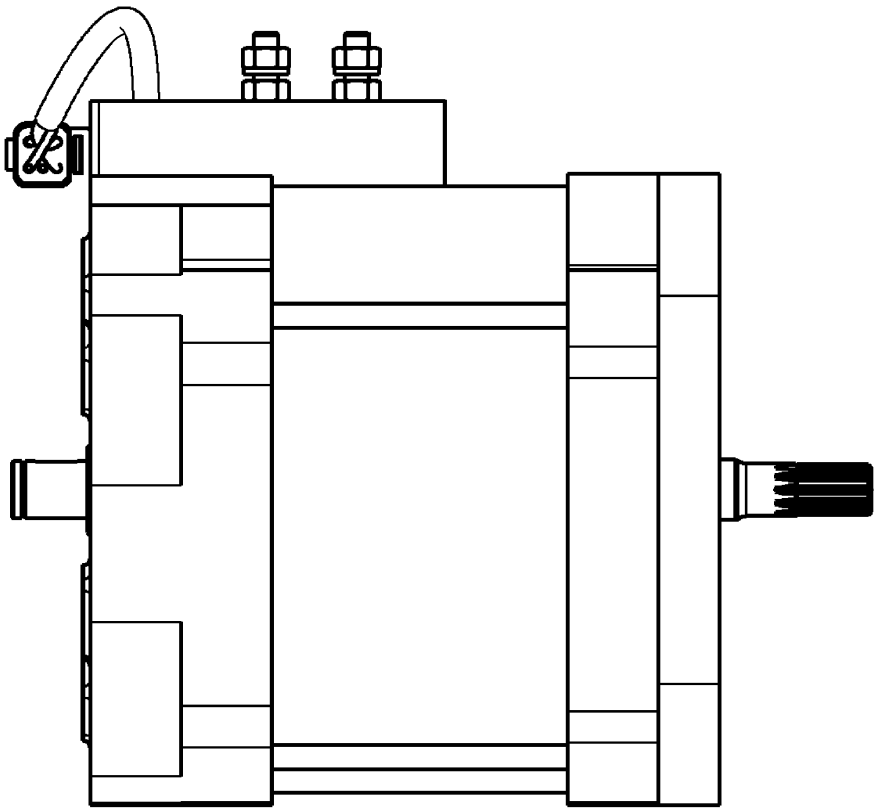
AC MOTOR REPAIR

ERP15-20VT (ERP030-040VT) [G807]; ERP16-20VF (ERP30-40VF) [A955]; ERC22-35VG (ERC045-070VG) [A968]; ERC16-20VA (ERC030-040VA) [A969]; ERP22-35VL (ERP045-070VL) [A976]; ESC030AC, ESC035AC, ESC040AC [B883]



11. Attach approved lifting device to stator housing and slowly lift straight up, removing it from rotor assembly and drive end head. See Figure 18.

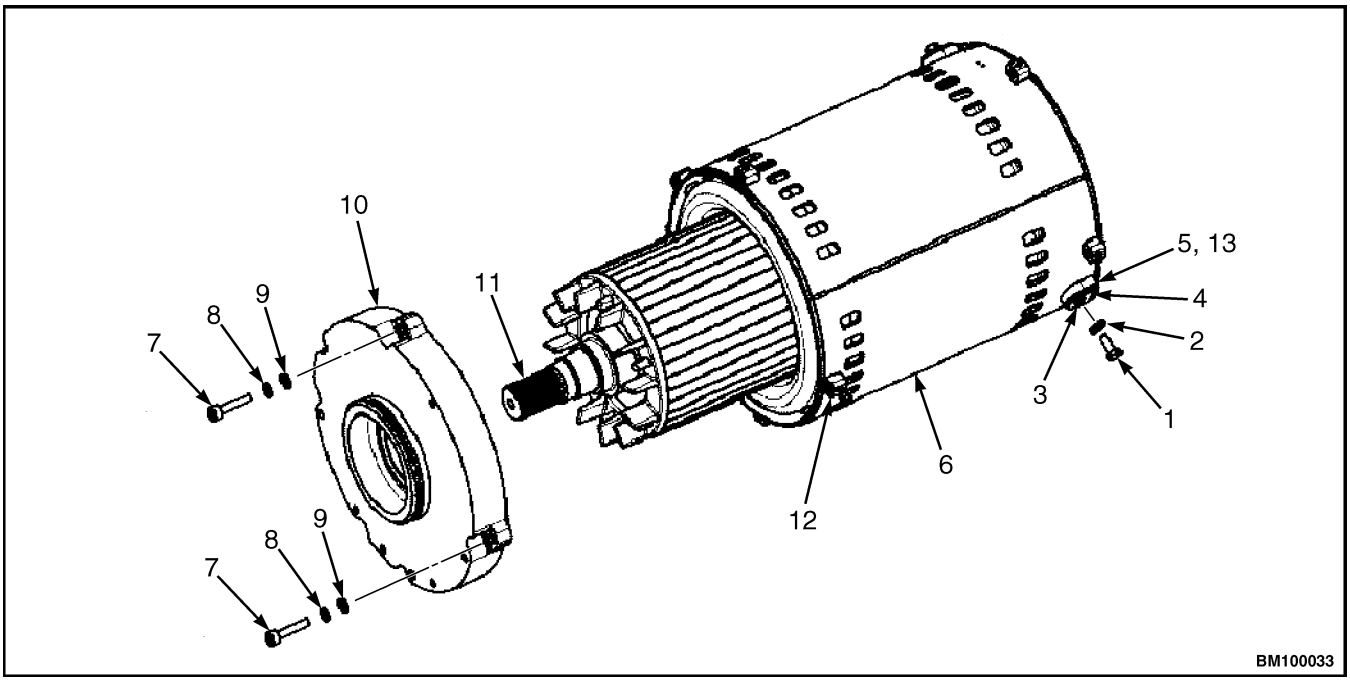
12. Screw lifting eye into threaded hole in end of rotor assembly. Attach approved lifting device and lift rotor assembly straight up from drive end head. See Figure 19.

