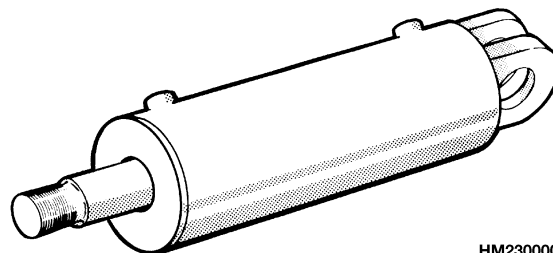


TILT CYLINDERS

**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

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**GC/GLC030-040AF, GDP/GLP16-20AF
(GP/GLP/GDP030-040AF)**
163 to 176 N•m (120 to 130 lbf ft)

**GC/GLC040-065TF/RF, GLP/GDP20-30RF/TF
(GP/GLP/GDP040-060RG/TG/ZG)**
170 to 237 N•m (125 to 175 lbf ft)

GP/GLP/GDP070-110LG/MG
400 to 500 N•m (295 to 369 lbf ft)

GDP60-70CA (GP/GLP/GDP135-155CA)
542 to 610 N•m (400 to 450 lbf ft)

GLP/GDP165-280DA
542 to 610 N•m (400 to 450 lbf ft)

GLP/GDP300-360EA
610 to 675 N•m (450 to 500 lbf ft)

GP80-120DB (GP170-280DB)
950 to 983 N•m (701 to 725 lbf ft)

GDP/GLP80-120DB (GDP/GLP170-280DB)
542 to 610 N•m (400 to 450 lbf ft)

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

GDP/GLP130-160EB (GDP/GLP300-360EB)
610 to 675 N•m (450 to 500 lbf ft)

GC/GLC030-040AF
163 to 176 N•m (120 to 130 lbf ft)

GLC60-70CA (GC/GLC/GDC135-155CA)
542 to 610 N•m (400 to 450 lbf ft)

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Tilt cylinder movement is slow or not smooth.	Air is in the hydraulic system.	Remove air from hydraulic system.
	The hydraulic pump is worn or damaged.	Repair or replace hydraulic pump.
	Restriction in the hydraulic lines.	Repair hydraulic lines.
	Seals in tilt cylinder are damaged.	Replace seals and inspect cylinder bore for damage.
	Tilt cylinders have internal damage.	Repair or replace cylinder.
	Load is greater than capacity.	Reduce load.
	Pressure relief valve(s) is not adjusted correctly or is damaged.	Repair or adjust relief valve(s).
	Large leaks between spool and bore.	Replace valve section.
	Spool is not fully extended or retracted.	Adjust linkage to spool.
Tilt control spool is damaged.	Repair control valve.	

General

THREADED FASTENERS

Threaded fasteners, like bolts, nuts, cap screws, 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.

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 cap screw will have the following description:

Metric	Inch
M12 x 1.75 x 50	1/2 x 13 UNC x 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

NOMENCLATURE, THREADS

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

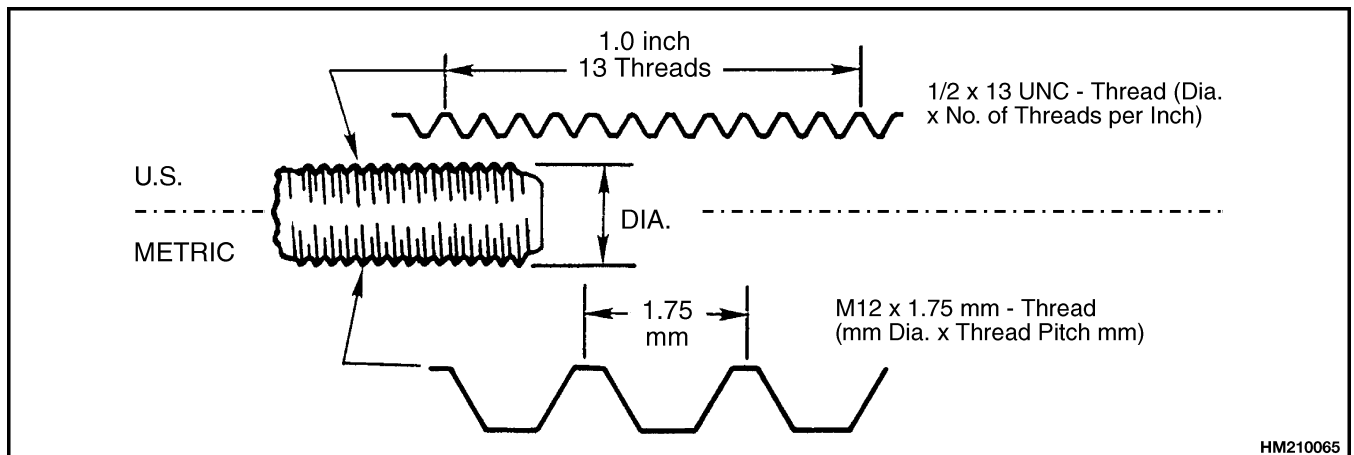
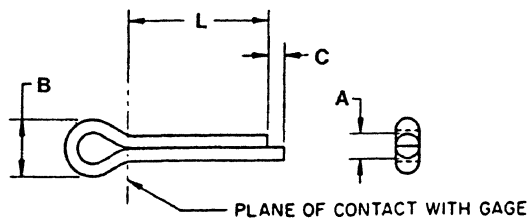


Figure 1. Thread Design

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.)	0221870	0221875			
9.525 mm (0.375 in.)	10.5 mm (0.413 in.)	8.80 mm (0.345 in.)	0221871	0221876			
12.7 mm (0.500 in.)	13.5 mm (0.530 in.)	11.5 mm (0.453 in.)	0221872	0221877	0015200	0015211	0015221
19.05 mm (0.750 in.)	20.5 mm (0.807 in.)	18.3 mm (0.720 in.)	0221873	0221878	0015201	0015212	0015222
25.4 mm (1.000 in.)	26.9 mm (1.060 in.)	23.9 mm (0.940 in.)	0221874	0221879	0015202	0015213	0015223
31.75 mm (1.250 in.)	33.3 mm (1.310 in.)	29.2 mm (1.150 in.)			0015203	0015216	0015224
38.1 mm (1.500 in.)	40.9 mm (1.610 in.)	36.6 mm (1.440 in.)			0015204	0015217	0015225
44.45 mm (1.750 in.)	46.0 mm (1.810 in.)	42.9 mm (1.690 in.)			0015205	0015218	0015226
50.8 mm (2.000 in.)	52.3 mm (2.060 in.)	49.3 mm (1.940 in.)			0015206	0015219	0015227
57.15 mm (2.250 in.)	58.7 mm (2.310 in.)	55.1 mm (2.170 in.)				0015220	0056997
63.5 mm (2.500 in.)	65.0 mm (2.560 in.)	62.0 mm (2.440 in.)				0221894	0015229
69.85 mm (2.750 in.)	72.1 mm (2.840 in.)	68.3 mm (2.690 in.)					0015230
76.2 mm (3.000 in.)	81.3 mm (3.200 in.)	74.7 mm (2.940 in.)					0015279
88.9 mm (3.500 in.)	91.4 mm (3.600 in.)	87.4 mm (3.440 in.)					



EXTENDED PRONG

HM211587

COTTER (SPLIT) PINS

Cotter (split) pins are used in many applications on your forklift. They are typically used to retain parts such as pins and nuts. Cotter (split) pins are typically not used as load-bearing members. Service personnel must use new cotter (split) pins. Do not reuse a cotter (split) pin. Replacement cotter (split) pin must be of the correct size. See Table 8.

The legs of a cotter (split) pin are bent for the following reasons:

- To retain the cotter (split) pin in the part
- To provide clearance between the cotter pin legs and other parts or members. One or both cotter (split) pin legs must be bent to provide a minimum 90° angle between the legs. See Figure 2.

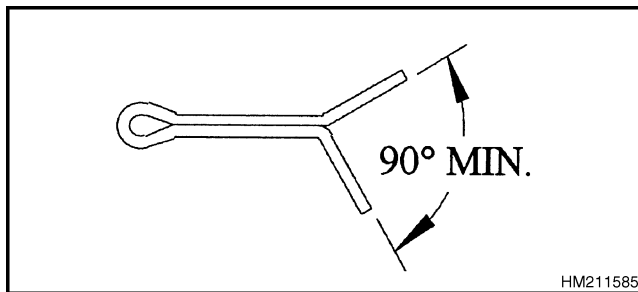
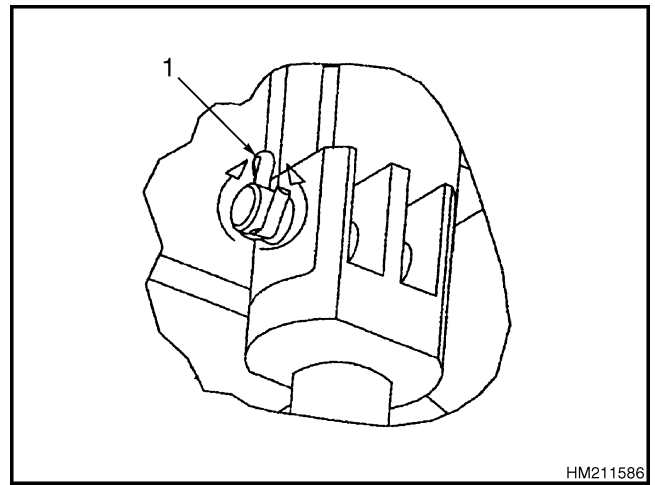


Figure 2. Minimum Angle Between Cotter Pin Legs

Unless otherwise specified, the legs of chain anchor cotter (split) pins are to be bent against the pin. See Figure 3.

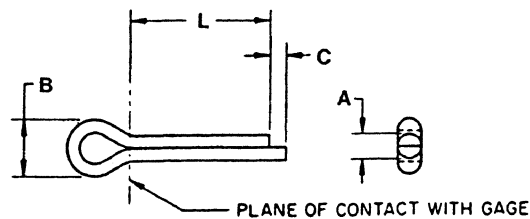


1. COTTER PIN

Figure 3. Cotter (Split) Pins Used On Mast Chain Anchors

Table 10. Cotter Pin Dimensional Data (Continued)

Nominal Length L	Length Range		Nominal Size - Part Numbers				
	max	min	4.00 mm (0.156 in.)	5.00 mm (0.188 in.)	6.30 mm (0.250 in.)	8.00 mm (0.312 in.)	9.52 mm (0.375 in.)
25.4 mm (1.000 in.)	26.9 mm (1.060 in.)	23.9 mm (0.940 in.)	0015233	0015242	0015251	0015261	
31.75 mm (1.250 in.)	33.3 mm (1.310 in.)	29.2 mm (1.150 in.)	0015234	0015243	0015252	0015262	0221884
38.1 mm (1.500 in.)	40.9 mm (1.610 in.)	36.6 mm (1.440 in.)	0015235	0015244	0015253	0015263	0221885
44.45 mm (1.750 in.)	46.0 mm (1.810 in.)	42.9 mm (1.690 in.)	0015236	0015245	0015254	0015264	0221886
50.8 mm (2.000 in.)	52.3 mm (2.060 in.)	49.3 mm (1.940 in.)	0015237	0015246	0015255	0015265	0015271
57.15 mm (2.250 in.)	58.7 mm (2.310 in.)	55.1 mm (2.170 in.)	0015238	0015247	0015256	0221880	0221887
63.5 mm (2.500 in.)	65.0 mm (2.560 in.)	62.0 mm (2.440 in.)	0015240	0015248	0015257	0221881	0015273
69.85 mm (2.750 in.)	72.1 mm (2.840 in.)	68.3 mm (2.690 in.)	0015280	0015249	0015258	0221882	0015286
76.2 mm (3.000 in.)	81.3 mm (3.200 in.)	74.7 mm (2.940 in.)	0015283	0015250	0015259	0015267	0015272
88.9 mm (3.500 in.)	91.4 mm (3.600 in.)	87.4 mm (3.440 in.)		0015239	0015284	0015266	0015274
101.6 mm (4.000 in.)	113.3 mm (4.460 in.)	98.8 mm (3.890 in.)		0015301	0015260	0128754	0015275
127.0 mm (5.000 in.)	128.5 mm (5.060 in.)	123.7 mm (4.870 in.)				0221883	0015277
152.4 mm (6.000 in.)	153.9 mm (3.060 in.)	5.460 mm (138.7 in.)					0221888



EXTENDED PRONG

HM211587

STEERING PUMP MOTOR

NOTE: Some electrical trucks use a steering pump motor. Refer to your truck model's service manual for instructions on removal and installation of steering pump motors.

1. Disconnect battery connector. Remove floor plate from lift truck for access to steering pump motor. Open hood for access to motor. Remove screws that hold two brush cover plates to motor housing.
2. Inspect brushes and commutator as described in previous paragraphs for traction and hydraulic pump motors. The brush replacement procedure is also the same, although there are only two brushes for the steering pump motor. See Table 3.
3. Install brush covers and screws. Install floor plate or close hood and connect battery connector.

NORMAL COMMUTATOR SURFACE

A commutator that has been in service will have a smooth and polished surface with a darker brown color where it rotates under the brushes. See Table 1. A variation of color on the commutator surface between light brown and darker brown is normal. This surface condition is the lubrication between the commutator and the brushes. The brushes will wear rapidly if this surface condition does not develop during the first 6 to 10 hours of operation after a commutator with a new surface is installed.

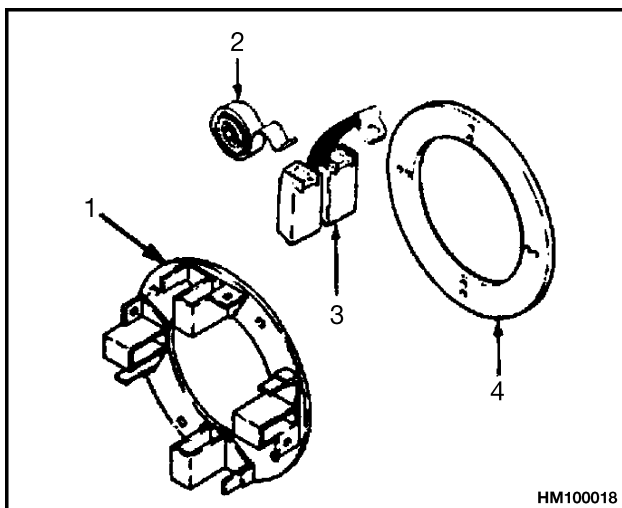
COMMUTATOR PROBLEMS

Commutator and motor problems and are shown in Table 2.

6. Remove drive end frame from armature.

If the brush holder (1) must be loosened or removed from the end frame for repairs, the brush holder must be installed again in the same position. See Figure 7. Make alignment marks between the brush holder and the end frame before the brush mounting plate (4) is released. The brush holder must be installed again in the same position.

If a new brush holder must be installed, there will not be an alignment mark on the new brush holder. Make an alignment mark on end frame with a reference point on brush holder that must be removed. Install new brush holder so reference point and alignment mark are aligned. The new brush holder must be installed in the same position as the old holder so the timing will be correct.



1. BRUSH HOLDER
2. BRUSH SPRING
3. BRUSH
4. BRUSH MOUNTING PLATE

Figure 7. Brush Holder and Mounting Plate

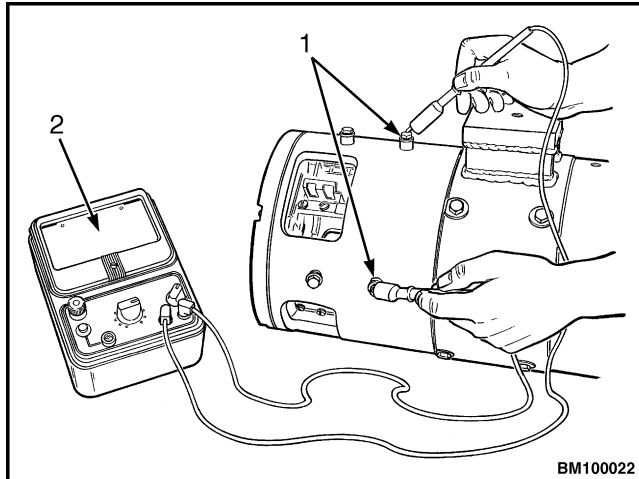
7. Remove screws that fasten brush holder assembly to commutator end frame.
8. Disassemble components of motor as necessary to make repairs.

Steering Pump Motor

NOTE: Some lift trucks could be equipped with a Brushless DC Power Steering motor, which is non-repairable.

NOTE: Some electrical trucks use a steering pump motor. Refer to the service manual for your truck model for instructions on the removal and installation of steering pump motors.

1. See **Power Steering Motor and Pump** for the removal and installation procedures for the steering pump motor. Make index marks on the steering pump and the drive end frame of the motor. Remove two capscrews that hold steering pump to motor. Remove pump and allow oil to drain from drive end frame.
2. Remove brush covers. See Figure 2. Remove two screws that hold brushes and terminal wires to brush holders. Pull brush springs out of the way and pull two brushes from holders.



1. FIELD COIL TERMINAL
2. RESISTANCE SHOULD BE LESS THAN 1 OHM

Figure 17. Test for Open Field Circuit

TEST FOR SHORT CIRCUIT IN FIELD COIL

A short circuit in a motor field winding is difficult to test because of the normal low resistance (less than 1 ohm) of a good field. Special equipment is necessary to check for a short circuit in a motor winding. A motor with a short circuit in a field winding will have a different sound when it begins to operate, but a service person must have experience to hear and under-

stand the difference in sound. A winding with a short circuit will also run hotter than a good winding and can have indications of heat damage.

Another indication of a short circuit will be a higher than normal current draw by the motor. A higher than normal current draw can also indicate other problems or needed adjustments and does not always indicate a short circuit in a motor winding.

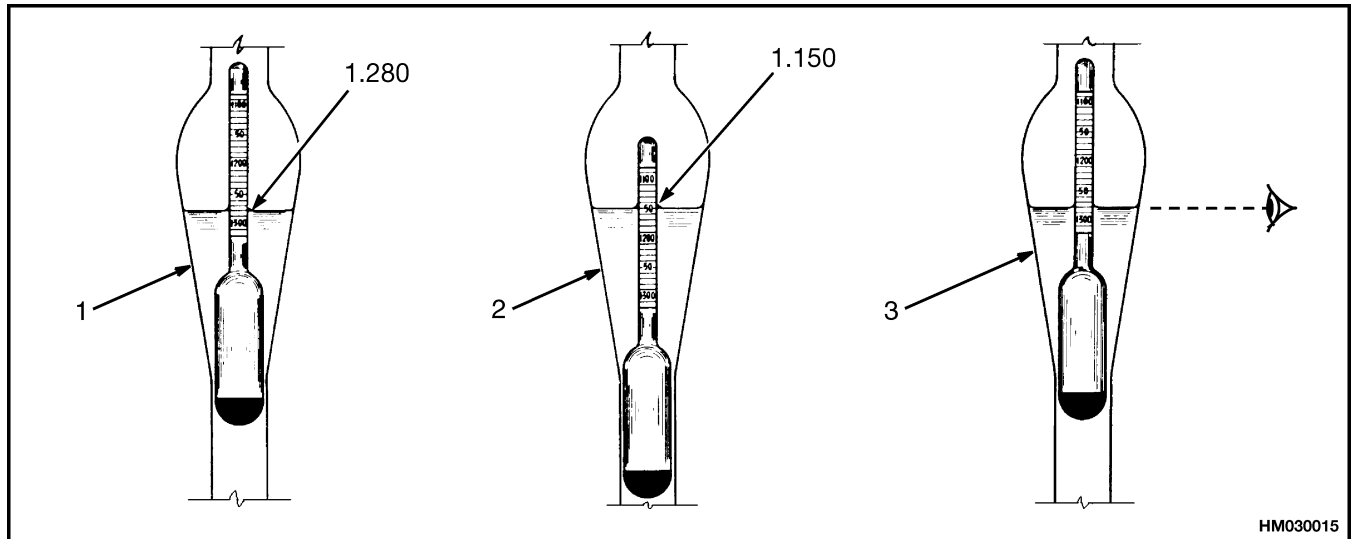
TEST FOR SHORT CIRCUIT BETWEEN FIELD AND MOTOR CASE

Make sure that carbon dust has been cleaned from the motor before making this test. An ohmmeter ($R \times 10,000$ scale) can be used to test for a short circuit between the field and the motor case. Put one probe on the motor case and the other probe on a field terminal. Check the resistance between the field terminal and the motor case. A resistance of less than 1 megohm indicates a problem between the field terminal and the motor case.

BRUSH HOLDER TEST

Make sure the carbon dust has been removed from the brush holders. Use an ohmmeter ($R \times 10,000$ scale) to measure the resistance between the brush holder and the motor case. The correct resistance is an indication of infinity (∞).

Yale[®] 



1. HIGH FLOAT MEANS HIGH SPECIFIC GRAVITY.
2. LOW FLOAT MEANS LOW SPECIFIC GRAVITY.
3. CORRECT METHOD OF READING HYDROMETER: EYE LEVEL EVEN WITH SURFACE OF ELECTROLYTE.

Figure 14. Reading Hydrometer

BATTERY TEMPERATURE

The temperature of the electrolyte will change the reading of the specific gravity. When the temperature increases approximately 6°C (10°F), the specific gravity will decrease by 0.003 point. See Figure 15 for making specific gravity corrections. If the hydrometer you are using does not have a temperature correction, you will have to use a thermometer. Special battery thermometers are available that will indicate the correction factor directly and add or subtract the correct number of points. See Figure 16.

NEVER charge a battery at a rate that will raise the electrolyte temperature above 49°C (120°F). NEVER let a battery stay discharged for long periods. A temperature above this amount will damage the battery. The cells in the center of the battery are normally at the highest temperature. If the battery temperature is too hot, make sure the ventilation of the battery is increased and make sure the charge or discharge rate is not too high. A recommendation for a battery in service is 8 hours of use (discharge), followed by 8 hours of charging, followed by 8 hours of cooling.

To charge the battery, a direct current must pass through the cells in the opposite direction to the discharging current. The ampere-hours must be equal to the discharging ampere-hours plus the energy lost as heat. This additional amount of charge will vary according to the battery and the temperature, but the average additional charge is 12 percent. When the battery is nearly charged, the final charging must be at a low rate. A charging rate that is too high will cause heating in the battery and a high loss of water from the electrolyte. The charging of the battery must be done correctly, or the service life of the battery will be decreased.



3. Lift batteries correctly with a crane or equipment designed for the job. Always use a spreader bar designed and adjusted for the battery. Move batteries with a lift truck or a conveyor or rollers designed for that purpose. If the battery does not have a cover, a rubber mat or insulating material must be put over the top of the battery to prevent a short circuit with other equipment. Make sure the lifting equipment has enough capacity for the job. Do not use chain or wire rope slings.
4. Never put metal materials or tools on a battery.
5. Disconnect battery from lift truck before doing maintenance or repairs.
6. When maintenance on the battery or the battery charger is required, disconnect both the AC and DC power. If the battery connectors must be replaced, make sure the positive and negative terminals and cables are kept separate and insulated from each other. Even a momentary short circuit can cause an explosion and damage the battery.
7. Keep water readily available to flush spilled electrolyte. Electrolyte in the eyes must be flushed with water immediately, and then quickly get medical attention. Special showers and eye wash systems are required in areas where battery maintenance is done.
8. If electrolyte is spilled on a work surface or the floor, flush area with water, use a solution of soda (sodium bicarbonate) to make the acid neutral.
9. Only trained persons are permitted to do maintenance on batteries and battery chargers. Make sure the regulations by government safety agencies, government insurers, private insurers, and private organizations are followed when doing maintenance on batteries.

MAINTENANCE RECORDS

NOTE: Follow the same sequence when you record the cell number. Always begin the record with a positive cell. Follow a sequence so the last cell is always the cell for the negative cable.

Record the beginning ampere reading of the charger each time the battery is charged. Any difference in the daily ampere reading can indicate a problem with the battery or the charger.

NEW BATTERY



CAUTION

Always use a spreader bar and slings that lift vertically on the lifting eyes of the battery. DO NOT use a chain or sling without a spreader bar or you will damage the battery case.

Use the correct blocks or spacers to hold the battery in position in the lift truck. Make sure the battery compartment is clean and dry. All vent caps must be in position when the battery is in service. If the vent caps are not installed, the electrolyte will leak, causing corrosion on the battery case and in the battery compartment.

Inspect a new battery for damage. Make sure the electrolyte in each of the cells is at the correct level. Charge the battery for 6 hours or until the specific gravity is correct. Make sure the battery is correctly installed in the lift truck. Use a spreader bar with slings designed for the battery to lift and move the battery. See Figure 10.

Always complete the Battery Inspection Report and the Daily Battery Report. See Figure 11 and Figure 12.

CLEANING BATTERY



WARNING

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

Keep the battery compartment clean and dry. Use a clean cloth to wash the battery with water. Dry with compressed air.



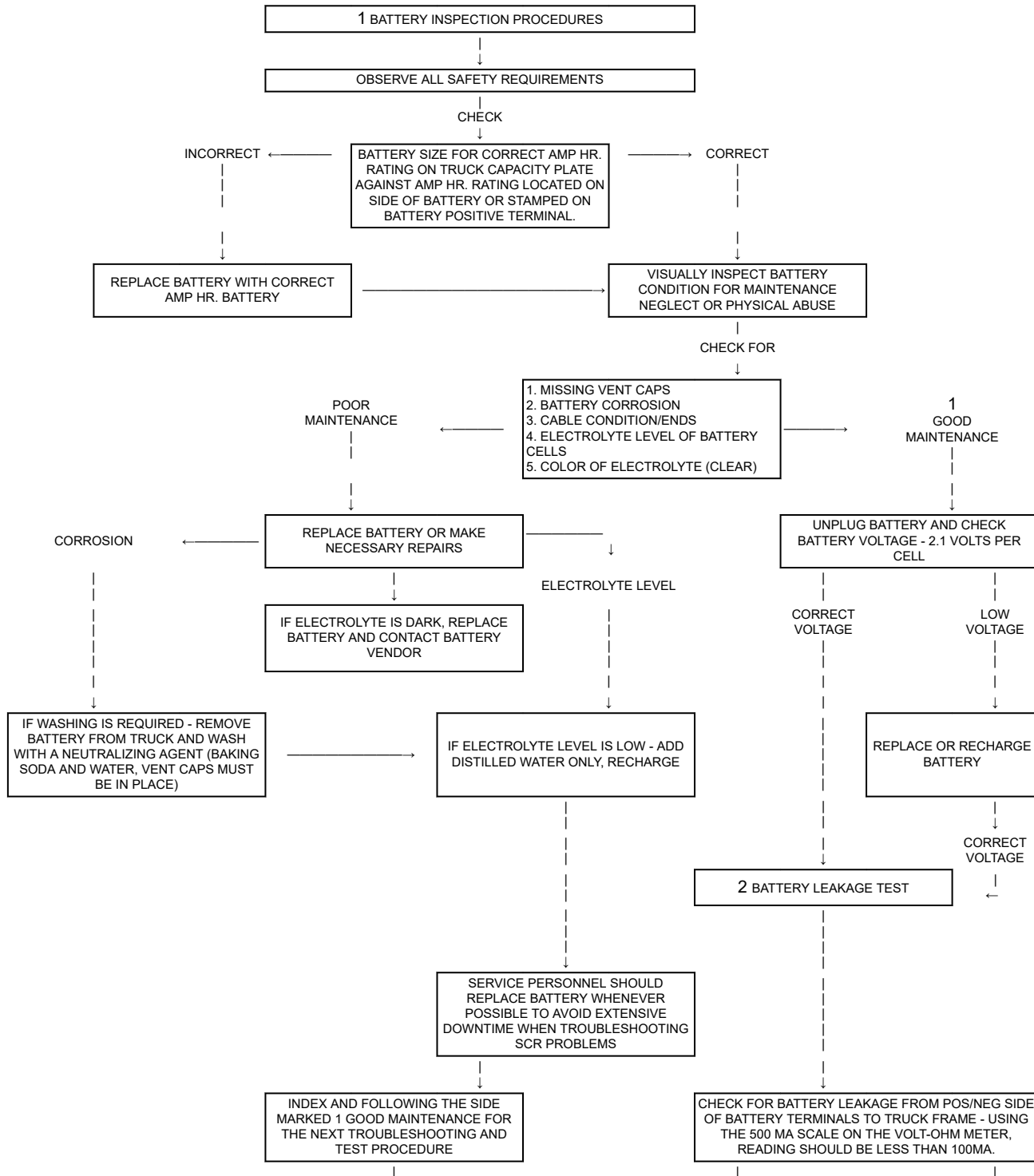
CAUTION

Do not clean the battery with steam or hot water. Do not use a high-pressure hose.

Remove any electrolyte from the battery compartment to prevent corrosion. If there is electrolyte on the top of the battery, apply a solution of bicarbonate of soda. Mix a solution containing 0.5 kg of soda for every 4 liters of water. Apply the solution, then flush the solution from the battery with clean water. Wash the battery and battery compartment as needed, but within a 6-month period as the maximum time.

Troubleshooting

Table 2. BATTERY TROUBLESHOOTING GUIDE



When the steering wheel stops moving, the metering action in the metering section also stops. The **NEUTRAL** position springs return the sleeve to the **NEUTRAL** position, stopping oil flow to or from the cylinder. The pressure stays in the steering cylinder to keep the steer tires in position. Oil from the pump flows through

the steering control unit to the tank or other parts of the system. To return the steer wheels to the straight position, the steering wheel must be rotated in the opposite direction. The steering control unit will operate as described, but all parts will rotate in the opposite direction.

Steering Wheel and Column Assembly Repair

The upper end of the steering shaft has splines for the steering wheel. A large hex nut holds the steering wheel onto the steering column. The horn button is the cover for the center of the steering wheel. The lower end of the steering column has splines or a tang to engage the steering control unit. See Figure 5 and Figure 6.

The steering column assembly is adjustable and held in position by a latch. The position of the steering column assembly can be changed as needed for different operator requirements. An access cover on the steering column gives access to the steering control unit, key switch, horn switch, and if installed, the direction switch.

ASSEMBLY COMPONENTS, REMOVE

NOTE: This procedure is for the removal of all components of the steering column assembly. All components are not often removed for a repair procedure. Do only those steps of the procedure necessary to remove the required component. See Figure 5 and Figure 6.



WARNING

The hydraulic hoses must be connected to the correct ports or the steering system will not operate as expected, which can cause damage or personal injury. Make sure the hoses are identified and connected correctly.



CAUTION

Disconnect the negative battery cable on internal combustion trucks. Disconnect the battery connector on electric trucks. Disconnect the battery before removing any covers.

1. Attach a tag on the battery connector or negative cable stating DO NOT CONNECT BATTERY. Move the steering column to the most **FORWARD** position. Remove the column tilt lever. Remove the

upper and lower access covers from the steering column.

2. Remove the key switch and static strap from the housing of the steering column. Make an identification of the electric wires and disconnect them from the key switch.
3. On units with the Direction Control Handle, Remove the direction switch assembly from the housing of the steering column. Make an identification of the electric wires and disconnect them from the direction switch. See Figure 3.
4. Remove the plastic rivets that fasten the bracket for the horn switch to the housing of the steering column. Move the horn switch and bracket away from the steering column. See Figure 5 and Figure 6.



CAUTION

If a puller tool is used to remove steering wheel from steering column, be careful not to damage the horn wires.

5. Remove the horn button assembly and electrical wires. Remove the large hex nut and the steering wheel from the shaft. A puller tool makes removal of the steering wheel easier, but not all steering wheels have puller holes.
6. On lift truck models ERC/P16-20AAF (ERC030-040AG/BG) (A814), (ERC20-30AGF (ERC040-065RG/ZG) (E108), and ERP20-30ALF (B216) units, remove the optical encoder housing and optical encoder from the steering column. Make an identification of the electrical wires and disconnect them from the assemblies. See Figure 5.

Two lift chains move the carriage. The chains fasten to mounts that are near the top of the lift cylinder shells. The chains go up and over the chain sheaves and connect to the carriage. The chain sheaves are installed at the top crossmember of the inner weldment. When the lift cylinders extend, the lift chains transfer the force from the lift cylinders to the carriage. The inner weldment and carriage can raise a small amount before the overall height of the mast increases. During lifting, the inner weldment moves at the same speed as the lift cylinders. The carriage moves at twice the speed of the inner weldment.

When the lift cylinders retract, the weight of the load, carriage, and inner weldment pushes the oil from the lift cylinders. The oil flows from the lowering control valves in the lift cylinders, through the external lowering control valve to the hydraulic tank.

Each cylinder has a check valve in the bottom of the rod assembly. When the cylinder is fully extended, oil above the piston is forced through the check valve. This action allows the cylinder to fully extend. See Cylinder Cushion During Lowering Sequence.

