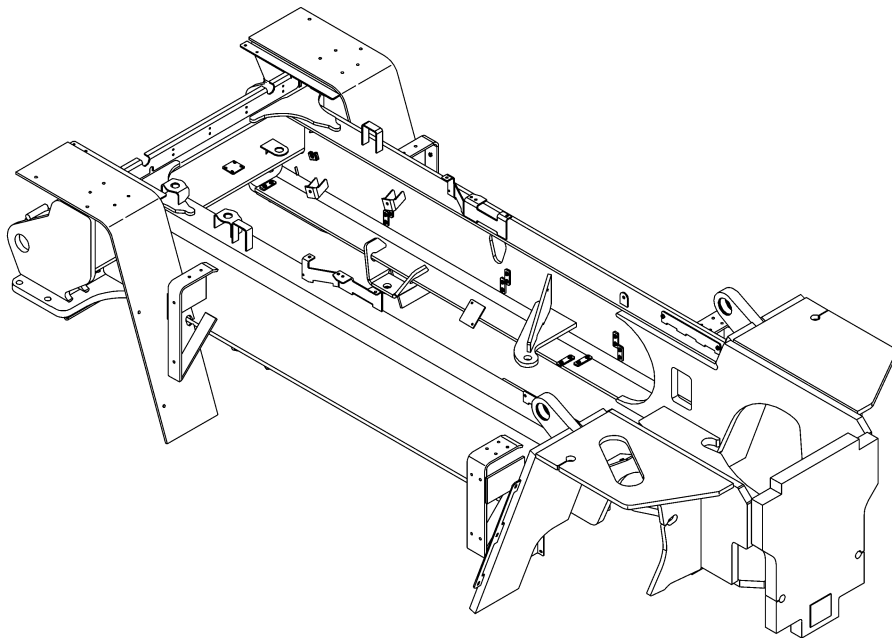


FRAME

H16.00-22.00XM-12EC
(H400-500HD/HDS-EC) [B214]



HYSTER

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This section is for the following models:
H16.00-22.00XM-12EC (H400-500HD/HDS-EC) [B214]

(More Content includes: Brake system, Capacities, and specifications, Frame, Hydraulic, System, Industrial battery, Main control, Valve, Mast repair, Fasteners, Schematics diagrams, Steering axle, Steering system, Wire harness repair And more)

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General

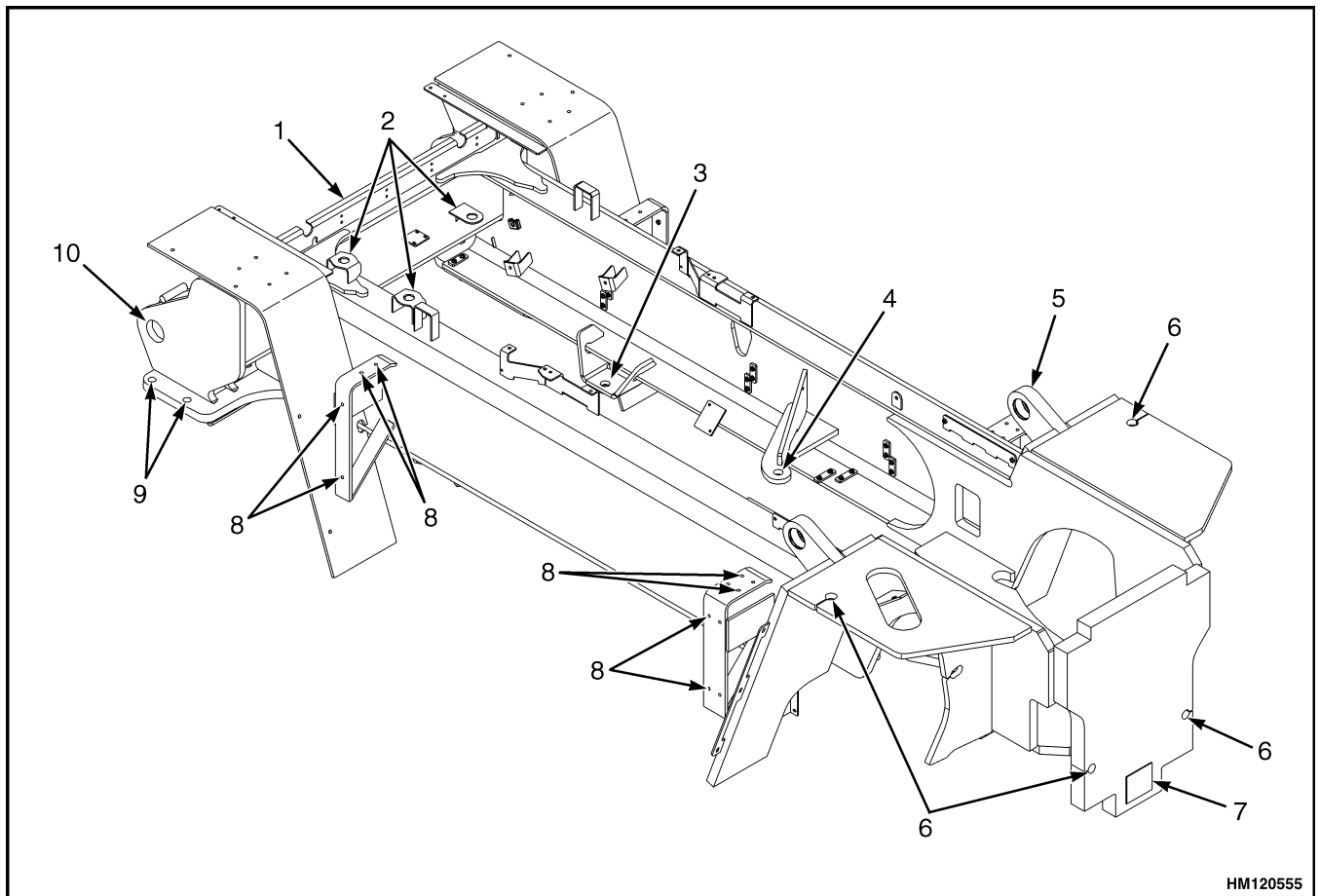
This section has the description and repair procedures for the lift truck frame and connected parts. Included in this section are the frame, counterweight, covers, floor plates, handrails and steps,

hydraulic tank, and fuel tank. The instructions for removal and installation of the engine are also included in this section.

Description

The frame is a one-piece weldment and has mounts for the main counterweight, engine, transmission,

axles, hydraulic and fuel tanks, operator's compartment, and other parts. See Figure 1.



HM120555

1. MAIN FRAME
2. VALVE-PLATE MOUNT
3. TRANSMISSION MOUNT
4. ENGINE MOUNT
5. TILT CYLINDERS MOUNT

6. MAIN COUNTERWEIGHT MOUNT
7. STEER AXLE MOUNT
8. FUEL/HYDRAULIC TANK MOUNT
9. DRIVE AXLE MOUNT
10. MAST MOUNT

Figure 1. Frame

Counterweight Repair

GENERAL

The shape of the main counterweights is the same, however, the weight will be different for each model. The model weights are shown in Table 1.

Table 1. Counterweight Weights

Model	Weight
H16.00XM-12EC	6,000 kg (13,230 lb)
H18.00XM-12EC	6,000 kg (13,230 lb)
H22.00XM-12EC	8,450 kg (18,633 lb)
H400HD-EC	6,000 kg (13,230 lb)
H440HDS-EC	6,000 kg (13,230 lb)
H450HD-EC	6,000 kg (13,230 lb)
H450HDS-EC	8,450 kg (18,633 lb)
H500HD-EC	8,450 kg (18,633 lb)

REMOVE



WARNING

The counterweight is very heavy. Verify that the lifting device has the capacity to lift the main counterweight. See Table 1 for counterweight weights.

