting device to the final drive assembly. Position the assembly and align the splines of the axle shaft and drive sprocket.
3. Apply threadlocking compound P/N 40945 to the bolts retaining the final drive split rings to the tandem. Install the bolts and lockwashers. Tighten the bolts to the specified torque.

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4. Install the end cap, new tabwasher and bolts securing the drive sprocket. Tighten the bolts to the specified torque. Bend the tabwasher corners to secure the bolt heads.
5. Apply a uniform bead of silicone sealant P/N 56247 to the side cover plate mounting surface. Install the side cover plate and secure with the bolts. Repeat steps 1 through 5 for the other tandem.
6. If applicable, install and connect the transverse brake lines. Remove any spilled brake fluid to avoid paint damage.
7. Attach a safe lifting device to the rear of the grader frame. Raise the end of the grader and remove the stands. Roll the final drive and tandem assembly under the grader. Lower the grader until the frame brackets rest on the final drive mounting plates. Install the bolts and special washers. Tighten the bolts to the specified torque.
8. Remove and discard the lockwire securing the slip yoke and drive shaft together. Connect and retain the lower drive shaft to the final drive yoke. Tighten the bolts to the specified torque.
9. Connect all brake lines between the rear frame and tandems. Ensure all connections are clean and tight. Remove any spilled brake fluid to prevent paint damage.

NOTE: For graders equipped with drum brakes, add brake fluid to the master cylinder reservoir as required. Bleed the brake fluid system before driving the grader. Refer to Section 16, *Master Cylinder - Drum Service Brakes*, of this Shop Manual.

10. Connect the sensor switch wiring harness to the main wiring harness. Install the hydraulic hose to the differential lock cylinder cover.

11. Pass the battery cables through the grommet. Install one battery and connect the battery cables. Close and secure the battery box(es).
12. Refer to the lubrication specifications detailed in your **700 Series Operator's Manual** for the capacities and recommended tandem and final drive lubricating oils. Remove the upper pipe plug from the final drive housing. Fill the final drive until oil reaches the bottom of the plug hole. Clean the plug. Apply pipe sealant P/N 19167 to the plug threads and install the plug.
13. Remove and clean the tandem filler plugs and level check plugs. Fill both tandems to the bottom of the check plug hole. Apply pipe sealant P/N 19167 to the plug threads and install the plugs.

Checking the Differential Lock - Stationary Test

Make sure you read and understand the following instructions before attempting the stationary test.

1. Make a visual safety check around the grader. Ensure all personnel are away from the area. Signal your intention and start the engine when it is safe to do so. Position the moldboard at 90° to the frame. Apply down pressure to the moldboard and lift the front wheels about 18 inches (45 cm) off the ground.
2. Pull the right-hand blade lift hydraulic control lever and retract the cylinder until both left-hand tandem wheels are about 2 inches (5 cm) off the ground.
3. Release the hand brake. Do not depress the service brake pedal or the engine will stall. Move the differential lock/unlock switch upward and unlock the differential. The light above the switch should energize.

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4. With the engine at idle, depress the clutch pedal. Shift the transmission pulser lever to 1 - 1. Shift the transmission model lever to forward.

5. Slowly release the clutch pedal.

a) Left-hand tandem wheels should rotate, indicating the differential has unlocked. System is working correctly.

b) Grader tries to lurch forward or the engine stalls, indicating the differential has not unlocked. Repeat steps 4 and 5 to remove the driving torque. The differential should unlock. If the differential does not unlock, return the grader to the SERVICE POSITION. Have a qualified service technician check the differential hydraulic and/or electrical system(s).

6. After this procedure, perform the road test before returning the grader to service.

Differential Electrical and Hydraulic Systems (See Fig. 100, electrical schematic).

1. Conditions when differential is locked:

- Right-hand door post switch in down position.
- Solenoid valve energized, and grounded at differential lock sensor switch.
- Electrical relay energized, and grounded through closed sensor switch.
- Electrical relay contacts open to deenergize light.

2. Conditions when differential is unlocked:

- Right-hand door post switch in up position.
- Solenoid valve deenergized.
- Differential unlocked by spring tension.
- Shift fork opens sensor switch contacts to deenergize electrical relay.
- Electrical relay terminals 87A NC and C connect to energize light.

