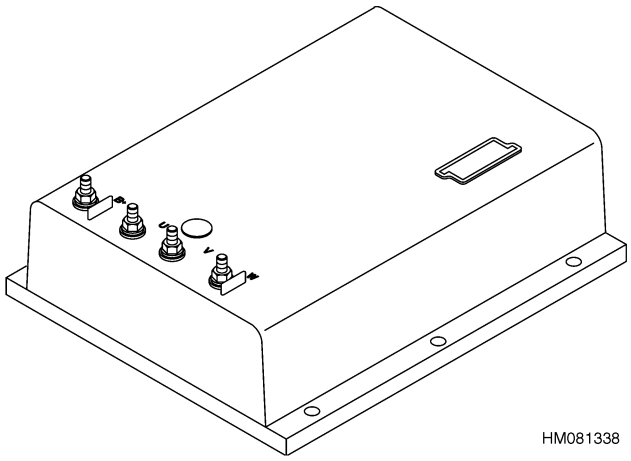
AC MOTOR CONTROLLERS/DISPLAY PANEL

DESCRIPTION, CHECKS, ADJUSTMENTS, AND TROUBLESHOOTING

ERC20-32AGF (ERC040-065GH) [A908];
ERC/P16-20AAF (ERC030, 040AH) [B814/C814];
ERP20-30ALF (ERP040-060DH) [D216];
ERP20-32ALF (ERP040-065DH) [E216];
ERC35-55HG (ERC70-120HH) [B839/C839]



HM081338

PART NO. 524183083 **2200 YRM 1056**

NOTE: The deceleration rate is less when the pedal is not fully depressed.

Function Number 7 AUTO DECELERATION

(Range 0-100)

Function 7 determines the maximum deceleration rate when the accelerator pedal is released. The strength of auto deceleration is a percentage of the regen braking strength determined by **Function 6**.

A **Function 7** setting of **zero** will turn off auto deceleration completely, and a setting of **100** will give auto deceleration the same strength as regen braking.

Function Number 8 BDI ADJUSTMENT

(Range 0-100)

Function 8 allows for adjustment to improve the accuracy of the **Battery Discharge Indicator** in the dash display. Increasing the setting will cause the gage to show **empty** at a higher specific gravity or battery voltage.

A setting of 30 is the recommended starting point for flooded cell batteries, and a setting of 50 for maintenance-free batteries. Further adjustments may be used to fine-tune the BDI accuracy.

Function Number 9 LIFT INTERRUPT

(Enable or Disable)

Function 9 enables or **disables** the lift interrupt feature. The lift interrupt feature stops hoist operation when the BDI reads **empty** to protect the battery from excessive discharge and possible damage.

NOTE: Trucks are shipped from the factory with this feature **enabled**.

Function Number 10 POWER STEERING TIME DELAY

(Range 0-100)

Function 10 sets the time delay for the power steering contactor to open after the seat switch opens. The setting range is 1.5 to 65 seconds. Opening the key switch will open the power steering contactor with no delay.

Function Number 11 SERVICE REMINDER

(Set Next Hourmeter)

Function 11 can be used by the service technician to show a **Status Code 99** when the truck is due for service.

To use this feature, set this function to the hourmeter reading that the service is to occur. When that hourmeter is reached, the dash display will display **Status Code 99** for 10 seconds each time the key is turned **ON**. After 20 hours of operation, the truck will slow to half speed and the code will display continuously until the service is performed. After servicing the truck, **Function 11** should be set to the next service hourmeter reading to regain full performance.

NOTE: A setting of **zero** will disable this feature.

Function Number 12 CUSTOM

(Range 0-100)

Function 12 is not used **except for special functions** required for special applications. Normally, this function is set to **zero**.

A setting value of 1 will change auto deceleration to work even with a partial release of the accelerator pedal. Normally, auto deceleration only works when the accelerator pedal is **fully** released.

A setting value of 2 will cause the maximum lift speed and pump motor acceleration rate to change with the performance mode selected. Normally, only traction speeds and acceleration rates change with the performance mode selected.

A setting value of 3 will combine the changes described for setting values of 1 and 2.

A setting value of 4 directs the master controller to output forward and reverse signals that are compatible with wire guided trucks.

Function Number 13 PUMP SPEED 1

NOTE: This function does not apply for lift trucks that are equipped with the e-hydraulics option.

(Range 0-100)

Function 13 determines the hydraulic pump motor **low speed**. **Low speed** is used for **tilt** and some auxiliary operations (sideshift).

AC Motor Controllers Status Code Charts

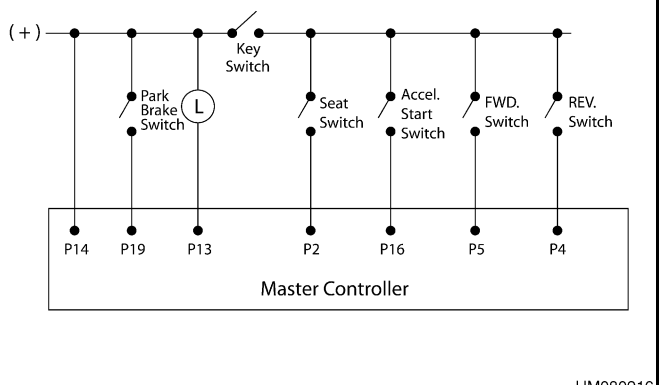
Status Code	Description	Memory Recall	Circuit
1	No seat switch input.	No	Traction

Symptom

Lift truck does not move.
Hydraulic functions are disabled.

Possible Causes and Test Procedures

- Seat switch malfunction.
  Check to see that the seat switch operates properly. Replace a failed switch.
- Check wiring to the seat switch and from the seat switch to the master controller



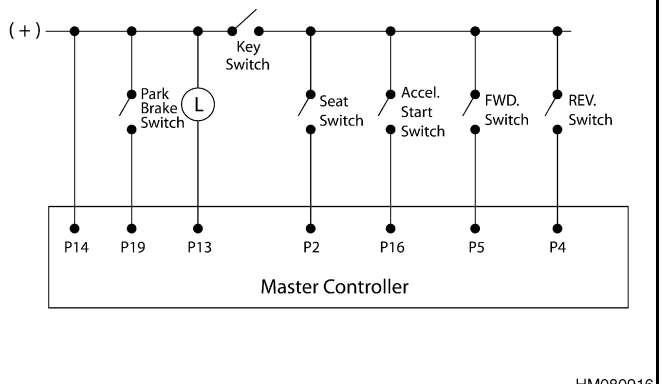
Status Code	Description	Memory Recall	Circuit
2	The forward switch is closed before the key or seat switch closes.	No	Traction

Symptom

Lift truck does not operate.

Possible Causes and Test Procedures

- A directional switch is closed when the key switch is turned to the **ON** position. This violates the Static Return to Off (SRO) Startup Procedure, move the directional lever to the neutral position, and then select a direction.
- A directional switch is failed closed or out of adjustment.



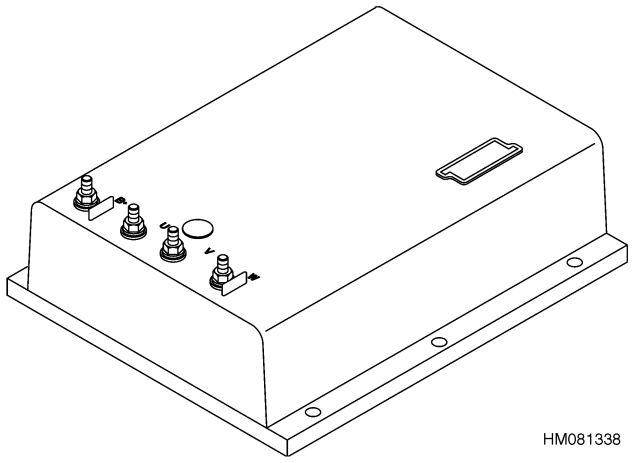
Status Code	Description	Memory Recall	Circuit
41	Traction motor controller overheated.	Yes	Traction

Symptom

Truck acceleration is reduced or truck may stop completely.

Possible Causes and Test Procedures

- Excessive pushing or stalling of traction motor.
- Check operation of cooling fans.
  See Fan Test.
- Check for proper application of thermal grease between motor controller and heat sink.


HM081338

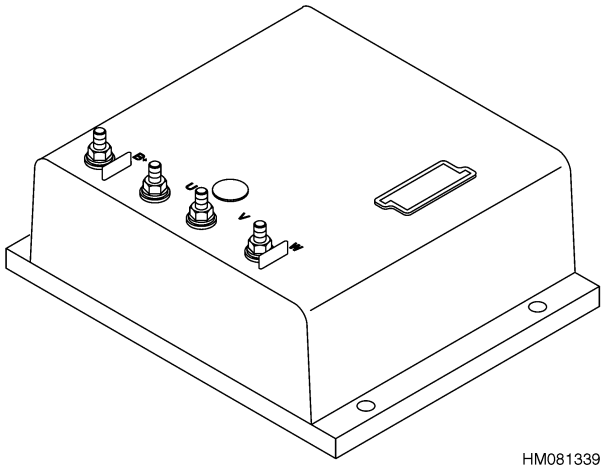
Status Code	Description	Memory Recall	Circuit
42	Pump motor controller overheated.	Yes	Traction

Symptom

Truck acceleration and travel speed is reduced and pump motor may stop completely.

Possible Causes and Test Procedures

- Excessive operation or stalling of the pump motor.
- Check operation of the cooling fans.
  See Fan Test.
- Check for proper application of thermal grease between motor controller and heat sink.


HM081339

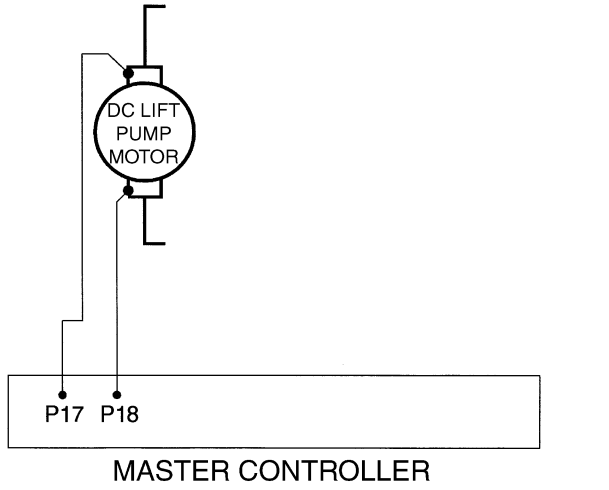
Status Code	Description	Memory Recall	Circuit
95	DC lift pump motor brushes are worn.	Yes	Pump

Symptom

Status code warning only.

Possible Causes and Test Procedures

- Pump motor brushes are worn too short.
- Motor brush wear sensor wires to motor controller may have a short to battery positive.



Status Code	Description	Memory Recall	Circuit
99	Maintenance Alert and Speed Limit.	No	Traction

Symptom

Status code is displayed and, after 20 hours, truck speed is reduced to 50% of normal top speed.

Possible Causes and Test Procedures

- Maintenance reminder indicating it is time to service truck. It was set by a technician through the dash display or with a PC.
- The technician must perform desired maintenance and reset reminder to next hourmeter reading that maintenance should occur.

FUSES

The fuses are found on the contactor panels. See Figure 8, Figure 9, Figure 10, Figure 11, and Figure 12. The condition of the fuses can normally be checked by looking at them. Some fuses do not change in appearance and must be checked with an ohmmeter.

FAN TEST

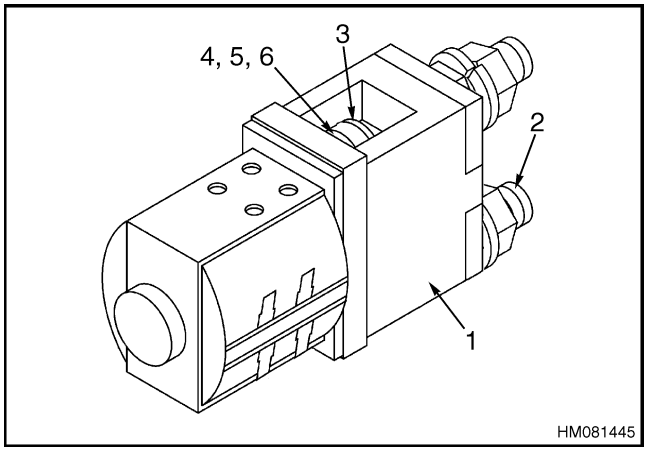
To determine if the fans are operating correctly, go to the Access to Service Functions section of this YRM. Using the procedures in that section, go to Diagnostics Menu and select No Run Diagnostics. From there, go to Fan On, which is the last menu item. As soon as Fan On is selected, the fans should start running.

On 36/48 volt trucks, the fans operate at battery voltage. If battery voltage is present at the fan terminal strip and the fan(s) doesn't run, replace the fan(s). If battery voltage is not present at the fan terminal strip, look for problems in the positive circuit from the key switch or the negative circuit to pin 15 on the master controller.

On 72/80 volt trucks, the fans operate with a fan power supply. If the power supply voltage (48 volts) is present and the fan(s) doesn't run, then replace the fan(s). If there is battery voltage to the fan power supply and there is no output voltage, then replace the fan power supply. If battery voltage is not present at the power supply, look for problems in the positive circuit from the key switch or the negative circuit to pin 15 on the master controller.

CONTACTORS

There can be three contactors on these lift trucks. All lift trucks have a power steering contactor and a line contactor. See Figure 13 and Figure 14. Lift truck models ERC35-55HG (ERC70-120HH) (B839/C839) have a separate line contactor for the pump motor controller. Lift trucks that do not have a pump motor controller also have a contactor to energize the lift pump motor. See Figure 13.



1. CONTACTOR
2. POWER TERMINALS
3. FIXED CONTACTS
4. MOVABLE CONTACTS
5. SPRING
6. PLUNGER

Figure 13. Pump Motor Contactor

Repair

Tag, identify, and disconnect the wires and cables from the contactor assembly. Remove the mounting screws and remove the contactor assembly. See Figure 14.

Contactor Contacts. The contacts in a contactor are made of special silver alloy. The contacts will look black and rough from normal operation. This condition does not cause problems with the operation of the lift truck. Cleaning is not necessary. **DO NOT** USE A FILE ON THE CONTACTS. **DO NOT** LUBRICATE THE CONTACTS.

⚠ CAUTION

ALWAYS replace all of the contacts in a contactor at the same time. Replace the contacts when the thickness of any area of a contact is less than 30 percent of the thickness of a new contact or if there is any transfer of contact material.

Coil. Check the coil with an ohmmeter for an open circuit or a short circuit. Coil resistance is very low. Approximate coil resistance, at room temperature, can be determined by looking at **Status Codes 63, 64, 65, and 69.** Replace the coil if it is damaged. Make sure the coil wires are connected again to the correct terminals.

NO OF FUNCTIONS

Setting 3 or 4: For hydraulic valves with a single auxiliary function, the number of auxiliary functions is set to 3. For hydraulic valves with double auxiliary functions, the number of auxiliary functions is set to 4.

CLAMP INSTALLED?

Setting Yes or No: If a clamp attachment is installed, then the setting is yes. If the number of functions is 3, then the clamp is assumed to be aux 1 position. If the number of functions is 4, then the clamp is assumed to be aux 2.

HI FLOW AUX INSTLD?

Setting Yes or No: If the E-hydraulic valve has the optional High Flow Auxiliary block installed, then set this to Yes. If it is a standard flow auxiliary block, then the setting is No. See Figure 25 and Figure 26.

- E-HYD CALIBRATION
  - CALIBRATE LIFT
  - CALIBRATE TILT FW
  - CALIBRATE TILE BK
  - CALIBRATE AUX1 DIR A
  - CALIBRATE AUX1 DIR B
  - CALIBRATE AUX2 DIR A
  - CALIBRATE AUX2 DIR B

Calibration procedure is as follows:

1. The operator must be on the seat, and the armrest down and latched in order to calibrate the valve.
2. Press the ▲ or ▼ keys to select the function for which calibration is desired. Press the ► key to start calibration of that function.
3. The master controller will run the pump at a slow speed and will command cracking current to that function. Use the ▲ or ▼ keys to increase or decrease the cracking current until there is creep in the function. A number from 0 to 15 will be displayed on the Dash Display which corresponds to a cracking current off set value. objective is to find the value of cracking current that produces the slowest creep speed. Press the ⋆ key to save.
4. Once the calibration is saved, the pump will stop and the Dash Display will return to the calibration menu. Repeat the above procedure to calibrate the next function.
5. No calibration is required for the lowering function.

- PASSWORD MENU
  - ENTER PASSWORD
  - TRUCK INSPECTION
  - ADD PASSWORD
  - DELETE PASSWORD
  - EDIT PASSWORD
- NO RUN DIAGNOSTICS
  - DIRECTION SWITCH
  - ACCELERATOR LOCK
  - THROTTLE POT VOLT
  - SEAT SWITCH
  - PARK BRAKE
  - PUMP SWITCH #1
  - PUMP SWITCH #2
  - PUMP SWITCH #3
  - DC PUMP BRUSH #1
  - DC PUMP BRUSH #2
  - DC PUMP MOTOR
  - FAN ON
- RUN DIAGNOSTICS
  - TRACTION MOTOR SPEED
  - TRACTION MOTOR AMPS
  - TRACTION MOTOR TEMP
  - TRACTION CNTRL TEMP
  - AC PUMP MOTOR SPEED
  - AC PUMP MOTOR AMPS
  - AC PUMP MOTOR TEMP
  - AC PUMP CNTRL TEMP
- E-HYD DIAGNOSTICS
  - LIFT/LOWER INPUT

    The four inputs are displayed on a scale from 0 to 255. The value ranges from 0 when the lever is moved to the full back position to 255 when the lever is moved to the full forward position. The value 128 must be displayed when the lever is in the neutral position.
  - TILT INPUT
  - AUX1 INPUT
  - AUX2 INPUT
  - CLAMP INTERLOCK

    When the clamp interlock switch on the mini-lever module is pressed, 1 will be displayed on the Dash Display.
  - DUAL FUNCTION SW

    If the truck is equipped with a third auxiliary function then the dual function switch will indicate whether it is pressed (1) or released (0).
  - LIFT COIL CURRENT

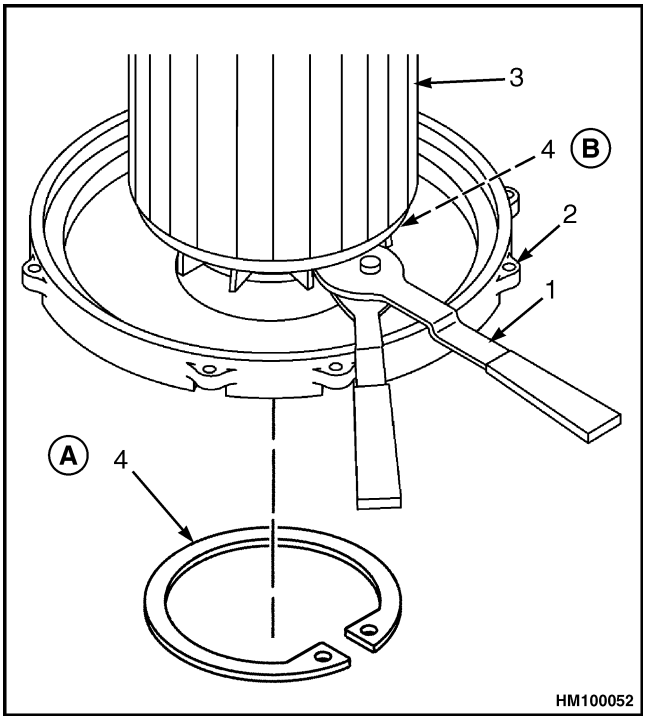
    The coil currents, as measured by the Valve Driver, is displayed in mA/10. The maximum value 255 corresponds with 2550 mA (or 2.55 amps).
  - TILT COIL CURRENT
  - AUX1 COIL CURRENT
  - AUX2 COIL CURRENT
- VIEW HOURMETER
  - TRACTION HOURMETER
  - PUMP HOURMETER
  - SECURE HOURMETER

NOTE: On the hydraulic pump motors there is a second air guide attached to the drive end bell. Remove screws from the second air guide so you are able to move the second air guide for access to the snap ring.

NOTE: On older lift truck models, the snap ring is between the rotor and drive end of end bell. You will need to feel with your fingers where the snap ring is located and attach the snap ring pliers. See Figure 11.

NOTE: On newer lift truck models, the snap ring is located in the drive end of the end bell. See Figure 11.

17. Remove snap ring. For older lift truck models, use snap ring pliers. See Figure 11.



A. LOCATION OF SNAP RING, NEWER LIFT TRUCK MODELS
B. LOCATION OF SNAP RING, OLDER LIFT TRUCK MODELS

1. SNAP RING PLIERS
2. DRIVE END BELL
3. ROTOR
4. SNAP RING

Figure 11. Snap Ring Removal ERC20-32AGF (ERC040-065GH) (A908) Model Shown

18. Screw lifting eye into the threaded hole in the end of the rotor shaft. Attach approved lifting device and lift rotor straight up from the drive end bell.

19. Using a bearing puller, remove bearing from drive end of rotor shaft.

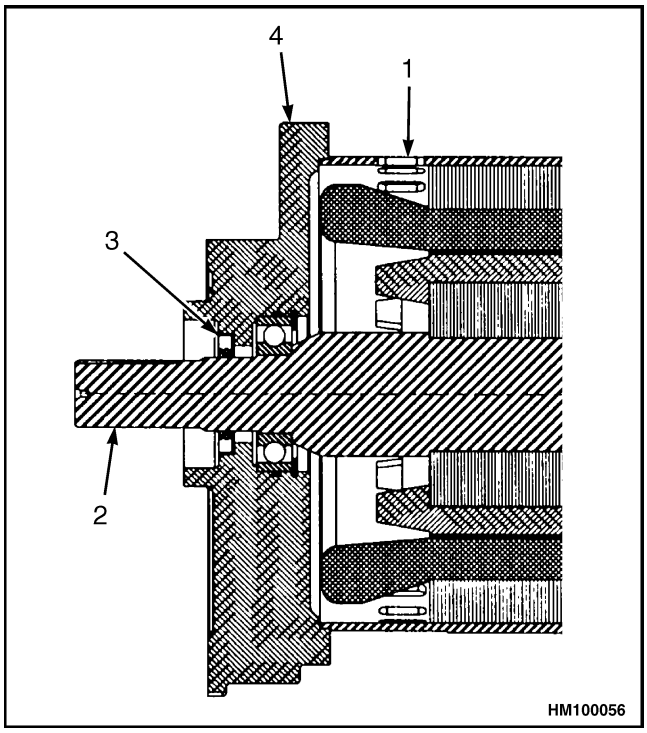
20. Remove snap ring from shaft.

21. Using a seal driver, remove drive shaft seal from end bell.

ASSEMBLE

NOTE: Perform Step 1 for ERC/P16-20AAF (ERC030-040AH) (B814/C814) model only.

1. Lubricate the drive end bell seal shaft with multi-purpose grease using 2 to 4 percent molybdenum disulfide. See Figure 12.



1. TRACTION MOTOR (SHOWN)
2. ROTOR ASSEMBLY
3. DRIVE END BELL SEAL SHAFT
4. DRIVE END HOUSING

Figure 12. Lubrication of Seal Shaft

General

This section has a description and the repair procedures for the parts of the hydraulic brake system. These parts include the brake booster, master cylinder, and brake shoe assemblies.

Description and Operation

The master cylinder is actuated by a brake booster on GC/GLC70-120LG/MG (B818) and GP/GLP/GDP70-120LG/MG (B813) lift trucks. The brake booster is a hydraulic valve actuated by the brake pedal. The brake booster uses the oil that flows from the steering control unit to multiply the force of the brake pedal. The system allows braking without hydraulic pressure at the brake booster.

Lift trucks of the ERC70-120HD, ERC70-120HG (A839) and ERC35-55HG (ERC70-120HH) (B839/C839) series have a different master cylinder that is not actuated by a brake booster.

BRAKE BOOSTER AND MASTER CYLINDER

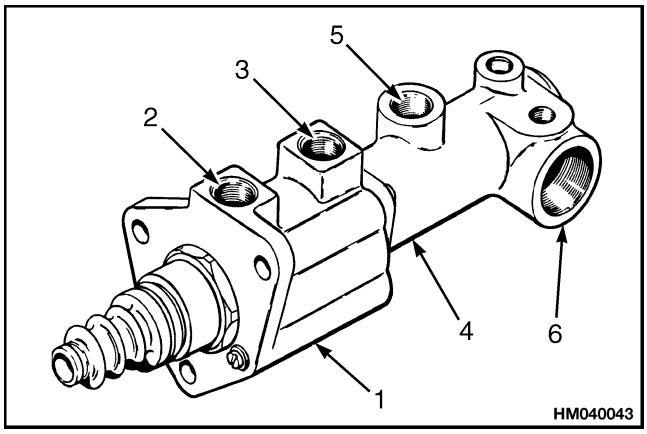
These parts are for the GC/GLC70-120LG/MG (B818) and GP/GLP/GDP70-120LG/MG (B813) models. See Figure 1. The operation of the parts is described in Figure 2.

MASTER CYLINDER

This master cylinder is for the ERC70-120HD, ERC70-120HG (A839) and ERC35-55HG (ERC70-120HH) (B839/C839) models. See Figure 3. The master cylinder has a housing and a piston assembly. The housing has two ports between the bore for the piston and the reservoir for the fluid. The compensator port in front of the piston is open when the piston is fully retracted. The compensator port lets fluid move to or from the brake system when the temperature changes. Another port keeps fluid in the cavity around the piston. The piston moves in the housing when the operator pushes the brake pedal. A small movement of the piston closes the compensator port. Hydraulic pressure actuates the wheel cylinders as the piston pushes fluid through the check valve. A return spring pushes the piston back to the stop plate when the pedal is released. Fluid can flow through passages in the piston and past the primary cup as the piston returns. Fluid flows across the piston to prevent a vacuum while fluid returns through the check valve. When the piston passes the compensator port, excess fluid from the system can return to the reservoir. The check valve keeps a very small amount of pressure in the brake system. The pressure helps to keep the system effectively sealed.

SERVICE BRAKE ASSEMBLY

A service brake assembly is installed at each end of the housing for the drive axle. See Figure 4. Each service brake assembly has a single wheel cylinder at the top of each back plate. The support plate has an anchor for each shoe. When the wheel cylinder is actuated by fluid pressure from the master cylinder, the shoes touch the drum. The primary shoe starts to turn with the drum. This action pushes the secondary shoe tight against the drum and the anchor. This servo action increases the force applied to the brake drums. When the lift truck is traveling in reverse, the primary shoe is pushed against the anchor and the drum by the secondary shoe.



NOTE: BRAKE BOOSTER AND MASTER CYLINDER FOR LIFT TRUCK MODELS GC/GLC70-120LG/MG (B818) AND GP/GLP/GDP70-120LG/MG (B813) SHOWN.