1. Place truck on solid, level surface.

2. Lower the mast completely.
3. Shut down the engine.
4. Apply parking brake.
5. Attach a lifting device to the two lift points of the counterweight. See Figure 2.
6. Remove four capscrews, washers, and nuts that hold the counterweight to the frame. See Figure 3.



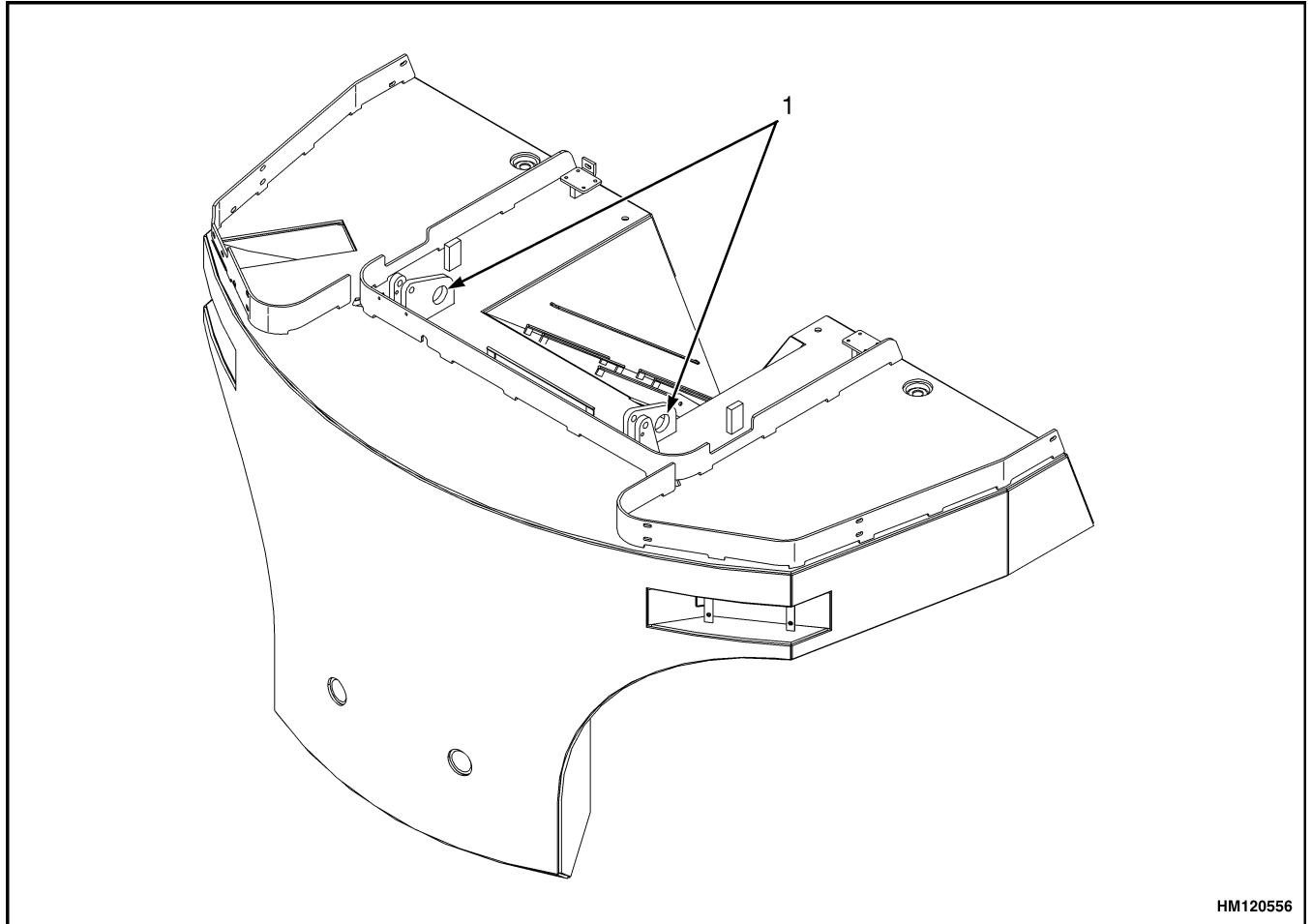
WARNING

Never lift the counterweight straight up. This will cause damage to the frame and may cause personal injury.

7. Raise and move backward the counterweight slowly at the same time.
8. Lower counterweight to the floor.

INSTALL

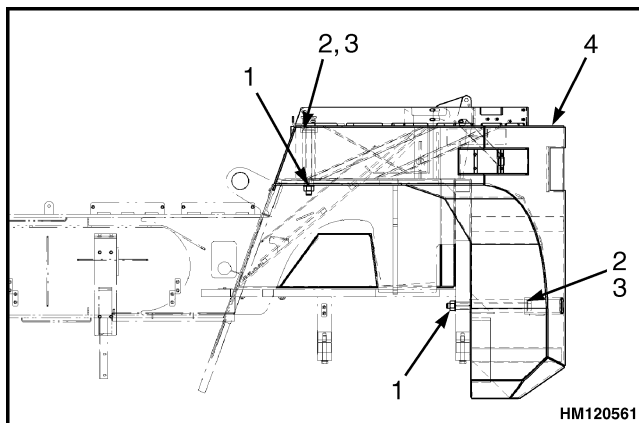
1. Attach a lifting device to the two lift points of the counterweight. See Figure 2.
2. Install the counterweight on the frame by aligning the flange over the frame member.
3. Install the four capscrews, washers, and nuts. Tighten the capscrews to 1100 N•m (811 lbf ft).



HM120556

1. LIFT POINTS

Figure 2. Lift Points



HM120561

Legend for Figure 3

- 1. NUT
- 2. CAPSCREW
- 3. WASHER
- 4. COUNTERWEIGHT

Figure 3. Counterweight Mounting Capscrews, Washers, and Nuts

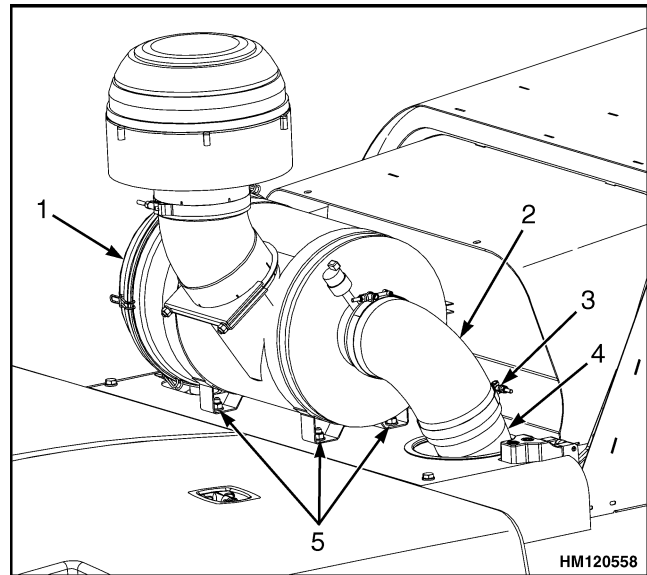
Air Cleaner Repair

REMOVE

1. Unlock the two front covers. See Figure 4.
2. Remove the two front covers.
3. Remove the band clamp from the air intake tube.
4. Remove the four capscrews, washers and nuts.
5. Remove the air intake tube from the air cleaner elbow.
6. Remove the air cleaner assembly from the hood.

INSTALL

1. Position the air cleaner assembly on the hood.
2. Connect the air cleaner elbow to the air intake tube.
3. Install the four capscrews, washers and nuts that hold the air cleaner assembly to the hood.
4. Tighten the band clamp to the air intake tube.
5. Install the two front covers.
6. Lock the two front covers.