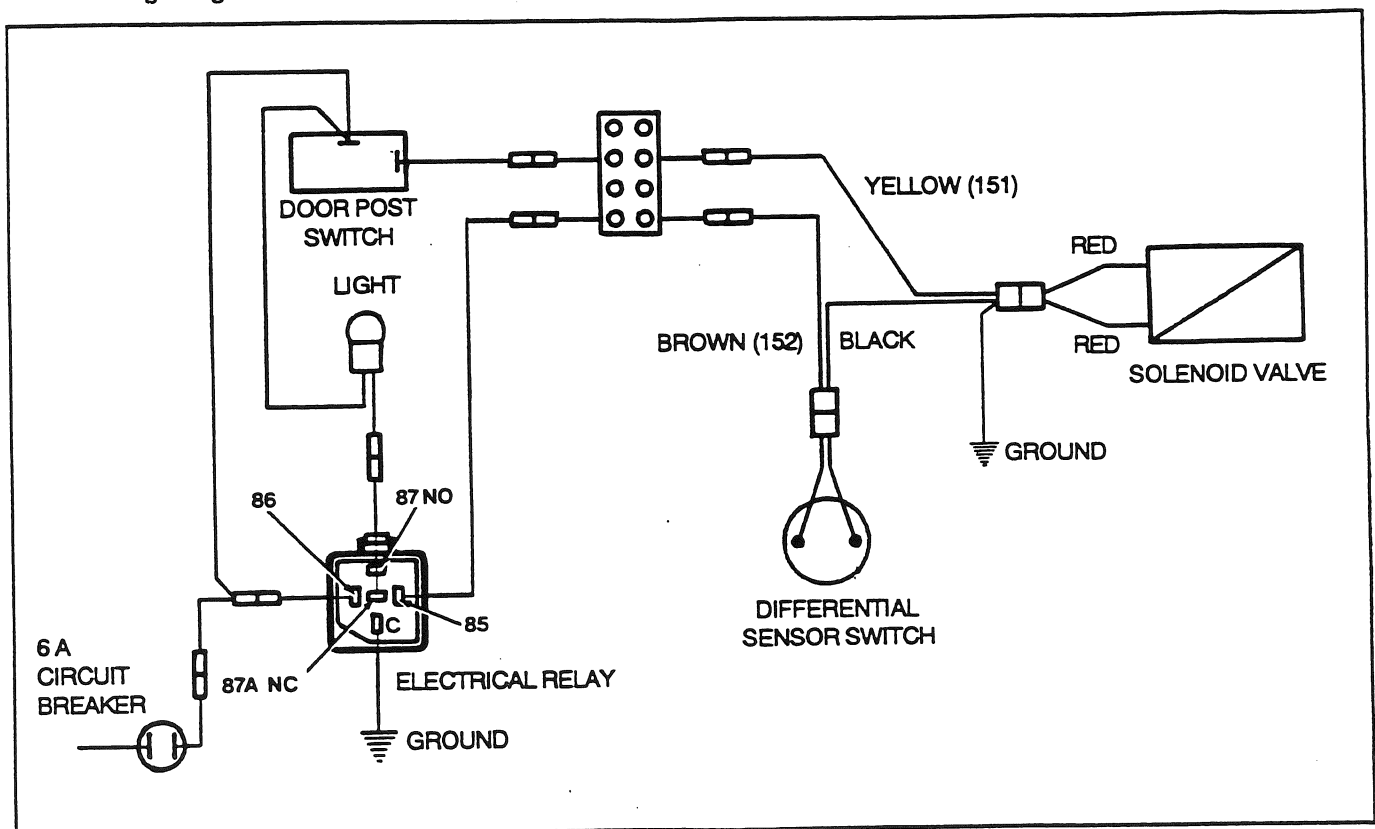


Fig. 100

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3. Install a tee fitting and 0 - 300 psi (0 - 20 bar) pressure gauge at the differential lock cover inlet to determine operation of the solenoid valve (see Fig.101).

NOTE: The differential may not lock if the differential case and shift collar splines do not align. The machine may have to be steered slightly to align the splines.

NOTE: If the light does not energize when you move the control switch to the unlocked (disengaged) position, the differential is still locked. Do not continue the test. Shut down the engine and place the grader in the SERVICE POSITION. Make sure the manual engaging bolt was removed from the differential lock cover. After this check, continue with the test.

