

SERVICE REPAIR

H16XM-12EC H18XM-12EC

H22XM-12EC Europe [C214]

HYSTER

Counterweight Weights

Unit	Main Counterweight
H16.00XM-12EC	6,000 to 6,180 kg (13,230 to 13,627 lb)
H18.00XM-12EC	6,000 to 6,180 kg (13,230 to 13,627 lb)
H22.00XM-12EC	8,450 to 8,704 kg (18,633 to 19,193 lb)
H400HD-EC	6,000 to 6,180 kg (13,230 to 13,627 lb)
H440HDS-EC	6,000 to 6,180 kg (13,230 to 13,627 lb)
H450HD-EC	6,000 to 6,180 kg (13,230 to 13,627 lb)
H450HDS-EC	8,450 to 8,704 kg (18,633 to 19,193 lb)
H500HD-EC	8,450 to 8,704 kg (18,633 to 19,193 lb)

Vehicle Weights

Vehicle Weights Without Power Pile Slope	
Unit	Weight
H16.00XM-12EC	32,302 kg (71,226 lb)
H18.00XM-12EC	32,967 kg (72,693 lb)
H22.00XM-12EC	35,946 kg (79,261 lb)

Vehicle Weights With Power Pile Slope	
Unit	Weight
H400HD-EC	32,996 kg (72,756 lb)
H440HDS-EC	33,321 kg (74,460 lb)
H450HD-EC	33,782 kg (74,477 lb)
H450HDS-EC	33,771 kg (78,862 lb)
H500HD-EC	36,652 kg (80,817 lb)

Container Attachment Weights

Extendable Attachment	Weight
6 to 12.2 m (20 to 40 ft)	
Shooting Pins	5346 kg (11,786 lb)
Double Horizontal Twist Locks	5300 kg (11,685 lb)
Hooks/Vertical/Horizontal Twist Locks	4500 kg (9,921 lb)

Capacities

Item	Specification
Engine Oil	15.4 liter (16.3 qt)
Tier 3/Stage IIIA Engines Engine Oil	18.9 liter (20 qt)
Tier 4i/Stage IIIB Engines Engine Oil	17.5 liter (18.5 qt)
Cooling System	25.0 liter (6.6 gal)
Hydraulic System Oil	335.0 liter (88.0 gal)
Transmission Oil	37.0 liter (9.8 gal)
Drive Axle Planetaries	4.5 liter (1.2 gal) - each side
Differential	43.0 liter (11.4 gal)
Fuel	364 liter (96 gal)
Tier 3/Stage IIIA Engines Fuel	335 liter (88.5 gal)
Tier 4i/Stage IIIB Engines Fuel	325 liter (85.9 gal)

Electrical System

24 Volt, Negative Ground
Alternator Output 70 Amps

Engine Specifications

Item	Cummins QSB 6.7
Number of Cylinders	6
Firing order	1-5-3-6-2-4
Bore	N/A
Stroke	N/A
Displacement	6.7 liter (408.86 in. ³)
Compression Ratio	17.2:1
Oil Pressure (Minimum 2000 RPM)	45 kPa (50 psi)
Governed Speed (No Load) 142 kW (190 hp) 164 kW (220 hp)	2320 to 2380 RPM 2110 to 2170 RPM
Idle Speed	800 RPM $\pm 2\%$
Stall Speed 142 kW (190 hp) 164 kW (220 hp)	1830 to 1980 RPM 1840 to 1990 RPM
Valve Clearance (Cold) Intake Exhaust	0.254 mm (0.010 in.) 0.508 mm (0.020 in.)
Minimum Cranking Speed	125 RPM
Weight (Dry)	485 kg (1070 lb)

Function Speeds

Unit	Lifting				Lowering			
	No Load		Rated Load		No Load		Rated Load	
	m/sec	ft/min	m/sec	ft/min	m/sec	ft/min	m/sec	ft/min
H16.00XM-12EC	0.56	110	0.52	102	0.47	93	0.49	96
H18.00XM-12EC	0.56	110	0.52	102	0.47	93	0.49	96
H22.00XM-12EC	0.54	106	0.52	102	0.47	93	0.49	96
H400HD-EC	0.56	110	0.52	102	0.47	93	0.49	96
H450HD-EC	0.56	110	0.52	102	0.47	93	0.49	96
H440HDS-EC	0.56	110	0.52	102	0.47	93	0.49	96
H450HDS-EC	0.56	110	0.52	102	0.47	93	0.49	96
H500HD-EC	0.54	106	0.52	102	0.47	93	0.49	96

Steering

Turning Radius		
No Load, Minimum Speed - Average Values, ± 76.2 mm (± 3 in.) Acceptable		
Unit	Outside Radius	Inside Radius
H16.00XM-12EC	5,440 mm (214.20 in.)	2,105 mm (82.90 in.)
H18.00XM-12EC	6,060 mm (238.60 in.)	2,334 mm (91.90 in.)
H22.00XM-12EC	6,060 mm (238.60 in.)	2,334 mm (91.90 in.)
H400HD-EC	5,440 mm (214.20 in.)	2,105 mm (82.90 in.)
H440HDS-EC	5,440 mm (214.20 in.)	2,105 mm (82.90 in.)
H450HD-EC	6,060 mm (238.60 in.)	2,334 mm (91.90 in.)
H450HDS-EC	5,440 mm (214.20 in.)	2,105 mm (82.90 in.)
H500HD-EC	6,060 mm (238.60 in.)	2,334 mm (91.90 in.)

Tire Sizes

Model	Size				Pressure
	Steer		Drive		
	12.00-24	14.00-24	12.00-24	14.00-24	
H16.00XM-12EC	X	Option	X	Option	10 bar (145 psi)
H18.00XM-12EC	X	Option	X	Option	
H22.00XM-12EC		X		X	
H400HD-EC	X	Option	X	Option	
H440HDS-EC	X	Option	X	Option	
H450HD-EC	X	Option	X	Option	
H450HDS-EC	X	Option	X	Option	
H500HD-EC		X		X	
NOTE: Tires are available in Pneumatic or Pneumatic-shaped solid. X = Standard					

Hydraulic System Specifications

Item	Specification
Hydraulic Pumps Output @ 2200 rpm (Governed speed-no load)	
Cummins 142 HP (190 KW)/164 HP (220 KW) Engine	
Main Control Valve Pump [74 cm ³ (4.51 in. ³) per revolution]	158.9 liter/min (41.95 gal/min)
Steering Pump [54 cm ³ (3.30 in. ³) per revolution]	115.95 liter/min (30.61 gal/min)
Brake Pump [23 cm ³ (1.40 in. ³) per revolution]	49.39 liter/min (13.04 gal/min)
Relief Valve (approximate operating pressure)	
Main Control Valve	
Lift Relief Valve Pressure	26.0 MPa (3771 psi)
Tilt Relief Valve Pressure	18.9 MPa (2741 psi)
Auxiliary Relief Valve Pressure	18.9 MPa (2741 psi)
Tilt Control Valves	14.0 MPa (2030 psi)
Service Brake Circuit	10.3 to 11.03 MPa (1494 to 1600 psi)
Steering Circuit	16.5 to 17.5 MPa (2393 to 2538 psi)
Container Attachment	14.0 MPa (2030 psi)
Power Pile Slope Circuit	21.0 MPa (3046 psi)
Twist Lock Circuit	8.3 MPa (1204 psi)
Sideshift Circuit	12.4 MPa (1798 psi)
Extend/Retract Circuit	8.6 MPa (1247 psi)
Check Port Pressures	
P1 - Steering Circuit	16.5 to 17.5 MPa (2393 to 2538 psi)
X1 - Lift/Lower Circuit	26 ±0.350 MPa (3771 ±50 psi)
X2 - Tilt/Auxiliary Circuit	18.9 ±0.350 MPa (2741 ±50 psi)
X2 - Lift/Lower Circuit	26 ±0.350 MPa (3771 ±50 psi)
X3 - Accumulator Charge Valve (lower limits)	12.25 ±0.6125 MPa (1777 ±89 psi)
X3 - Accumulator Charge Valve (upper limits)	17.5 ±0.175 MPa (2538 ±25 psi)
XB - Service Brake Pressure at 2200 rpm	10.3 to 11.03 MPa (1494 to 1600 psi)
Main Return Line Filter	
Bypass Pressure	300 kPa (43.5 psi)
Brake Filter	
Bypass Pressure	100 kPa (14.5 psi)