NOTE: When replacing one bearing, it is strongly recommended to replace both bearings.

NOTE: Note orientation of bearing components prior to disassembly to aid in assembly.

13. Using bearing puller, remove bearing from drive end head. See Figure 19.

14. Remove and discard shaft seal from drive end head. See Figure 19.



1. HEX-HEAD BOLT
2. SPRING WASHER
3. TERMINAL FLAG
4. TERMINAL COVER
5. TERMINAL BLOCK
6. STATOR HOUSING
7. CAPSCREW
8. LOCKWASHER
9. WASHER
10. DRIVE END HEAD
11. ROTOR ASSEMBLY
12. STATOR Z-NUT
13. SPECIAL NUT

Figure 18. Traction Motor Drive End Head

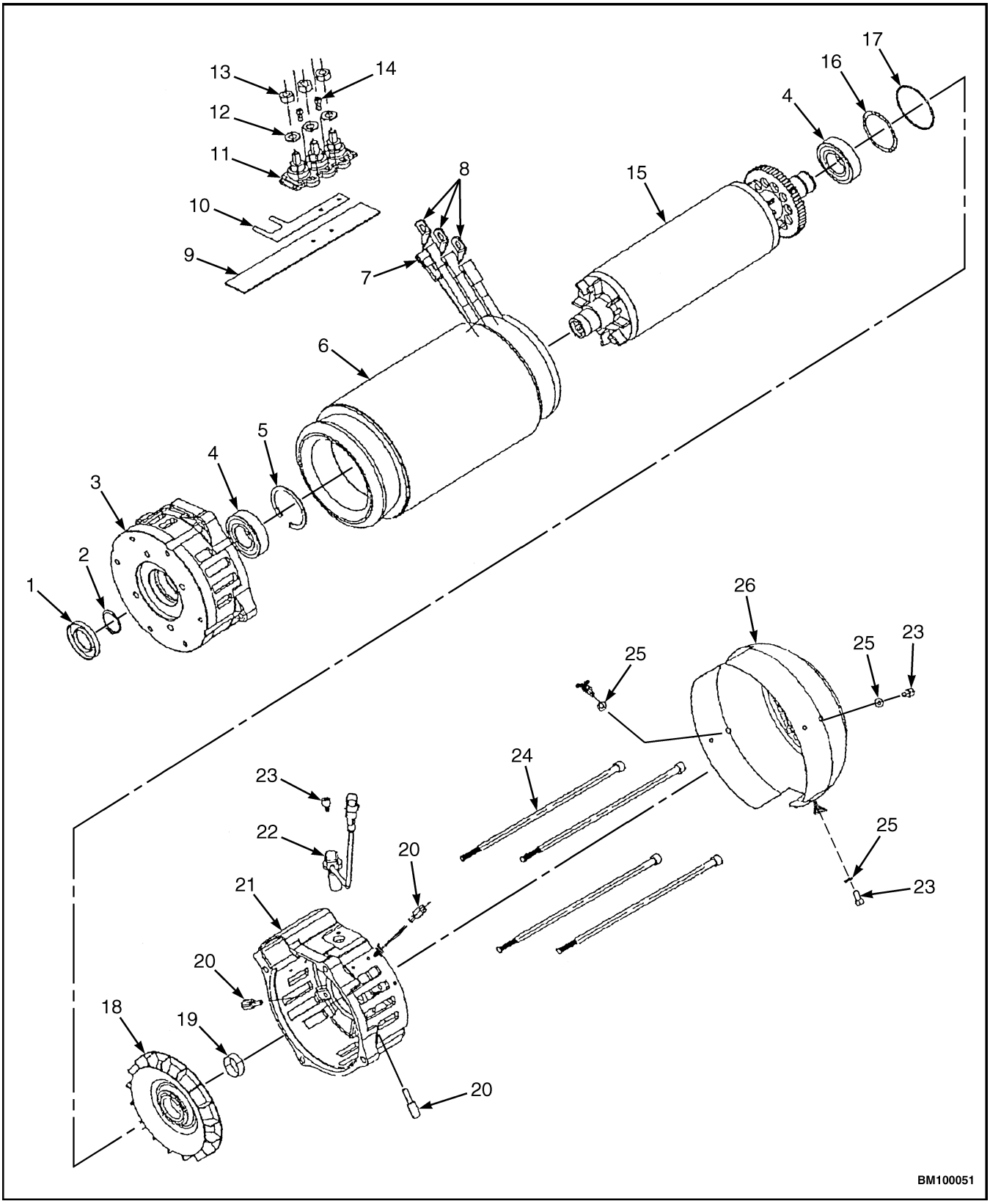


Figure 36. Hydraulic Motor, Lift Truck Models ERP2.2-3.5VL (ERP045-070VL) (A976)