Legend for Figure 6

NOTE: TYPICAL MAST ASSEMBLY IS SHOWN HERE.

1. OUTER WELDMENT
2. INNER WELDMENT
3. LIFT CHAIN(S)
4. LIFT CYLINDER(S)
5. LOWERING CONTROL VALVE (EXTERNAL)

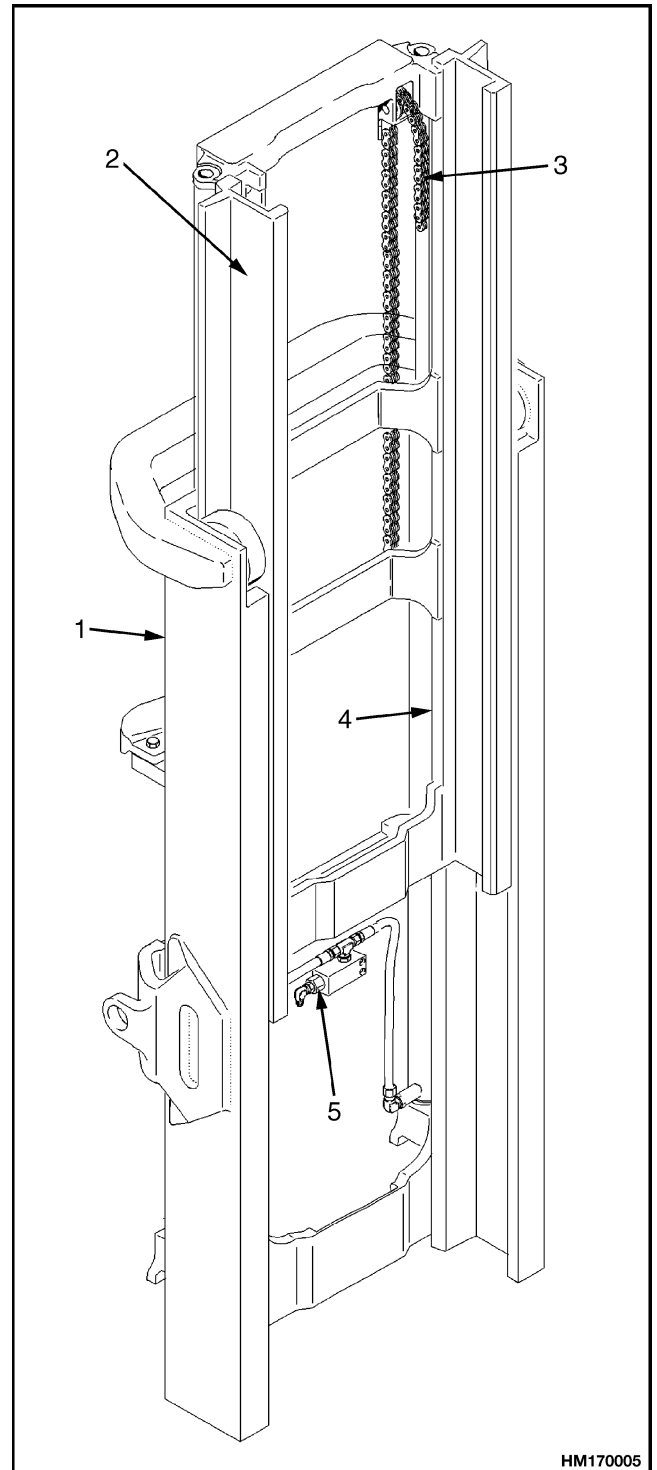
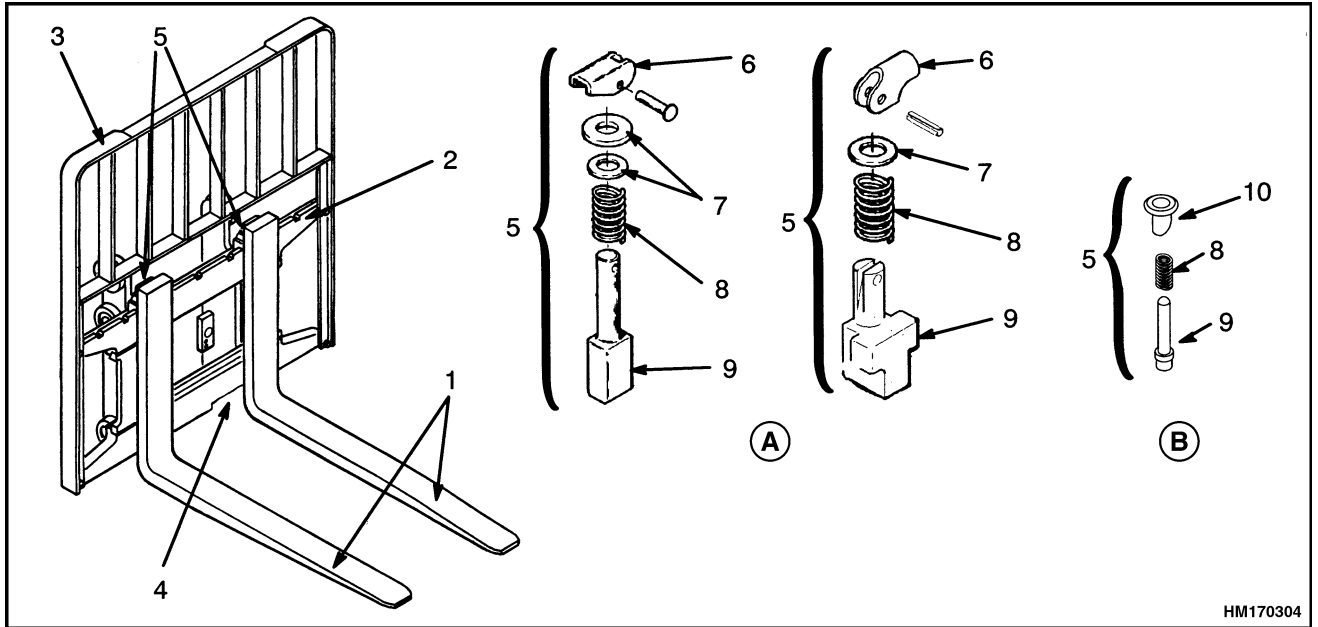


Figure 6. Two-Stage Mast, Limited Free-Lift (LFL)



HM170304

A. EARLIER MODELS

B. LATER MODELS

- | | |
|----------------------------|-----------|
| 1. FORKS | 6. LEVER |
| 2. CARRIAGE | 7. WASHER |
| 3. LOAD BACKREST EXTENSION | 8. SPRING |
| 4. FORK REMOVAL NOTCH | 9. PIN |
| 5. LATCH PIN ASSEMBLY | 10. KNOB |

Figure 3. Carriage and Forks

Install

NOTE: Use a wood block or a plastic hammer to fully seat the upper bearings onto the upper carriage bar. Proper lower hook clearance requires the upper bearings be fully seated.

1. If necessary, install the lower sideshift bearings. Then install the upper sideshift bearings. Lubricate the upper and lower sideshift bearings with chassis grease. See Figure 7 .

NOTE: The pin, located on the left top of the cylinder looking from the front of the carriage, is for alignment purposes and to prevent the cylinder from rolling to the front or to the back.

2. Install sideshift cylinder onto the carriage with the pin in the up position. Install two pins and two hair-pins. See Figure 7.

3. Use a crane with a capacity of at least 450 kg (992 lb) to install the outer frame on the inner frame.
4. Install the lower mounting hooks using four cap-screws. Tighten to $165 \pm 15 \text{ N}\cdot\text{m}$ ($120 \pm 12 \text{ lbf ft}$). For proper sideshift operation, make sure there is 0.76 to 1.52 mm (0.03 to 0.06 in.) clearance between the bottom of the hooks and the outer frame. See **B** in Figure 10.
5. Connect the hydraulic lines, as noted during removal, to the sideshift cylinder.
6. Install the backrest on the sideshift carriage. Tighten the capscrews to $195 \text{ N}\cdot\text{m}$ (144 lbf ft).
7. Install the forks.

THREE-STAGE FFL MAST

Disassemble

WARNING

Always wear the proper protective equipment including eye protection and petroleum-resistant gloves when handling hydraulic oil. Thoroughly wash oil from exposed areas of skin as soon as possible.

Completely lower forks to relieve hydraulic pressure before disassembling any part of the lift pump or disconnecting any hoses.

Hydraulic oil is hot at normal operating temperatures. Be careful when draining the oil.

CAUTION

Protect the hydraulic system from dirt and contaminants when servicing the hydraulic system.

1. Disconnect the main free-lift chains at the cross-member. See Figure 18.
2. Disconnect and remove the hydraulic lines for the main free-lift cylinder. Remove the brackets for the main free-lift cylinder. Remove the main free-lift cylinder.
3. Disconnect the main lift chains from the chain anchors near the top of the main lift cylinders. Disconnect the other end of the main lift chains at the bottom of the inner mast weldment. Push the inner mast weldment toward the bottom of the mast assembly until the bottom load rollers can be seen.

WARNING

The weldments can slide when the mast is moved. A weldment that slides can cause injury. Use a crane to turn the mast slowly and carefully.

4. Remove the strip bearings at the top of the intermediate mast weldment. Remove the load rollers at the bottom of the inner mast weldment. Remove the load rollers at the top of the intermediate mast

weldment. Make a note of each shim arrangement and load roller location. The shim arrangements will be approximately the same during assembly.

WARNING

The mast is heavy. The mast can weigh approximately 681 kg (1501 lb). Make sure all lifting devices (hoists, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the mast.

5. Slide the inner mast weldment halfway out of the top of the intermediate mast weldment. Connect a crane with a capacity of at least 681 kg (1501 lb) to the center of the inner mast weldment. See Figure 17. Slide the inner mast weldment out of the intermediate mast weldment until the stub shafts are in the notches of the intermediate mast weldment. Remove the inner mast weldment from the intermediate mast weldment.

WARNING

Be careful when removing or installing snap rings. These snap rings can come loose during removal or installation with enough force to cause an injury. Always use the correct snap ring pliers, and wear eye and face protection during removal or installation.

6. Remove the snap rings and washers at the top of the main lift cylinders. Remove the nut, bolt, and spacer at the mount near the top of each main lift cylinder.
7. Push the intermediate mast weldment to disengage the main lift cylinders. Remove the main lift cylinders.
8. Slide the intermediate mast weldment from the bottom of the outer mast weldment approximately 30 cm (12 in.). Remove the strip bearings at the top of the outer mast weldment. Remove the snap rings and load rollers from both weldments. Make a note of each shim arrangement and load roller location. The shim arrangements will be approximately the same during assembly.

Two-Stage Full Free-Lift Mast, Left-Hand Main Lift Cylinder

CAUTION

Carefully disassemble the lift cylinders so the piston rods and sliding surfaces are not damaged.

1. Loosen the gland with a spanner wrench. Remove the gland from the shell and rod. See Figure 23.
2. Remove wiper, backup ring, rod seal, wear ring, O-ring, and backup ring from gland. See Figure 23. Discard the rod seal, wear ring, and O-ring.
3. Pull the rod and piston assembly from the shell. See Figure 23. Drain the hydraulic oil into a container.
4. Remove the piston from the rod. See Figure 23.
5. Remove the piston ring and wear ring from the piston. See Figure 23. Discard the wear ring.

WARNING

Be careful when removing or installing snap rings. Snap rings can eject with enough force to cause injury. Always use the correct snap ring pliers and wear eye and face protection during removal or installation.

6. If present, remove the snap ring, washer, and check valve from the base of the piston. Remove and discard the O-ring from the check valve. See Figure 23.
7. If present, remove the screw and sealing washer from the shell. See Figure 23.

Two-Stage Limited Free-Lift Mast and Three-Stage Full Free-Lift Mast, Main Lift Cylinders for Lift Trucks

GP/GLP/GDP16-20AF/BF (GP/GLP/GDP030-040AF/BF), GC/GLC030-040AF, GLP/GDP16-20AF (GP/GLP/GDP030-040AF), and ERC/P16-20AAF (ERC030-040AF, AG/BG) (A814), and ERC/P16-20AAF (ERC030-040AH) (B814)

CAUTION

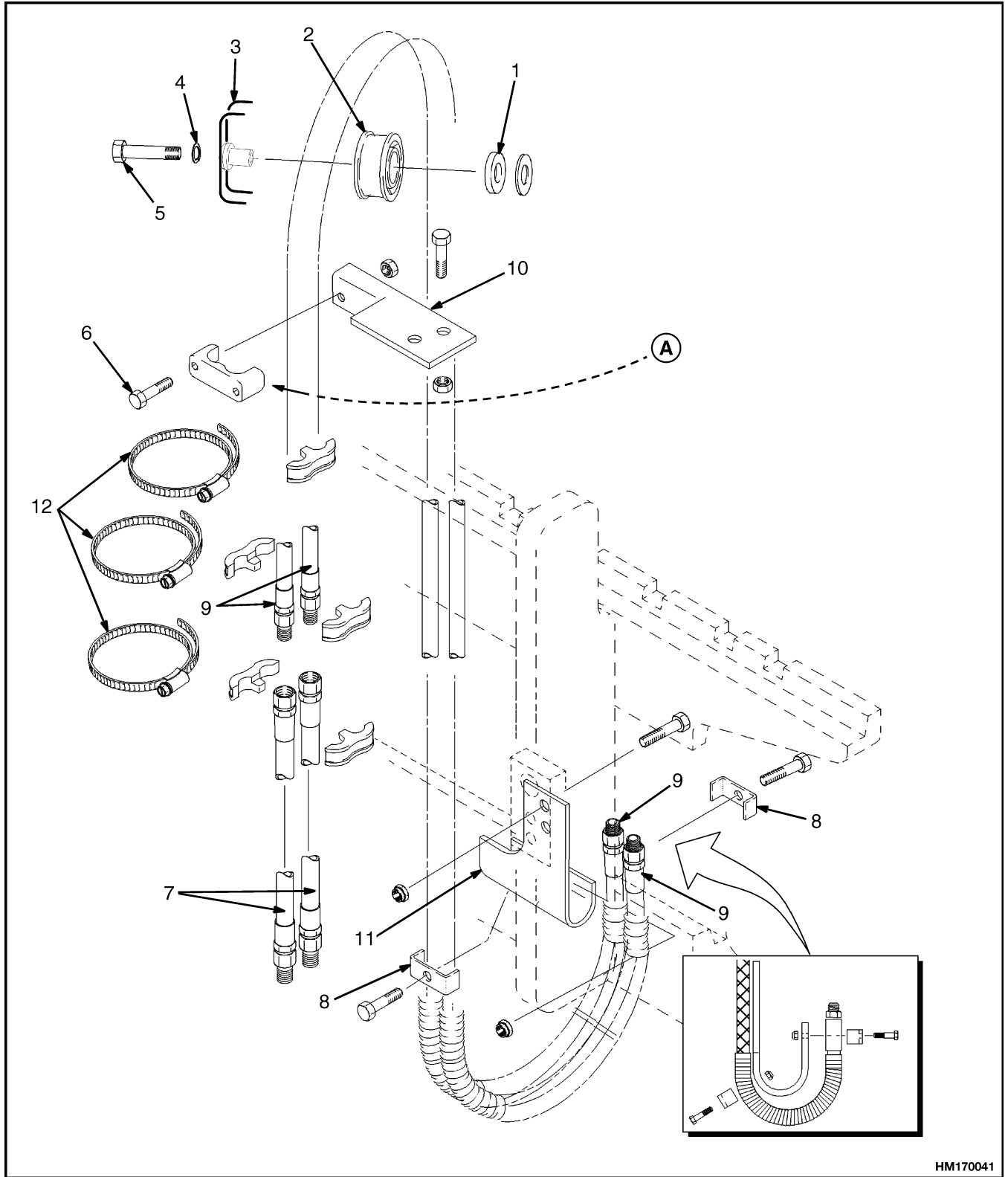
Carefully disassemble the lift cylinders so the piston rods and sliding surfaces are not damaged.

1. Loosen the gland with a spanner wrench. Remove the gland from the shell and rod and piston assembly. See Figure 24.
2. Remove wiper, backup ring, rod seal, O-ring, and wear ring from gland. See Figure 24. Discard the rod seal, O-ring, and wear ring.
3. Pull the rod and piston assembly from the shell. See Figure 24. Drain the hydraulic oil into a container.
4. Remove the spacer from the rod. See Figure 24.
5. Remove the piston ring from the piston. See Figure 24.
6. Remove the wear ring, seal, and backup ring from the piston. See Figure 24. Discard the wear ring and seal.

WARNING

Be careful when removing or installing snap rings. Snap rings can eject with enough force to cause injury. Always use the correct snap ring pliers and wear eye and face protection during removal or installation.

7. Remove the snap ring, washer, and check valve from the base of the piston. Remove and discard the O-ring from the check valve. See Figure 24.



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Figure 28. Header Hoses, Two-Stage Limited Free-Lift Mast

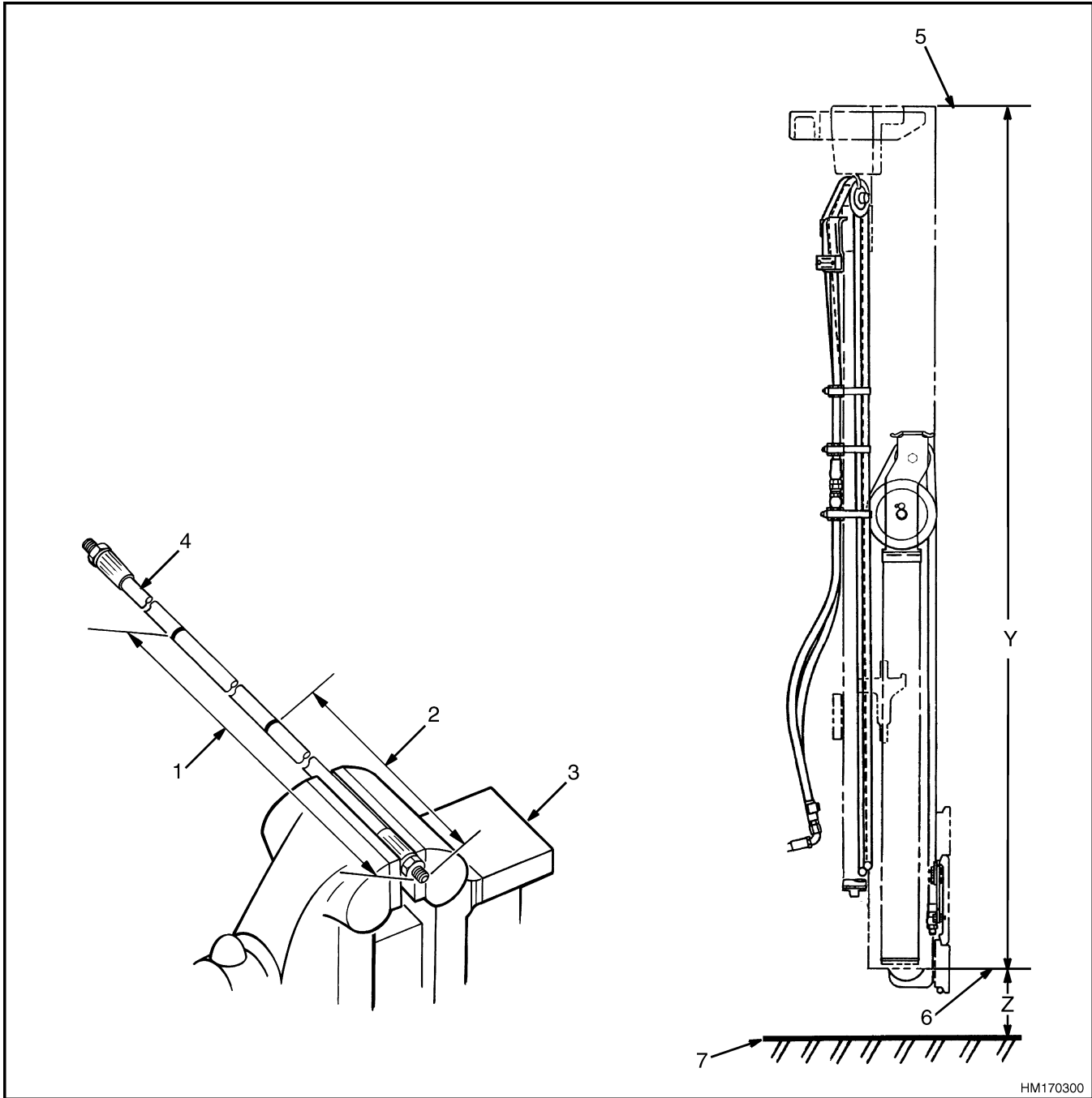


Figure 33. Header Hose Measurement, Three-Stage Full Free-Lift Mast

Header Hose Arrangement

NOTE: This is the Header Hose Arrangement for GP/GLP/GDP16-20AF/BF (GP/GLP/GDP030-040AF/BF), GC/GLC030-040AF, GLP/GDP16-20AF (GP/GLP/GDP030-040AF), ERC/P16-20AAF (ERC030-040AF, AG/BG) (A814), ERC/P16-20AAF (ERC030-040AH) (B814), and ERP1.60-1.80-2.00ATF (ERP030-040TH) models.

NOTE: Hoses have a service life that is determined by application and time. All hoses must be inspected at the intervals specified in the **Maintenance Schedule** for the hydraulic system. Install a new hose if the hose is worn, damaged, soft or hard, and no longer flexible. If necessary, make a comparison to a new hose that is the correct replacement for the hose you are inspecting.

Some lift trucks have auxiliary hydraulic equipment that is attached to the carriage. Examples of auxiliary equipment are a sideshift carriage or a roll clamp. These auxiliary functions require arrangements of header hoses for their operation.

TWO-STAGE LFL MAST, NEW HOSE INSTALL



WARNING

Before working on or near the mast, see Safety Procedures When Working Near Mast in this section.

NOTE: This procedure is for the four-function option. The three-function option will have hoses **A** and **B** only.

NOTE: The lift chains and carriage height must be correctly adjusted before the header hoses can be adjusted. See the section Lift Chains Adjustment for adjustment procedures.

1. Mark each hose with a single letter: **A**, **B**, **C**, or **D**. See Figure 29, Figure 37, and Figure 38.
2. Use a calculator to calculate dimension **E**. See Figure 37.
3. Clamp the end of the hose (the smaller fitting) that attaches to the carriage in a vise (do NOT clamp on the threads), and pull on the other end until the hose is straight. Do NOT apply enough force to stretch the hose. See Figure 37.
4. Mark all the hoses with dimension **E** (all measurements are made from the carriage end of the hose [the smaller fitting]). See Figure 37.
5. Attach the hoses to the carriage brackets with the clamps. See Figure 38.
6. Place the hoses at the location of the hose sheave. The hose sheave and stub shaft must be assembled on to the hose before they are attached to the mast. Tighten the mounting hardware to 66 N•m (49 lbf ft).

TWO-STAGE FFL MAST, ADJUST HOSES AFTER INSTALLATION

NOTE: The lift chains and carriage height must be correctly adjusted before the header hoses can be adjusted. See the section Lift Chains Adjustment for adjustment procedures.

1. Loosen the clamps and pull (if the hoses are loose) or push (if the hoses are tight) on the hoses so they move 15 mm (0.6 in.). Tighten the hardware to 8 N•m (71 lbf in). See Figure 36, Figure 39, Figure 40, and Figure 41.
2. With no load on the forks, check the header hose adjustment by operating the mast through the full lift cycle two times. When properly adjusted, the hoses will not be so tight that they compress when they pass over the sheaves nor will they be so loose that they touch the load backrest or any crossmember that is next to a sheave. If necessary, repeat Step 1 until the hoses are properly adjusted.

THREE-STAGE FFL MAST, NEW HOSE INSTALL



WARNING

Before working on or near the mast, see Safety Procedures When Working Near Mast in this section.

NOTE: This procedure is for the four-function option. The three-function option will have hoses **A** and **B** only.

NOTE: The lift chains and carriage height must be correctly adjusted before the header hoses can be adjusted. See the section Lift Chains Adjustment for adjustment procedures.

1. Mark each hose with a single letter: **A**, **B**, **C**, or **D**. See Figure 36, Figure 42, Figure 43, and Figure 44.
2. Use a calculator to calculate the dimensions **E** and **G**. See Figure 42.
3. Clamp the end of the hose (the smaller fitting) that attaches to the carriage in a vise (do NOT clamp on the threads), and pull on the other end until the hose is straight. Do NOT apply enough force to stretch the hose. See Figure 42.
4. Mark the all the hoses with dimensions **E** and **G** (all measurements are made from the carriage end of the hose [the smaller fitting]). See Figure 42.
5. Attach the hoses to the carriage bracket with clamps. See Figure 43. Apply spray lubricant to the surface of the hose guide that contacts the hoses.
6. Place the hoses over the top of the free-lift chains and under the hose guides. See Figure 43 and Figure 44. Attach the hose guides to the lower crossmember and tighten the mounting hardware to 33 N•m (24 lbf ft). Make sure the bracket is between the crossmember and the hose guide. Put the clamps over the hoses and attach the clamps to the free-lift bracket. (DO NOT tighten the hardware.)

Tilt Cylinders Adjustment



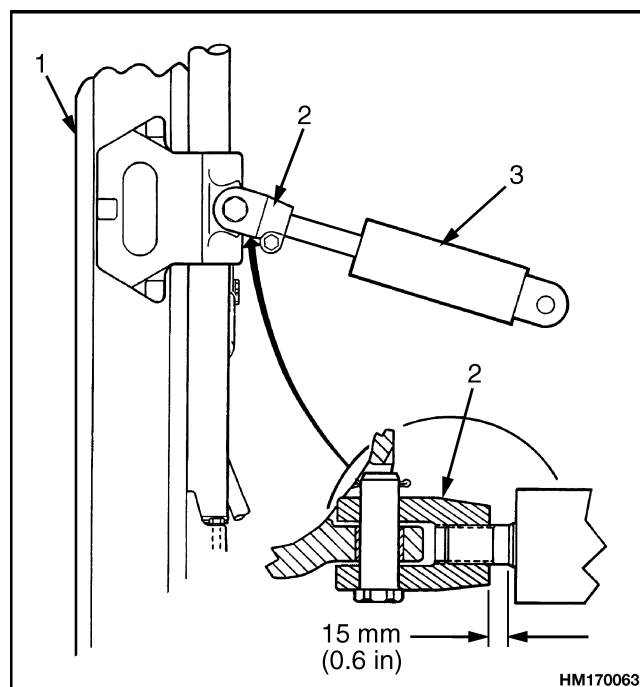
WARNING

When the tilt cylinders have tilt limit spacers, make sure they are installed during installation procedures. Without the tilt limit spacers, the mast can tilt too much and cause an accident or serious injury.

Check the tilt cylinder stroke by slowly tilting the mast fully forward and backward several times. Both tilt cylinders must stop their stroke at the same time. Adjust the rod ends as shown in Figure 45, Figure 46, and Figure 47. There must be no twist in the mast weldments.

1. Adjust the stroke of the tilt cylinders WITHOUT tilt limit spacers as follows:
 - a. Adjust the rod ends to 15 mm (0.6 in.) for all tilt cylinders shown in Figure 45, and 32.00 mm (1.25 in.) for all tilt cylinders shown in Figure 47.
 - b. Slowly tilt the mast backward until one cylinder rod stops. On the opposite cylinder, loosen the capscrews on the rod end. Measure the distance from the end of cylinder to the back end of the rod end. Use a wrench and turn the cylinder rod IN until the dimension starts to decrease, then stop. Repeat this procedure until both cylinder rods stop at the same position within 1.00 mm (0.04 in.). After the adjustments are complete, tighten the capscrews on the rod ends.
 - c. Tilt the mast fully backward and measure the tilt angle. (See the nameplate for tilt angles.) If necessary, adjust both rod ends equally for the correct angle.
2. Adjust the stroke of the tilt cylinders WITH tilt limit spacers as follows:
 - a. Adjust the rod ends to 15.0 mm (0.6 in.) for all tilt cylinders as shown in Figure 46.
 - b. Slowly tilt the mast forward until one cylinder rod stops. On the opposite cylinder, loosen the capscrews on the rod end. Use a wrench and turn the cylinder rod IN as necessary. Repeat this procedure until both cylinder rods stop at the same position within 1.00 mm (0.04 in.).

- c. Slowly tilt the mast backward until one rod end just contacts the spacer. Add shims to fill the gap at the opposite rod end until both rod ends contact the spacers within 0.50 mm (0.02 in.).
- d. After the adjustments are complete, tighten the capscrews on the rod ends.
- e. Tilt the mast fully backward and measure the tilt angle. (See the nameplate for tilt angles.) If necessary, add an equal number of shims to both rods for the correct angle.



NOTE: THE END OF THE ROD IS EVEN WITH THE FRONT FACE OF THE ROD END.

- | | |
|-------------|------------------|
| 1. MAST | 3. TILT CYLINDER |
| 2. ROD ENDS | |

Figure 45. Tilt Cylinder Adjustment for GPI/GLP/GDP16-20AF/BF (GPI/GLP/GDP030-040AF/BF), GC/GLC030-040AF, GLP/GDP16-20AF (GPI/GLP/GDP030-040AF), and ERC/IP12-16-20AAF (ERC030-040AG/BG) (A814), and ERC/IP16-20AAF (ERC030-040AH) (B814)

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

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

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



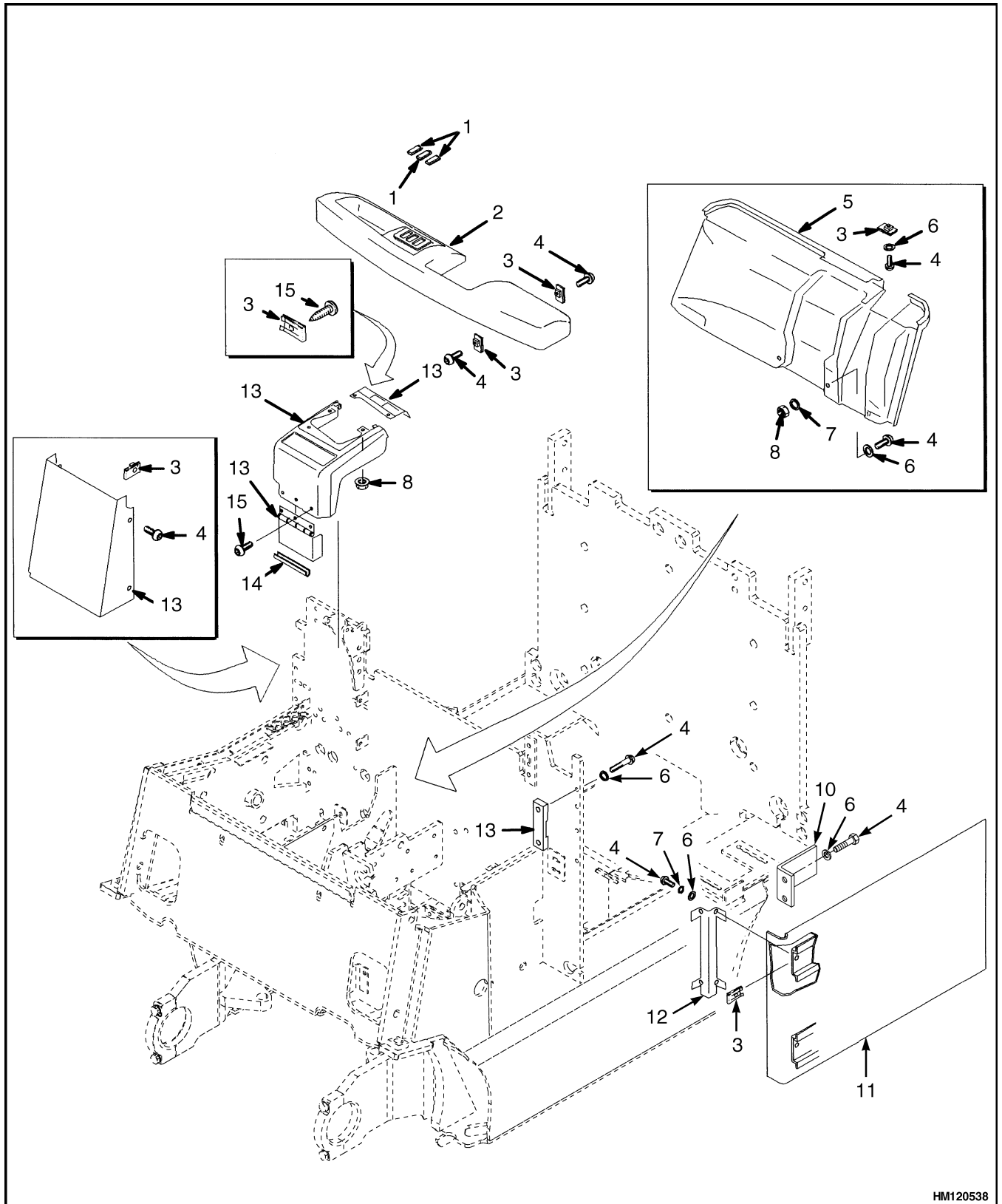
WARNING

Indicates a condition that can cause immediate death or injury!



