

SERVICE REPAIR

MANUAL

Hyster E019 (H13.00XM, H14.00XM, H16.00XM,
H10.00XM-12EC, H12.00XM-12EC Europe) Forklift

HYSTER

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manual**

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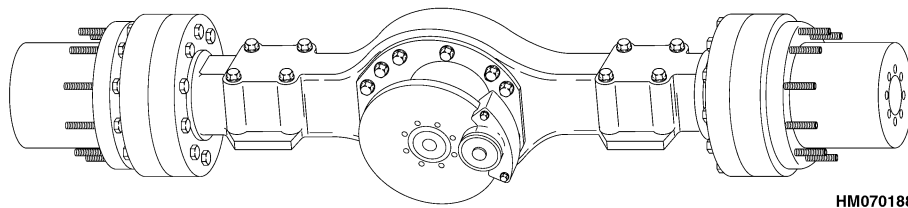
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PLANETARY DRIVE AXLE (WET SYSTEM)

**H8.00-12.00XM
(H170-280HD) [F007, G007, H007];
H13.00-14.00XM
(H300-330HD) [E019, F019, G019];
H16.00XM-6 (H360HD) [E019, F019,
G019]; H10.00-12.00XM-12EC
(H360HD-EC) [E019, F019, G019]**



HM070188

HYSTER

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- **DISCONNECT THE BATTERY CONNECTOR** before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See **HOW TO PUT THE LIFT TRUCK ON BLOCKS** in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a **DO NOT OPERATE** tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

NOTE: The following symbols and words indicate safety information in this manual:



WARNING

Indicates a condition that can cause immediate death or injury!



CAUTION

Indicates a condition that can cause property damage!

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This section is for the following models:

H8.00-12.00XM (H170-280HD) [F007, G007, H007];
H13.00-14.00XM (H300-330HD) [E019, F019, G019];
H16.00XM-6 (H360HD) [E019, F019, G019];
H10.00-12.00XM-12EC (H360HD-EC) [E019, F019, G019]

**"THE
QUALITY
KEEPERS"**

**HYSTER
APPROVED
PARTS**

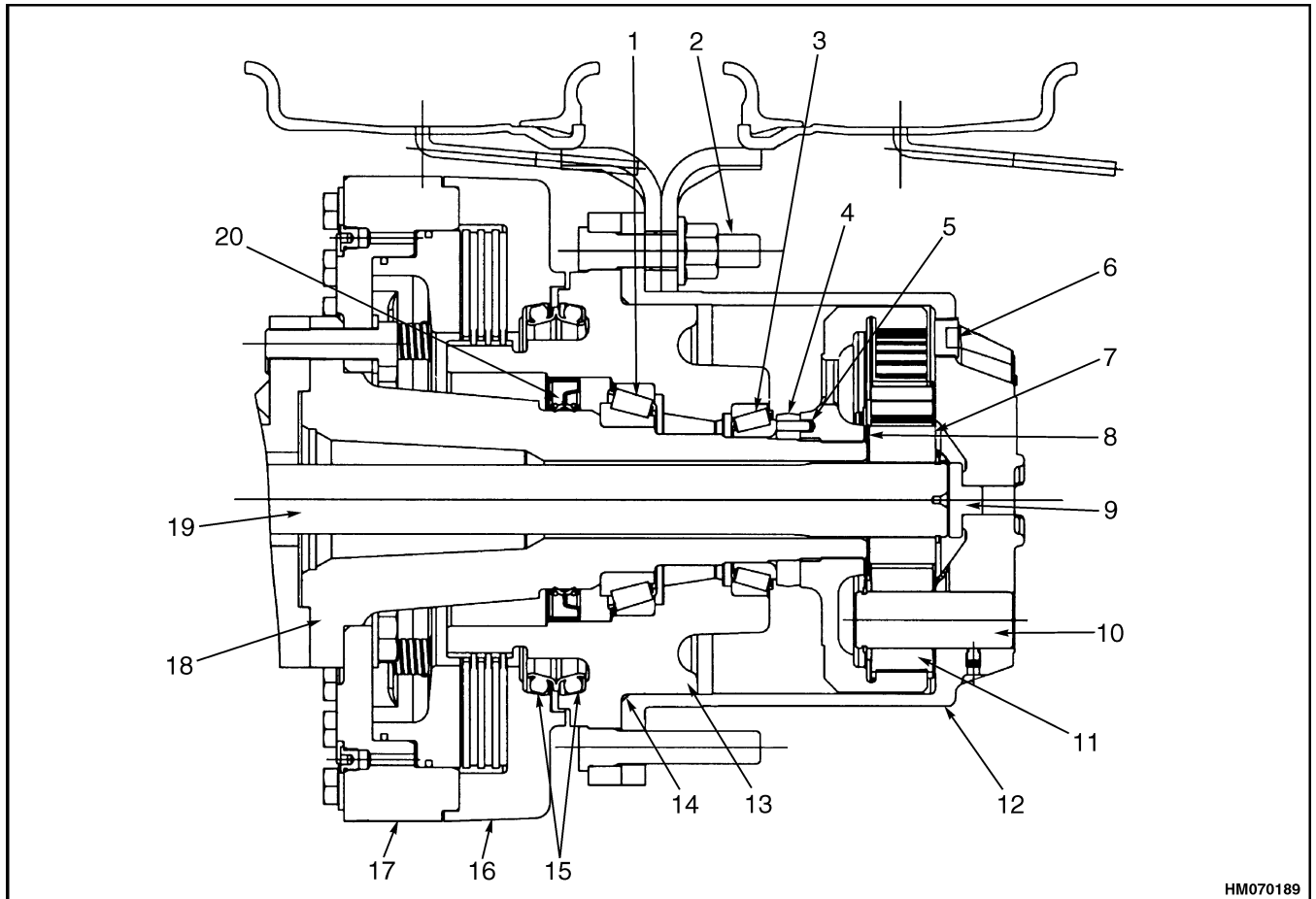
General

This section has a description and the repair procedures for the planetary gear axle.