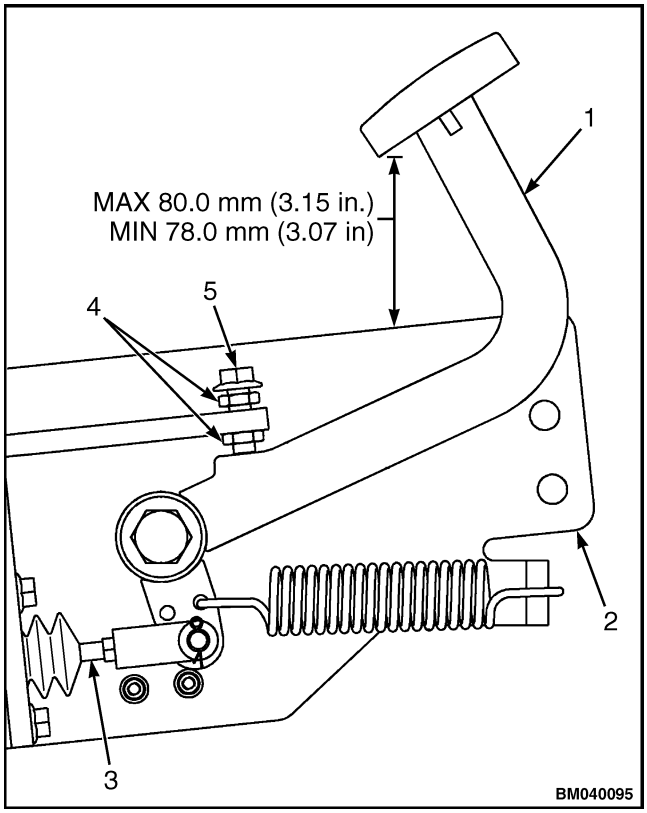
ASSEMBLE

For the following procedures, see Figure 4, and Figure 5.

1. Install brake pedal:
   a. Install new bushings into pedal if removed. Install sleeve into bushings. See Figure 5.
   b. Position pedal and washer into bracket and align holes. Make sure clevis is positioned properly if the master cylinder was not removed.
   c. Install bolt through washer, pedal, and bracket and secure with nut. Tighten to 165 to 206 N•m (122 to 152 lbf ft). See Figure 4.
2. Install pedal return spring.
3. Install master cylinder if removed. See Master Cylinder Repair in this section.
4. Install clevis to pedal using clevis pin and washer. Install new cotter pin to secure. See Figure 4.

INSTALL

1. Place brake pedal assembly in position and align the bracket with the mounting holes in the frame.
2. Install three capscrews and nuts securing bracket to frame.
3. Connect transducer and fluid sensor wiring as removed.
4. Connect the main pressure line to the elbow fitting on top of the master cylinder.
5. Bleed air from the brake system. See Master Cylinder Repair - Bleed the Brake System in this section.
6. Adjust the brake pedal to the proper height:
   a. Measure distance from the top of the bracket to the foot pedal as shown in Figure 6.
   b. Loosen locknuts and adjust capscrew so pedal is within the proper distance from the bracket.
   c. Retighten locknuts to secure capscrew in place.
7. Adjust the master cylinder linkage. See Adjust Linkage in this section.
8. Connect the battery and test for proper operation.
9. Install the floor covers and the floor mat.



1. PEDAL
2. BRACKET
3. MASTER CYLINDER LINKAGE
4. LOCKNUTS
5. CAPSCREW

Figure 6. Pedal Adjustment

Torque Specifications

FRAME

Screws - Overhead Guard Grab Handle
224 N•m (165 lbf ft)

Front Nuts - Overhead Guard
122 N•m (90 lbf ft)

Overhead Guard Leg Capscrews- Front
66 N•m (49 lbf ft)

Overhead Guard Leg Capscrews- Rear
66 N•m (49 lbf ft)

ELECTRICAL

Load Weight Sensor
37 N•m (27 lbf ft)

Motor Controller Power Cables
13 to 15 N•m (115 to 133 lbf in)

STEERING SYSTEM

Steering Disc
41 to 54 N•m (30 to 40 lbf ft)

Capscrews- Rotary Actuator to Frame
63 N•m (46 lbf ft)

Capscrews- Power Steering Pump Body
34 to 40 N•m (25 to 30 lbf ft)

Capscrews - Hydraulic Steering Motor
5 to 8 N•m (4 to 6 lbf ft)
Capscrews - Flange Cover (6 places) 30 to 36 N•m (22 to 27 lbf ft)
Capscrews - End Cover (6 places) 30 to 36 N•m (22 to 27 lbf ft)
Capscrews - Steering Control Unit to Steering Column 19 N•m (14 lbf ft)

Capscrews - Steering Motor Assembly Upper Mounting Brackets
52 N•m (38 lbf ft)

Capscrews - Steering Motor Assembly Lower Mounting Brackets
34 N•m (25 lbf ft)

Capscrews - Gear Housing
84 N•m (62 lbf ft)

Hydraulic Fittings - Steering Pump
24.9 to 29.4 N•m (18 to 22 lbf ft)

Steer Tire Wheel Nuts
81 N•m (60 lbf ft)

HYDRAULIC SYSTEM

Hydraulic Pump Fittings (Supply)
98 to 110 N•m (72 to 81 lbf ft)

Hydraulic Pump Fitting (Return)
151 to 166 N•m (111 to 122 lbf ft)

E-HYDRAULIC CONTROL VALVE

Tie Rod Nuts
19 to 22 N•m (14 to 16 lbf ft)

Jam Nuts
7 to 11 N•m (5 to 8 lbf ft)

Fitting, Inlet Section
16 N•m (12 lbf ft)

Compensator Plug
47 N•m (35 lbf ft)

Main Relief Valve
27 N•m (20 lbf ft)

Pilot Cartridge
65 N•m (48 lbf ft)

Plug, Lift Section
27 N•m (20 lbf ft)

Manual Lowering Valve
54 N•m (40 lbf ft)

Port Option Plug
54 N•m (40 lbf ft)

Plug, Tilt Section
27 N•m (20 lbf ft)

Tilt Relief Valve
27 N•m (20 lbf ft)

TRANSAXLE

Transaxle to Frame
220 N•m (162 lbf ft)

Fixing Plate and Disc Carrier to Spur Gear
70 N•m (52 lbf ft)

Wheel Lug Nuts
170 N•m (125 lbf ft)(Lubed)

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:

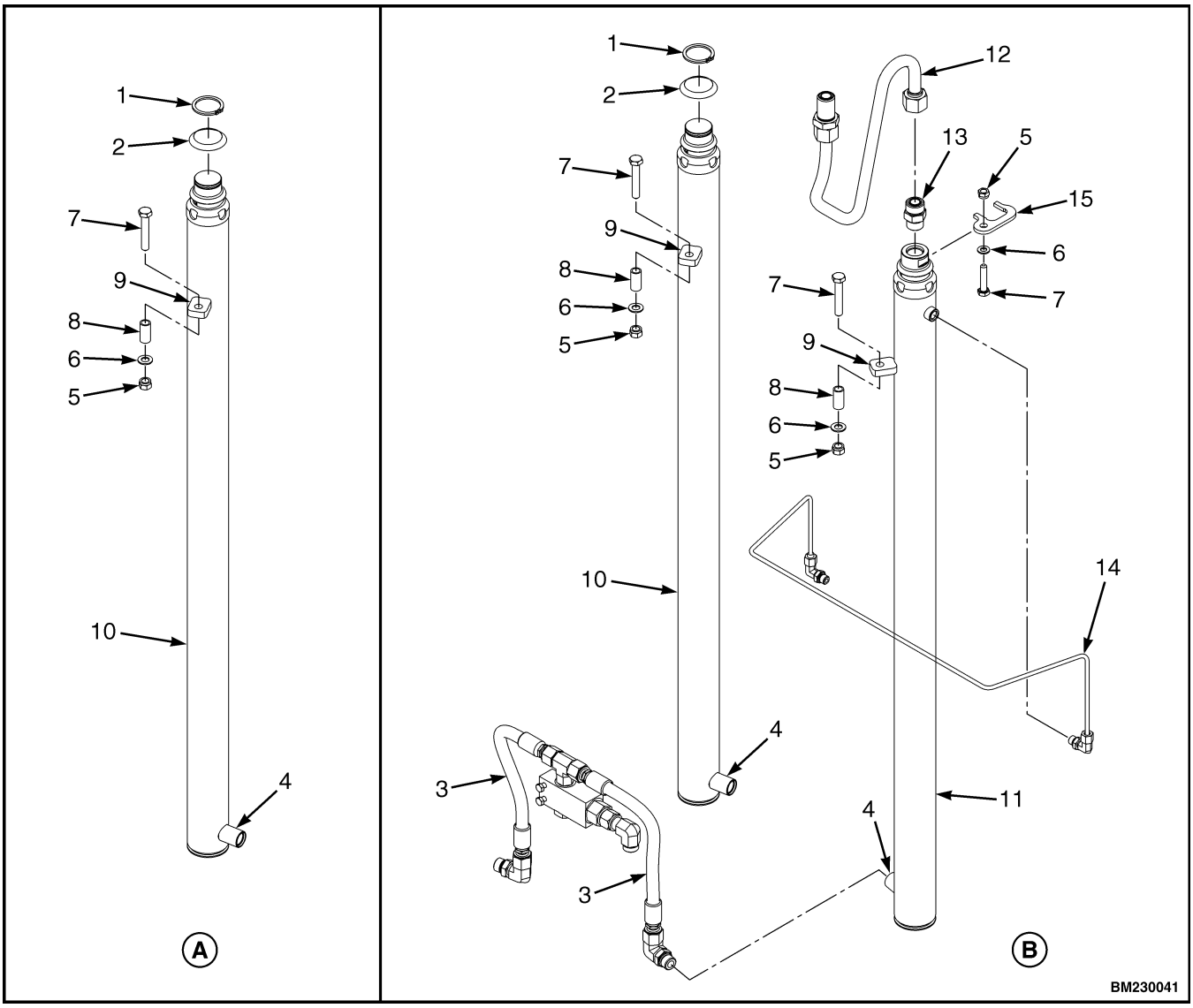
WARNING

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.