1. BRAKE BOOSTER
2. INLET FROM STEERING CONTROL UNIT
3. OUTLET TO HYDRAULIC TANK
4. MASTER CYLINDER
5. INLET FROM RESERVOIR
6. OUTLET TO WHEEL CYLINDERS

Figure 1. Brake Booster and Master Cylinder

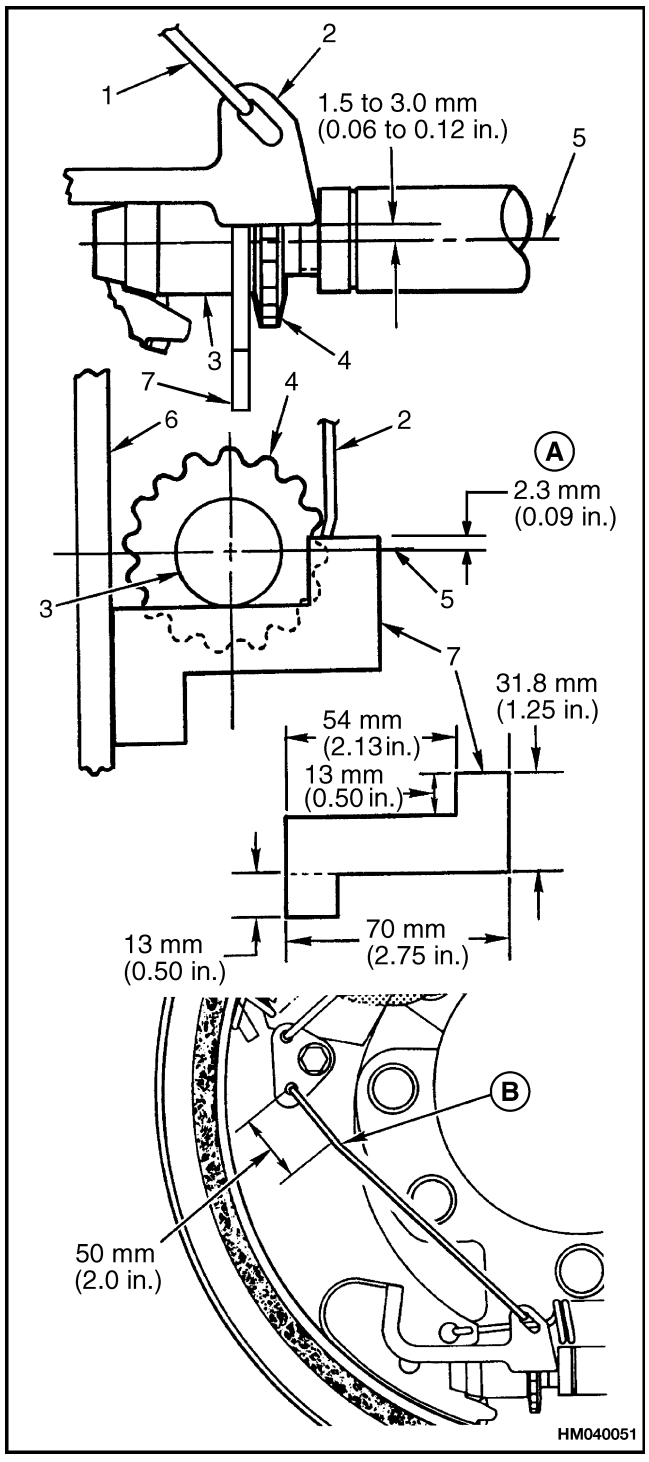


Figure 11. Brake Adjustment (Right Side Shown)

Legend for Figure 11

A. REFERENCE
B. BEND

1. ACTUATOR LINK
2. AUTOMATIC ADJUSTMENT LEVER
3. ADJUSTER SCREW GUIDE
4. ADJUSTER SCREW WHEEL
5. ADJUSTER SCREW WHEEL CENTERLINE
6. BACKPLATE
7. TOOL

CAUTION

When the wheels have been installed, check all wheel nuts after 2 to 5 hours of operation. Tighten the nuts to the correct torque. When the nuts stay tight after an 8-hour check, the interval for checking can be extended to 350 hours.

e. Apply sealant (Yale Part Number 520042831) to flange of axle shaft. Install axle shaft. Tighten capscrews to 225 N•m (165 lbf ft).

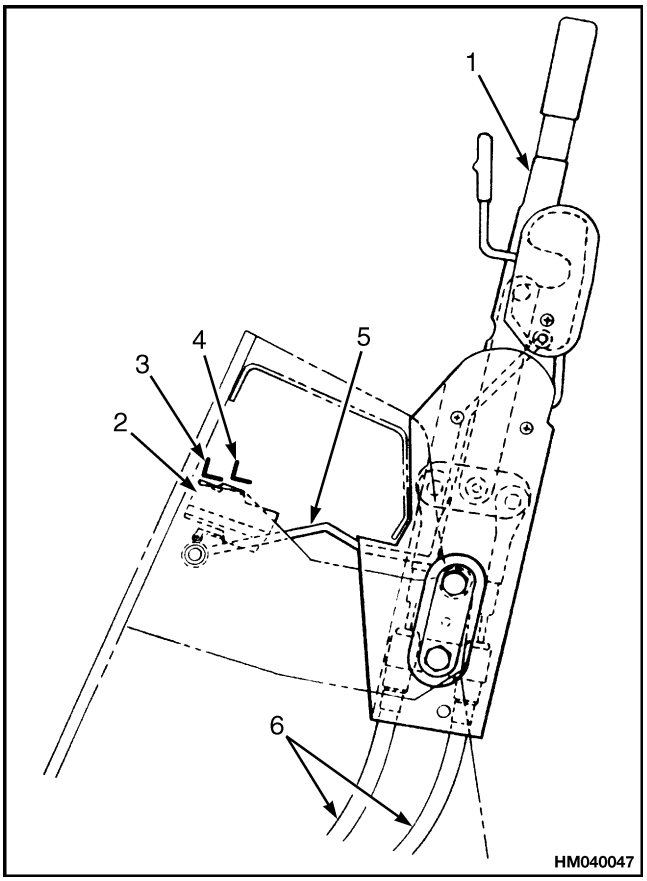
11. Use the following procedures to install hub and brake drum for lift truck models (see Figure 12) **GC/GLC70-120LG/MG (B818), ERC70-120HD, and ERC70-120HG (A839), and ERC35-55HG (ERC70-120HH) (B839/C839)**:

a. Use new oil seals. Install inner seal, bearing cups, and outer seal in hub. Install inner bearing cone on spindle. Lubricate inner bearing with grease.

b. If brake drum was removed, install brake drum on hub. Install several nuts on studs for wheel.

c. Install hub assembly on spindle. Lubricate outer bearing cone with 80W-90 oil for gears. Install outer bearing cone and adjustment nut.

d. Tighten adjustment nut to 203 N•m (150 lbf ft) while you rotate hub. Loosen nut until hub rotates freely. The torque must be less than 27 N•m (20 lbf ft). Tighten nut to 34 N•m (25 lbf ft) or to first alignment position after 34 N•m (25 lbf ft). Install lockwasher to hold nut. Install lock nut. Tighten lock nut to 135 N•m (100 lbf ft).



1. HAND LEVER
2. SWITCH
3. TERMINALS, NORMALLY CLOSED (NC) CIRCUIT
4. TERMINALS, NORMALLY OPEN (NO) CIRCUIT
5. LINK
6. CABLES TO BRAKE SHOES

Figure 20. Parking Brake Arrangement, Lift Truck Models GC/GLC70-120LG/MG (B818) and GP/GLP/GDP70-120LG/MG (B813)

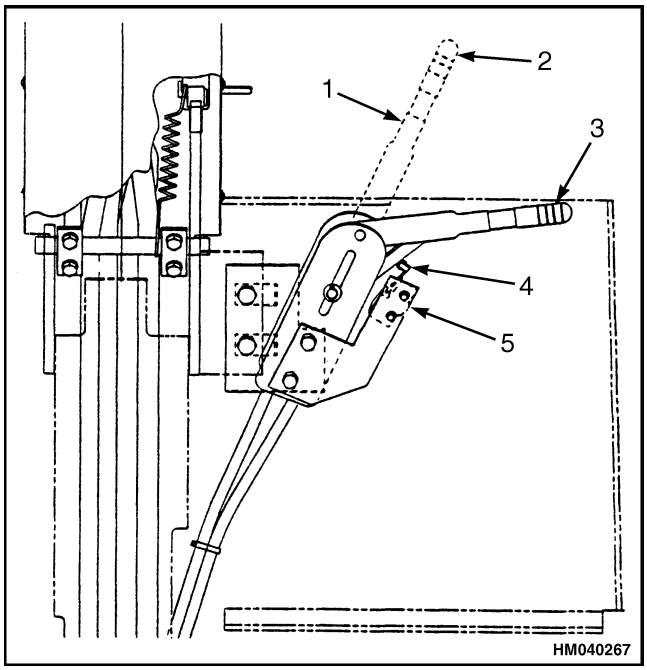
PARKING BRAKE LEVER AND SWITCH ADJUSTMENT ERC70-120HD AND ERC70-120HG (A839) AND ERC35-55HG (ERC70-120HH) (B839/C839)

NOTE: See the section **Frame** 100 YRM 284 for lift truck models ERC70-120HD and ERC70-120HG (A839) and **Frame** 100 YRM 1200 for lift truck models ERC35-55HG (ERC70-120HH) (B839/C839) for the adjustment procedure for the seat brake.

Turn knob on parking brake lever to adjust parking brake. See Figure 21. The brake must hold the lift truck with a capacity load on a 15% grade [a slope that increases 1.5 m in 10 m (1.5 ft increase in 10 ft)].

The parking brake switch is actuated by the parking brake lever. When the lever is released (**OFF**), the switch is closed, energizing the traction circuit. When the parking brake is applied, the switch is open and the traction circuit will not operate.

Check the adjustment of the parking brake switch when the lever is released. In this position, the switch lever must be 1 to 3 mm (0.04 to 0.12 in.) past the applied position.



1. PARKING BRAKE LEVER
2. APPLIED POSITION
3. RELEASED POSITION
4. SWITCH LEVER
5. SWITCH

Figure 21. Parking Brake ERC70-120HD and ERC70-120HG (A839) and ERC35-55HG (ERC70-120HH) [B839/C839]

Maximum Carriage and Tilt Creep Rates

NOTE: Start measurement with mast at vertical position and the load raised to 2.5 m (8.2 ft). Use maximum lift height if the maximum is less than 2.5 m (8.2 ft).

Hydraulic Oil Temperature	Vertical Creep at Carriage		Tilt Creep at Cylinder Rod		
	mm/Min	in./Min	°/Min	mm/Min	in./Min
20°C (68°F)	2.2 mm	0.09 in.	0.11°	0.74 mm	0.029 in.
30°C (86°F)	4.2 mm	0.17 in.	0.21°	1.42 mm	0.54 in.
40°C (104°F)	6.3 mm	0.25 in.	0.31°	2.10 mm	0.83 in.
50°C (122°F)	10.0 mm	0.39 in.	0.50°	3.38 mm	.133 in.
60°C (140°F)	14.6 mm	0.57 in.	0.73°	4.94 mm	.194 in.

Battery Specifications

Model	Volts	Minimum Compartment Size Length × Width	Battery Length*	Weight	
			Min./Max.	Min.	Max.
ERC35-40HG (ERC070-080HH)	36, 48, 80	841 × 987 mm (33.1 × 38.9 in.)	950 to 990 mm (37.4 to 39.0 in.)	1542 kg (3400 lb)	2177 kg (4799 lb)
ERC45HG (E100HH) (Short Frame)	36, 48, 80	841 × 987 mm (33.1 × 38.9 in.)	950 to 990 mm (37.4 to 39.0 in.)	1633 kg (3600 lb)	2177 kg (4799 lb)
ERC45HG (ERC100HH) (Long Frame)	36, 48, 80	694 × 1037 mm (27.3 × 40.8 in.)	1115 to 1150 mm (43.9 to 45.3 in.)	1814 kg (4000 lb)	2517 kg (5681 lb)
ERC55HG (ERC120HH)	36, 48, 80	993 × 1146 mm (39.3 × 45.1 in.)	1115 to 1150 mm (43.9 to 45.3 in.)	1919 kg (4231 lb)	2517 kg (5681 lb)

*BATTERY WIDTH
Batteries without cover: 950 to 1117 mm (37.4 to 44.0 in.)
Batteries with cover: 950 to 1143 mm (37.4 to 45.0 in.)

NOTE: Maximum tolerances are +0 and -13 mm (+0 and -0.5 in.) for the size of the battery compartment. The battery specification chart shows the maximum size tolerances that will permit the battery to still fit into a battery compartment.

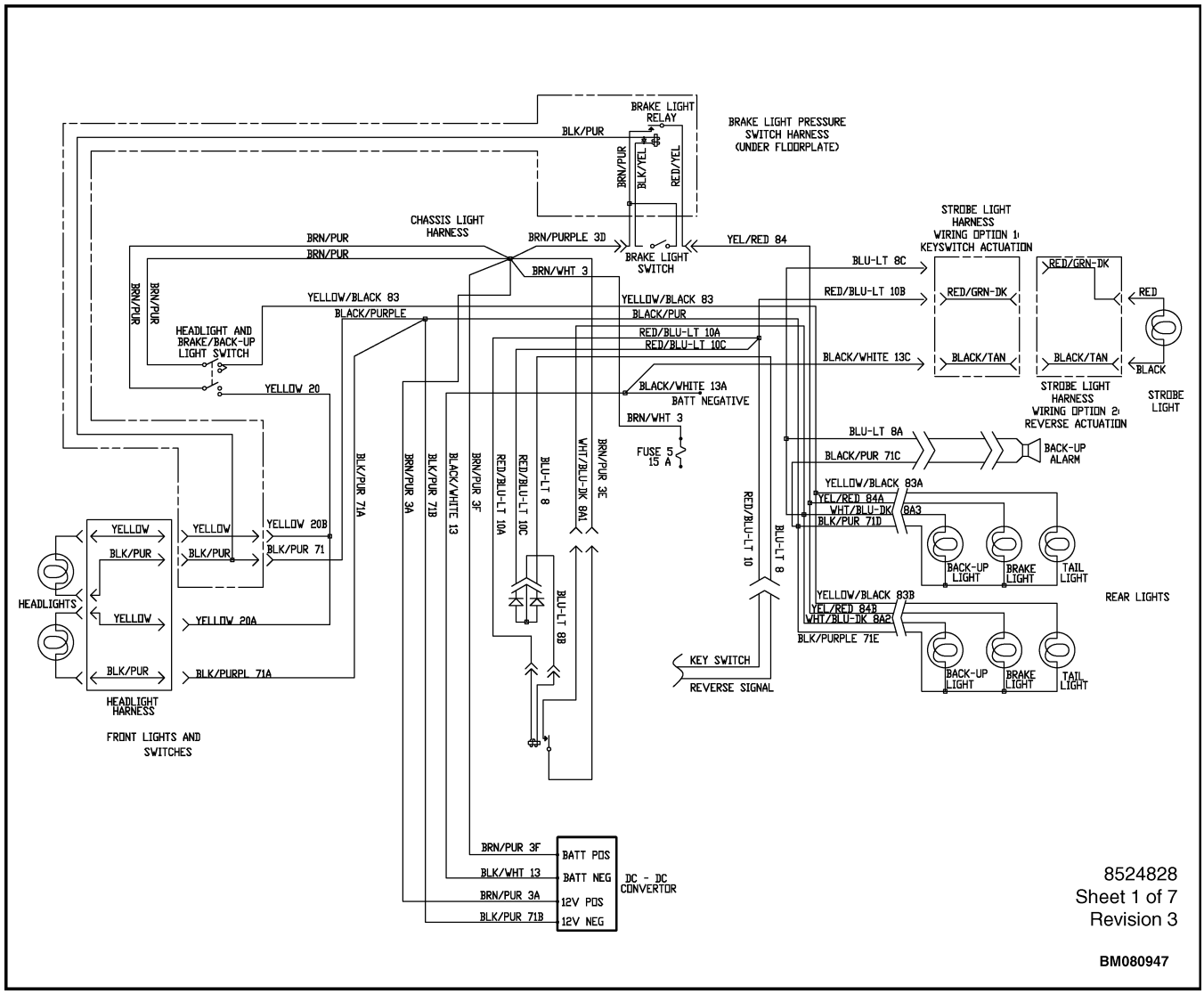


Figure 1. Wiring Schematic Diagram for ERC35-55HG (ERC70-120HH) (B839), 36/48 Volts (Sheet 1 of 7)

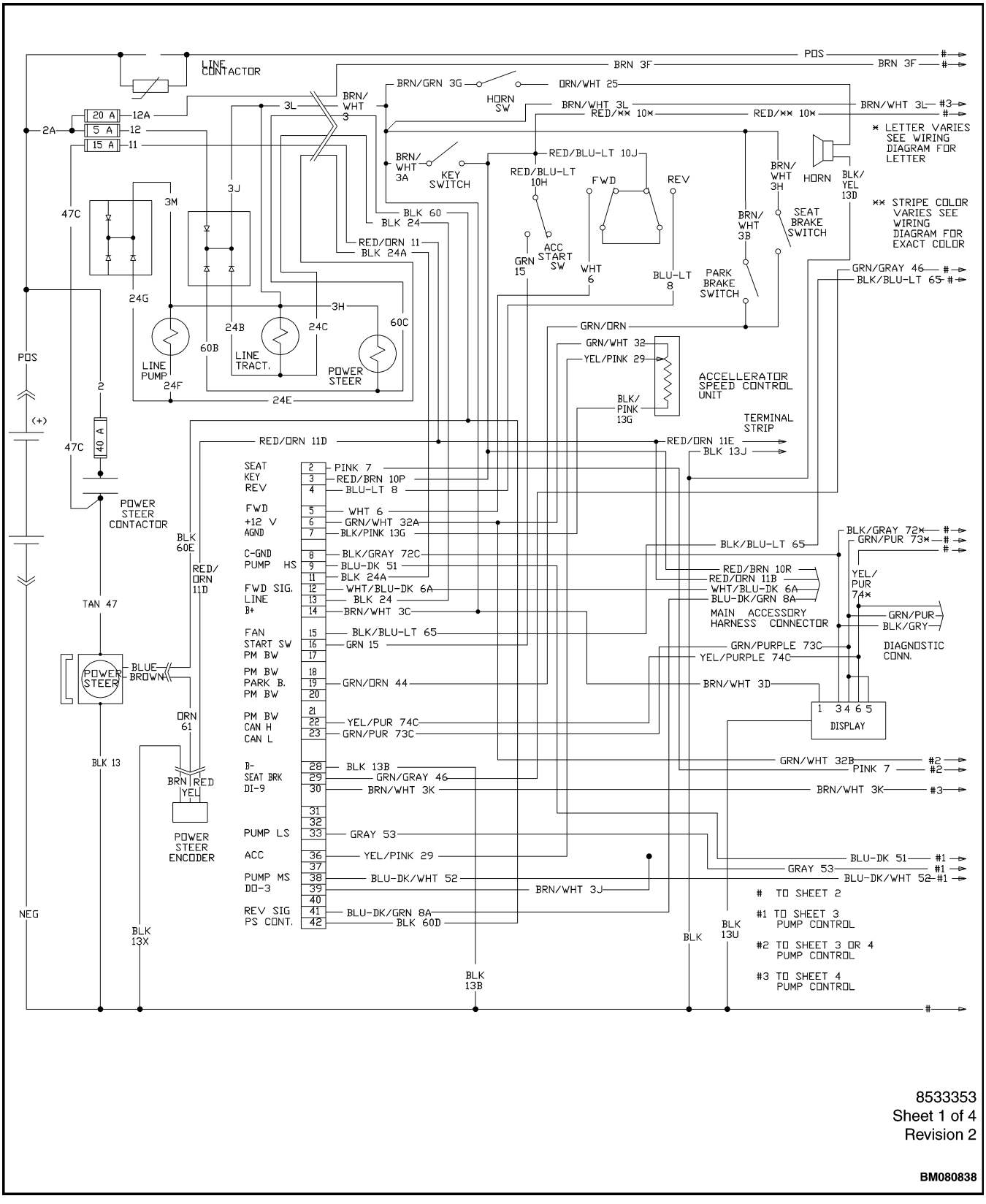


Figure 3. Schematic Wiring Diagram ERC35-55HG (ERC70-120HH) (C839), 36/48 and 80 Volts (Sheet 1 of 4)

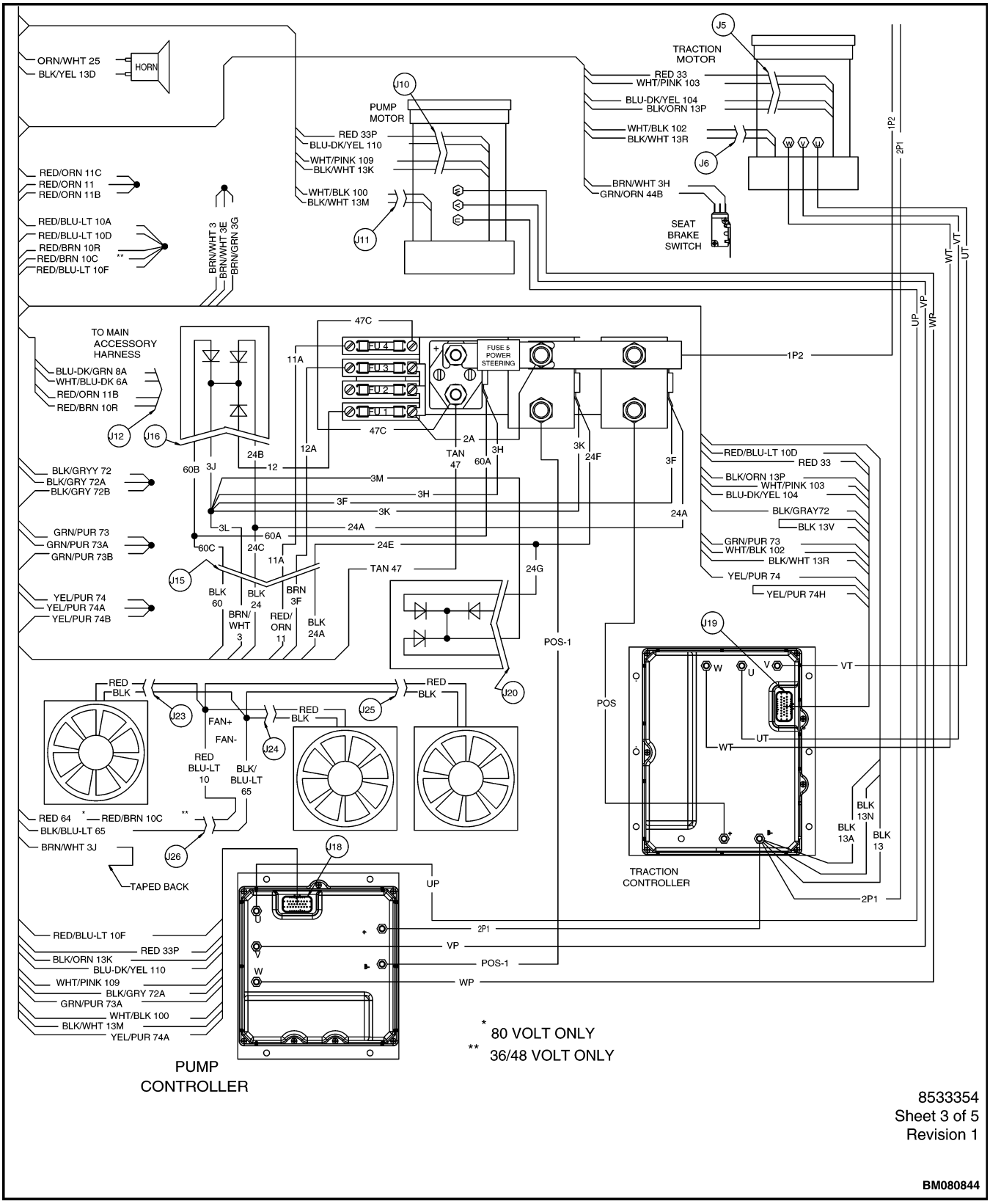
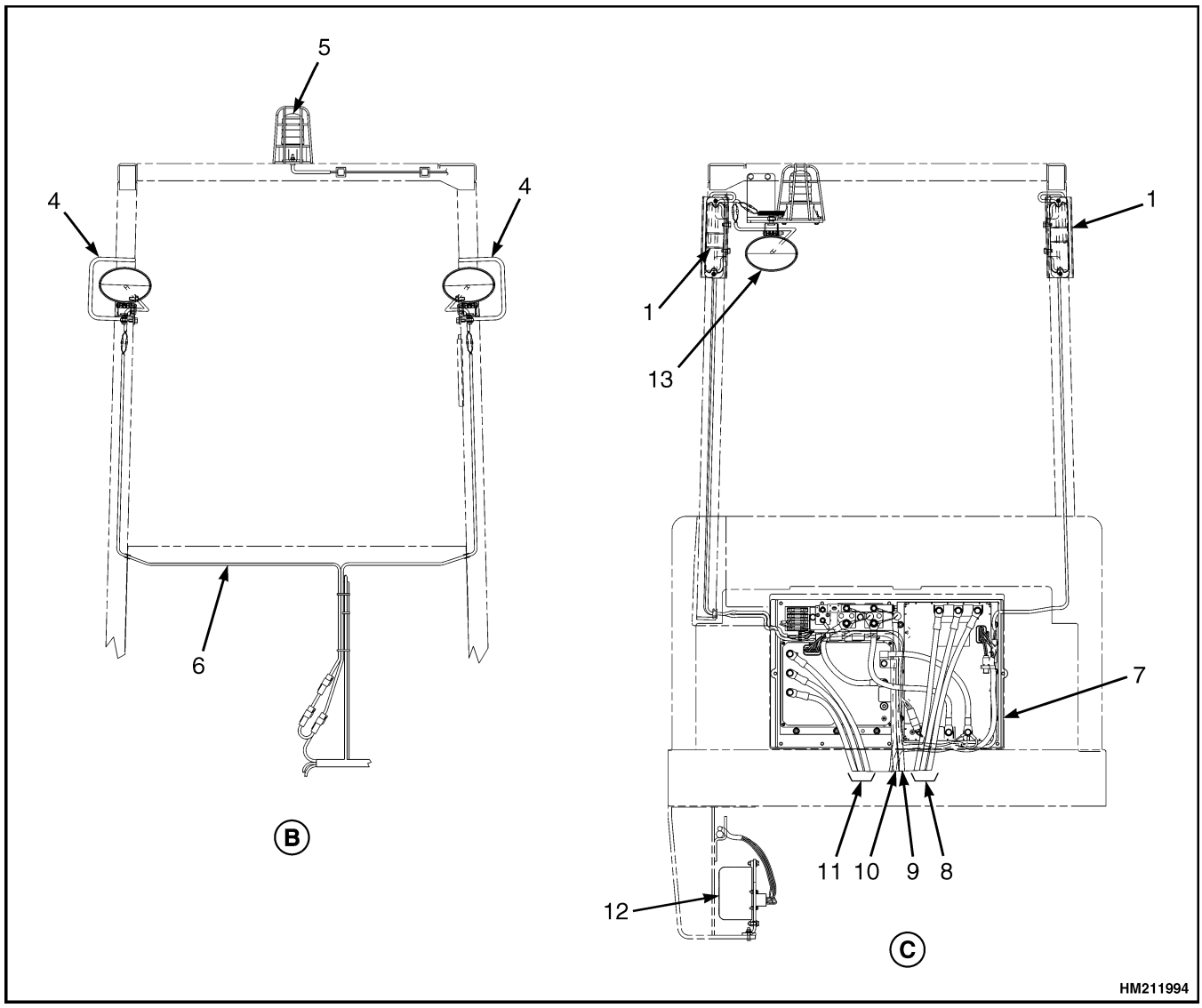


Figure 5. Wiring Diagram ERC35-55HG (ERC70-120HH) (C839), 36/48 and 80 Volts (Sheet 3 of 5)



A. SIDE VIEW
B. FRONT VIEW
C. REAR VIEW

1. REVERSE/BRAKE LIGHT
2. MAIN WIRING HARNESS
3. DC CONVERTER
4. FRONT HEADLIGHT ASSEMBLY
5. STROBE LIGHT
6. HEADLIGHT WIRING HARNESS
7. CONTROL PANEL
8. TRACTION MOTOR POWER CABLES
9. BATTERY POSITIVE CABLE (B+)
10. BATTERY NEGATIVE CABLE (B−)
11. HYDRAULIC PUMP MOTOR POWER CABLES
12. 24 VOLT RELAY
13. REAR HEADLIGHT

Figure 11. Lights Wiring Arrangement ERC35-55HG (ERC70-120HH) (B839/C839) (Sheet 2 of 2)

General

This section has the description and repair procedures for the differential, speed reducer, drive axle, wheel bearings, and mounts for the axle housing.