Description

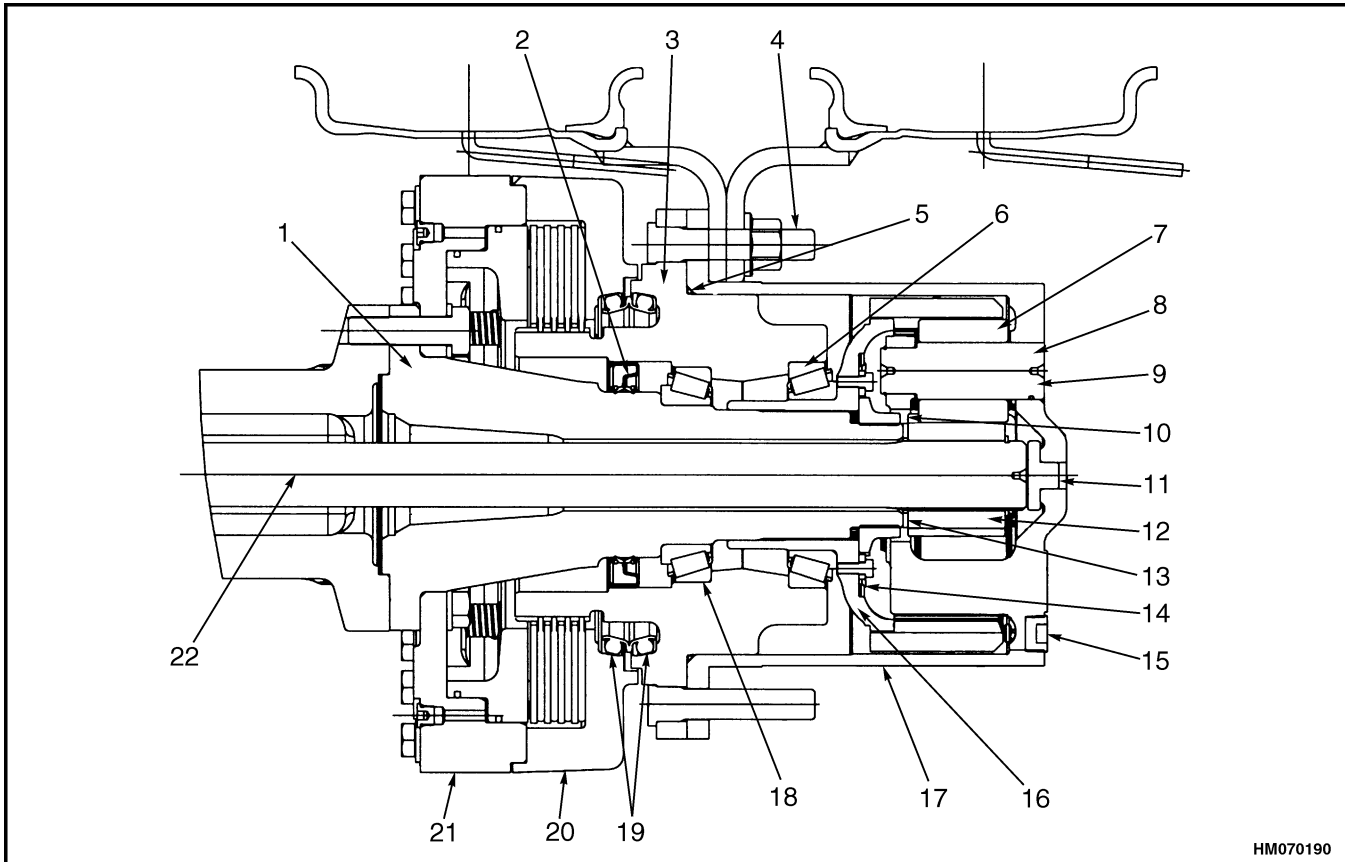
The planetary axles incorporate a single reduction carrier/differential assembly with hypoid gearing. The final reduction is of planetary spur designed gearing built into the wheel hubs. See Figure 1 and

Figure 2. The axles have only cast housings. See Figure 3. See the section **Differential** for your lift truck.



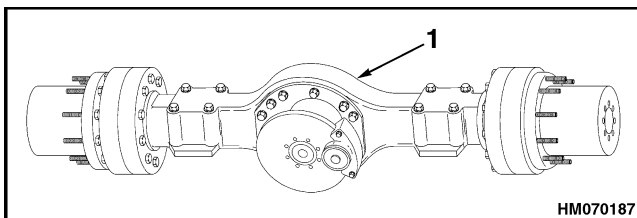
- | | |
|----------------------------|------------------------------|
| 1. INNER BEARING | 11. PLANETARY GEAR |
| 2. WHEEL STUD | 12. PLANETARY SPIDER |
| 3. OUTER BEARING | 13. WHEEL HUB |
| 4. LOCK NUT | 14. O-RING |
| 5. PIN | 15. FACE SEAL |
| 6. MAGNETIC DRAIN PLUG | 16. WET BRAKE DISC HOUSING |
| 7. SUN GEAR | 17. WET BRAKE PISTON HOUSING |
| 8. SUN GEAR THRUST WASHER | 18. SPINDLE |
| 9. THRUST BUTTON | 19. AXLE SHAFT |
| 10. PLANETARY PINION SHAFT | 20. OIL SEAL |

Figure 1. Wheel End Cross Section H8.00-12.00XM (H170-280HD)



- | | |
|---------------------------|------------------------------|
| 1. SPINDLE | 12. SUN GEAR |
| 2. OIL SEAL | 13. SUN GEAR THRUST WASHER |
| 3. WHEEL HUB | 14. LOCK |
| 4. WHEEL STUD | 15. MAGNETIC DRAIN PLUG |
| 5. WHEEL HUB O-RING | 16. RING GEAR HUB |
| 6. OUTER BEARING | 17. PLANETARY SPIDER |
| 7. PLANETARY GEAR | 18. INNER BEARING |
| 8. O-RING | 19. FACE SEAL |
| 9. PLANETARY PINION SHAFT | 20. WET DISC BRAKE HOUSING |
| 10. ADJUSTING NUT | 21. WET BRAKE PISTON HOUSING |
| 11. THRUST BUTTON | 22. AXLE SHAFT |

Figure 2. Wheel End Cross Section H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), and H10.00-12.00XM-12EC (H360HD-EC)



Legend for Figure 3

- 1. PLANETARY DRIVE AXLE HOUSING

Figure 3. Planetary Drive Axle

Operation

The planetary axles permit the hypoid gearing of the carrier and the axle shafts to carry only a nominal torsional load. At the same time, they provide the highest practical numerical gear reduction at the wheels.

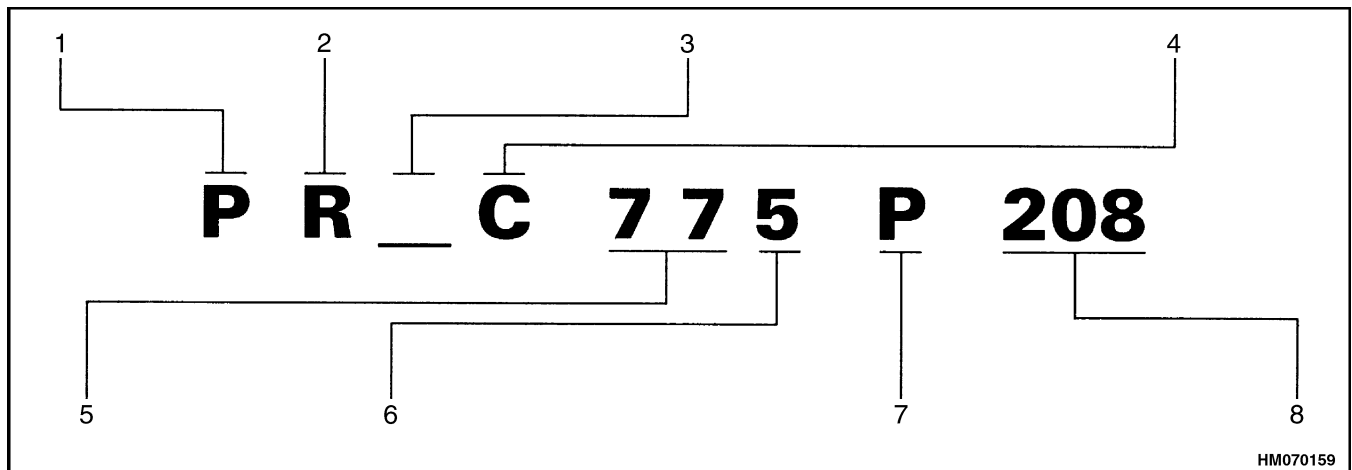
- The hypoid pinion and differential assembly of the first reduction supports the roller bearings.
- A hardened precision spacer between the inner and outer pinion bearings adjusts and maintains the pinion bearing preload.
- The positioning of the threaded adjusting rings in the carrier leg and cap bores adjusts and maintains the differential tapered bearing preload.
- The teeth of the floating sun gear mesh with the teeth of the planetary spur gears.
- The planetary gears rotate on planetary shafts that are mounted on a spider. The planetary gear teeth

in turn mesh with the teeth of the floating ring gear.