Checking the Differential Lock - Road Test

1. Make a visual check around the grader. Ensure the hand brake is applied and the transmission is in neutral. Signal your intention to start the engine. Start the engine when it is safe to do so.
2. The lock/unlock differential control switch is mounted in the electrical panel on the right-hand door post. Move the control switch to the unlocked (disengaged) position. The light above the switch should energize.

3. Drive the grader at 5 to 10 mph (8 to 16 km/h) and check the differential lock/unlock light. The light must remain energized when the control switch is in the unlocked position.
4. Continue to drive the grader and move the control switch to the locked (engaged) position. The light should deenergize when the control switch is in the locked position. Return the grader to the repair shop. Place the grader in the SERVICE POSITION.

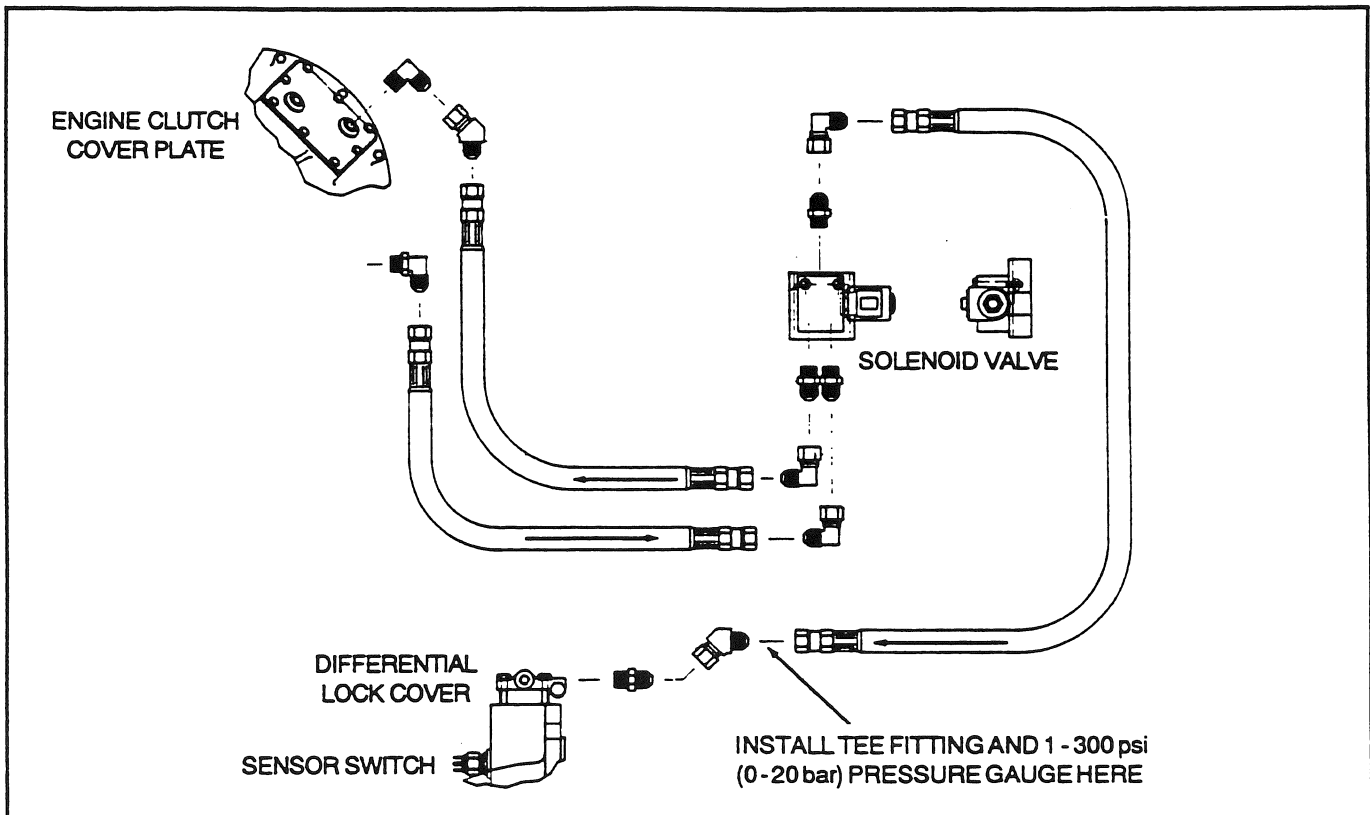


Fig. 101

