Date 1-1-89

MC-9 MAINTENANCE MANUAL

SECTION 2

REAR AXLES

SUBJECT **PAGE**

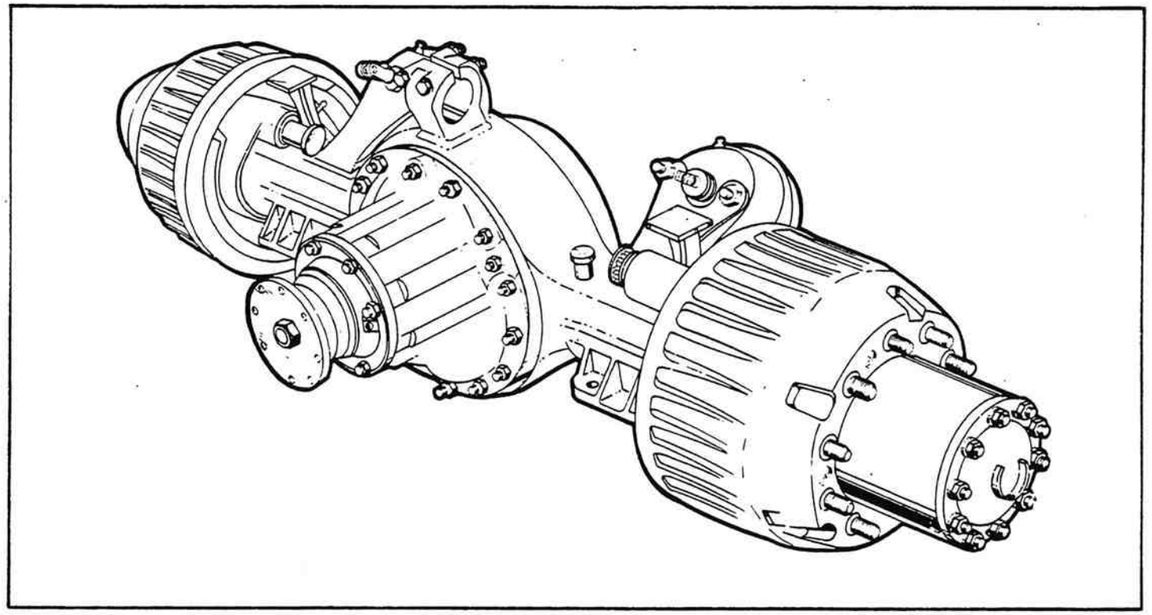


Figure 2-1. Drive Axle

REAR AXLES

DRIVE AXLE

The drive axle (figure 2-1) is a Rockwell Standard full floating type with pressed steel housing, fitted with replaceable pressed in steel sleeves. A magnetic drain plug is installed in the bottom of the housing.

The single reduction final drive employs a heavy duty hypoid drive pinion and ring gear. The differential and gear assembly is mounted on tapered roller bearings and lubricated by the differential oil.

The straddle-mounted pinion has two tapered roller bearings in front of the pinion teeth which take the forward and reverse thrust, and a third bearing behind the pinion teeth to carry the radial load.

The standard drive axle ratio on all of the coach models is 3.73:1. Optional ratios which may be present are 3.33:1 and 4.10:1.

LUBRICATION

Lubrication recommendations will be found in Section 10 of this manual.

During initial stages of normal operation, tiny metal particles are freed from mating surfaces of moving parts. These metal particles are carried by the lubricant through the assembly and act as lapping compound which accelerates wear of all parts.

To ensure maximum life of the differential and prevent premature failure, the original "factory fill" lubricant should be drained. This also prevents lubricant contamination caused by differences in the "factory fill" and lubricant used by the operator when topping up.

CAUTION: Change break-in oil after 1,000 miles (1,600 km) but no later than 3,000 miles (4,800 km). Drain the unit while still warm from operation.