- The hypoid gear set in the carrier transmits power to the axle shafts and the sun gear of the final reduction, through the revolving planetary gears, and into the planetary spider.
- The planetary wheel ends on both the H8.00-12.00XM (H170-280HD) and H10.00-12.00XM-12EC (H360HD-EC) are serviced almost identically for cam or wet disc brakes.

IDENTIFICATION

NOTE: The exact axle model specification tag is located on the axle housing. See Figure 4.



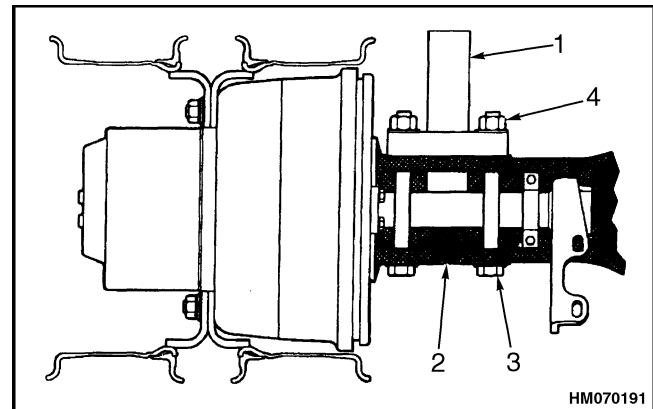
- | | |
|---|--|
| 1. P - PLANETARY | 6. CARRIER DESIGNATION FOR BASE MODEL NUMBER (LAST DIGIT) |
| 2. R - RIGID | 7. BRAKE TYPE |
| 3. L - MOUNTING OTHER THAN PAD WITH DRILLING (ONLY IF APPLICABLE) | N - NONE |
| 4. C - INTEGRAL CAST (HOUSING TYPE DESIGNATION) | P - DRY BRAKES |
| 5. WHEEL END DESIGNATION (BASIC MODEL NUMBER) FIRST TWO OR THREE DIGITS | 8. EXACT SPECIFICATION |

Figure 4. Planetary Drive Axle Identification

Removal

NOTE: The planetary assemblies can be removed with the drive axle installed in the lift truck. If the drive axle must be removed, do the following steps. If the drive axle will not be removed, do only Step 1 and Step 2, then the Disassembly procedures.

1. Put blocks under lift truck frame to raise drive wheels from ground. See "How to Put Lift Truck on Blocks" in the **Operating Manual** or the **Periodic Maintenance** section for your lift truck.
2. Remove mast assembly from lift truck as described in the section **Masts 4000 SRM 445** or **Masts and Carriages, Starting 2003 4000 SRM 1062**.
3. Drain lubricant from axle as described in the **Periodic Maintenance** section.
4. Disconnect drive shaft from drive axle. See Figure 5.
5. Remove wheels. See Disassembly, Step 1 through Step 3.



1. LIFT TRUCK FRAME
2. AXLE HOUSING
3. BOLT
4. NUT

Figure 5. Axle Mount

Disassembly

WARNING

Completely remove air pressure from tires before removing wheels from lift truck. Air pressure in tires can cause tire and rim parts to explode, causing serious injury or death.

WARNING

To prevent serious eye injury, always wear eye protection when performing vehicle maintenance or service.

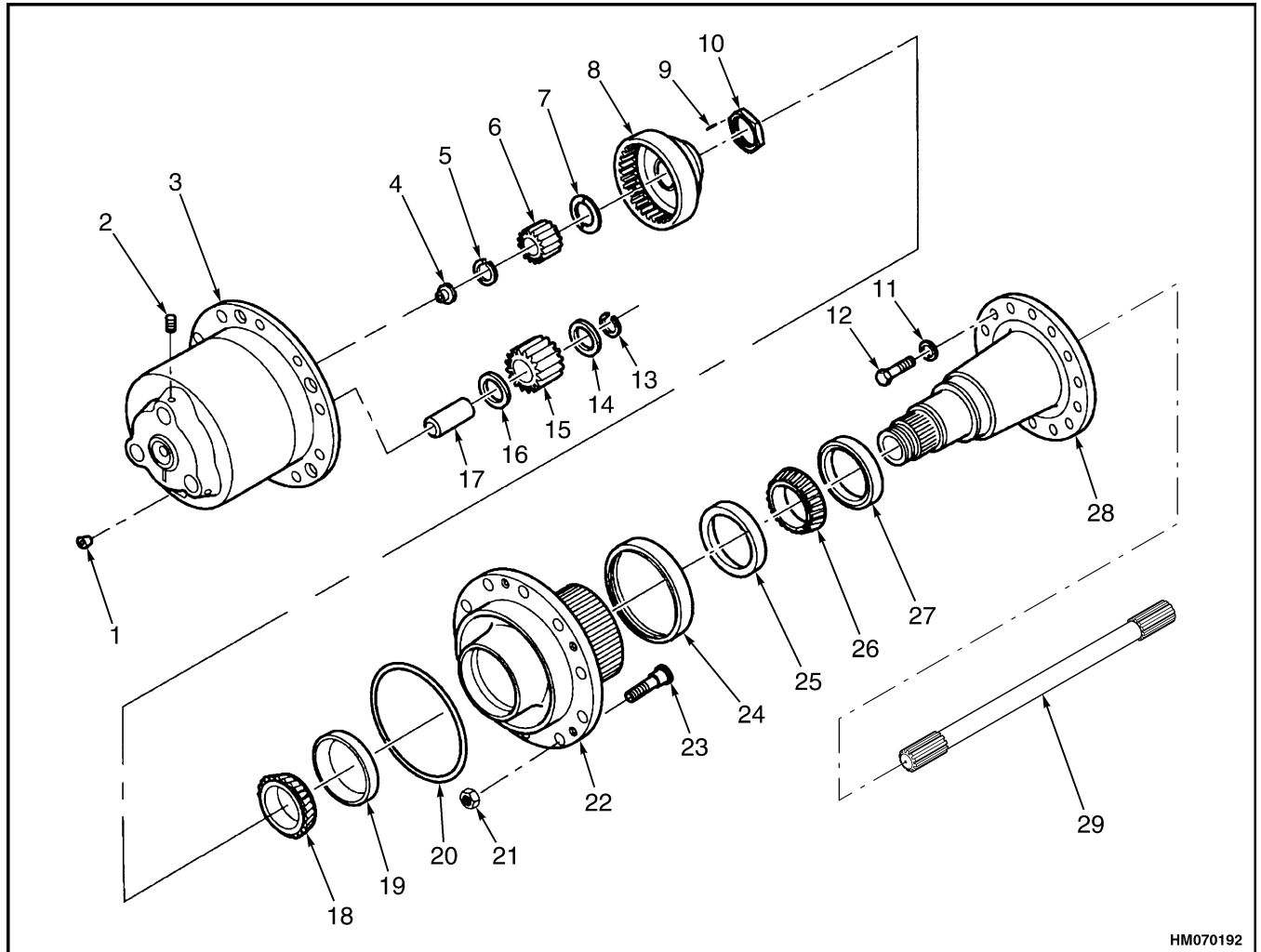
1. Put blocks under lift truck frame to raise drive wheels from ground. See Removal, Step 1. Raise axle to remove weight from tires, ensure tires are still touching floor. Loosen wheel nuts just enough so they can be easily removed. Remove air from tires. Remove valve core to make sure all air is out of inner tube. Push a wire through valve stem to make sure valve stem does not have a restriction.