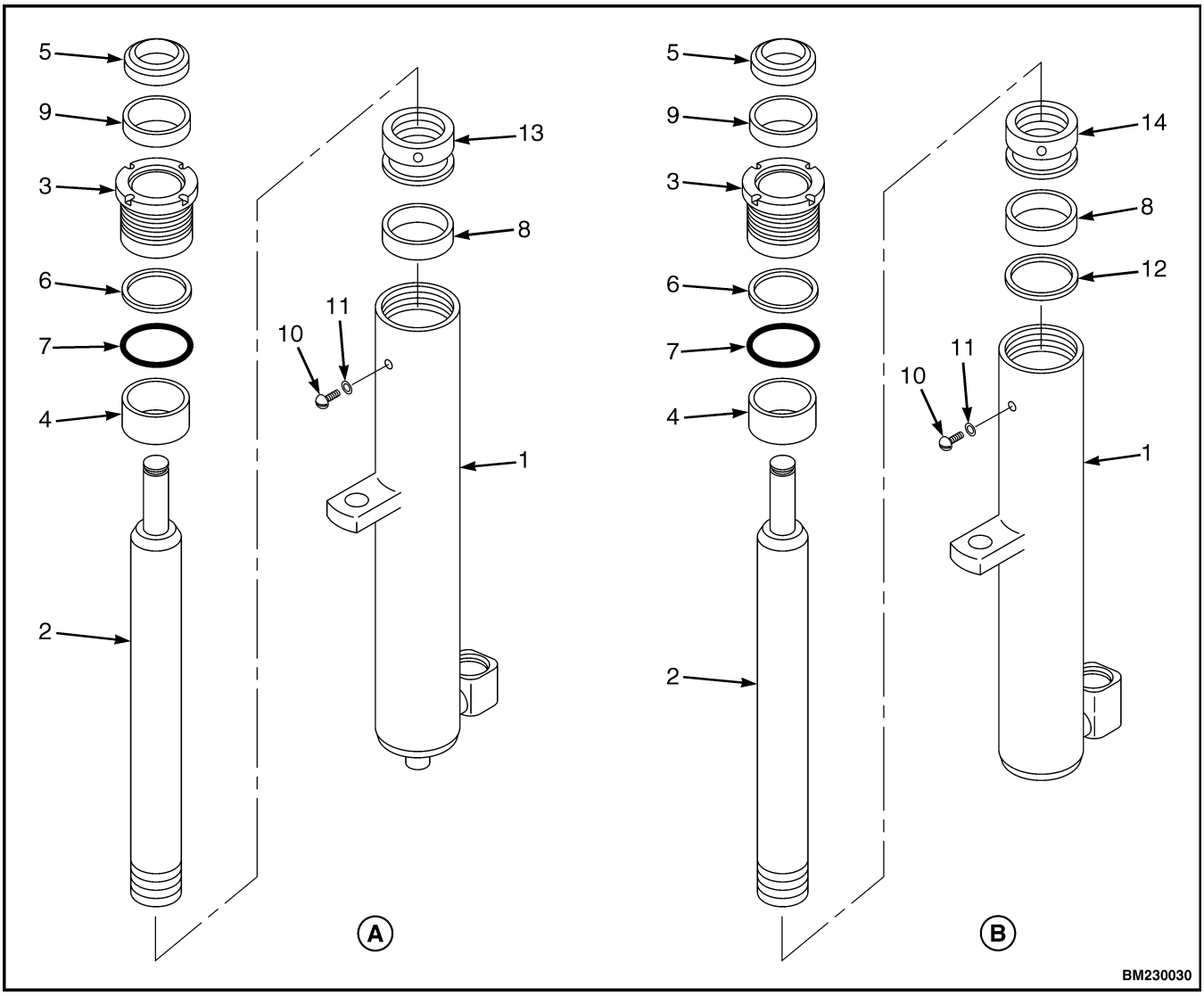


NOTE: BALANCE LINE IS USED ON FOUR-STAGE FFL MAST ONLY. MASTS REMOVED FOR CLARITY.

A. TWO AND THREE-STAGE FFL. TYPICAL FOR BOTH RIGHT-HAND AND LEFT-HAND CYLINDERS ON TWO AND THREE-STAGE MASTS.
B. FOUR-STAGE FFL

1. SNAP RING
2. SHIM
3. HYDRAULIC LINE
4. CYLINDER PORT
5. NUT
6. WASHER
7. CAPSCREW
8. SPACER
9. MOUNTING PLATE
10. LEFT-HAND MAIN LIFT CYLINDER
11. RIGHT-HAND MAIN LIFT CYLINDER
12. TUBE ASSEMBLY
13. STRAIGHT FITTING
14. BALANCE LINE
15. KEEPER

Figure 12. Main Lift Cylinders Installation



A. RIGHT-HAND CYLINDER

1. SHELL
2. ROD
3. GLAND
4. SPACER
5. ROD WIPER
6. BACKUP RING
7. O-RING

B. LEFT-HAND CYLINDER

8. WEAR RING
9. ROD SEAL
10. CAPSCREW
11. SEAL
12. PISTON RING
13. RIGHT-HAND PISTON
14. LEFT-HAND PISTON

Figure 22. Main Lift Cylinder Two-Stage FFL Mast

Perform Step 11 through Step 19 for Left-Hand Main Lift Cylinder.

NOTE: Lubricate new rings and seals with clean hydraulic oil prior to assembly.

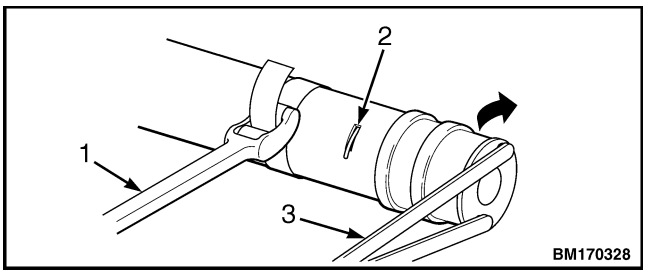
1. Install wire ring, spacer, nylon ring, piston seal, and wear ring onto piston as noted during disassembly. See Figure 30.
2. Install new backup rings and O-rings onto rod. See Figure 30.
3. Install spacer, if present, and new O-ring onto rod. See Figure 30.

NOTE: Apply Loctite™ 242 or equivalent to rod end threads prior to assembly.

4. Install rod end onto rod. See Figure 30. Tighten rod end to 68 N•m (50 lbf ft).
5. Install cushion sleeve into bottom of piston. See Figure 30.

NOTE: Apply Loctite™ 242 or equivalent to piston threads prior to assembly.

6. Install piston onto rod as specified below:
   a. Install new circlip onto piston. See Figure 34.
   b. Install piston onto rod. See Figure 34.
   c. Tighten piston to 68 N•m (50 lbf ft).
7. Install three check valves into piston. See Figure 31.
8. Install rod and piston assembly into shell. See Figure 30.



1. STRAP WRENCH
2. CIRCLIP
3. SPANNER WRENCH

Figure 34. Piston Installation

NOTE: Lubricate new rings and seals with hydraulic oil prior to installation. Be sure to install rod seal as noted during disassembly.

9. Install new wiper, rod seal, O-rings, and backup rings onto gland. See Figure 30.

NOTE: Apply Loctite™ 242 or equivalent to gland threads prior to assembly.

10. Install gland onto rod end and shell. See Figure 30. Tighten gland to 68 N•m (50 lbf ft).

NOTE: Perform Step 11 through Step 19 for Left-Hand Main Lift Cylinder.

NOTE: Lubricate new rings and seals with hydraulic oil prior to installation.

11. Install new O-ring onto control valve. See Figure 33.
12. Install control valve, washer, and new circlip into piston. See Figure 33.
13. Install new wire ring, nylon ring, piston seal, and war ring onto piston. See Figure 33.
14. Install cushion sleeve and new circlip into bottom of piston. See Figure 33.