Torque Specifications

MAIN CONTROL VALVE

Main Control Valve Fastening Bolts

225 N•m (166 lbf ft)

Relief Valve

65 N•m (48 lbf ft)

Mounting Nut (Small)

65 N•m (48 lbf ft)

Mounting Nut (Large)

100 N•m (74 lbf ft)

ENGINE

Mounting Capscrews (Bracket Mount to Engine)

108 N•m (80 lbf ft)

Mounting Capscrews (Engine Bracket to Frame)

165 N•m (122 lbf ft)

For torque instructions for the Cummins 6.7 liter (409 in.³) diesel engine, contact your local **Hyster** dealer or see **Hyster Hypass Online**.

ELECTRICAL SYSTEM

Alternator

Shaft Nut

95 to 108 N•m (70 to 80 lbf ft)

Mount Nut

81 to 95 N•m (60 to 70 lbf ft)

Battery (B+) Terminal

9.0 to 13.6 N•m (80 to 120 lbf in)

Indicator (I) Terminal

1.7 to 2.8 N•m (15 to 25 lbf in)

Ground (B-) Terminal

5.6 to 6.8 N•m (50 to 60 lbf in)

COUNTERWEIGHT

Capscrews (Top)

1100 N•m (811 lbf ft)

Capscrews (Rear)

1100 N•m (811 lbf ft)

DRIVE AXLE

Mounting Capscrews

1050 to 1150 N•m (774 to 848 lbf ft)

PLANETARY GEAR AXLE

Lock Plate Capscrews

81 to 102 N•m (60 to 75 lbf ft)

Cover Capscrews

115 to 156 N•m (85 to 115 lbf ft)

STEERING AXLE

Mounting Capscrews

580 N•m (430 lbf ft)

WHEEL BEARING ADJUSTING NUT (PRC1756-W3H)**Initial Torque**

542 N•m (400 lbf ft)

Final Torque

474 N•m (350 lbf ft)

DIFFERENTIAL

Refer to the section **Differential** 1400 SRM 46.

TRANSMISSION

Refer to the section **Transmission Operation and Diagnostics, (TE13 and TE17)** 1300 SRM 1271.

TORQUE CONVERTER

Refer to the section **Transmission Operation and Diagnostics, (TE13 and TE17)** 1300 SRM 1271.

STEERING

Steering Shaft Nut for Steering Wheel

35 to 45 N•m (26 to 33 lbf ft)

Block of Steering Control Unit

40 N•m (30 lbf ft)

Cover of Steering Control Unit (Bottom)

Initial Torque 17 N•m (150 lbf in)

Final Torque 30 N•m (265 lbf in)

WHEEL NUTS

Drive Wheels (Final Torque Value)

640 to 680 N•m (472 to 502 lbf ft)

Steer Wheels (Final Torque Value)

640 to 680 N•m (472 to 502 lbf ft)

ATTACHMENT

Load Roller Retainer Capscrews

66 N•m (49 lbf ft)

Carriage Bearing Block Bracket to Carriage

66 N•m (49 lbf ft)

Differential Repair

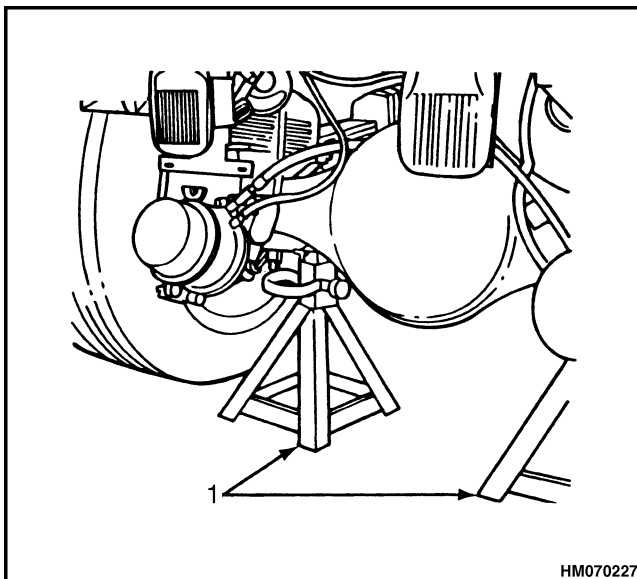
REMOVE

NOTE: The repair procedures cover all units unless otherwise indicated.

Differential Carrier From Axle Housing, Remove

NOTE: The differential assembly can normally be removed without removing the drive axle. On some trucks, including the H7.00-12.50H (H150-275H), the drive axle must be removed to remove the differential assembly. If removal of the drive axle is necessary, see the **Drive Axle** service manual for your lift truck model.

1. Remove the mast. See the **Mast** service manual for your lift truck model for the removal procedures.
2. Raise the end of the vehicle where the axle is mounted. Use a jack or other lifting tool, and place safety stands under each side of the axle. See Figure 2.