Description

The drive axle assembly is fastened to the frame of the lift truck by separate mounts. See Figure 1. The drive axle assembly can rotate in the mounts. The outer ends of the axle housings are the spindles for the wheel bearings. The wheel bearings are tapered roller bearings with the cups pressed into the hubs. The nut on the end of the axle housing adjusts and holds the wheel bearings. The axle shafts are fastened to the hubs by capscrews and two dowel pins. The back plate and brake assembly are fastened to the axle mounts. The axle housing also has bearing journals for the upright.

The outer wheel bearing is lubricated by gear oil from the differential housing. The inner wheel bearing is lubricated by wheel bearing grease.

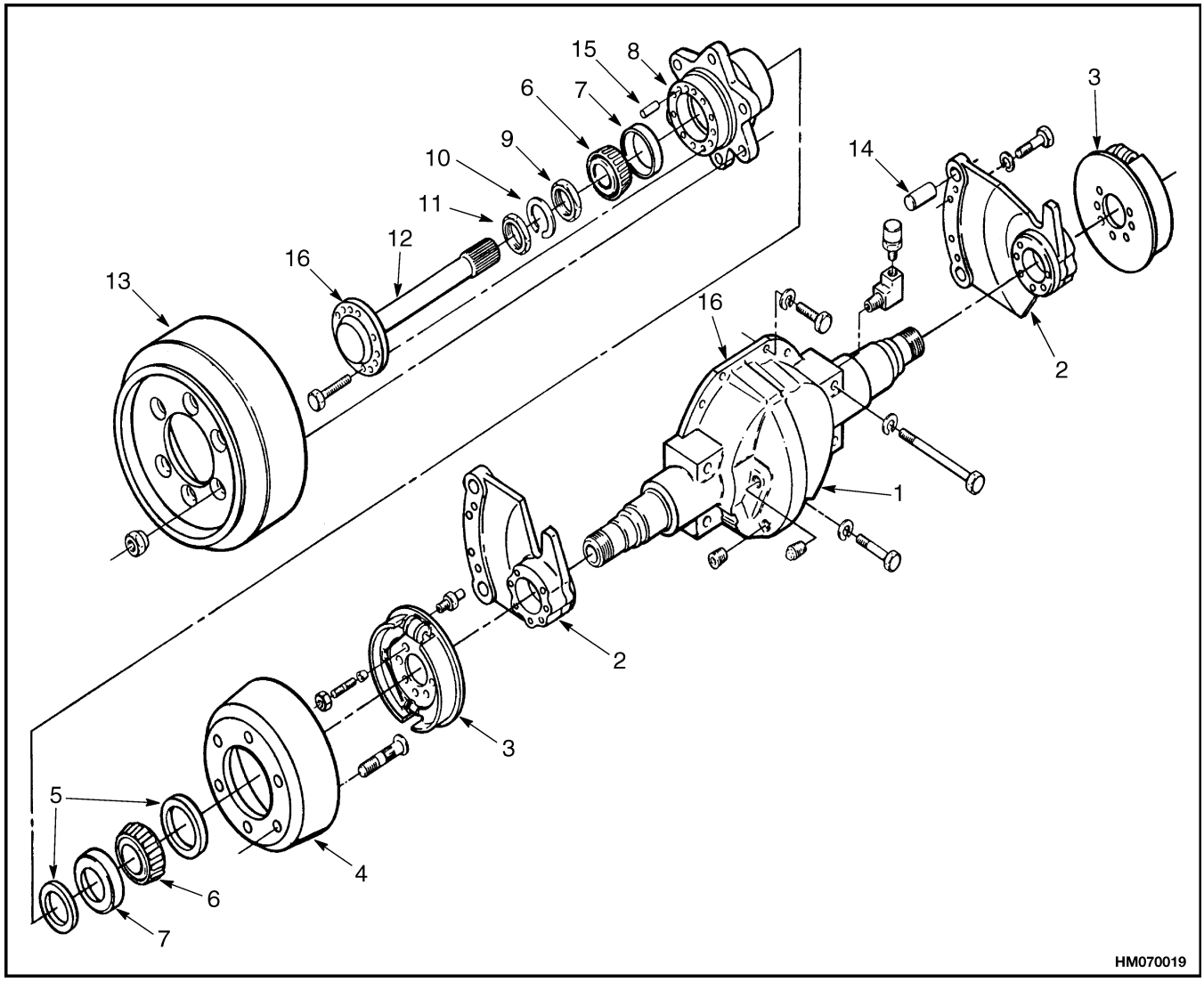


Figure 1. Drive Axle Assembly

Differential

1. Lubricate and install an axle gear and thrust washer in speed reducer case. Put spider gears and thrust washer on cross and put spider gear assembly into speed reducer case. Install second axle gear and thrust washer. Put two halves of speed reducer case together. Apply Loctite to threads of capscrews and install twelve capscrews and washers. Tighten capscrews to 130 to 170 N•m (96 to 125 lbf ft).

2. If ring gear was removed from speed reducer case, put ring gear into hot water [82 to 100°C (180 to 212°F)] for approximately 10 minutes. Remove ring gear from the liquid and put it into position on speed reducer case. Do not use a press or a hammer to install ring gear. Install 12 bolts and chamfered washers, position washers with chamfer facing away from the capscrew head. Tighten bolts to 142 N•m (105 lbf ft). Make sure ring gear is in correct position against flange of speed reducer case.

WARNING

Hot parts. Wear protective clothing and gloves to prevent burns.

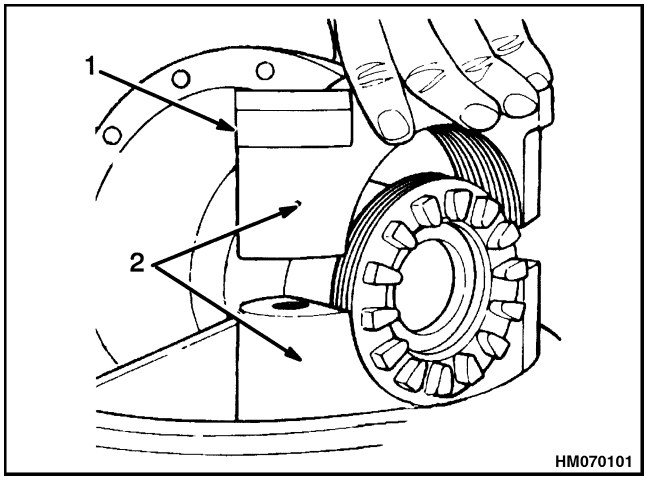
3. Use a press to install bearing cones on each side of speed reducer case.

4. Install differential assembly, bearing cups, adjusting nuts, and bearing caps in speed reducer housing. Make sure parts are installed in their original positions. Tighten capscrews for bearing caps to 225 N•m (166 lbf ft). See Figure 8.

5. Tighten adjusting nuts to 14 N•m (10 lbf ft) to remove clearance between adjusting nuts and bearings. Make sure there is clearance between ring gear and pinion. Loosen one adjusting nut until there is zero clearance between bearings and adjusting nut. Tighten adjusting nut three notches more than zero clearance to put a preload on bearings.

6. Check clearance between ring gear and pinion. The ring gear and pinion must have a clearance of 0.254 to 0.330 mm (0.010 to 0.013 in.). Use adjusting nuts to move ring gear toward or away from engagement with pinion gear. Loosen one adjusting nut the same amount as the other adjusting nut is tightened to adjust clearance between ring gear and pinion. See Figure 9.

7. Check pattern on teeth of ring gear. Apply an indicator color (Prussian blue or yellow) to teeth. Use a pry bar between ring gear and housing to prevent ring gear from turning freely. Turn pinion shaft. Compare pattern on ring gear teeth with patterns shown in Table 2. Adjust gear clearances as necessary.



1. BEARING CAP 2. MATCHMARKS

Figure 8. Bearing Caps Installation

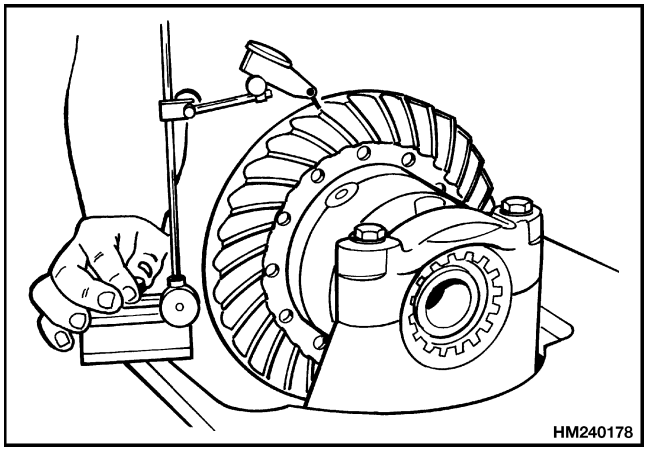


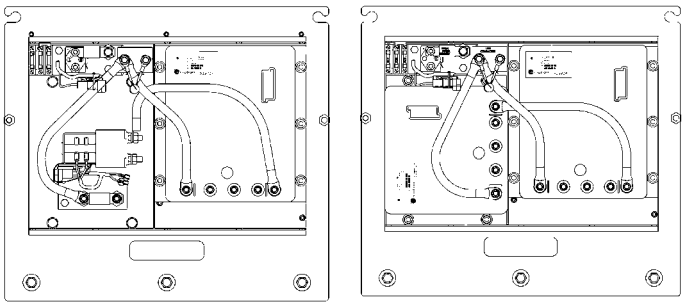
Figure 9. Clearance Check Between Ring Gear and Pinion

Yale

Maintenance

ELECTRICAL SYSTEM (TRUCKS WITH AC CONTROLLERS)

ERC20-32AGF (ERC040-065GH) [A908]; ERC/P16-20AAF (ERC030-040AH) [B814/C814]; ERP20-30ALF (ERP040-060DH) [D216]; ERP20-32ALF (ERP040-065DH) [E216]; ERC35-55HG (ERC70-120HH) [B839/C839]



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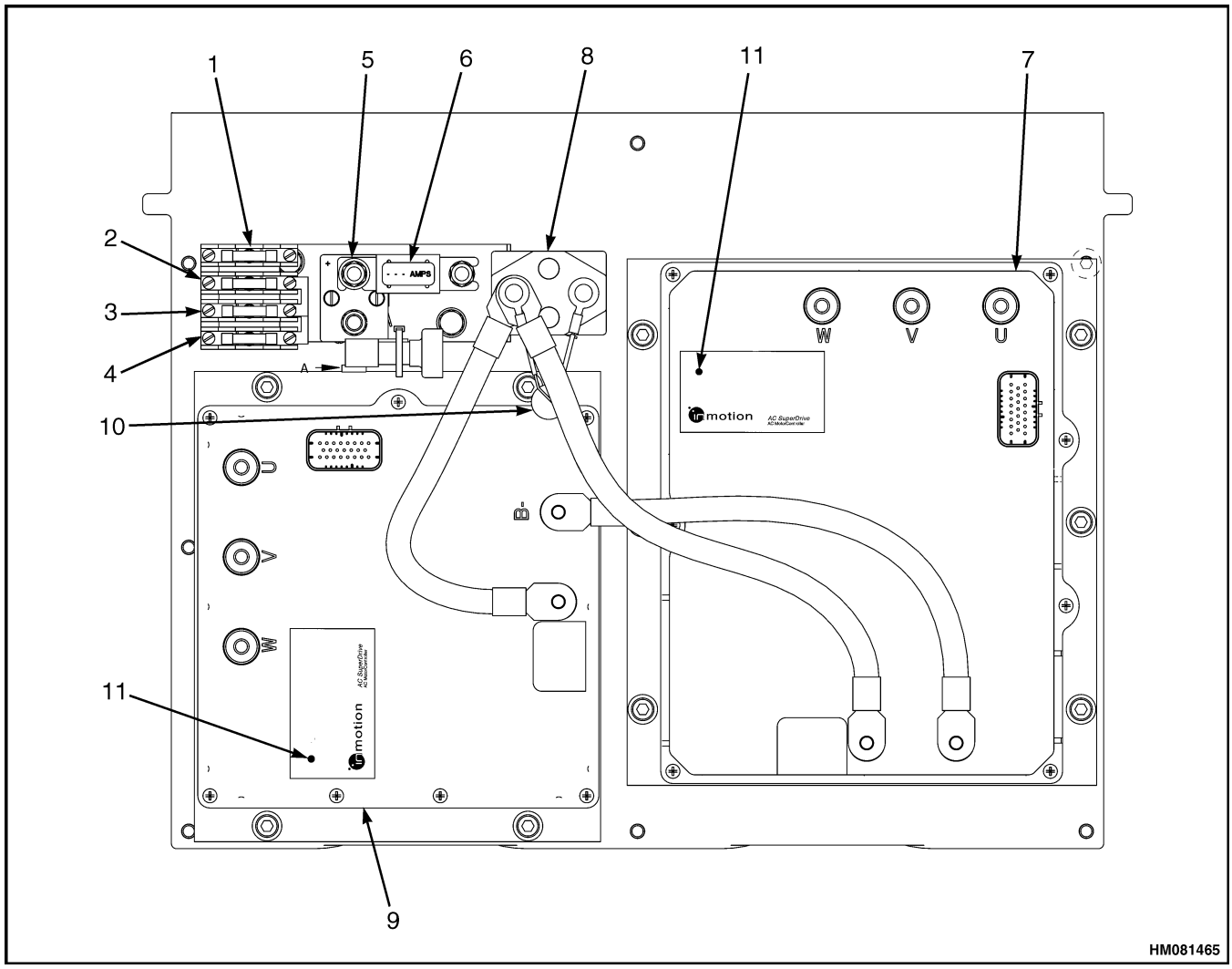
2200 YRM 1055



1. FUSE 1 (15A) AUXILIARY TERMINAL STRIP
2. FUSE 2 (15A) (SLOW BLOW) SEAT BRAKE SOLENOID
3. FUSE 3 (15A) LIGHTS
4. FUSE 4 (5A) KEYSWITCH
5. POWER STEERING CONTACTOR
6. FUSE 5 (40A) POWER STEERING
7. AC TRACTION MOTOR CONTROLLER
8. LINE CONTACTOR
9. AC PUMP MOTOR CONTROLLER
10. POSITIVE TEMPERATURE COEFFICIENT RESISTOR (PTC)
11. LED INDICATOR

Figure 4. AC Traction and Pump Motor Controllers (Gen V) (36v/48v or 72v/80v) for ERP20-30ALF (ERP040-060DH) (D216) and ERC20-32AGF (ERC040-065GH) (A908), Later Models Only and for ERC/P16-20AAF (ERC030-040AH) (B814) Lift Truck Models

Control Components Replacement

GENERAL

Prior to performing the replacement procedures in this section, it is advised that the technician perform adjustment procedures as appropriate if not already done. The various adjustment procedures may be found later in this manual.

START SWITCH, REPLACE

The start switch is a small switch fastened to the mount plate for the Foot Directional Control pedal or accelerator pedal. The switch operates as soon as the pedal starts to move, for an input to the master controller to energize the traction motor. Replace the start switch as follows:

1. Disconnect the battery and discharge the capacitors by holding the horn button down until the horn stops making a sound. Attach a tag to truck battery connector stating DO NOT CONNECT BATTERY. Remove the key.

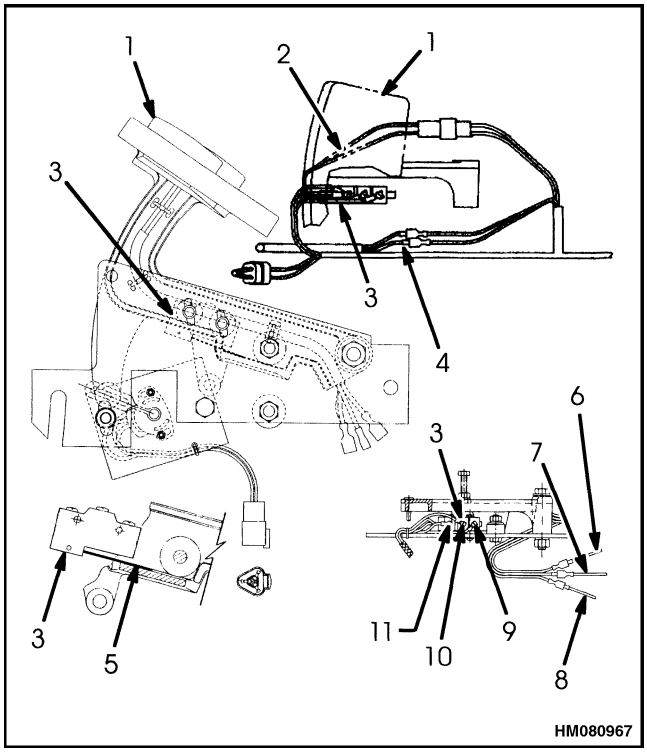
2. Remove the floor plates. The start switch is under the accelerator or Foot Directional Control pedal. See Figure 12.

3. Install tags on the wires of the start switch for correct connection during installation. Remove the wires and the mount screws for the start switch.

4. Install the replacement start switch in the same position. Do not bend or damage the leaf of the switch during installation. Connect the wires as tagged during removal.

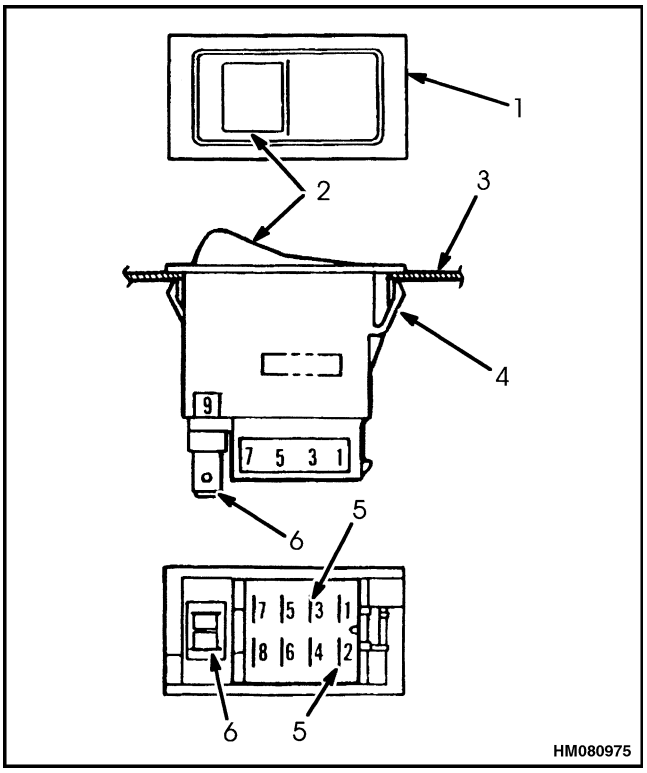
5. Adjust the start switch as described in Start Switch Adjustment. Install the floor plates.

6. Remove the DO NOT CONNECT BATTERY tag from truck battery connector and reconnect the battery.



1. FOOT DIRECTIONAL CONTROL PEDAL OR ACCELERATOR PEDAL
2. TO ACCELERATOR POSITION SENSOR
3. START SWITCH
4. TO DIRECTION CONTROL LEVER IF INSTALLED
5. ACTUATOR OF START SWITCH
6. RED/PINK
7. BLU-LT
8. WHT
9. GRN
10. WHT OR WHT/BLK
11. RED/YEL, RED/PINK

Figure 12. Start Switch



1. SWITCH ASSEMBLY
2. LENS AND FUNCTION SYMBOL (NOT ON ALL SWITCHES)
3. INSTRUMENT PANEL
4. RETAINER CLIP
5. SWITCH LIGHT AND OTHER TERMINALS
6. POWER TERMINALS

Figure 22. Rocker Switch

3. Use a flat blade screwdriver or other similar tool and press in on the retainer clips at each side of the switch. Remove the switch from the face of the instrument panel or switch mounting surface while holding the retainer clips in the released position.

4. Remove the switch and install the replacement switch in the panel. Make sure the switch is in the correct position for reading by the operator.

⚠ CAUTION

Make sure wire connectors do not touch other switch or meter terminal wire connectors, metal brackets, or the bracket mounting nuts. Make sure there is no tension or binding on the wires or connectors.

5. Connect the wires or wire harness to the electrical terminals on the switch as tagged during removal.

6. Remove the DO NOT CONNECT BATTERY tag from truck battery connector and reconnect the battery.

ACCELERATOR POSITION SENSOR, REPLACE

The accelerator position sensor is a voltage divider that sends a signal to the master controller. The accelerator position sensor has a link to the Foot Directional Control pedal or accelerator pedal. As the Foot Directional Control pedal or accelerator pedal position changes, the signal changes to change the speed. The accelerator position sensor and start switch must be adjusted as shown in Figure 19.

NOTE: If you must replace an accelerator position sensor, make sure that you use the correct part number. Many potentiometers look the same and will fit in the same position, but they will NOT work.

1. Disconnect the battery and discharge the capacitors by holding the horn button down until the horn stops making a sound. Attach a tag to truck battery connector stating DO NOT CONNECT BATTERY. Remove the key.

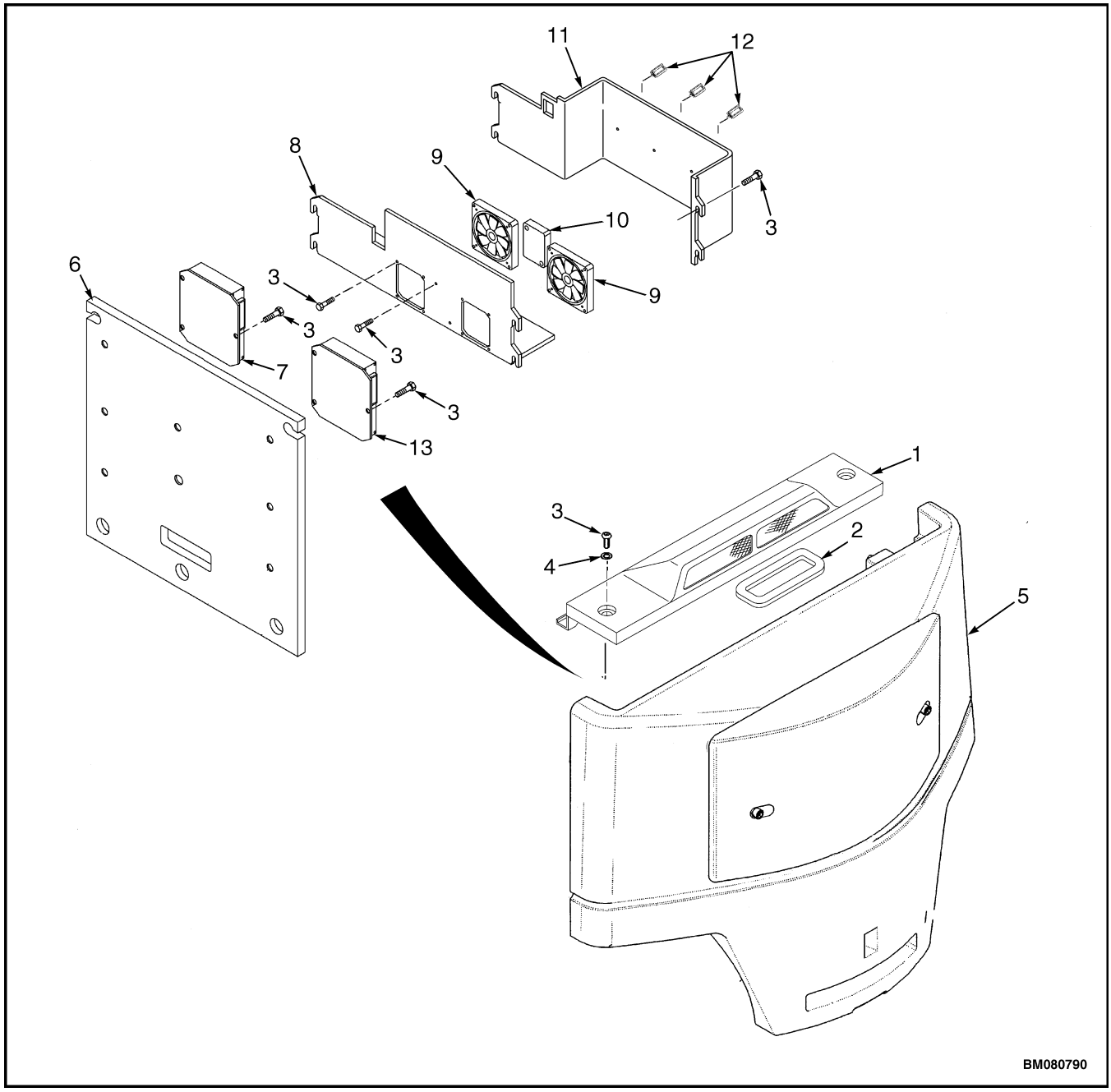
2. Remove the floor plates. The accelerator position sensor is under the accelerator or Foot Directional Control pedal. See Figure 19. Disconnect the electrical connector for the sensor.

3. Remove the capscrews, washers, and nuts that fasten the mount plate for the sensor. Carefully move the sensor assembly down while pushing down on the Foot Directional Control pedal so the pin of the pedal assembly will come out of the arm of the sensor. Remove the sensor assembly.

4. Cut the cable tie that fastens the wires for the sensor. Remove the two screws, washers, and nuts that fasten the sensor to the mount plate.

5. Install the replacement sensor on the mount plate using the same screws, washers, and nuts. Rotate the sensor as far as possible clockwise on the slots. Tighten the nuts to hold the sensor so that it can still be moved on the plate, but will stay in position. Install a cable tie to fasten the wires.

6. Install the mount plate in the truck using the reverse of the removal procedure. Make sure the pin of the Foot Directional Control pedal assembly is in the sensor arm.



1. COUNTERWEIGHT COVER
2. SEAL
3. CAPSCREW
4. WASHER
5. COUNTERWEIGHT
6. MOUNTING PLATE
7. CONVERTER
8. FAN MOUNTING PLATE
9. FANS
10. FAN POWER SUPPLY
11. FAN COVER PLATE
12. CLIPS
13. MASTER CONTROLLER

Figure 28. Converter Replacement for ERP20-30ALF (ERP040-060DH) (D216), ERP20-32ALF (ERP040-065DH) (E216) Lift Truck Models

WARNING

If the steering wheel has been removed, make sure the steering wheel nut has been tightened. The correct torque is 40.7 to 54.2 N•m (30 to 40 lbf ft) for all lift trucks except ERC35-55HG (ERC70-120HH) (B839/C839). For lift trucks ERC35-55HG (ERC70-120HH) (B839/C839), tighten steering wheel nut to 35 to 45 N•m (26 to 33 lbf ft).

5. Put the replacement assembly in position over the steering wheel and install the wires in the contacts. Tighten the setscrews to fasten the wires.

NOTE: If the contact set, spring, contact plate, and cover are separated, make sure they are installed and aligned correctly.

6. Carefully push the wires into the shaft bore as far as possible. Align the horn button assembly and press down on the edges of the cover to install it in the steering wheel.

7. Remove the DO NOT CONNECT BATTERY tag from truck battery connector and reconnect the battery.

HYDRAULIC PUMP SWITCHES

NOTE: For lift trucks equipped with an Electro-Hydraulic Control Valve, see the section **Electro-hydraulic Control Valve** 2000 YRM 1224 for replacement procedures of the Electro-Hydraulic Valve Driver Module.

See the section **Manual hydraulic Control Valve** 2000 YRM 562 for lift truck models ERC20-32AGF (ERC040-065GH) (A908), ERC/P16-20AAF (ERC030-040AH) (B814/C814), ERP20-30ALF (ERP040-060DH) (D216), and ERP20-32ALF (ERP040-065DH) (E216) or the section **Manual hydraulic Control Valve** 2000 YRM 77 for lift truck models ERC35-55HG (ERC70-120HH) (B839/C839) to replace and adjust the hydraulic pump switches.

FAN POWER SUPPLY, REPLACE

NOTE: The information in this section applies only to lift trucks that are 72 or 80 volts.

Remove, Lift Truck Models ERC35-55HG (ERC70-120HH) (B839/C839)

1. Disconnect the battery and discharge the capacitors by holding the horn button down until the horn stops making a sound. Attach a tag to truck battery connector stating DO NOT CONNECT BATTERY. Remove the key.