NOTE: Apply Loctite™ 242 or equivalent to gland threads prior to assembly.

15. Install piston onto rod. See Figure 33. Tighten piston to 68 N•m (50 lbf ft).

NOTE: Lubricate new rings and seals with hydraulic oil prior to installation.

16. Install spacer and new O-ring onto rod. See Figure 33.
17. Install rod and piston assembly into shell.
18. Install new O-ring, backup ring, U-cup seal, and wiper onto gland. See Figure 33.

NOTE: Apply Loctite™ 242 or equivalent to gland threads prior to assembly.

19. Install gland onto rod and shell. See Figure 33. Tighten gland to 68 N•m (50 lbf ft).

Install

NOTE: Except as noted, the following procedures are for installation of both lift cylinders.

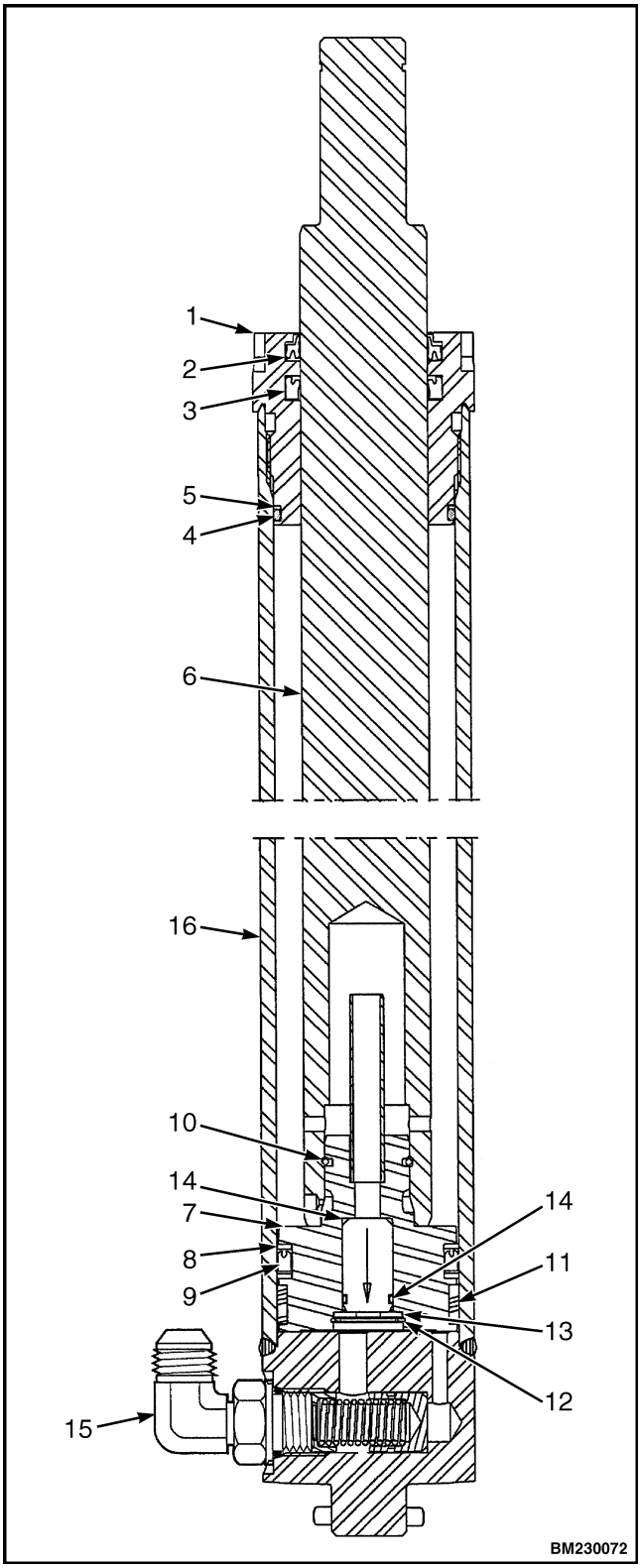


Figure 48. Free-Lift Cylinder Assembly

Legend for Figure 48

1. GLAND
2. WIPER
3. ROD SEAL
4. BACKUP RING
5. O-RING
6. ROD
7. PISTON
8. NYLON RING
9. PISTON SEAL
10. WIRE RING
11. WEAR RING
12. CIRCLIP
13. WASHER
14. CHECK VALVE
15. FITTING
16. SHELL

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.

WARNING

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

CAUTION

DO NOT allow cleaning solvent to come in contact with rubber components, as it will damage those components.

Clean all metal parts in solvent and dry with compressed air.

Inspect

Inspect gland for damage to threads and seal surfaces. If damaged, replace gland.

Inspect piston for damage to seal surfaces. If damaged, replace rod and piston assembly.