1. AIR CLEANER ASSEMBLY
2. ELBOW
3. BAND CLAMP
4. AIR INTAKE TUBE
5. MOUNTING PARTS

Figure 4. Air Cleaner

Hoods and Covers

REMOVE

NOTE: The two front covers can be removed easily from the frame using a lock/unlock system.

1. Unlock the two front covers. See Figure 5.
- NOTE:** If necessary, remove the air cleaner assembly. See the section Air Cleaner Repair.
2. Remove the two front covers.
 3. Remove the two gas springs by removing the nuts.
 4. Remove the hoods.

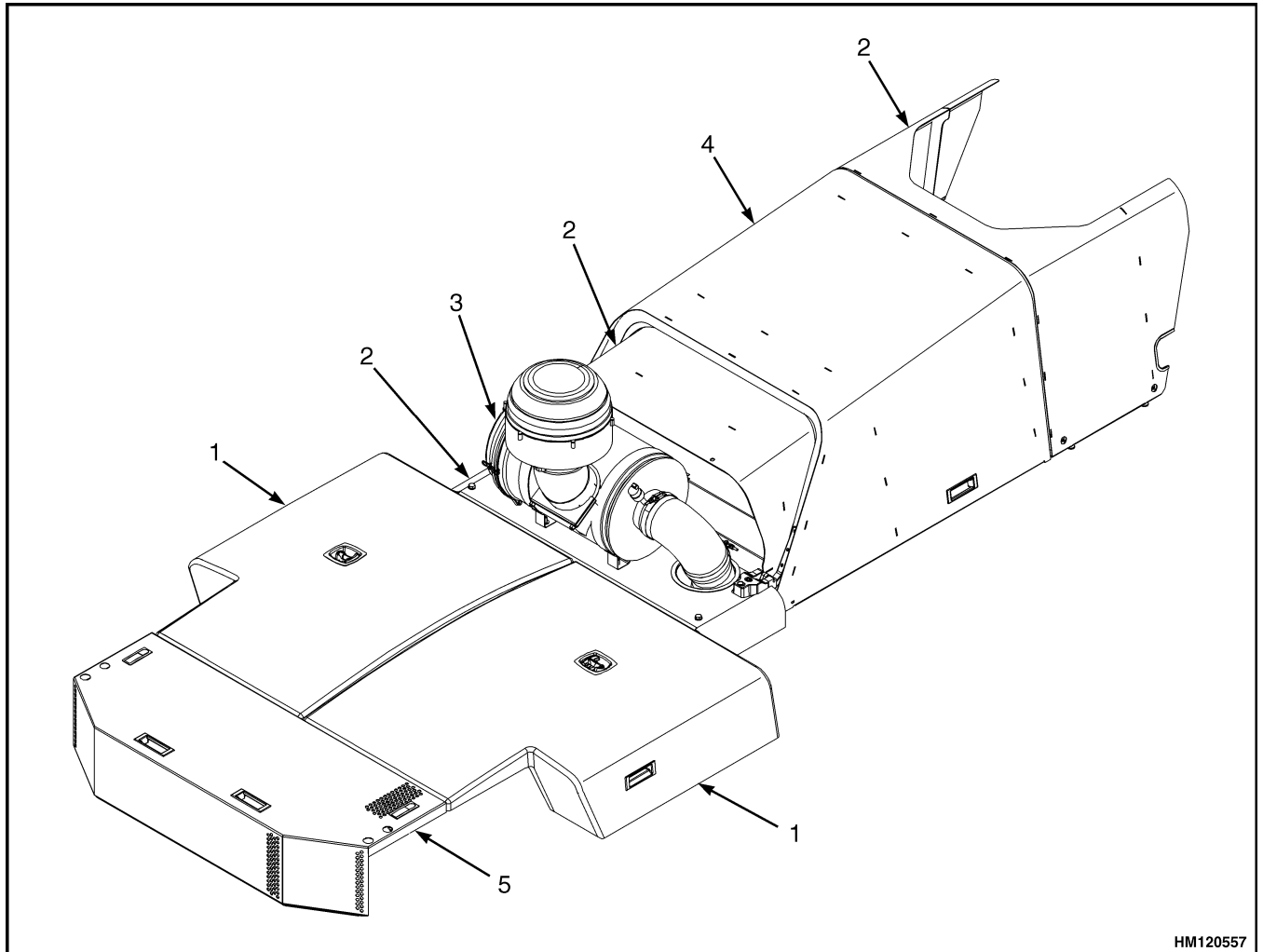
5. Remove the oil cooler cover.

INSTALL

1. Install the oil cooler cover.
2. Install the hoods.
3. Install the two gas springs using the nuts.

NOTE: If necessary, install the air cleaner assembly. See the section Air Cleaner Repair.