CAUTION

Indicates a condition that can cause property damage!



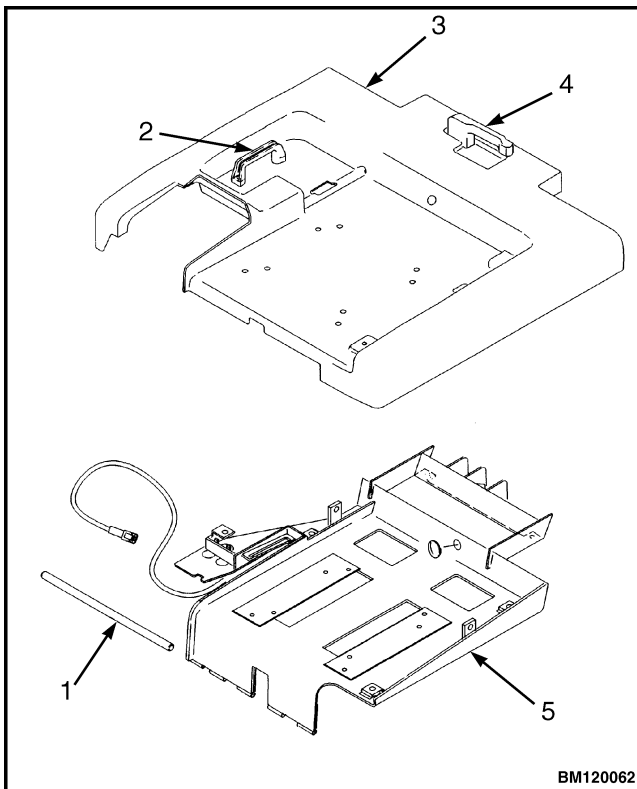
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Figure 6. Covers Manual Hydraulics ERCIP16-20AAF (ERC030, 040AH) (C814)

HOOD AND SEAT BRAKE

NOTE: The steering column must be all the way forward before raising the hood.

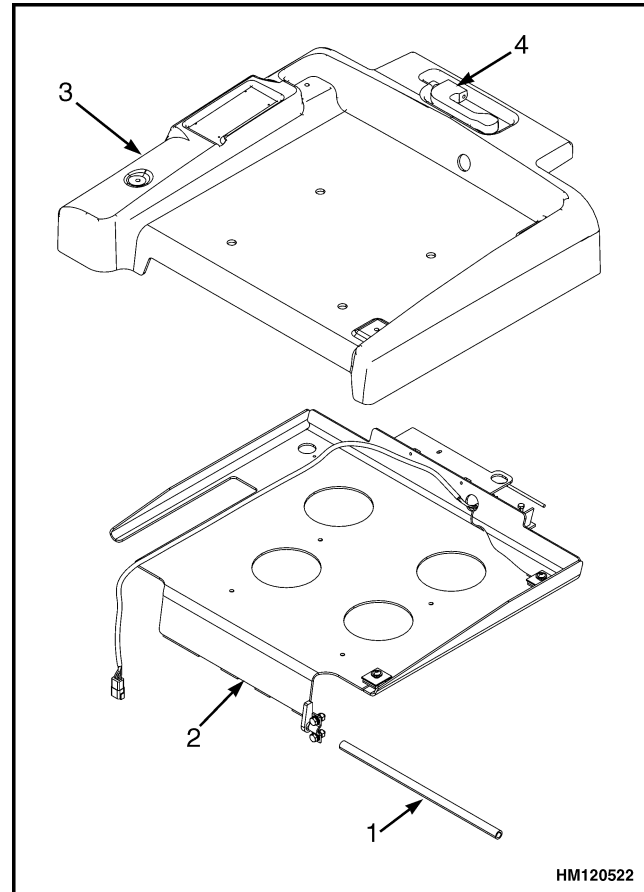
The hood must be locked in the down position during operation. The battery must have the spacers correctly adjusted to prevent movement of 13 mm (0.5 in.) maximum. On lift trucks ERC/P16-20AAF (ERC030-040AF, AG/BG) (A814), if the unit has a seat brake, raise the seat and seat plate assembly. Use the latch handle at the rear of the hood (see Figure 16) to release the hood frame and battery restraint. Raise the latch handle and slide the handle toward the right side of the truck. A spring moves the handle back to the left.



- | | |
|----------------|----------------------------------|
| 1. HINGE | 4. LATCH HANDLE |
| 2. LIFT HANDLE | 5. SEAT PLATE (WITH SEAT BRAKE*) |
| 3. HOOD | |

* THE SEAT PLATE (WITH SEAT BRAKE) IS USED ON ERC/P16-20AAF (ERC030-40AF, AG/BG) (A814) ONLY.

Figure 16. Seat Brake Assembly, Manual Hydraulics, Lift Truck Models ERC/P16-20AAF (ERC030-040AF, AG/BG) (A814) ERC/P16-20AAF (ERC030, 040AH)(B814)



- | |
|-----------------|
| 1. HINGE |
| 2. SEAT PLATE |
| 3. HOOD |
| 4. LATCH HANDLE |

Figure 17. Seat Brake Assembly, E-Hydraulics, Lift Truck Models ERC/P16-20AAF (ERC030, 040AH)(C814)

Use the lift handle by the seat to raise the hood (see Figure 16) or Figure 17. A gas spring and stop rod will hold the assembly in the up position. Make sure that the battery cannot move more than a total of 13 mm (0.5 in.) in any one horizontal direction. If necessary, adjust the battery spacers as shown in Figure 4.

Release the stop rod by moving it to the right before lowering hood. See the label in Figure 15. Make sure the latch handle is fully to the right when closing the hood so that the latch can engage the latch plate. Make sure the hood is locked securely. Try to raise the hood using only the lift handle to make sure the hood is latched and will not move.

ADDITIONAL PREPARATIONS FOR REPAIR

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

1. Fill the tank with water to just below the point where the work will be done. Make sure the space above the level of the water has a vent.
2. Use acceptable welding practices to repair the tank. See the American National Standard *Safety in Welding and Cutting*, AWS Z 49.1 - 1999.

NOTE: Make sure to install all plugs, hoses, and clamps to prevent leaks when oil is added to the tank.

SMALL LEAKS, REPAIR

Use the following procedure to seal small leaks:



WARNING

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

1. Use steam to clean the area around the leak. Remove all paint and dirt around the leak.



WARNING

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

2. Apply Loctite® 290 to the leak. Follow the instructions of the manufacturer.

LARGE LEAKS, REPAIR

1. To clean and prepare the tank for repair, use one of the two cleaning procedures in the Clean section of this YRM.
2. Use acceptable welding practices to repair the tank. See the American National Standard *Safety In Welding and Cutting* AWS Z 49.1 - 1999.

PREPARATIONS FOR USAGE AFTER REPAIR

1. Add more water to the tank so that the water goes above the point of where the work was done. Check to see if there are any leaks coming from tank.
2. If there are no leaks coming from the tank, remove all the water from the tank.

Painting Instructions



WARNING

Always use solvents and paints in an area with ventilation. Do not use solvents or paints near heat, fire, or electrical equipment that can make sparks. Follow the manufacturer's instructions and Cautions.

1. Remove all dirt from the surface to be painted. Clean the area to be painted. Use a solvent for painted surfaces to remove grease and oil before sanding. Do not use solvent on new paint. Make sure all oil and grease is removed.
2. Use sandpaper to remove the top surface of the paint and rust from the metal. All metal surfaces where the paint is completely removed, must be

painted. Use a primer. Apply the primer before applying the final coat of paint.

3. Protect all surfaces that will not be painted. See the list of items in Figure 32.



CAUTION

Do not paint the pads, plastic covers or knobs, cables, labels, and information plates, or controls. Paint can make some assemblies not operate correctly.

4. Paint the surfaces. Use the correct paint from your dealer for Yale lift trucks. Follow the directions on the container. The correct arrangement of colors is shown in Figure 32.

Yale 

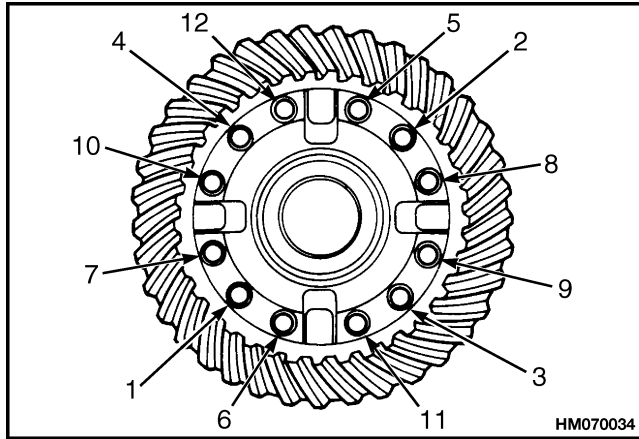
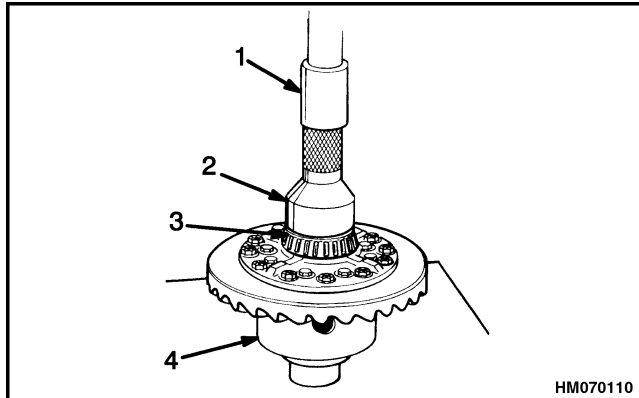


Figure 10. Tighten Hex Head Screws in Cross Pattern

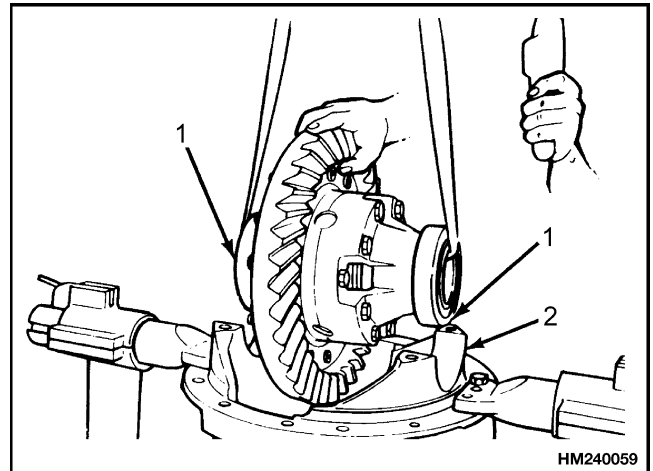
4. Install the bearing cones on the differential case. See Figure 11.



1. PRESS
2. SLEEVE
3. BEARING CONE
4. DIFFERENTIAL CASE

Figure 11. Bearing Cones Installation

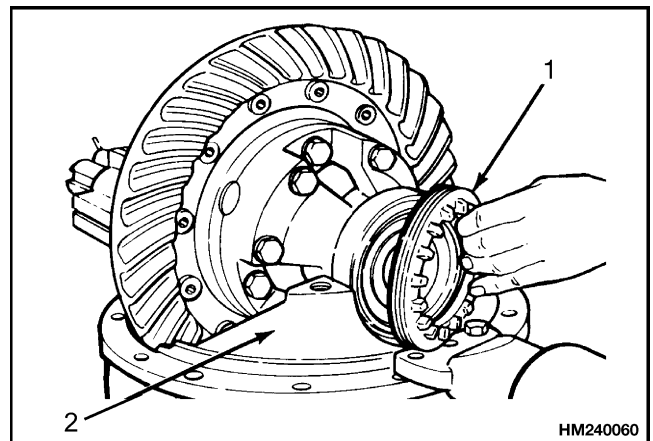
5. Apply axle lubricant on the inner diameter of the bearing cups and on both bearing cones that are installed on the differential. Do not permit lubricant on the outer diameter of the bearing cups or the bearing bores of the housing.
6. Install the differential assembly into the housing. See Figure 12. The bearing cups must fit correctly into the bores of the housing.



1. BEARING CUP
2. HOUSING

Figure 12. Differential Assembly Installation into Housing

7. Install the two bearing adjustment nuts into position in the housing bores. See Figure 13. Use your hand to tighten each adjustment nut against the bearing cup.



1. ADJUSTMENT NUT
2. HOUSING

Figure 13. Adjustment Nuts Installation

8. Align the marks on the bearing caps with the marks on the housing. See Figure 14 and Figure 15. Apply Loctite® to the threads, and install and tighten the bolts for the bearing caps to 263 to 315 N•m (194 to 233 lbf ft).



Yale Materials Handling Corp.
1400 Sullivan Dr., Greenville, NC 27834-2011

Spindles, Bearings, and Links Repair

REMOVE AND DISASSEMBLE; LIFT TRUCK MODELS ERC/P16-20AAF (A814/B814/C814)

1. Remove two lock nuts, two setscrews, two link pins, and the intermediate link. See Figure 2 and Figure 5.
2. Remove the upper and lower expansion plugs, lock nut, setscrew, king pin, spindle, thrust bearing, shims, and the oil seal. Discard the oil seal.
3. Remove damaged lubrication fittings. Make a note of the direction of the 90° fittings.
4. Using a press, remove the upper and lower needle bearings from the axle weldment.
5. Do Step 1 through Step 4 to remove and disassemble the other spindle, bearings, and links.
6. If the link bushings in the spindles are loose on the pins or in the bores, remove the bushings from the spindles and discard.

CLEAN



WARNING

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

Clean all parts with petroleum solvent. Make sure the bearings are clean. Make sure all solvent has evaporated from inside the bearing cones before filling them with grease.

ASSEMBLE AND INSTALL; LIFT TRUCK MODELS ERC/P16-20AAF (A814/B814/C814)

NOTE: Perform Step 1 through Step 3 only if the needle bearings, bushing, and/or the lubrication fittings were removed.

1. If removed, install a new link bushing into the spindle. Make sure the lubrication hole in the bushing

is aligned with the lubrication fitting hole in the spindle. See Figure 2 and Figure 5.

2. Lubricate new needle bearings with the wheel bearing grease specified in your vehicle's **Periodic Maintenance**. For lift truck models ERC/P16-20AAF (A814); see **Periodic Maintenance** 8000 YRM 552. For lift truck models ERC/P16-20AAF (B814/C814); see **Periodic Maintenance** 8000 YRM 1060. Install the needle bearings into the axle weldment using a press. Make sure the lubrication holes in the bearing races are aligned with the lubrication fitting holes in the axle weldment.
3. Install new lubrication fittings as necessary. Make sure the 90° fittings are pointing in the same direction as removed for access during lubrication.
4. Coat the new oil seal with grease, and install it into the axle weldment with the lip of the oil seal facing up.
5. Lubricate the thrust bearing with the wheel bearing grease specified in your vehicle's **Periodic Maintenance**. For lift truck models ERC/P16-20AAF (A814); see **Periodic Maintenance** 8000 YRM 552. For lift truck models ERC/P16-20AAF (B814/C814); see **Periodic Maintenance** 8000 YRM 1060. Install the spindle and thrust bearing into the axle weldment.
6. Lift the spindle and thrust bearing combination as high as possible so that all the clearance is at the bottom. Using a feeler gauge, measure the distance between the bottom of the spindle and the oil seal. Subtract 0.2 mm (0.008 in.) from the measured dimension to find the shim pack thickness.



CAUTION

The shims used in Step 7 are very thin and are easily bent. Use care when installing the shims and the kingpin to prevent damage to the shims.

7. Install the shim pack, of Step 6, between the bottom of the spindle and the axle weldment.

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

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

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



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

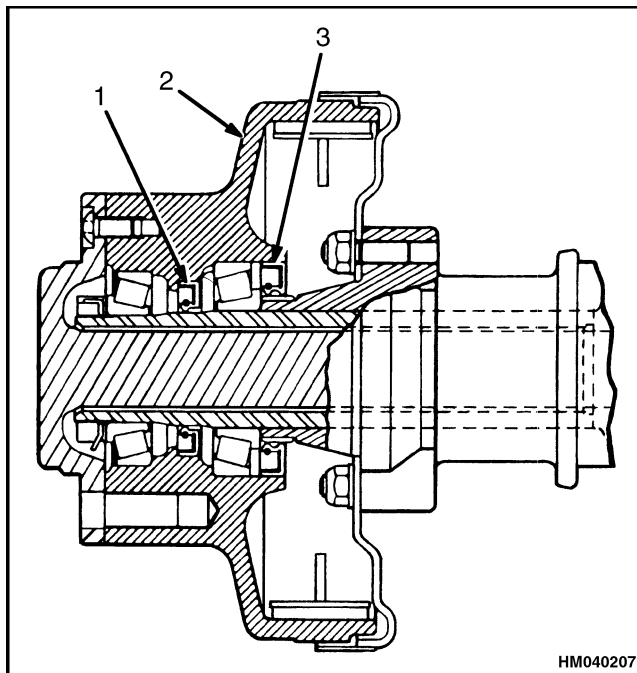
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the **WARNING** symbol and word are on orange background. The **CAUTION** symbol and word are on yellow background.

17. Use the correct tools to install the return springs. The shape of the return springs permits them to be installed correctly in only one position.
18. Make sure the bottom edge of the adjuster wheel actuator is just above the center of the teeth of the adjuster wheel. Check for correct installation if the alignment is not correct.

NOTE: To prevent damage to the inner oil seal when installing the hub, the hub can be temporarily fastened to the wheel. Align the height of the axle housing with hub bearings. Put grease under the tire and slide the wheel toward the axle housing.

19. Clean the bearings and fill them with wheel bearing grease. Install the bearings and seals in the hub. Install the assembly on the axle housing. See Figure 8. Install the outer bearing and castle nut.



1. OUTER SEAL
2. HUB
3. INNER SEAL

Figure 8. Grease Seals Location

20. Adjust the hub bearings by tightening the castle nut until the hub cannot rotate, then loosen nut 30 to 60° until the hub turns freely. The torque must be

less than 27 N•m (20 lbf ft). Tighten the nut until the hub rotating torque is 3.4 N•m (30 lbf in) or until the first alignment position after the hub rotating torque is 3.4 N•m (30 lbf in). Bend the lock plate over the nut.

CAUTION

If there is too much clearance, the automatic adjusters will not operate. If the clearance is too small, the automatic adjuster cannot turn the adjuster wheel to increase the clearance and the adjuster wheel will not turn until the brake shoes wear. If the adjuster wheel does not move for a long operating period, the adjuster link can wear a spot on the adjuster wheel so that it will not turn correctly.

21. Adjust the clearance of the brake shoes. Put a brake adjustment tool or a screwdriver through the slot in the back plate. Use the tool to rotate the adjuster wheel.
22. The actuator for the adjuster wheel will only permit rotation in one direction. Turn the adjuster wheel until the brake shoes are pushed against the hub and the hub will not turn.
23. Use a small screwdriver to lift the actuator away from the adjuster wheel and turn the adjuster wheel approximately 15 teeth in the opposite direction. The brakes will adjust to the correct clearance when they are applied while the lift truck is traveling in the REVERSE direction.
24. Put liquid sealant on the flange of the axle shaft. Install the axle shaft and socket head capscrew. Tighten socket head capscrew to 40 N•m (30 lbf ft)..
25. For cushion lift trucks, install the wheel and capscrews and tighten the capscrews in a cross pattern to 330 N•m (244 lbf ft).

For pneumatic lift trucks, install the wheel and nuts and tighten the nuts in a cross pattern to 305 to 330 N•m (225 to 244 lbf ft).

26. Do Step 1 through Step 25 to assemble and install the other brake assembly.

Parking Brake Switch Replacement

The parking brake switch is fastened near the arm of the parking brake pedal. This switch operates the indicator in the Display and the Parking Brake Alarm through the control card for the Display.

The park brake alarm operates for 10 seconds when the operator gets off the seat or the key is moved to the **OFF** position if the park brake is not applied. The alarm is operated by the display from the switch signal and is located within the display housing. The alarm does not operate if the parking brake switch is damaged or not adjusted correctly. An alarm that does not operate cannot be repaired and must be replaced as part of the display. See Display Assembly. Replace the parking brake switch as follows: See Figure 10.

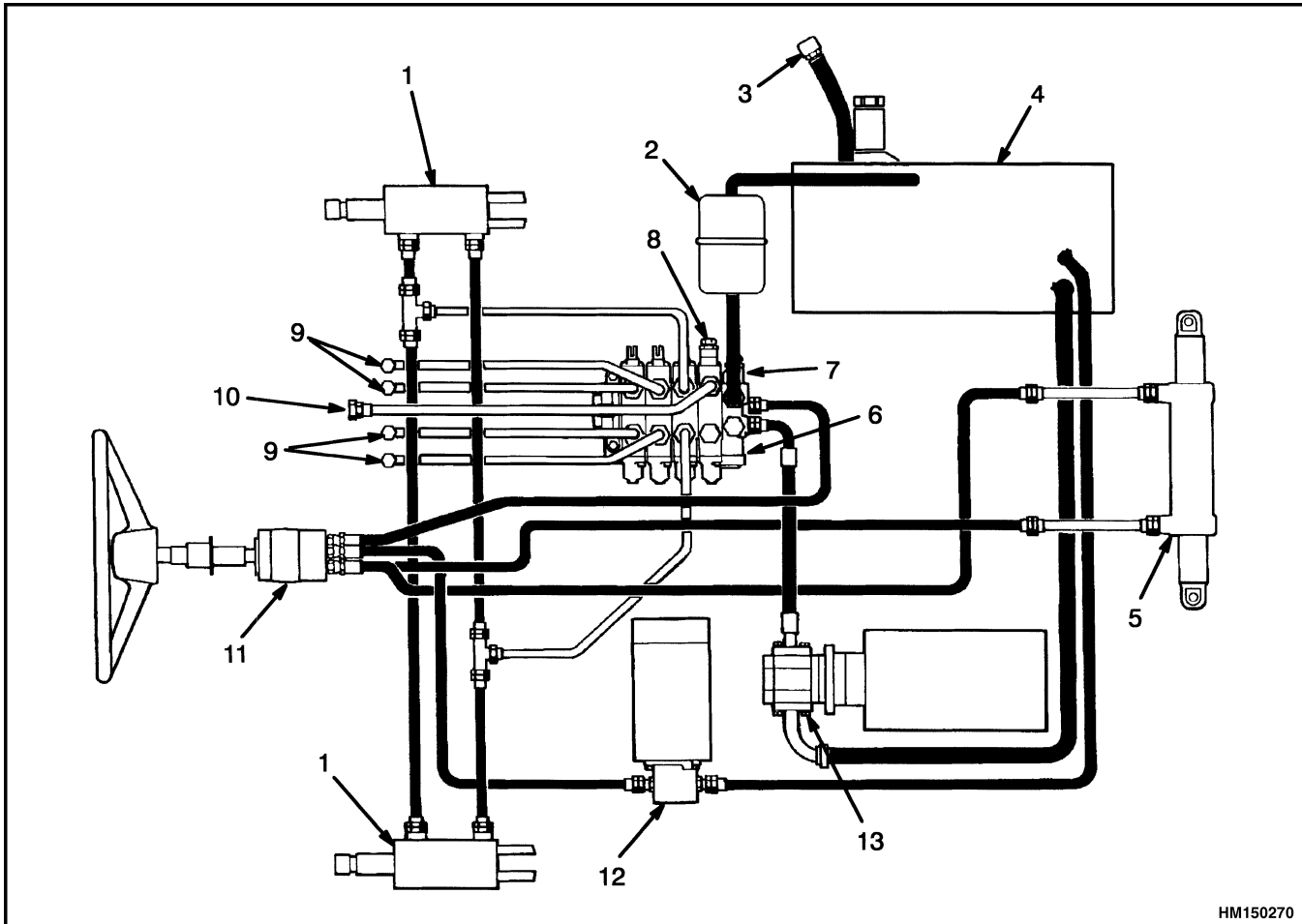
1. Disconnect the battery.
2. Install blocks on each side of a steer wheels to prevent movement of the lift truck. Release the parking brake.
3. Remove the floor plate under the parking brake pedal. Remove the screws and nuts that fasten the switch to the bracket. Do not lose the screws, nuts, or washers.
4. Turn the switch so that you can see the terminals. Make a note of the wires fastened to the switch terminals for correct connection during installation. Remove the wires from the switch terminals. Connect the wires to the correct terminals of the replacement switch.
5. Install the replacement switch using the same screws, nuts, or washers. Do not damage the actuator of the switch during installation. Tighten the screws and nuts.
6. Check for correct operation and if necessary, adjust the switch as described in Parking Brake Not Applied Switch Test. Install the floor plates. Apply the parking brake and remove the wheel blocks.

Brake System Air Removal

Adjust the service brakes before the air is removed from the brake system.

1. Fill the master cylinder reservoir with brake fluid.
2. Put one end of a rubber hose on the special fitting of the wheel cylinder. Put the other end of the hose into a clear container of brake fluid.
3. Loosen the special fitting at the wheel cylinder one turn so that the air can be removed from the brake system. Slowly push the brake pedal and hold it at the end of its stroke. Close the special fitting.
4. Repeat the procedure in Step 1 through Step 3 until there are no air bubbles in the container.
5. Check the level of the brake fluid in the reservoir for the master cylinder during the procedure. Make sure to keep the brake fluid at the correct level.
6. Repeat the procedure for the other wheel cylinder. If there is still air in the system, the air must be removed from the master cylinder. Push on the brake pedal with a steady stroke. Release the pedal slowly. Repeat this procedure until no air bubbles enter the reservoir.

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
One brake does not release.	A brake shoe is damaged.	Install new brake shoes.
	A return spring is wrong.	Install new correct spring.
	The brake lines have a restriction.	Remove restriction or install new lines. Remove air from the system.
	A parking brake cable is damaged or needs adjustment.	Adjust cable or install new cable.
	The wheel cylinder is damaged.	Repair or install new wheel cylinder. Remove air from the system.
	The backplate is worn or damaged.	Install new backplate.
The brakes make too much noise.	Dirt, oil, water, or brake fluid is on the linings.	Clean or install new linings.
	The brake linings are worn.	Install new linings.
	The hub is damaged.	Repair or install new hub.
	A brake shoe is worn or damaged.	Install new brake shoe(s).
The brakes do not operate equally.	Oil or brake fluid is on the linings.	Repair leak. Install new linings.
	The linings are worn or hard.	Install new linings.
	A wheel cylinder is leaking.	Repair or install new wheel cylinder. Remove air from the system.
	The brake linings are not correctly installed.	Install brake linings correctly.
	The backplate or brake shoes are damaged.	Install new parts.
	The hubs are not round.	Check to make sure there is adequate material to allow for machining. Machine the brake shoe area of hubs to make them round or install new hubs.
	The brake shoes are adjusted too tight.	Adjust brakes. Check self-adjusters.



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- | | |
|---|-------------------------------------|
| 1. TILT CYLINDER (2) | 7. PRIMARY RELIEF VALVE |
| 2. FILTER | 8. SECONDARY RELIEF VALVE |
| 3. BREATHER | 9. TO AUXILIARY HYDRAULIC FUNCTIONS |
| 4. HYDRAULIC TANK (CAN BE DIFFERENT SHAPE) | 10. TO LIFT CYLINDERS |
| 5. STEERING CYLINDER | 11. STEERING CONTROL UNIT |
| 6. MAIN CONTROL VALVE (4-SPOOL VALVE SHOWN) | 12. STEERING PUMP |
| | 13. HYDRAULIC PUMP |

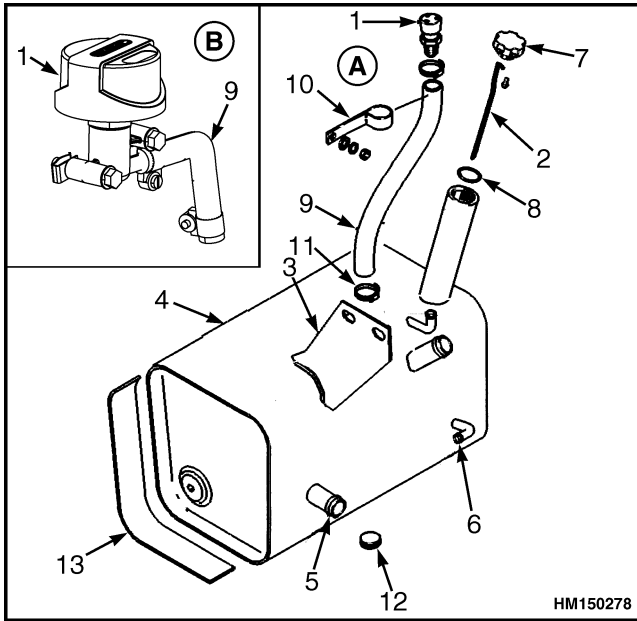
Figure 1. Hydraulic System for ERCIP16-20AAF (ERC030-040AF, AGIBG) (A814); ERCIP16-20AAF (ERC030-040AH) (B814/C814); ERC20-32AGF (ERC040-065GH) (A908); and ERC20-30AGF (ERC040-065RF/ZF, RGIZG) (E108) (Early Models)

Legend for Figure 2

- | | |
|----------------------------------|-------------------------------|
| 1. STEERING CONTROL UNIT | 9. STEERING CYLINDER |
| 2. STEERING HOSES | 10. HYDRAULIC PUMP AND MOTOR |
| 3. TILT CYLINDERS | 11. STEERING PUMP AND MOTOR |
| 4. TILT CYLINDER HOSES | 12. BREATHER |
| 5. HYDRAULIC CONTROL VALVE | 13. HYDRAULIC FILTER GAUGE |
| 6. HYDRAULIC TANK | 14. HYDRAULIC FILTER ASSEMBLY |
| 7. STEERING PUMP AND MOTOR HOSE | 15. RETURN TO TANK HOSE |
| 8. HYDRAULIC PUMP AND MOTOR HOSE | |

Legend for Figure 9

1. AUXILIARY 2 VALVE (SP5)
2. AUXILIARY 1 VALVE (SP4)
3. TILT CYLINDERS
4. LIFT CYLINDER
5. SECONDARY LOWERING CONTROL INTEGRAL WITH LIFT CYLINDERS
6. PRIMARY LOWERING CONTROL (MOUNTED ON MAST)
7. STEERING CYLINDER
8. STEERING WHEEL
9. CHECK PORT
10. STEERING CONTROL UNIT
11. HAND PUMP
12. STEERING VALVE
13. MAIN CONTROL VALVE
14. STEERING PUMP
15. STEERING RELIEF VALVE
16. HYDRAULIC TANK
17. HYDRAULIC FILTER
18. HYDRAULIC PUMP
19. PRIMARY RELIEF VALVE (3300 PSI) (RV1)
20. SECONDARY RELIEF VALVE (2250 PSI) (RV2)
21. TILT SOLENOID VALVE (SP3)
22. LIFT SOLENOID VALVE (SP1)
23. PRIORITY COMPENSATOR VALVE (EC1)
24. LOWERING COMPENSATOR VALVE (EC2)
25. TILT COUNTERBALANCE VALVE (CB1)
26. CHECK VALVE LIFT CIRCUIT (CV1)
27. FLOW REGULATOR VALVE (FR1)
28. LOWER SOLENOID VALVE WITH MANUAL OVERRIDE (SP2)



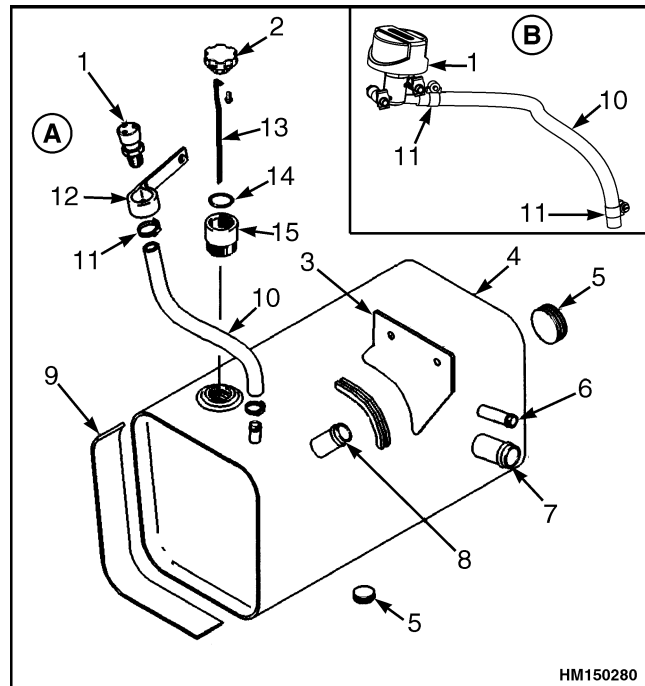
- A. ERC/P16-20AAF (ERC030-040AF, AG/BG) (A814), ERC/P16-20AAF (ERC030-040AH) (B814)
- B. ERC/P16-20AAF (ERC030-040AH) (B814/C814)

- | | |
|-------------------------------|------------------|
| 1. BREATHER | 7. FILL CAP |
| 2. DIPSTICK ASSEMBLY | 8. SEAL |
| 3. MOUNTING BRACKET | 9. BREATHER HOSE |
| 4. TANK | 10. CLAMP |
| 5. HYDRAULIC PUMP SUPPLY PORT | 11. STRAP CLAMP |
| 6. STEERING PUMP SUPPLY PORT | 12. PLUG |
| | 13. PAD |
| | 14. RETURN PORT |

Figure 16. Hydraulic Tank Assembly for ERC/P16-20AAF (ERC030-040AF, AG/BG) (A814) and ERC/P16-20AAF (ERC030-040AH) (B814/C814)

7. Remove screws that fasten bracket holding hydraulic tank in truck frame. Remove bracket assembly.
8. Carefully remove hydraulic tank from frame.