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

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

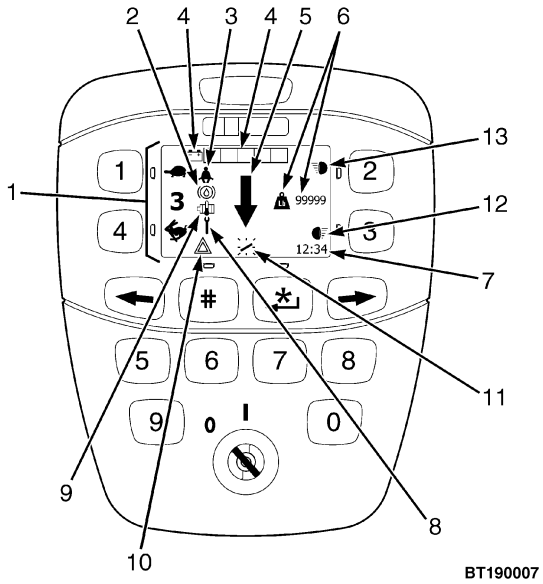
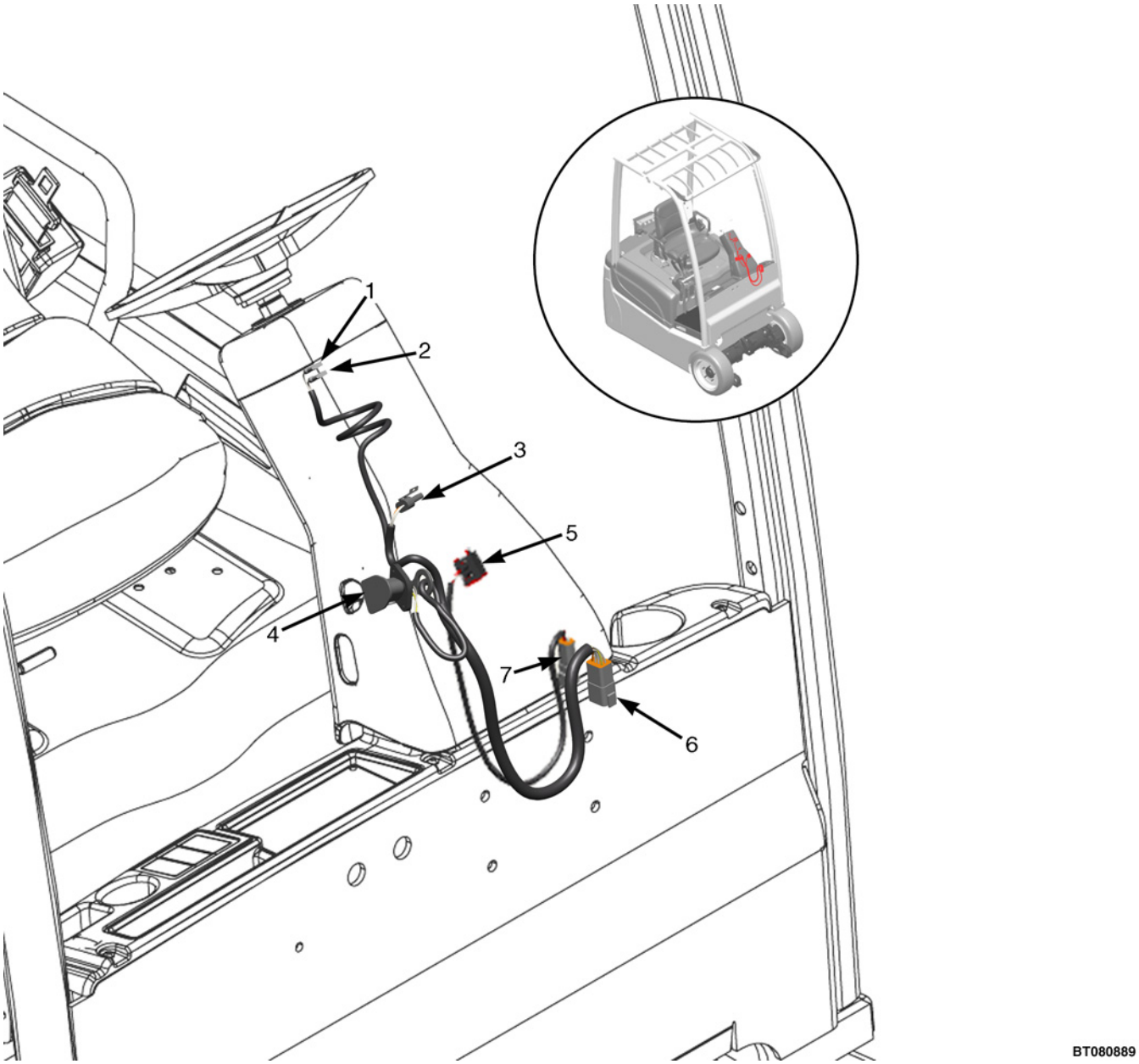
CHECK	PROCEDURE	ACTION
Display Backlight and Icon Power Check	 **1.** INDICATOR LIGHT, PERFORMANCE MODE **2.** WARNING LIGHT, LOW BRAKE FLUID **3.** WARNING LIGHT, FASTEN SEAT BELT **4.** INDICATOR LIGHT, BATTERY DISPLAY INDICATOR (BDI) **5.** INDICATOR LIGHT, DIRECTION INDICATORS **6.** INDICATOR LIGHT, LOAD WEIGHT **7.** INDICATOR LIGHT, SYSTEM TIME **8.** WARNING LIGHT, SERVICE DUE LIGHT **9.** WARNING LIGHT, MOTOR TEMPERATURE HIGH WARNING **10.** INDICATOR LIGHT, HAZARD FLASHERS **11.** INDICATOR LIGHT, TIRE ANGLE **12.** INDICATOR LIGHT, FRONT WORK LIGHTS **13.** INDICATOR LIGHT, REAR WORK LIGHTS Turn Keyless Start Switch or Key Switch to **ON** position with park brake applied. ***Do the Display Backlight and icons appear on the LCD screen?*** **NOTE:** Fasten seat belt, icon will turn off after 10 seconds. *Continue:*	**YES:** Display power is OK. Go to next step. **NO:** See No Display/No Truck Operation.
Light Circuit Check	**1.** Turn front and rear work light switches ON. ***Do lights turn on?***	**YES:** Lights are OK. Go to next check. **NO:** See Observed Symptoms, Light Operation