4. Install the two front covers.
5. Lock the two front covers.



HM120557

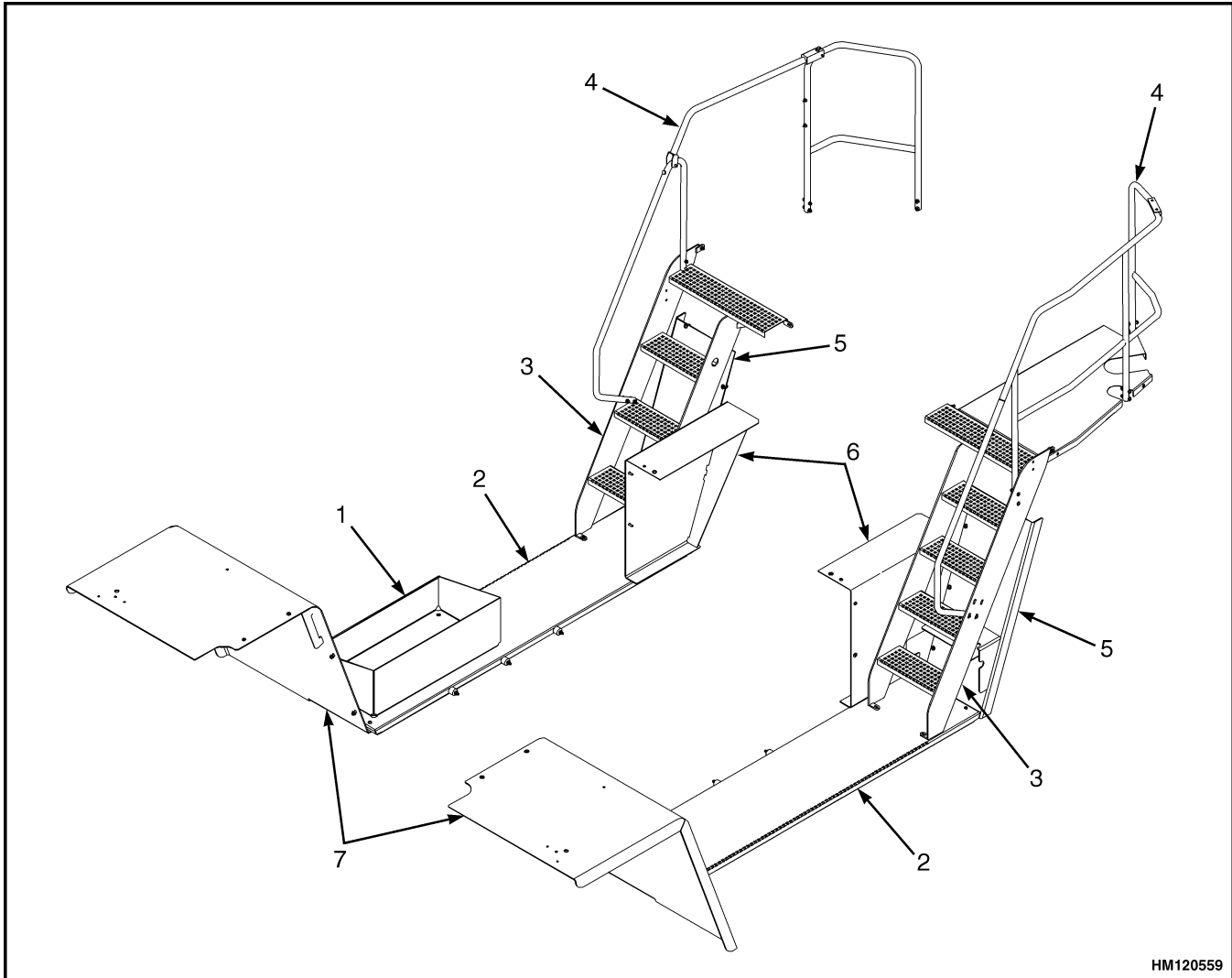
- 1. FRONT COVER (LH AND RH)
- 2. HOOD
- 3. AIR CLEANER ASSEMBLY

- 4. HOOD (WITH GAS SPRING)
- 5. OIL COOLER COVER

Figure 5. Hoods and Covers

Floor Plates, Handrails, and Steps

The floor plates, handrails, and steps can be removed from the frame for access to components. See Figure 6.



HM120559

- 1. STORAGE BOX
- 2. FLOOR PLATE
- 3. STEPS
- 4. HANDRAILS

- 5. REAR FENDER
- 6. EXTENSION COVER
- 7. FRONT FENDER

Figure 6. Floor Plates, Handrails, and Steps

Hydraulic Tank Repair

The hydraulic tank is installed on the right side of the frame. See Figure 7.

REMOVE



WARNING

The hydraulic oil tank contains 321 liter (84.8 gal) of hydraulic oil. Drain the oil from the tank before removing the hydraulic tank. Failure to drain the tank could result in an oil spill.

After use of the hydraulic system, the hydraulic oil is very hot. Do not begin any maintenance procedures until the hydraulic oil has cooled. Monitor the temperature of the hydraulic oil by observing the temperature gauge on the outside of the hydraulic tank.

1. Place truck on solid, level surface.
2. Lower the mast completely.
3. Shut down the engine.
4. Apply the brake.
5. Unlock the right-hand side front cover.
6. Remove the right-hand side front cover.
7. Use a pan to catch the oil that is in the hydraulic lines.
8. Remove the drain plug at the bottom of the tank to drain the oil into clean barrels.
9. Disconnect the hydraulic line positioned on the outside of the tank, pointing toward the center of the frame.
10. Disconnect the hydraulic return lines at the upper front of the hydraulic tank.
11. Use a pan to catch the oil that is in the hydraulic lines.
12. Put tags on the lines for identification.
13. Put caps on the open lines and fittings.



CAUTION

These lift trucks have a 24-volt electrical system (two 12-volt batteries in series). The

higher voltage can cause an electrical shock. Always move battery disconnect switch to disconnected position (pointer to left) before working on electrical system.

For trucks with ECM (engine control module), battery disconnect should only be performed after switching OFF ignition for 30 seconds.

14. Disconnect all electrical connectors from the hydraulic tank and tag connectors to aid in the installation.



WARNING

Batteries are very heavy and should not be lifted without assistance or personal injury may occur.

15. Disconnect the cables from the batteries and remove the batteries through the access door.
16. Remove handrail, floor plate, extension cover, and storage box from the hydraulic tank.
17. Remove the front fender.
18. Remove rear fender.
19. Attach a lifting device to the hydraulic tank at the lifting eye.
20. Create tension on the chains.
21. Position the lifting device so hydraulic tank will be moved a little toward the frame.
22. Remove the eight capscrews holding the hydraulic tank to the frame.



WARNING

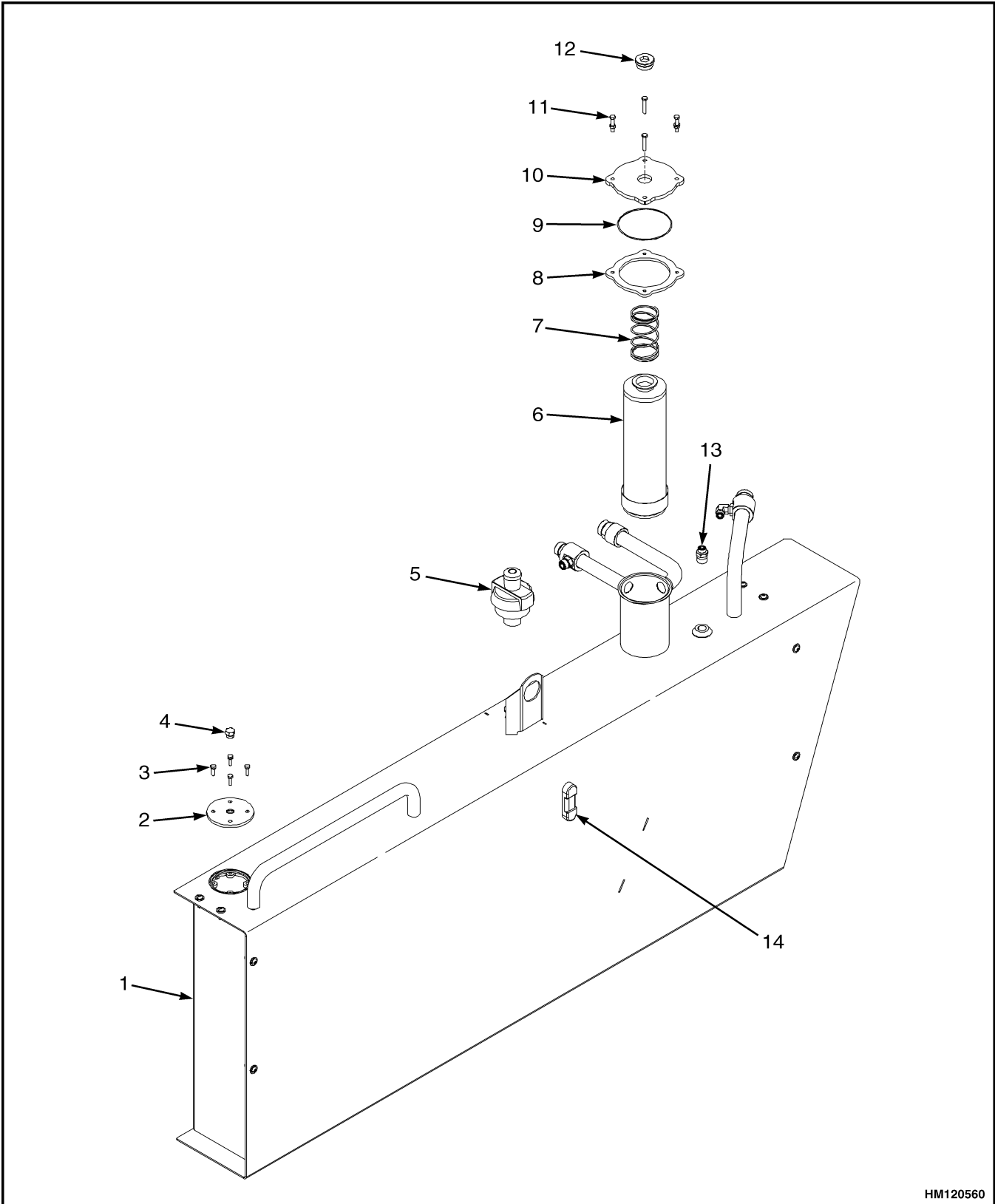
The hydraulic tank weighs 153 kg (337.3 lb). Verify that the lifting device has the rated capacity to remove the hydraulic tank.



CAUTION

Verify the hydraulic hose and electrical cables are not damaged during the removal of the hydraulic tank.

