SERVICE REPAIR

MANUAL

Hyster F007 (H8.00-12.00XM Europe) Forklift

HYSTER

WET BRAKE SYSTEM

H16.00-18.00XM/XMS-12 (H400-450HD/HDS) [A236]; H16.00-22.00XM-12EC (H400-500HD/HDS-EC) [B214]; 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]

HYSTER

PART NO. 1498450

1800 SRM 951

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:

H16.00-18.00XM/XMS-12 (H400-450HD/HDS) [A236];
H16.00-22.00XM-12EC (H400-500HD/HDS-EC) [B214];
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]

General

This manual has description, operation, and repair procedures for components of the brake system.

The main parts of the system are the hydraulic pump with charge valve, two brake pedals, brake pedal valve, two accumulators, oil cooler, two wet disc brakes, park brake, and park brake valve. See Figure 1, Figure 2, and Figure 8.

Description and Operation

The hydraulic pump (see Figure 1 and Figure 2) supplies the oil to operate the brakes and cool the brakes and the parking brake. Oil pressure for the brakes is maintained between 14.8 and 18.5 MPa (2146.5 and 2683 psi). The accumulators have a precharge pressure of 9.0 ±0.5 MPa (1305 ±72.5 psi). When the brake pedal is operated, the brake treadle allows oil to flow to the brake pistons. There are two oil pressure checkpoints near the brake treadle. One detects pressure and is used for the brake lights and the other one detects insufficient pressure and is used for indicating/signaling at the instrument panel and instruments. When the brake pedal is released, oil pressure in the brake cylinders is relieved to the hydraulic tank. Brakes can be bled at the manifold. When pressure in the system reaches 18.5 MPa (2683 psi), the charge valve switches to provide pressurized oil for the cooling of the brakes. A return line carries the cooling oil back to the hydraulic tank via a filter. A filter bypass is also provided. When pressure drops below 14.8 MPa (2146.5 psi), the charge valve switches back to provide pressurized oil to the brake system. The parking brake is operated via the parking brake valve.

SERVICE BRAKES

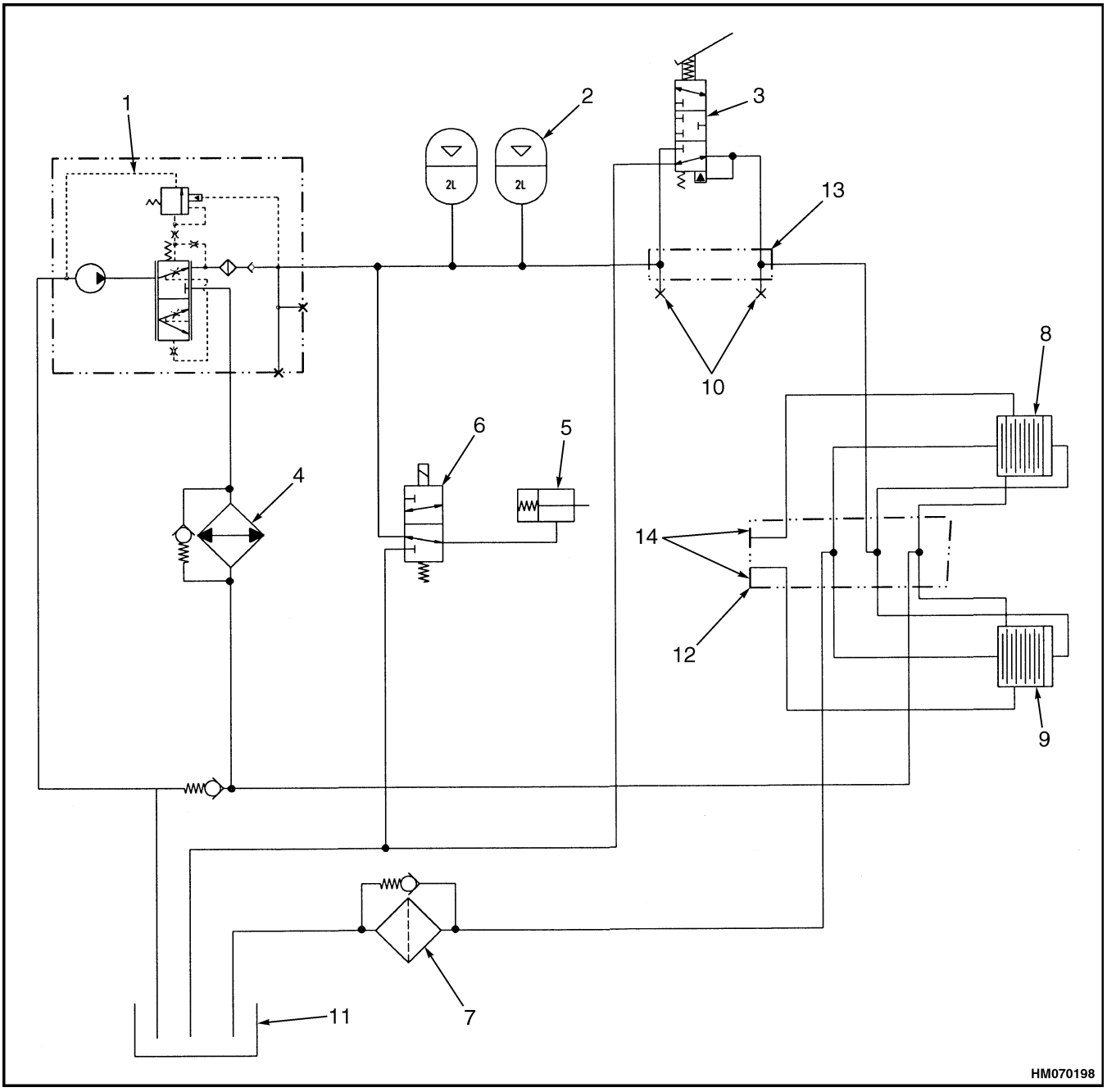
There is an oil-cooled brake assembly at each drive wheel as shown in Figure 3. There are discs that rotate with the wheel hub and stationary discs that are locked to the brake housing. The discs are assembled so that there is a friction (rotating) disc between each stationary disc. A piston, moved by hydraulic pressure, pushes the discs together for the braking action. A separate oil cooling system circulates oil through the sealed case to cool the discs. The brake pedal activates the brake treadle and controls the flow of oil to the service brakes. Pushing the inching pedal will at first control the declutch action and further pushing will activate the brakes due to the mechanical coupling to the brake pedal.

PARKING BRAKE

The parking brake system uses a spring-applied caliper and is installed at the rear of the differential. Under normal conditions, the red knob on the instrument panel is pushed in, and an electrical signal triggers the parking brake valve. Oil pressure compresses the spring and the parking brake is released. The parking brake is applied by pulling out the red knob on the instrument panel. The parking brake valve position changes, and oil pressure in the parking brake cylinder is relieved. This causes the springs to apply the brakes for parking. The spring automatically applies the brake if the system loses oil pressure. The minimum system oil pressure is 14.8 MPa (2146.5 psi).