1. SAFETY STANDS

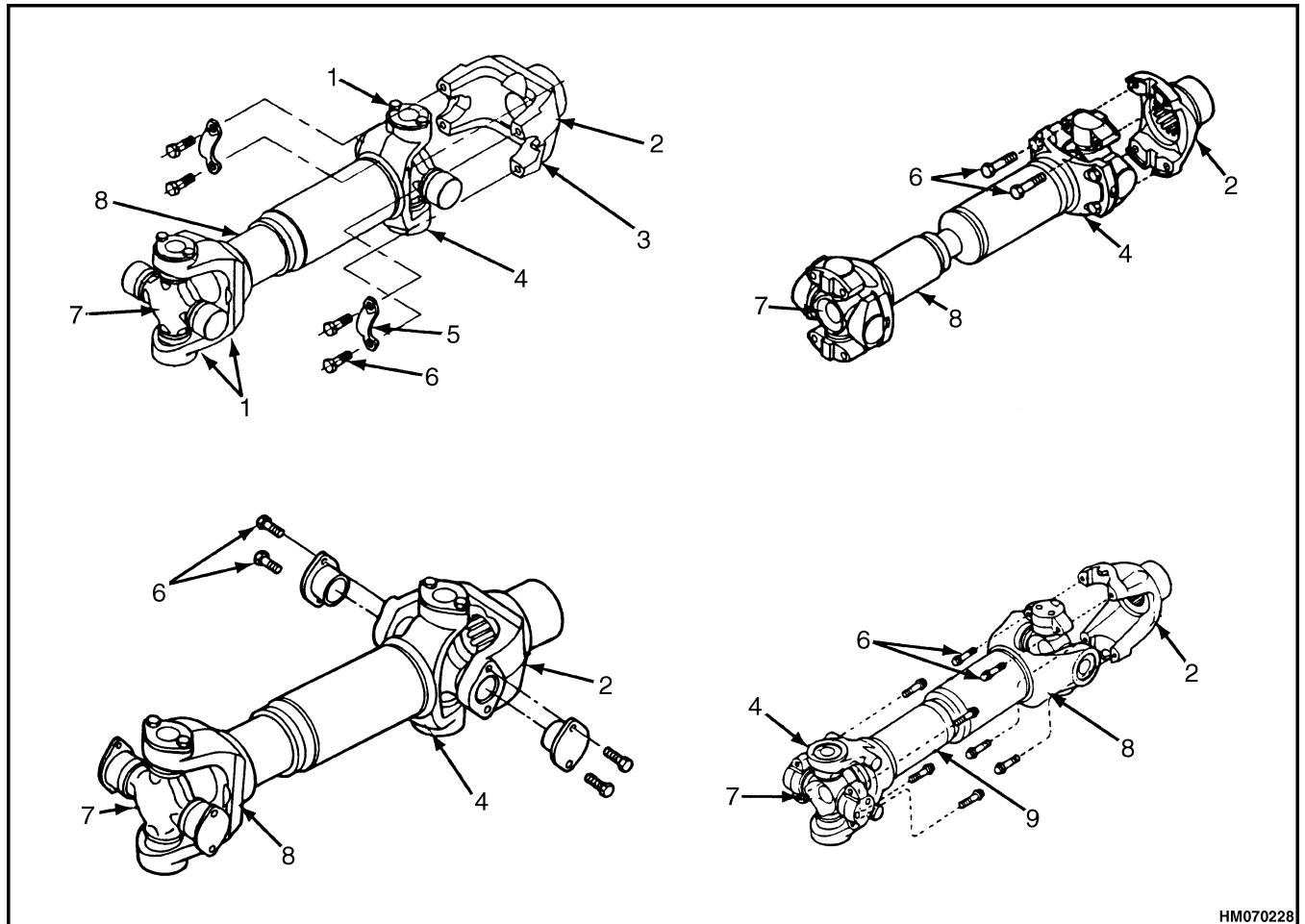
Figure 2. Lift Truck Support



WARNING

Block the wheels to prevent the lift truck from moving. Support the lift truck with safety stands. DO NOT work under a lift truck supported only by jacks. Jacks can slip and fall over. Serious personal injury can result.

3. Place jack stands under each spring seat of the axle, to hold the lift truck in the raised position.
4. Remove plug from the bottom of the axle housing and drain the oil from the axle assembly.
5. Disconnect the drive shaft at the differential. If a speed reducer or gear box is installed, remove the speed reducer or gear box.
6. Some units have a drum or disc brake attached to the output yoke. Disconnect any brake linkage or brake lines. See the **Brake** manual for your unit.
7. Disconnect the driveline universal joint from the pinion input yoke or flange on the differential carrier. See Figure 3.

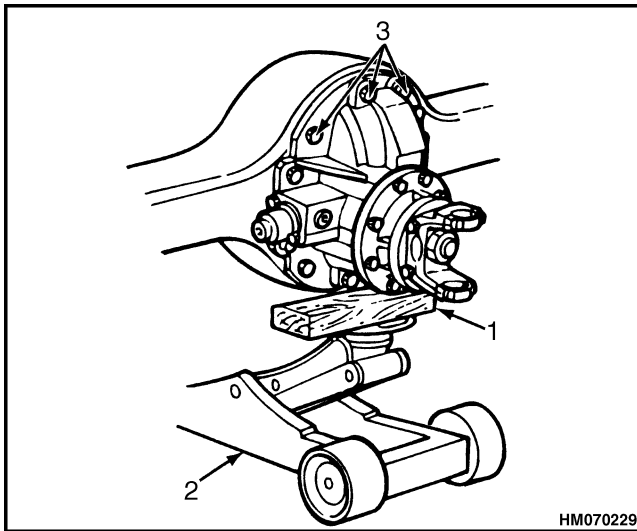


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- | | | |
|-----------------|------------------|------------------|
| 1. BEARING CUPS | 4. WELD YOKE | 7. U-JOINT CROSS |
| 2. END YOKE | 5. BEARING STRAP | 8. SLIP YOKE |
| 3. YOKE SADDLE | 6. CAPSCREWS | 9. TUBING |

Figure 3. Typical Driveline Universal Joint

8. Remove the axle shafts from the axle housing. See the **Drive Axle** manual for your model of lift truck for the procedures.
 - a. On Straddle Trucks™, disconnect the drive axle universal joints at the differential yokes. Remove the capscrews that fasten the bearing retainers to the differential housing. Pull the yoke, stub shaft and bearing retainer from the housing.
9. Place a transmission jack under the differential carrier for support. See Figure 4.



1. WOOD BLOCK
2. TRANSMISSION JACK
3. CAPSCREWS

Figure 4. Differential Carrier Support

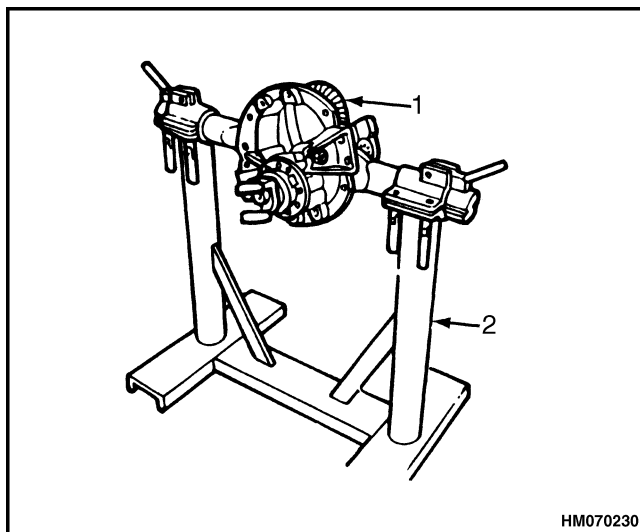
10. Remove all but the top two differential carrier housing capscrews. See Figure 4.
11. Loosen the top two differential carrier housing capscrews and leave them attached to the assembly. The capscrews will hold the differential carrier in the housing.
12. Loosen the differential carrier in the axle housing. Use a leather mallet to hit the mounting flange of the differential carrier at several points.
13. After the differential carrier is loosened, remove the top two capscrews.



CAUTION

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

14. Remove the differential carrier from the axle housing. Use a pry bar with a round end, to help remove differential carrier from housing.
15. Remove the differential carrier assembly from under the lift truck.
16. Use a lifting device and lift the differential carrier by the input yoke or flange and place the assembly on a repair stand. See Figure 5.



1. DIFFERENTIAL CARRIER
2. REPAIR STAND

Figure 5. Differential Carrier Stand

Differential and Ring Gear From Differential Carrier, Remove

NOTE: Some of the parts described below are not found on some differential carrier models. See Figure 1.

NOTE: Before working on the differential carrier, inspect the hypoid gear set for damage. If inspection shows no damage, the same gear set can be used again. Measure the backlash of the gear set and make a record of the dimension. See the section Ring Gear Backlash, Adjust. During differential re-assembly, adjust the backlash to the original recorded dimension when the gear set is installed into the differential carrier.

1. Loosen the jam nuts on the thrust screw.
2. Remove the thrust screw and jam nut from the differential carrier. See Figure 6.