2. Raise axle so tires and wheels can be removed. Remove wheel nuts. Use a tire jack to remove tires and wheels.
3. If necessary, remove magnetic drain plug from bottom of axle housing. Drain and discard lubricant from carrier center section.

PLANETARY SPIDER AND GEARING ASSEMBLY H8.00-12.00XM (H170-280HD)

NOTE: If only the planetary pinions are removed for inspection without removing the pinion shaft, proceed to Step 5. See Figure 6.

1. With a lifting device, remove planetary spider from wheel hub. Set its large flange side on a workbench.
2. Matchmark outer ends of pinion shafts and planetary spider to aid in reassembly if the original pinion shafts are used.
3. Remove setscrew from each pinion shaft.



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- | | |
|-----------------------------|----------------------------|
| 1. MAGNETIC DRAIN/FILL PLUG | 16. OUTER THRUST WASHER |
| 2. SETSCREW | 17. PLANETARY PINION SHAFT |
| 3. PLANETARY SPIDER | 18. OUTER BEARING CONE |
| 4. THRUST BUTTON | 19. OUTER BEARING CUP |
| 5. SNAP RING | 20. O-RING |
| 6. PLANETARY SUN GEAR | 21. WHEEL NUT |
| 7. THRUST WASHER | 22. HUB |
| 8. PLANETARY RING GEAR | 23. WHEEL STUD |
| 9. PIN | 24. FACE SEAL ASSEMBLY |
| 10. LOCK NUT | 25. INNER BEARING CUP |
| 11. FLAT WASHER | 26. INNER BEARING CONE |
| 12. CAPSCREW | 27. OIL SEAL ASSEMBLY |
| 13. SNAP RING | 28. SPINDLE |
| 14. INNER THRUST WASHER | 29. SHAFT |
| 15. PLANETARY PINION GEAR | |

Figure 6. Hub and Shaft Assembly H8.00-12.00XM (H170-280HD)

 **WARNING**

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

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**

To avoid damage to the pinion shaft, provide a soft cushioned area to receive pinion shaft when it is removed from spider.

4. Use a press to remove pinion shafts. If a press is not available, use a brass drift and mallet to drive out shaft. Press or drive pinion shaft out toward large flanged end of planetary spider.
5. Remove snap ring, inner thrust washer, planetary pinion, and outer thrust washer from each pinion shaft.
6. Remove axle shaft thrust button only if it is worn. Press it out TOWARD large end of planetary spider.

NOTE: The sun gear thrust washer may come out with the axle shaft and sun gear assembly.

7. Remove axle shaft, planetary sun gear, and snap ring assembly.
8. If necessary, remove snap ring from axle shaft to allow removal of sun gear and sun gear thrust washer.
9. If necessary, remove sun gear thrust washer from end of planetary ring gear.
10. Remove planetary ring gear.
11. Mark the position of wheel bearing adjusting nut. Remove wheel bearing adjusting nut.

 **CAUTION**

The outer bearing cone will be loose as you pass it over the end of the spindle. Hold cone securely to avoid dropping it and damaging cone.

12. Remove outer bearing cone and wheel hub assembly with brake driver splines from friction

discs. Wheel bearings and oil seal will come off with wheel hub.

NOTE: If replacing hub oil seal and bearings, continue with Step 13 through Step 16.

 **CAUTION**

Do not damage hub oil seal bore surface in wheel hub. Damage to this surface will result in oil leakage after assembly.

13. Remove wheel hub oil seal from wheel hub.
14. Remove inner bearing cone.
15. If replacement of wheel bearings is necessary, press out outer bearing cup and inner bearing cup from hub.
16. Remove and discard O-ring from wheel hub.

PLANETARY SPIDER AND GEARING ASSEMBLY H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), AND H10.00-12.00XM-12EC (H360HD-EC)