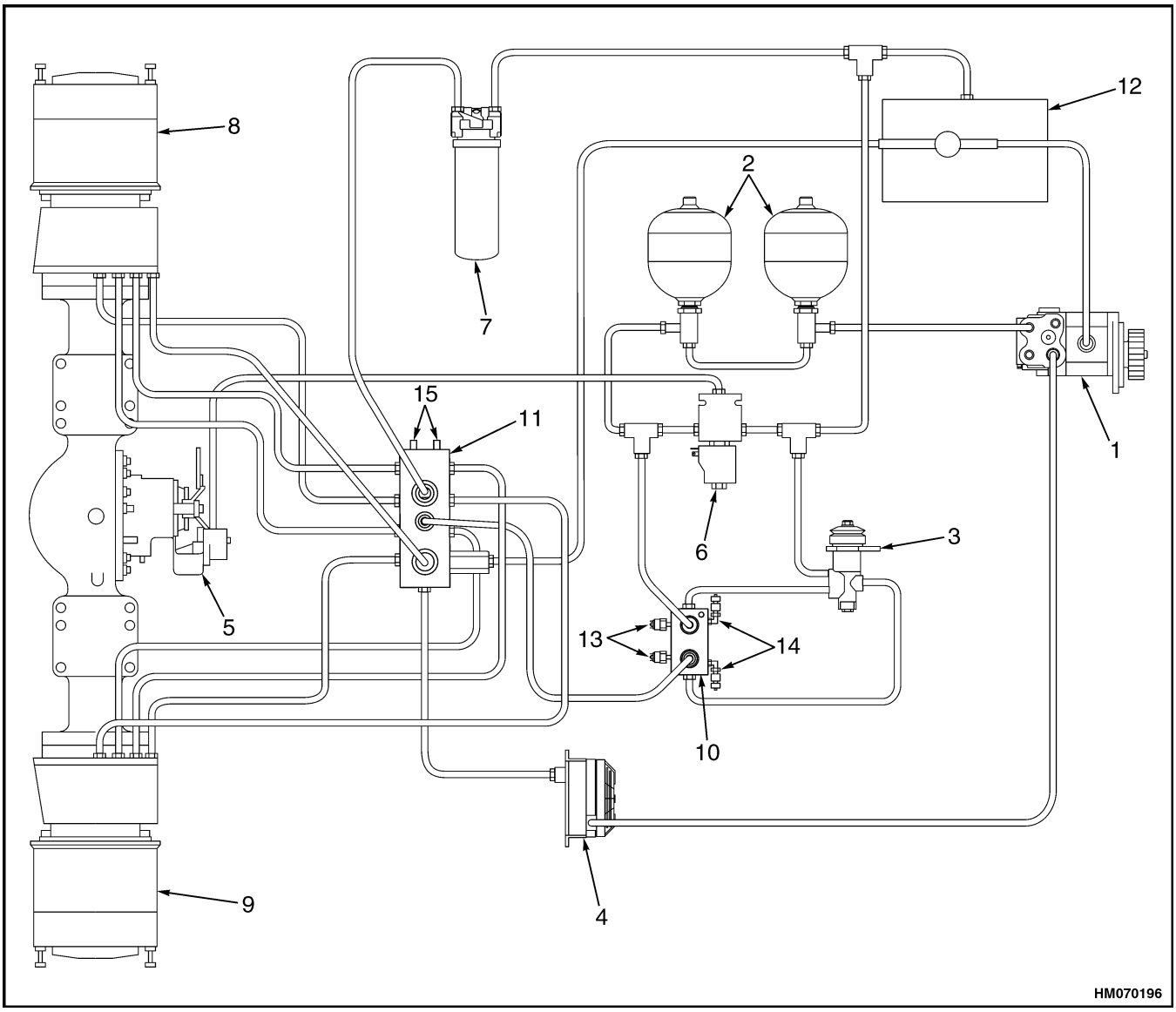
OIL COOLER CIRCUIT

The oil for cooling of the brakes is cooled by the oil cooler. See Figure 4. In the event that measured oil temperature is above 97°C (206.6°F), a cooling fan is activated. When the temperature of the oil drops below 92°C (197.6°F) the fan is switched off. The cooling system oil pressure is 0.1 MPa (14.5 psi).



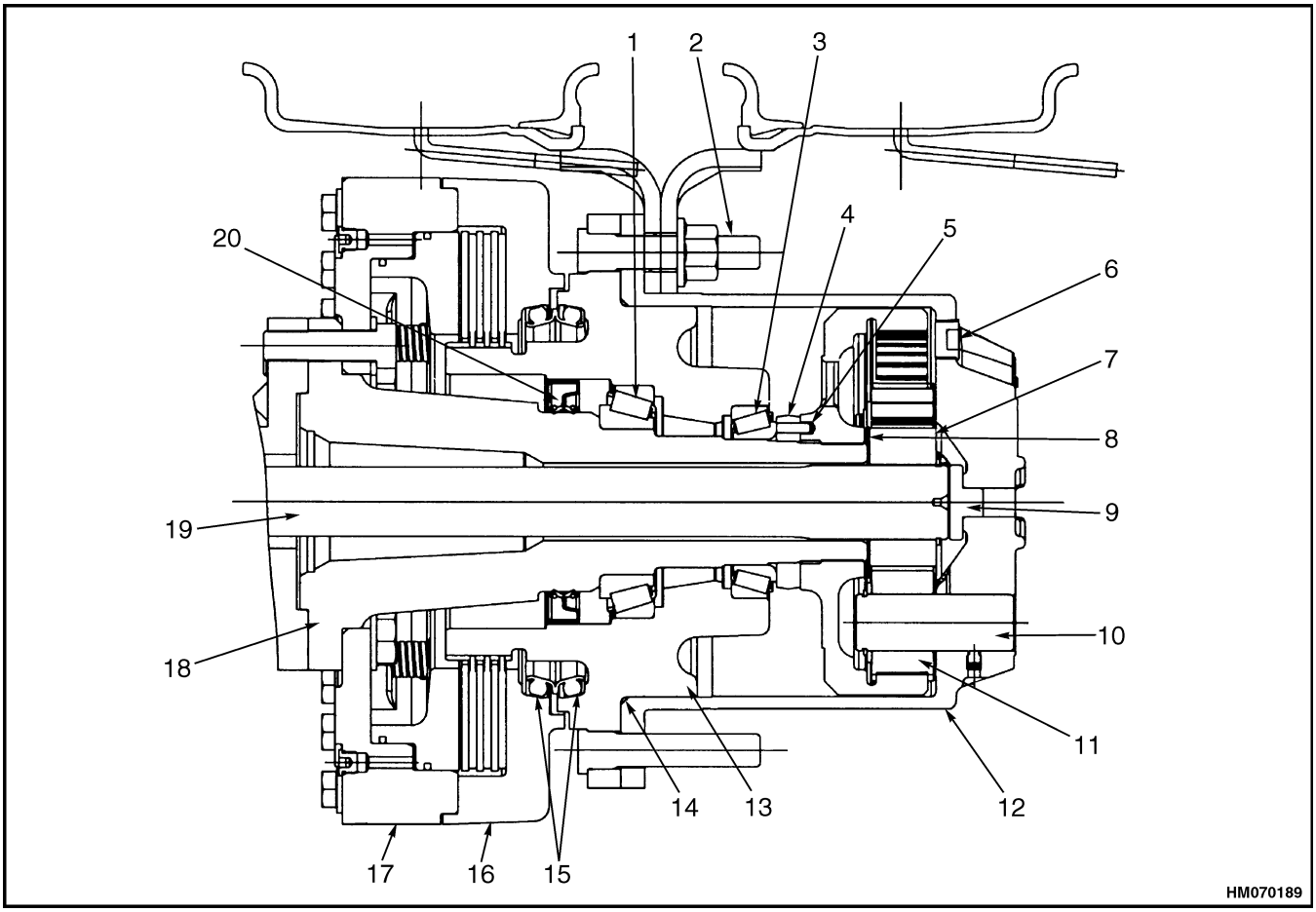
1. PUMP/CHARGE VALVE
2. ACCUMULATORS
3. BRAKE TREADLE
4. OIL COOLER
5. PARK BRAKE
6. PARK BRAKE VALVE
7. OIL FILTER
8. RH BRAKE
9. LH BRAKE
10. PRESSURE CHECK PORTS
11. HYDRAULIC TANK
12. MANIFOLD
13. MANIFOLD
14. BLEEDER