2. Disconnect the electrical connection between the power supply and fans.

3. Remove the screws and washers that attach the power supply to mounting bracket. See Figure 36.

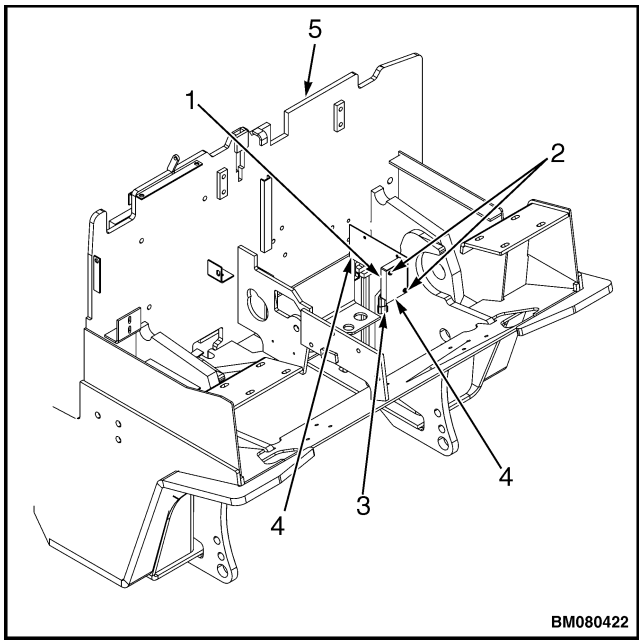
4. Remove power supply from mounting bracket.

Install, Lift Truck Models ERC35-55HG (ERC70-120HH) (B839/C839)

1. Install new power supply on mounting bracket using screws and washers.

2. Connect the electrical connection between the power supply and fans. See Figure 36.

3. Remove the DO NOT CONNECT BATTERY tag from truck battery connector and reconnect the battery.



1. FAN POWER SUPPLY (48 VOLTS)
2. CAPSCREWS AND WASHERS
3. ELECTRICAL CONNECTION
4. MOUNTING BRACKET
5. COWL

Figure 36. Fan Power Supply

After the pedal and push rod are correctly adjusted, loosen the screws and nuts that fasten the switch to the plate. Place a 0.4 to 0.6 mm (0.016 to 0.024 in.) shim between the adjustment screw for the pedal stop and the stop surface. Move the brake light switch so the switch operates from the normally open position to the closed position. Tighten the switch mount screws and nuts to 2.0 to 2.3 N•m (18 to 20 lbf in) without moving the switch. Remove the shim and check that the switch operates correctly.

If you can't hear the switch operate, check the switch with an ohmmeter. Separate the connector and connect the ohmmeter between the common (COM) and normally closed (NC) terminals at the switch. A good switch will indicate less than 50 ohms between the terminals as soon as the pedal moves off the stop. Connect the switch connector after the switch operation is correct and install the floor plates.

Seat Switch Check

WARNING

Some checks and adjustments in this section must be done with the battery connected and power applied to the controller. Lift truck movement during checks or adjustments can cause personal injury. Raise the drive wheels to prevent lift truck movement. See the Operating Manual or Periodic Maintenance 8000 YRM 1060 for lift truck models ERC20-32AGF (ERC040-065GH) (A908), ERC/P16-20AAF (ERC030-040AH) (B814/C814), and ERP20-30ALF (ERP040-060DH) (D216); the section Periodic Maintenance 8000 YRM 1226 for lift truck models ERP20-30ALF (ERP040-060DH) (D216) and ERP20-32ALF (ERP040-065DH) (E216); or the section Periodic Maintenance 8000 YRM 1201 for lift truck model ERC35-55HG (ERC70-120HH) (B839/C839) to raise the drive wheels.

Never have any metal on your fingers, arms, or neck. These metal items can accidentally make an electrical connection and cause an injury.

ALWAYS disconnect the battery before making checks or adjustments that do not need power applied.

NOTE: There is no adjustment for the seat switch located in the cushion of the operator seat. Check that the seat switch is good.

Check as follows:

1. Sit on the seat.
2. Turn the key to the **START** and **ON** positions.
3. Depress the Foot Directional Control pedal or accelerator pedal. If the seat switch is bad, the lift truck will not operate. Replace the seat switch. See Seat Switch, Replace of this section.

Seat Brake Adjustment

Lift truck models ERC20-32AGF (ERC040-065GH) (A908), ERC/P16-20AAF (ERC030-040AH) (B814/C814), and ERC35-55HG (ERC70-120HH) (B839/C839) have a seat brake that is adjustable. The seat brake adjustment procedures for lift trucks ERC20-32AGF (ERC040-065GH) (A908) are located in the section **Brake System** 1800 YRM 574.

The seat brake adjustment procedures for lift trucks ERC/P16-20AAF (ERC030-040AH) (B814/C814) are located in **Brake System** 1800 YRM 620. The seat brake adjustment procedures for lift trucks ERC35-55HG (ERC70-120HH) (B839/C839) are located in **Brake System** 1800 YRM 338.

TABLE OF CONTENTS

This section is for the following models:

ERC35-55HG (ERC70-120HH) [B839/C839]

fully closed. Lift the hood to make sure it is closed and will not move.

SEAT BRAKE REPAIR

See the section **Brake System** 1800 YRM 338 for the procedures for the seat brake.

Counterweight Replacement

NOTE: If the lift truck must be put on blocks for maintenance and repair, see the section **How to Put a Lift Truck on Blocks** in the **Operating Manual** or in the section **Periodic Maintenance** 8000 YRM 1201.

WARNING

The counterweight is very heavy. Make sure that the crane and lifting devices have enough lifting capacity to safely lift the counterweight. The weights of the counterweights are shown in Table 2.

The counterweight normally is not removed for most repairs. Replacement of the AC controllers is accomplished by removing the cover from the counterweight. See Figure 9. The counterweight is fastened to the frame with four capscrews. The weights for the counterweights are shown in Table 2.

Table 2. Weight of Counterweights

Model	Weight*
ERC35HG (ERC070HH)	822 kg (1812 lb)
ERC40-45HG (ERC080-100HH) (Long Frame)	1253 kg (2762 lb)
ERC45HG (ERC100HH) (Short Frame)	1912 kg (4215 lb)
ERC55HG (ERC120HH)	1912 kg (4215 lb)
* ±50 kg (110 lb)	

REMOVE

1. Remove battery. See **How to Change the Battery** in the section **Periodic Maintenance** 8000 YRM 1201. See Battery Specifications section for information on battery weights and sizes.

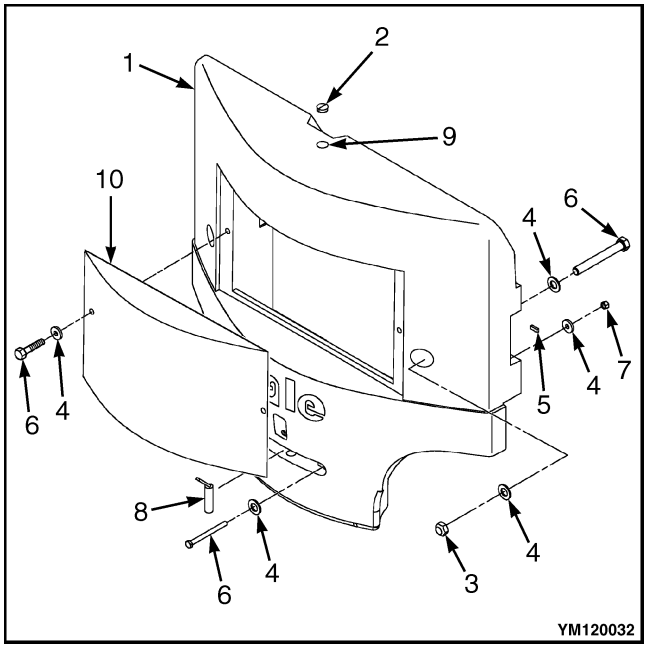
2. Remove overhead guard as described in the paragraphs under Overhead Guard Replacement.

3. Install lifting eyebolt in hole on top of counterweight. See Figure 9. Attach chain or sling to eyebolt. Use crane to hold the weight of the counterweight.

CAUTION

To prevent damage to the controller when removing the counterweight, carefully lift counterweight upward until it is off the frame, then straight back from the lift truck.

4. From inside the battery compartment, remove two capscrews that hold counterweight to frame. Remove two capscrews from tow pin area of counterweight. Use crane to lift counterweight away from frame. Make sure you do not damage the electronic controls.

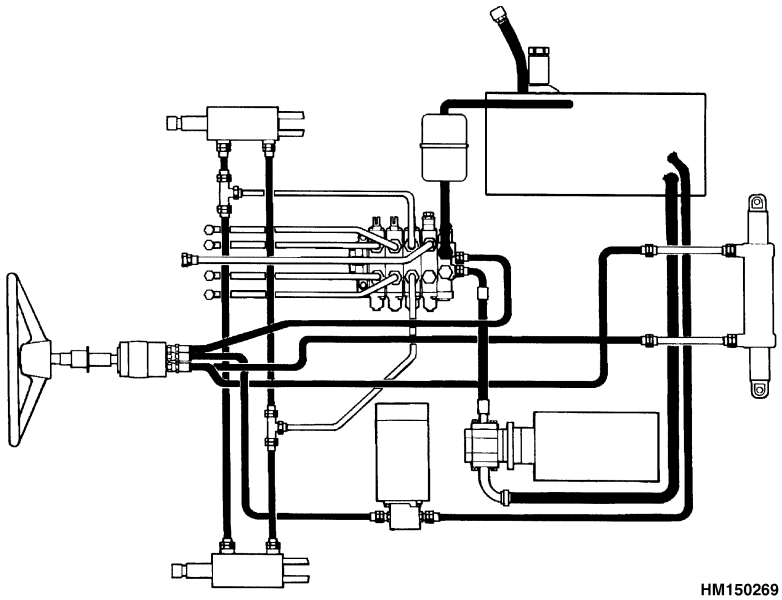


1. COUNTERWEIGHT
2. PLUG
3. NUT
4. WASHER
5. TAPE
6. CAPSCREW
7. LOCK NUT
8. TOW PIN
9. EYEBOLT HOLE
10. CONTROLLERS COVER

Figure 9. Counterweight Assembly

HYDRAULIC SYSTEM

ERC/P16-20AAF
(ERC030-040AF, ERC030-040AG/BG) [A814];
ERP20-30ALF [B216];
ERP20-30ALF (ERP040-060DH) [D216];
ERP20-32ALF (ERP040-065DH) [E216];
ERC20-30AGF
(ERC040-065RF/ZF, ERC040-065RG/ZG) [E108];
ERC20-32AGF (ERC040-065GH) [A908];
ERC/P16-20AAF (ERC030-040AH) [B814/C814];
ERC35-55HG (ERC70-120HH) [B839/C839]



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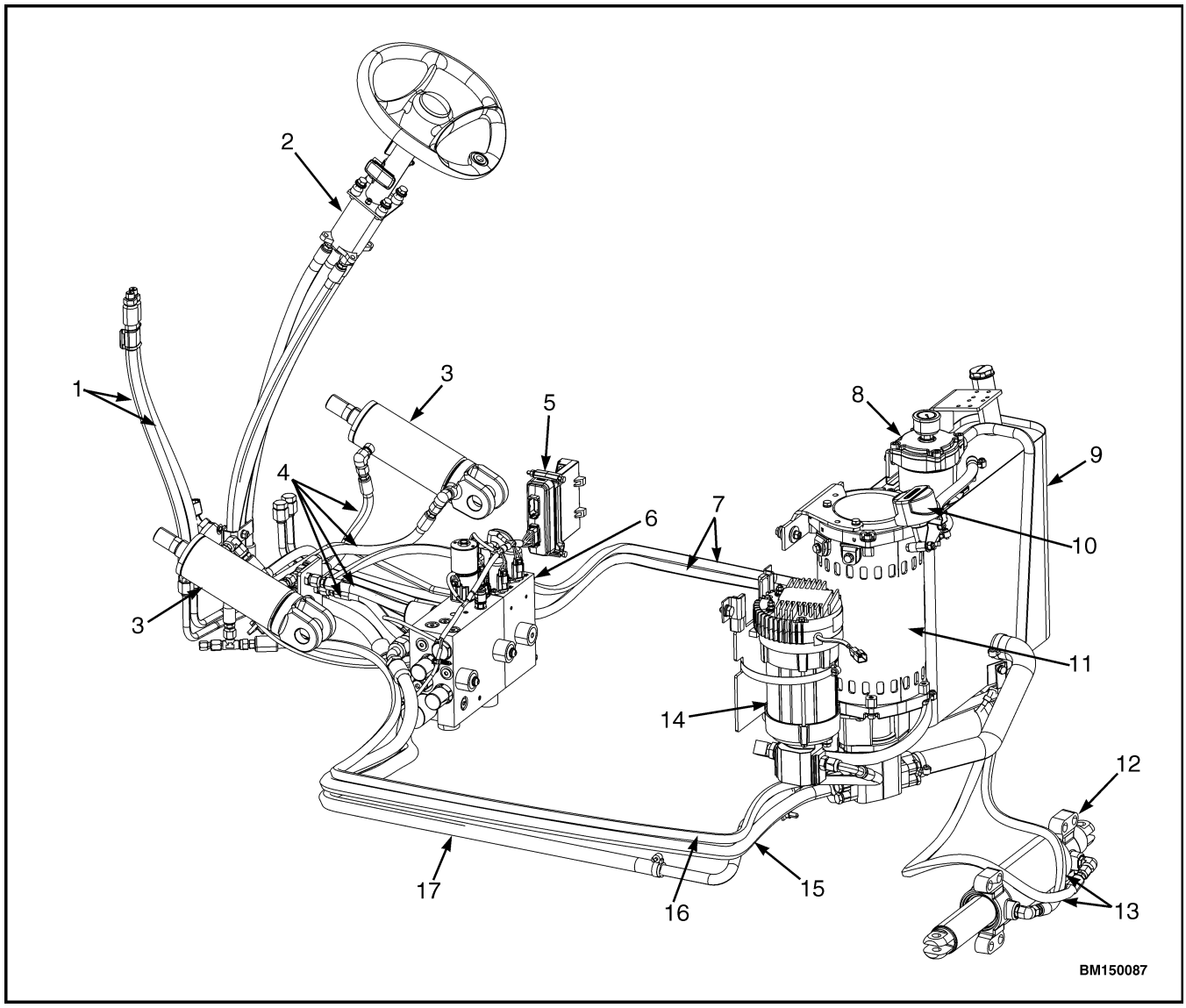


1. AUXILIARY HYDRAULIC HOSES
2. STEERING CONTROL UNIT
3. TILT CYLINDERS
4. TILT CYLINDER HOSES
5. VALVE DRIVER MODULE
6. MAIN CONTROL VALVE
7. HOSES TO STEERING CONTROL UNIT
8. HYDRAULIC FILTER
9. HYDRAULIC TANK
10. HYDRAULIC TANK BREATHER
11. HYDRAULIC PUMP AND MOTOR
12. STEER CYLINDER
13. STEER CYLINDER HOSES
14. STEERING PUMP AND MOTOR
15. HYDRAULIC PUMP AND MOTOR HOSES
16. HOSES TO STEER PUMP AND MOTOR
17. HOSES TO HYDRAULIC TANK

Figure 6. Hydraulic System for ERP20-32ALF (ERP040-065DH) (E216) Lift Trucks With E-Hydraulic Controls

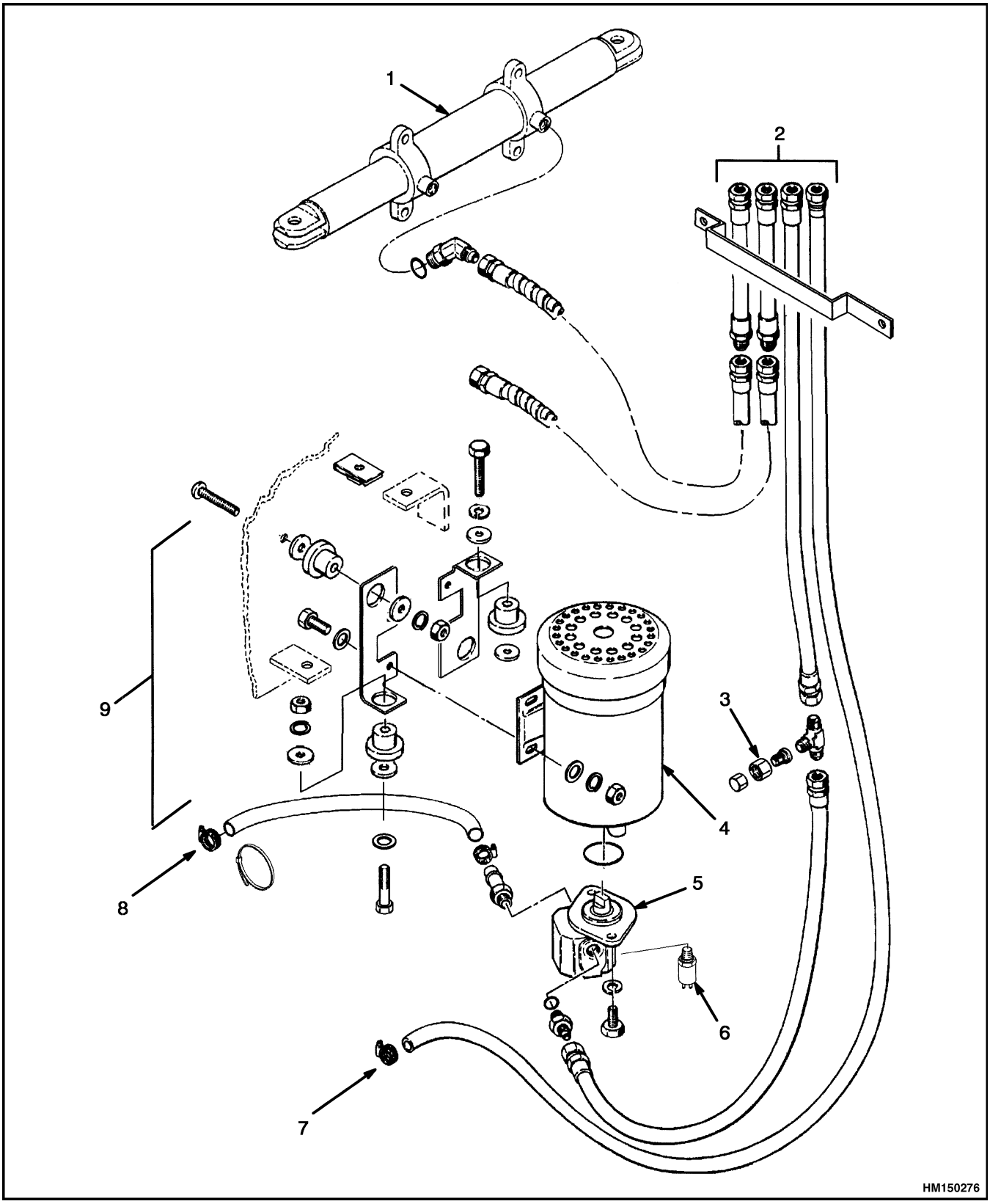


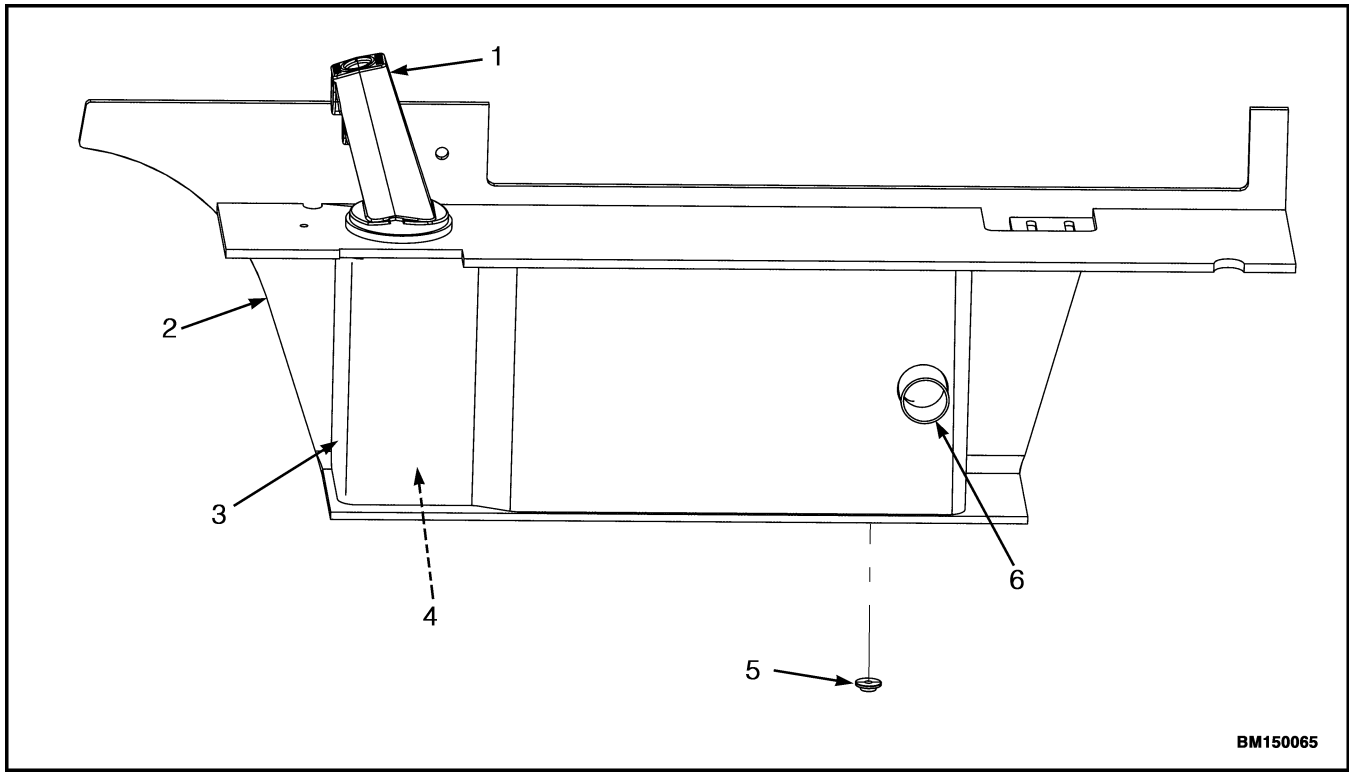
Figure 12. Steering Pump and Hydraulic Circuit for ERC20-30AGF (ERC040-065RF/ZF, RG/ZG) (E108) Lift Truck Models

INSPECT

Make visual inspection of all sides of tank. Inspect welds for cracks and leakage. Check for wet areas, accumulation of dirt, and loose or missing paint caused by leakage. Areas of the tank that are not easily seen can be checked with an inspection mirror and a light that is approved for locations with flammable vapors.

For all lift truck models covered in this manual, except for ERC35-55HG (ERC70-120HH) (B839/C839) truck models, the hydraulic tank is a separate sheet metal tank and can be removed from the lift truck if necessary to check for leaks or for replacement. On lift truck models ERC35-55HG (ERC70-120HH) (B839/C839), the hydraulic tank is a part of the frame and cannot be removed or installed separately from the frame weldment. However, it can be checked for leaks.

Repairs for leaks in the hydraulic tank can require special procedures described in the next paragraphs. The most common cause of leaks is from rust caused by the moisture of condensation. Drain any water out of tank by removing drain plug and letting tank drain until there is no water in oil.



NOTE: THE HYDRAULIC FILTER IS INSIDE THE HYDRAULIC TANK AND ATTACHED TO THE FILTER HEAD ASSEMBLY. IT IS NOT SHOWN HERE FOR CLARITY (SEE FIGURE 24). THE HYDRAULIC FILTER AND TANK ARE ON THE RIGHT SIDE.

1. HYDRAULIC FILTER HEAD ASSEMBLY
2. FRAME
3. HYDRAULIC TANK
4. HYDRAULIC FILTER
5. DRAIN PLUG
6. SUPPLY OUTLET

Figure 20. Hydraulic Tank for ERC35-55HG (ERC70-120HH) (B839/C839) Lift Truck Models

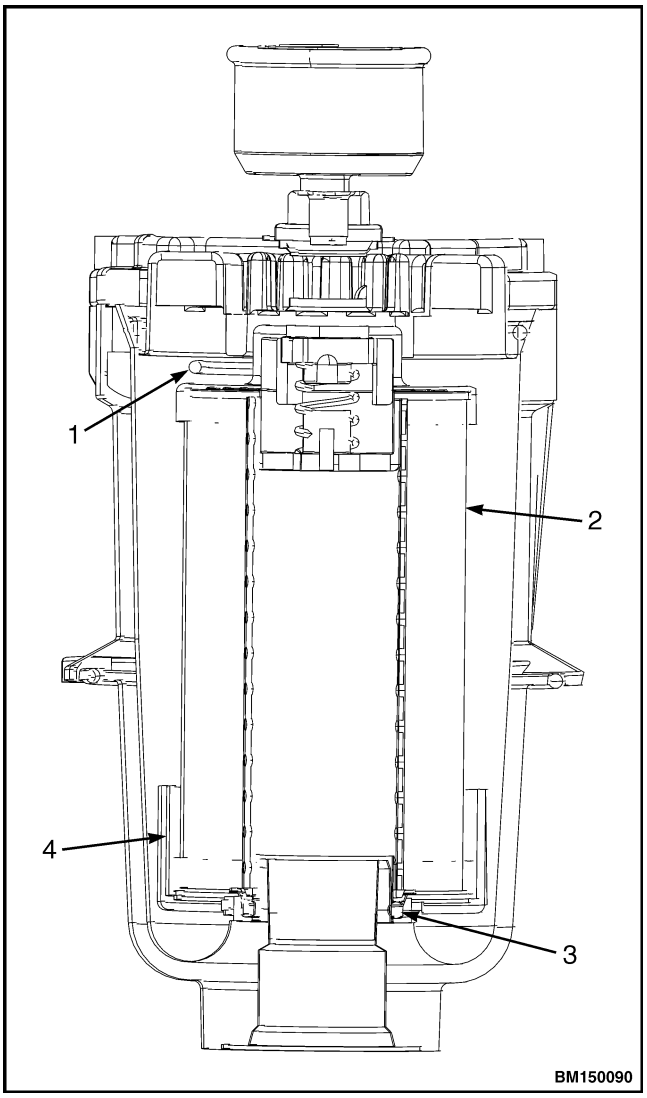
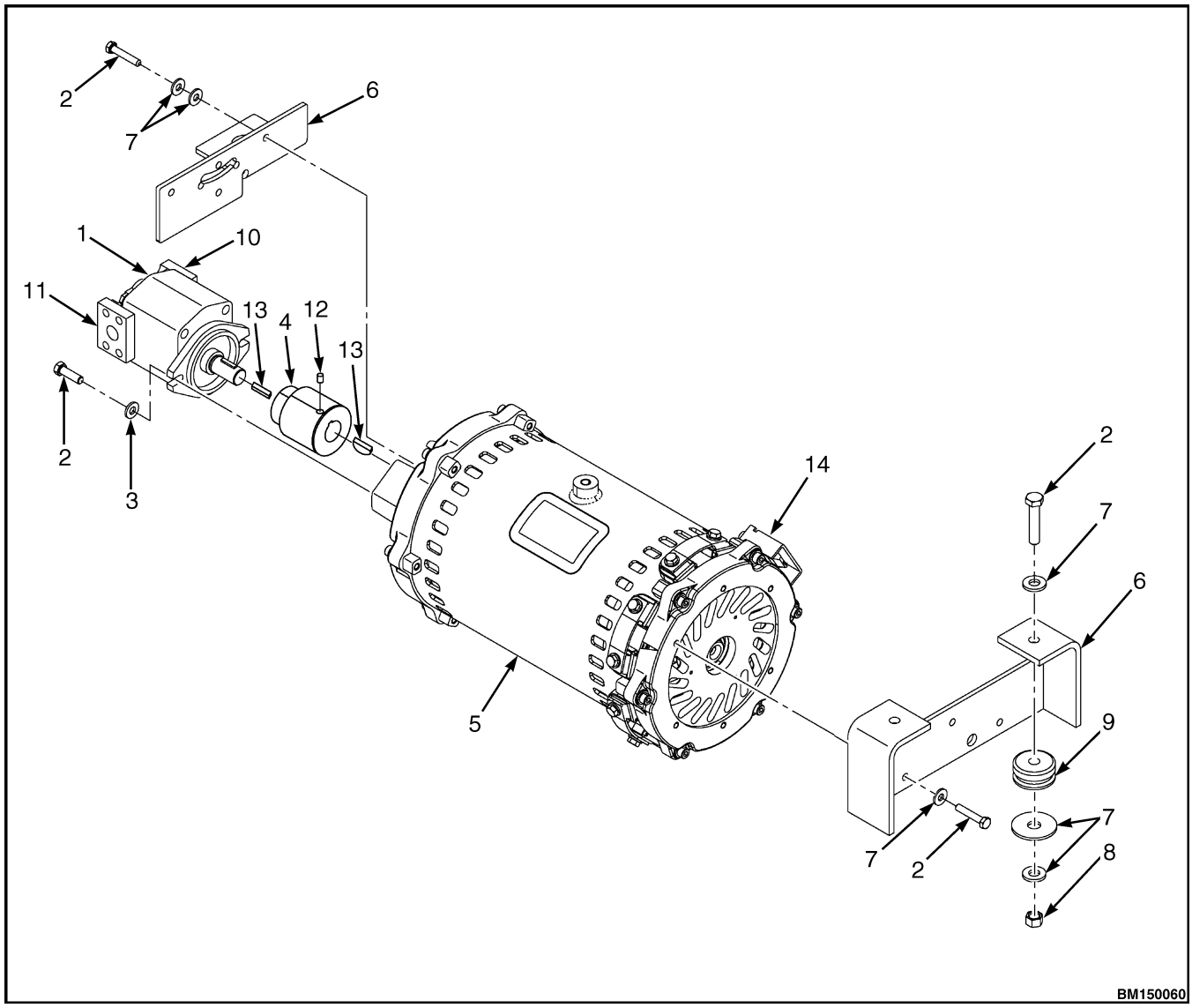


Figure 27. Hydraulic Filter Components for ERP20-32ALF (ERP040-065DH) (E216), ERC20-32AGF (ERC040-065GH) (A908) and ERC/P16-20AAF (ERC030-040AH) (B814/C814) Lift Truck Models

Legend for Figure 27

1. COVER O-RING
2. FILTER ELEMENT
3. OIL SEAL
4. DEBRIS CAP



NOTE: HOSES REMOVED FOR CLARITY.