9. Make repairs to hydraulic tank.



- A. ERC20-30AGF (ERC040-065RF/ZF, RG/ZG) (E108)
- B. ERC20-32AGF (ERC040-065GH) (A908)

- | | |
|-------------------------------|-----------------------|
| 1. BREATHER AND HOSE | 8. RETURN PORT |
| 2. FILL CAP | 9. PAD |
| 3. MOUNT BRACKET | 10. BREATHER HOSE |
| 4. HYDRAULIC TANK | 11. STRAP CLAMP |
| 5. PLUG | 12. CLAMP |
| 6. STEERING PUMP SUPPLY PORT | 13. DIPSTICK ASSEMBLY |
| 7. HYDRAULIC PUMP SUPPLY PORT | 14. SEAL |
| | 15. ADAPTER |

Figure 17. Hydraulic Tank Assembly for ERC20-30AGF (ERC040-065RF/ZF, RG/ZG) (E108) and ERC20-32AGF (ERC040-065GH) (A908)

LIFT TRUCK MODELS [ERP20-32ALF (ERP040-065DH) (E216)]

Remove



WARNING

The hydraulic oil is **HOT** at operating temperature. Do not permit the hot oil to contact the skin and cause a burn.



CAUTION

Do not permit dirt to enter the hydraulic system when the oil level is checked or the filter is changed. Dirt can cause damage to components of the hydraulic system.

Never operate the pump without oil in the hydraulic system. The operation of the hydraulic pump without oil will damage the pump.

1. Turn key to the **OFF** position and remove key.
2. Remove top counterweight cover and open hood for access to hydraulic filter assembly. See Figure 26.
3. Remove the four socket head screws from filter cover. See Figure 26. Remove O-ring seal from filter cover and discard O-ring. See Figure 27.

4. Remove filter element from filter housing and discard filter element. If debris cap was removed with filter element, remove cap from filter element. See Figure 27.

Install

1. Lubricate oil seal on new filter element. If debris cap was removed from filter element, install cap onto new filter element and install filter element into filter housing. See Figure 27.
2. Lubricate new O-ring and install new O-ring into filter cover. See Figure 27.
3. Place filter cover onto housing, making sure the pin on the cover lines up with the notch on the housing, and secure cover to housing with four socket head screws. See Figure 26.
4. Close hood and install counterweight cover.
5. Turn key to the **ON** position and operate hydraulic system, check for leaks and check oil level.

HYDRAULIC PUMP, INSPECT [ERC35-55HG (ERC70-120HH) (B839/C839) AND ERP20-32ALF (ERP040-065DH) (E216)]

Check parts for wear and damage. If any parts are worn or damaged, replace the damaged parts. If the pump housing is damaged, replace the pump.

HYDRAULIC PUMP, CLEAN [ERC35-55HG (ERC70-120HH) (B839/C839) AND ERP20-32ALF (ERP040-065DH) (E216)]



WARNING

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



WARNING

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

Clean all parts in solvent. Dry parts with compressed air. Do not dry the parts with a cloth. Make sure all surfaces are free of scratches and sharp edges.

HYDRAULIC PUMP, ASSEMBLE [ERC35-55HG (ERC70-120HH) (B839/C839) AND ERP20-32ALF (ERP040-065DH) (E216)]

1. Put oil on all parts of the pump. Use the hydraulic oil shown in the maintenance table of the section **Periodic Maintenance** 8000 YRM 1201 for lift truck models ERC35-55HG (ERC70-120HH) (B839/C839) and **Periodic Maintenance** 8000 YRM 1226 for lift truck models ERP20-32ALF (ERP040-065DH) (E216). Make sure to keep the parts clean.
2. Use new plate and backup seals and install the pressure plates and gears. Make sure to install the pressure plates as removed during disassembly. See the notes made during disassembly. Make sure all seals are complete and in the correct positions. See Figure 32.

3. Install a new shaft seal in the flange end housing. Carefully install the flange end housing. Do not move the pressure plates. Make sure the seals do not move out of the correct position.
4. Carefully install the valve end housing on the pump body using the four capscrews and lockwashers. Make sure the pressure plates do not move and that the seals stay in the correct position. Make sure the marks made during disassembly are aligned. Tighten the capscrews to 46 to 49 N•m (34 to 36 lbf ft).

HYDRAULIC PUMP AND MOTOR, INSTALL [ERP20-30ALF (B216); ERP20-30ALF (ERP040-060DH) (D216); AND ERP20-32ALF (ERP040-065DH) (E216)]

1. Turn key to **OFF** position and remove key.



WARNING

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

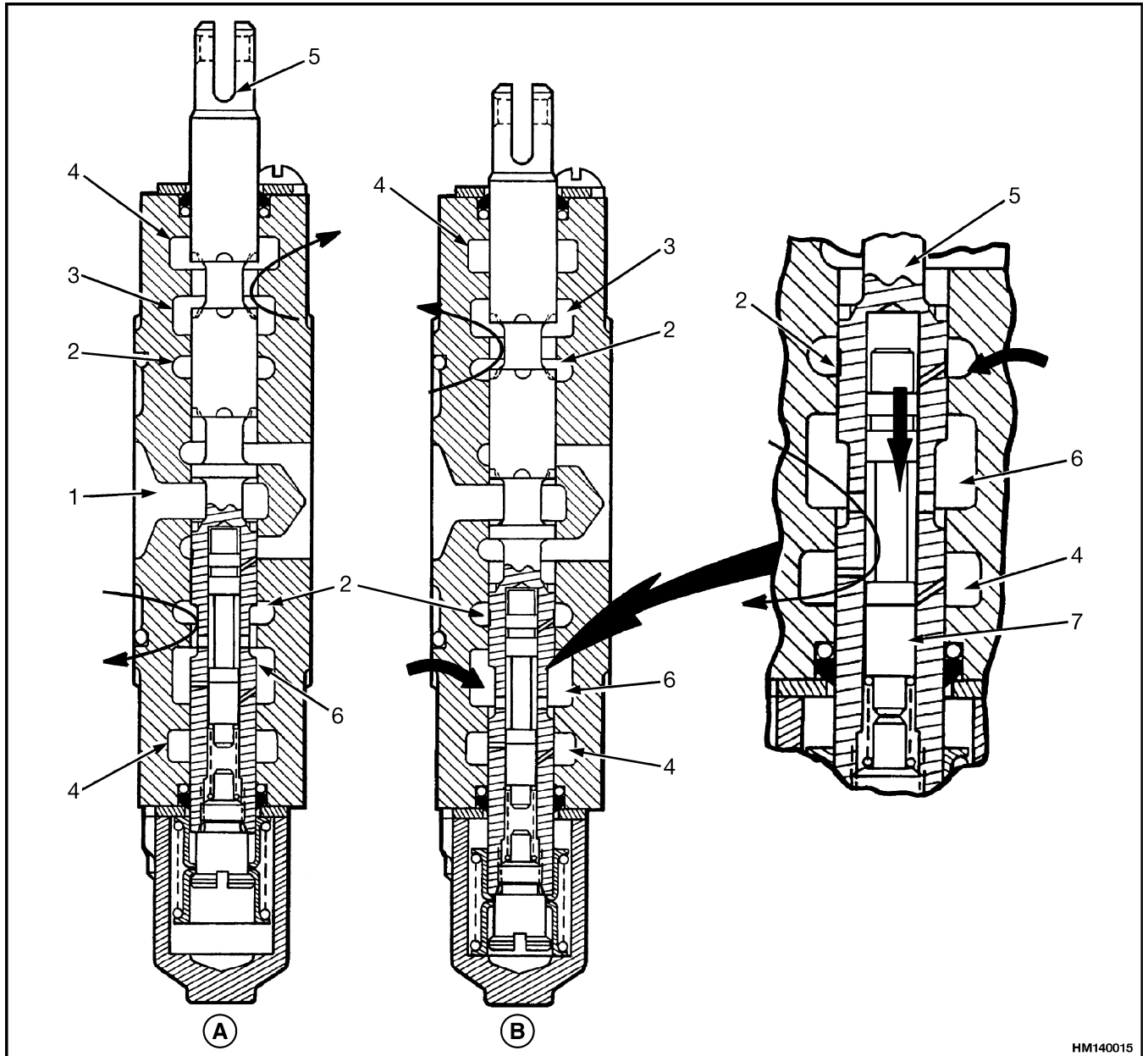
2. Open hood and install cardboard or plywood cover on top of battery to prevent accidental short circuits.
3. Install coupling onto pump shaft. Install pump to motor and tighten capscrews to 31 N•m (23 lbf ft). Connect sling and crane to motor. See Figure 31. Make sure crane and sling have a capacity of approximately 113 kg (250 lb) or more. Use crane to lift hydraulic pump and motor into correct position in motor compartment. Make sure isolator mounts are between motor and chassis bracket. See Figure 32.
4. Connect the temperature and speed sensors (see Figure 33).
5. Connect the power cables as marked during removal. Tighten connections for power cables to 18 to 22 N•m (159.3 to 195.0 lbf in).
6. Keep motor horizontal and secure motor and pump to lift truck frame.
7. Install steer motor and mounting bracket. See the section Steering Pump Repair in this YRM for the procedures.

Legend for Figure 38

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



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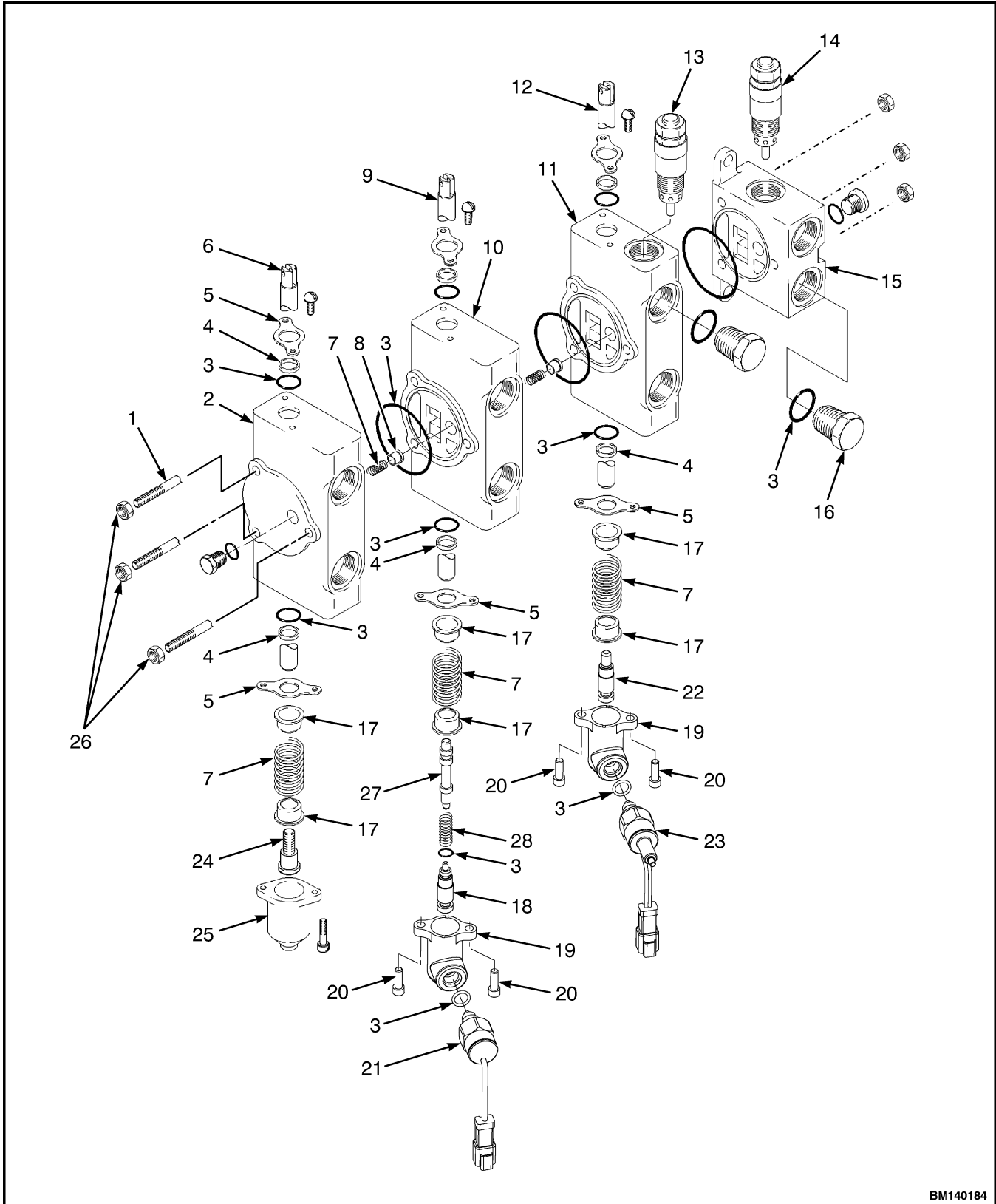
A. TILT BACKWARD

- 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 5. Tilt Spool Operation



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Figure 12. Main Control Valve with OPS

Troubleshooting

PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Slow or no movement of cylinders.	Air is in the hydraulic system.	Remove air from hydraulic system.
	The hydraulic pump is worn or damaged.	Repair or replace hydraulic pump.
	Restriction in the hydraulic lines.	Repair hydraulic lines.
	Cylinder seals are damaged.	Repair cylinders.
	Load is greater than capacity.	Reduce load.
	Linkage is disconnected or damaged.	Repair and adjust linkage for control levers.
	Pressure relief valve(s) is not adjusted correctly or is damaged.	Repair or adjust relief valve(s).
	Large leaks between spool and bore.	Replace valve section.
	Spool is not fully extended or retracted.	Adjust linkage to spool.
	Switch plates are not installed or adjusted correctly.	Check position of switch plates.
	Optical sensors on printed circuit board do not work.	Install new printed circuit board.
Oil leaks at the end of a spool.	Seal for spool is damaged.	Replace seal.
	Spool is damaged.	Replace valve section.
	Valve body is damaged.	Replace valve section.
Hydraulic pressure is above specifications.	Pressure relief valve(s) is not adjusted correctly or is damaged.	Repair or adjust relief valve(s).
	Restriction in return line.	Clean or replace return line or filter.

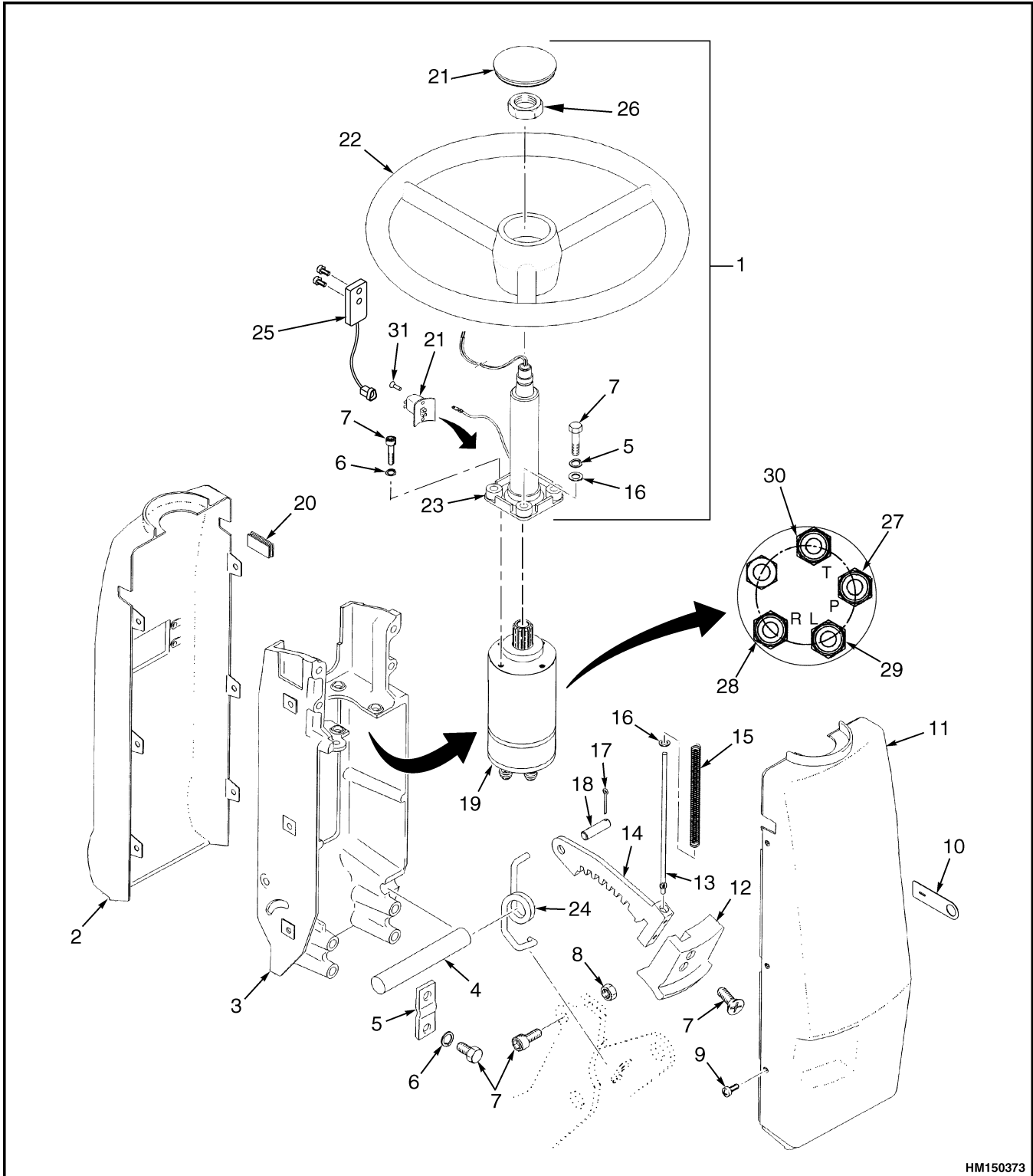


Figure 3. Steering Column Assembly

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PROBLEM	POSSIBLE CAUSE	PROCEDURE OR ACTION
Steering wheel turns the tires in the wrong direction.	The hydraulic lines are not connected correctly at the steering cylinder or at the steering control unit.	Connect lines correctly. Remove air from the system.
The steering operation is not smooth.	The oil level in the tank is low.	Fill tank to the correct level. Check for leaks.
	Air was not removed after repair to the hydraulic system.	Remove air from the system.
	The hydraulic pump is leaking at the inlet.	Fix leaks. Remove air from the system.
The pump motor will not stop operating after steering wheel stops turning.		See Steering Motor Circuits Check.
The power steering pump makes noise that is not normal.	There is not enough oil in hydraulic tank.	Fill the tank to the correct level. Check for leaks.
	Air is entering the system at the inlet side of the pump.	Repair the leaks.
The power steering motor does not operate when the steering wheel is turned.		See Steering Motor Circuits Check.

Display Panel and Key Switch Replacement

DISPLAY PANEL, REPLACE



WARNING

Before replacing the Display Panels, fully lower all parts of the mast and tilt it forward until the tips of the forks touch the ground. This action will prevent the mast from lowering suddenly if the control lever is accidentally moved.

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



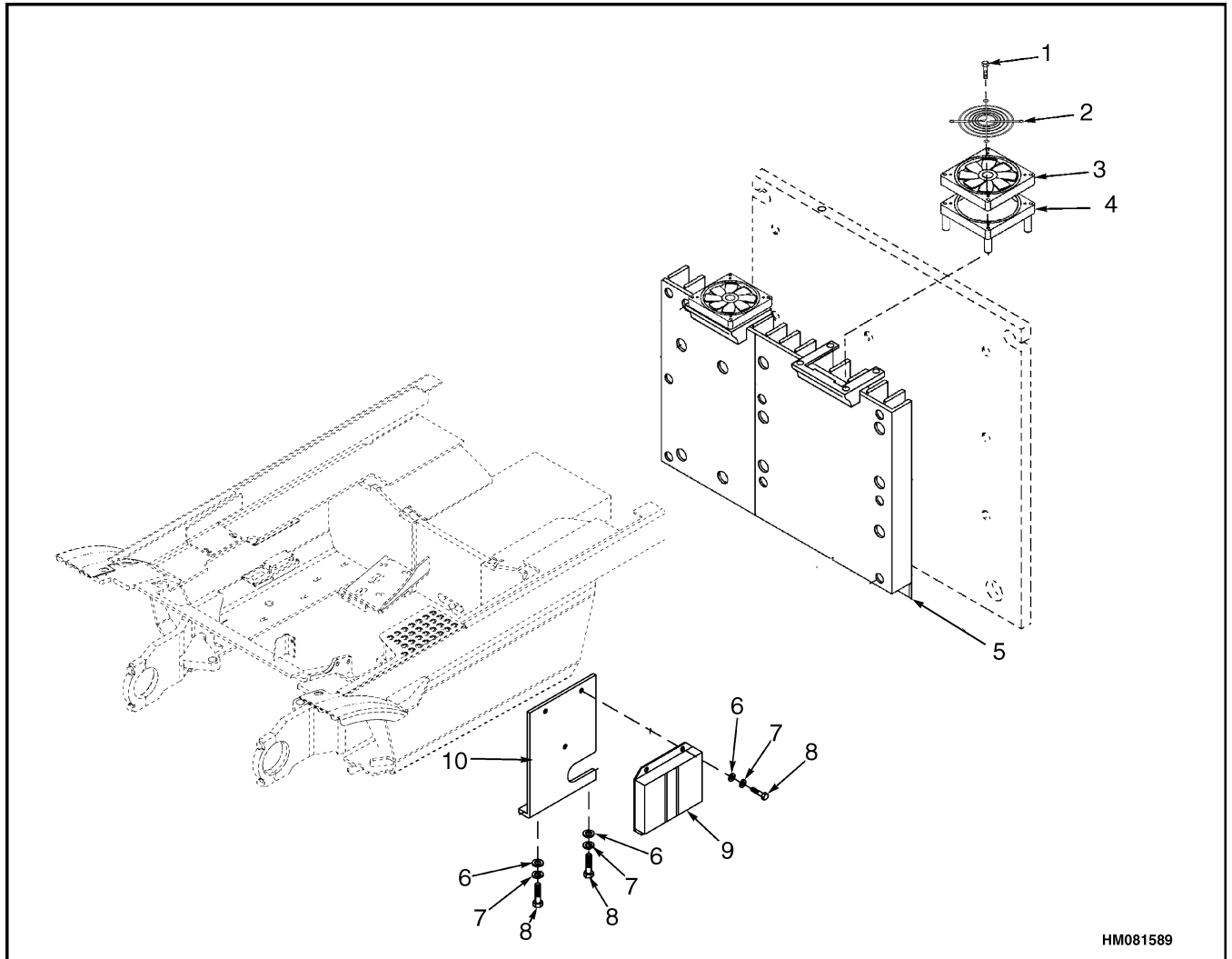
CAUTION

A short circuit and damage can occur if wires are not installed correctly. Make sure wire connectors do not touch the other meter terminals or wire connectors, metal brackets, or the bracket mounting nuts. Make sure the wires are not pulled tight and are not touching other parts to damage the insulation.

The Display Panel is in the dash cover. The Display Panel cannot be repaired and must be replaced if it has

a malfunction. These Display Panels must be replaced as a unit. See Figure 2.

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 two nuts that fasten the Display Panel and mount bracket. See Figure 2. Remove the nuts and bracket. Lift the Display Panel up and out of the instrument panel.
3. Disconnect the plug connector on the back of the Display Panel.
4. On the replacement Display Panel, install the plug connector on the back of the Display Panel.
5. Put the replacement Display Panel back into the instrument panel.
6. Install the mounting bracket and mounting nuts. Tighten the nuts that fasten the Display Panel in the instrument panel.



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- | | |
|--------------|----------------------|
| 1. SCREW | 6. WASHER |
| 2. GUARD | 7. LOCKWASHER |
| 3. FAN | 8. CAPSCREW |
| 4. SPACER | 9. MASTER CONTROLLER |
| 5. HEAT SINK | 10. BRACKET |

Figure 10. AC Master Controller for ERCIP16-20AAF (ERC030-040AH) (B814/C814) and ERC20-32AGF (ERC040-065GH) (A908)

Legend for Figure 21

NOTE: FOR CORRECT CONNECTION, SEE THE **ELECTRICAL DIAGRAMS, AC MOTOR CONTROL SYSTEM** 8000 YRM 1059 FOR LIFT TRUCK MODELS ERC20-32AGF (ERC040-065GH) (A908), ERC/P16-20AAF (ERC030-040AH) (B814/C814), AND ERP20-30ALF (ERP040-060DH) (D216). SEE **ELECTRICAL DIAGRAMS, AC MOTOR CONTROL SYSTEM** 8000 YRM 1225 FOR LIFT TRUCK MODELS ERP20-32ALF (ERP040-065DH) (E216). SEE **DIAGRAMS, AC MOTOR CONTROL SYSTEM** 8000 YRM 1203 FOR LIFT TRUCK MODELS ERC35-55HG (ERC70-120HH) (B839/C839).

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. ON-DEMAND STEERING COMPONENTS 2. UPPER ACCESS COVER 3. BRACKET 4. PIVOT (STEERING) SHAFT 5. PLATE 6. LOCKWASHER 7. CAPSCREW 8. LOCK NUT 9. SCREW 10. STATIC GROUND PATCH 11. LOWER ACCESS COVER 12. COLUMN TILT LEVER 13. PUSH ROD 14. LATCH 15. SPRING 16. WASHER | <ol style="list-style-type: none"> 17. COTTER PIN 18. PIN 19. STEERING CONTROL UNIT 20. PLUG (WITHOUT TURN SIGNAL) 21. HORN SWITCH AND HORN BUTTON 22. STEERING WHEEL 23. STEERING COLUMN 24. RETURN SPRING 25. STEERING SENSOR 26. LARGE HEX NUT 27. INPUT 28. RIGHT TURN 29. LEFT TURN 30. RETURN 31. PLASTIC RIVET |
|--|--|

BRAKE FLUID SWITCH, REPLACE

NOTE: The information below does not apply to lift truck models ERC35-55HG (ERC70-120HH) (B839/C839).

This switch is a magnetic switch on the reservoir of the master cylinder for the service brakes. It sends a signal to the control card of the display panel to illuminate the indicator for low fluid level. The switch is part of the reservoir, and is not replaced separately. To replace the reservoir, see the **Brake System** YRM for your lift truck model.

BRUSH WEAR AND OVER TEMPERATURE SENSORS (DC PUMP MOTOR ONLY)

NOTE: The information below does not apply to lift truck models ERC35-55HG (ERC70-120HH) (B839/C839).

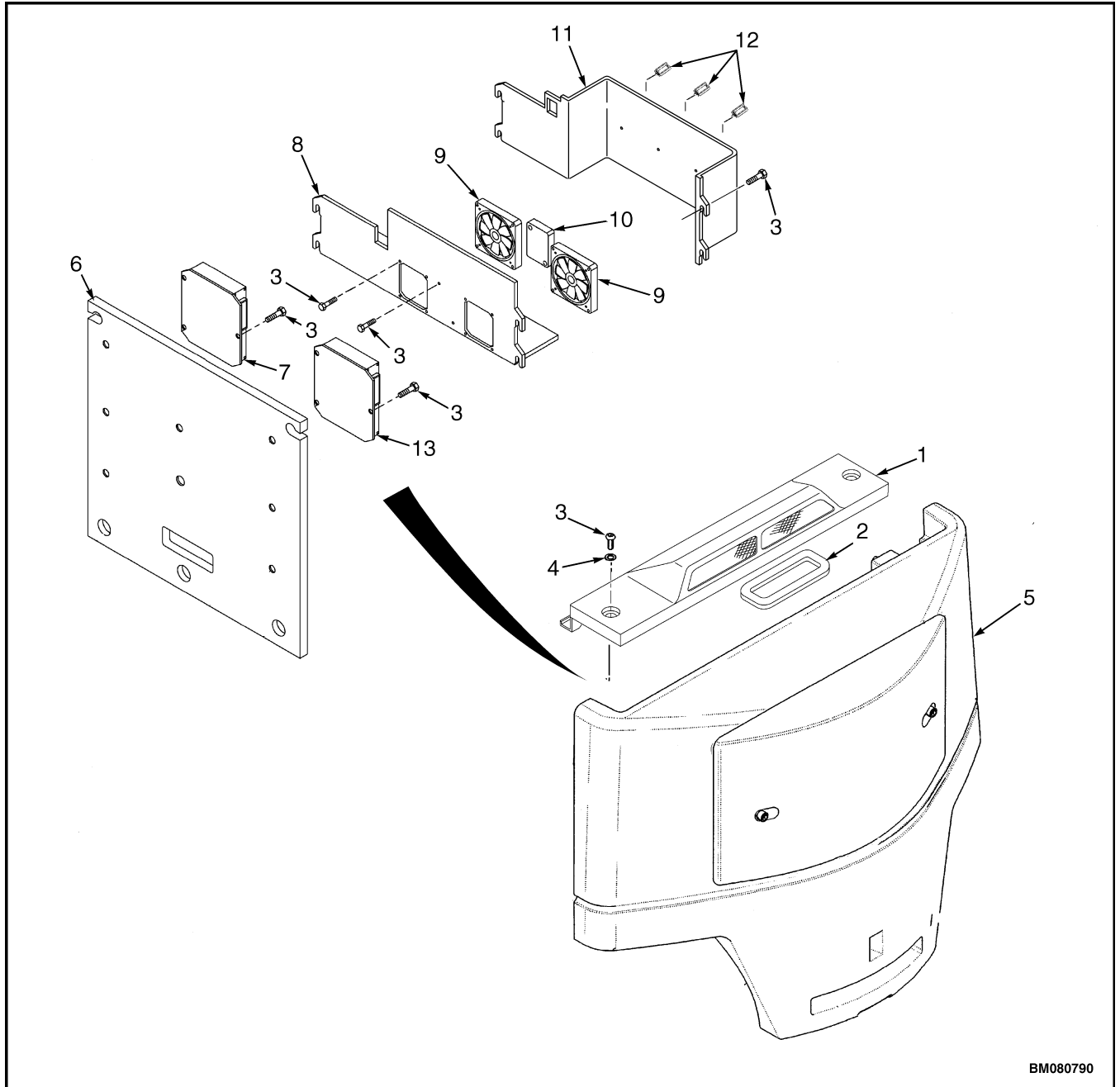
On the DC Pump Motor, which is standard on ERP20-30ALF (ERP040-060DH) (D216), ERP20-32ALF (ERP040-065DH) (E216), ERC/P16-20AAF (ERC030-040) (B814/C814), and ERC20-32AGF (ERC040-065GH) (A908), when brush wear is detected, the dash display shows a status code of **Code 95** to indicate that the brushes need to be replaced. See **DC Motor Maintenance** 620 YRM 294.

The over temperature sensors are thermal switches. These switches are in the lift pump motors. They send a signal to the master controller. The dash display shows a status code of **Code 91** to indicate that the motor is too hot. The master controller sends a signal to the traction control for a slower travel speed if the pump motor is too hot.