Figure 1. Brake System Schematic



1. PUMP/CHARGE VALVE
2. ACCUMULATORS
3. BRAKE TREADLE
4. OIL COOLER
5. PARK BRAKE
6. PARK BRAKE VALVE
7. OIL FILTER
8. RH BRAKE
9. LH BRAKE
10. MANIFOLD
11. MANIFOLD
12. HYDRAULIC TANK
13. PRESSURE SWITCH
14. PRESSURE CHECK PORTS
15. BLEEDER

Figure 2. Brake System Arrangement



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

Figure 3. Service Brake

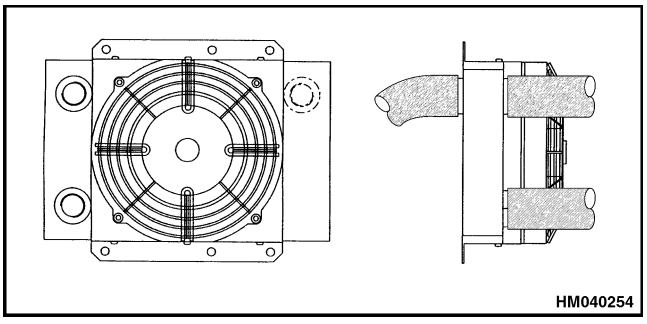


Figure 4. Oil Cooler Circuit Pump

Pressure Switch Replacement

WARNING

Before disconnecting any hydraulic lines, release pressure from hydraulic circuit as follows:

1. **Shut engine OFF and completely lower mast. Install blocks at wheels to prevent vehicle from moving.**
2. **Operate brake pedal until hydraulic pressure is released.**

NOTE: There are two pressure switches, one for detection of low pressure and the other detects when the brake pedal is applied and activates the brake lights.

1. Raise cab. See the section **Operators Cab** for your lift truck.
2. Put tags for identification on lines. See Figure 2. Disconnect lines from switch.
3. Put caps on open lines. Disconnect electrical connector.
4. Install new switch. Connect hydraulic lines and connector at switch.
5. Remove air from hydraulic system and check pressure at switch as described in System Air Removal.

Accumulators Replacement

WARNING

The accumulator has a pressure charge and can cause an injury if the pressure is released too fast. Follow the manufacturer's instructions during removal and installation.

Before disconnecting any hydraulic lines, release pressure from hydraulic circuit as follows:

1. **Shut off engine and completely lower mast. Install blocks at wheels to prevent vehicle from moving.**
2. **Operate brake pedal until hydraulic pressure is released.**

1. Put tags for identification on lines. See Figure 2. Slowly disconnect hydraulic lines from accumulator to release any pressure slowly. Put caps on open lines. Remove accumulator.
2. Follow the manufacturer's instructions during installation of the new accumulator. Tighten bracket nuts. Connect lines.
3. Operate system and check for leaks.

Brake Treadle Valve Repair

REMOVE AND DISASSEMBLE

WARNING

Before disconnecting any hydraulic lines, release pressure from hydraulic circuit as follows:

1. **Shut off engine and completely lower mast. Install blocks at wheels to prevent vehicle from moving.**
2. **Operate brake pedal until hydraulic pressure is released.**

NOTE: The brake treadle valve is mounted to the base of the operator's cab in line with the brake pedal.

1. Put tags for identification on lines. Disconnect lines from valve. See Figure 2. Put caps on open lines.
2. If valve assembly will be repaired or replaced, remove bolts that fasten brake treadle valve assembly to floor plate of cab.

CLEAN AND INSPECT

WARNING

Cleaning solvents are flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

Clean parts in solvent. Inspect spool and bores for scratches. If there are scratches or other damage, parts must be replaced. Lubricate parts with clean hydraulic oil for assembly.

ASSEMBLE AND INSTALL

1. Install valve assembly using bolts that fasten valve assembly to floor plate of cab.
2. Install lines to brake treadle valve.
3. Operate system and check valve connections for leaks. Remove air from hydraulic system as described in System Air Removal.

Parking Brake Valve Repair

REMOVE

WARNING

Before disconnecting any hydraulic lines, release pressure from hydraulic circuit as follows:

1. **Shut engine OFF and completely lower mast. Install blocks at wheels to prevent vehicle from moving.**
2. **Operate brake pedal until hydraulic pressure is released.**

1. Put blocks in front and back of tires so the vehicle cannot move.
2. Disconnect electrical connector. Put tags for identification on hydraulic lines.
3. Disconnect lines from parking brake valve. See Figure 2. Put caps on open lines. Remove valve.

CLEAN AND INSPECT

WARNING

Cleaning solvents are flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the solvent manufacturer's recommended safety precautions.

Clean parts in solvent. Inspect parts and bores for scratches. Replace valve if there are scratches or other damage. Lubricate parts with clean hydraulic oil for assembly.

REPAIR

Install new O-rings at each port.

INSTALL

1. Install parking brake valve. Connect lines.
2. Operate system and check for leaks and correct operation of parking brake system. Remove air from brake system as described in System Air Removal.