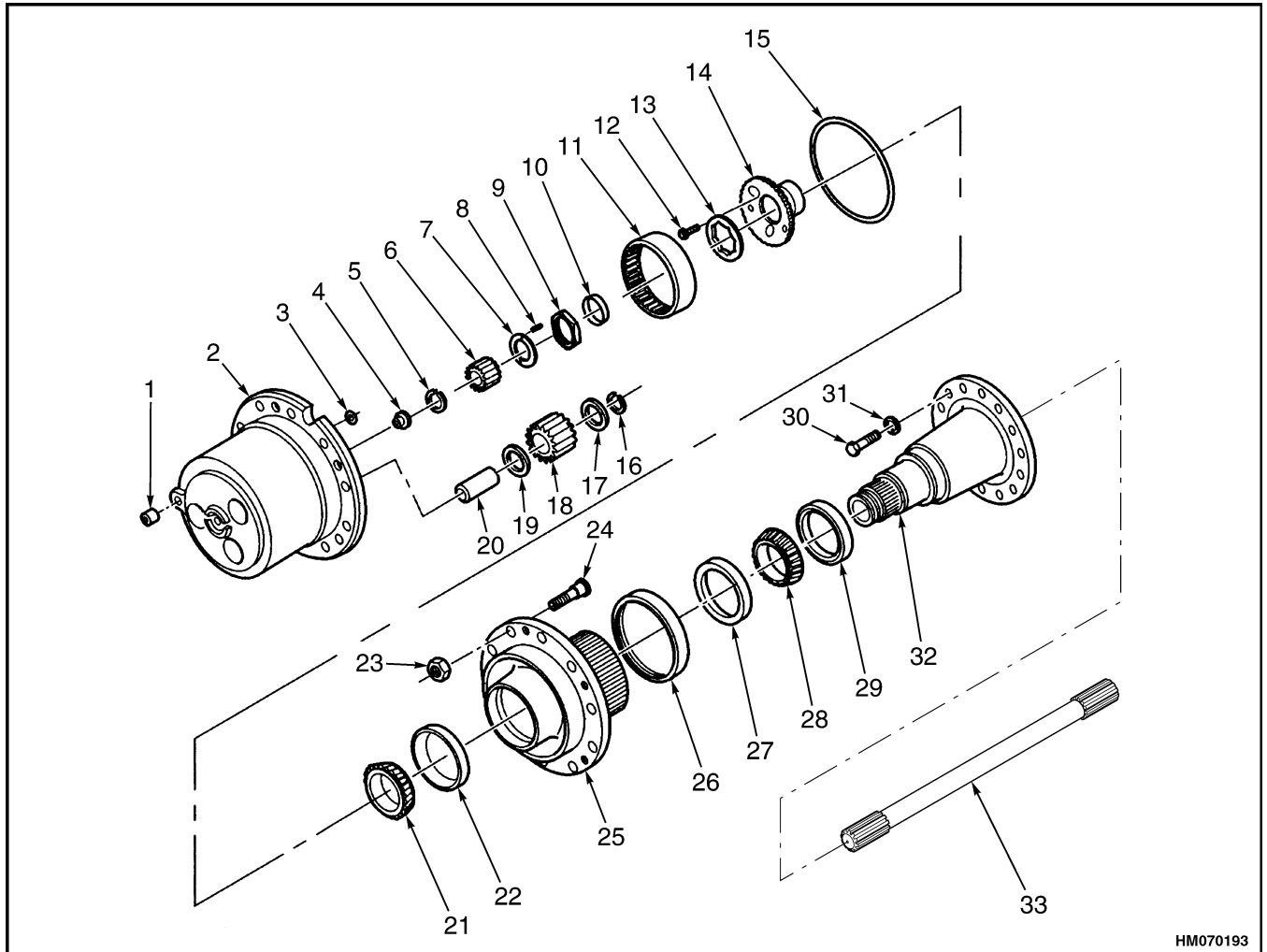
 **WARNING**

To prevent serious personal injury and possible damage to components, be very careful when using lifting devices during service and maintenance procedures.

Inspect to make sure that neither lifting strap is damaged.

Do not subject lifting straps to any shock or drop loading.

1. With a lifting device, remove planetary spider assembly from wheel hub and set it on a workbench. Rest spider on its large flange end.
2. If planetary ring gear did not remain with planetary spider assembly during assembly's removal, remove ring gear from planetary ring gear hub. See Figure 7.
3. Mark large ends of planetary pinion shafts and planetary spider to aid in reassembly if the original pinion shafts are used.
4. Place planetary spider assembly on blocks with large flanged end facing UP. Remove snap ring from each pinion shaft.



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- | | |
|-----------------------------|---|
| 1. MAGNETIC DRAIN/FILL PLUG | 18. PLANETARY PINION GEAR |
| 2. PLANETARY SPIDER | 19. OUTER THRUST WASHER |
| 3. THRUST BUTTON | 20. PINION SHAFT (O-RING ON OPTIONAL SHAFT) |
| 4. THRUST BUTTON | 21. OUTER BEARING CONE |
| 5. SNAP RING | 22. OUTER BEARING CUP |
| 6. PLANETARY SUN GEAR | 23. WHEEL NUT |
| 7. THRUST WASHER | 24. WHEEL STUD |
| 8. PIN | 25. HUB |
| 9. ADJUSTING NUT | 26. FACE SEAL ASSEMBLY |
| 10. SLEEVE | 27. INNER BEARING CUP |
| 11. PLANETARY RING GEAR | 28. INNER BEARING CONE |
| 12. CAPSCREW | 29. OIL SEAL ASSEMBLY |
| 13. LOCK | 30. CAPSCREW |
| 14. PLANETARY RING GEAR HUB | 31. FLAT WASHER |
| 15. O-RING | 32. SPINDLE |
| 16. LOCK RING | 33. SHAFT |
| 17. INNER THRUST WASHER | |

Figure 7. Hub and Shaft Assembly H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), and H10.00-12.00XM-12EC (H360HD-EC)

 **WARNING**

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

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**

To avoid damage to pinion shaft, provide a soft cushioned area to receive pinion shaft when it is removed from spider.

5. Use a press to remove pinion shafts out of spider. If a press is not available, use a brass drift and mallet to drive out shaft. Press or drive pinion shaft out toward small end of spider which faces DOWN.
6. Remove planetary pinions and thrust washers from planetary spider.
7. If axle shaft thrust button and/or ring gear support thrust buttons are worn and require replacement, place planetary spider on blocks with the large flanged end facing DOWN. Press them out toward the large end of planetary spider.
8. Remove axle shaft, planetary sun gear, and snap ring assembly.

NOTE: Sun gear thrust washer may come out with axle shaft and sun gear assembly.

9. Remove snap ring from axle shaft to allow removal of sun gear from axle shaft.
10. If necessary, remove sun gear thrust washer from axle shaft.
11. If necessary, remove sun gear thrust washer from end of spindle.
12. Remove two lock plate capscrews. Remove lock plate from planetary ring gear hub.
13. Remove wheel bearing adjusting nut.

14. Remove planetary ring gear hub. Outer wheel bearing cone will remain on ring gear hub. If it is damaged, remove it from hub.

15. Remove wheel hub with brake driver splines from friction discs. Hub oil seal and inner bearing assembly will remain in hub.

NOTE: If replacing hub oil seal and bearings, continue with Step 17 through Step 19.

16. Remove hub oil seal.

17. Remove inner bearing cone.

18. If replacement of wheel bearings is necessary, press out outer bearing cup and inner bearing cup.

19. Remove and discard O-ring from wheel hub.

WHEEL END

 **CAUTION**

Face seal comes off with hub. Do not set hub down on face seal. Damage to face seal can result. Remove face seal from hub.

1. Remove half of face seal from hub assembly.
2. Remove rest of face seal from brake housing assembly.

 **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.

3. Loosen sixteen M16 × 1.5 threaded capscrews. Hit threaded capscrew heads with a mallet to separate wet disc brake housing.
4. Replace two capscrews with assembly studs to support disc housing weight. Then remove remaining capscrews.

**CAUTION**

Do not reuse a damaged friction disc or stationary disc. Damage to components can result.

**CAUTION**

Friction discs and stationary discs are loose inside brake housing assembly. Reach through center of brake housing and keep discs from falling out.

5. Remove brake housing assembly from piston housing and set it on a table with discs facing up to prevent discs from falling out.
6. Remove friction discs and stationary discs from disc housing.
7. If replacing dowels, remove eight dowels from slots in brake housing.
8. Remove four shoulder bolts from piston and piston housing.
9. Remove washers and springs from four shoulder bolts. Remove piston from piston housing.

NOTE: Place face seals together and store in a safe package to prevent damage.

10. Remove D seals from grooves in piston.

SPINDLE AND PISTON HOUSING**WARNING**

To prevent serious personal injury and possible damage to components, be very careful when using lifting devices during service and maintenance procedures.

- Inspect to make sure that neither lifting strap is damaged.
- Do not subject lifting loops or lifting straps to any shock or drop loading.

**WARNING**

Removal of capscrews allows spindle and brake assembly to separate. They can fall from planetary axle housing and cause damage to components and serious personal injury.

1. To prevent spindle and brake spider from falling after all the mounting capscrews are removed, use one of the following procedures.
 - a. Use a lifting device to support spindle during disassembly.
 - b. Remove only two capscrews. Replace them with two temporary 102 mm (4 in.) M20 × 2.5 thread studs before remaining capscrews are removed. See Figure 8.
 - Install one stud at eleven o'clock position.
 - Install one stud at one o'clock position.
2. Remove capscrews and washers that secure piston housing and spindle to axle housing.
3. Remove piston housing from spindle.
4. Remove spindle from axle housing. If necessary, tap lightly on spindle to loosen pilot fit and to overcome adhesion due to cured gasket material in flange joint.