1. GEAR PUMP
2. CAPSCREW
3. LOCKWASHER
4. COUPLING
5. HYDRAULIC MOTOR
6. MOUNTING BRACKET
7. WASHER
8. LOCK NUT
9. MOTOR MOUNT (ISOLATOR)
10. INLET HOSE
11. PRESSURE HOSE
12. SETSCREW
13. KEYS
14. SENSOR CONNECTION

Figure 33. Hydraulic Pump and Motor Assembly With Mounting Brackets for ERC35-55HG (ERC70-120HH) (B839/C839) and ERP20-32ALF (ERP040-065DH) (E216) Lift Truck Models

8. Remove cap on pressure hose. Install pressure hose on outlet of pump. Remove plug in inlet hose and quickly connect inlet hose at pump. Leave fittings loose.

9. If oil was drained from hydraulic system, make sure drain plug is installed in tank. If necessary, turn steering wheel for a full left turn for access to drain plug near front of right rear wheel. If drained, fill

Legend for Figure 38

1. ON-DEMAND STEERING COMPONENTS
2. UPPER COVER
3. BRACKET
4. PIVOT SHAFT
5. PLATE
6. LOCKWASHER
7. CAPSCREW
8. LOCK NUT
9. SCREW
10. STATIC GROUND PATCH
11. LOWER COVER
12. COLUMN TILT LEVER
13. PUSH ROD
14. LATCH
15. SPRING
16. WASHER
17. COTTER PIN
18. PIN
19. STEERING CONTROL UNIT
20. PLUG
21. OPTICAL ENCODER HOUSING
22. GEAR
23. OPTICAL ENCODER
24. HORN BUTTON
25. STEERING WHEEL
26. STEERING COLUMN
27. RETURN SPRING
28. LARGE HEX NUT
29. INPUT
30. RIGHT TURN
31. LEFT TURN
32. RETURN
33. PLASTIC RIVET

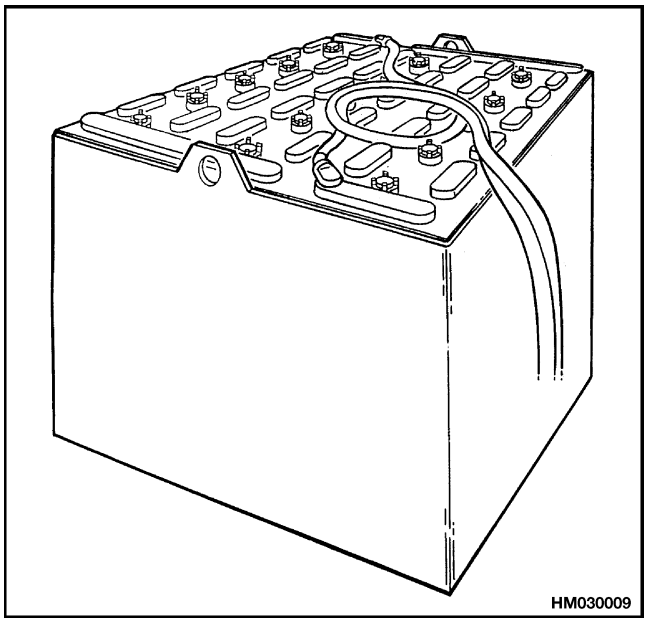


Figure 9. Multicell Battery for Electric Lift Truck

Battery Voltage

NOTE: The voltage of the battery can be found on the lift truck's Nameplate. See the **Frame** section or **Operating Manual** for your lift truck for the location of the Nameplate.

The battery voltage you need is found as follows:

- Will your lift truck operate on more than one voltage?
- If you have more than one lift truck in operation, do the battery voltages need to be the same?

To reach the necessary battery voltage, the cells are connected in series. For example:

24 volts = 12-cell battery
36 volts = 18-cell battery
48 volts = 24-cell battery
72 volts = 36-cell battery
80 volts = 40-cell battery

Battery as a Counterweight

On electric lift trucks that use the battery as part of the counterweight, the battery is part of the capacity of the lift truck to lift loads. The minimum weight of the battery is shown on the nameplate. If the battery is not the minimum weight, the capacity of the lift truck is reduced. If the battery used in the lift truck is less than the size of the battery compartment, blocks and spacers must be installed to hold the battery in position.

See the **Frame** or **Periodic Maintenance** service manual or **Operating Manual** for your lift truck model for the correct measurements for installing battery spacers.

BATTERY CONNECTORS

A special heavy-duty connector is used to connect the battery to the electrical system of the lift truck. See Figure 22 and Figure 23. When a connector has a handle and is within the operator's reach, the connector is also a safety device that can be used to quickly disconnect the battery in an emergency. Most connectors have a handle to connect the two halves of the connector. The connector can be quickly disconnected by pulling the handle upward. This action separates the two halves of the connector. The connector and its attached handle must be kept in good repair so that it will function correctly. The battery connector must be disconnected when maintenance is done on the lift truck that does not require electric power. The SBE, SBX, and FEM or DIN 12- volt battery connectors are shown in Figure 23.

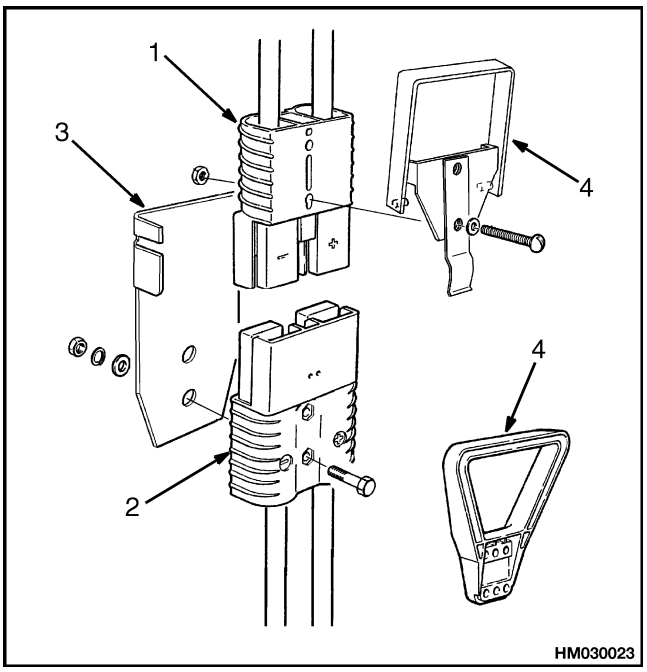


Figure 22. SB Battery Connector

Legend for Figure 22

1. SB CONNECTOR FOR BATTERY CABLES
2. SB CONNECTOR FOR POWER CABLES TO LIFT TRUCK
3. BRACKET
4. CONNECT AND DISCONNECT HANDLES

BATTERY CARE

1. Keep batteries clean. Remove any spilled electrolyte.

2. DO NOT overcharge the battery. This action will damage the battery.

3. DO NOT discharge the battery to less than the recommendation. A deep discharge will shorten the battery life.

4. Charge batteries in an area with good ventilation to remove explosive gases and acid fumes.

5. Keep the electrolyte at the correct level. Check the electrolyte level before and after charging the battery. Use distilled water. Do not add acid.

6. Prevent batteries from freezing.

7. Keep batteries charged. A discharged battery in storage will shorten the battery life.

8. Use a battery charger that is correct for the battery. A battery charger that is set for an ampere-hour rate that is too high will cause a high internal heat and damage the battery. A low ampere-hour rate setting on a battery charger can require a longer charging time but will not damage the battery.

9. When batteries are moved, make sure a short circuit does not occur. See the Safety Procedures in Battery Maintenance of this section.

General

This section has the description for lift cylinders used on the masts for model lift trucks ERC070-120HG (A839), GLP/GDP3.5-5.5LJ/MJ (GP/GLP/GDP070-120LJ/MJ), ERC35-55HG (ERC70-120HH) [B839], and GC070-120LJ/MJ and the instructions for their repair. The operation and repair procedures for the different lift cylinders are similar. See the section **Lift Cylinders** 4000 YRM 135 for lift cylinders used on other units.

Description

All lift cylinders for the masts are single-action hydraulic cylinders. The hydraulic force is applied only in one direction. When hydraulic oil enters one end of the lift cylinder, the hydraulic force extends the piston rod. When the force is removed, the weight of the carriage and inner mast causes the piston rod to retract.

A common maintenance problem is the repair of oil leaks. If the bore of the shell of the lift cylinder is damaged and cannot be repaired, the lift cylinder must be replaced.

The two-stage and three-stage masts have two main lift cylinders. The free-lift mast has two main lift cylinders and a shorter free-lift cylinder. See Figure 2 and Figure 3.

Spacers are used in some cylinders to limit the stroke of the piston rod. Worn spacers must be replaced with the same size spacer.

The free-lift cylinder has a single-lip seal on the piston to prevent hydraulic oil leaks past the piston and retainer. The piston rod has a smaller diameter than the piston.

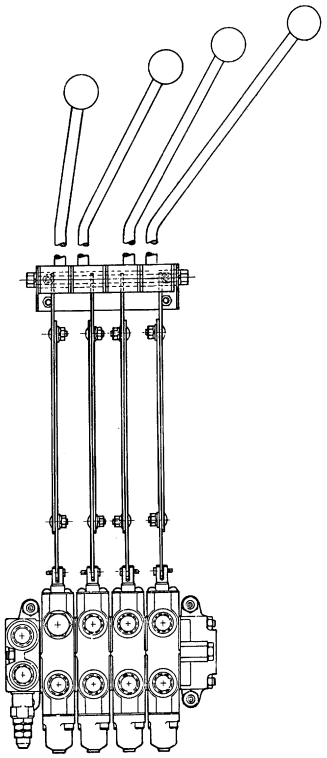
During operation, some hydraulic oil will leak past the piston area to the rod end of the lift cylinder. Small leaks are permitted if the internal leak rate of the hydraulic system is not greater than the specification. An internal check valve is installed in the piston of the free-lift cylinders. When the piston rod extends, the pressure increases more quickly on any oil in the rod end of the lift cylinder. The hydraulic oil transfers through the check valve to the piston end of the free-lift cylinder. This action prevents hydraulic damage to the single-lip seal and the wiper ring. See Figure 4.

LOWERING CONTROL VALVE (VELOCITY FUSE)

A lowering control valve is installed in the hydraulic line to the bases of the main lift cylinders and at the inlet port of each lift cylinder. The lowering control valves (velocity fuses) permit easy entry of hydraulic oil into the cylinders, but give a restriction when the rods retract. This restriction controls the maximum speed at which a load on the forks can be lowered. The lowering control valves (velocity fuses) prevent a load on the forks from freely falling if a hydraulic hose breaks.

MANUAL HYDRAULIC CONTROL VALVE

ERC35-55HG (ERC070-120HG) [A839]; GP/GLP/GDP070-110LG/MG [B813]; GC070-120LJ/MJ [B818]; ERC35-55HG (ERC70-120HH) [B839/C839]



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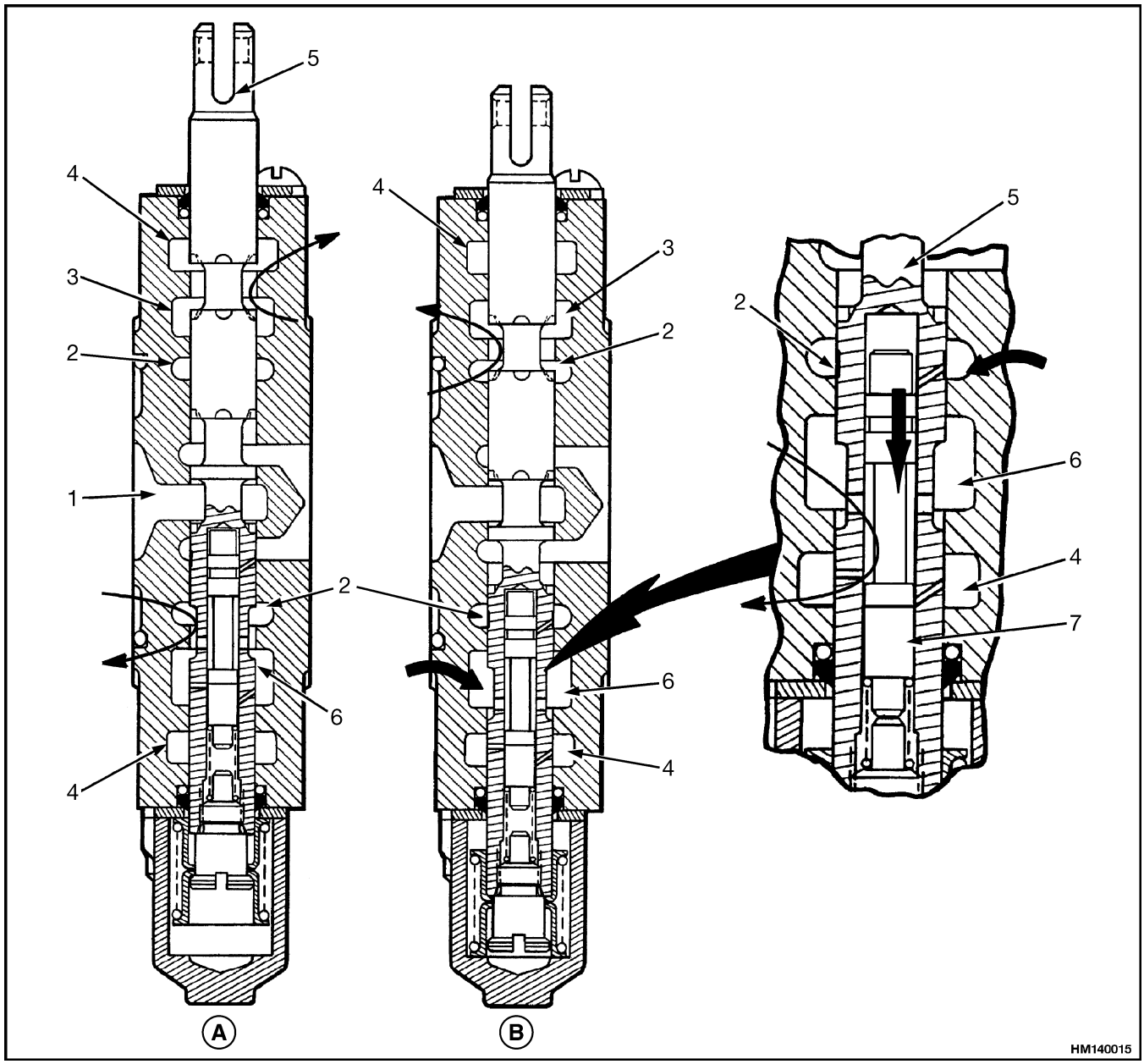
2000 YRM 77



A. TILT BACKWARD

1. OPEN CENTER PASSAGE
2. SUPPLY CAVITY
3. TO/FROM PISTON END OF TILT CYLINDERS
4. DRAIN CAVITY

B. TILT FORWARD

5. TILT SPOOL
6. TO/FROM ROD END OF TILT CYLINDERS
7. TILT CONTROL SPOOL

Figure 6. Tilt Spool Operation

Control Lever Arrangement and Adjustment

NOTE: For electric lift trucks, see the section **Hydraulic System** 1900 YRM 286 or **Hydraulic System** 1900 YRM 559 section for the arrangement and adjustment of the control valve levers. See Figure 13.

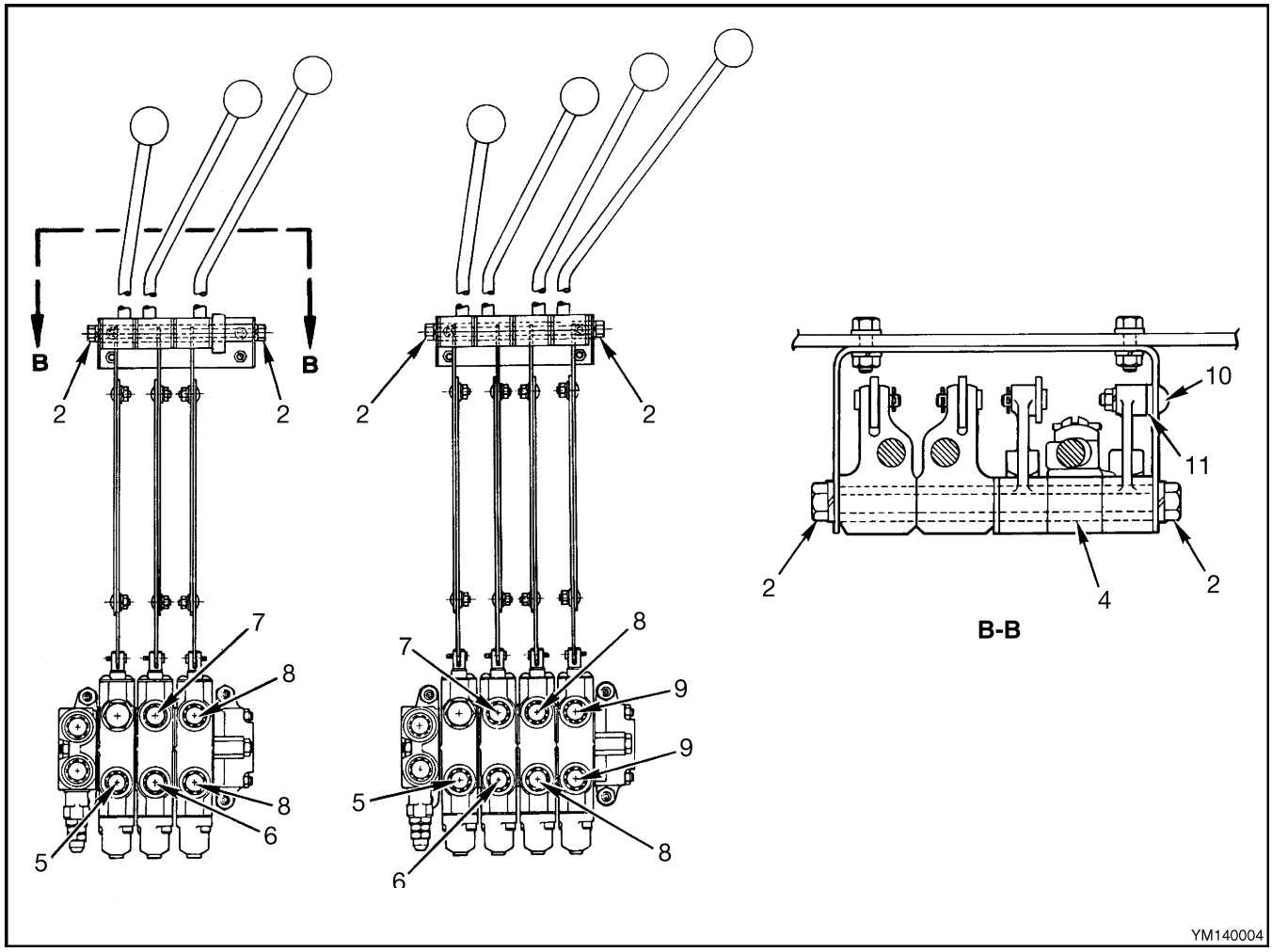


Figure 13. Control Lever Arrangement (Sheet 1 of 2)

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Carriage Repair

REMOVE

WARNING

Do not work under a raised carriage. Lower the carriage or use a chain or blocks to prevent the carriage and inner weldment from lowering.

NOTE: If the mast is equipped with a sideshift carriage, see the paragraphs under Sideshift Carriage Repair.

1. Put weight on the forks so carriage has stability and will not fall when it is disconnected from the mast.
2. Lower carriage and forks on blocks so lift chains become loose.

WARNING

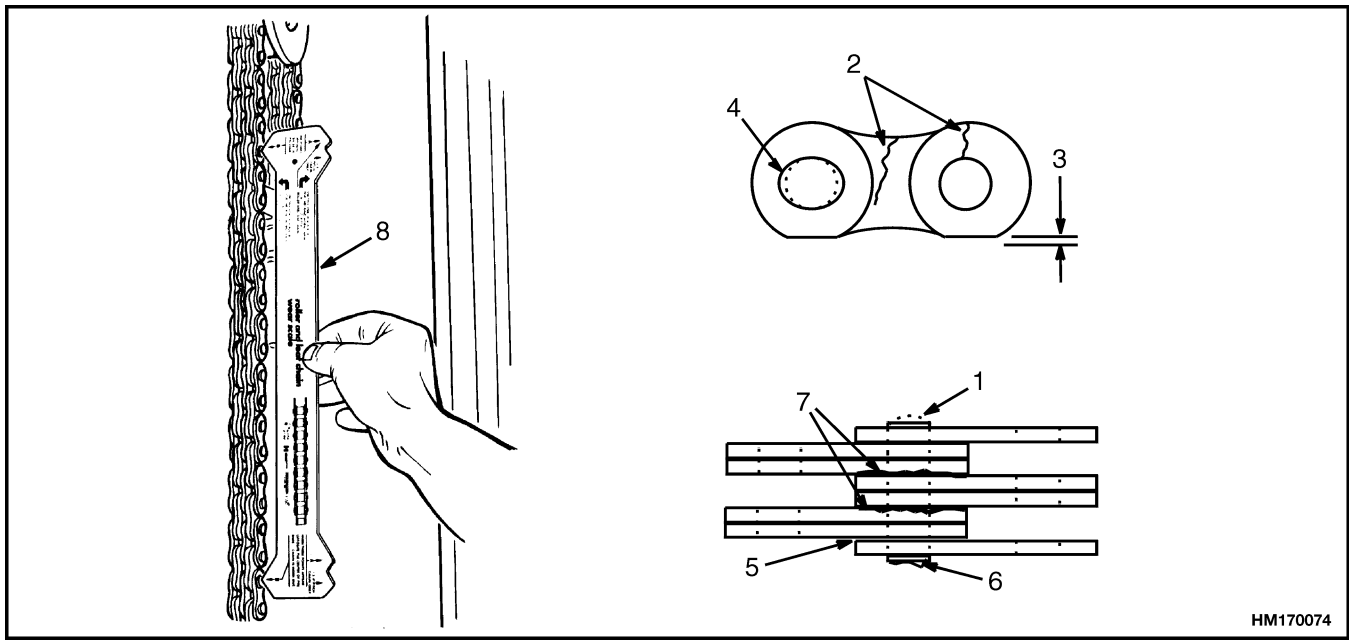
When disconnecting the lift chains, keep control of the ends. Use wire to temporarily connect the ends of the lift chains to the mast. This procedure will prevent the lift chains from falling and causing an injury or damage.

3. Remove pin from each chain anchor at the carriage. Disconnect lift chains from carriage. See Figure 9.

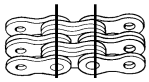
WARNING

Make sure the carriage has stability and will not fall over when the inner weldment is raised above the load rollers of the carriage.

4. Use lift cylinders to raise inner weldment until it is above the load rollers of the carriage. If the hydraulic system cannot be used, connect a lifting device to the top of the inner weldment. Carefully raise inner weldment until it is above the load rollers of the carriage.
5. Move lift truck from carriage. Connect a lifting device to the carriage. Make sure carriage is stable. Remove load backrest and forks. Put carriage on floor so that load rollers are up.
6. If any of the load rollers must be replaced, make a note of the arrangement of the shims.
7. Reverse this procedure for carriage installation.



NOTE: THE INSTRUCTIONS FOR MEASURING CHAIN WEAR ARE SHOWN ON THE CHAIN WEAR SCALE.

Pitch 	Total Length of 20 Links (Pitch) of New Chain	Wear Limit The Maximum Length of 20 Links
25.4 mm (1.00 in.) 31.8 mm (1.25 in.)	508.0 mm (20.0 in.) 635.0 mm (25.0 in.)	523.3 mm (20.6 in.) 654.1 mm (25.8 in.)