23. Carefully lift the hydraulic tank from the lift truck frame.



HM120560

Figure 7. Hydraulic Tank

Legend for Figure 7

- | | |
|----------------------------|-------------------------|
| 1. HYDRAULIC TANK | 8. GASKET |
| 2. COVER | 9. O-RING |
| 3. MOUNTING PARTS | 10. PLATE |
| 4. FITTING | 11. MOUNTING PARTS |
| 5. BREATHER WITH INDICATOR | 12. PLUG |
| 6. FILTER | 13. ADAPTER |
| 7. SPRING | 14. OIL LEVEL INDICATOR |

REPAIR**Small Leaks**

NOTE: See the section Steam Method for preparations for leak repairs.

**WARNING**

Do not use tools that can make sparks, heat, or static electricity. The vapors in the tank can cause an explosion.

1. Use steam to clean the area around the leak. Remove all paint and dirt around the leak.
2. Apply Loctite 290® to the leak. Follow the instructions of the manufacturer.

Large Leaks

NOTE: See the section Steam Method for preparations for leak repairs.

1. Use acceptable welding practices to repair the tank. See the American National Standard Safety in Welding and Cutting AWS Z 49.1 - 1999.

CLEAN**WARNING**

The power connect to the ECM (electronic control module) must be disconnected before welding on the vehicle. This is accomplished by disconnecting the 50-pin OEM interface connector. Ground for the welder must be located as near as possible to the welding location. Never attach the welder ground clamp to the ECM.

Special procedures must be followed when large leaks or other repairs need welding or cutting. All work must be done by authorized personnel. If the tank is cleaned inside of a building, make sure there is enough ventila-

tion. See the following manuals for additional information:

- "Safe Practices for Welding and Cutting Containers That Have Held Combustibles" by the American Welding Society, F4.1 - 1999.
- "Safety In Welding and Cutting," American National Standard, AWS Z 49.1 - 1999.

When cleaning the tank, do not use solutions that make dangerous gases at normal temperatures or when heated. Wear device for the protection of the eyes. Protect the body from burns.

When cleaning with steam, use a hose with a minimum diameter of 19 mm (0.75 in.). Control the pressure of the steam by a valve installed at the nozzle of the hose. If a metal nozzle is used, it must be made of a material that does not make sparks. Make an electrical connection between the nozzle and the tank. Connect a ground wire to the tank to prevent static electricity.

Steam Method

1. Remove all the parts from the hydraulic tank, except inspection cover.
2. Install the drain plug.
3. Fill the tank 1/4 full with a solution of water and sodium bicarbonate or sodium carbonate. Mix 0.5 kg (1 lb) per 4 liter (1 gal) of water.
4. Mix the solution in the tank using compressed air. Verify all the surfaces on the inside of the tank are flushed with the solution.
5. Drain the tank.
6. Put steam into the tank until the tank does not have odors and the metal is hot. Steam vapors must come from all the openings.
7. Flush the inside of the tank with boiling water. Verify all the loose material is removed from the inside of the tank.

8. Make an inspection of the inside of the tank. If it is not clean, repeat Step 6 and Step 7 and make another inspection. When making inspections, use light that is approved for locations with flammable vapors.
9. Put plugs in all the openings in the tank. Wait 15 minutes; then remove the inlet and outlet plugs. Test a sample of the vapor with a special indicator for gas vapors. If the amount of flammable vapors is above the lower flammable limit, repeat the cleaning procedures.

Chemical Solution Method

NOTE: If the tank cannot be cleaned with steam, use the following procedure:

1. Mix a solution of water and trisodium phosphate or a cleaning compound with an alkali base. Follow the instructions given by the manufacturer.
2. Fill the tank with the cleaning solution. Use compressed air to mix the solution in the tank.
3. Drain the tank. Flush the inside of the tank with hot (boiling) water. Make sure all the cleaning compound is removed.
4. Make an inspection of the inside of the tank. If the tank is not clean, repeat Step 1, Step 2, and Step 3. Make another inspection of the tank. When making inspections, use a light that is approved for locations with flammable vapors.
5. Check the tank for flammable vapors using a special indicator for gas vapors. If the amount of flammable vapors is not below the lower flammable limit, repeat the cleaning procedures.

OTHER METHODS OF PREPARATION FOR REPAIR

If nitrogen gas or carbon dioxide gas is available, prepare the tank for welding using these gases. See the manual *Safe Practices for Welding and Cutting Containers That Have Held Combustibles* by the American Welding Society, F4.1 - 1999. If these gases are not available, another method using water can be used as follows:

1. Fill the tank with water to just below the point where the work will be done. Make sure the space above the level of the water has a vent.

2. Use acceptable welding practices to repair the tank. See the American National Standard *Safety In Welding and Cutting* AWS Z 49.1 - 1999.

INSTALL



WARNING

The hydraulic oil tank contains 321 liter (84.8 gal) of hydraulic oil. Drain the oil from the tank before removing the hydraulic tank. Failure to drain the tank could result in an oil spill.

NOTE: Verify that the drain plug is installed at the bottom of the hydraulic tank.

1. Attach a lifting device to the hydraulic tank at the lifting eye.
2. Raise the hydraulic tank and put the hydraulic tank in position on the frame.
3. Install the eight capscrews that hold the hydraulic tank to the frame.
4. Install front fender.
5. Install rear fender onto hydraulic tank.
6. Install extension cover, floor plate, handrails, and storage box onto hydraulic tank.
7. Connect all electrical connectors as tagged during removal.



WARNING

Batteries are heavy and should not be lifted without assistance or personal injury may occur.

8. Install the batteries through the access door and connect the battery cables.
9. Connect the hydraulic return lines located at the upper front of the hydraulic tank.
10. Connect the hydraulic line positioned on the outside of the tank, pointing toward the center of the frame.
11. Install the right-hand side front cover.
12. Lock the right-hand side front cover.

**WARNING**

Before filling the hydraulic tank with hydraulic oil, replace the O-ring and gasket to avoid oil leakage. See Figure 7.

13. Fill the hydraulic tank to the correct level with the oil specified in the Maintenance Schedule table in the section **Periodic Maintenance** 8000 SRM 1280.

14. Start the engine and operate the hydraulic system. Verify all functions work correctly.

**WARNING**

Do not try to locate hydraulic leaks by putting hands on pressurized hydraulic components. Hydraulic oil can be injected into the body and cause personal injury.

15. Check for leaks.
16. Bleed the system.

Fuel Tank Repair

The fuel tank is installed on the left-hand side of the frame. See Figure 8.

REMOVE

1. Place the lift truck on solid, level surface.
2. Lower the mast completely.
3. Shut down the engine.
4. Apply the parking brake.

**WARNING**

When removing the fuel tank, do not use tools that can make sparks, heat, or static electricity. The vapors in the tank can cause an explosion and personal injury may occur.

5. Put a drain pan under the fuel tank.
6. Remove drain plug to drain the fuel from the tank.

**WARNING**

If the fuel is drained from the fuel tank, put the fuel in a can or barrel that has a sealed cap to prevent contamination.

7. Disconnect the fuel lines at the fuel tank.
8. Remove the hand rails, floor plate, extension cover, and steps from the fuel tank.
9. Remove front fender.
10. Remove rear fender.

**CAUTION**

These lift trucks have a 24-volt electrical system (two 12-volt batteries in series). The higher voltage can cause an electrical shock. Always move battery disconnect switch to disconnected position (pointer to left) before working on electrical system.

11. Disconnect all electrical connectors from the fuel tank and tag connectors to aid in the installation.
12. Attach a lifting device to the fuel tank at the lifting eye and handle bar.
13. Create tension on the chains.
14. Position the lifting device so the fuel tank will be moved a little toward the frame.
15. Remove the eight capscrews that hold the fuel tank to the frame.