NOTE: To disassemble the H8.00-12.00XM (H170-280HD), H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), and H10.00-12.00XM-12EC (H360HD-EC) wet brakes, see the section **Wet Brake System** 1800 SRM 951.

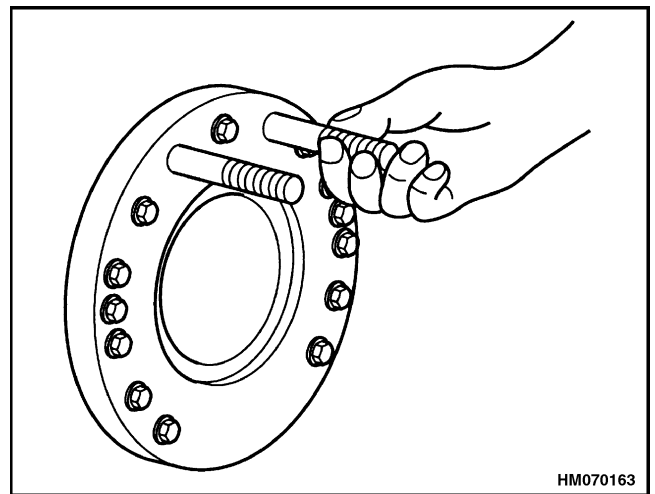


Figure 8. Spindle and Brake Spider Studs

Cleaning

CLEAN GROUND OR POLISHED PARTS

WARNING

To prevent serious eye injury, always wear safe eye protection when performing vehicle maintenance or service.

WARNING

Solvent cleaners are flammable and poisonous and can cause burns. Examples of solvent cleaners are carbon tetrachloride, emulsion-type cleaners, and petroleum-based cleaners. To avoid serious personal injury when using solvent cleaners, carefully follow the manufacturer's product instructions and these procedures.

- Wear safe eye protection.
- Wear clothing that protects your skin.
- Work in a well-ventilated area.
- Do not use gasoline or solvents that contain gasoline. Gasoline can explode.
- Use hot solution tanks or alkaline solutions correctly. Follow the manufacturer's instructions carefully.

CAUTION

- Use only solvent cleaners to clean ground or polished metal parts. Hot solution tanks or water and alkaline solutions will damage these parts. Isopropyl alcohol, kerosene, or diesel fuel can be used for this purpose.
- If required, use a sharp knife to remove gasket material from parts. Be careful not to damage the ground or polished surfaces.

1. Use a cleaning solvent, kerosene, or diesel fuel to clean ground or polished parts or surfaces. NEVER USE GASOLINE.

2. Remove gasket material from parts. Take care not to damage ground surfaces with grease to prevent corrosion.
3. DO NOT clean ground or polished parts in a hot solution tank, water, steam, or alkaline solution.

CLEAN PARTS WITH ROUGH FINISH

1. Use a cleaning solvent or a hot solution tank with a weak alkaline solution to clean parts with a rough finish.
2. Leave parts in the hot solution tank until they are completely cleaned and heated. When the parts are clean, remove them from the tank.
3. Wash the parts with water until you completely remove the alkaline solution.

CLEAN AXLE ASSEMBLIES

NOTE: A complete axle assembly can be steam cleaned on the outside to remove dirt.

NOTE: Before the axle is steam cleaned, close or put a cover over all the openings in the axle assembly. Examples of openings are the breathers or vents in air chambers.

DRYING CLEANED PARTS

CAUTION

Dry bearings with clean paper or rags. Do not use compressed air, which can cause abrasive particles to contaminate the bearings. Damage to components and reduced lining life can result.

Immediately after cleaning, use clean paper, rags, or compressed air to dry parts.

Corrosion Prevention

NOTE: Parts must be clean and dry before lubricating them.

1. If assembling the parts immediately after cleaning them, lubricate the clean, dry parts with grease to prevent corrosion.

2. If storing the parts after cleaning them, apply a corrosion-preventive material to all machined surfaces. Store the parts in a special paper or other material that prevents corrosion.

Parts Inspection

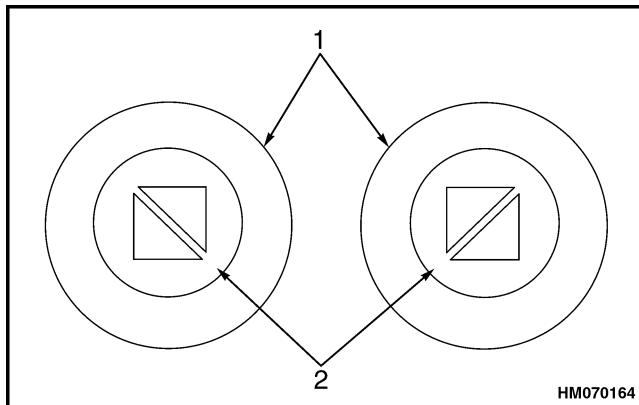
NOTE: It is important to carefully inspect all parts for wear and damage before you assemble the axle carrier.

Replace damaged parts.

TAPERED ROLLER BEARINGS

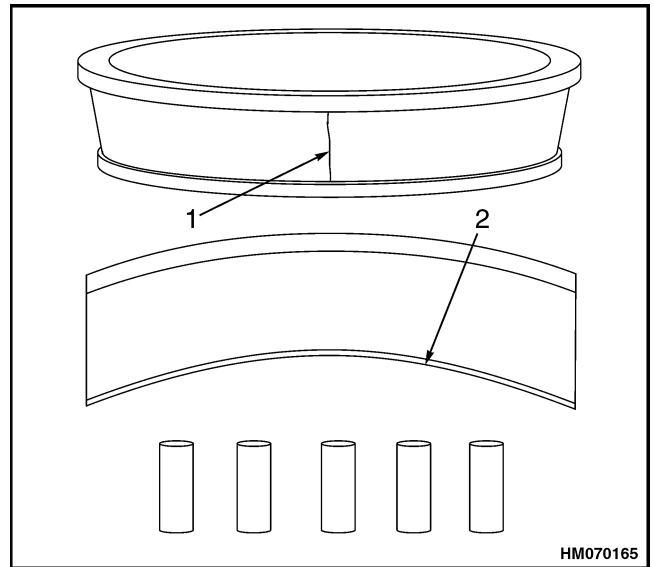
NOTE: Inspect cup, cone, rollers, and cage of all tapered roller bearings in the assembly. If any of the following conditions exist, replace the bearing.

- The centers of the large diameter end of the rollers are worn level with or below surface. See Figure 9.
- The centers of the large diameter end of the rollers are worn to a sharp edge. See Figure 9.
- A visible roller groove is worn in the cup or cone inner race surfaces. You can see the groove at the small or large diameter ends of both parts. See Figure 10.
- Deep cracks or breaks are present in the cup, cone inner race, or roller surfaces. See Figure 11.
- Bright wear marks are present on the outer surface of the roller cage. See Figure 11.
- Etching and pitting are present on the rollers and on surfaces of the cup and cone inner race that touches the rollers. See Figure 12.
- Spalling or flaking is present on the cup and cone inner race surfaces that touch the rollers. See Figure 13.