See figure 2-2 for fill and drain plugs. Magnetic drain plugs perform the vital function of trapping small metallic particles that circulate in the lubricant, through the gears and bearings. They prevent rapid wear and premature failure. The magnet must be strong enough to firmly hold the particles under service conditions. We recommend plugs with elements having a minimum pick-up capacity of 2 pounds of low carbon steel in plate or flat bar form.

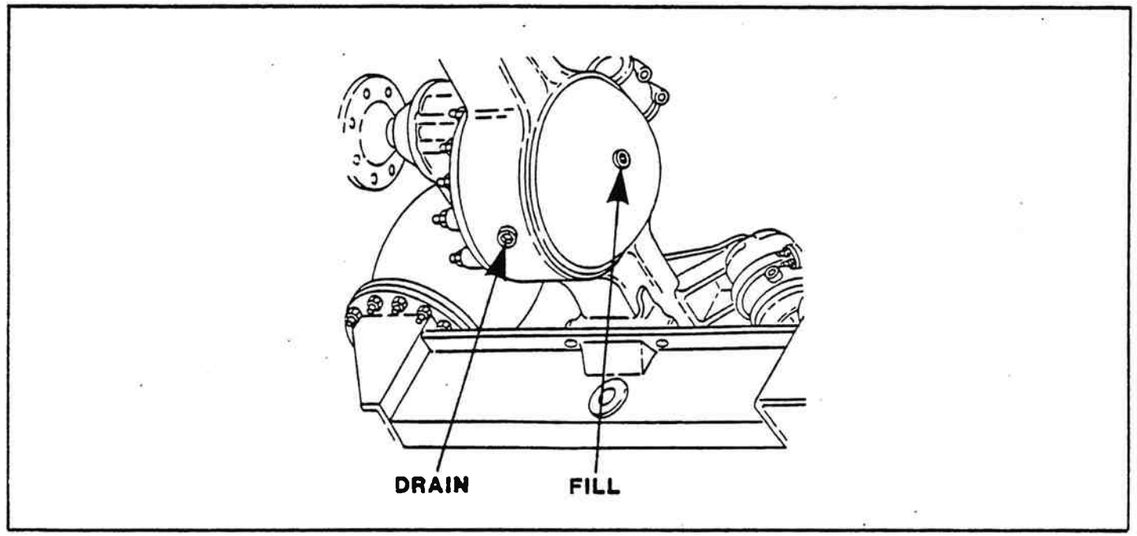


Figure 2-2. Drive Axle Housing.

Clean all magnetic drain plugs prior to reinstallation.

1. Fill axle housing to the correct level with specified lubricant with the vehicles on level ground. Use general purpose gear lubricant SAE 90 above 0°F. (-18°C.) or SAE 140 below 0°F. (-18°C.).
2. Lubricate universal joint.
3. Drive the vehicle, unloaded, for one to two miles at speeds not to exceed 25 miles per hour to thoroughly circulate the lubricant throughout the assembly.

For reconditioned axles, follow the same procedures as above, after overhaul.

OIL CHANGE INTERVALS

Gear oil should be changed every 25,000-30,000 miles (40,000-48,000 km) on units run over 60,000 miles (96,000 km) annually.

For units run less than 60,000 miles, the oil should be changed twice yearly (spring and fall) regardless of mileage.

The Rockwell axle drive unit employs the gravity feed (splash) system of distributing lubricant throughout the assembly. As the vehicle is initially driven in service, a short period of time is required for the lubricant to reach all areas of the drive units.

MAINTENANCE

Careful adherence to maintenance and lubrication procedures will go a long way toward successful operation.

The most common causes of drive axle carrier failures are spinout, shock, fatigue and poor lubrication.

Spinout is defined as excessive differential action. On a single rear axle, main differential spinout occurs when one wheel remains stationary while the other wheel is spinning. The relatively high speed differences between the mating parts generate heat, and the rate of heat generation increases with the speed differences. When the heat becomes excessive it can cause galling of the journals of the cross and the mating differential pinion bores. In extreme cases of spinout, enough heat may be generated to weld the differential pinion to the cross and cause a catastrophic failure.