**WARNING**

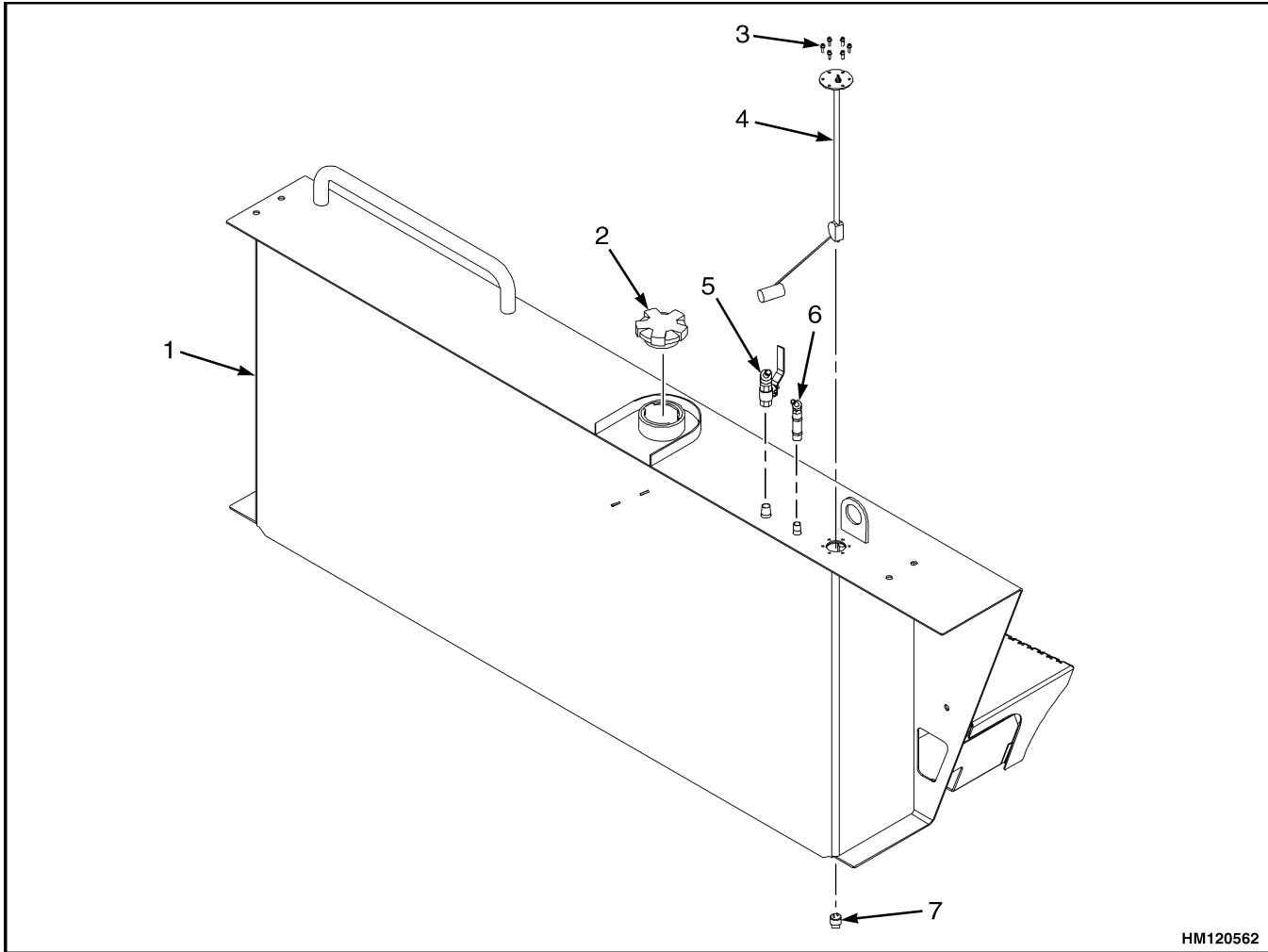
The fuel tank weighs 173 kg (381.4 lb). Verify that the lifting device has the rated capacity to lift the fuel tank.

16. Carefully lift the fuel tank from the lift truck frame.

REPAIR**WARNING**

Do not use tools that can make sparks, heat, or static electricity. The vapors in the tank can cause an explosion.

Repair the fuel tank as described in the repair procedures for the hydraulic tank.



HM120562

- 1. FUEL TANK
- 2. FUEL CAP
- 3. MOUNTING PARTS

- 4. FUEL SENDER
- 5. BALL VALVE
- 6. CHECK VALVE

- 7. DRAIN PLUG

Figure 8. Fuel Tank Repair

INSTALL

- 1. Attach a lifting device to the fuel tank at the lifting eye and handle bar.



WARNING

The fuel tank weighs 173 kg (381.4 lb). Verify that the lifting device has the rated capacity to lift the fuel tank.

- 2. Raise fuel tank and put in position on the frame.
- 3. Install the eight capscrews that hold the fuel tank to the frame.
- 4. Install the extension cover, floor plate, steps, and handrails to the fuel tank.
- 5. Install the rear fender.

6. Install the front fender.
7. Connect all electrical connectors as tagged during removal.
8. Connect fuel lines to the tank.
9. Fill fuel tank to correct level with fuel specified in the Maintenance Schedule of the section **Periodic Maintenance** 8000 SRM 1280.
10. Start engine.
11. Check for leaks.

Exhaust System Repair

REMOVE



WARNING

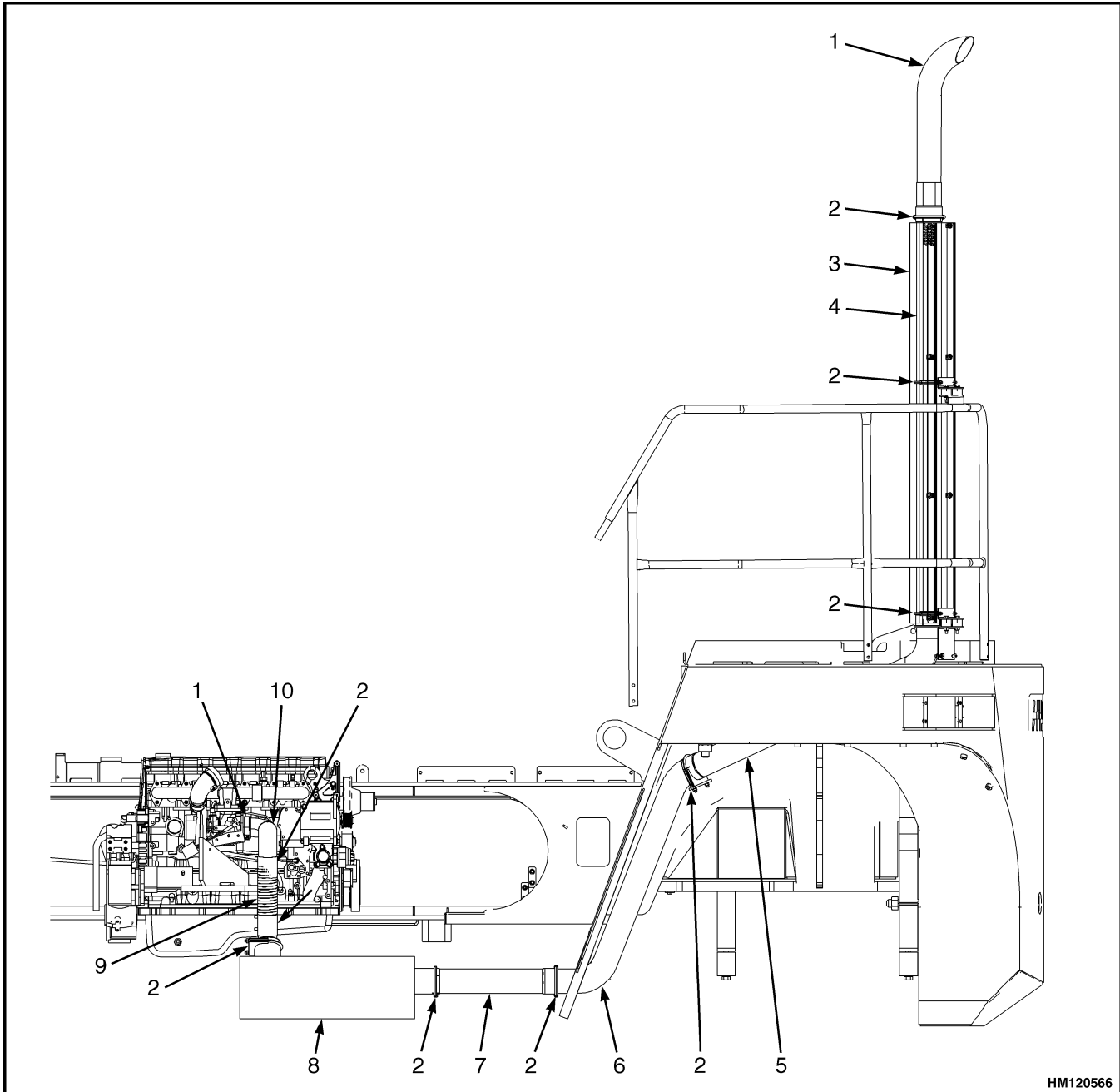
Exhaust system must be at room temperature before starting disassembly or personal injury may occur.