1. WORN PIN
2. CRACKS
3. EDGE WEAR
4. HOLE WEAR
5. LOOSE LEAVES
6. DAMAGED PIN
7. RUST
8. CHAIN WEAR SCALE

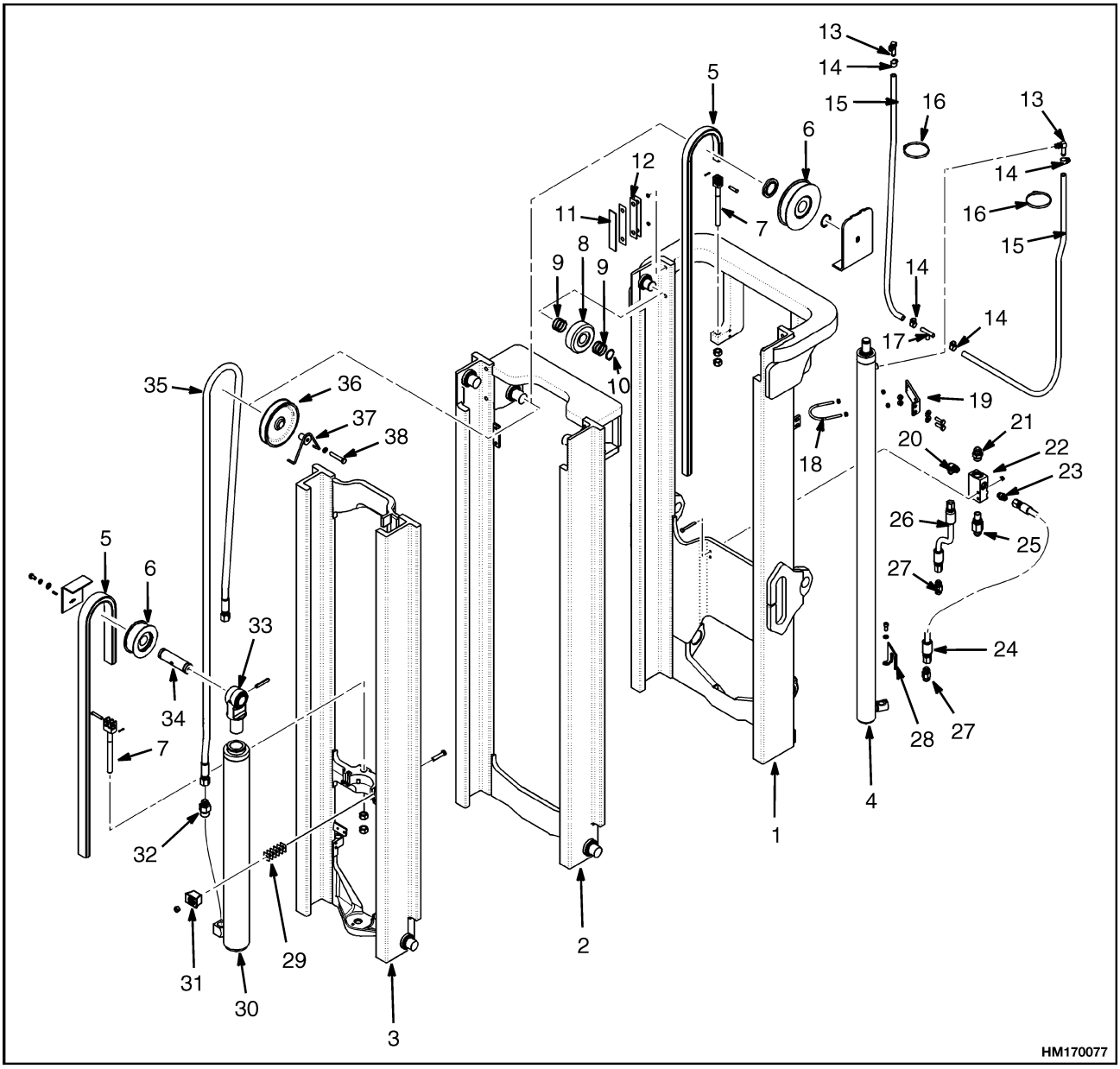
Figure 15. Lift Chains Check

ASSEMBLE

NOTE: The shims for the load rollers keep the weldments parallel and provide correct clearance. During assembly, the location of the shims will be approximately the same as they were before disassembly. Check clearance and adjust shims for wear or changes because of repairs. Strip bearings are also adjusted by using shims. See Mast Adjustments in this section for the instructions to make the necessary adjustments.

1. Connect a lifting device to the center of inner weldment (see Figure 14). Put stub shafts through notches in the outer weldment. Slide inner weldment into the outer weldment so stub shafts are seen at the top and bottom of the weldments.

2. Install strip bearings and shims on the outer weldment. Apply grease to bearing surface. See Figure 16.



1. OUTER WELDMENT
2. INTERMEDIATE WELDMENT
3. INNER WELDMENT
4. MAIN LIFT CYLINDER
5. LIFT CHAIN
6. CHAIN SHEAVE
7. CHAIN ANCHOR
8. LOAD ROLLER
9. SHIMS
10. SNAP RING
11. BEARING STRIP
12. SHIM
13. FITTING
14. CLAMP
15. HOSE
16. CLAMP
17. FITTING
18. CLAMP
19. BRACKET
20. FITTING
21. FITTING
22. HOUSING, VALVE
23. FITTING
24. HOSE
25. LOWERING CONTROL VALVE
26. HOSE
27. VELOCITY FUSE
28. BRACKET
29. SHIM
30. FREE-LIFT CYLINDER
31. CLAMP
32. VELOCITY FUSE
33. CROSSHEAD
34. PIN
35. HOSE
36. HOSE SHEAVE
37. STUB SHAFT
38. CAPSCREW

Figure 21. Three-Stage Mast With Full Free-Lift GLP/GDP3.5-5.5LJ/MJ (GP/GLP/GDP070-120LJ/MJ) Lift Truck Models

Legend for Figure 26

NOTE: HOSE HEADER ARRANGEMENT SHOWN FOR LIFT TRUCK MODELS ERC35-55HG (ERC70-120HH) (B839) WITH MAST HEIGHTS OF 5240 mm (17 ft) AND 5500 mm (18 ft)

1. SNAP RING
2. WASHER
3. SHEAVE
4. CLAMP
5. CAPSCREW
6. HOSE
7. NUT
8. BRACKET
9. LOCKWASHER
10. FITTING
11. O-RING
12. MOUNTING BLOCK
13. HOSE REEL
14. PLATE
15. FLOW VALVE
16. PIN
17. STRAIN RELIEF
18. SPACER

Mast Operation Check

WARNING

Lower the lift mechanism completely. Never allow anyone under a raised carriage. Do not put any part of your body in or through the lift mechanism unless all parts of the mast are completely lowered and the engine is STOPPED.

Before making any repairs, use blocks and chains on the mast weldments and carriage so they cannot move. Make sure the moving parts are attached to a part that does not move.

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

1. Check for leaks in the hydraulic system. Check condition of hydraulic hoses and tubes.

NOTE: Some parts of the mast move at different speeds during raising and lowering.

2. Slowly raise and lower the mast several times without a load. Mast components must raise and lower smoothly in correct sequence. Carriage raises first, then inner weldment and intermediate weldment (three-stage masts only).

3. Inner weldments and the carriage must lower completely.

4. Check that controls for the attachment operate the functions of the attachment. See symbols by each of the controls. Make sure all hydraulic lines are connected correctly and do not leak.

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
No movement of the lift or tilt cylinders.	Pilot line(s) to control valve are disconnected or leaking.	Tighten or connect fittings.
	No oil or not enough oil in hydraulic tank.	Fill tank. Check for leaks.
	Relief valve is not set correctly.	Adjust or install new relief valve.
	Hydraulic pump does not operate or has damage.	Repair or install new pump.
	Remote control valve does not operate.	Check and repair valve.
Slow movement of the lift or tilt cylinders.	No oil or not enough oil to the lift or tilt cylinders.	Fill tank. Check for leaks.
	Cylinders have internal or external leaks.	Repair leaks. Install new parts.
	Relief valve is not set correctly.	Adjust or install new relief valve.
	There is a restriction in a hydraulic line.	Remove restriction. Install new parts.
Rough movement of the mast assembly.	There is air in the hydraulic system.	Remove air. Check for loose connections or breaks in lines.
	Lift cylinder(s) is damaged.	Repair or install new lift cylinder.
	Mast weldments are damaged or not aligned.	Align weldments. Install new parts.
	Mast weldments are not lubricated correctly.	Lubricate correctly.
	Load rollers or bearing blocks are damaged or not adjusted correctly.	Repair or adjust the parts.
	Lift chains are damaged.	Replace lift chains.
Lift or tilt cylinders extend or retract when control valve lever (spool) is in the **NEUTRAL** position.	Load check valves and spools have damage.	Repair or install new load check valve and spool.
	Cylinder seals have leaks.	Install new seals.
	Hydraulic lines have leaks.	Repair leaks. Install new parts. Remove air from system.

General

THREADED FASTENERS

Threaded fasteners, like bolts, nuts, capscrews, and studs, are made to specifications that describe the mechanical strength and hardness of the fastener. A fastener used in a design application is selected according to its specifications. Yale Company buys parts from many countries. Parts that are purchased must be to Yale Company standards. There are several standards used by these countries in the manufacture of threaded fasteners. Many of these fasteners are similar, but cannot be used as a direct replacement. To make sure that you have the correct fastener, order fasteners and parts through the Yale Parts Depot.

Service persons must use replacement fasteners that have the same specifications. Fasteners made to each specification have identification marks for that specification. This specification is commonly called "Grade" for SAE standards and "property class" for metric standards. This section describes the identification of some common fasteners.

The metric system used by Yale Company is described as SI (Le Systeme d'Unites or the International System of units, also called SI in all languages). The SI System of measurement is described in ISO Standard 1000, 1973. A conversion table of common measurements is shown in Table 7.

NOMENCLATURE, THREADS

The thread design is specified by a series of numbers and letters for inch and metric fasteners. See Figure 1.

The diameter of the shank of the fastener is shown first in the series [M12 = 12 mm, M20 = 20 mm (1/2 = 1/2 in., 3/4 = 3/4 in.)].

The number of threads per inch is normally not shown for inch nomenclature and only the UNC (Unified National Coarse) or UNF (Unified National Fine) is shown. This number of threads per inch is not shown because a UNC or UNF fastener has a standard number of threads per inch for a specific diameter. Metric fasteners show the number of threads per millimeter.

The length of the shank is often indicated as part of the description of a fastener. This length is shown in inches for inch fasteners and in millimeters for metric fasteners.

A capscrew will have the following description:

Metric	Inch
M12 × 1.75 × 50	1/2 × 13 UNC × 1-1/2
A B C	A B C D
A = Thread Size	A = Shank Diameter
B = Pitch	B = Number of Threads Per Unit of Length
C = Length	C = Type of Thread
	D = Shank Length

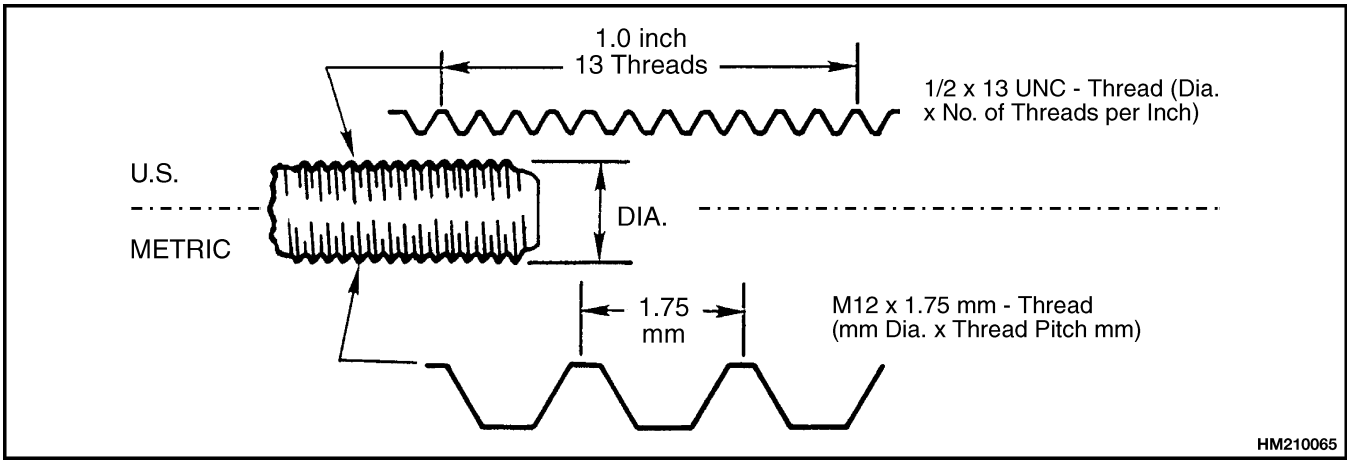
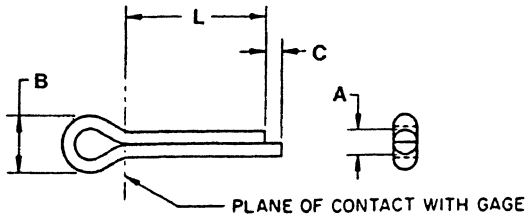


Figure 1. Thread Design

Table 9. Cotter Pin Dimensional Data

Nominal Length L	Length Range		Nominal Size - Part Numbers				
	max	min	1.00 mm (0.031 in.)	1.60 mm (0.047 in.)	2.00 mm (0.062 in.)	2.50 mm (0.094 in.)	3.20 mm (0.125 in.)
6.35 mm (0.250 in.)	7.10 mm (0.280 in.)	5.50 mm (0.217 in.)					
9.525 mm (0.375 in.)	10.5 mm (0.413 in.)	8.80 mm (0.345 in.)					
12.7 mm (0.500 in.)	13.5 mm (0.530 in.)	11.5 mm (0.453 in.)	015414100	505959587	015414700	015415900	015417600
19.05 mm (0.750 in.)	20.5 mm (0.807 in.)	18.3 mm (0.720 in.)	015414300		015414900	015416200	015417900
25.4 mm (1.000 in.)	26.9 mm (1.060 in.)	23.9 mm (0.940 in.)	015414500		015415100	015416500	015418200
31.75 mm (1.250 in.)	33.3 mm (1.310 in.)	29.2 mm (1.150 in.)			015415200	015416600	015418300
38.1 mm (1.500 in.)	40.9 mm (1.610 in.)	36.6 mm (1.440 in.)			015415400	015416700	015418400
44.45 mm (1.750 in.)	46.0 mm (1.810 in.)	42.9 mm (1.690 in.)			015415500	015416800	015418500
50.8 mm (2.000 in.)	52.3 mm (2.060 in.)	49.3 mm (1.940 in.)			015415600	015416900	015418600
57.15 mm (2.250 in.)	58.7 mm (2.310 in.)	55.1 mm (2.170 in.)				015417000	015418700
63.5 mm (2.500 in.)	65.0 mm (2.560 in.)	62.0 mm (2.440 in.)				015417100	015418800
69.85 mm (2.750 in.)	72.1 mm (2.840 in.)	68.3 mm (2.690 in.)					015418900
76.2 mm (3.000 in.)	81.3 mm (3.200 in.)	74.7 mm (2.940 in.)					015419000
88.9 mm (3.500 in.)	91.4 mm (3.600 in.)	87.4 mm (3.440 in.)					
101.6 mm (4.000 in.)	113.3 mm (4.460 in.)	98.8 mm (3.890 in.)					



EXTENDED PRONG

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TABLE OF CONTENTS (Continued)

This section is for the following models:

ERC35-55HG (ERC70-120HH) [B839/C839]

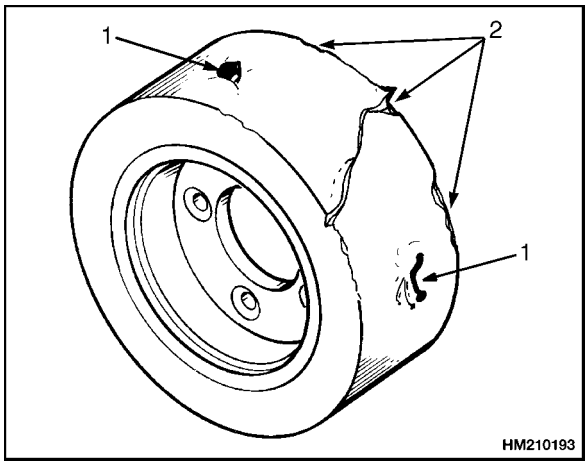
HOW TO MAKE CHECKS WITH KEY SWITCH OFF

Tires and Wheels

CAUTION

Check all drive wheel nuts after 2 to 5 hours of operation: when new lift trucks begin operation and on all lift trucks when the drive wheels have been removed and installed. Tighten nuts in a cross pattern to correct torque value shown in Maintenance Schedule. When nuts stay tight for eight hours, interval for checking torque can be extended to 500 hours.

Inspect tires for wire, rocks, glass, pieces of metal, holes, cuts, and other damage. Remove any object that will cause damage. See Figure 5. Check for loose or missing hardware. Remove any wire strapping or other material wrapped around axle. Make sure that drive wheel nuts are tight. Tighten drive wheel nuts in a cross pattern to correct torque value shown in Maintenance Schedule.



1. CHECK FOR DAMAGE AND REMOVE NAILS, GLASS, METAL, AND OTHER OBJECTS
2. MAKE EDGES SMOOTH

Figure 5. Tires Check

Forks

NOTE: Forks must be removed and installed by trained personnel.

The identification of a fork describes how the fork is connected to the carriage. These lift trucks have hook forks.

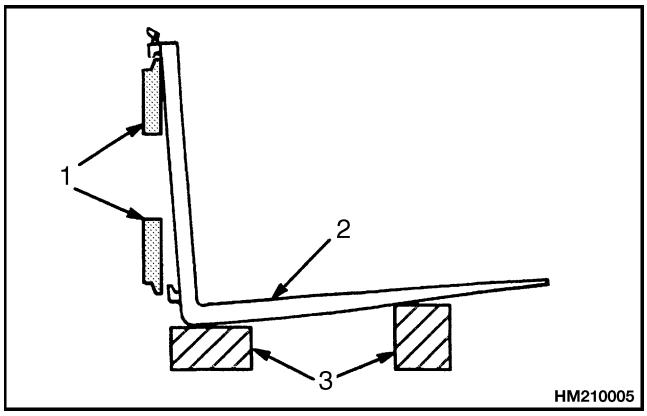
Remove

WARNING

Do not try to move a fork without a lifting device. Each hook fork for these lift trucks can weigh 35 to 180 kg (80 to 395 lb).

NOTE: Forks are to be replaced only in pairs and not individually.

A fork can be removed from the carriage for replacement of the fork or other maintenance. Slide a hook fork to the fork removal notch on the carriage. See Figure 6 and Figure 7. Lower the fork onto blocks so that the bottom hook of the fork moves through the fork removal notch. See Figure 7. Lower the carriage further so that the top hook of the fork is disengaged from the top carriage bar. Move the carriage away from the fork, or use a lifting device to move the fork away from the carriage.



1. CARRIAGE BARS
2. HOOK FORK
3. BLOCKS

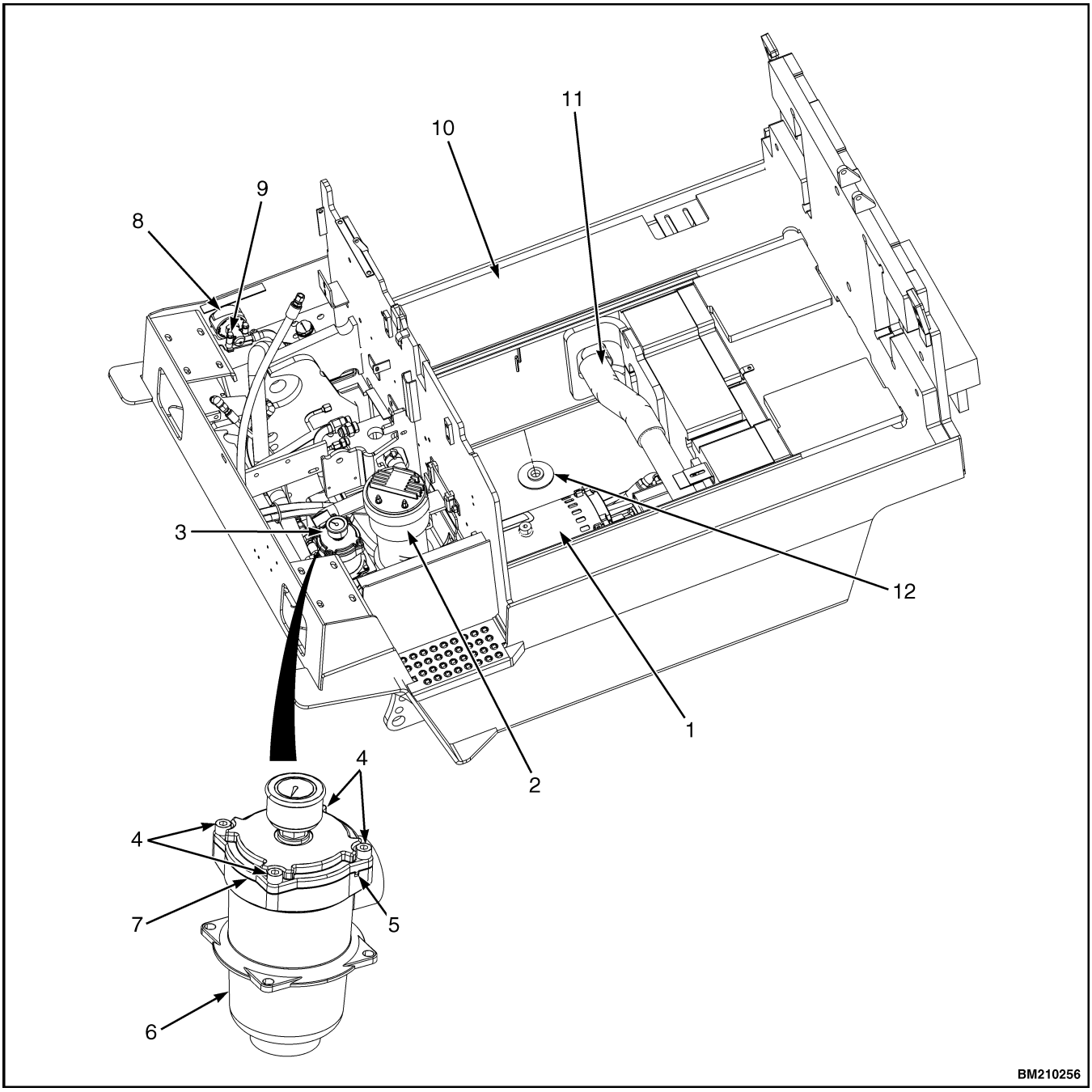
Figure 6. Hook Fork Removal

Inspect

WARNING

Do not try to correct fork tip alignment by bending the forks or adding shims. Replace bent forks. Never repair damaged forks by heating or welding. Forks are made of special steel using special procedures. Replace damaged forks. Forks are to be replaced only in sets and not individually.

1. Inspect the forks for cracks and wear. Check that the fork tips are aligned to within 13 mm (0.5 in.) of each other (see Figure 7). Check that the bottom of the fork is not worn (Item 4 in Figure 7).



NOTE: FLOOR PLATE NOT SHOWN FOR CLARITY.

1. HYDRAULIC PUMP AND MOTOR
2. STEERING PUMP AND MOTOR
3. HYDRAULIC FILTER
4. SOCKET HEAD SCREWS
5. ALIGNMENT PIN AND NOTCH
6. FILTER HOUSING
7. FILTER COVER
8. HYDRAULIC BREATHER
9. BREATHER ADAPTER
10. HYDRAULIC TANK
11. HYDRAULIC TANK SUCTION HOSE
12. HYDRAULIC TANK DRAIN PLUG

Figure 15. Hydraulic Filter Removal and Hydraulic Oil Change, Lift Truck Models ERC35-55HG (ERC70-120HH) (C839)

Legend for Figure 25

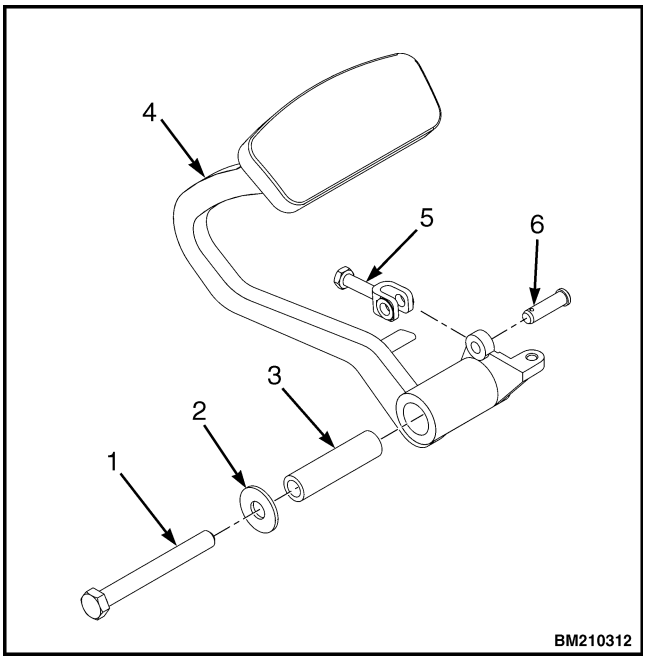
1. PIVOT
2. APPLIED POSITION
3. RELEASED POSITION
4. PARKING BRAKE SLIDE

BRAKE LINKAGE SHAFTS

NOTE: Lubricate the brake linkage shafts at 1000 hours if lift truck is used in a clean, dry warehouse environment. If lift truck is used in a more severe environment, lubricate at 500 hours.

NOTE: Under dusty or dirty conditions, clean and lubricate the brake linkage shafts more frequently.

Lubricate rod end and pedal assembly with multipurpose grease as specified in the Maintenance Schedule. See Figure 26.



1. CAPSCREW
2. WASHER
3. PIVOT TUBE
4. PEDAL ASSEMBLY
5. ROD END
6. ROD END PIN

Figure 26. Brake Linkage Shafts

Lubricate the pivot tube in the pedal assembly using the following procedure:

1. Remove floor plate.
2. Remove capscrew, washer, and tube from pedal assembly. Apply multipurpose grease, as specified in the Maintenance Schedule, on the outside of the tube.
3. Install tube, washer, and capscrew into pedal assembly. Tighten capscrew to 165 N•m (122 lbf ft).
4. Install floor plate.

STEERING SPINDLES AND TIE ROD ENDS

Use multipurpose grease, as specified in the Maintenance Schedule, to lubricate the tie rod ends on the steering axle and the steering spindles. For the tie rod ends, there are two fittings, one on each end of the steering axle. For the steering spindles, there are four lube fittings, one on the top and bottom on each end of the steering axle.

SEAT RAILS

NOTE: Lubricate the seat rails at 1000 hours if lift truck is used in a clean, dry warehouse environment. If lift truck is used in a more severe environment, lubricate at 500 hours.

Lubricate the seat rails with multipurpose grease, as specified in the Maintenance Schedule.

SEAT PLATE HINGES

NOTE: Lubricate the seat plate hinges at 1000 hours if lift truck is used in a clean, dry warehouse environment. If lift truck is used in a more severe environment, lubricate at 500 hours.

NOTE: Under dusty or dirty conditions, clean and lubricate the seat plate hinges more frequently.

Lubricate the seat plate hinges with silicone lubricant-spray as specified in the Maintenance Schedule.

Battery Maintenance

HOW TO CHARGE BATTERY

WARNING

If the lift truck was operated with a low battery, inspect all contactors for welded contacts BEFORE connecting a charged battery. The lift truck cannot be controlled if contacts are welded. This condition can cause personal injury when battery is connected.

WARNING

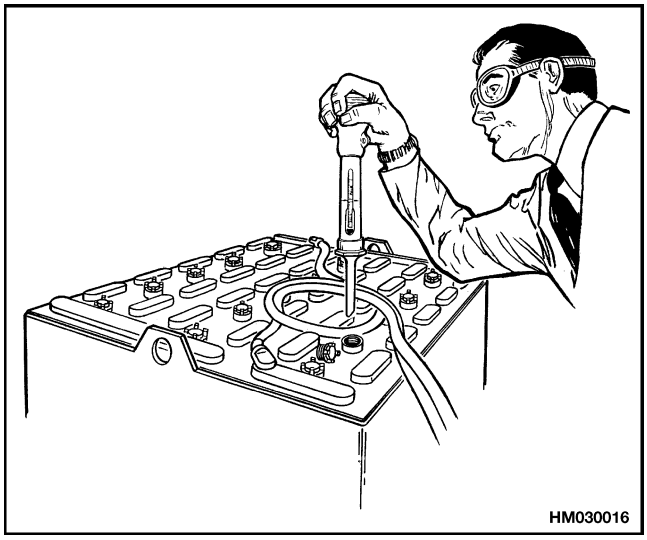
The acid in the electrolyte can cause injury. Use water to flush area and make acid neutral with a water and soda solution. Acid in eyes must be flushed with water. Batteries generate explosive fumes when they are being charged. Keep fire, sparks, and burning material away from battery charger area. Avoid sparks from battery connections. Charge batteries only in the special area for charging batteries. When battery is being charged, keep vent caps clear. Battery charger area must have ventilation so that explosive fumes are removed. Open battery cover on a covered battery. Disconnect battery when doing cleaning and maintenance.

CAUTION

Never connect battery charger plug to plug of lift truck. You can damage electronic controller. Make sure battery charger voltage is correct voltage for battery.

NOTE: Many users have battery chargers that can follow a program to automatically charge a battery according to recommendations of the battery manufacturer. Use recommendations of battery manufacturer for charging battery.