Shock is another common cause of carrier failure. It results from a rapidly applied load or force that is severe enough to exceed the strength of the carrier component and cause it to crack or fail instantly.

There are a number of operating conditions which can result in a shock failure:

A. Hitting dry pavement with a spinning wheel.
B. Missing a shift.
C. "Popping" the clutch.
D. Reverse interlock failure.

If the failed part separates into two or more pieces, the operator will usually realize the fact immediately. But if the part is only cracked, the operator may not be aware of the damage until sometime later. Depending on the severity of the crack in the part, the final failure may not occur until many miles later. the crack will be a point of origin for a fatigue failure, and can progress until the part fails. Thus the failure could happen while the vehicle is being operated under normal conditions.

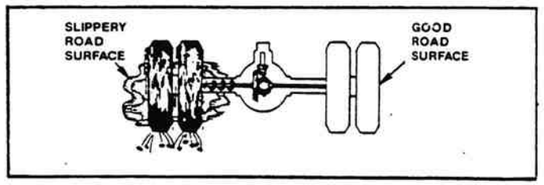
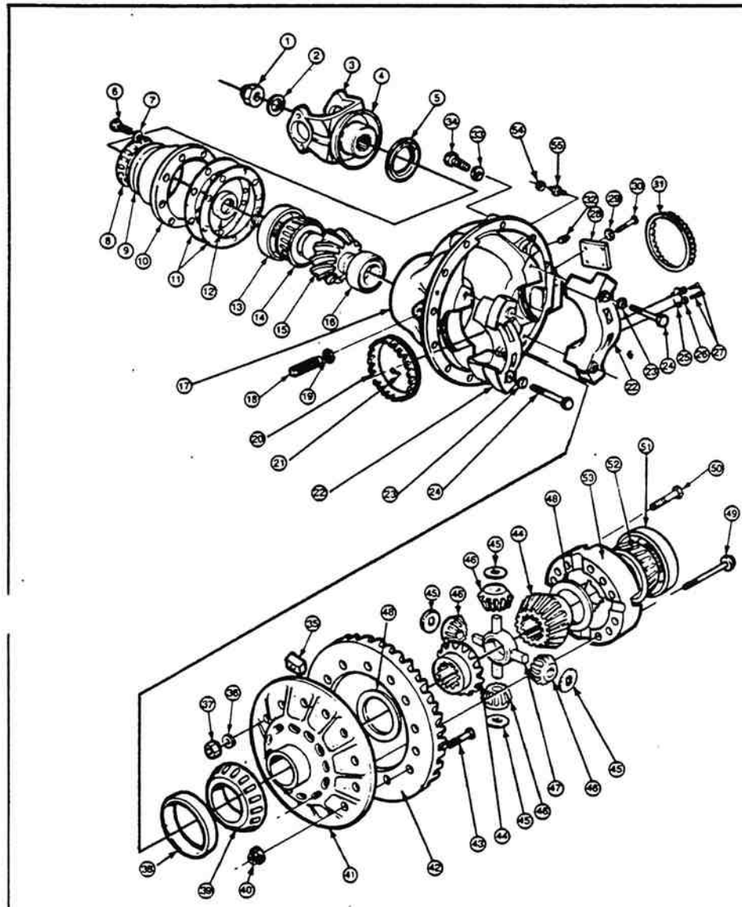


Figure 2-3. Drive Axle Spinout.