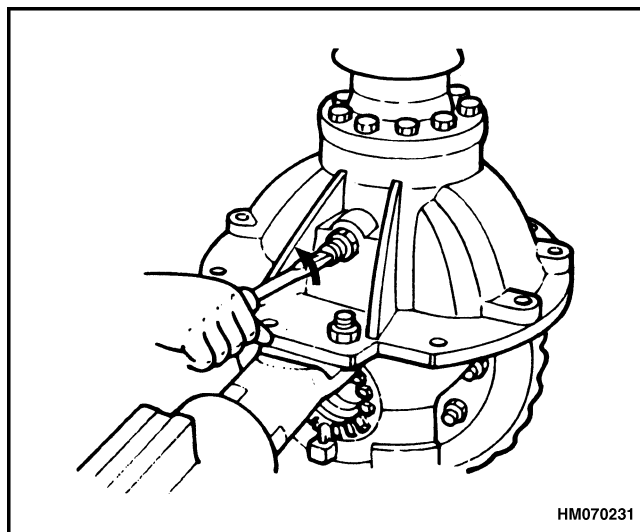
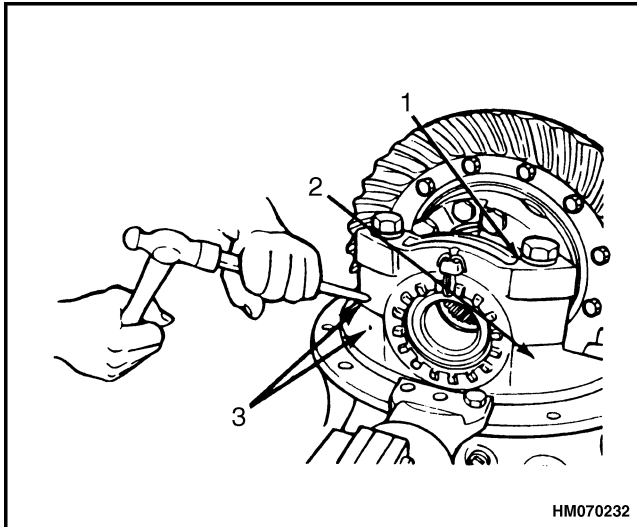


Figure 6. Thrust Screw and Jam Nut Removal

3. Rotate the differential carrier until the ring gear is at the top of the assembly.
4. Mark one differential carrier leg and bearing cap to correctly match the parts during differential carrier assembly. Mark the parts using a center punch and hammer. See Figure 7.

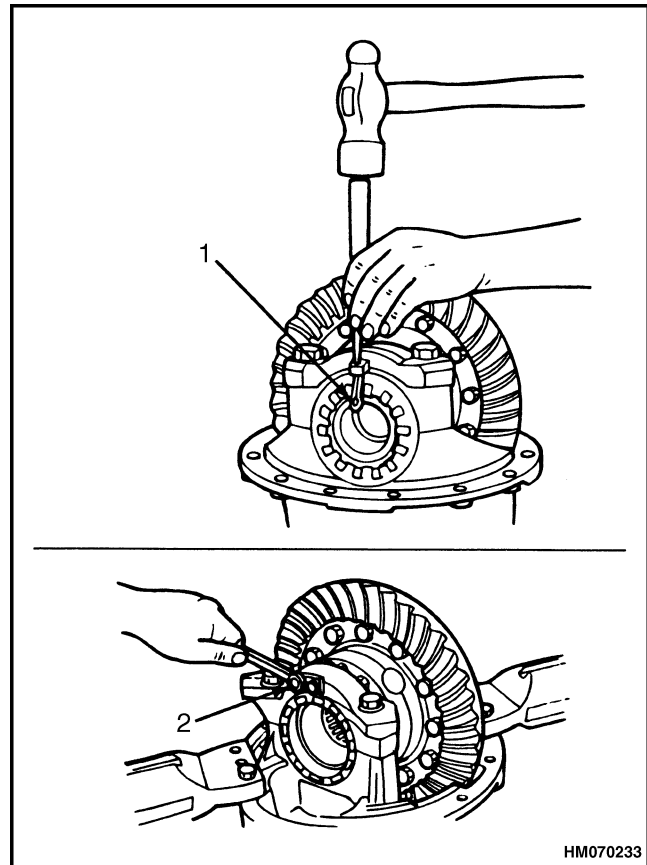


1. BEARING CAP
2. DIFFERENTIAL CARRIER LEG
3. MATCHMARKS

Figure 7. Mark Differential Carrier Leg and Bearing Cap

5. Remove the cotter pins that hold the bearing adjusting rings in position. Some differential carrier models have dowel pins or lock plates holding the bearing adjusting rings in position. Each lock plate is held in position by two cap-screws. See Figure 8.

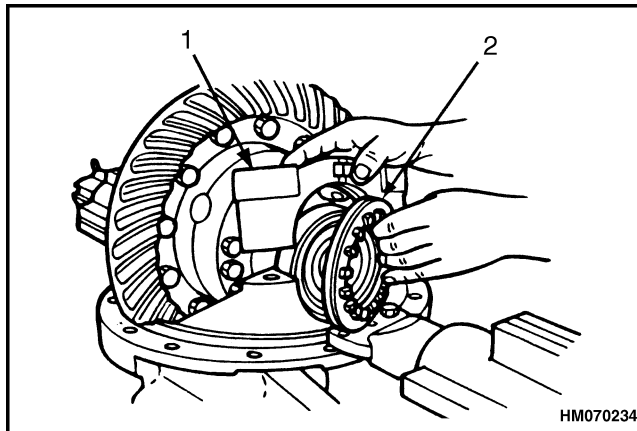
6. Remove capscrews and washers holding the two bearing caps on the differential carrier. See Figure 8.



1. COTTER PIN
2. LOCK PLATE

Figure 8. Bearing Adjusting Ring Removal

7. Remove the bearing caps and bearing adjusting rings from the differential carrier. See Figure 9.



1. BEARING CAP
2. BEARING ADJUSTING RING

Figure 9. Bearing Cap Removal

8. Use a lifting device and lift the main differential and ring gear assembly from the differential carrier. See Figure 10.

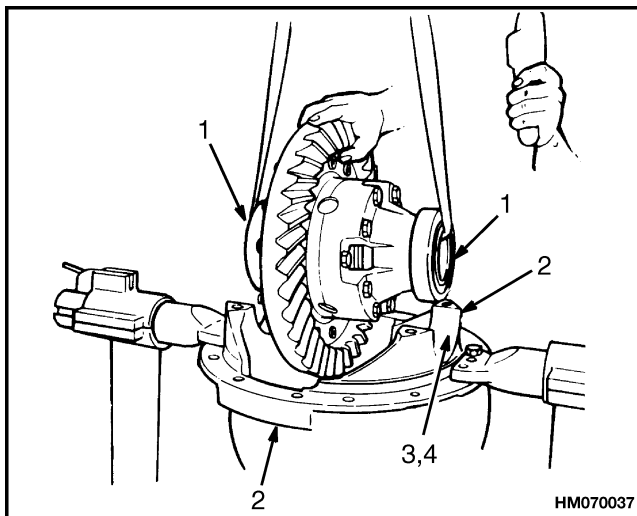


Figure 10. Main Differential and Ring Gear Assembly Removal

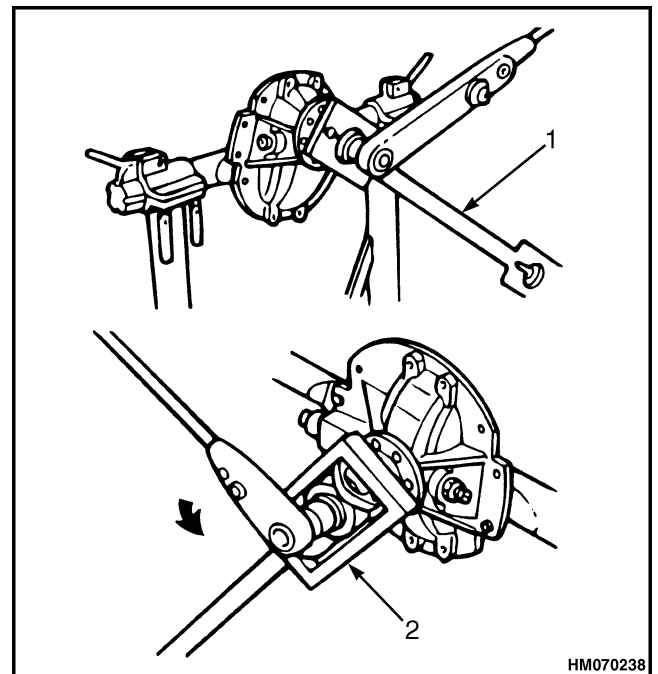
Legend for Figure 10

1. BEARING CUP
2. DIFFERENTIAL CARRIER
3. BEARING BORE
4. PUT ADHESIVE HERE (INSTALLATION ONLY)

Drive Pinion and Pinion Carrier From Differential Carrier, Remove

NOTE: Some of the parts described below are not found on some differential carrier models. See Figure 1.