Correct use of the hydrometer (Figure 33) and proper operation of the battery charger is important. Follow instructions of charger manufacturer. Never let battery discharge below minimum value given by battery manufacturer. A fully charged battery will have a specific gravity of 1.265 to 1.310 at 25°C (77°F). Never charge a battery at a rate that will raise electrolyte temperature above 49°C (120°F). Never let battery stay discharged for long periods.



Specific Gravity Reading	Electrolyte Temp.	Correction Points	Correct Value
1.210	31°C (87°F)	+0.003	1.213
1.210	27°C (80°F)	+0.001	1.211
1.210	25°C (77°F)	0.000	1.210
1.210	18°C (64°F)	−0.004	1.206
+0.001 or −0.001 for each 2°C from the 25°C base value.			

Figure 33. Check Specific Gravity

1. NORMAL CHARGE: This charge is the charge that is normally given to a battery that is discharged from normal service. Many users give this charge at a regular interval based on usage. This practice will keep the battery fully charged if the battery is not discharged below the limit. Always use a hydrometer (Figure 33) to check battery if interval charge cycle is used. Frequent charging of a battery that has 2/3 of a full charge or more can decrease battery life.

2. EQUALIZING CHARGE: This charge is at a low rate and balances the charge in all of the cells. The equalizing charge is normally given approximately once a month. It is a charge at a slow rate for three to six hours in addition to the regular charging cycle.

DO NOT give an equalizing charge more than once a week. The most accurate specific gravity measurements for a charged battery will be after an equalizing charge. If the specific gravity difference is more than 0.020 between cells of the battery after an equalizing

Overhead Guard Changes

WARNING

DO NOT weld mounts for lights or accessories to the legs of the overhead guard. The strength of the overhead guard can be reduced by welding or heating.

DO NOT operate lift truck without overhead guard correctly fastened to the lift truck.

Observe previous **WARNING** before doing any changes to overhead guard.

Wheels and Tires

GENERAL

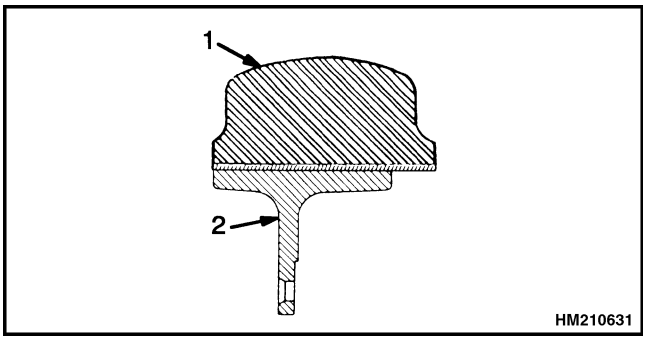
WARNING

The type of tires are shown on the lift truck Nameplate. Make sure Nameplate is correct for type of tires that are installed on lift truck.

Wheels must be changed and tires repaired by trained personnel only.

Always wear safety glasses.

These lift trucks use solid rubber tires. See Figure 40. Solid rubber tires made from softer or harder material can be installed as optional equipment. Tread on solid rubber tires can be either smooth or it can have lugs. Electric compound tires are recommended. **DO NOT** mix types of tires or tread on lift truck. Make sure the type of tires that are installed on lift truck are same as shown on lift truck Nameplate.



1. SOLID RUBBER TIRE (PRESS-ON)
2. WHEEL

Figure 40. Wheel and Tire

REMOVE WHEELS FROM LIFT TRUCK

WARNING

Wheels must be changed and tires repaired by trained personnel only.

Always wear safety glasses.

1. Raise lift truck as described in How to Put Lift Trucks on Blocks in this manual.
2. Remove wheel nuts and remove wheel from lift truck. Lift truck wheels are heavy.

REMOVE TIRE FROM WHEEL AND INSTALL TIRE ON WHEEL

Remove

The correct tools, equipment, and a press ring must be used for each size of wheel. Use a press to push wheel from the tire assembly. The capacity of the press must be approximately 36,000 to 181,600 kg (80,000 to 400,000 lb).

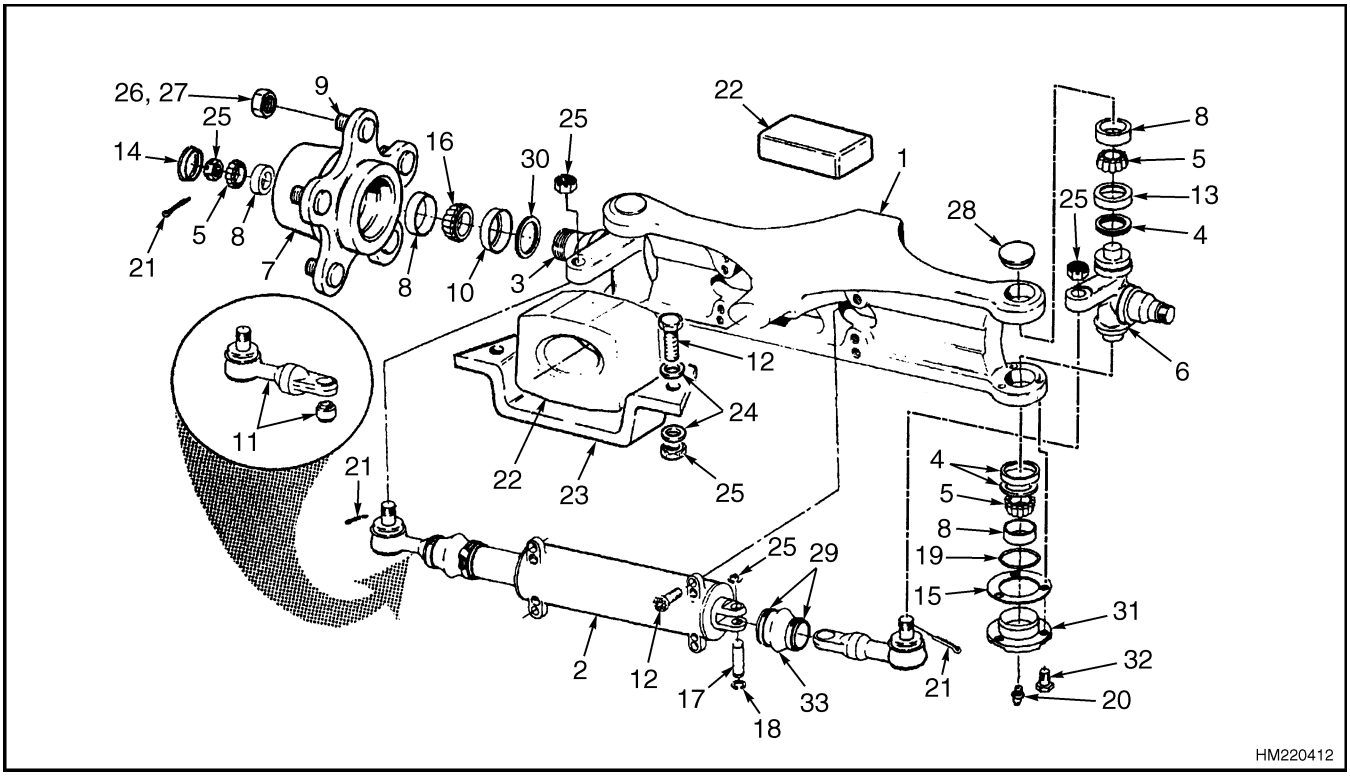
Install

NOTE: Make sure tires are installed on wheels according to dimensions shown in Figure 41. Tires must be installed the same for both wheels (drive or steer). Also check Nameplate of lift truck for correct tread width.

The correct tools, equipment, and a press ring must be used for each size of wheel. Use a press to push the wheel into the tire assembly. The capacity of the press must be approximately 36,000 to 181,600 kg (80,000 to 400,000 lb).

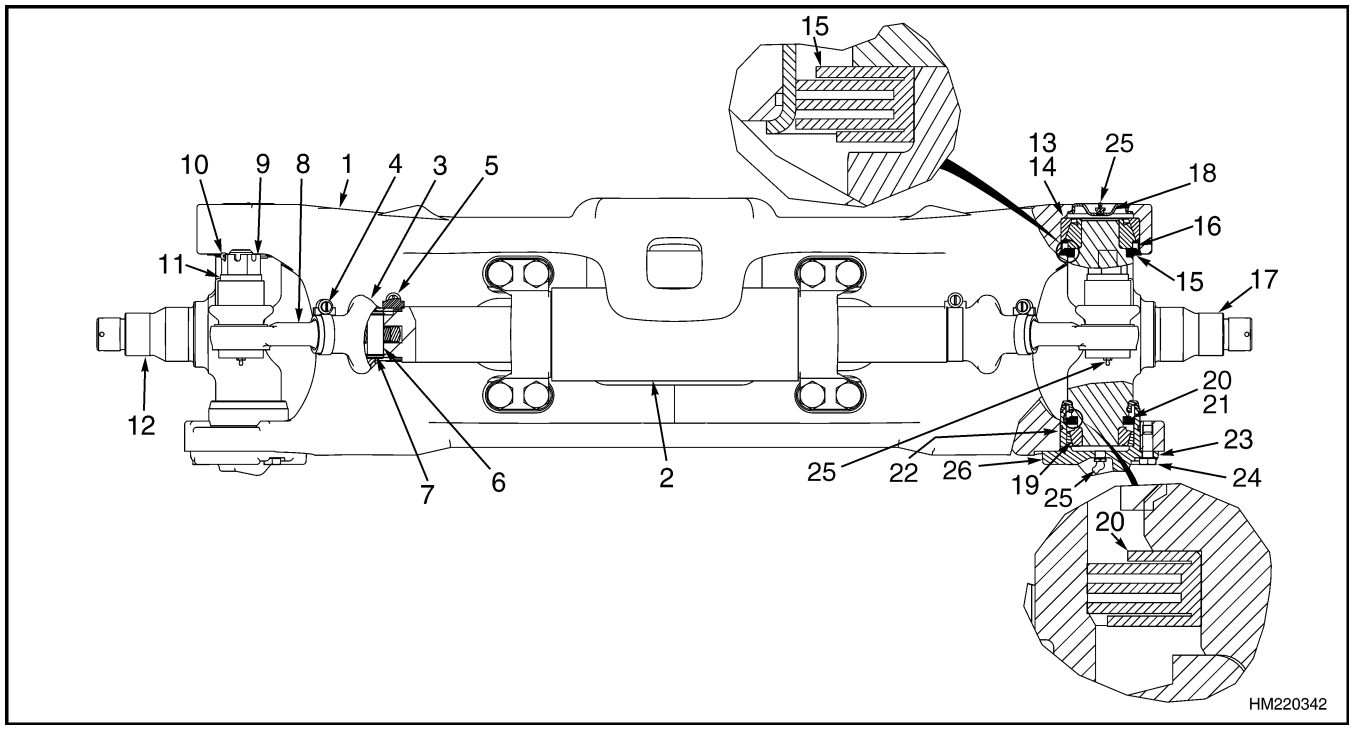
Legend for Figure 2

1. HUB ASSEMBLY
2. STUD
3. BEARING CUP
4. WEAR SLEEVE
5. HUB CAP
6. COTTER PIN
7. NUT
8. WASHER
9. LOCKWASHER
10. CAPSCREW
11. BEARING CONE
12. BEARING CAP
13. SHIM
14. OIL SEAL
15. LUBE FITTING
16. PIN
17. PLUG
18. SPINDLE
19. FRAME
20. SHAFT
21. TIE ROD
22. BUSHING
23. ANCHOR
24. STEERING CYLINDER
25. FITTING
26. O-RING
27. FLANGE
28. LUG NUT
29. HANGER CUP



1. STEERING AXLE
2. STEER CYLINDER
3. SPINDLE (LH)
4. SEAL
5. BEARING CONE
6. SPINDLE (RH)
7. HUB
8. BEARING CUP
9. STUD (WHEEL)
10. WEAR SLEEVE
11. TIE ROD
12. CAPSCREW
13. NUT (SPINDLE)
14. CAP (HUB)
15. SHIM
16. CAP ASSEMBLY
17. PIN
18. SNAP RING
19. O-RING
20. GREASE FITTING
21. COTTER PIN
22. MOUNT
23. PLATE
24. WASHER
25. NUT
26. LUG NUT
27. PIN
28. PLUG AND SEALANT
29. CLAMP
30. OIL SEAL
31. BEARING CAP
32. CAPSCREW
33. COVER

Figure 3. Steering Axle GP/GLP/GDP070-110LG/MG (B813)



1. STEER AXLE
2. STEERING CYLINDER
3. BOOT
4. CLAMP
5. CLAMP
6. PIN
7. SNAP RING
8. TIE ROD ASSEMBLY
9. CASTLE NUT
10. COTTER PIN
11. WASHER
12. L.H. SPINDLE
13. BEARING CONE
14. BEARING CUP
15. SEAL
16. WEAR SLEEVE
17. R.H. SPINDLE
18. CAP
19. BEARING CONE
20. SEAL
21. SEAL
22. O-RING
23. SHIM(S)
24. CAPSCREW
25. LUBE FITTING
26. BEARING CAP

Figure 7. Steering Axle GC/GLC070-120LG/MJ (B818), GC070-120LJ/MJ (C818, D818), ERC35-55HG (ERC070-120HD/HG) (A839), and ERC35-55HG (ERC70-120HH) (B839/C839)

c. GLP/GDP165-280DA (A876), GDP/GLP80-120DB (GP/GDP/GLP170-280DB) (B876, C876, D876), GLP/GDP300-360EA (A877), and GDP/GLP130-160EB (GP/GDP/GLP300-360EB) (B877, C877, D877) units. Install seals on tie rod bushings. Use an alignment pin to align seals with bushings. Lubricate pin with an antiseize compound and install tie rod pin into the tie rod and cylinder rod or spindle arm. Grease fittings on tie rod pins must face downward. Install anchor pin and capscrew to fasten the pin. Tighten capscrew in the anchor pin to 44 N•m (32 lbf ft).

NOTE: Tie rods do not have an adjustment.

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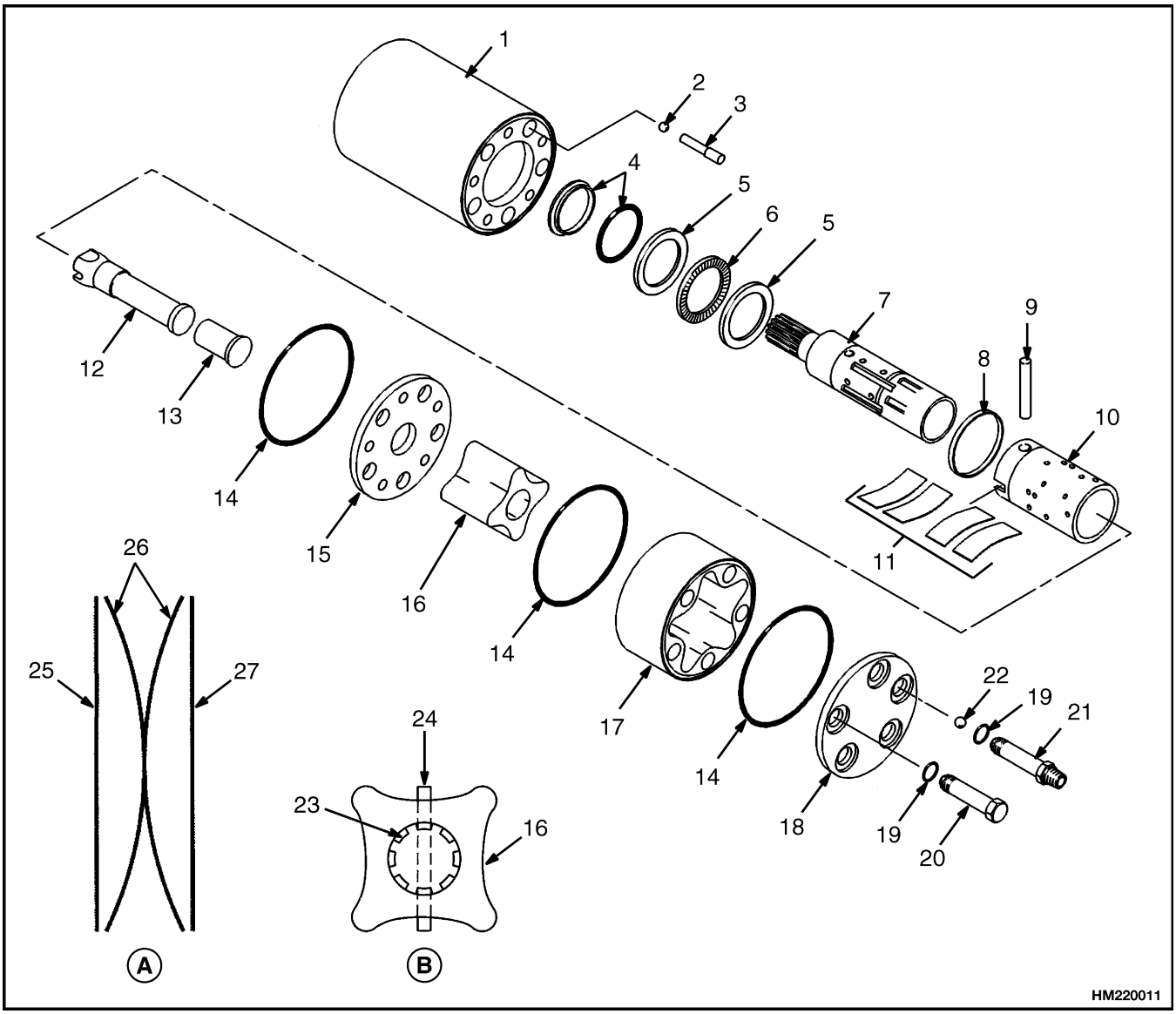
This section is for the following models:

ERC20-30AGF (ERC040-065RG/ZG) [E108];
ERC/P16-20AAF (ERC030-040AG/BG) [A814];
ERP20-30ALF [B216];
GC/GLC030-040AF [B809];
GLP/GDP16-20AF (GP/GLP/GDP030-040AF) [B810];
GP/GLP/GDP2.00-3.00RF/TF (GP/GLP/GDP040-060RG/TG/ZG) [A875];
GC/GLC040-065RG/TG/ZG [E187];
ERP20-30ALF (ERP040-060DH) [D216];
ERP20-32ALF (ERP040-065DH) [E216];
ERC/P16-20AAF (ERC030-040AH) [B814];
ERC20-32AGF (ERC040-065GH) [A908];
ERC35-55HG (ERC70-120HH) [B839/C839]



A. ORIENTATION OF NEUTRAL SPRINGS

1. PUMP HOUSING
2. EMERGENCY STEERING BALL
3. BALL STOP
4. SHAFT SEAL
5. THRUST WASHER
6. THRUST BEARING
7. SPOOL
8. RETAINING RING
9. CROSS PIN
10. SLEEVE
11. SPRING SET
12. CARDAN SHAFT
13. SPACER
14. O-RING

B. ORIENTATION OF GEAR WHEEL

15. DISTRIBUTOR PLATE
16. GEAR
17. GEAR HOUSING
18. END COVER
19. O-RING
20. SCREW
21. SPECIAL SCREW (HYDRAULIC FITTING)
22. CHECK BALL
23. CARDAN SHAFT GEAR TEETH
24. SPOOL ASSEMBLY PIN
25. FLAT SPRING
26. CURVED SPRING
27. FLAT SPRING

Figure 7. Steering Pump

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This section is for the following models:

ERC20-32AGF (ERC040-065GH) [A908];
ERC/P16-20AAF (ERC030, 040AH) [B814/C814];
ERP20-30ALF (ERP040-060DH) [D216];
ERP20-32ALF (ERP040-065DH) [E216];
ERC35-55HG (ERC70-120HH) [B839/C839]

Legend for Figure 6

NOTE: TOP VIEW SHOWN

A. ERP20-30ALF (ERP040-060DH) (D216) AND ERP20-32ALF (ERP040-065DH) (E216)
B. ERC20-32AGF (ERC040-065GH) (A908), AND ERC35-55HG (ERC70-120HH) (B839/C839)
C. ERC/P16-20AAF (ERC030-040AH) (B814/C814)

1. DC HYDRAULIC MOTOR
2. HYDRAULIC TANK
3. STEERING MOTOR

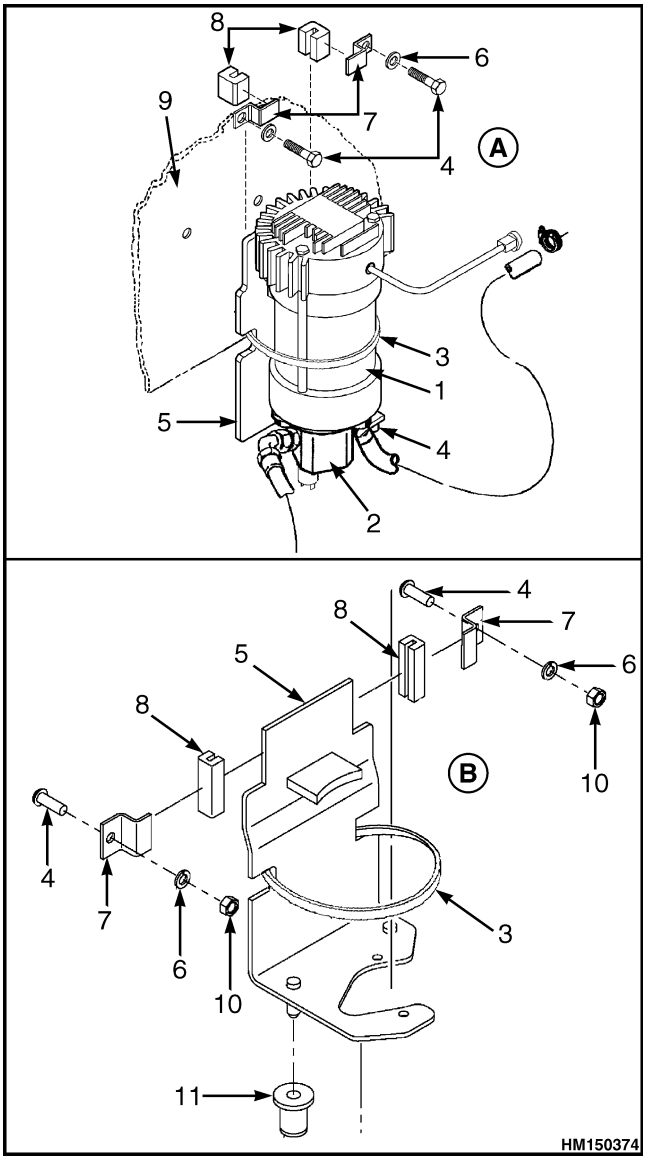


Figure 7. Steering Pump and Motor

Legend for Figure 7

A. STEERING MOTOR AND PUMP MOUNTING BRACKET AND HARDWARE FOR ERC20-32AGF (ERC040-065GH) (A908), ERC/P16-20AAF (ERC030-040AH) (B814/C814), ERP20-30ALF (ERP040-060DH) (D216) AND ERP20-32ALF (ERP040-065DH) (E216) TRUCKS SHOWN
B. STEERING MOTOR AND PUMP MOUNTING BRACKET AND HARDWARE FOR ERC35-55HG (ERC70-120HH) (B839/C839) TRUCKS SHOWN

1. STEERING MOTOR
2. STEERING PUMP
3. METAL STRAP
4. CAPSCREW
5. BRACKET WELDMENT
6. WASHER
7. BRACKET
8. RUBBER CHANNEL
9. TRUCK FRAME
10. NUT
11. GROMMET

WARNING

Never put tools or other metal objects on the battery. Metal on the battery can cause a short circuit and possible damage or injury.

4. Open the hood and install a cardboard or plywood cover on the top of the battery to prevent accidental short circuits.

5. Remove the cover panel from the left side of the battery.

6. Remove the cover from the top of the counterweight.

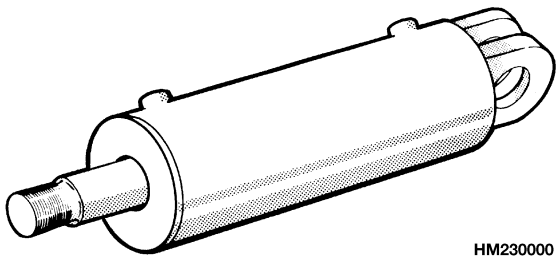
7. On ERC/P16-20AAF (ERC030-040AH) (B814/C814), ERC20-32AGF (ERC040-065GH) (A908), and ERC35-55HG (ERC70-120HH) (B839/C839), remove the floor boards.

8. Remove the suction hose at the pump. Quickly put plugs in the end of the hose and the pump port to keep oil from draining and dirt from entering the system.

9. Disconnect the pressure hose from the steering pump. Install a plug at the fitting for the hose and the pump port.

TILT CYLINDERS

ALL MODELS EXCEPT GLP/GDP3.5-5.5LJ/MJ (GP/GLP/GDP70-120LJ/MJ) [C813, E813]; GC070-120LJ/MJ [C818, D818]; ESC030-040FA [A883]; MCW025/030/040-E [C819]



HM230000

Table 1. Movement Rates (Maximum) for Tilt Cylinders (Continued)

Lift Truck Model	Hydraulic Oil Temperature/Mast Tilt Rate			
	20°C (68°F)		60°C (140°F)	
	mm/min	in./min	mm/min	in./min
GDP/GLP80-120DB (GP/GDP/GLP170-280DB), GDP/GLP130-160EB (GP/GDP/GLP300-360EB)	1.8	0.07	11.7	0.05
GLC60-70CA (GC/GLC/GDC135-155CA)	1.2	0.05	8.2	0.32

Tilt Cylinder Stroke and Mast Tilt Angle Adjustment

Adjust the tilt cylinders as described in the **Mast** section.

Torque Specifications

PISTON ROD NUT

ERP16-20ATF
163 to 190 N•m (120 to 140 lbf ft)

ERC20-30AGF (ERC040-065GH) (A908), ERC20-30AGF (ERC040-065RF/ZF RG/ZTG) (E108), ERP20-30ALF (B216), and ERP20-30ALF (ERP040-060DH) (D216/E216)
150 N•m (110 lbf ft)

ERC35-55HD/HG (ERC070-120HD/HG) (A839) and ERC35-55HG (ERC70-120HH) (B839/C839)
400 to 440 N•m (295 to 325 lbf ft)

GC/GLC030-040AF, GDP/GLP16-20AF (GP/GLP/GDP030-040AF), ERC/P16-20AAF (ERC030-040AF, AG/BG) (A814), and ERC/P16-20AAF (ERC030-040AH) (B814/C814)
163 to 190 N•m (120 to 140 lbf ft)

GC/GLC040-065RG/TG/ZG, GLP/GDP20-30RF/TF (GP/GLP/GDP040-060RG/TG/ZG)
150 N•m (110 lbf ft)

GP/GLP/GDP070-110LG/MG
400 to 440 N•m (295 to 325 lbf ft)

GDP60-70CA (GP/GLP/GDP135-155CA)
407 to 440 N•m (300 to 325 lbf ft)

GLP/GDP165-280DA
950 to 985 N•m (700 to 725 lbf ft)

GLP/GDP300-360EA
1105 to 1140 N•m (815 to 840 lbf ft)

GDP/GLP80-120DB (GP/GDP/GLP170-280DB), GDP/GLP130-160EB (GP/GDP/GLP300-360EB)
950 to 983 N•m (701 to 725 lbf ft)

GP130-160EB (GP300-360EB)
1105 to 1140 N•m (815 to 841 lbf ft)

GC/GLC030-040AF
163 to 190 N•m (120 to 140 lbf ft)

GC/GLC070-120LG/MG
400 to 440 N•m (295 to 325 lbf ft)

GLC60-70CA (GC/GLC/GDC135-155CA)
407 to 440 N•m (300 to 325 lbf ft)

RETAINER

ERP16-20ATF
163 to 176 N•m (120 to 130 lbf ft)

ERC20-30AGF (ERC040-065GH) (A908), ERC20-30AGF (ERC040-065RF/ZF RG/ZG) (E108), ERP20-30ALF (B216), ERP20-30ALF (ERP040-060DH) (D216/E216)
170 to 237 N•m (125 to 175 lbf ft)

ERC35-55HD/HG (ERC070-120HD/HG) (A839) and ERC35-55HG (ERC70-120HH) (B839/C839)
400 to 500 N•m (295 to 370 lbf ft)

General

The information contained in this manual gives the user a brief overview of the Electric Truck AC Controls Program. This manual also explains the common drop-down menu features for the user that are listed under the **File** menu, the **Reports** menu, the **Tools** menu, and the **Help** menu.