1. Nut - Drive Pinion
2. Washer - Drive Pinion
3. Input Yokr or Flange
4. Deflector
5. Oil Seal
6. Capscrew - Bearing Cage
7. Washer
8. Bearing Cone - Pinion Outer
9. Bearing Cup - Pinion Outer
10. Bearing Cage - Drive Pinion
11. Shims
12. Spacer - Pinion Bearing
13. Bearing Cup - Pinion Inner
14. Bearing Cone - Pinion Inner
15. Drive Pinion
16. Spigot Bearing
17. Carrier
18. Thrust Screw
19. Jam Nut - Thrust Screw
20. Adjusting Ring - LH
21. Cotter or Pin
22. Caps - Differential Bearing
23. Washers
24. Capscrews - Differential Bearing Cap
25. Lock Plate - Adjusting Ring
26. Washers - Lock Plate
27. Capscrews - Lock Plate
28. Cover - Air Cylinder Opening
29. Washers - Cover
30. Capscrews - Cover
31. Adjusting Ring - RH
32. Plug - Oil Fill Hole (Carrier)
33. Washer - Capscrew Plug
34. Capscrew Plug - Sensor Hole
35. Thrust Block
36. Washers - Differential Case
37. Nuts - Differential Case
38. Bearing Cup - Differential LH
39. Bearing Cone - Differential LH
40. Nuts - Ring Gear & Case Half
41. Case Half - Flange
42. Ring Gear
43. Bolts or Rivets - Ring Gear & Case Half
44. Side Gears - Differential
45. Thrust Washeers - Differential Pinion
46. Pinions - Differential
47. Spider - Differential
48. Thrust Washers - Differential Side Gear
49. Capscrews - Differential Case
50. Bolts - Differential Case
51. Bearing Cup - Differential RH
52. Bearing Cone - Differential RH
53. Case Half - Plain

Figure 2-4. Single Reduction Differential Carrier.

Fatigue is another type of failure in axle carriers, one that results from repeated loadings of a component. A single application of these loads or forces is not great enough to damage the part but repeated applications gradually weaken it to the point of failure. Fatigue failures that occur in drive axle carriers have two sources:

1. Exceeding the GVW/GCW rating of the carrier
2. Shock loads

When the vehicle is operated at a weight in excess of what the carrier was designed for, the life of the components is reduced. The rated GVW/GCW of a carrier changes with the ıad grade and surface. As the grade increases, so does the effort (torque) required to move a vehicle loaded to a given GVW/GCW. Again, as the road surface changes from hard to soft, rolling resistance increases and more torque is needed. Thus, a vehicle loaded to a given GVW/GCW will have a reduced carrier life when operated in hilly or mountainous terrain as opposed to being operated on the level. The same is true for operation on soft or unimproved surfaces as compared to hard surface roads.

The fourth common cause of axle carrier failures originates with the lubricant, or with lubricant change practices. The lubricant which protects the axle components has three key functions:

A. To reduce friction between parts.
B. To carry heat away from parts.
C. To carry dirt and wear particles away from parts.

When lubricant failure occurs, it is generally the result of improper maintenance and has its roots in one of three basic problem areas:

A. Low lubricant level.
B. Improper type of lubricant or lubricant with depleted additives.
C. Contaminated lubricant.

DRIVE AXLE REMOVAL

Removal of the entire axle is recommended to facilitate repair work on the carrier. Axle removal and replacement instructions follow.

Block front wheels of the coach to prevent rolling. Raise the rear end of the vehicle with jacks until the bottom of the body is approximately 18" (457.2 mm) from the floor. Block the body in this position as outlined in Section 3 under Coach Jacking Points.

CAUTION: Do not allow the rear axle assembly to hang on the air springs. Damage to the air springs may result.