ROCKER SWITCHES FOR LIGHTS, REPLACE

These switches are ON/OFF switches that control the optional front, rear, and operator compartment lights. See Figure 22. Rocker switches for the lights are mounted to the instrument panel to the right of the steering column. Replace a switch as described in the following paragraphs:

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. Put tags on the switch wires or wire harness for correct identification during installation. Remove the wires from the switch terminals.



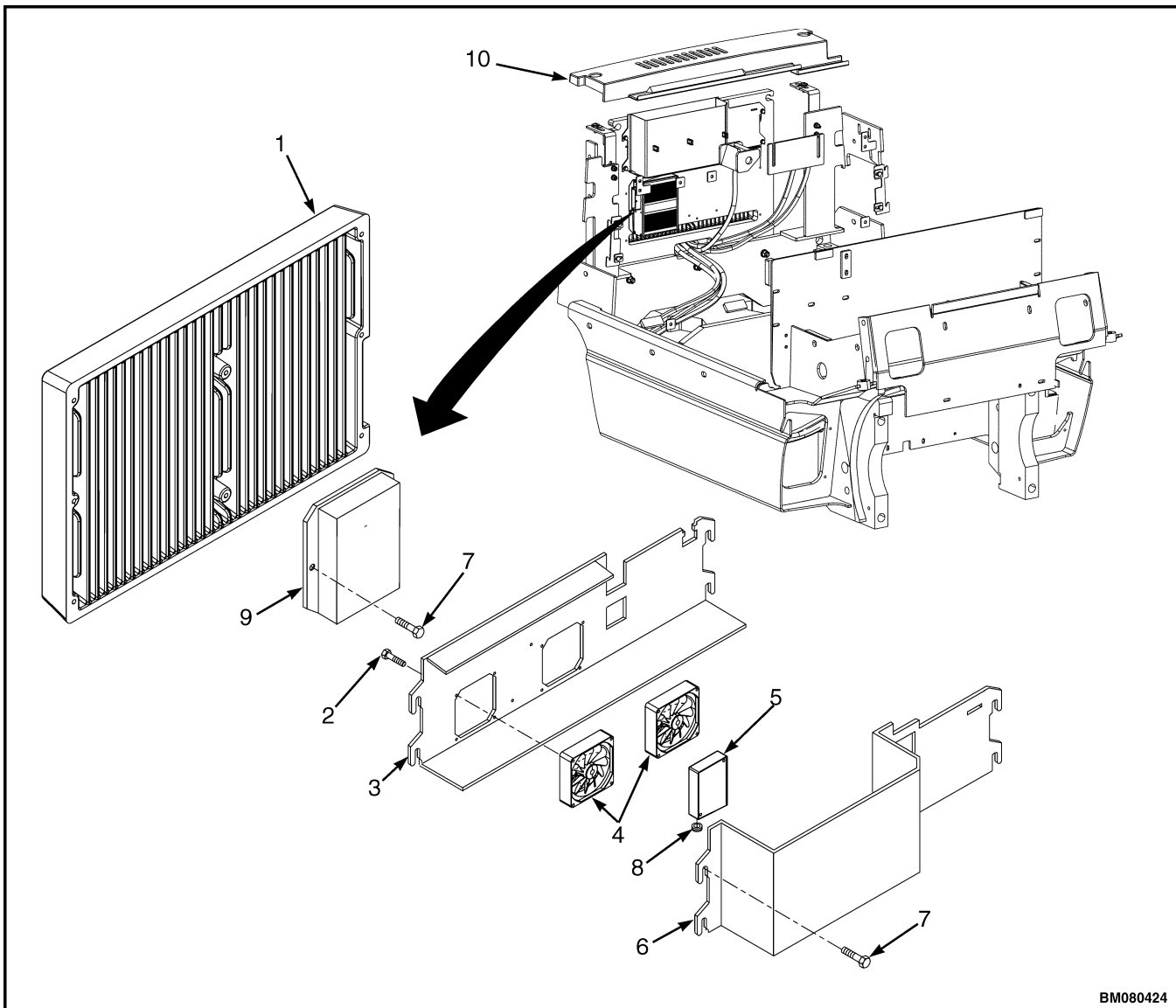
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- | | |
|------------------------|-----------------------|
| 1. COUNTERWEIGHT COVER | 8. FAN MOUNTING PLATE |
| 2. SEAL | 9. FANS |
| 3. CAPSCREW | 10. FAN POWER SUPPLY |
| 4. WASHER | 11. FAN COVER PLATE |
| 5. COUNTERWEIGHT | 12. CLIPS |
| 6. MOUNTING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

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

Remove, Lift Truck Models ERP20-30ALF (ERP040-060DH) (D216) and ERP20-32ALF (ERP040-065DH) (E216)

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 counterweight cover located between the hood and the counterweight. See Figure 37.
3. Loosen capscrews and remove fan cover.
4. Disconnect fan power supply from master controller. Remove grommet that attaches fan power supply to plate. Remove power supply from lift truck.



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- | | |
|-----------------------|-------------------------|
| 1. MOUNTING PLATE | 6. FAN COVER |
| 2. SCREW | 7. CAPSCREW |
| 3. PLATE | 8. GROMMET |
| 4. FAN PLATE ASSEMBLY | 9. MASTER CONTROLLER |
| 5. POWER SUPPLY | 10. COUNTERWEIGHT COVER |

Figure 37. Fan Power Supply for ERP20-30ALF (ERP040-060DH) (D216) and ERP20-32ALF (ERP040-065DH) (E216) Lift Truck Models

parallel arrangement so that both direction contactors cannot be energized at the same time.

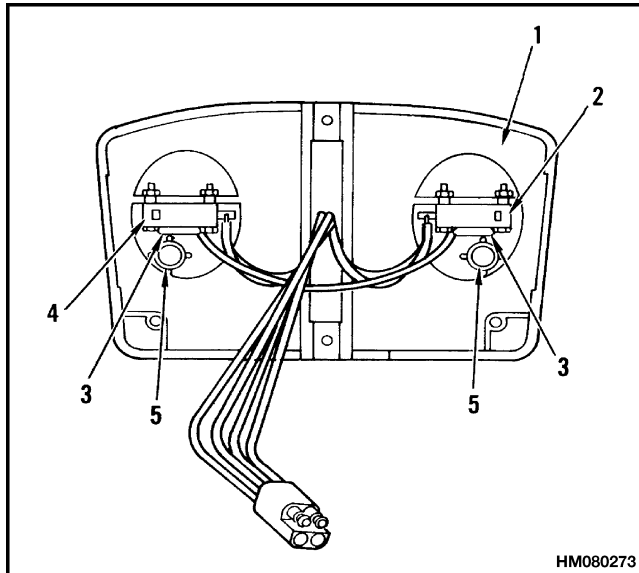


Figure 45. Foot Directional Control Pedal

Legend for Figure 45

1. PEDAL PAD
2. FORWARD DIRECTION SWITCH
3. CAPACITOR
4. REVERSE DIRECTION SWITCH
5. SPRING

STEERING COLUMN

The controller includes logic circuits for an optional direction control on the steering column. See Figure 20. The Forward and Reverse switches complete the circuit for the controller card to energize the Forward or Reverse contactors.

Check that the direction switches operate correctly by operating the lift truck in the forward and reverse directions. If the lift truck operates correctly, the switches are good. See Foot Directional Control Pedal Direction Switches, Replace and Steering Column Direction Control Switches, Replace for the replacement of direction switches. There is no adjustment for these switches.

Foot Directional Control Pedal or Accelerator Pedal Adjustment



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 the section 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 models ERC35-55HG (ERC70-120HH) (B839/C839) to raise the drive wheels.

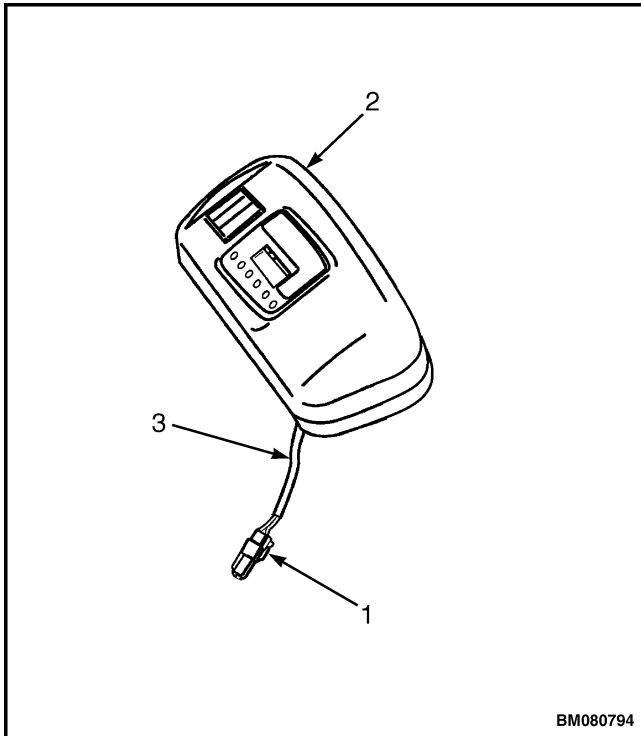
Never have any metal on your fingers, arms, or neck. These metal items can accidentally make an electrical connection and cause an injury.

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

If the unit has a Foot Directional Control pedal, there are direction switches that must be correctly adjusted.

There is also a start switch for the Foot Directional Control pedal or accelerator pedal. There is also an accelerator position sensor for either pedal. Adjust the pedal movement in this procedure before adjusting the switches. See Start Switch Adjustment and Accelerator Position Sensor Adjustment of this section to adjust these parts.

The movement of the Foot Directional Control pedal or accelerator pedal must be correctly adjusted before the start switch or accelerator position sensor is adjusted. The floor plate must be in position to check or adjust the pedal movement. Push the pedal down. Check that the pedal arm is against the down stop when the pedal is within 0.2 mm (0.08 in.) of the floor plate. If adjustment is necessary, loosen the bolts that fasten the pedal mount plate to the frame. See Figure 19. The bolts must be tight enough to hold the position, but loose enough to permit plate movement. Move the plate to the maximum UP position and install the floor plate. Slowly push down on the pedal until it touches the down stop. Continue to push the pedal down to move the plate until the pedal is within 0.2 mm (0.08 in.) of the floor plate. See Figure 19. Tighten the bolts without changing the plate position. Check that the adjustment is still correct.

*Legend for Figure 1*

1. DIAGNOSTIC CONNECTOR
2. DASH DISPLAY
3. DASH WIRE HARNESS

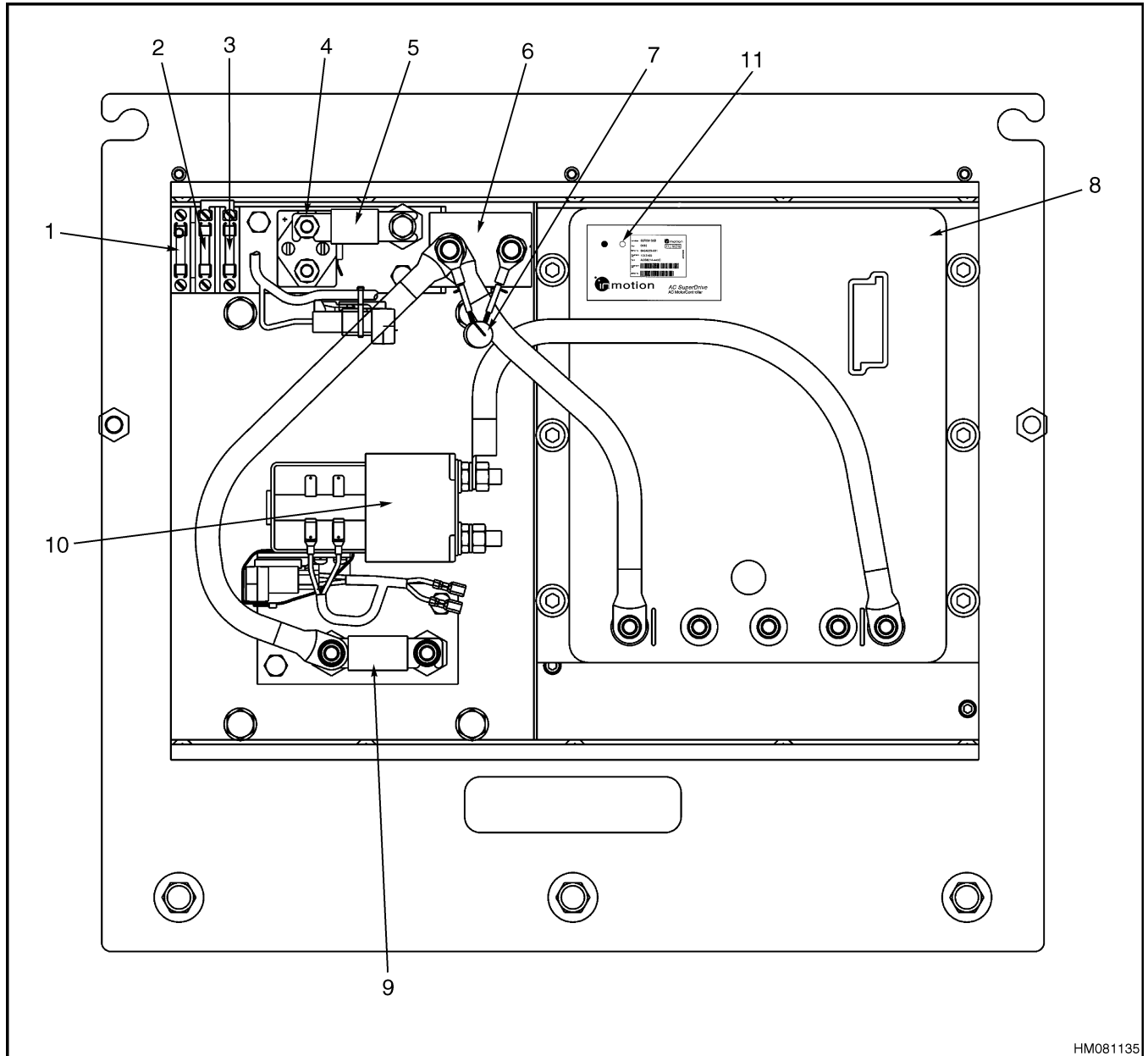
Figure 1. Diagnostic Connector

Master Controller Checks and Adjustments

NOTE: All checks and adjustments to the master controller can be done with a personal computer (PC) that has the ETACC service software installed. See **Troubleshooting and Adjustments Using the AC Controls Program (ETACC)** 2200 YRM 1058 for software installation procedures. A diagnostics connector in the wiring harness below the display panel can connect the PC to the CANbus system to communicate to the master controller (see Figure 1). Many checks can also be done at the display panel without being connected to a PC.

The following checks and adjustments may be made using a PC or the dash display:

- Check the system status codes history.
- Check the state of charge of the battery.
- Check the hourmeter readings on the traction circuit and hydraulic pump controllers.
- Monitor or adjust the register values for each function as shown in Table 1, Table 2, and Table 3.



- | | |
|--|--|
| 1. FUSE 7 (15A) AUXILIARY TERMINAL STRIP | 7. POSITIVE TEMPERATURE COEFFICIENT RESISTOR (PTC) |
| 2. FUSE 5 (15A) LIGHTS | 8. AC TRACTION MOTOR CONTROLLER |
| 3. FUSE 3 (5A) KEY SWITCH | 9. FUSE 2 (325A) PUMP |
| 4. POWER STEERING CONTACTOR | 10. CONTACTOR FOR DC PUMP MOTOR |
| 5. FUSE 4 (40A) POWER STEERING | 11. LED INDICATOR |
| 6. LINE CONTACTOR | |

Figure 6. AC Traction Motor Controller and Contactor Control for DC Lift Pump Motor (72v/80v) (Gen IV) for Early Model ERP20-30ALF (ERP040-060DH) (D216) and ERC20-32AGF (ERC040-065GH) (A908) Lift Trucks

Status Code	Description	Memory Recall	Circuit
13	Brake Pressure is out of range	No	Traction
<p>Symptom Top speed reduced to half</p> <p>Possible Causes and Test Procedures</p> <ul style="list-style-type: none"> Failed sensor Check wiring for damage. Replace sensor. 		<p style="text-align: right;">HM140160</p>	

Status Code	Description	Memory Recall	Circuit										
15	Battery voltage is too low or truck is adjusted to the wrong battery voltage.	No	Traction										
<p>Symptom Lift truck does not move.</p> <p>Possible Causes and Test Procedures</p> <ul style="list-style-type: none"> Discharged battery. Check battery for correct open circuit voltage. Correct voltages are listed on right. Charge battery if required. Battery is damaged. Check each battery cell for correct voltage (greater than 1.85 volts each cell). Replace or repair battery. Incorrect master controller adjustment. Check the battery volts setting in the master controller for the correct battery volts. Check the battery volts on the main power cables at the motor controllers. 		<table border="1"> <thead> <tr> <th>NOMINAL BATTERY VOLTAGE</th> <th>MINIMUM LIMIT VOLTS AT 1.85 VDC PER CELL</th> </tr> </thead> <tbody> <tr> <td>36</td> <td>33.3</td> </tr> <tr> <td>48</td> <td>44.4</td> </tr> <tr> <td>72</td> <td>66.6</td> </tr> <tr> <td>80</td> <td>74.0</td> </tr> </tbody> </table> <p style="text-align: right;">HM080939</p>		NOMINAL BATTERY VOLTAGE	MINIMUM LIMIT VOLTS AT 1.85 VDC PER CELL	36	33.3	48	44.4	72	66.6	80	74.0
NOMINAL BATTERY VOLTAGE	MINIMUM LIMIT VOLTS AT 1.85 VDC PER CELL												
36	33.3												
48	44.4												
72	66.6												
80	74.0												

Status Code	Description	Memory Recall	Circuit
69	Current to the pump line contactor coil is too high during operation.	No	Traction
<p>Symptom Lift truck does not move. If fault occurred during truck operation, status code will not display until the key switch is cycled to OFF and then to ON again.</p> <p>Possible Causes and Test Procedures</p> <ul style="list-style-type: none"> • Pump line contactor coil or wire to coil has a short. Check the coil resistance with wires disconnected. Approximate coil resistance, at room temperature, should be: 36/48 volt trucks 31 ohms 72/80 volt trucks 85 ohms • If status code is displayed while contactor coil wires are disconnected, the fault is probably in master controller. 		<p style="text-align: right;">BM220071</p>	

Status Code	Description	Memory Recall	Circuit
70	Current to brake light relay is too high during operation.	No	Traction
<p>Symptom Lift truck does not move. If fault occurred during truck operation, status code will not display until the key switch is cycled to OFF and then to ON again.</p> <p>Possible Causes and Test Procedures</p> <ul style="list-style-type: none"> • Brake light relay coil or wiring may have a short. Check the coil resistance with the wires disconnected. The approximate resistance is 160 ohms. • If status code is displayed while relay coil wires are disconnected, the fault is probably in master controller. 			

Status Code	Description	Memory Recall	Circuit
76	Capacitor voltage too high.	No	Traction
<p style="text-align: center;">Symptom Lift truck does not work.</p> <p style="text-align: center;">Possible Causes and Test Procedures</p> <ul style="list-style-type: none"> • Regen setting too high. Combination of a fully charged battery and a high regen setting may cause status code. 			

GENERAL MAINTENANCE INSTRUCTIONS

The motor controllers, like other electronic devices, have temperature limits. These devices can be damaged if they get too hot. Normal maintenance will help prevent high-temperature conditions. Always make sure motor controllers are installed using heat sink compound and that all heat sink surfaces are clean. **DO NOT** block cooling airflow.

Special Precautions

WARNING

To avoid injury and prevent electrical shock, perform the following steps before troubleshooting, adjustments, or repair:

- Turn the key switch to the **OFF** position and disconnect the battery connector.
- Discharge the capacitors in the controllers by pushing and holding the horn button down until the horn stops making a sound.

CAUTION

To help prevent controller damage:

- **ALWAYS** disconnect the battery when servicing the controllers.
- **ALWAYS** discharge the capacitors before performing any service.
- **NEVER** make a short circuit at any motor controller terminal to battery (+), battery (–), or the frame.
- Remove the motor controllers before performing any authorized welding procedures.

Never add any electrical component to the lift truck without approval from your dealer for your lift truck. Other electrical components can prevent operation and/or damage the motor controller.

NEVER USE STEAM TO CLEAN ELECTRONIC COMPONENTS.

In dusty areas, blow low-pressure air over the controller to remove dust. In oily or greasy areas, a mild solution of detergent or denatured alcohol can be used to wash off the controller; and then, low-pressure air should be used to completely dry the controller.

For the controller to be most effective, it must be mounted against the finned aluminum heat sink. During installation of the controller, apply a sufficient layer

of silicone (heat transfer) grease, Yale P/N 504223239, between the controller and the heat sink to not allow air gaps between the two.

Controller wire plugs and other exposed transistor controller parts should be kept free of dirt and paint that might change the effective resistance between points.

CAUTION

DO NOT operate the traction system at high speed or rapidly change direction of operation with the wheels raised. Motor controller damage can occur.

DO NOT subject the controller to any high voltage (hipot or megger) testing.

Use a lead acid battery with the voltage and ampere hour rating specified for the lift truck. Follow normal battery maintenance procedures, recharging at 80 percent discharge, with monthly equalizing charges.

Parts of these assemblies not covered in this manual cannot be repaired and must be replaced if they malfunction. The contactors are serviceable.

WARNING

Some checks in this section must be done with the battery connected and power applied to the controller. When making these checks, make sure the drive wheels are raised from the floor. See procedures given in the Periodic Maintenance Manual or the Operating Manual for your lift truck.

Make sure you disconnect the battery and separate the connector before you remove any power cables from the power terminals of the motor controller. The capacitor stores electrical energy and can cause injury, if a person discharges a capacitor, to parts of the body. **AFTER** the battery is disconnected and the key switch is in the **OFF** position, make sure you also discharge the capacitors.

Discharge the capacitors in the controllers by pushing and holding the horn button down until the horn stops making a sound.

NOTE: The bolts and screws connected to the electronic components are normally metric sizes.

Make sure that you use the correct fastener for the part that has been disassembled or removed.

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

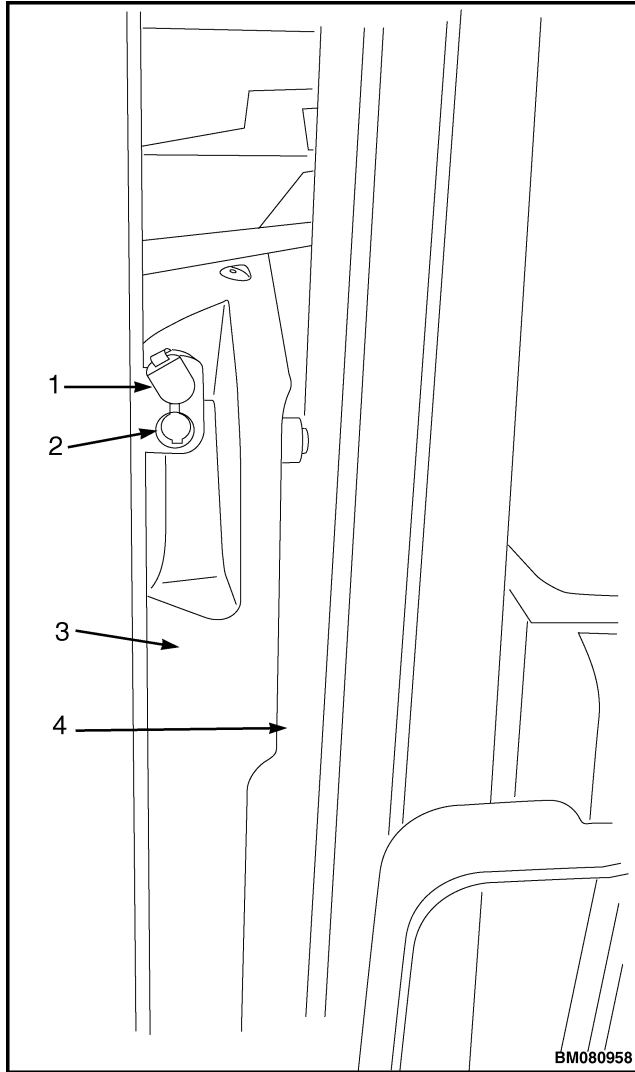
TRACTION HOURMETER

PUMP HOURMETER

SECURE HOURMETER



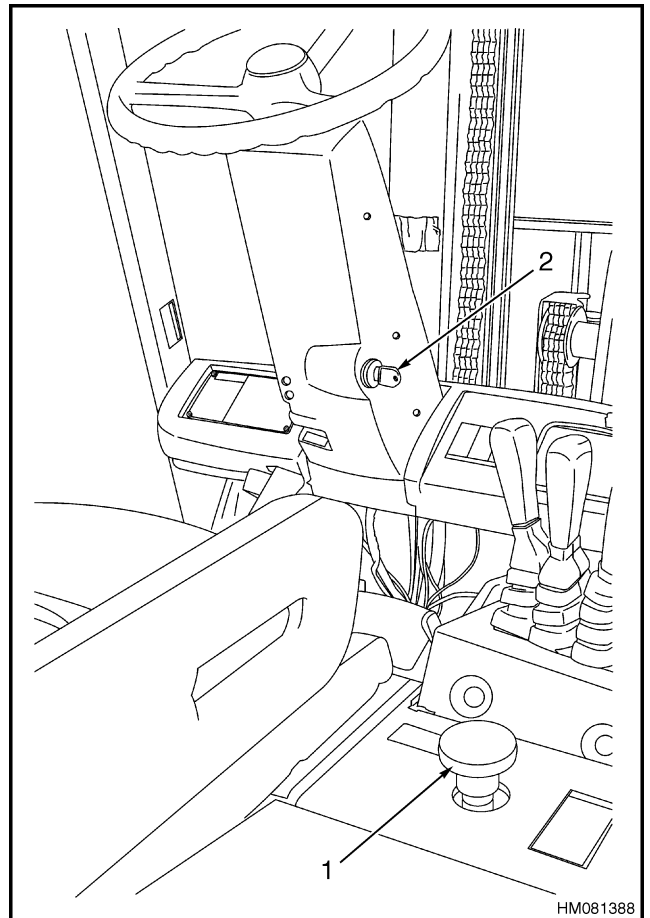
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1. ETACC CONNECTOR (CAP INSTALLED)
2. 12V POWER CONNECTION
3. FRONT FRAME COVER (RH)
4. MAST

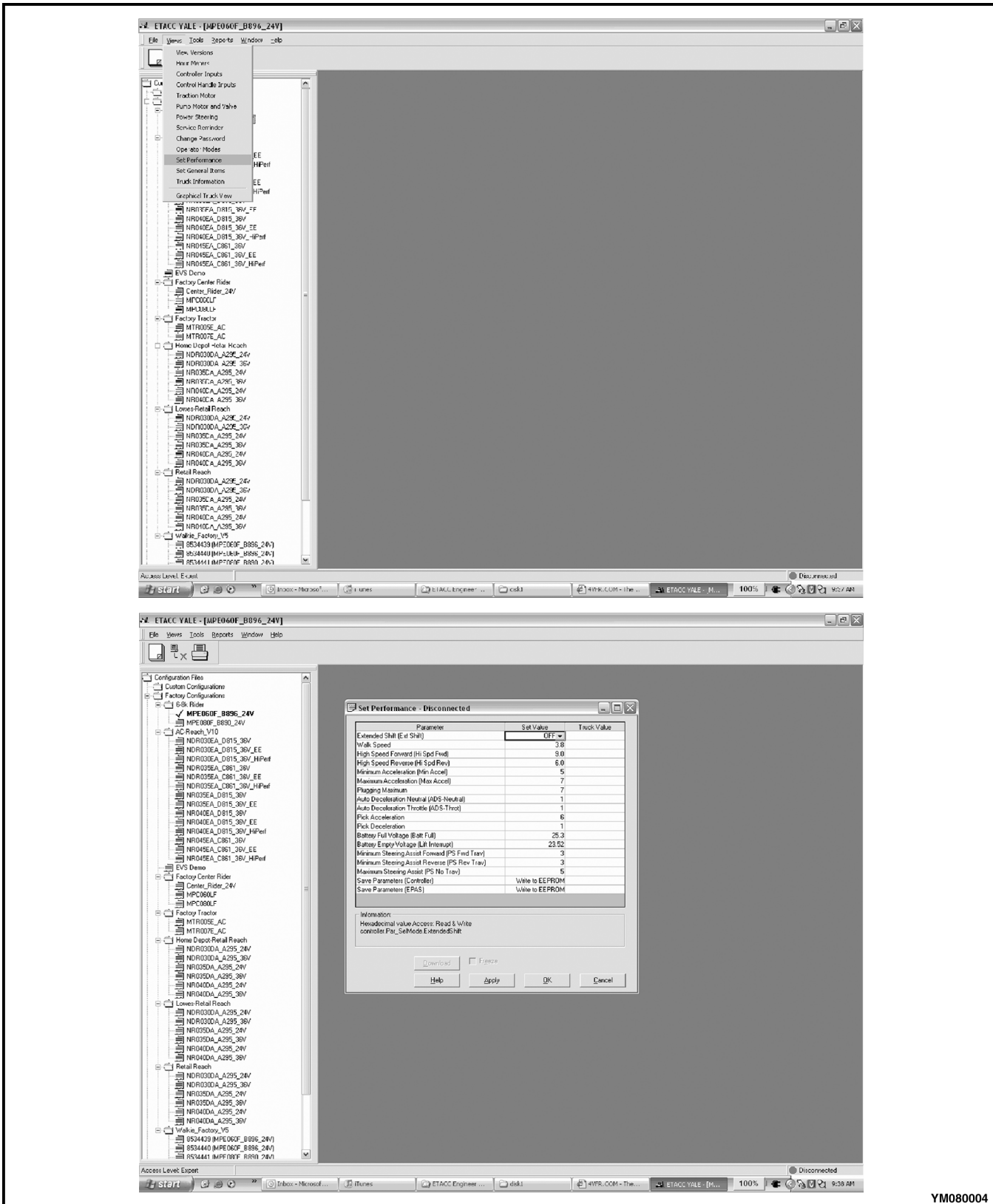
Figure 6. NDR030DA, NR035/040DA, NDR030/035EA, and NR030/040/045EA [A295, C861, and D815] ETACC Connector

5. Connect the battery connector, or lift the red battery disconnect button, if the lift truck is so equipped. See Figure 7.
6. Turn the key switch to the **ON** position. See Figure 7.