1. Fasten a yoke or flange bar to the input yoke or flange. When the nut is removed, the bar will hold the drive pinion in position. See Figure 11.
2. Remove the nut and washer from the drive pinion.
3. Remove the yoke or flange bar.



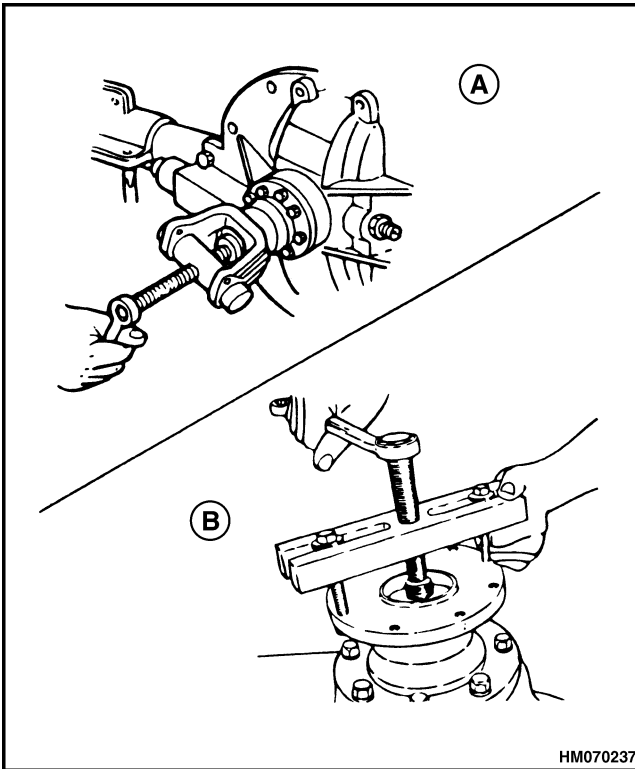
1. FLANGE BAR
2. YOKE BAR

Figure 11. Flange and Yoke Bar

**CAUTION**

Do not use a hammer or mallet to loosen and remove the yoke or flange. A hammer or mallet can damage the parts and cause driveline runout or driveline imbalance problems after carrier to driveline assembly.

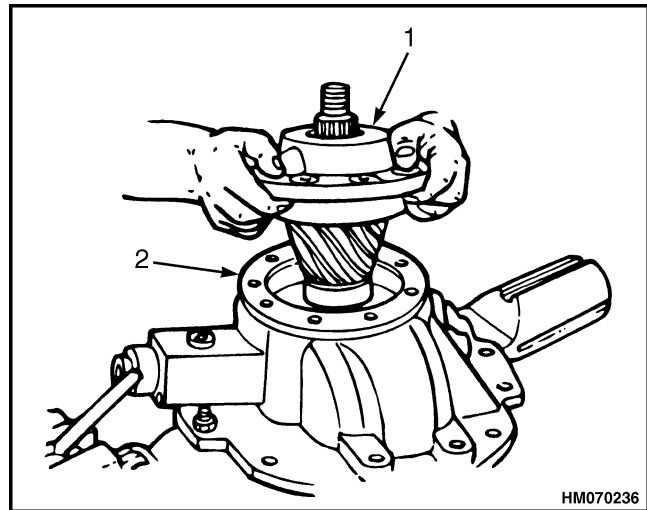
4. Remove the yoke or flange from the drive pinion. If the yoke or flange is tight on the pinion, use a puller for removal. See Figure 12.



- A. YOKE PULLER
- B. FLANGE PULLER

Figure 12. Yoke and Flange Puller Tools

5. Remove the capscrews and washers that hold the pinion carrier in the differential carrier. See Figure 13.



1. DRIVE PINION AND PINION CARRIER
2. SHIMS
3. CAPSCREWS

Figure 13. Pinion Carrier Removal

**WARNING**

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

**CAUTION**

Do not use a pry bar to remove the pinion carrier from the carrier. A pry bar can damage the bearing case, shims, and differential carrier.

6. Remove the drive pinion, pinion carrier, and shims from the differential carrier. See Figure 13. If the pinion carrier is tight on the differential carrier, hit the pinion carrier at several points around the flange area with a leather, plastic or rubber mallet.
7. Inspect the shims. If they are in good condition, keep the shims together for use during differential carrier assembly.
8. If the shims are to be replaced, first measure the total thickness of the pack. Make a note of the dimension. The dimension will be needed to calculate the depth of the drive pinion in the differential carrier when the gear set is installed.

DISASSEMBLE

Differential and Ring Gear Assembly, Disassemble

NOTE: Some of the parts described below are not found on some differential carrier models. See Figure 1.

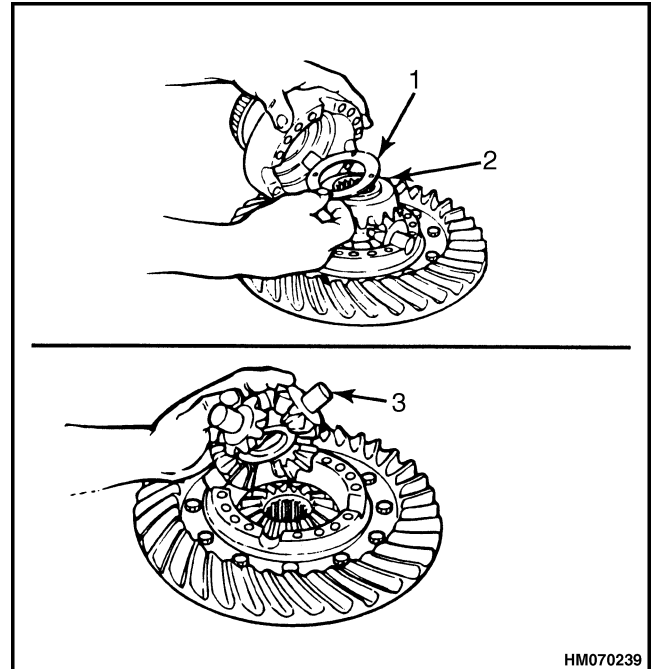
NOTE: Make sure there are matching marks on the case halves of the differential assembly. See Step 4 in the section Differential and Ring Gear Assembly, From Differential Carrier, Remove. See Figure 7.



WARNING

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

1. Remove the capscrews and washers that hold the case halves together and separate the case halves. If necessary, use a brass, plastic, or leather mallet to loosen the parts.
2. Remove the differential spider, four pinion gears, two side gears, and six thrust washers from inside the case halves. See Figure 14.



1. THRUST WASHER
2. SIDE GEAR
3. SPIDER, PINIONS, AND THRUST WASHERS

Figure 14. Ring Gear Disassembly

3. If the ring gear needs to be replaced, remove bolts, nuts, and washers holding the ring gear to the flange case half.

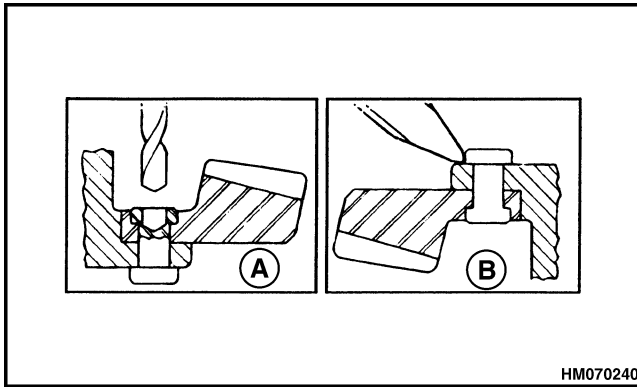


CAUTION

Do not remove the rivets or rivet heads with a chisel and hammer. Using a flat edge tool can cause damage to the flange case. See Figure 15.