1. Exhaust air pressure from the suspension system air tank by opening the drain cock on the bottom of air filter.

2. Disconnect the sway bar links.

3. Disconnect the brake chamber hoses.

4. Disconnect the driveline universal joint from the pinion input yoke or flange on the carrier (figure 2-5).

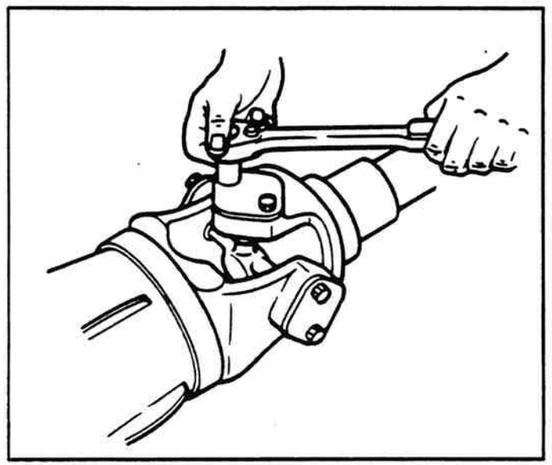


Figure 2-5. Disconnecting Universal Joint.

5. Disconnect both height control valve links from brackets, and pull down on each height control valve arm to exhaust air from the air springs.

6. Disconnect both ends of all four radius rods as outlined in this section under Radius Rods.

7. Remove shock absorbers.

8. Disconnect air springs from the suspension supports.

9. Lower the axle and carefully remove from under the coach body.

Replacement is the reverse of removal.

SINGLE REDUCTION DIFFERENTIAL CARRIER

DESCRIPTION

The single reduction differential carrier (Figure 2-6) is front mounted into the axle housing. This carrier has a hypoid drive pinion and ring gear set and bevel gears in the differential assembly.

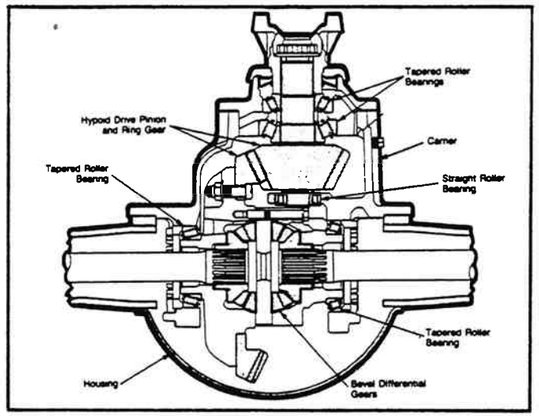


Figure 2-6. Single Reduction Differential Carrier.

A straight roller bearing (spigot) is mounted on the head of the drive pinion. All other bearings in the carrier are tapered roller bearings.

When the carrier operates, there is normal differential action between the wheels all the time.

REMOVAL OF CARRIER ASSEMBLY FROM AXLE HOUSING

1. After the axle has been removed from the coach, support it securely under the axle shaft housings. Support the axle at a height sufficient to allow a roller jack to pass under the center (banjo) of the axle.

2. Remove the plug from bottom of axle housing and drain lubricant from the assembly.

3. Remove the stud nuts and washers from the flanges of both axle shafts.

4. Loosen the tapered dowels in the flanges of both axle shafts as follows.

WARNING: Wear safe eye protection. Do not hit the round driving lugs on the head of axle shafts. Lugs can break and cause injury.

a. Hold a 1½-inch-diameter brass drift against the center of the axle shaft, inside the round driving lugs (Figure 2-7).

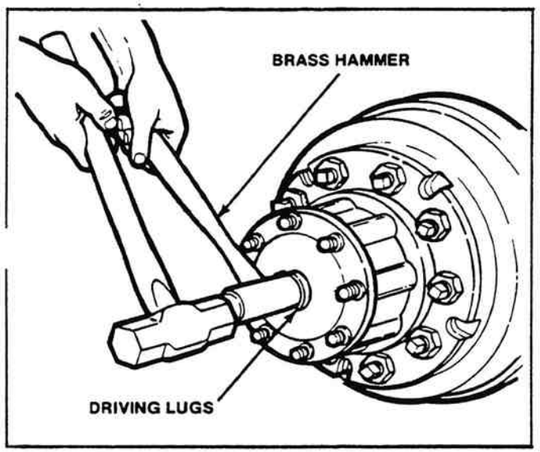


Figure 2-7. Loosening Shaft And Dowels.