1. BATTERY DISCONNECT SWITCH
2. KEY SWITCH

Figure 7. Power Switches - ERP20-30ALF (ERP040-060DH) [D216/E216] Models Only



YM080004

Figure 17. View Menu Factory Setup - MPE080-F (B890), MPE060-F (B896), MPC060-F (B904), MPE080-F (B905), MTR005-F (B902), MTR007-F (B903), MPE060-VG (A292), and MPE080-VG (A287)

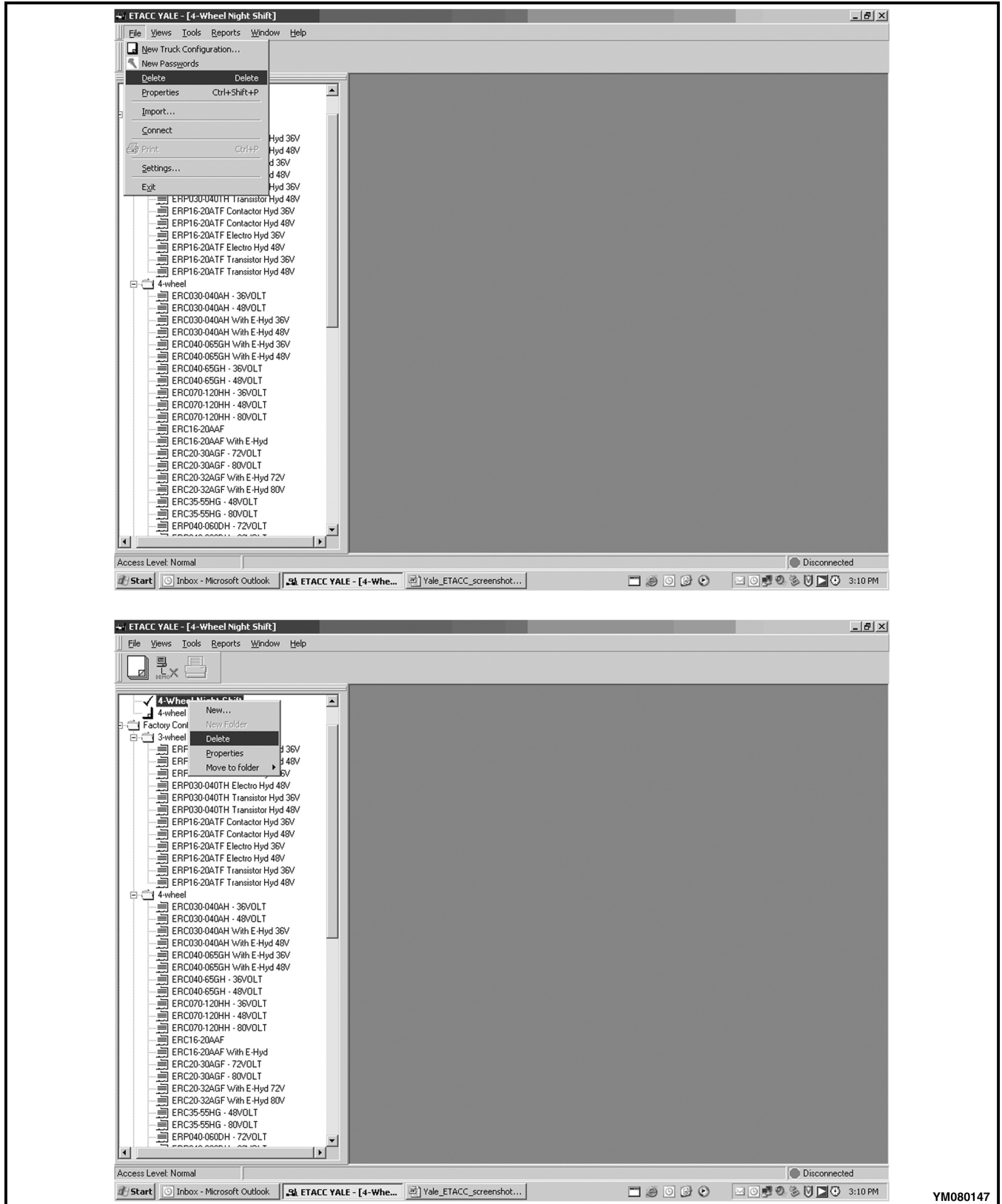
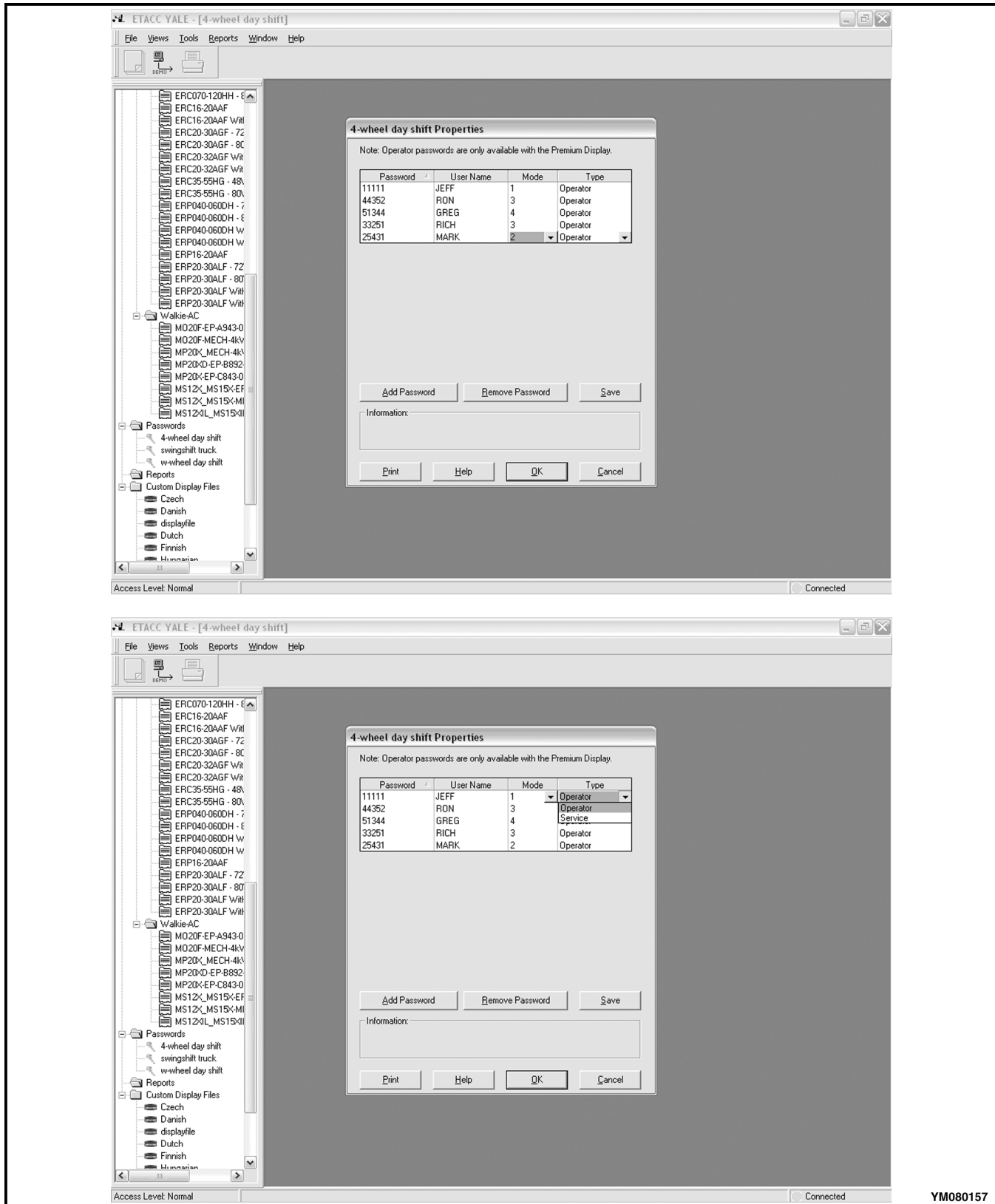


Figure 26. Delete Configuration



YM080157

Figure 35. Password File Editing

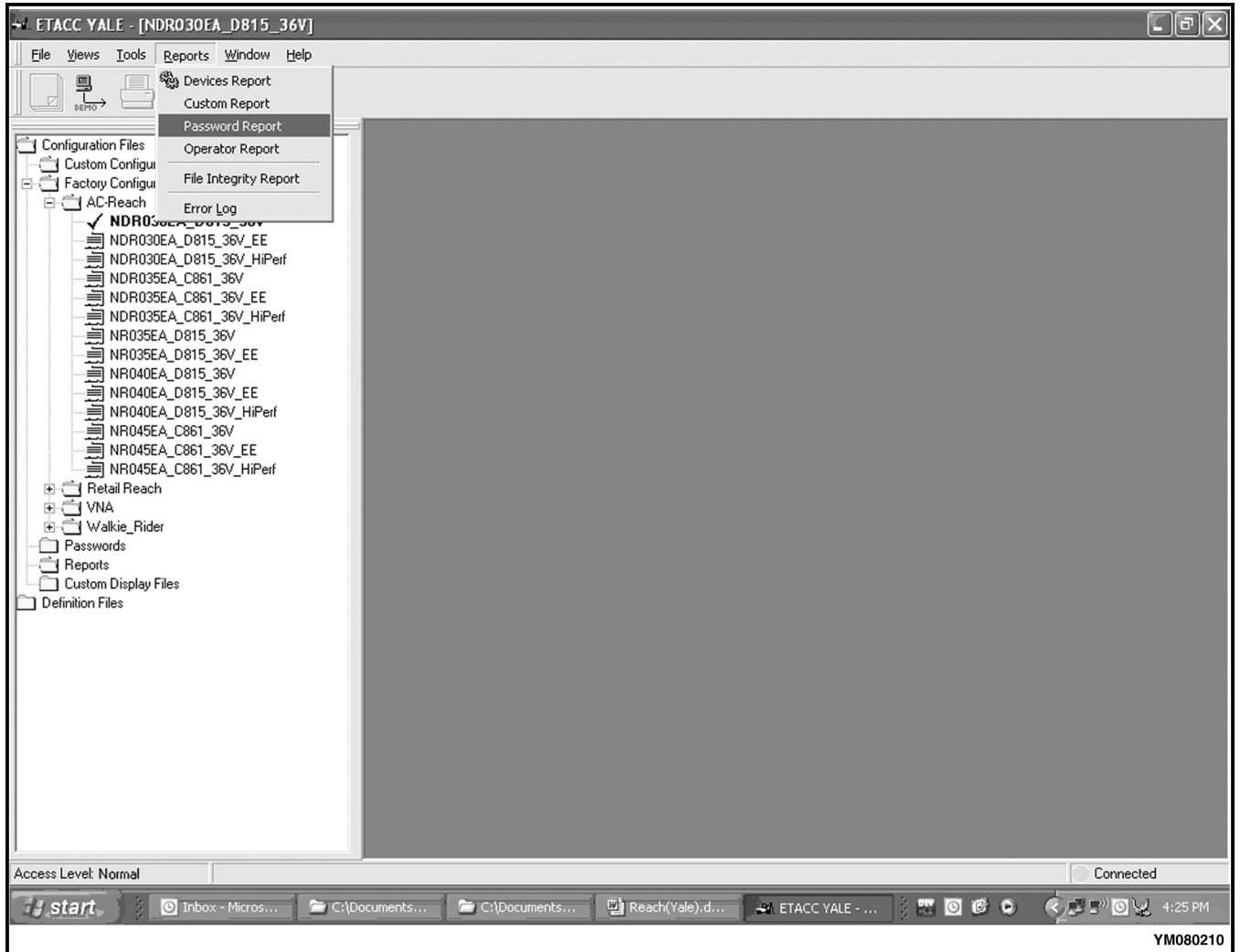


Figure 45. Reports Menu, Passwords for Lift Truck Models NDR030DA, NR035/040DA (A295); NDR035EA, NR045EA (C861); and NDR030EA, NR035/040EA (D815)

ETACC YALE - [ERC030-040AH - 36VOLT] - [Status Code Report - 4/19/2006 7:30:30 AM]

File Views Tools Reports Window Help

Configuration Files

- Custom Configurations
 - 3-wheel
 - 4-Wheel Night Shift
 - 4-wheel special
- Factory Configurations
 - 3-wheel
 - ERP030-040TH Contactor Hyd 36V
 - ERP030-040TH Contactor Hyd 48V
 - ERP030-040TH Electro Hyd 36V
 - ERP030-040TH Electro Hyd 48V
 - ERP030-040TH Transistor Hyd 36V
 - ERP030-040TH Transistor Hyd 48V
 - 4-wheel
 - ERC030-040AH - 36VOLT**
 - ERC030-040AH - 48VOLT
 - ERC030-040AH With E-Hyd 36V
 - ERC030-040AH With E-Hyd 48V
 - ERC040-065GH With E-Hyd 36V
 - ERC040-065GH With E-Hyd 48V
 - ERC040-65GH - 36VOLT
 - ERC040-65GH - 48VOLT
 - ERC070-120HH - 36VOLT
 - ERC070-120HH - 48VOLT
 - ERC070-120HH - 80VOLT
 - ERC16-20AAF
 - ERC16-20AAF With E-Hyd
 - ERC20-30AGF - 72VOLT
 - ERC20-30AGF - 80VOLT
 - ERC20-32AGF With E-Hyd 72V
 - ERC20-32AGF With E-Hyd 80V

Status Code Report

Truck Type Name	Truck Type Article Number
CB 4-wheel	P43071V210P4b

Device Name	Node ID	Article Number
Master Control	1	69U03501C21
Display	3	69Y20002C04
Valve Controller	5	V101
Traction Motor Control	7	69Y05101C16
Pump Motor Control	8	69Y05101C16

Individual data	Value
Parameter	Value
Serial Number	A123B12345C
Secure Hours	200 Hour
Traction Hours	250 Hour
Pump hour	125 Hour

Status Codes Log	Code	Time [hour:min:sec]	Description
	41	2002:00:00	Traction control temperature too high
	42	3602:00:00	Pump control temperature too high
	55	6000:00:00	Dash display no respond
	8	8000:00:00	Accelerator voltage too low

Help Export Save Print Close

Access Level: Normal Connected

Start | Inboxes - Microsoft Outlook | Yale_ETACC_screenshot... | ETACC YALE - [ERC030... | 7:30 AM

YM080167

Figure 55. Truck Status Code Report

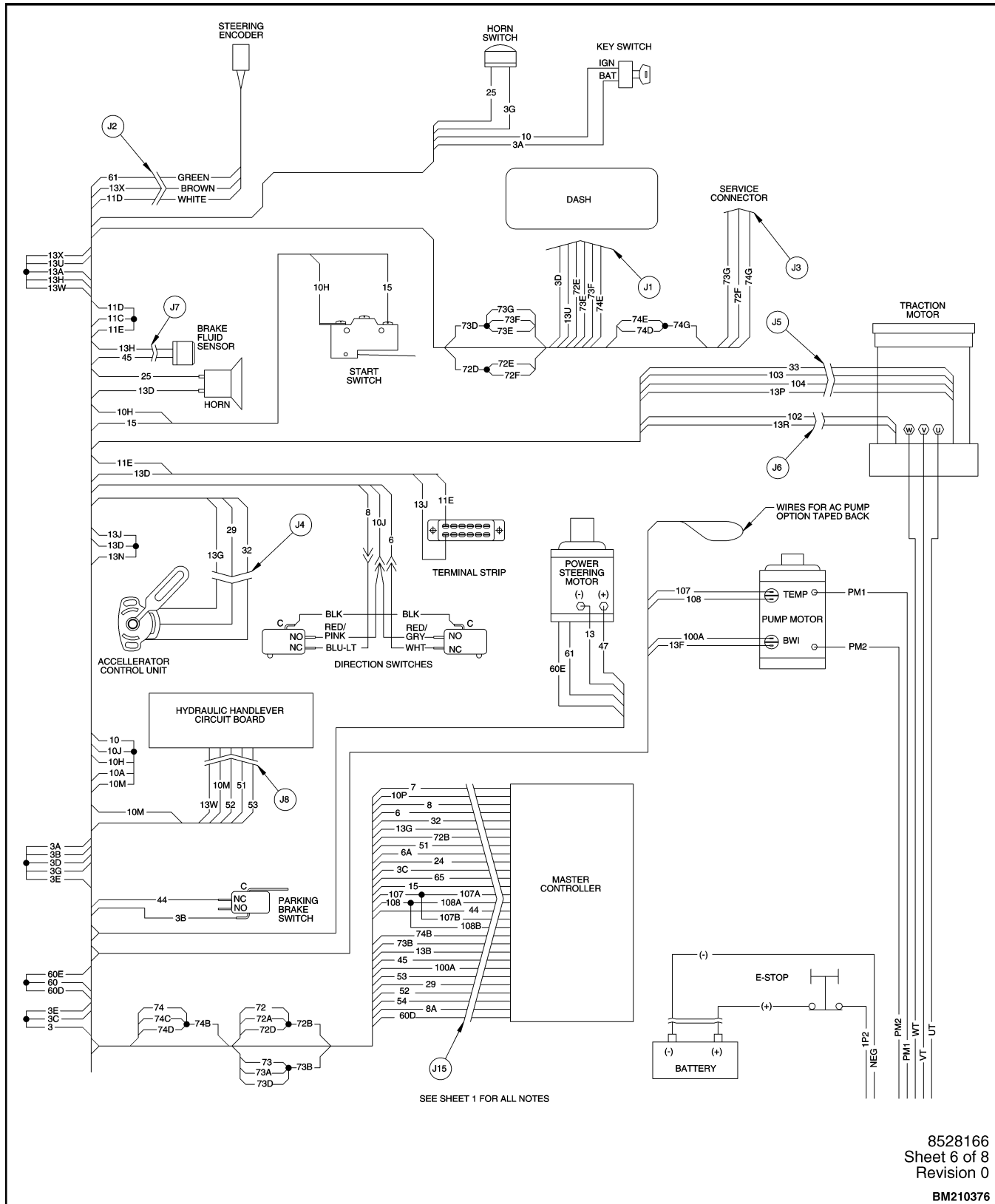


Figure 1. Wiring Schematic Diagram for ERP20-30ALF (ERP040-060DH) (D216) (Sheet 6 of 8)

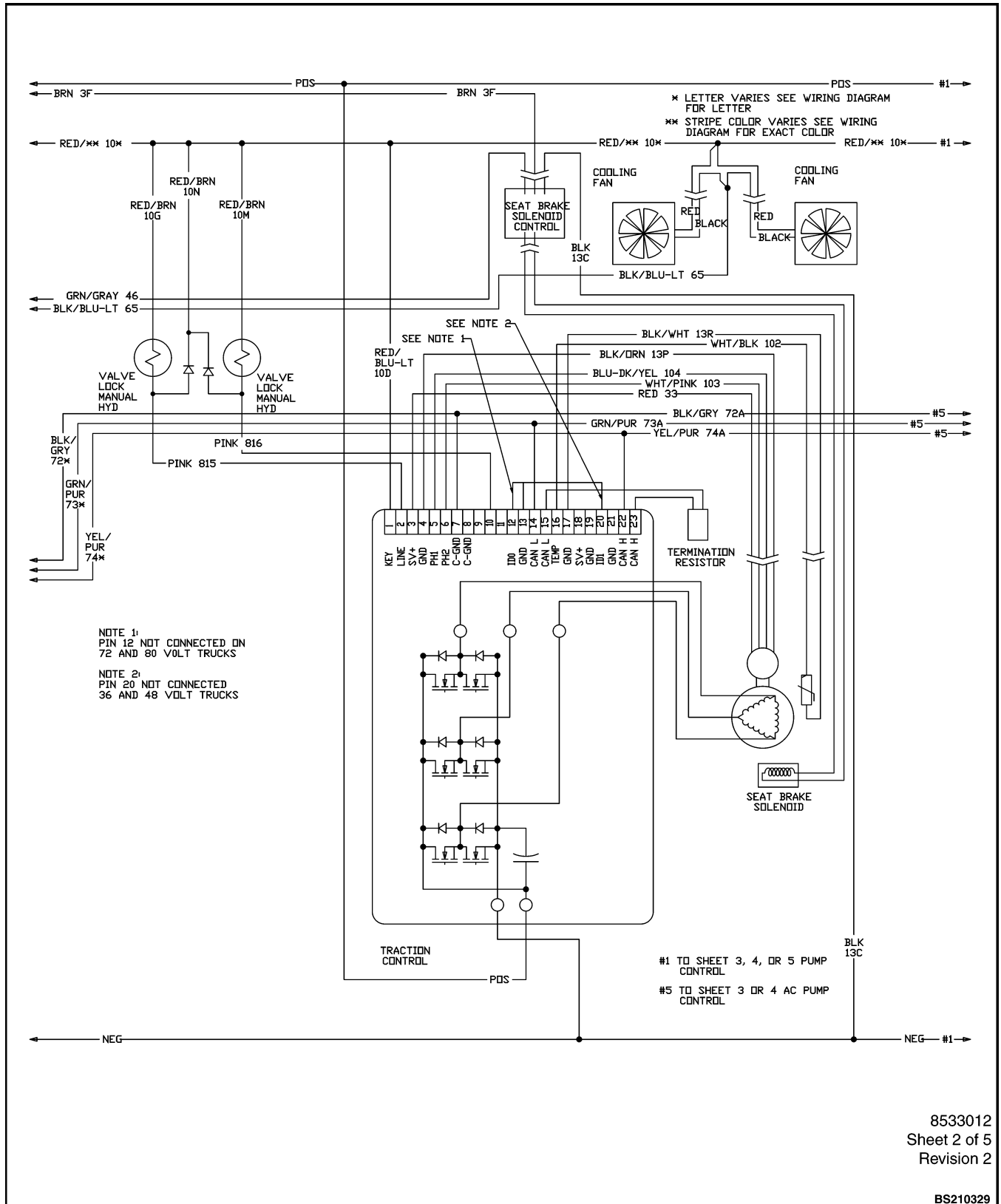


Figure 3. Wiring Schematic Diagram for ERC20-32AGF (ERC040-065GH) (A908), 36v/48v Lift Trucks With Electro-Hydraulic Control Valve (Sheet 2 of 5)

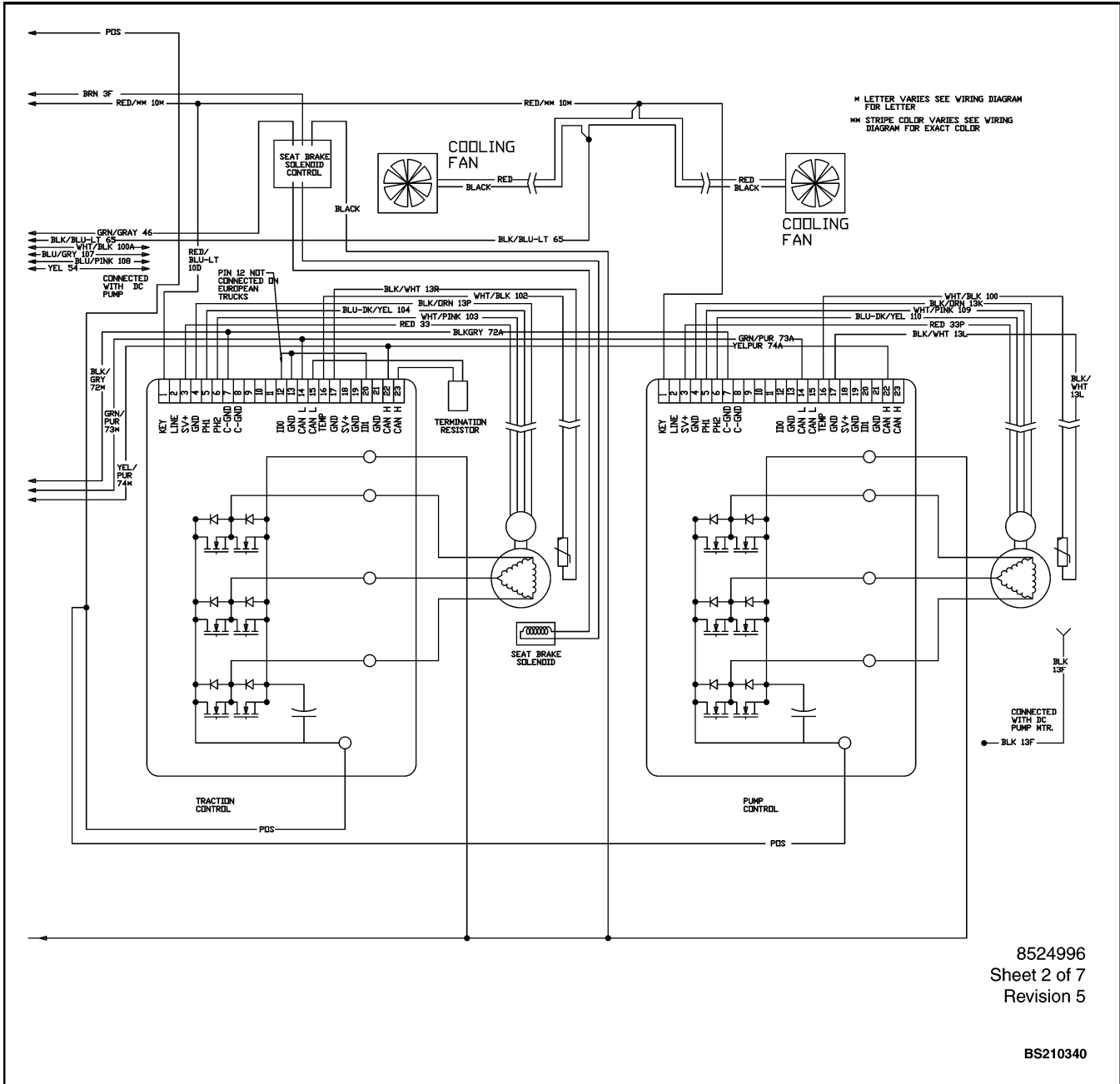


Figure 5. Wiring Schematic Diagram for ERC/P16-20AAF (ERC030-040AH) (B814), 36v/48v Lift Trucks (Sheet 2 of 7)

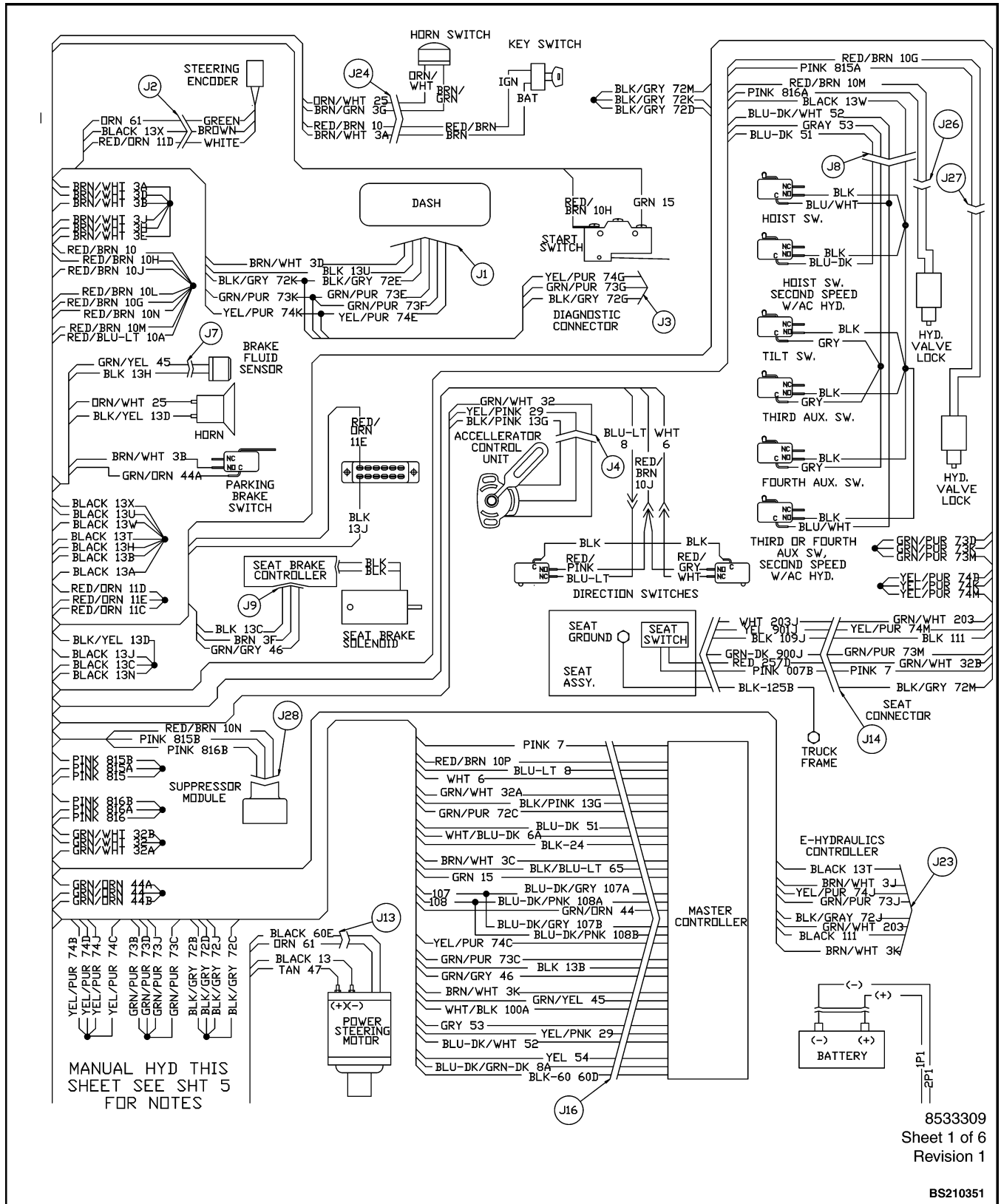


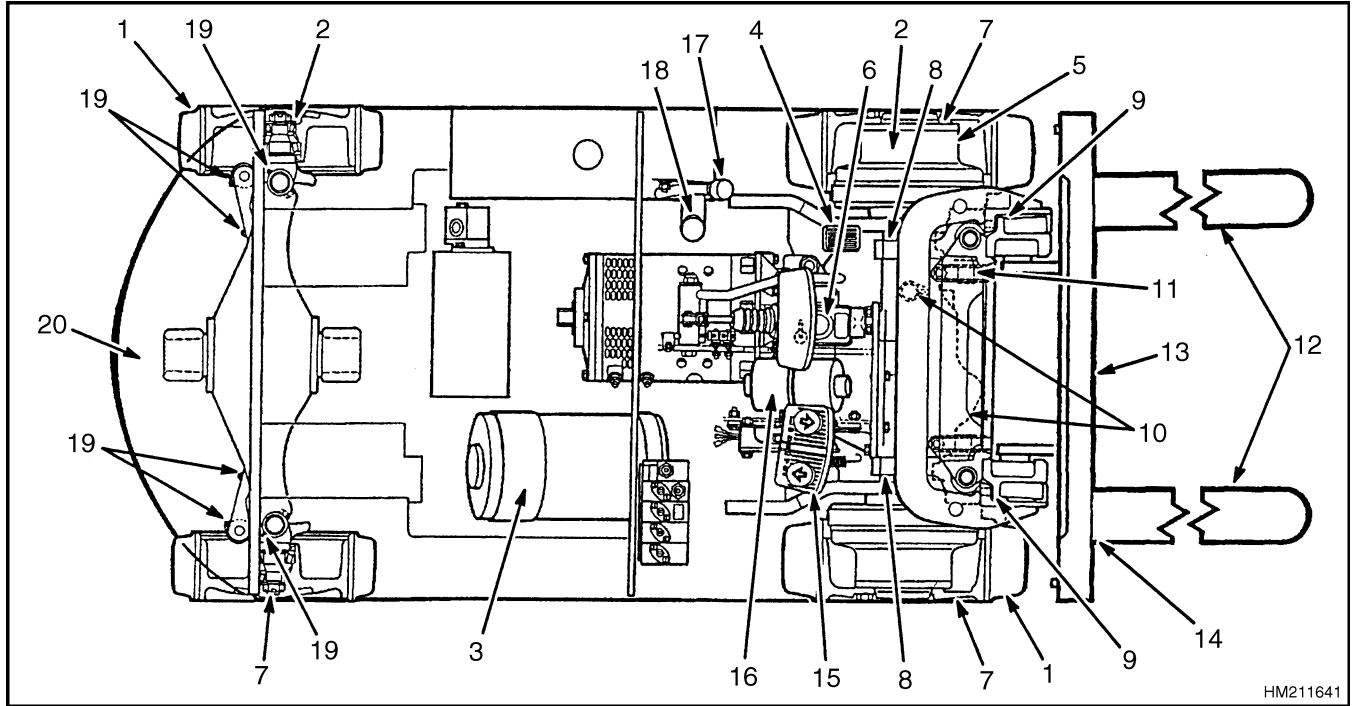
Figure 7. Wiring Diagrams With Electro-Hydraulics for ERC/P16-20AAF (ERC030-040AH) (C814) (Sheet 1 of 6)

Legend for Figure 14

1. PILOT-OPERATED SPOOL VALVE (PE1)
2. PILOT-OPERATED SPOOL VALVE (PE2)
3. TILT CYLINDERS
4. LIFT CYLINDERS
5. SECONDARY LOWERING CONTROL INTEGRAL WITH LIFT CYLINDERS
6. PRIMARY LOWERING CONTROL (MOUNTED ON MAST)
7. STEERING CYLINDER
8. STEERING WHEEL
9. STEERING CHECK PORT
10. STEERING CONTROL UNIT
11. HAND PUMP
12. STEERING VALVE
13. MAIN CONTROL VALVE
14. STEERING PUMP
15. STEERING RELIEF VALVE
16. HYDRAULIC TANK
17. HYDRAULIC FILTER
18. HYDRAULIC PUMP
19. PRIMARY RELIEF VALVE (RV1)
20. SECONDARY RELIEF VALVE (RV2)
21. TILT SOLENOID VALVE (SP3)
22. LIFT SOLENOID VALVE (SP1)
23. PRIORITY COMPENSATOR VALVE (EC1)
24. LOWERING COMPENSATOR VALVE (EC2)
25. PILOT OPERATED SOLENOID VALVE (EHPR 1 THROUGH 4)
26. TILT COUNTERBALANCE VALVE (CB1)
27. FLOW REGULATOR VALVE (FR1)
28. LOWER SOLENOID VALVE WITH MANUAL OVERRIDE (SP2)
29. CHECK VALVE LIFT CIRCUIT (CV1)
30. GAUGE PORT

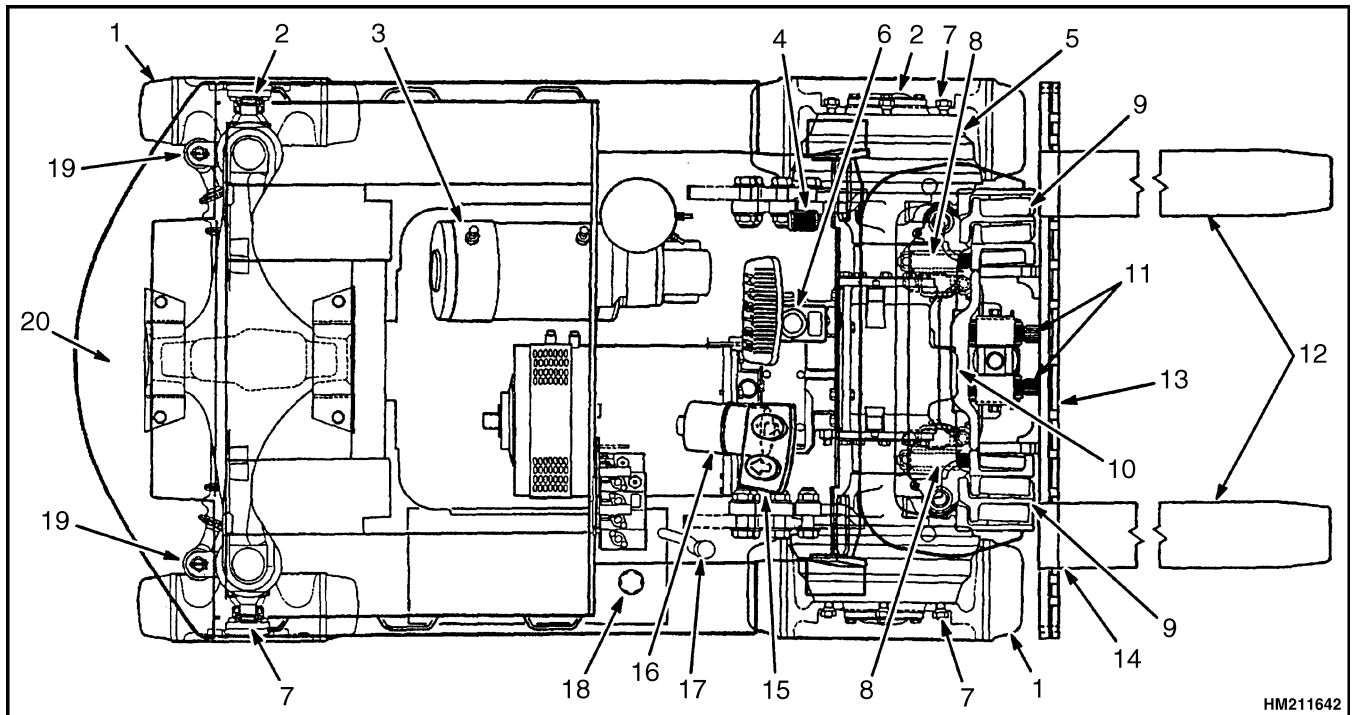


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HM211641

Figure 3. Maintenance Points for ERCIP16-20AAF (ERC030,040AH) (B814/C814)



HM211642

Figure 4. Maintenance Points for ERC20-32AGF (ERC040-065GH) (A908)

The hood must be locked in the down position during operation. The battery must have the front spacer plate and side spacers correctly adjusted to prevent any horizontal movement of more than 13 mm (0.5 in.). If the unit has a seat brake, raise the seat and seat plate assembly. Use the latch handle at the rear of the hood to release the hood frame and battery restraint. See Figure 11. Raise the latch handle and slide the handle toward the right side of the truck. A spring moves the handle back to the left. Use the lift handle by the seat to raise the hood. A gas spring and stop rod will hold the assembly in the up position. Make sure that the battery cannot move more than a total of 13 mm (0.5 in.) in any one horizontal direction. Release the stop rod by moving it to the right before lowering hood. See the label in Figure 11. Make sure the latch handle is fully to the right when closing the hood so the latch can engage the latch piece. Make sure the hood is locked securely. Try to raise the hood using only the lift handle to make sure the hood is latched and will not move.