1. Remove the exhaust tube at the left side of the frame. See Figure 9.
2. Remove the exhaust shield.
3. Remove the stack pipe.
4. Remove the exhaust pipe upwards through the counterweight.
5. Remove the second exhaust pipe.
6. Disconnect the flex tube from the muffler.
7. Remove the exhaust extension (if equipped).
8. Remove the muffler.
9. Remove the flex tube.
10. Remove the tube from the engine (turbocharger).

INSTALL

NOTE: To make repositioning possible, do not tighten the exhaust clamps.

1. Install the tube to the engine (turbocharger).
- NOTE:** Verify overlap of flex tube to tube and to muffler are equal.
2. Install the flex tube to the tube and provide a minimum overlap of 25 mm (1 in.).
 3. Install the muffler.
 4. Install the exhaust extension (if equipped).
 5. Install the flex tube to the muffler and provide a minimum overlap of 25 mm (1 in.).
 6. Install the second exhaust pipe.
 7. Position and install the exhaust pipe through the counterweight from the top side.
 8. Install the stack pipe.
 9. Install the exhaust shield.
 10. Install the exhaust tube.
 11. Tighten all clamps.



HM120566

- | | |
|-------------------|------------------------|
| 1. EXHAUST TUBE | 6. SECOND EXHAUST PIPE |
| 2. EXHAUST CLAMP | 7. EXHAUST EXTENSION |
| 3. EXHAUST SHIELD | 8. MUFFLER |
| 4. STACK PIPE | 9. FLEX TUBE |
| 5. EXHAUST PIPE | 10. TUBE |

Figure 9. Exhaust

Engine Repair

REMOVE



CAUTION

Battery disconnect should only be performed at least 30 seconds after switching OFF ignition.

Remove the engine as follows:

1. Place truck on solid, level surface.
2. Lower the mast completely.
3. Shut down the engine.
4. Apply parking brake.



CAUTION

Remove the ground cable first.

5. Disconnect the cables at the battery.



WARNING

Verify that the lifting device has the rated capacity of 2500 kg (5512 lb).

6. Unlock the two front covers.
7. Remove the two front covers.
8. Disconnect the air intake tube from the air cleaner assembly.
9. Remove the two gas springs by removing the nuts.
10. Remove the three hoods.
11. Remove the hood including the air cleaner assembly.
12. Drain the coolant from the cooling system.

NOTE: Do not disconnect the cooling lines from the radiator.

13. Disconnect the cooling lines from the engine.
14. Remove the capscrews to the fan.

15. Remove the fan.

NOTE: Use a pan to catch the oil in the hydraulic lines.

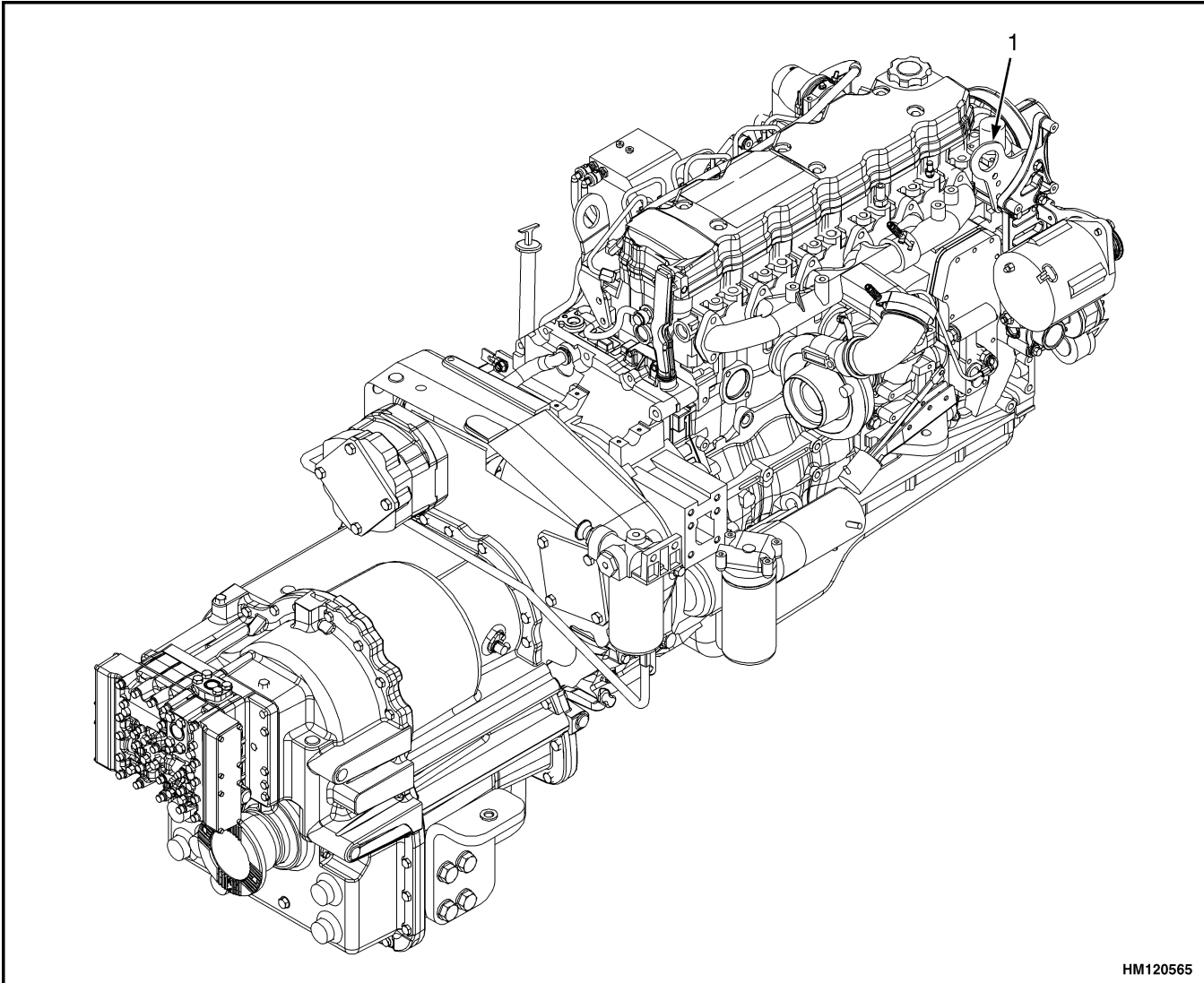
16. Disconnect the hydraulic line at the pump.
17. Put caps on open line and fitting.
18. Disconnect the flex tube attached to the engine, from the exhaust tube. See Figure 9.
19. Disconnect the fuel lines at the fuel filter.
20. Disconnect the electrical wires and wiring harnesses from the engine.
21. Disconnect the starter cable from the starter.
22. Disconnect the electrical wires from the transmission.
23. Disconnect the cooling lines from the transmission.
24. Disconnect hydraulic lines from the transmission to the hydraulic filter.
25. Put caps on the hydraulic lines.
26. Disconnect the charge air cooler lines from the charge air cooler core on the radiator.
27. Disconnect the lines from the expansion tank.
28. Disconnect the drive shaft from the transmission.