NOTE: A 1½-inch-diameter brass hammer can be used as a drift.

b. Hit the end of the drift with a large hammer (five to six pounds) and the axle shaft and tapered dowels will loosen.

CAUTION: Do not use a chisel or wedge to loosen the axle shafts and dowels. The chisel or wedge can damage the hub, axle shafts and oil seals.

5. Remove the tapered dowels and both axle shafts from the axle assembly.

6. Place a hydraulic roller jack under the differential carrier to support the assembly (Figure 2-8).

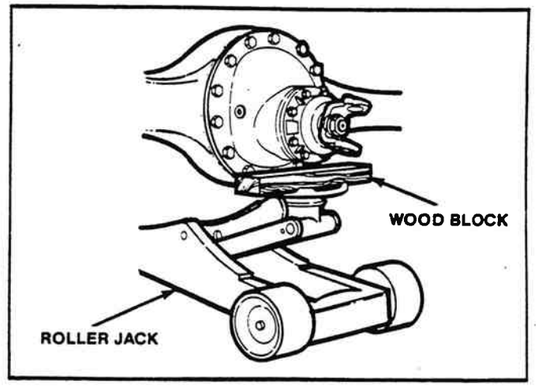


Figure 2-8. Supporting Carrier Assembly.

7. Remove all but the top two carrier-to-housing capscrews or stud nuts and washers.

8. Loosen the top two carrier-to-housing fasteners and leave attached to the assembly. The fasteners will hold the carrier in the housing.

9. Loosen the differential carrier in the axle housing. Use a leather mallet to hit the mounting flange of carrier at several points.

NOTE: Some carrier models have threaded puller screw holes in the mounting flange. Puller screws can be used to loosen and pull the carrier from the axle housing. If puller screws are used, clean the threaded holes before the puller screws are installed.

10. After carrier is loosened, remove the top two fasteners. Carefully remove the carrier from the axle housing using the hydraulic roller jack. Use a pry bar that has a round end to help remove the carrier from the housing.

CAUTION: When using a pry bar be careful not to damage the carrier or housing flange. Damage to these surfaces will cause oil leaks.

11. Remove and discard the carrier-to-housing gasket.

12. Lift the differential carrier by the input yoke or flange and put the assembly in a repair stand. Figure 2-9 shows the carrier in a stand. Such a stand may be purchased; see tools at end of this section. Do not lift the carrier assembly by hand; use a lifting tool.

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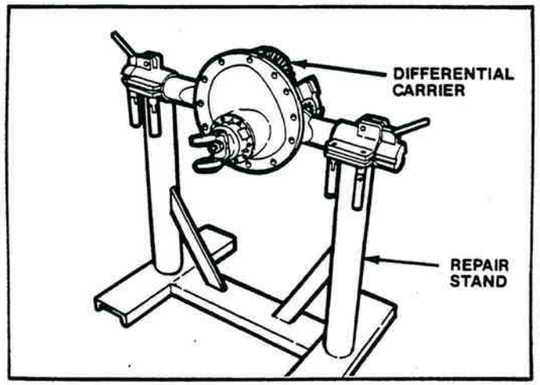

Figure 2-9. Carrier Mounted In Repair Stand.

REMOVAL OF DIFFERENTIAL AND RING GEAR

NOTE: Before starting work on the differential carrier, inspect the hypiod gear set for damage. If the inspection shows no damage, the same gear set can be used again. Using a dial indicator as shown in Figure 2-10, measure the backlash of the gear set and make a note of it. This measurement will be needed when the set is reinstalled.