4. If your differential model uses rivets to hold the ring gear to the flange case half, remove the rivets as follows:
 - a. Center punch each rivet head in the center, on the ring gear side of the assembly.

- b. Drill each rivet head on the ring gear side of the assembly to a depth equal to the thickness of one rivet head. Use a drill bit that is 1/32 of an inch smaller than the body diameter of the rivets. See Figure 15.
- c. Press the rivets through holes in the ring gear and flange case half. Press from the drilled rivet head.



- A. CORRECT DRILLING RIVETS FROM HEAD
- B. WRONG CHISELING RIVETS FROM HEAD

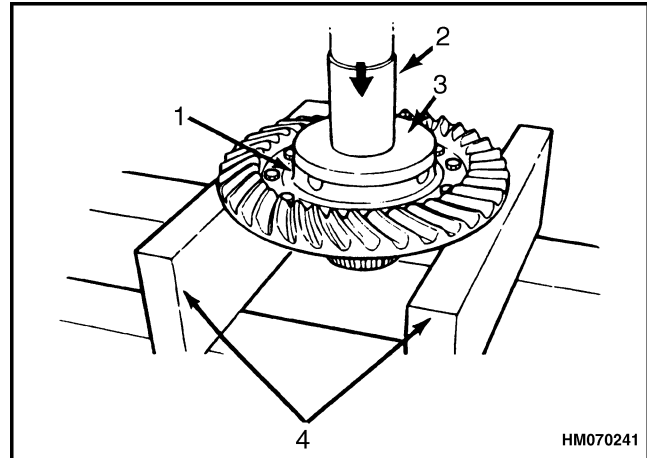
Figure 15. Rivet Removal



WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

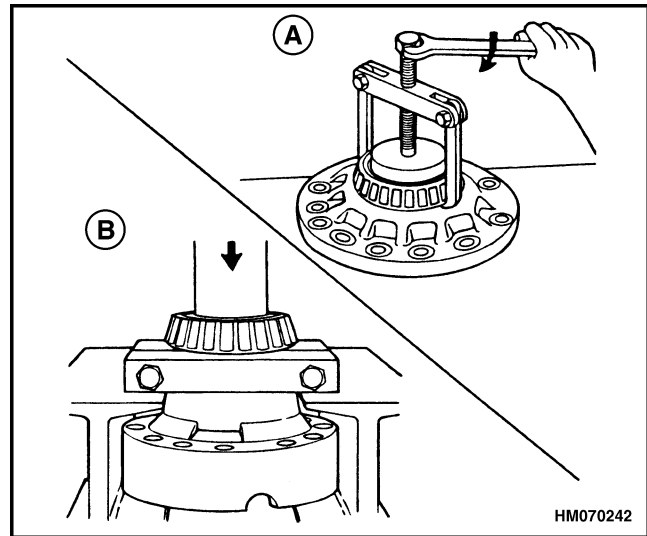
5. Separate the case half and ring gear using a press. Support the assembly under the ring gear with metal or wood blocks and press the case half through the gear. See Figure 16.



1. CASE HALF
2. PRESS
3. PLATE
4. SUPPORTS

Figure 16. Case Half and Ring Gear Separation

6. If the differential bearings need to be replaced, remove the bearing cones from the case halves. Use a bearing puller or press. See Figure 17.



- A. PULLER
- B. PRESS

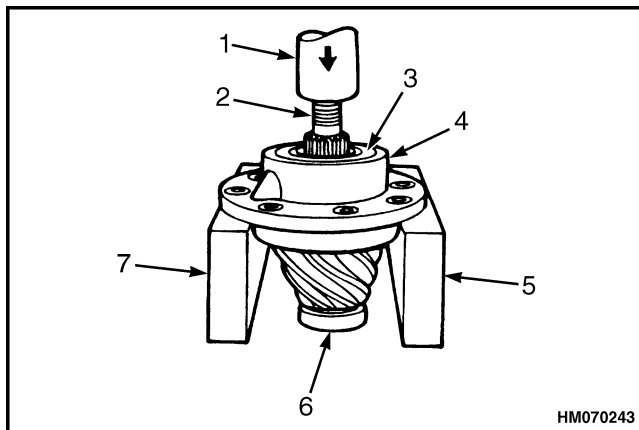
Figure 17. Differential Bearings Replacement

Drive Pinion and Pinion Carrier, Disassemble**WARNING**

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

NOTE: Some of the parts described below are not found on some differential carrier models. See Figure 1.

1. Place drive pinion and pinion carrier in a press. The pinion shaft must be toward the top of the assembly. Add supports for the pinion carrier under the flange area. See Figure 18.
2. Press the drive pinion through the pinion carrier. See Figure 18.



- | | |
|-------------------|-------------------|
| 1. PRESS | 5. SUPPORT |
| 2. DRIVE PINION | 6. SPIGOT BEARING |
| 3. OIL SEAL | 7. FLANGE SUPPORT |
| 4. PINION CARRIER | |

Figure 18. Drive Pinion Disassembly

**WARNING**

Use a brass or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

NOTE: The inner bearing cone and bearing spacer will remain on the pinion shaft. See Figure 19.

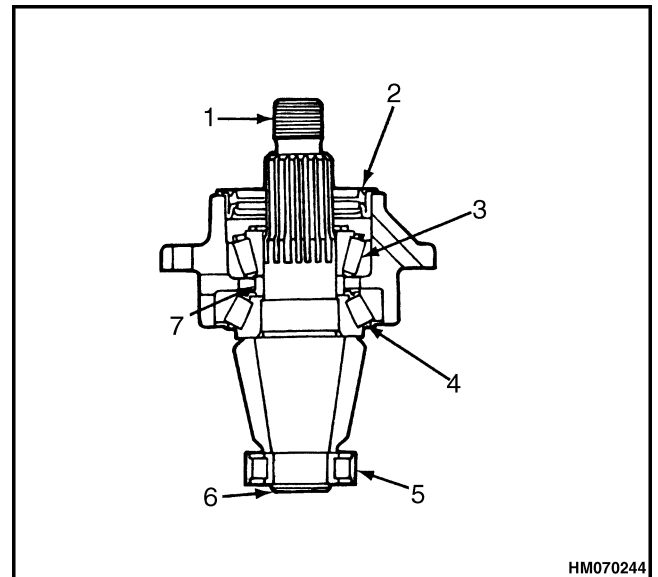
3. If a press is not available, use a leather, plastic or rubber mallet to drive the pinion through the pinion carrier.

**CAUTION**

When removing the oil seal, Do not damage the wall of the bore. Damage to the bore wall can result in oil leaks.

NOTE: Always replace the oil seal with a new seal during reassembly.

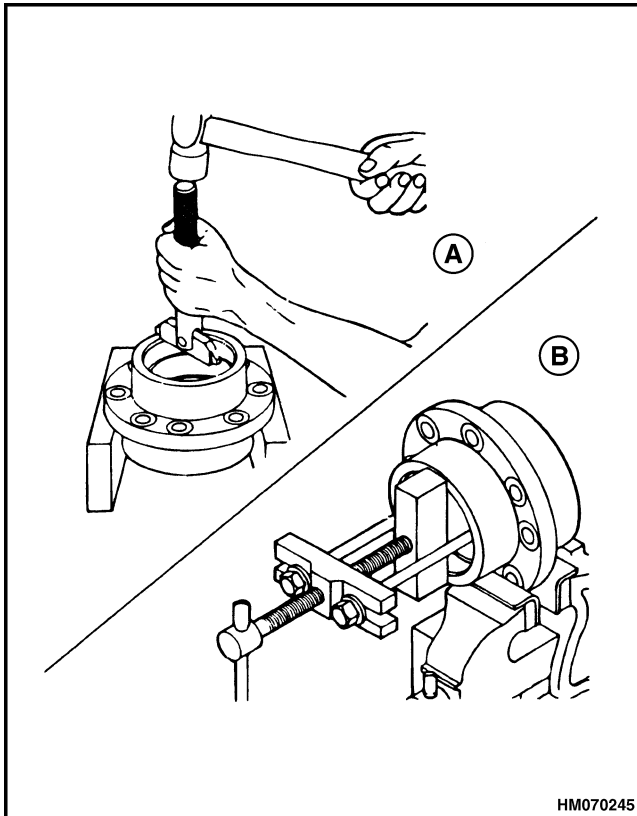
4. Remove the oil seal from the pinion carrier. See Figure 19.