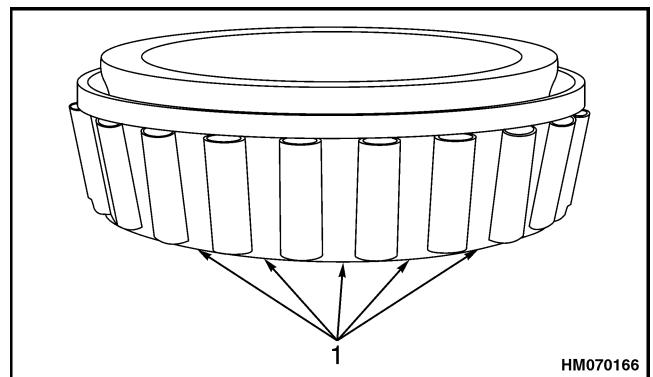
1. WORN RADIUS 2. WORN SURFACE

Figure 9. Tapered Roller Bearings



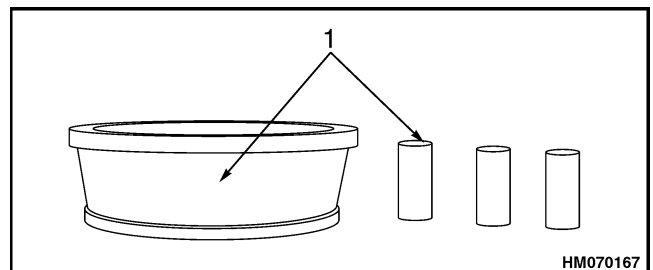
1. CRACK 2. WEAR GROOVES

Figure 10. Tapered Roller Bearings



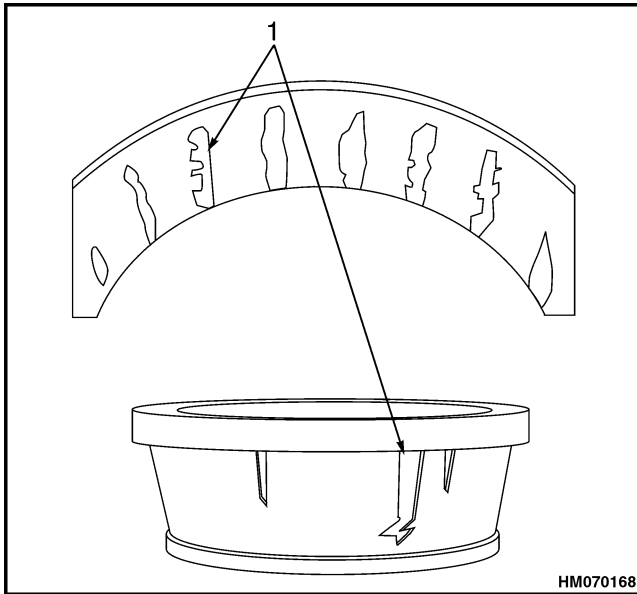
1. WEAR MARKS

Figure 11. Tapered Roller Bearings



1. ETCHING AND PITTING

Figure 12. Tapered Roller Bearings



1. SPALLING AND FLAKING

Figure 13. Tapered Roller Bearings

BEVEL PINION AND RING GEAR SETS

CAUTION

The bevel drive pinions and ring gears are machined in matched sets. When a drive pinion or ring gear of a bevel set needs to be replaced, both drive gear and pinion must be replaced at the same time. A higher stress on the original parts and early failure of the entire assembly will result if a new part is used in combination with parts that are older or worn.

1. Inspect bevel drive pinions and ring gears for wear and damage. Gears that are worn or damaged must be replaced.
2. Verify the condition of bearing cone seats and spline on pinion shaft.

MAIN DIFFERENTIAL ASSEMBLY

1. Use a cleaning solvent, kerosene, or diesel fuel to clean the interior of the main differential assembly. NEVER USE GASOLINE.
2. Use the left shaft to rotate one side gear. Replace differential assembly if there is evidence of binding.
3. Observe side gear and differential pinions during rotation. Replace differential assembly if

chipped or broken teeth can be seen, or if there are damaged cases.

AXLE SHAFTS

NOTE: If there is any wear or cracks at the flange, shaft, and splines, replace axle shaft.

YOKE

NOTE: If there is excessive wear at the seal journal area, replace yoke.

BRAKES

See the section **Wet Brake System** 1800 SRM 951.

REPAIR OR REPLACE PARTS

Replace worn or damaged parts of an axle assembly. The following are some examples to check for repair and possible replacement.

- Replace any fastener if corners of head are worn.
- Replace washers if damaged.
- Replace gaskets, oil seals, or grease seals at time of axle repair.
- Clean parts and apply new liquid gasket material where required when axle is assembled.
- Remove nicks, marks, and burrs from parts having machined or ground surfaces. Use a fine file, India stone, emery cloth, or crocus cloth for this purpose.
- Clean and repair threads of fasteners and holes. Use a die or tap of correct size or a fine file for this purpose.
- If there is excessive wear at seal journal area, replace yoke. Tighten all fasteners to correct torque values. See Figure 18 and Figure 19 for fastener torque value.

REPAIR WELDING

WARNING

Do not weld repair, heat, bend, or recondition axle components. This will reduce component strength and can result in serious personal injury and damage to components. Always replace damaged or out-of-specification components.

Inspect axle components. Replace if damaged or worn. Do not weld repair or recondition.

APPLY SILICONE GASKET MATERIAL

WARNING

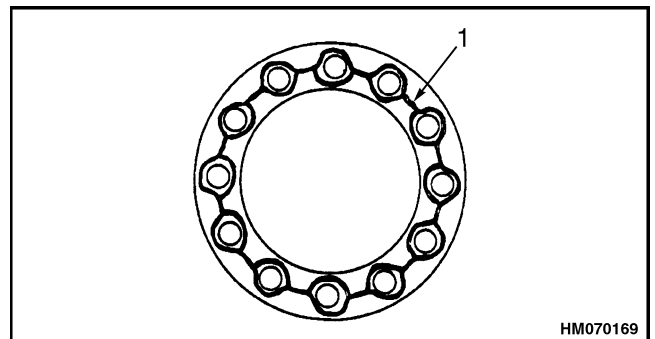
When applying some silicone gasket materials, small amounts of acid vapor are present. To prevent possible serious injury, the work area must be well ventilated. If the silicone gasket material gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

1. Remove all old gasket material from surfaces of both components.
2. Clean surfaces where liquid gasket material will be applied. Remove all oil, grease, dirt, and moisture.
3. Thoroughly dry both surfaces.

CAUTION

The amount of liquid gasket material applied to component surface must not exceed 3.18 mm (0.125 in.) diameter bead. Too much gasket material can block lubrication passages. Damage to components can result.

4. Apply a 3.18 mm (0.125 in.) diameter continuous bead of silicone gasket material around one surface. Also apply gasket material around edge of all fastener holes on that surface. See Figure 14.
5. Assemble components immediately to permit gasket material to compress evenly between parts. Tighten fasteners to required torque value for that size fastener using an X torquing pattern. See Figure 18 and Figure 19.
6. Wait 20 minutes before filling assembly with lubricant.



1. SILICONE GASKET MATERIAL BEAD

Figure 14. Silicone Gasket

Assembly

SPINDLE AND PISTON HOUSING TO AXLE HOUSING

1. Install two temporary studs 102 mm (4 in.) M20-2.5 threads into axle housing flange. Install studs at eleven o'clock and one o'clock positions. See Figure 15.