Parking Brake Caliper Repair

REMOVE

WARNING

Before disconnecting any hydraulic lines, release pressure from hydraulic circuit as follows:

1. **Shut off engine and completely lower mast. Install blocks at wheels to prevent vehicle from moving.**
2. **Operate brake pedal until hydraulic pressure is released.**

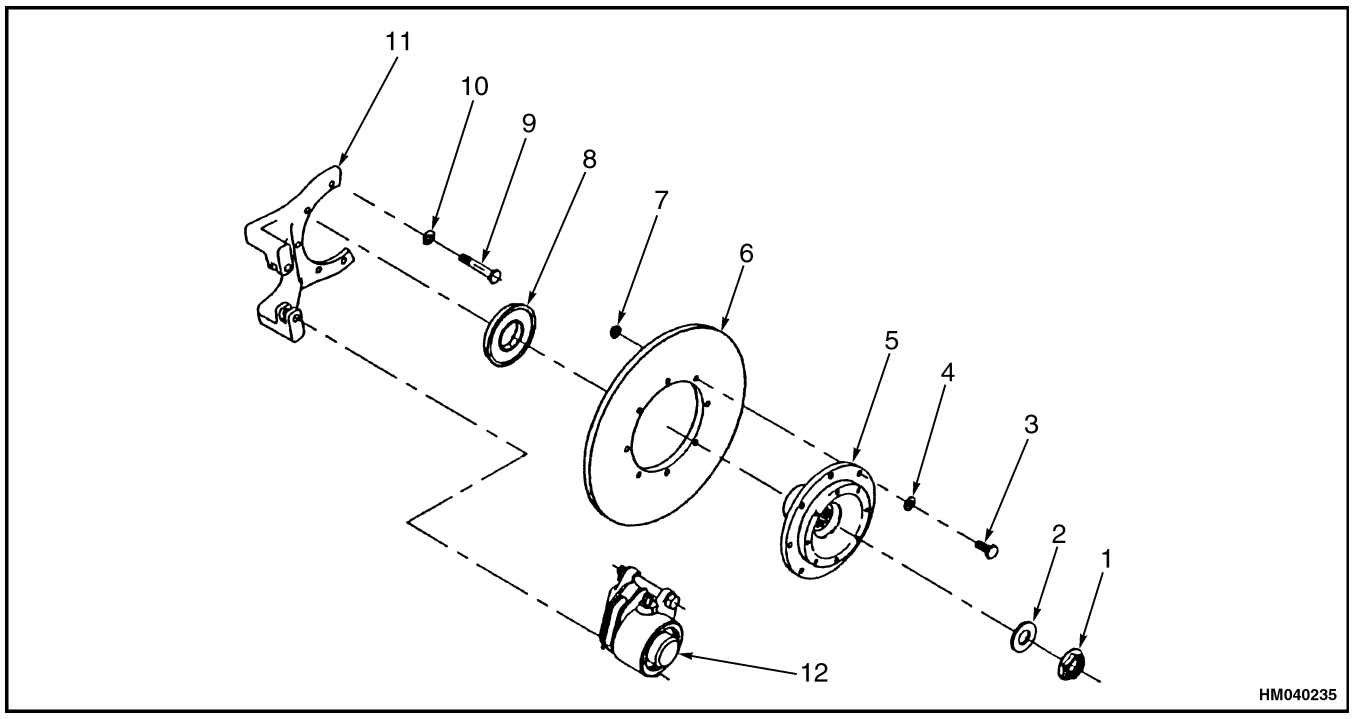
1. Put blocks in front and back of tires so the vehicle cannot move.
2. Remove cap.
3. Loosen lock nut.
4. Turn setscrew counterclockwise until brake pads no longer touch brake disc.
5. Slowly release pressure from accumulator. Disconnect hydraulic line at caliper. Put a cap on open line.

WARNING

Brake linings can contain dangerous fibers. Breathing dust from these linings can be a cancer or lung disease hazard. Do not make dust! Do not clean brake parts with compressed air or by brushing. Use vacuum equipment approved for brake dust or follow the cleaning procedure in this section. When calipers are removed, do not make dust.

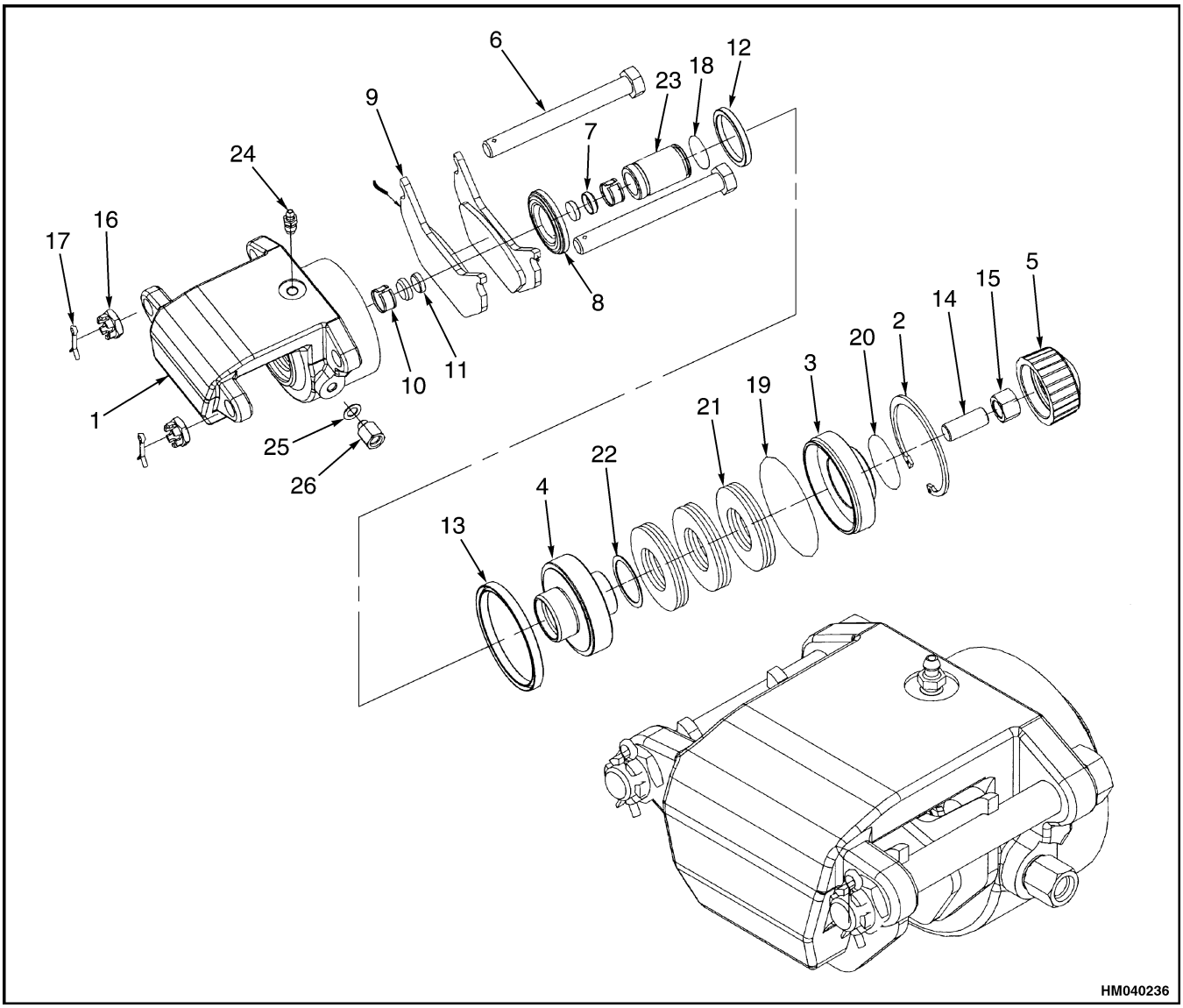
Do not sand, grind, chisel, hammer, or change linings in any way that will make dust. Any changes to linings must be done in a restricted area with special ventilation. Protective clothing and a respirator must be used.