1. DRIVE PINION
2. OIL SEAL
3. OUTER BEARING (CUP AND CONE)
4. INNER BEARING (CUP AND CONE)
5. SPIGOT BEARING
6. SNAP RING
7. BEARING SPACER

Figure 19. Drive Pinion

5. Inspect the pinion bearings and replace if necessary. If the pinion bearings need to be replaced, perform the following:
 - a. Remove the inner and outer bearing cups from the inside of the cage. Use either a press and sleeve, bearing puller, or a small drift pin. See Figure 17 and Figure 20. If a press is used, provide support for the pinion carrier under the flange area with metal or wood blocks.



A. BEARING DRIVER B. BEARING PULLER

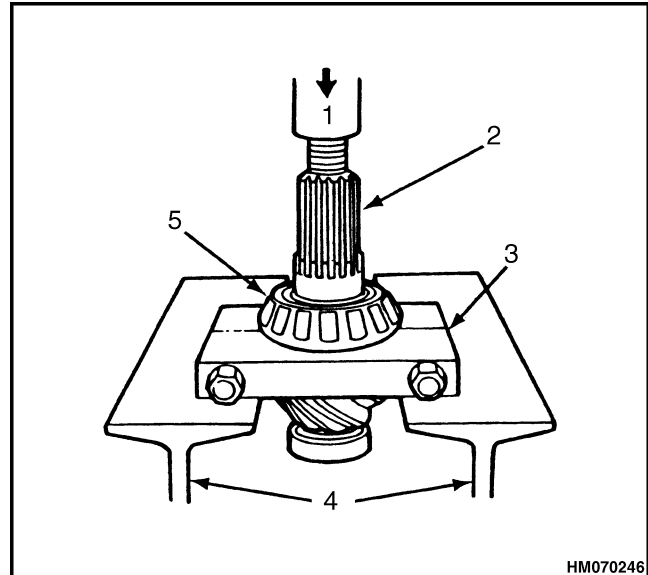
Figure 20. Pinion Bearing Replacement



CAUTION

The puller must fit under the inner race of the cone to remove the cone correctly without damage.

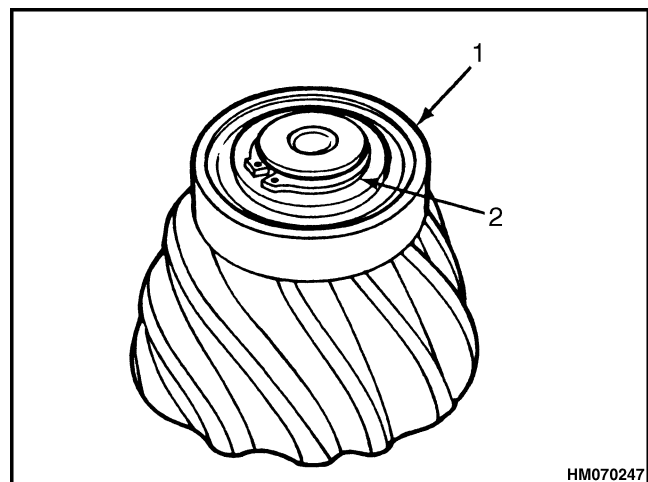
- b. Remove the inner bearing cone from the drive pinion with a press or bearing puller. See Figure 21.



1. PRESS
2. DRIVE PINION
3. BEARING PULLER
4. SUPPORTS
5. INNER BEARING CONE

Figure 21. Pinion Bearing Replacement

6. If the spigot bearing needs to be replaced, place the drive pinion in a vise. Install a soft metal cover over each vise jaw to protect the drive pinion.
7. Remove the snap ring from the end of the drive pinion. See Figure 22.



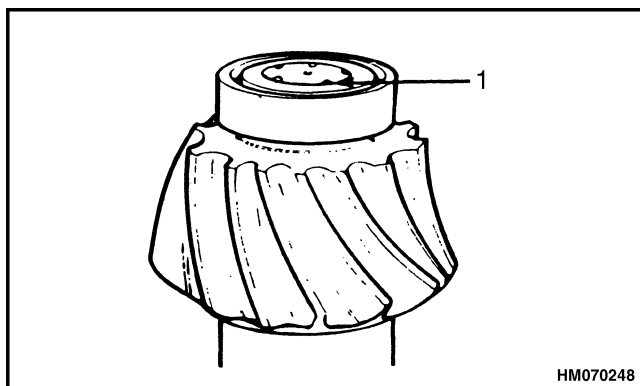
1. SPIGOT BEARING 2. SNAP RING

Figure 22. Snap Ring Removal

NOTE: Some spigot bearings are fastened to the drive pinion with a special peening tool. See Figure 23.

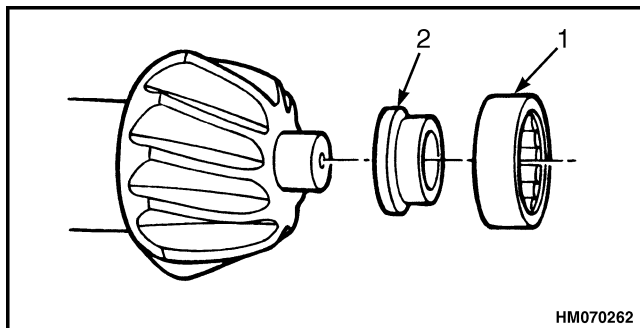
NOTE: Some spigot bearings are a two-piece assembly. Remove the inner race from the pinion with a bearing puller. Remove the outer race/roller assembly from the pinion carrier with a drift or a press. See Figure 24.

8. Remove the spigot bearing from the drive pinion with a bearing puller.



1. PEENING POINTS

Figure 23. Spigot Bearing Peening Points



1. REMOVE OUTER RACE AND ROLLER ASSEMBLY FROM CARRIER
2. REMOVE INNER RACE FROM PINION

Figure 24. Two-Piece Spigot Bearing

CLEAN AND INSPECT



WARNING

Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the recommendations of the manufacturer.