A personal computer (PC) can be used to set the traction motor and pump motor controller functions, read status codes, and perform numerous diagnostic and troubleshooting functions.

COMPUTER REQUIREMENTS

The PC must have the following minimum configuration:

1. **Microsoft Windows 2000™** or later operating system must be installed.
2. There must be an open Universal Serial Bus (USB) port available on the computer to connect to the lift truck.
3. There must be a compact disk read-only-memory (CD-ROM) drive installed on the computer.
4. **Microsoft Internet Explorer™ Version 5.01** or later must be installed on the computer.
5. The display screen resolution should be set to 800×600 pixels.

SOFTWARE, INSTALL

NOTE: See instructions included with CD, Yale part number 524187015 (Initial Installation), and/or **readme.txt** file on the CD for additional instructions and possible password requirements.

NOTE: You must have **Administrator** rights to install this software on a PC. After installation, folders "EVS" and "Program Files/ETACC YALE/" and their sub-folders must have their security permissions set to allow full control.

NOTE: When installing the software on a PC with **Microsoft Windows 2000** or a later Operating System, make sure that the computer is setup with **Administrator** rights on the computer.

NOTE: In the following examples, the **D:** drive represents the CD-ROM drive. The CD-ROM drive could be a different letter on the computer.

To run the setup program, follow these steps:

1. Place the CD in the CD-ROM drive. Installation will start automatically if the computer is set for automatic startup. If the computer is not set for automatic startup, go to Step 2.
2. Click **Start**.
3. Select **Run** and in the **Open** line enter **D:\disk1\setup.exe**.
4. Click **OK**. The setup program will guide you through the rest of the steps to install the Electric Truck AC Controls Program Yale on the computer.

It is recommended that the program is installed to the default directories.

LANGUAGE SELECTION

1. When the program is first installed the language setup screen will appear. Click on the down arrow to see the languages to be selected. Select the desired language from the list. See Figure 1. The Electric Truck AC Controls Program Yale text will appear in the selected language.

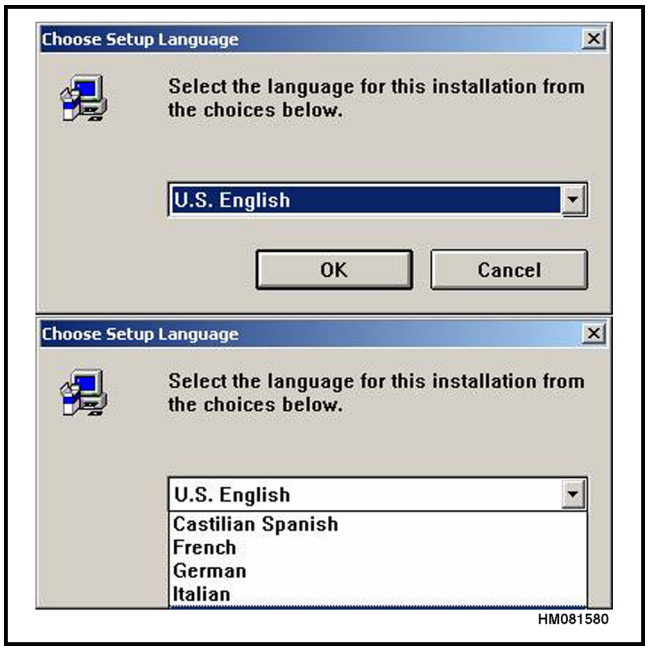


Figure 1. Language Selection

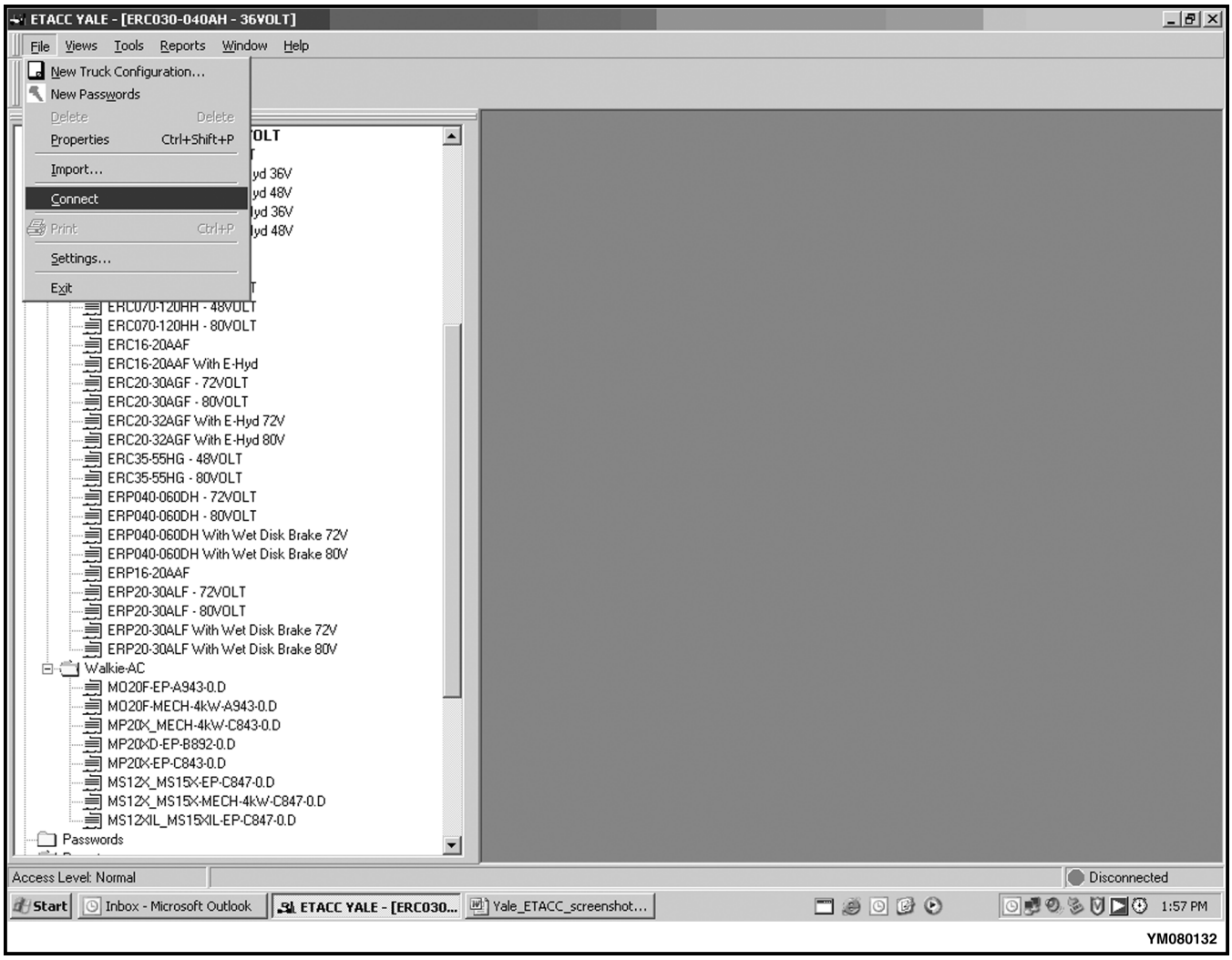


Figure 10. File Menu, Connect PC to Lift Truck

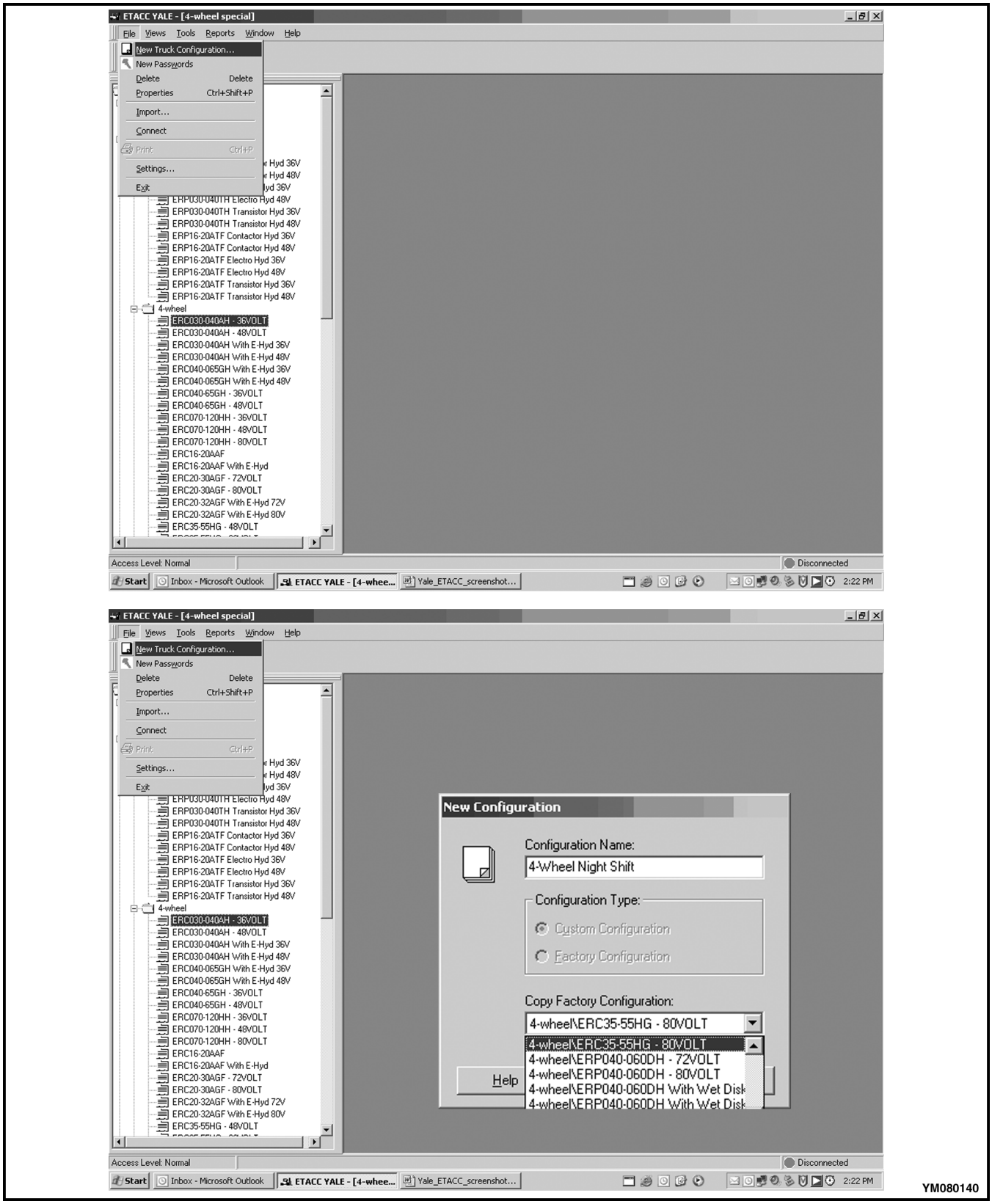


Figure 20. New Truck Configuration

Dash Display

This section contains the following processes: **Custom Display Language** which allows technicians to create a language that is not loaded in the system. **Download Display Language** which allows customized changes to be downloaded to the lift truck. **Clear Operator Log** allows the operator log to be cleared from the display after the log has been either saved or printed.

CUSTOM DISPLAY LANGUAGES

1. Click **Custom Display Languages** on the **Tools** menu. See Figure 28.

NOTE: The Custom Display Languages table is a two-column table. The left column is the **Select Standard Language** line that is the current language on the computer. The right column is where the customized language will appear.

2. Click the **Select Standard Language** line; a drop-down list will appear containing English, French, German, Italian, or Spanish. See Figure 29.

3. Select one of the drop-down list languages.

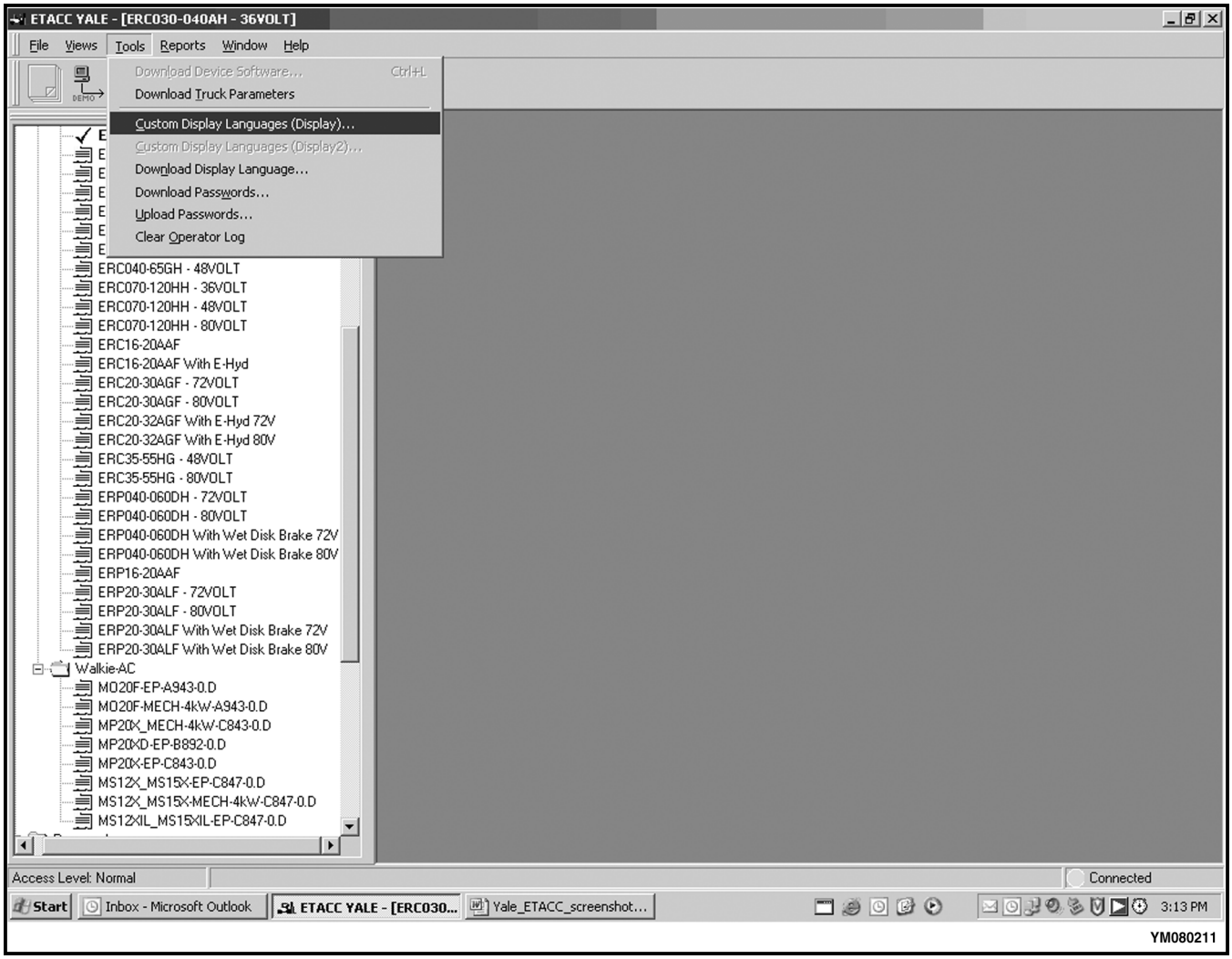


Figure 28. Tools Menu Custom Display Languages

CREATE NEW PASSWORD FILE

1. Click **New Passwords** from the **File** menu, or select an existing Password file from the **Passwords** folder, right-click the mouse, and select **New** from the pop-up box. A **New Password File** pop-up box will appear on the computer screen. See Figure 36 and Figure 37.

2. In the **New Passwords** dialog box, enter the new password file name in the **Passwords File Name** line and select an existing password file from the **Copy passwords from** drop-down list, if applicable. See Figure 37.

3. Click **OK**. The **New Passwords** file is created and placed in the **Passwords** folder.

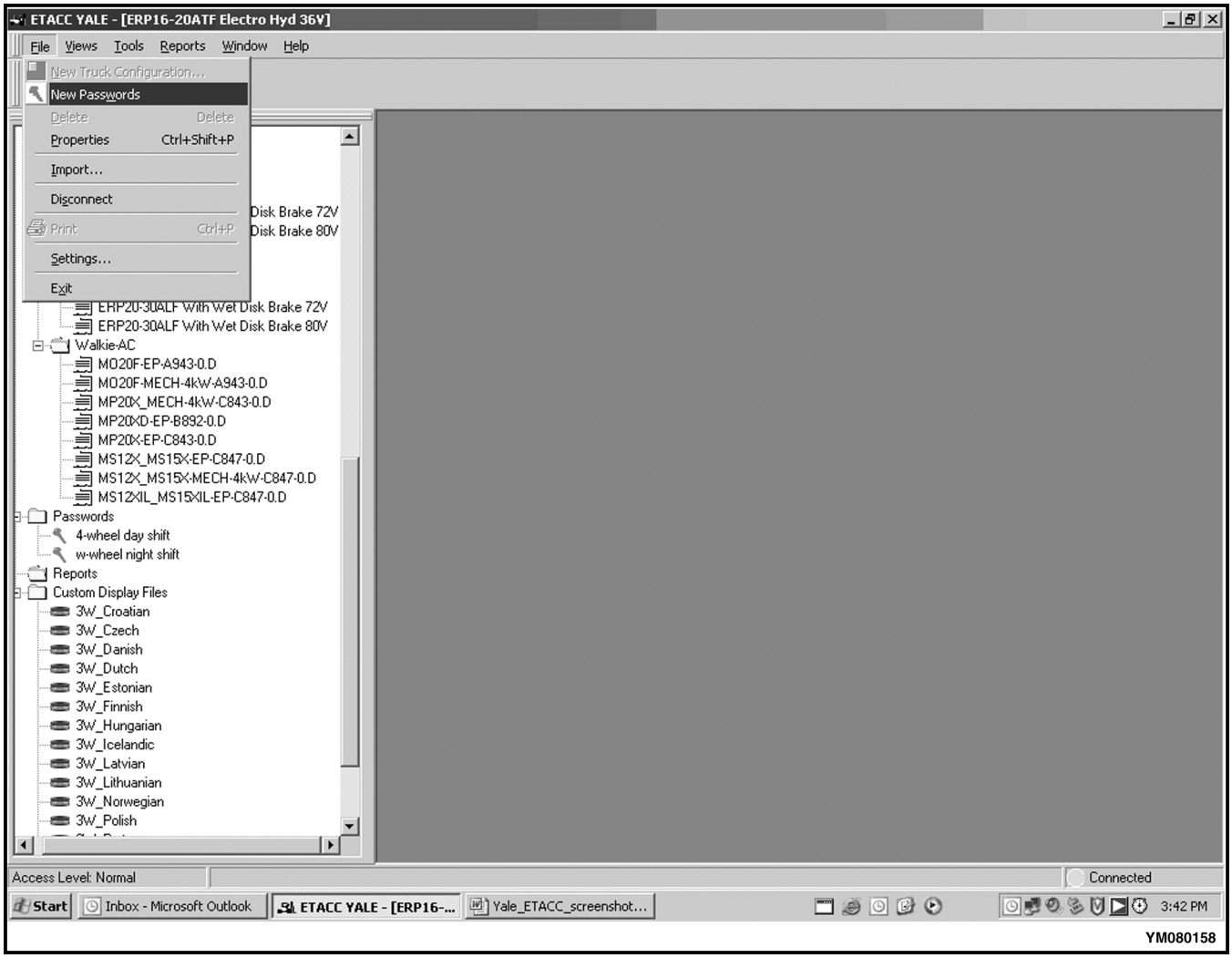


Figure 36. File Menu New Password Selection

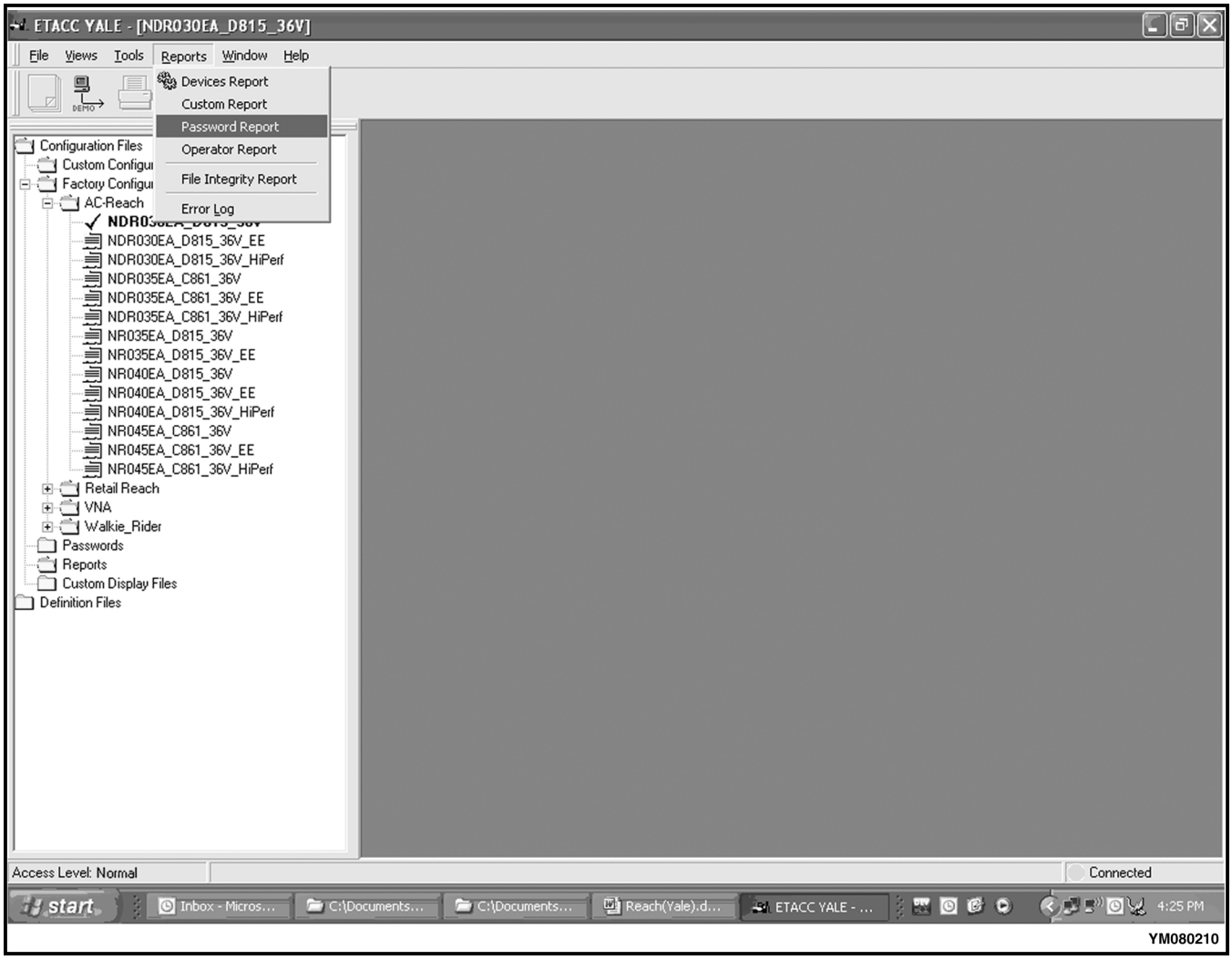


Figure 45. Reports Menu, Passwords for Lift Truck Models NDR030DA, NR035/040DA (A295); NDR035EA, NR045EA (C861); and NDR030EA, NR035/040EA (D815)

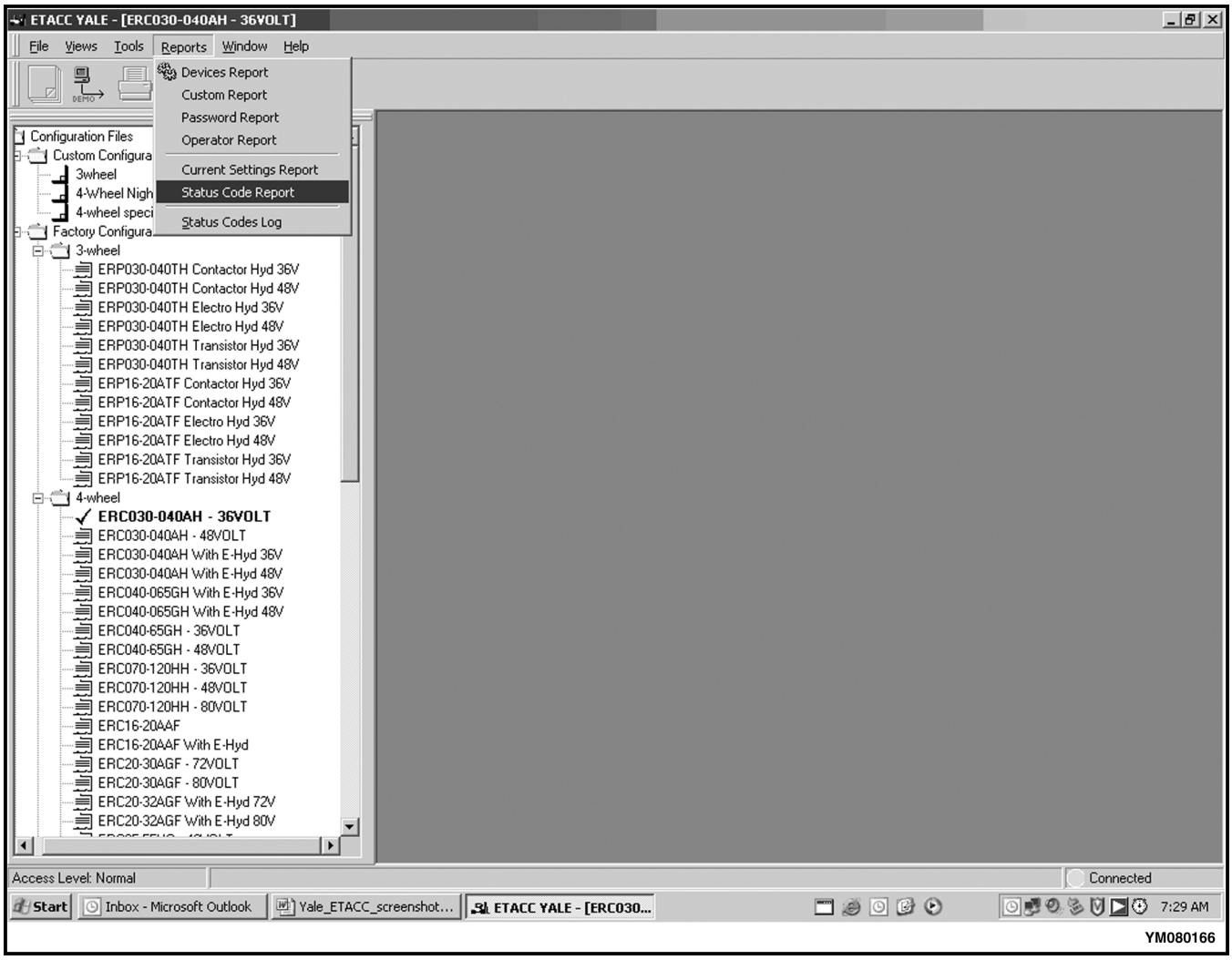


Figure 54. Reports Menu Status Code