6. Remove bolts that hold caliper to bracket. See Figure 5 and Figure 6. Remove caliper and brake linings.



1. LOCK NUT
2. FLAT WASHER
3. CAPSCREW
4. HARDENED WASHER
5. YOKE ASSEMBLY
6. DISC BRAKE
7. LOCK NUT
8. SEAL ASSEMBLY
9. SPECIAL SCREW (LONG)
10. HARDENED WASHER
11. BRAKE ADAPTER
12. BRAKE DISC ASSEMBLY

Figure 5. Parking Brake Assembly



1. BRAKE HOUSING
2. RETAINING RING
3. PISTON STOP
4. PISTON
5. CAP
6. 145MM LONG BOLTS
7. RETAINING CUP
8. DUST BOOT
9. BRAKE PADS
10. FRICTION SLEEVE
11. MAGNET
12. CUP SEAL
13. CUP SEAL
14. SETSCREW
15. LOCKING NUT
16. NUT
17. COTTER PIN
18. O-RING SEAL
19. O-RING SEAL
20. O-RING SEAL
21. DISC SPRING
22. WEAR PLATE
23. RAM
24. BLEEDER
25. WASHER
26. ADAPTER

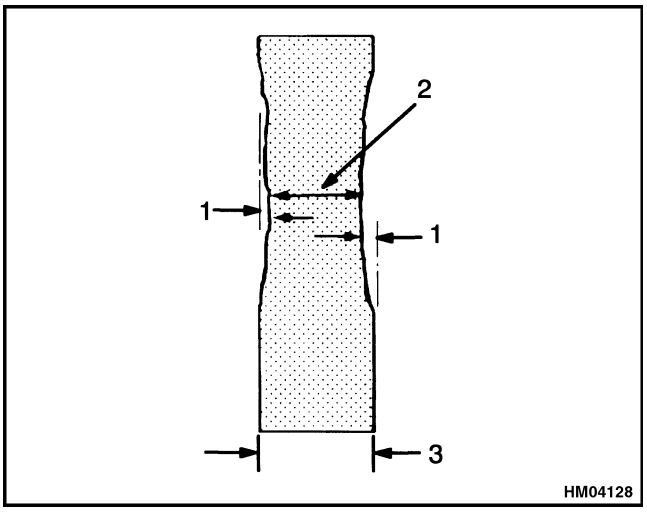
Figure 6. Parking Brake Caliper

DISASSEMBLE

Disassemble caliper to remove and service as necessary.

INSPECT

Inspect parts and bores for scratches. If there are scratches or other damage, replace damaged parts. Inspect rotor as shown in Figure 7.



1. MAXIMUM ROTOR WEAR 1.5 mm (0.06 in.)
2. MINIMUM ROTOR THICKNESS 11.0 mm (0.43 in.)
3. ROTOR THICKNESS 13.0 mm (0.51 in.)

Figure 7. Inspect Rotor for Parking Brake Caliper

INSTALL

NOTE: Brake setting is required after mounting new brake pads or brake disc, as well as during all repair stages and in the event of insufficient braking performance.

NOTE: All mounting and setting work must be carried out on the brake when cold.

1. Remove cap.
2. Release lock nut and turn setscrew counterclockwise until ram comes to rest against face of piston.
3. Mount caliper to bracket and secure with bolts.
4. Mount pressure connection and apply the necessary release pressure to brake until bank of disc springs are completely pretensioned.
5. Adjust brakes.

ADJUST

NOTE: During this adjustment process, the parking brake must be released and the disc springs pretensioned.

1. Put blocks in front and back of tires so the vehicle cannot move.
2. Remove cap.
3. Release lock nut and turn setscrew clockwise until brake pads touch brake disc.
4. Turn setscrew counterclockwise and set clearance specified. See Table 1.
5. Hold setscrew in position and tighten lock nut.
6. Replace cap and tighten.
7. Bleed piston chamber using bleeder. See Figure 6.
8. Operate brake valve several times and check braking efficiency of parking brake on a slope.

Table 1. Brake Pad Adjustment

Type	Adjustment Screw	Clearance mm (in.)		Revolutions
Small	M16 (size 8)	Minimum	0.5 mm (0.020 in.)	1/4
		Rated Clearance	**1.0 mm (0.039 in.)**	**1/2**
		Maximum	1.5 mm (0.059 in.)	3/4
Large	M20 (size 10)	Minimum	1.0 mm (0.039 in.)	2/5
		Rated Clearance	**2.0 mm (0.079 in.)**	**4/5**
		Maximum	3.0 mm (0.118 in.)	1-1/5

Brake Pad Repair

NOTE: The brake pads themselves are maintenance free. All that is required here is a check for damaged parts, as well as, inspection to ensure that the brake disc spins freely.

INSPECT

The thickness of the brake lining must be subjected to a visual inspection at regular intervals, which depends on vehicle usage, but every 6 months at the latest. In the event of a minimal residual lining thickness, these intervals must be reduced accordingly in order to avoid major damage to the brake or disk.

- Small brake: Minimum residual thickness 1.0 mm (0.039 in.) per brake lining plate [6 mm (0.236 in.) carrier plate thickness]
- Large brake: Minimum residual thickness 2.0 mm (0.079 in.) per brake lining plate [8 mm (0.315 in.) carrier plate thickness]

REMOVE

⚠ CAUTION

If the pressure hose is too short, it must be disconnected in order to allow the brake to be removed. Step 2 and Step 3 must be performed beforehand. Then release pressure by actuating hand brake valve.

NOTE: During this adjusting process, the parking brake must be released.

1. Release cap and unscrew. See Figure 6.
2. Release lock nut and turn setscrew clockwise until it is flush with inside of piston.
3. Press back ram bolt using a suitable screwdriver until it comes to rest against piston.

NOTE: In the event there is insufficient clearance to remove brake pads, brake must be completely removed. To do this, pull 145 mm (5.708 in.) long bolts out of brake housing.