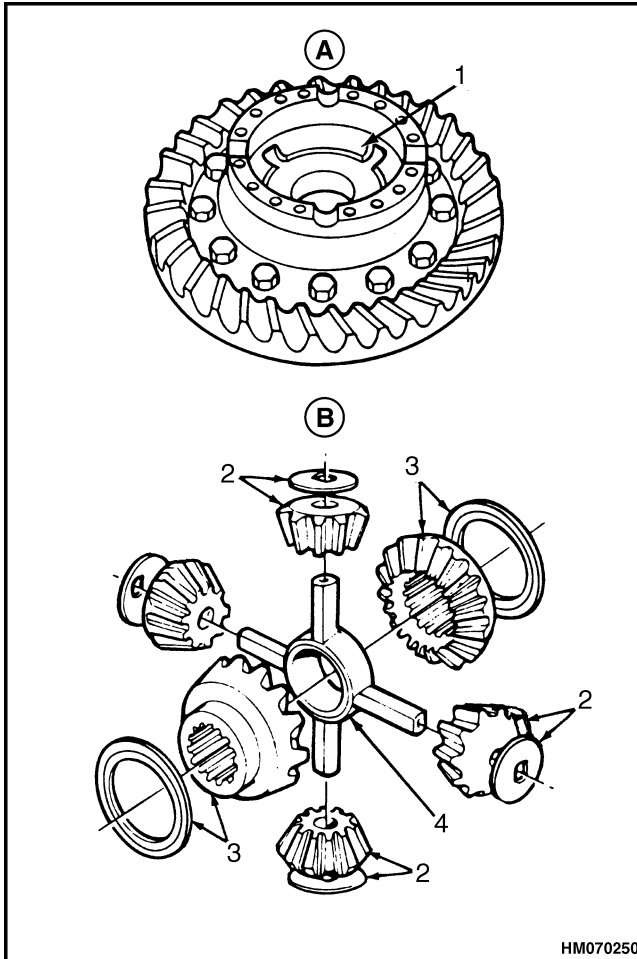


WARNING

Compressed air can move particles so that they cause injury to the user or to other personnel. Make sure that the path of the compressed air is away from all personnel. Wear protective goggles or a face shield to prevent injury to the eyes.

Clean and inspect the following parts of the differential:

- **Yoke**
 - Clean the surface of the yoke journal with a cleaning solvent and inspect the original yoke seal surface for any grooves.
- **Drive Axle**
 - Clean the parts of the axle with solvent and dry with compressed air. Inspect all machined surfaces and bearings for wear and damage.
- **Tapered Roller Bearings**
 - Inspect the cup, cone, rollers, and cage of all tapered roller bearings in the assembly. If bearings show signs of wear, cracks, or damage, replace with new bearing.
- **Pinions and Gears**
 - Inspect the pinions and gears for wear or damage. Gears that are worn or damaged must be replaced.
- **Axle Shafts**
 - Inspect the axle shafts for wear and cracks at the flange, shaft and splines. If axle shafts show signs of wear or damage, replace the axle shafts.
- **Main Differential Assembly**
 - Inspect all parts of the main differential assembly for wear or damage. Parts that are damaged must be replaced. See Figure 25 for parts to inspect.



A. DIFFERENTIAL CASE HALVES
B. DIFFERENTIAL GEAR NEST ASSEMBLY

1. INSPECT INSIDE SURFACES
2. PINION AND THRUST WASHER
3. SIDE GEAR AND THRUST WASHER
4. SPIDER

Figure 25. Main Differential Assembly Inspection

ASSEMBLE

Pinion, Bearings, and Pinion Carrier, Assemble

NOTE: Some of the parts described below are not found on some differential carrier models. See Figure 1.

1. Put differential oil on the bearings and cups. Install the cups in the pinion carrier. See Figure 1.

2. Install the inner bearing and spigot bearing against the pinion shoulders. Use a sleeve and press to push against the inner bearing race.



CAUTION

If a new pinion is installed, a new ring gear must also be installed. The pinion and ring gear are a set (see Figure 32) and must be installed together.

NOTE: During assembly at the factory, one spacer is used. Two thinner spacers are used if the pinion or bearings are replaced. These spacers are selected for correct bearing preload.

NOTE: Some spigot bearings are fastened to the pinion with a snap ring, and some are fastened with a punch. Others can have a two-piece bearing. See Figure 24.

3. Install the spigot bearing washer and snap ring. Put the pinion assembly in the pinion carrier. Install the spacers on the pinion. See Figure 19.
4. Use a press to install the outer bearing against the spacer. Rotate the carrier to make sure the bearings are installed correctly.
5. Use either the Press Method or the Yoke or Flange Method, and apply the correct preload. See Specifications, Table 6. Check the bearing preload as described in Pinion Bearings, Adjust Preload of this section.

Pinion Bearings, Adjust Preload

Press Method



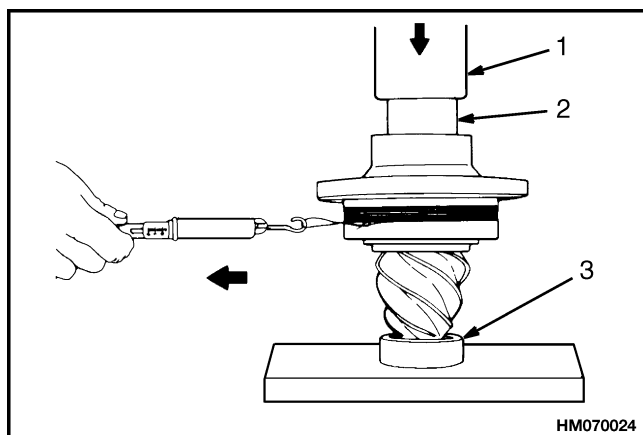
WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

NOTE: If a press is not available, or the press does not have a pressure gauge, use the Yoke or Flange Method to adjust pinion bearing preload.

1. Place the drive pinion and carrier assembly in a press with the gear head (teeth) toward the bottom.
2. Install a sleeve of the correct size against the inner race of the outer bearing. See Figure 19.

3. Apply and hold the correct amount of pressure to the pinion bearings. See Specifications, Table 6. As pressure is applied, rotate the pinion carrier several times so that the bearings make normal contact.
4. While pressure is held against the assembly, wrap a cord several times around the pinion carrier. Fasten a Newton or pound scale to the cord. See Figure 26.
5. Pull the scale to unwind the cord. Check the reading on the scale as the cord unwinds smoothly. Do not read starting torque. Read only the torque value after the pinion carrier starts to rotate. The starting torque will provide a false reading.



1. PRESS
2. SLEEVE
3. PINION BEARING

Figure 26. Bearing Preload Check



CAUTION

On H7.00-12.50H (H150-275H) trucks, **DO NOT** use the washer that is on the new pinion. Use the thicker spacer (Hyster PN 125277). The threads can be damaged or the nut can loosen if the washer is used.

6. The scale reading must indicate 2.2 to 7.0 kg (5 to 15 lb).

A pinion carrier that has a 76.2 mm (3 in.) radius and a 2.2 kg (5 lb) scale reading is equal to 1.70 N•m (15 lbf in). Select a bearing spacer set for the correct preload. A thinner set will increase the preload. A thicker bearing spacer set will decrease preload.

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

- Pounds pulled $\times$ radius (inches) = lb-in preload.

$$\text{- Preload} \times 0.113 = \text{N} \cdot \text{m preload.}$$

- Kilograms pulled $\times$ radius (cm) = kg-cm lb-in preload

$$\text{- Preload} \times 0.098 = \text{N} \cdot \text{m preload.}$$

OR

EXAMPLES:

- Reading from spring scale = 3.4 kg (7.5 lb).

- Diameter of pinion carrier = 16.8 cm (6.62 in.).

- Radius of pinion carrier = 8.4 cm (3.31 in.).

$$7.5 \text{ lb} \times 3.31 \text{ in} = 24.8 \text{ in-lb preload.}$$

$$\text{Preload} \times 0.113 = 2.8 \text{ N} \cdot \text{m preload.}$$

OR

$$3.4 \text{ kg} \times 8.4 \text{ cm} = 28.6 \text{ kg-cm preload.}$$

$$\text{Preload} \times 0.098 = 2.8 \text{ N} \cdot \text{m preload.}$$

Yoke or Flange Method



WARNING

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.



CAUTION

Do not install tight fit yokes or flanges on shafts using a hammer or mallet. A hammer or mallet will damage the yoke or flange.

NOTE: Use a press to install the yoke or flange.

1. Install the input yoke or flange, nut, and washer on the drive pinion. The yoke or flange must be seated against the outer bearing for proper preload.
2. Temporarily install the drive pinion and pinion carrier assembly into the differential carrier. Do not install shims under the pinion carrier. See Figure 34.

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