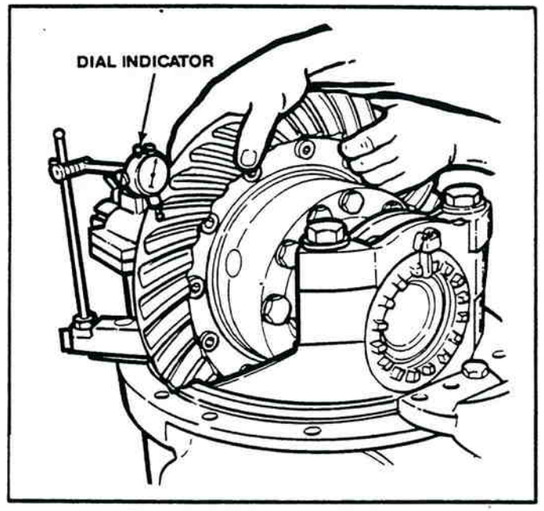

Figure 2-10. Measuring Backlash.

1. Loosen the jam nut on the thrust screw.

2. Remove the thrust screw and jam nut from the differential carrier (Figure 2-11).

3. Rotate the differential carrier in the repair stand until the ring gear is at the top of the assembly.

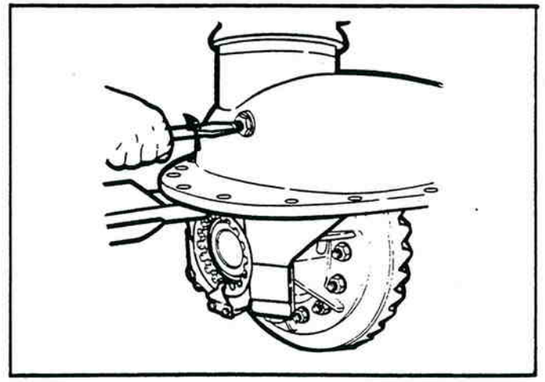

Figure 2-11. Removing Thrust Screw And Jam Nut.

4. Mark one carrier leg and bearing cap for the purpose of correctly matching the parts when you assemble the carrier. A center punch and hammer can be used to mark the parts (Figure 2-12).

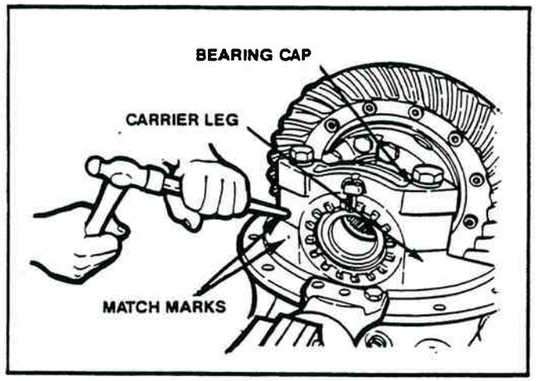

Figure 2-12. Making Match Marks.

5. Remove the cotter keys, pins or lock plates that hold the two bearing adjusting rings in position. Use a small drift and hammer to remove pins. Each lock plate is held in position by two capscrews (Figure 2-13).

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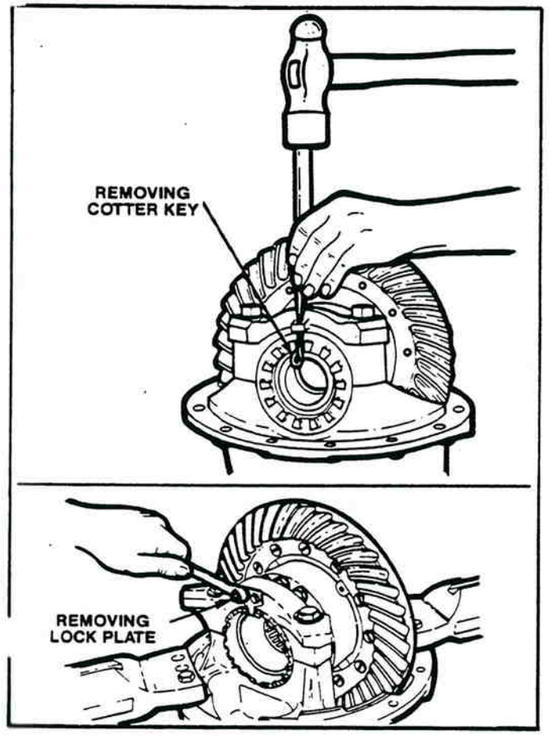

Figure 2-13. Cotter Key/Lock Plate Removal.