4. Depending on free space available, release one of two 145 mm (5.708 in.) bolts, remove cotter pin, unscrew nut, and pull 145 mm (5.708 in.) long bolt out of brake housing. Remove brake pads.

INSTALL

NOTE: If magnets do not have sufficient force, they must also be replaced. Remove by prying out with a screwdriver.

NOTE: When brake has been completely removed, pressure hose must be reconnected to brake housing. Brake must then be bled.

1. Replace brake pads and insert 145 mm (5.708 in.) long bolts into brake housing. Verify magnets have sufficient force to hold brake pads.
2. Secure to bracket with 145 mm (5.708 in.) long bolts, nuts, and cotter pins.
3. Adjust brakes. See Adjust.

Seals Repair

REMOVE

1. Release lock nut and turn setscrew clockwise until it is flush with inside of piston.
2. Release pressure by actuating hand brake valve; then remove pressure hose and completely remove brake. The disc springs are now completely depressurized.
3. Remove piston stop and remove retaining ring from housing.
4. Remove bank of disc springs and piston.

INSTALL

CAUTION

Verify mounting direction of seal rings, otherwise leaks may occur.

CAUTION

When mounting new seal rings, use caution not to damage sealing lip by using a suitable mounting needle with rounded edges.

NOTE: When replacing piston, sliding and sealing surfaces must be greased lightly using lubricating grease.

1. Replace seals as needed.
2. Replace remaining individual parts in reverse order of removal.
3. Install caliper assembly and adjust. See Adjust.

Service Brake Repair

The service brake assemblies are hydraulically actuated wet brakes. Most repairs are seal replacement at the hub and brake disc housing. Replace these seals any time the hub is removed. See Figure 8.

REMOVE AND DISASSEMBLE

NOTE: Disassembly of the wet disc brake is required to replace a leaky seal or worn brake disc pack. Various fluids must be drained from the wheel ends. Prepare the truck as follows:

WARNING

Allow the brakes to cool to ambient temperature (cool to the touch) before draining fluid. Wear protective gloves. Personal injury can result.

Use only the type of fluid specified by the equipment manufacturer. Do not use or mix different types of fluid. An incorrect fluid can damage the rubber parts of the assemblies, which could cause loss of braking and serious personal injury.

Do not reuse hydraulic fluid or coolant. Used fluid may be contaminated and can cause incorrect operation, which can result in serious personal injury and damage to components.

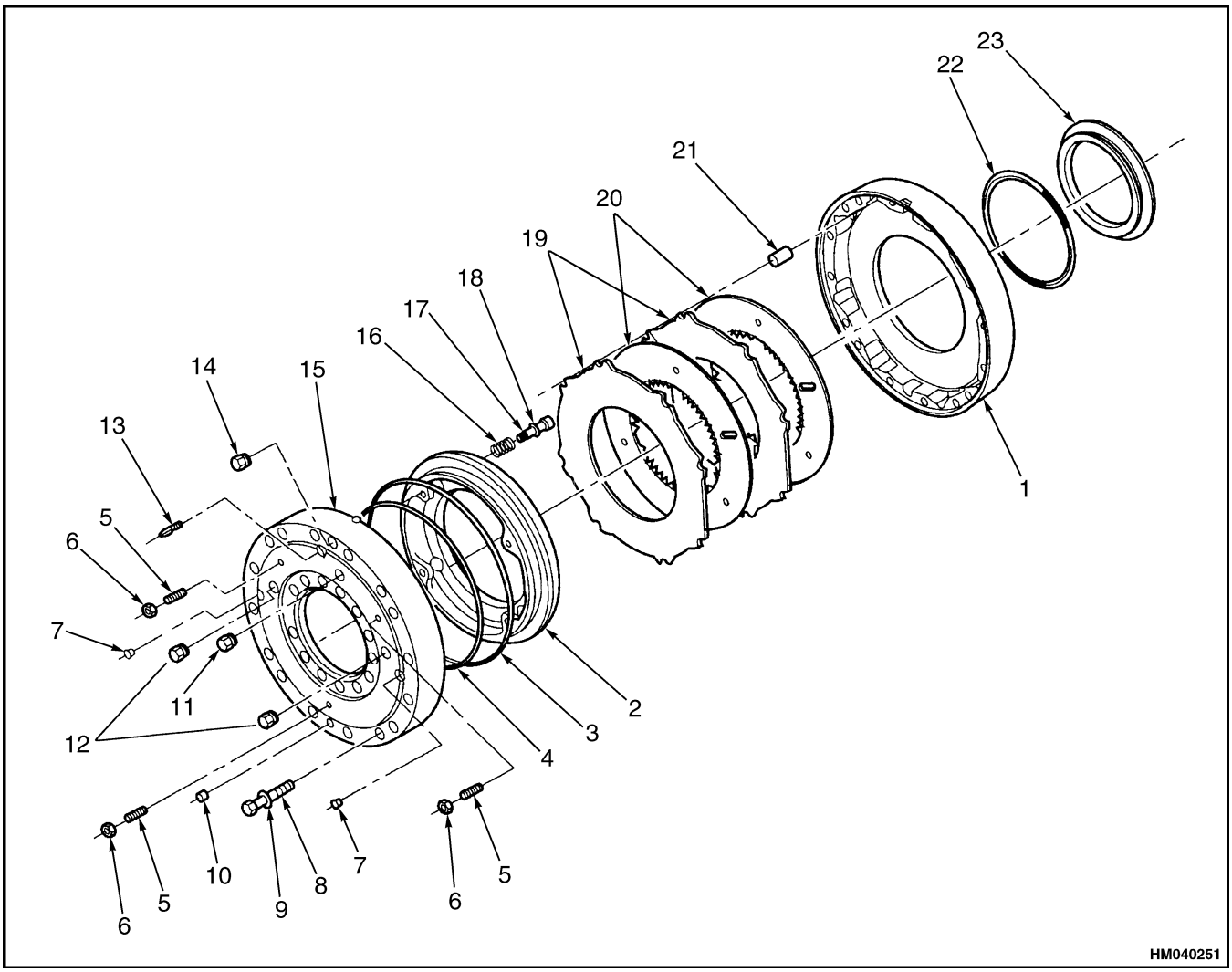
WARNING

Block the wheels to prevent the vehicle from moving. Support vehicle with safety stands. Do not work under a vehicle that is supported only by jacks. Jacks can slip or fall over. Serious personal injury can result.

1. Verify vehicle is on level surface.
2. Place blocks under wheels not being serviced to keep vehicle from moving.
3. Raise vehicle so that wheels of axle to be serviced are off the ground. Support vehicle with safety stands. See the section **Periodic Maintenance** for your lift truck.
4. Remove wheel nuts and dual tire/rim assemblies from both wheel ends.