Battery Restraint System ERP20-30ALF (ERP040-060DH) (D216) Lift Truck Models

The battery restraint is a heavy steel rod at the rear of the battery compartment. See Figure 12. An adjustable spacer plate is used inside the battery compartment to prevent forward and backward movement of the battery. The batteries for these lift trucks must fit the battery compartment width with a maximum of 13 mm (0.5 in.) clearance.

The hood cannot be closed unless the battery restraint is engaged. The battery restraint rod at the top rear of the battery compartment must be aligned over the edge of the battery. The handle of the battery restraint must also be in the down position to close the hood. Use the handle to move the battery restraint rod over the edge of the battery so the handle can be moved to the down position.

If necessary, adjust the front and side spacer plates for the battery as shown in Figure 44.

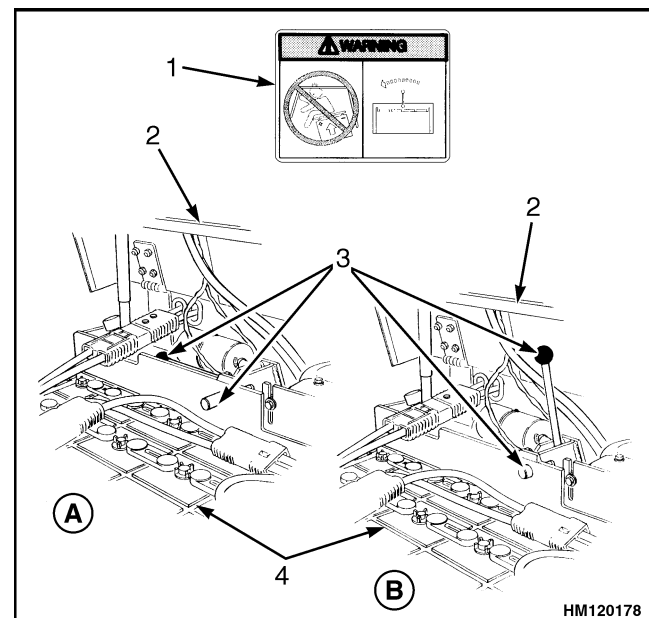
Battery

WARNING

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

The acid in the electrolyte can cause injury. If the electrolyte is spilled, use water to flush the area.

Make the acid neutral with a solution of sodium bicarbonate (soda). Acid in the eyes must be flushed with water immediately.



A. EXTENDED B. RETRACTED

1. BATTERY RESTRAINT WARNING LABEL
2. HOOD
3. BATTERY RESTRAINT
4. BATTERY

Figure 12. Battery Restraint for ERP20-30ALF (ERP040-060DH)

WARNING

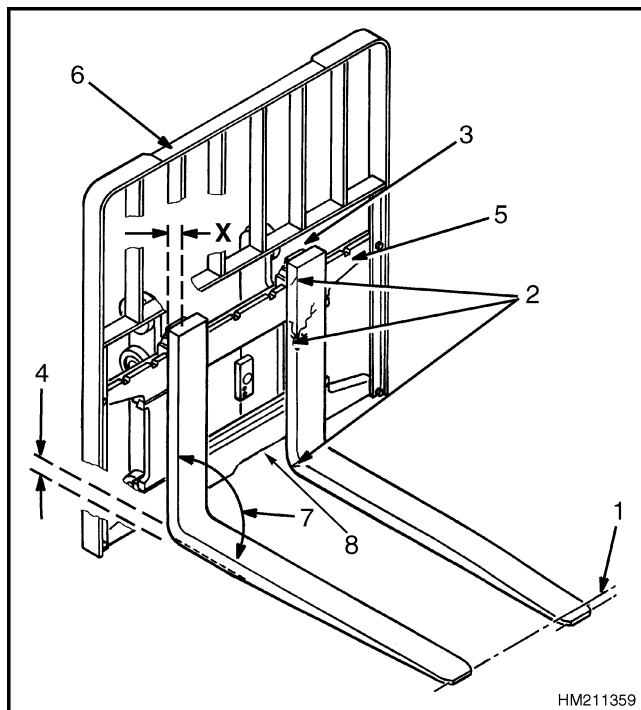
Batteries generate explosive fumes. Keep the vents in the caps clean. Keep sparks or open flames away from the battery area. Do not make a spark from the battery connections.

Disconnect the battery when doing maintenance.

NOTE: There can be one of two types of batteries. One type has removable cell caps. The other type has sealed cells. The sealed batteries require a different charger, the electrolyte level or specific gravity cannot be checked, and water cannot be added to the electrolyte.

Make sure that the voltage and the weight of the battery are correct as shown on the Nameplate.

Keep the battery case, top cover, and the area for the battery clean and painted. Leakage from the battery and corrosion can cause a malfunction in the electric



Fork Tip Alignment	
Length of Forks	3% Dimension
915 mm (36 in.)	27 mm (1.10 in.)
1067 mm (42 in.)	32 mm (1.26 in.)
1220 mm (48 in.)	37 mm (1.46 in.)
1372 mm (54 in.)	41 mm (1.61 in.)
1524 mm (60 in.)	46 mm (1.81 in.)
1830 mm (72 in.)	55 mm (2.17 in.)

1. TIP ALIGNMENT (MUST BE WITHIN 3% OF FORK LENGTH)
2. CRACKS
3. LATCH DAMAGE
4. HEEL OF FORK (MUST BE 90% OF DIMENSION X)
5. CARRIAGE
6. LOAD BACKREST EXTENSION
7. MAXIMUM ANGLE 93°
8. FORK REMOVAL NOTCH

Figure 29. Forks Check

Adjust

NOTE: During the adjustment of the forks, the heel of the forks should not be touching the ground.

The forks are connected to the carriage by hooks and lock pins. See Figure 27 and Figure 28. The lock pins are installed through the top fork hooks and fit into slots in the top carriage bar. If pin does not remain engaged

in carriage slot, replace with new pin. Adjust the forks as far apart as possible for maximum support of the load. Hook forks will slide along the carriage bars to adjust for the load to be lifted. Raise the lock pin in each fork to slide the fork on the carriage bar. Make sure the lock pin is engaged in the carriage bar to lock the fork in position after the width adjustment is made. Use clean engine oil as necessary to lubricate the fork guides of the carriage and the locks for the forks.

BRAKE FLUID ERC/P16-20AAF (ERC030-040AH) (B814/C814) AND ERC20-32AGF (ERC040-065GH) (A908) LIFT TRUCKS

WARNING

Loss of fluid from the master cylinder indicates a leak. This condition can cause brake failure. The result can be material damage or personal injury. Repair the brake system before the lift truck is used. Replace the brake fluid in the system if there is dirt, water, or oil in the system.

CHECK THE INDICATOR LIGHT DURING OPERATION. There is an indicator light on the display panel for low brake fluid. The red light is **ON** for approximately eight to ten seconds when the key is first moved to the **ON** position. The light comes on during operation when brake fluid is low.

Check the brake fluid in the reservoir for the master cylinder. The reservoir is under the floor plate near the brake pedal. Add brake fluid as necessary. Use the brake fluid shown in the Maintenance Schedule.

PARKING BRAKE ADJUSTMENT

Adjusting the park brake by first making sure the lift truck cannot move (block wheels). Release the parking brake and access the adjustment knob located on the lower left hand side of the cowl weldment. Turn the knob clockwise to increase the braking force. The parking brake, when in good condition and correctly adjusted, will hold a lift truck with a capacity load on a 15 percent grade [1.5 m (1.5 ft) rise in 10 m (10 ft)].

For park brake adjustment procedures, see **Brake System** 1800 YRM 566 for lift truck models ERP20-30ALF (ERP040-060DH) (D216), **Brake System** 1800 YRM 620 for lift truck models ERC/P16-20AAF (ERC030-040AH) (B814/C814), and **Brake System** 1800 YRM 574 for lift truck models ERC20-32AGF (ERC040-065GH) (A908).

BRAKE FLUID REPLACEMENT

Perform the following procedure to remove used brake fluid from the remainder of the brake system.

1. Ensure that the master cylinder reservoir is filled with brake fluid at all times.
2. Put one end of a rubber hose on the bleeder screw of the wheel cylinder. Put the other end of the hose into a empty container.
3. Loosen bleeder screw at the wheel cylinder one turn so that the used brake fluid can be removed from the brake system. Slowly push the brake pedal, and hold it at the end stroke. Close the bleeder screw. Release the brake pedal.

NOTE: The new brake fluid will be easily recognized, as the color will be more clear than the used fluid which will be darker.

4. Repeat Step 1 through Step 3 until there is new brake fluid in the container.
5. Check the level of the brake fluid in the reservoir for the master cylinder during the procedure. Make sure to keep the brake fluid at the correct level.
6. Repeat the procedure for the other wheel cylinder

SERVICE BRAKES



WARNING

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

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

Cleaning Procedures:

1. Do not release brake lining dust from the brake linings into the air when the brake drum is removed.



CAUTION

Do NOT use an oil solvent to clean the wheel cylinder. Use a solvent approved for cleaning of brake parts. Do not permit oil or grease in the brake fluid or on the brake linings.

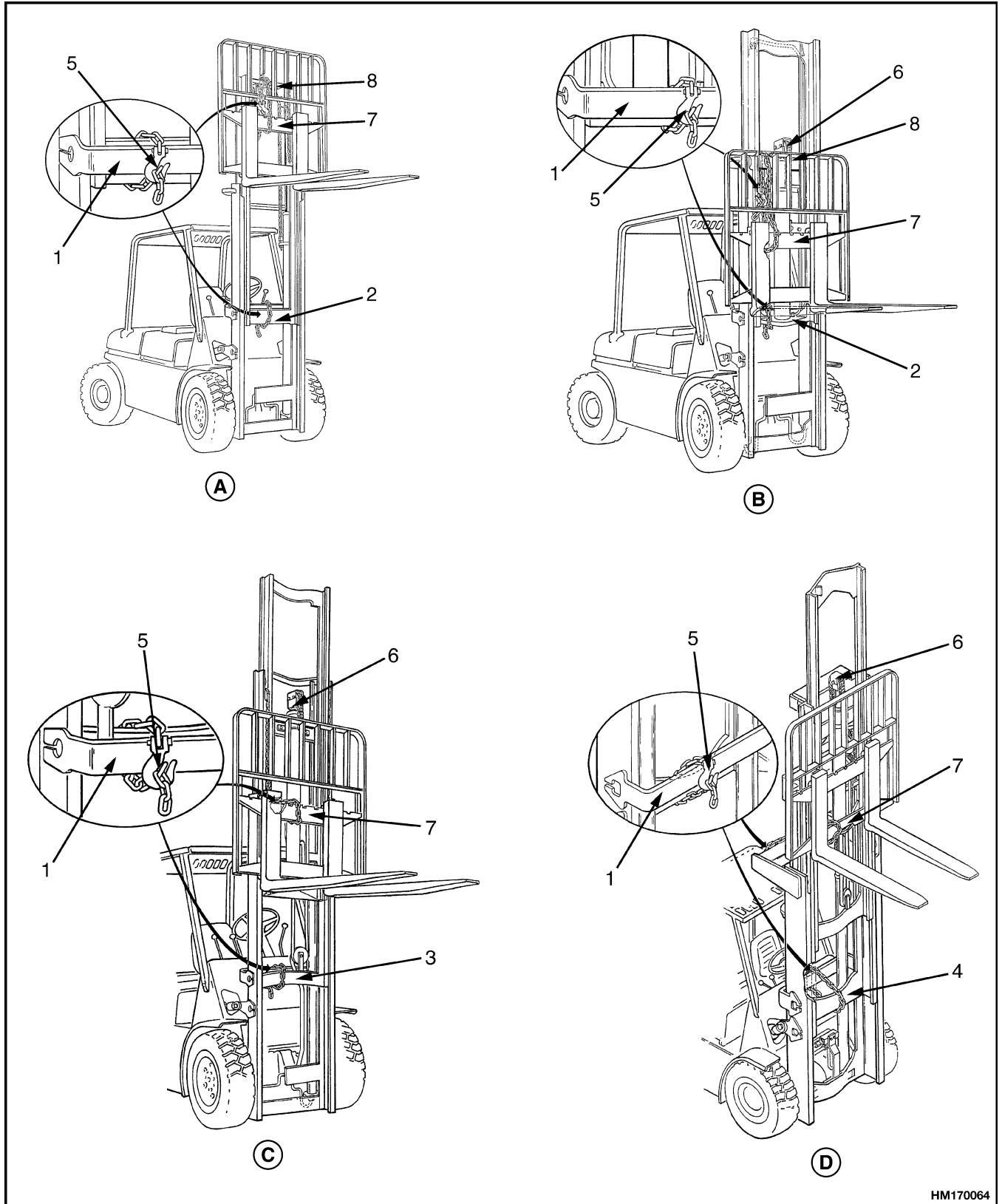
2. Use a solvent approved for cleaning of brake parts to wet the lining dust. Follow the instructions and cautions of the manufacturer for the use of the solvent. If a solvent spray is used, do not create brake lining dust with the spray.
3. When the brake lining dust is wet, clean the parts. Put any cloth or towels in a plastic bag or an airtight container while they are still wet. Put a DANGEROUS FIBERS warning label on the plastic bag or airtight container.
4. Any cleaning cloths that will be washed must be cleaned so fibers are not released into the air.

NOTE: Some lift trucks are used in operations where the automatic adjusters can be slow to adjust the brake shoes. If the brakes need adjustment, operate the lift truck in forward and reverse 10 times. Apply the brake pedal firmly, but do not cause the wheels to slide. If the automatic adjusters do not adjust the brake shoes, a qualified service person must check the operation and condition of the brakes.

Check the brake lining [minimum thickness 1 mm (0.4 in.)] and parts of the brake assembly for wear or damage. See the **Brake System** YRM for your vehicle, for the removal and installation procedures of the drive wheels and hubs. If the brake linings or brake shoes are worn or damaged, they must be replaced. Brake shoes must be replaced in complete sets. Inspect the brake drums for cracks or damage. Check backing plate mounting hardware and torque. Replace any damaged parts.

STEERING TIE RODS AND SPINDLE LIFT TRUCK MODELS ERC030-040AH (B814/C814) ONLY

Lubricate the steering tie rods and spindle with multi-purpose grease (see Figure 41). See the Maintenance Schedule for specifications. More frequent lubrication may be required if the lift truck operates in dirty or difficult conditions.

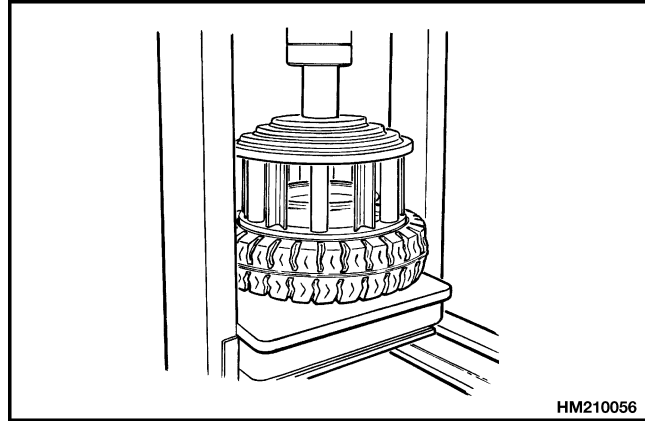


HM170064

Figure 48. Two-Stage, Free-Lift, Three-Stage, and Four-Stage Masts

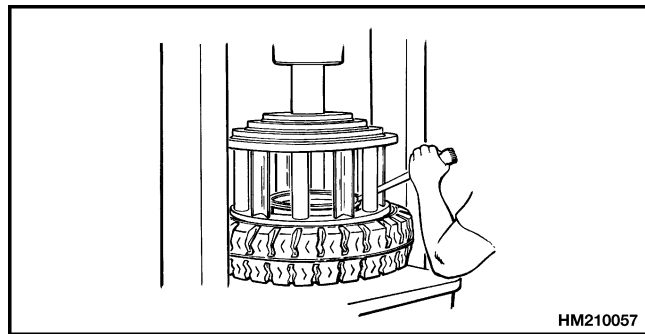
STEP 3.

Remove the cage and put the flange seat (if used), the side flange, and the lock ring in position on the wheel rim. Install the cage on the tire. Use the press to push the tire onto the wheel rim so the side flange and lock ring can be installed.



STEP 4.

While the cage is holding the tire on the wheel rim, install the lock ring. Use a tire tool to make sure the lock ring is in the correct position.



Wheels, Install

⚠ WARNING

Check all wheel nuts after 2 to 5 hours of operation: when new lift trucks begin operation and on all lift trucks when the wheels have been removed and installed. Tighten the nuts in a cross pattern to the correct torque value shown in the Maintenance Schedule. When the nuts stay tight for 8 hours, the interval for checking the torque can be extended to 500 hours.

Install the wheel on the hub. Tighten the nuts as shown in the Maintenance Schedule.

SNAP-ON TIRE, CHANGE

⚠ WARNING

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

Always wear safety glasses.

1. Put lift truck on blocks as described in How to Put Lift Truck on Blocks at the beginning of this section.
2. Remove wheel nuts and remove wheel and tire from lift truck. Lift truck tires and wheels are heavy.

NOTE: When you disassemble the wheels, see Figure 53. There are several types of wheels used on these series of lift trucks.

General

This section describes the disassembly, assembly, and inspection procedures and checks for malfunctions of AC motors.

AC traction motors and AC hydraulic pump motors are similar in design. See Figure 1. The AC hydraulic pump and AC steering pump motors are a smaller version of the AC traction motor. Disassembly and repair of these motors are similar.

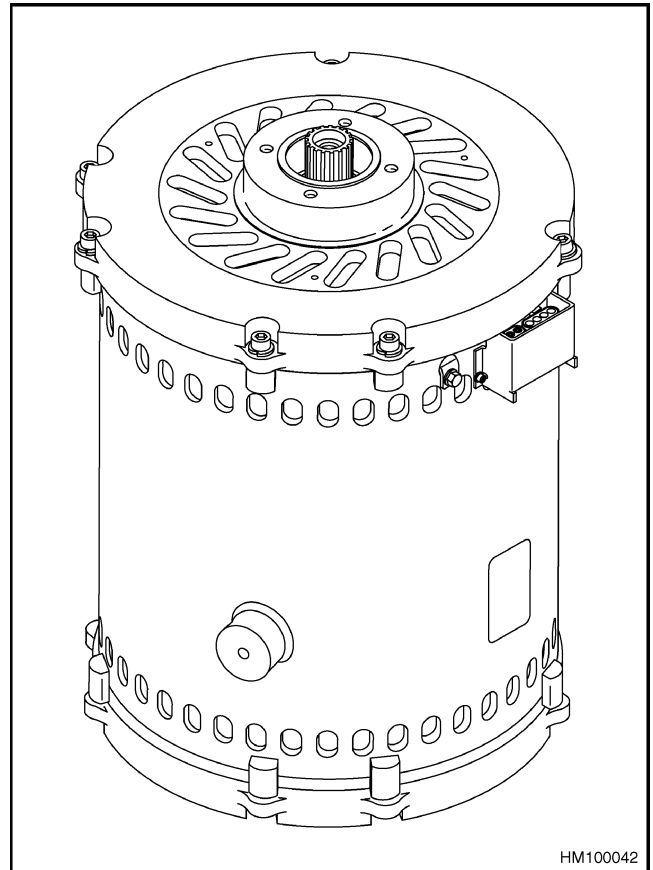


Figure 1. AC Traction Motor ERC20-32AGF (ERC040-065GH) (A908) Model Shown

AC Motor Repair

DISASSEMBLE



CAUTION

The bearings and seal on the AC traction motor are serviceable parts, while the only serviceable parts on the AC hydraulic pump motor are the bearings. **Be careful to not damage bearings when replacing.**

NOTE: When replacing one bearing, it is strongly recommended to replace both bearings and the seal of the AC traction motor.

1. Remove motor from the lift truck. See the **Frame YRM** for your lift truck model for removal information.



WARNING

The AC hydraulic pump motor can weigh as much as 113 kg (250 lb) and the AC traction motor can weigh as much as 204 kg (450 lb). **To prevent injury, use a lifting device capable of lifting the assembly.**

2. Screw lifting eye into the threaded hole in the end of the rotor shaft, and connect a chain to lifting eye. Attach approved lifting device and lift motor.
3. Place motor on level blocks on a flat surface with drive end pointing down. Remove approved lifting device and lifting eye. See Figure 1.
4. Remove connector cover. See Figure 2.

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

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

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



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury and property damage.

On the lift truck, the **WARNING** symbol and word are on orange background. The **CAUTION** symbol and word are on yellow background.

High Flow Auxiliary Solenoids
3 to 4 N•m (26.5 to 34.5 lbf in)

Check Valve
45 to 50 N•m (33 to 37 lbf ft)

Counterbalance Valve
41 to 47 N•m (30 to 35 lbf ft)

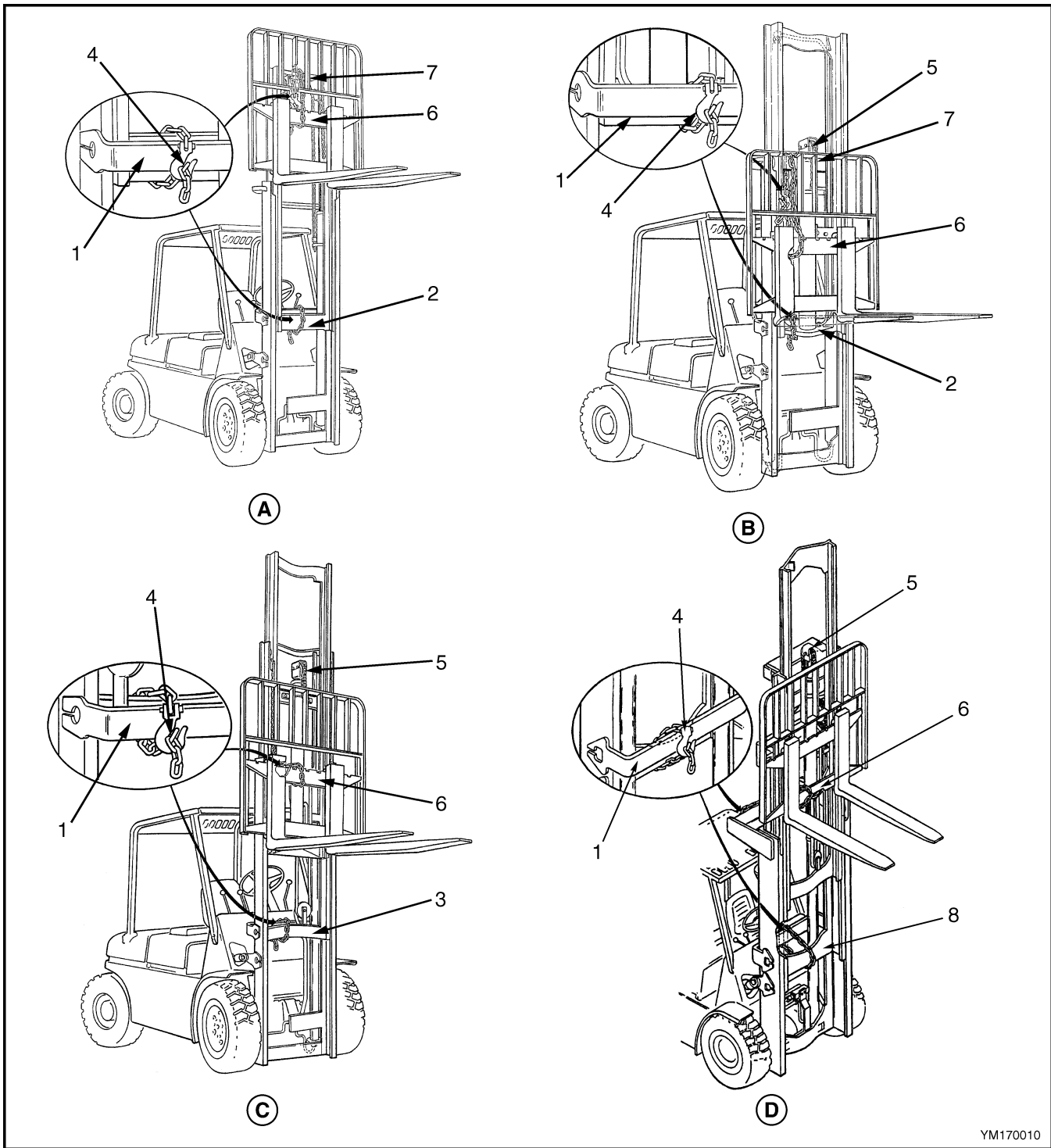
Relief Valves
33 to 35 N•m (24 to 26 lbf ft)

Flow Regulator
24.5 to 27.2 N•m (18 to 20 lbf ft)

Adhesives and Sealants

Yale Part No.	Loctite® Part No.	Description	Size
501702901	222	Small Screw Threadlock (Purple)	50 ml (1.7 oz)
580012519*	271	High Strength Threadlock (Red)	10 ml (0.34 oz)
501702904	290	Low Viscosity Threadlock (Green)	50 ml (1.7 oz)
518806679*	422	SuperBonder® Adhesive	3 ml (0.1 oz)
500009917*	515	Gasket Eliminator (Purple)	50 ml (1.7 oz)
518795676*	567	Pipe Sealant with Teflon® (White)	50 ml (1.7 oz)
502058904	595	Super Flex® Silicone	100 ml (3.4 oz)
150015825		Chisel Gasket Remover (10 Aerosol cans per case)	536 ml (18 oz)

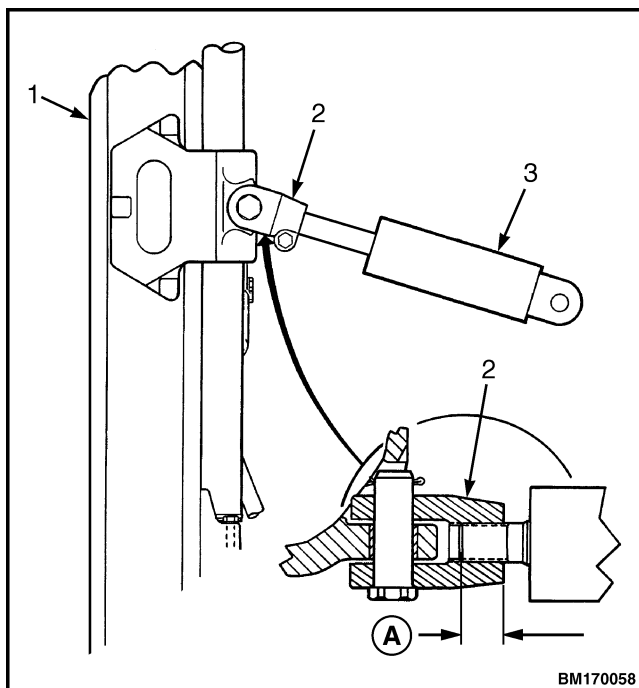
Loctite®, Super Flex®, and SuperBonder® are registered trademarks of the Loctite Corporation.
Teflon® is a registered trademark of Du Pont de Nemours Co. Inc.



YM170010

Figure 1. Two-Stage LFL, Two-Stage FFL, Three-Stage FFL, and Four-Stage FFL Masts

- (2) 0.5 mm (0.02 in.) for lift truck model
- GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818)
- (3) After the adjustments are complete, tighten the nuts on the rod ends to 90 N•m (66 lbf ft).
- c. Tilt the mast fully backward and measure the tilt angle. See the Nameplate for tilt angles. If necessary, adjust both rod ends equally for the correct angle.



A. 32 mm (1.25 in.) FOR ERP1.60-1.80-2.00ATF (ERP030-040TH) (F807) SHOWN.

1. MAST
2. ROD END
3. TILT CYLINDER

Figure 7. Tilt Cylinder Adjustments for Lift Truck Models ERP1.60-1.80-2.00ATF (ERP030-040TH) (F807), GLC40, 45, 55VX; GLC55SVX; (GC/GLC080, 100, 120VX; GC/GLC080, 100VXBCS; GC/GLC120SVX; GC/GLC120VXPRS) (E818, F818), GLP/GDP40VX5/VX6; GLP/GDP45SVX5, GLP/GDP45VX6; GLP/GDP50-55VX (GP/GLP/GDP080,090,110,120VX) (F813, G813, H813, J813) Only

2. Adjust the stroke of the tilt cylinders WITH tilt limit spacers as follows:
- a. Adjust the rod ends to 15 mm (0.6 in.) for all tilt cylinders as shown in Figure 6.
 - b. Slowly tilt the mast forward until one cylinder rod stops. On the opposite cylinder, loosen the capscrews on the rod end. Use a wrench and turn the cylinder rod IN as necessary. Repeat this procedure until both cylinder rods stop at the same position within 1 mm (0.04 in.).
 - c. Slowly tilt the mast backward until one rod end just contacts the spacer. Add shims to fill the gap at the opposite rod end until both rod ends contact the spacers within 0.5 mm (0.02 in.).
 - d. After the adjustments are complete, tighten the nuts on the rod ends to 90 N•m (66 lbf ft).
 - e. Tilt the mast fully backward and measure the tilt angle. See the nameplate for tilt angles. If necessary, add an equal number of shims to both rods for the correct angle.