6. Remove the capscrews and washers that hold the two bearing caps on the carrier. Each cap is held in position by two capscrews and washers (Figure 2-14).

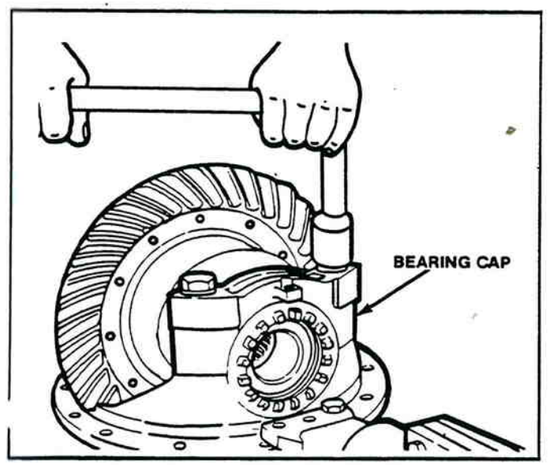

Figure 2-14. Removal of Bearing Cap Capscrews.

7. Remove the bearing caps and bearing adjusting rings from the carrier (Figure 2-15).

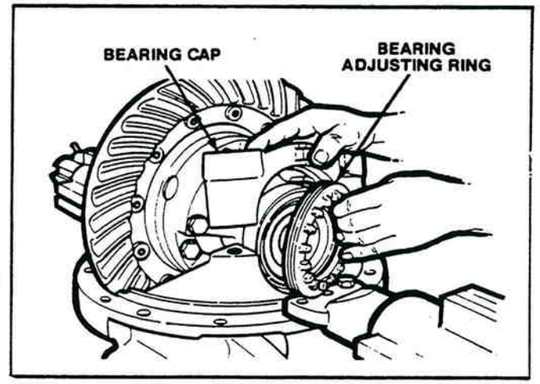

Figure 2-15. Removing Bearing Cap And Adjusting Ring.

8. Safely lift the main differential and ring gear assembly from the carrier. Put the assembly on a work bench (Figure 2-16).

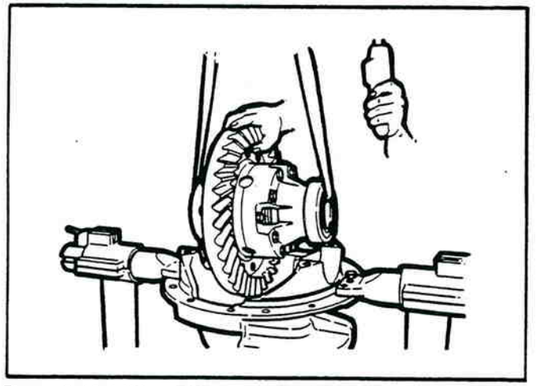

Figure 2-16. Lifting Differential And Ring Gear From Carrier.

DISASSEMBLING THE DIFFERENTIAL AND RING GEAR ASSEMBLY

1. If the matching marks on the case halves of the differential assembly are not visible, mark each case half with a center punch and hammer. The purpose of the marks is to match the plain half and flange half correctly when you assemble the carrier (Figure 2-17).

2. Remove the lock wire, capscrews and washers or bolts, nuts and washers that hold the case halves together.

WARNING: Wear eye protection. Do not hit steel parts with a steel hammer. Parts can break and cause injury.