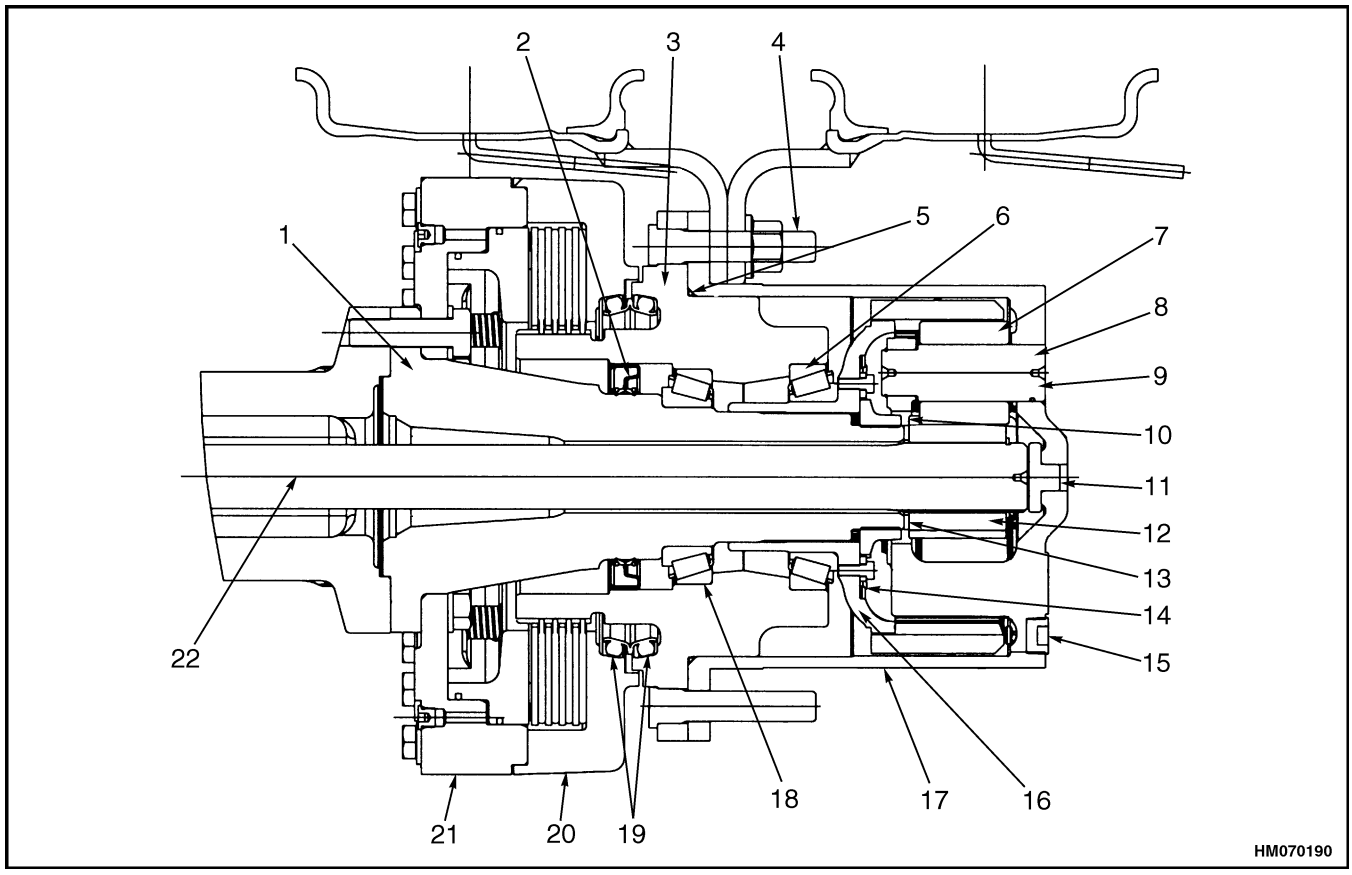
Drain Lubricating Oil

1. Rotate wheel ends so magnetic drain plug in planetary spider is at bottom. See Figure 9 and Figure 10.
2. Place a suitable container under wheel end. Remove magnetic drain plug from spider, then drain lubricant. Dispose of lubricant according to local recommendations.
3. If necessary, remove magnetic drain plug from bottom of brake piston housing. Drain and dispose of lubricant from carrier center section. See Figure 11, Figure 12, and Figure 13.



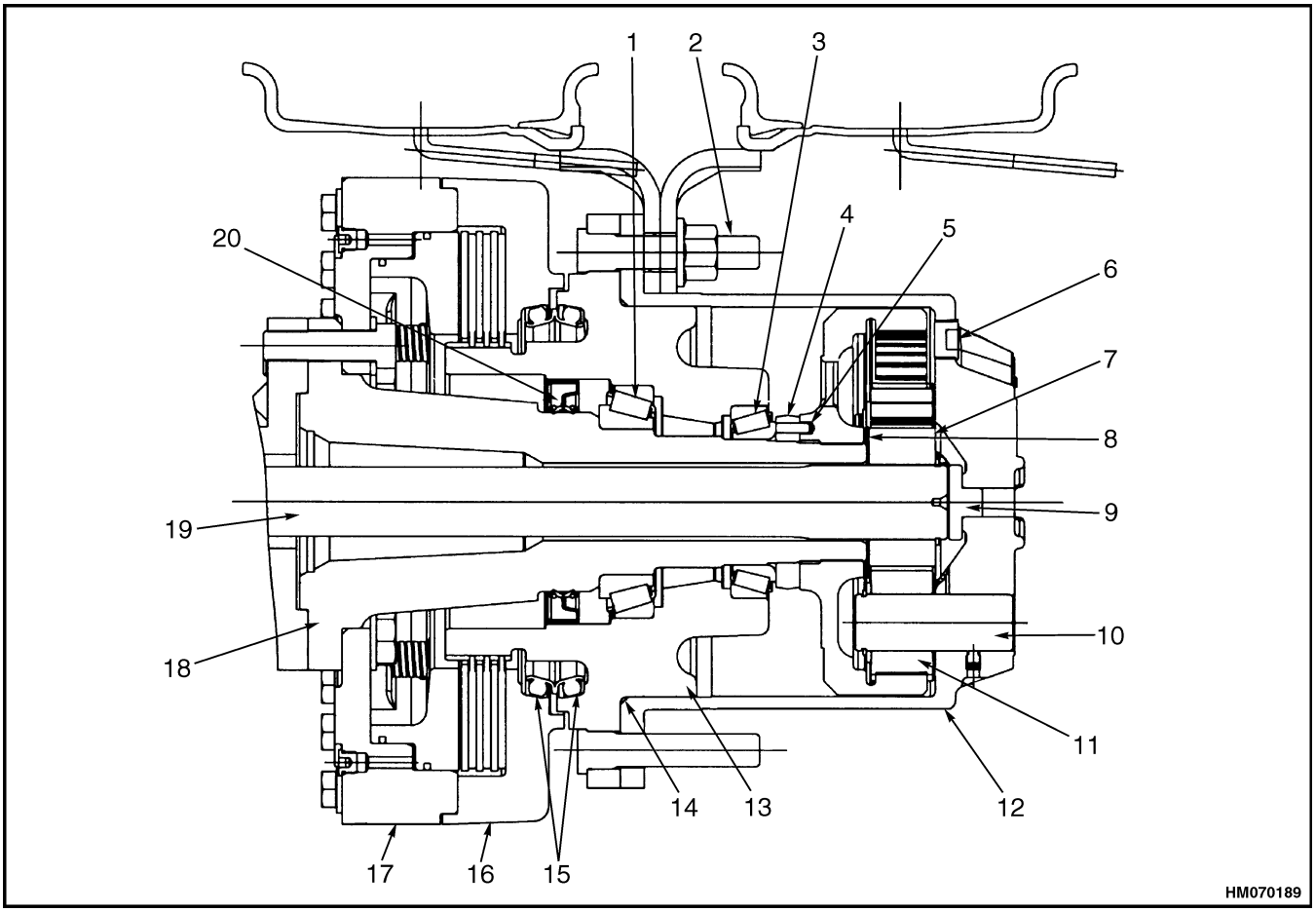
1. BRAKE DISC HOUSING
2. PISTON
3. D-SEAL
4. D-SEAL
5. ADJUSTING SCREW
6. ADJUSTING SCREW JAM NUT
7. PLUG ASSEMBLY, SERVICE BRAKE INLET
8. CAPSCREW
9. HARDENED WASHER
10. MAGNETIC DRAIN PLUG (COOLANT)
11. AIR EVACUATION PLUG (COOLANT)
12. FORCED COOLING OUTLET PLUG
13. BRAKE BLEEDER SCREW
14. FORCED COOLING INLET PLUG
15. BRAKE PISTON HOUSING
16. PISTON RETURN SPRING
17. SHOULDER BOLT
18. HARDENED WASHER
19. STATIONARY DISC
20. FRICTION DISC ASSEMBLY
21. STATIONARY DISC LOCKING DOWEL PIN
22. SEAL RING
23. DUO-CONE FACE SEAL HALF