WARNING

Take care when using Loctite to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to eyes and skin. If Loctite gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

NOTE: The piston housing has TOP identified by a raised lug.

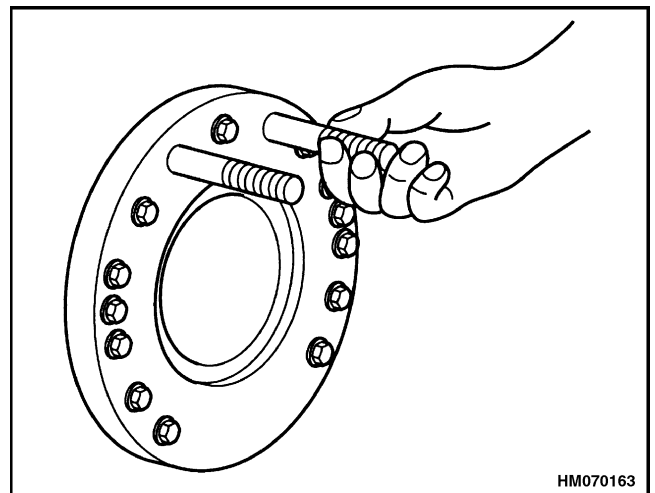


Figure 15. Spindle Studs

3. Mount spindle and piston housing (lug on TOP) onto axle housing using 13 M20 × 2.5 thread capscrews. Tighten capscrews in an "X" torquing pattern to achieve 370 to 480 N•m (273 to 354 lbf ft) bolt torque. Install 10 mm × 60 mm long assembly studs into the four M8 × 1.25 thread holes in piston cover.

WET DISC BRAKES

NOTE: To assemble H8.00-12.00XM (H170-280HD), H13.00-16.00XM (H300-360HD), and H10.00-12.00XM-12EC (H360HD-EC) wet brakes, see the section **Wet Brake System** 1800 SRM 951.

NOTE: To continue assembling wet disc brake wheel end, continue with the following steps.

1. Clean and inspect piston for damage. Inspect piston grooves to ensure no contaminants remain in grooves.
2. Apply an oil lubricant to the D seals and assemble the D seals into the appropriate grooves in piston.



WARNING

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NOTE: The piston slightly sticks out of the piston housing.

3. Apply an oil film coating on piston housing bores. Use C clamps to assemble piston over assembly studs and push piston into piston housing until it bottoms out.
4. Remove and store four assembly studs.
5. Install washers and springs on four shoulder bolts.
6. Apply a small bead of Loctite 518 to four shoulder bolt threads and install four shoulder bolts into piston and piston housing. Tighten four shoulder bolts to 22 to 30 N•m (16 to 22 lbf ft).

NOTE: The brake housing has TOP identified with a raised lug.

7. Clean and inspect brake housing, stationary plates, and dowels for damage.
8. Place brake housing on an assembly bench. Assemble eight dowels into slots in brake housing.



CAUTION

Do not reuse a damaged friction disc or stationary disc. Damage to components can result.

NOTE: The friction discs and stationary discs are loose inside the brake housing assembly. Reach through center of brake housing and keep discs from falling out.

9. Line up all friction disc splines and grooves in a stack so they can be assembled this way inside brake housing.
10. Place a friction disc inside brake housing. Place a stationary disc into brake housing while engaging all dowels in disc's slots.
11. Repeat these steps until completing assembly stack of discs. Realign all friction discs' splines and grooves.
12. Apply a small, continuous 2-mm bead of Loctite 518 onto mounting face of brake housing. Carefully lift brake housing assembly (lug on TOP) and install it onto piston housing already mounted on axle.
13. Tighten 16 M16 × 1.5 threaded capscrews in an X torquing pattern to achieve 200 to 258 N•m (148 to 190 lbf ft) bolt torque.

NOTE: Use a Permatex coating to seal against leaks around hub oil seal. Leaks would result in requiring disassembly should the leak be noted after the final axle assembly.

NOTE: Use isopropyl alcohol to lubricate O-ring immediately before this installation.

14. Install half of face seal into brake housing by using a Caterpillar assembly tool to properly position O-ring and steel ring assembly beyond lip and into tapered bore in brake housing.
15. Measure height of metal face above housing to ensure tolerance is within 1 mm variation.
16. Clean and inspect hub.

17. Install inner and outer bearing cups into hub. Install inner bearing cone and spindle seal into hub. Press spindle seal flush with shoulder in hub bore.
18. Apply a light, uniform coating of Permatex to wheel hub bore.
19. Install second half of face seal into hub and cup assembly by using a Caterpillar assembly tool to properly position O-ring and steel ring assembly beyond lip and into tapered bore in hub.

**CAUTION**

Do not apply lubricant to O-ring. Damage and leaks will result.

20. Apply a light coating of lubricant to two mating surfaces of face seal's steel rings only. Do not allow lubricant to contact O-ring. Use the same lubricant that was used on coolant side.
21. Install hub with brake driver splines through friction discs.
22. Install outer bearing cone on spindle. Install spindle nut on spindle. Rotate hub while tightening nut as recommended in wheel bearing adjustment procedure.
23. Perform pressure test.

ADJUST WHEEL BEARING PRELOAD**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: To adjust wheel bearing preload, bearings must be seated and rollers in correct alignment.

1. Install wheel bearing adjusting nut. Tighten nut to 542 N•m (400 lbf ft).
2. Rotate hub in both directions. At the same time, tap hub several times with a brass or plastic mallet.
3. Tighten nut to 542 N•m (400 lbf ft) again.
4. Back off nut approximately 1/4 turn to relieve preload produced in Step 3.
5. Tighten nut to 271 N•m (200 lbf ft).

NOTE: Step 6 and Step 7 vary between the H8.00-12.00XM (H170-280HD) and H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), and H10.00XM-12EC (H360HD-EC). Verify correct procedures.

**WARNING**

Carefully align adjusting nut dowel pin within a ring gear tooth spline to avoid damage to pin. A damaged dowel pin will cause adjusting nut to back off and loosen wheel during vehicle operation. This can result in serious personal injury and damage to components.

NOTE: If you move adjusting nut to align lock plate mounting holes, tighten nut. Do not loosen or back off nut.

6. **H8.00-12.00XM (H170-280HD).** Carefully align adjusting nut dowel pin within a ring gear tooth spline to avoid damage to dowel pin. Tighten adjusting nut to produce proper alignment. Do not back off adjusting nut.

H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), and H10.00XM-12EC (H360HD-EC). Install lock plate.

**WARNING**

Take care when using Loctite to avoid serious personal injury. Follow the manufacturer's instructions to prevent irritation to eyes and skin. If Loctite gets into your eyes, flush them with water for 15 minutes. Have your eyes checked by a doctor as soon as possible.

7. **H8.00-12.00XM (H170-280HD).** Install planetary ring gear onto spindle. Dowel pin in adjusting nut must be installed in hole in ring gear face to allow ring gear to seat against adjusting nut.

H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), and H10.00XM-12EC (H360HD-EC). Install lock plate mounting screws. Tighten mounting screws to 27 to 41 N•m (20 to 30 lbf ft).

- The new lock plate mounting screw threads come equipped with a preapplied locking agent.
- If using original lock plate mounting screws, apply two or three drops of Loctite 277 or equivalent to internal threads of ring gear hub.