WARNING

Verify that the lifting device has the rated capacity of 2500 kg (5512 lb).

29. Connect a lifting strap around the transmission and use the lifting eye at the engine. See Figure 10.
30. Remove the engine mount capscrews that hold the engine to the frame. See Figure 11.



HM120565

1. LIFTING EYE

Figure 10. Engine Assembly

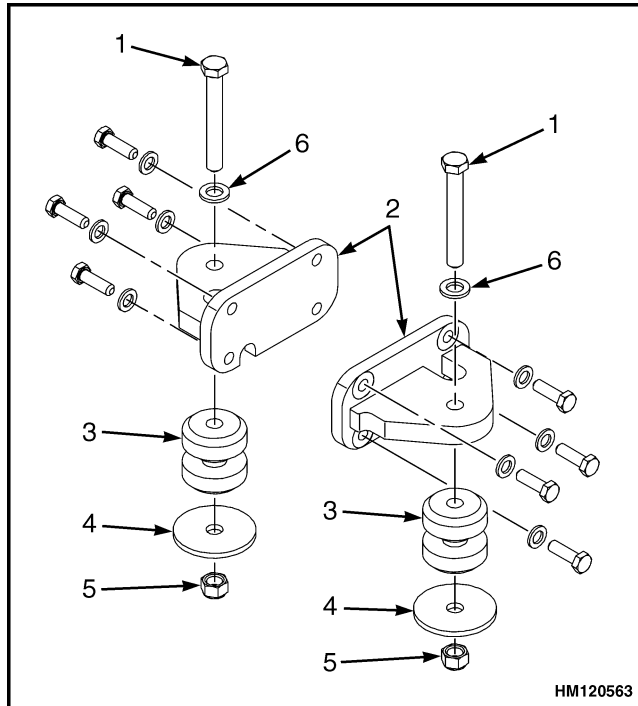
31. Remove the two transmission mount capscrews that hold the transmission to the frame. See Figure 12.
32. Carefully lift the engine and transmission assembly from the frame. See Figure 10. Verify all the connections to the engine or transmission have been removed.

INSTALL

WARNING

Verify that the lifting device has the rated capacity of 2500 kg (5512 lb).

1. Connect a lifting strap around the transmission and use the lifting eye at the engine. See Figure 10.



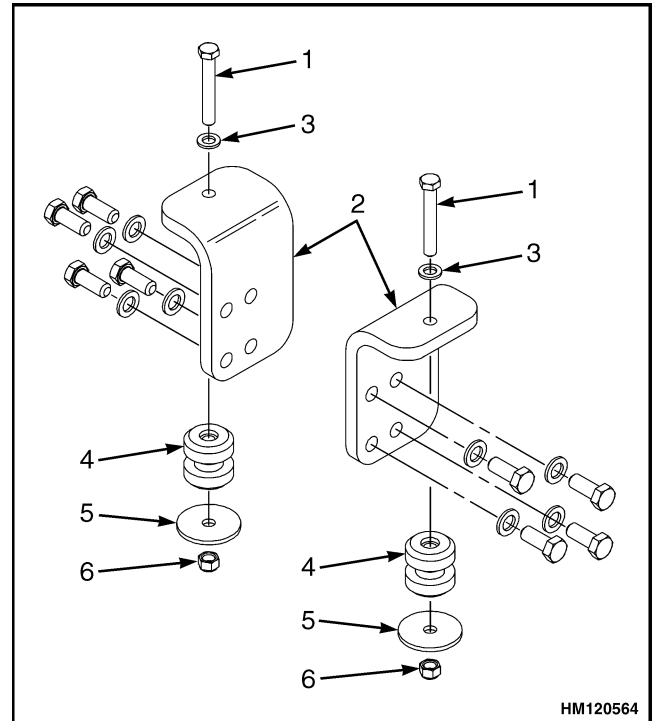
1. ENGINE MOUNT CAPSCREW
2. ENGINE MOUNT BRACKET
3. ISOLATOR
4. WASHER
5. NUT
6. WASHER

Figure 11. Engine Mounts

2. Install the engine and transmission assembly in the frame.

NOTE: Lubricate isolators only with rubber lubricant or water. Do Not use a mineral oil lubricant.

3. Install the engine mount cap screws, washers, isolators, and nuts to the engine mount brackets and frame. Tighten to 165 N•m (122 lbf ft).
4. Install the transmission mount cap screws, washers, isolators, and nuts to the transmission mount brackets and frame. Tighten to 165 N•m (122 lbf ft).
5. Connect the lines to the expansion tank.
6. Connect the charge air cooler lines to the charge air cooler core on the radiator.
7. Connect the hydraulic lines from the transmission to the hydraulic filter.
8. Connect the cooling lines to the transmission.



1. TRANSMISSION MOUNT CAPSCREW
2. TRANSMISSION MOUNT BRACKET
3. WASHER
4. ISOLATOR
5. WASHER
6. NUT

Figure 12. Transmission Mounts

9. Connect the electric wires to the transmission.
10. Connect the starter cable to the starter.
11. Connect electric wires and wire harnesses to the engine.
12. Install the fuel lines between the fuel filter on the engine assembly and fuel tank and water separator.
13. Connect the flex tube, attached to the engine, from the tube using a new clamp.
14. Connect the hydraulic line to the hydraulic pump.
15. Mount the fan to the engine.
16. Install the cap screws to retain the fan.
17. Connect the cooling lines to the engine.
18. Fill cooling system with coolant.

19. Connect the drive shaft to the transmission.
20. Check all oil levels.

**CAUTION**

Install the power cable first or lift truck damage may occur.

21. Connect the cables to the battery.
22. Start the engine and check for leaks and correct operation.
23. Shut down the engine.

24. Install the hood including the air cleaner assembly.
25. Install the three hoods.
26. Install the two gas springs by using the nuts.
27. Connect the air intake tube to the air cleaner assembly.
28. Install the two front covers.
29. Lock the two front covers.

Label Replacement

**WARNING**

If labels that have warnings or cautions are damaged, they must be replaced. Refer to the PARTS MANUAL for the labels and locations of the labels.

If a mast of a different size or an accessory carriage is installed, the capacity rating can change. Changes in the size of drive tires can change the capacity rating. See a dealer for Hyster lift trucks for a replacement nameplate. The nameplate information is a safety item and must be correct.

1. Make sure the surface is dry and has no oil or grease. Do not use solvent on new paint. Clean the surface of old paint using a cleaning solvent.

2. Remove the paper from the back of the label. Do not touch the adhesive surface.
3. Carefully hold the label in the correct position above the surface. The label cannot be moved after it touches the surface. Put the label on the surface. Make sure all air is removed from under the label, and the corners and edges are tight.

If the labels or information plates are missing or damaged, they must be replaced. Refer to the **PARTS MANUAL** for the labels and locations of the labels.