TILT CYLINDER LEAK CHECK



WARNING

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**.

DO NOT try to find hydraulic leaks by putting your hand on hydraulic components under pressure. Hydraulic oil can be injected into the body by the pressure.

1. Put a capacity load on the forks. Use a safety chain to hold the load to the carriage. Raise the load approximately 2.5 m (8 ft). Put the mast in a vertical position.
2. Measure the distance that the rod for tilt cylinder extends from the shell. Check the distance the rod moves in five or ten minutes. Multiply the rate in Table 1 by the time of the test and compare the numbers.

Inspect the rod for damage to the rod surface and ensure that the rod is not bent. If damaged, replace rod.

Inspect the inner surface of the cylinder tube for damage. If damaged, replace cylinder assembly.

Assemble

NOTE: To prevent damage to sealing surfaces, use brass tools when installing seals and O-rings.

1. Install piston ring and wear ring onto piston. See Figure 11.
2. Install rod wiper and rod seal in gland. Install O-ring, backup ring, and spacer outside of gland.
3. Install gland onto rod and install the piston. Tighten piston to 170 to 200 N•m (125 to 150 lbf ft).
4. Install gland, rod, and piston assembly into shell.
5. Tighten gland in shell until tight. Use the correct spanner. DO NOT hit gland with a hammer and driver. Tighten gland to 340 to 410 N•m (250 to 300 lbf ft).



CAUTION

The correct screw and sealing washer must be used in this location. The wrong parts will cause leaks or damage the cylinder. See your Hyster lift truck dealer for the correct parts.



CAUTION

Additives may damage the hydraulic system. Before using additives, contact your local Hyster dealer.

6. Remove screw and sealing washer. Pour 150 cc (5 oz) of hydraulic oil into the cylinder through the hole. This oil provides a hydraulic cushion when the cylinder reaches the top of its stroke. Install screw and sealing washer and tighten to 6 N•m (53 lbf in). See Figure 8.

7. Install fitting at base of free-lift cylinder. This is a special fitting that limits flow of the hydraulic oil.

Install

See the installation procedures in the section Main Lift Cylinders.

FREE-LIFT CYLINDER

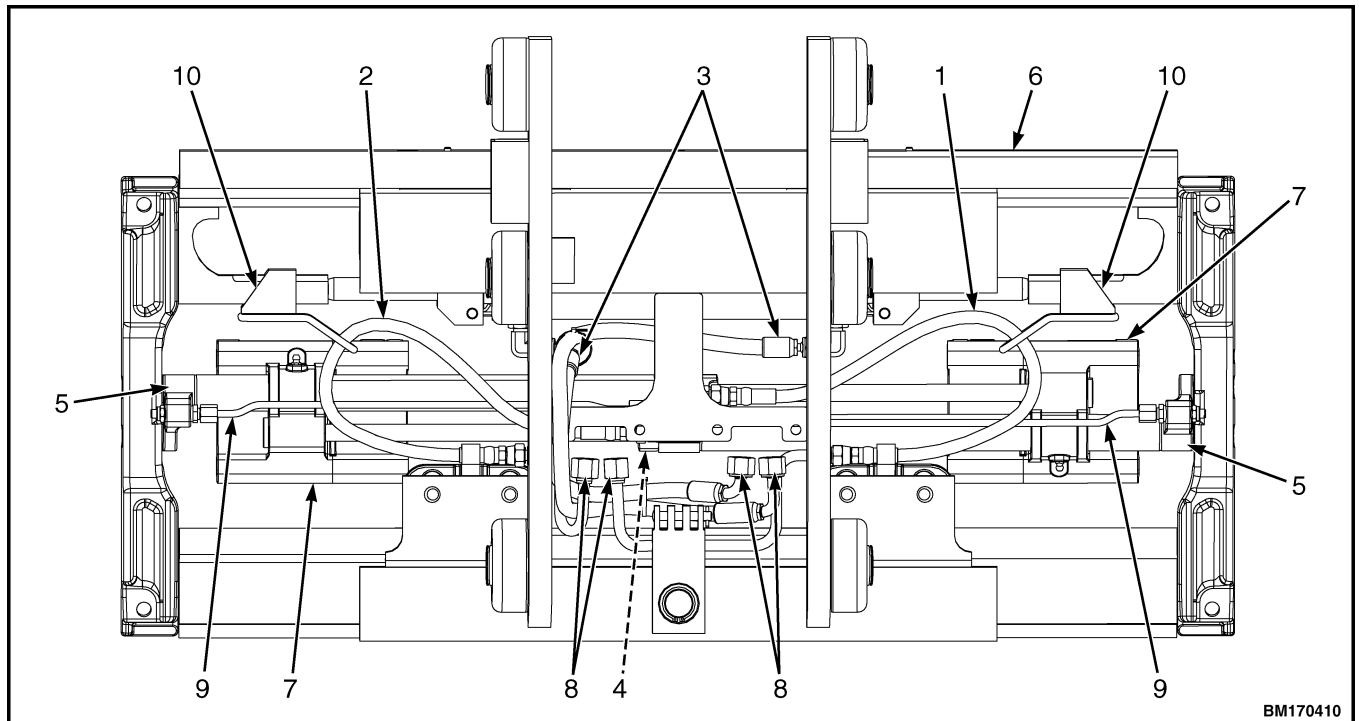
Remove

1. Remove the carriage as described in the carriage removal procedures, located in the section

Mast Repairs (S/N A551, A555, A559, A661, A662, A663, A66, B507, B508, B509, B551, B555, B559, B562, B563, B564, B661, B662, B663, C515, C551, C555, C559, D507, D508, D509, D515, D562, D563, D564, E509, and E564)

4000YRM1148 for lift truck models shown below:

- GC/GLC030VX, GC/GLC035VX, GC/GLC040SVX (C809)
- H1.6FT, H1.8FT, H2.0FTS (H30FT, H35FT, H40FTS) (F001)
GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX (GP/GLP/GDP030VX, GP/GLP/GDP035VX, GP/GLP/GDP040SVX) (C810)
- GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)
- GLP/GDP20-35VX (GP/GLP/GDP040-70VX) (B875)
- ERC/P16-20AAF (ERC030-040AH) (B814, C814)
- ERC20-32AGF (ERC040-065GH) (A908)
- ERP20-32ALF (ERP040-35DH) (E216)
- ERP1.60-1.80-2.00ATF (ERP030-040TH) (F807)



NOTE: FORK POSITIONER AND INTEGRAL SIDESHIFT CARRIAGE FOR LIFT TRUCKS GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910) AND GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875) SHOWN. FORK POSITIONER AND INTEGRAL SIDESHIFT CARRIAGE FOR OTHER LIFT TRUCKS COVERED IN THIS MANUAL ARE SIMILAR.

NOTE: BACK (DRIVER'S) VIEW SHOWN. THREE STAGE FFL INTEGRAL SIDESHIFT CARRIAGE SHOWN.

- | | |
|--|-------------------------|
| 1. FORK POSITIONER HYDRAULIC HOSE (OPEN) | 6. OUTER FRAME |
| 2. FORK POSITIONER HYDRAULIC HOSE (CLOSE) | 7. FORK CARRIER |
| 3. INTEGRAL SIDESHIFT CARRIAGE HYDRAULIC HOSES | 8. TUBE ASSEMBLY |
| 4. MANIFOLD | 9. RELIEF TUBE ASSEMBLY |
| 5. FORK POSITIONER CYLINDER | 10. HOSE GUIDE |

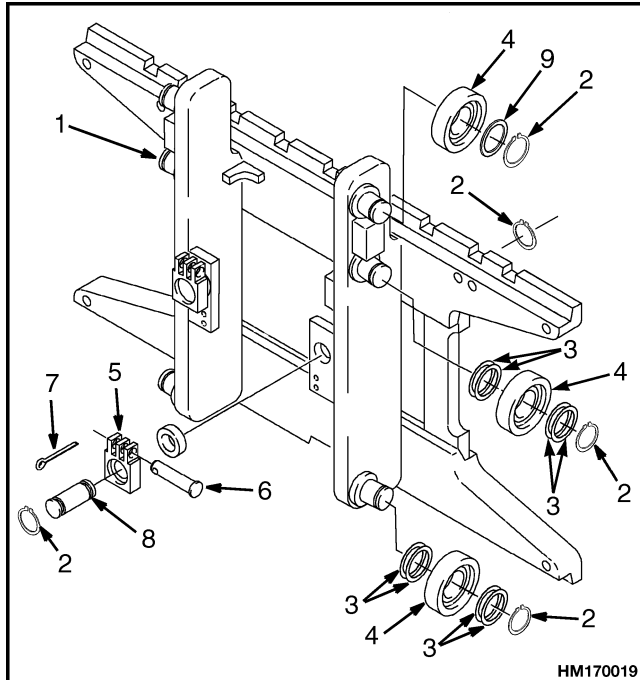
Figure 17. Hydraulic Connections, Fork Positioner Cylinder

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This section is for the following models:

(GC/GLC030VX, GC/GLC035VX, GC/GLC040SVX) [C809];
 GLP/GDP16VX, GLP/GDP18VX, GLP/GDP20SVX (GP/GLP/GDP030VX, GP/GLP/
 GDP035VX, GP/GLP/GDP040SVX) [C810];
 GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) [A910];
 GLP/GDP20-35VX (GP/GLP/GDP040-070VX) [B875];
 ERC/P16-20AAF (ERC030-040AH) [B814/C814];
 ERP1.60-1.80-2.00ATF (ERP030-040TH) [F807];
 ERP20-32ALF (ERP040-065DH) [E216];
 ERC20-32AGF (ERC040-065) [A908]



NOTE: TWO-STAGE LFL CARRIAGE SHOWN.

1. CARRIAGE
2. SNAP RING
3. SHIM
4. LOAD ROLLER
5. CHAIN ANCHOR
6. CHAIN PIN
7. COTTER PIN
8. ANCHOR PIN
9. SPACER

Figure 10. Standard Carriage

WARNING

To help prevent possible injury, make sure the carriage is stable when the inner mast is above the load rollers of the carriage.

5. Use the lift cylinders to raise the inner or intermediate mast. If the hydraulic system cannot be used, disconnect the lift cylinders from the inner or intermediate mast. See the section **Cylinder Repair (Mast S/N A551, A555, A559, A661, A662, A663, A66, B507, B508, B509, B551, B555, B559, B562, B563, B564, B661, B662, B663, C515, C551, C555, C559, D507, D508, D509, D515, D562, D563, D564, E509, and E564) 2100YRM1139.**

6. Connect a crane [the capacity of the crane must be at least 681 kg (1501 lb)] to the top of the inner mast. Carefully raise the inner mast until it is above the load rollers of the carriage. Install safety chains to secure the mast in its extended position and disconnect the crane. See Safety Procedures When Working Near Mast.
7. Move the lift truck away from the carriage. Completely lower the inner mast so it cannot move.

Repair

NOTE: The carriage can have four or six load rollers. When the carriage has four load rollers, shims are used behind all of the load rollers. When the carriage has six load rollers, shims are installed on the bottom and middle rollers only.

1. If any of the load rollers must be replaced, make a note of the location and number of the shims. Install the shims, load rollers, and snap rings. See Carriage Adjustments for correct adjustment of the load rollers.

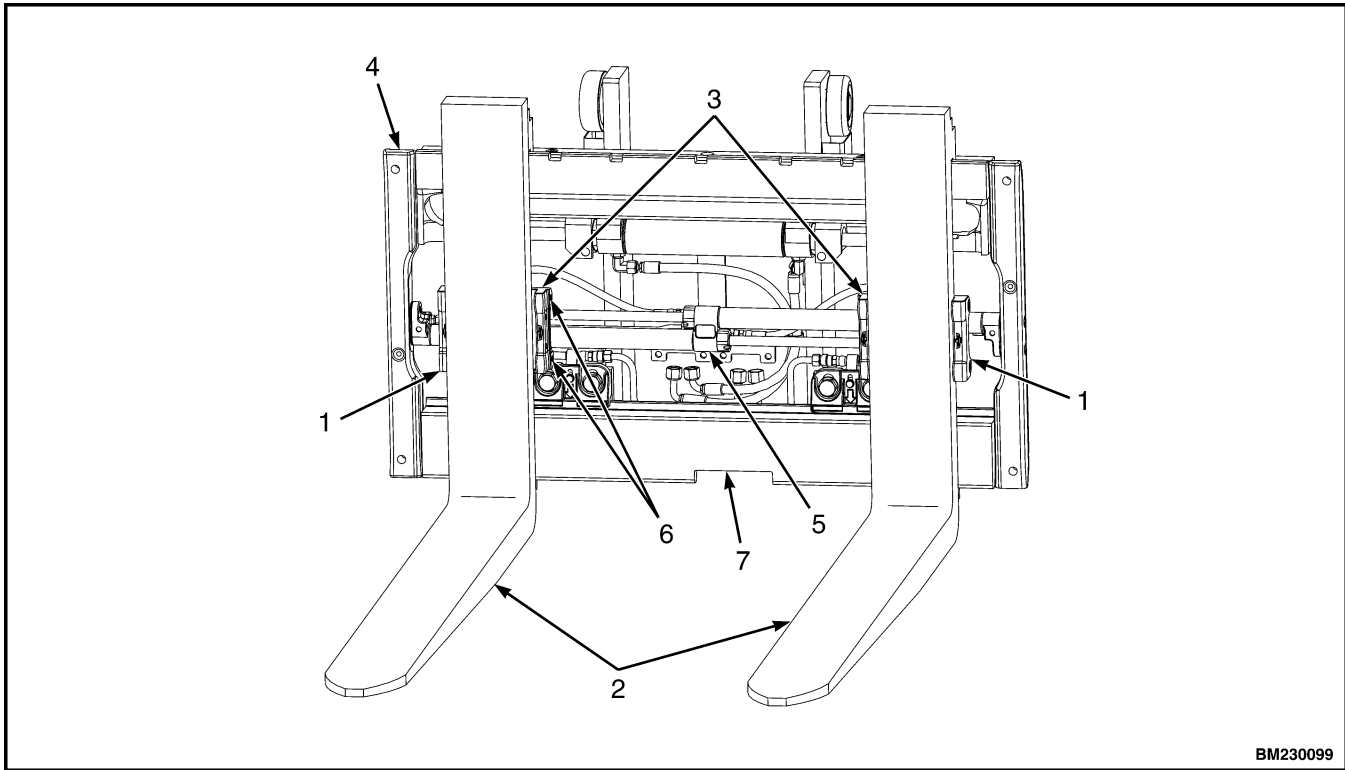
WARNING

Improper welding procedures can damage the structure of the mast or cause incorrect function of the mast. Consult your Yale® lift truck dealer for more information before welding on the mast.

2. If the carriage bars have any protruding welds or damaged notches, repair by grinding, filing, or welding.

Install

1. Use the hydraulic system of the lift truck or a crane to raise the inner mast. Connect a crane [the capacity of the crane must be at least 681 kg (1501 lb)] to the top of the inner mast. Carefully raise the inner mast until it is above the load rollers of the carriage. Install safety chains to secure the mast in its extended position and disconnect the crane. See Safety Procedures When Working Near Mast.



BM230099

- | | |
|-----------------------|-----------------------|
| 1. OUTER FORK CARRIER | 5. FORK POSITIONER |
| 2. FORKS | 6. CAPSCREWS |
| 3. INNER FORK CARRIER | 7. FORK REMOVAL NOTCH |
| 4. OUTER FRAME | |

Figure 18. Fork Removal

TWO-STAGE LFL AND TWO-STAGE FFL MASTS

Disassemble

- Slide the inner mast from the bottom of the outer mast approximately 30 cm (12 in.). Remove the strip bearings (see Figure 30) and load rollers from the top of the outer mast. Remove the load rollers from the bottom of the inner mast. Make a note of each shim arrangement and load roller location. The shim arrangements will be approximately the same during assembly.

See Figure 31 for lift truck models

- GLC2035VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)
- GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875)
- ERP20-32ALF (ERP040-065DH) (E216)
- ERC20-32AGF (ERC040-065GH) (A908)

See Figure 32 for lift truck models

- GC/GLC030-035VX, GC/GLC040SVX (C809)
- ERC/P16-20AAF (ERC030-040AH) (B814/C814)
- ERP1.60-1.80-2.00ATF (ERP030-040TH) (F807)
- GLP/GDP16-18VX, GLP/GDP20SVX (GP/GLP/GDP030-035VX, GP/GLP/GDP040SVX) (C810)

See Figure 33 for lift truck models

- GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)
- GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875)
- ERP20-32ALF (ERP040-065DH) (E216)
- ERC20-32AGF (ERC040-065GH) (A908)

See Figure 34 for lift truck models

- GC/GLC030-035VX, GC/GLC040SVX (C809)
- ERC/P16-20AAF (ERC030-040AH) (B814/C814)
- ERP1.60-1.80-2.00ATF (ERP030-040TH) (F807)

- GLP/GDP16-18VX, GLP/GDP20SVX (GP/GLP/GDP030-035VX, GP/GLP/GDP040SVX) (C810)

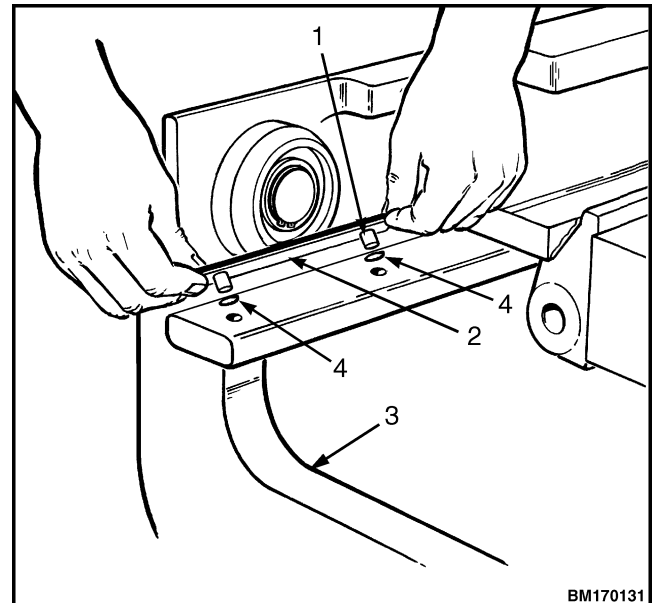


WARNING

The mast is heavy. The mast can weigh approximately 907 kg (2000 lb). Make sure all lifting devices (hoists, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the mast.

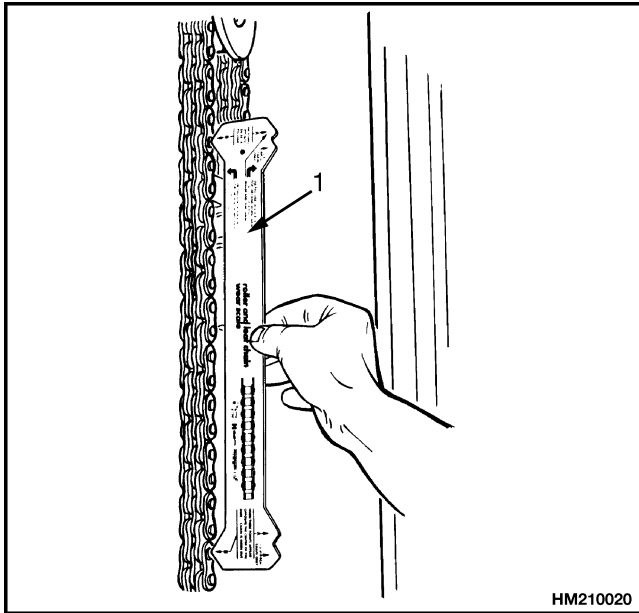
NOTE: When replacing the outer mast, copy the part number and date code information from the old channel and stamp that information on the new channel with a letter **R** at the end to indicate that it has been replaced.

- Slide the inner mast halfway out of the top of the outer mast. Connect a crane [the capacity of the crane must be at least 907 kg (2000 lb)] to the center of the inner mast. See Figure 35. Slide the inner mast out of the outer mast until the mast stub shafts of the inner mast are in the notches of the outer channels. Remove the inner mast from the outer mast.



- STRIP BEARING
- SHIMS
- TOP OF OUTER MAST
- O-RINGS

Figure 30. Strip Bearings



NOTE: THE INSTRUCTIONS FOR MEASURING CHAIN WEAR ARE SHOWN ON THE CHAIN WEAR SCALE (YALE PART NO. 580037684).

1. CHAIN WEAR SCALE

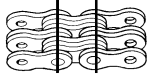
Pitch 	Total length of 20 links (pitch) of new chain	Wear Limit The maximum length of 20 links
12.7 mm (0.5 in.)	254.0 mm (10.0 in.)	261.6 mm (10.3 in.)
15.9 mm (0.6 in.)	317.5 mm (12.5 in.)	327.0 mm (12.9 in.)
19.1 mm (0.8 in.)	381.0 mm (15.0 in.)	392.4 mm (15.5 in.)
25.4 mm (1.0 in.)	508.0 mm (20.0 in.)	523.3 mm (20.6 in.)

Figure 37. Lift Chains Check

THREE-STAGE FFL MAST

Disassemble

1. Remove the pins for the lift chains at the chain anchors on the inner mast.

WARNING

The weldments can slide when the mast is moved. A weldment that slides can cause injury. Use a crane to turn the mast slowly and carefully.

2. Disconnect and remove lift chains between the outer mast and inner mast. Slide inner mast from bottom of the intermediate mast approximately 30 cm (12 in.). Remove the strip bearings at the top of the intermediate mast. Remove the load rollers at the bottom of the inner mast. Remove the load rollers at the top of the intermediate mast. Make a note of each shim arrangement and load roller location. The shim arrangements will be approximately the same during assembly.

See Figure 33 for lift truck models

- GLC20-35VX (GC/GLC040-070VX, GC/GLC055SVX) (A910)
- GLP/GDP20-35VX (GP/GLP/GDP040-070VX) (B875)
- ERP20-32ALF (ERP040-065DH) (E216)
- ERC20-32AGF (ERC040-065GH) (A908)

See Figure 34 for lift truck models

- GC/GLC030-035VX, GC/GLC040SVX (C809)
- ERC/P16-20AAF (ERC030-040AH) (B814/C814)
- ERP1.60-1.80-2.00ATF (ERP030-040TH) (F807)
- GLP/GDP16-18VX, GLP/GDP20SVX (GP/GLP/GDP030-035VX, GP/GLP/GDP040SVX) (C810)

2. Install the strip bearings and the shims on the outer mast. See Figure 42. Apply chassis lube to the bearing surface. Check the clearance of the strip bearings as described in Carriage Adjustments.

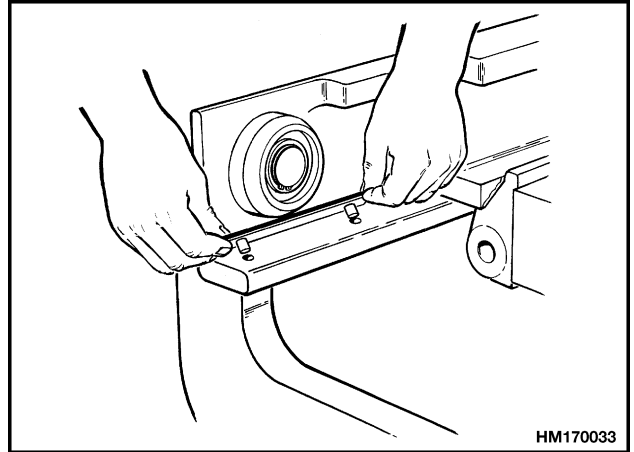


Figure 42. Strip Bearings

3. Install the load rollers and shims on both weldments. Check the clearance of the load rollers as described in Carriage Adjustments.
4. Install the housing for the lowering control valve on the outer mast. Tighten the nuts for the lowering control valve to 18 N•m (13 lbf ft). Install the lowering control valve in the housing. Connect the hydraulic lines and fittings between the housing and the main lift cylinders.

Assemble

NOTE: The shims for the load rollers keep the mast uprights parallel and provide correct clearance. During assembly, the shim arrangement will be approximately the same as before disassembly. Check clearance and adjust shims for wear or for changes caused by repairs. The strip bearings are also adjusted by using shims. See in this section for the adjustment procedures.

NOTE: When the mast has header hoses, see the procedures for the .

1. Put outer mast on floor with mast pivots toward floor. See Figure 45. Connect crane to center of first intermediate mast (see Figure 46.) Fit lower stub shafts of first intermediate mast into notches in top of outer mast. Slide first intermediate mast into outer mast so stub shafts are seen at top and bottom of both mast uprights.
2. Install strip bearings and shims on channels of outer mast. See Figure 49. Apply grease to bearing surfaces.

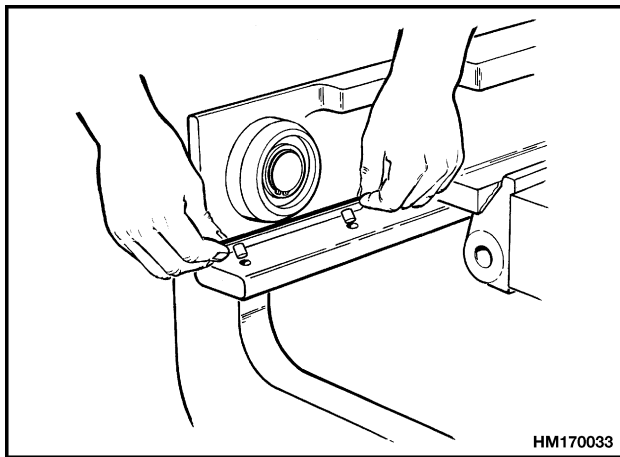


Figure 49. Strip Bearings

3. Install load rollers and shims on outer mast and at bottom of first intermediate mast. Before doing the next step, adjust first intermediate mast as described in . Install chain sheaves, shims, and snap rings on first intermediate weldment.
4. Install housing for lowering control valve on outer mast. Tighten nuts for lowering control valve to 18 N•m (13 lbf ft). Install lowering control valve in housing. Connect hydraulic lines and fittings between lowering control valve and main lift cylinders. See Figure 47.
5. Install chain sheaves and snap rings on second intermediate mast.
6. Connect crane to center of second intermediate mast. Slide mast into first intermediate mast so stub shafts are seen at top and bottom of both mast uprights.
7. Install strip bearings and shims on channels of first intermediate mast. Apply grease to bearing surfaces. Install load rollers and shims on first and second intermediate mast. Before doing the next step, adjust second intermediate mast as described in .
8. Connect lift chains to chain anchors at outer mast. Put lift chains over chain sheaves on first intermediate mast and connect them to anchors at bottom of second intermediate mast.
9. Connect crane to center of inner mast. Slide mast into second intermediate mast so stub shafts are seen at top and bottom of both uprights.

Assemble

NOTE: The shims for the load rollers keep the mast uprights parallel and provide correct clearance. During assembly, the shim arrangement will be approximately the same as before disassembly. Check clearance and adjust shims for wear or for changes caused by repairs. The strip bearings are also adjusted by using shims. See in this section for the adjustment procedures.

NOTE: When the mast has header hoses, see the procedures in the section .

1. Assemble and install chain sheaves onto mast weldments. See Figure 50 and Figure 51.
2. Install housing for lowering control valve on outer mast. Tighten nuts for lowering control valve to 18 N•m (13 lbf ft). Install lowering control valve in housing. Connect hydraulic lines and fittings between lowering control valve and main lift cylinders. See Figure 55.
3. Install hose channels onto outer mast using nuts, washers, and capscrews. Tighten capscrews to 8 N•m (71 lbf in). See Figure 53.
4. Put outer mast on floor with mast pivots toward floor. See Figure 51. Connect crane to center of first intermediate mast (see Figure 52.) Fit lower stub shafts of first intermediate mast into notches in top of outer mast. Slide first intermediate mast into outer mast so stub shafts are seen at top and bottom of both mast uprights.
5. Install strip bearings and shims on channels of outer mast. See Figure 57. Apply grease to bearing surfaces.
6. Install load rollers and shims on outer mast and at bottom of first intermediate mast. Before doing the next step, adjust first intermediate mast as described in . Install chain sheaves, shims, and snap rings on first intermediate weldment.
7. Connect crane to center of second intermediate mast. Slide mast into first intermediate mast so stub shafts are seen at top and bottom of both mast uprights.

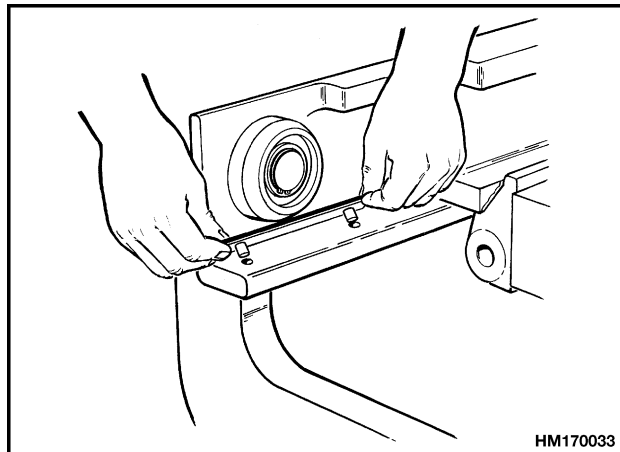


Figure 57. Strip Bearings

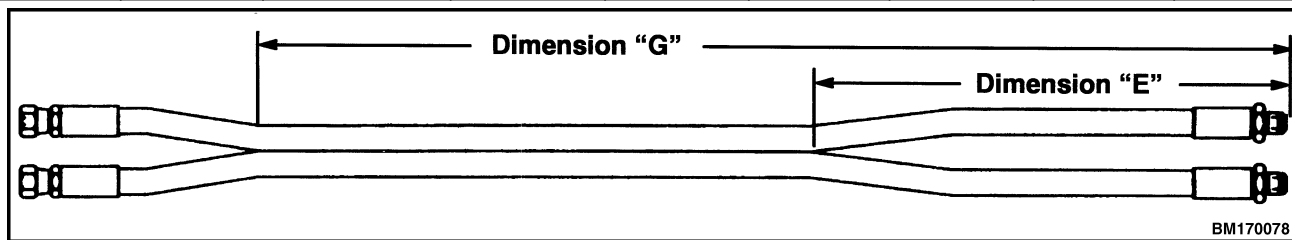
8. Install strip bearings and shims on channels of first intermediate mast. Apply grease to bearing surfaces. Install load rollers and shims on first and second intermediate mast. Before doing the next step, adjust second intermediate mast as described in .
9. Connect lift chains to chain anchors at outer mast. Put lift chains over chain sheaves on first intermediate mast and connect them to anchors at bottom of second intermediate mast.
10. Connect crane to center of inner mast. Slide mast into second intermediate mast so stub shafts are seen at top and bottom of both uprights.
11. Install strip bearings and shims on channels of second intermediate mast. Apply grease to bearing surfaces. Install load rollers and shims on second intermediate and inner mast. Before doing the next step, adjust inner mast as described in .
12. Connect lift chains to chain anchors at top of first intermediate mast. Put lift chains over chain sheaves on second intermediate mast and connect them to anchors at bottom of inner weldment.
13. Connect free-lift chains to chain anchors at inner crossmember. Attach wire between other end of lift chain and bottom of mast to control free-lift chain during installation of mast.

9. Connect the header hoses to the cowl hoses.
10. Use the rubber clamps and hose clamps to attach the hoses to the main lift cylinders. **DO NOT** allow the hoses to stretch or fold while tilting the mast fully forward and backward.
11. With no load on the forks, check the header hose adjustment by operating the mast through the full lift cycle two times. When properly adjusted, the

hoses will not be so tight that they compress when they pass over the sheaves nor will they be so loose that they touch the load backrest or any crossmember that is next to a sheave. If necessary, repeat until hoses are properly adjusted. See Table 5.

Table 5. Standard Two-Stage Hose Dimensions

Lift Height		Channel Length (Reference)	Dimension "E"		Dimension "G" Third Function		Dimension "G" Fourth Function	
mm	in.	mm	mm	in.	mm	in.	mm	in.
2043	80.8	1440	1780	70.1	X	X	X	X
3060	120.5	2040	1363	53.7	3183	125.3	3054	120.2
3159	124.4	2090	2420	95.3	X	X	X	X
3252	128.0	2040	2370	93.3	X	X	X	X
3260	128.3	2140	1412	55.6	3380	133.1	3251	128.0
3262	128.4	2040	1397	55.0	3234	127.3	3106	122.3



BM170078

"E" = (0.985 × channel length in mm) - 358.2 "G" = (2.095 × channel length in mm) - 291.0

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