Figure 8. Wet Brake System



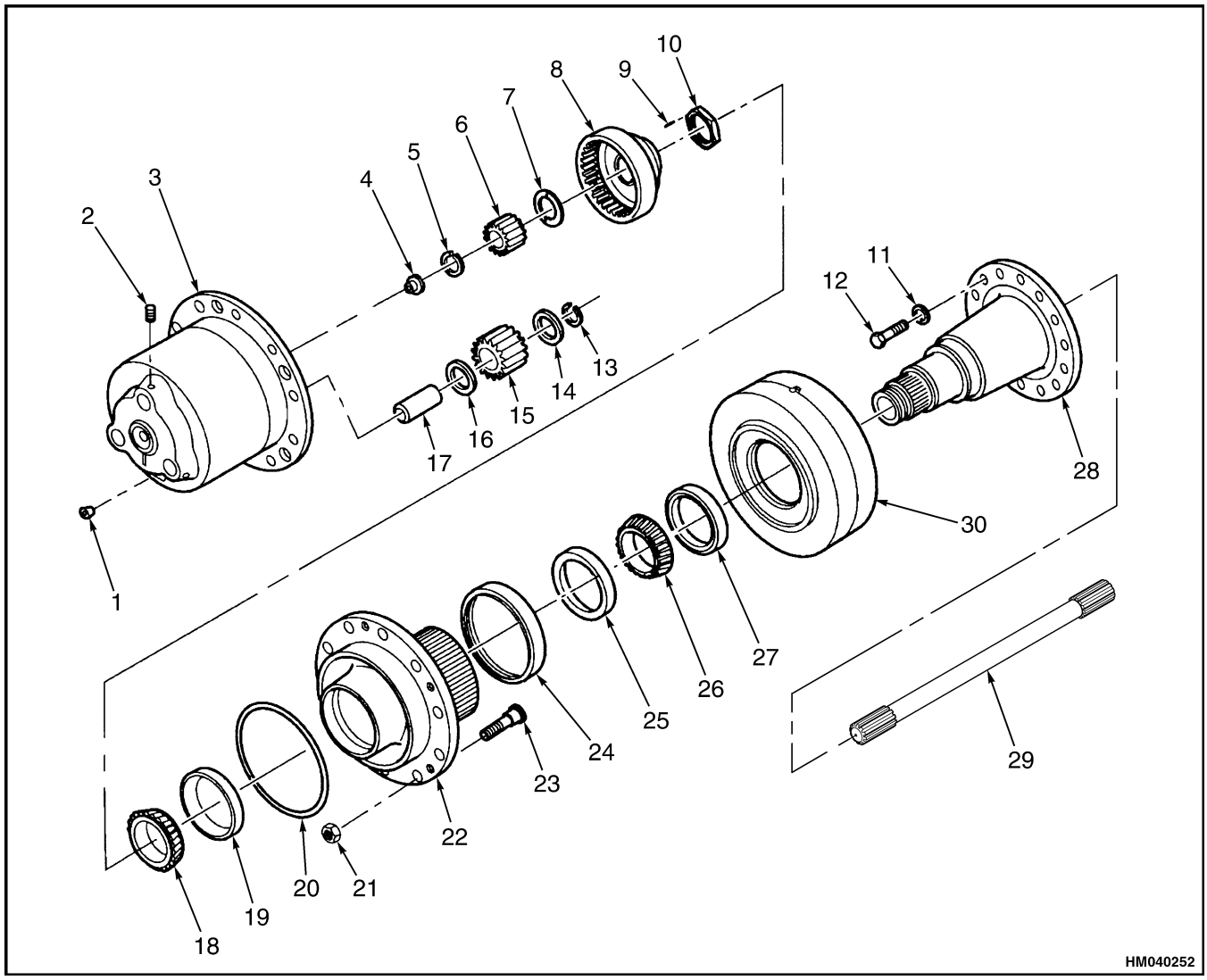
1. SPINDLE
2. OIL SEAL
3. WHEEL HUB
4. WHEEL STUD
5. WHEEL HUB O-RING
6. OUTER BEARING
7. PLANETARY GEAR
8. O-RING
9. PLANETARY PINION SHAFT
10. ADJUSTING NUT
11. THRUST BUTTON
12. SUN GEAR
13. SUN GEAR THRUST WASHER
14. LOCK
15. MAGNETIC DRAIN PLUG
16. RING GEAR HUB
17. PLANETARY SPIDER
18. INNER BEARING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

Figure 9. Wheel End Cross Section H13.00-14.00XM (H300-330HD), H16.00XM-6 (H360HD), and H10.00-12.00XM-12EC (H306HD-EC)



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

Figure 10. Wheel End Cross Section H8.00-12.00XM (H170-280HD), H16.00-22.00XM-12EC (H400-500HD/HDS-EC) and H16.00-18.00XM/XMS-12 (H400-450HD/HDS)



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

Figure 11. Wheel End H8.00-12.00XM (H170-280HD)