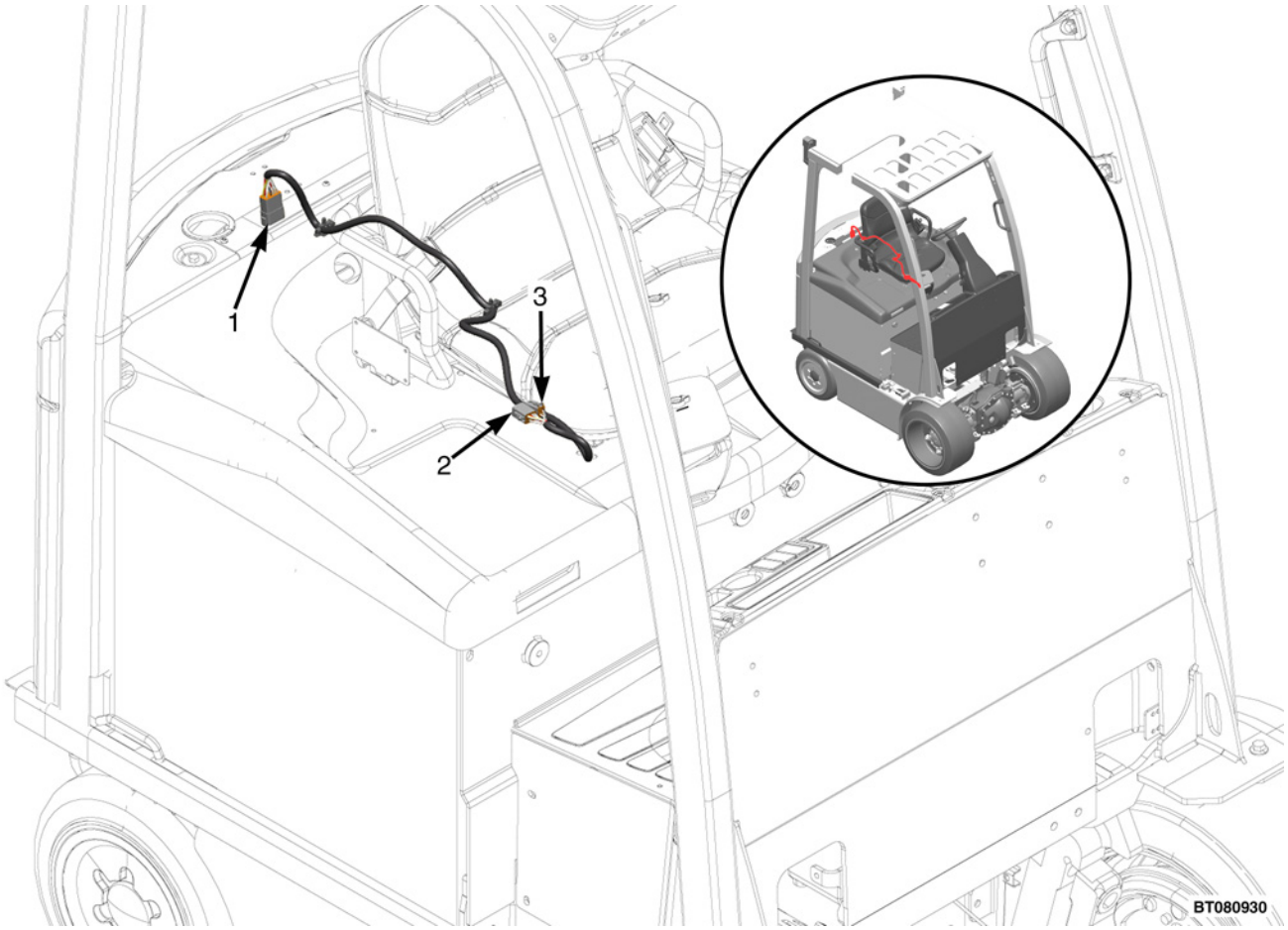
TABLE OF CONTENTS (Continued)

A955 – G807 CAN Communication Failure:
DTC 33025 - VSM to Display
DTC 33026 - VSM to Traction 1 (Right)
DTC 33027 - VSM to Traction 2 (Left)
DTC 33029 - VSM to Pump
DTC 33034 - VSM to MLM (DCS)
DTC 33035 - VSM to Impact
DTC 33036 - VSM to CAN Reserved 1
DTC 33037 - VSM to CAN Reserved 2
DTC 33038 - VSM to CAN Reserved 3
DTC 33057 - Display to VSM 9030-20-122
CBB 4 Wheel CAN Communication:
DTC 33025 - VSM to Display
DTC 33026 - VSM to Traction 1 (Right)
DTC 33027 - VSM to Traction 2 (Left)
DTC 33029 - VSM to Pump
DTC 33034 - VSM to MLM (DCS)
DTC 33035 - VSM to Impact
DTC 33036 - VSM to CAN Reserved 1
DTC 33037 - VSM to CAN Reserved 2
DTC 33038 - VSM to CAN Reserved 3
DTC 33057 - Display to VSM 9030-20-136
DBB 4 Wheel CAN Communication:
DTC 33025 - VSM to Display
DTC 33026 - VSM to Traction 1 (Right)
DTC 33027 - VSM to Traction 2 (Left)
DTC 33029 - VSM to Pump
DTC 33034 - VSM to MLM (DCS)
DTC 33035 - VSM to Impact
DTC 33036 - VSM to CAN Reserved 1
DTC 33037 - VSM to CAN Reserved 2
DTC 33038 - VSM to CAN Reserved 3
DTC 33057 - Display to VSM 9030-20-152
MLM Failure:
DTC 21830 - MLM EEPROM Write Error
DTC 21834 - MLM Sensor 1 Out of Range
DTC 21835 - MLM Sensor 2 Out of Range
DTC 21836 - MLM Sensor 3 Out of Range
DTC 21837 - MLM Sensor 4 Out of Range
DTC 25344 - MLM Checksum Error 9030-20-164
MLM Incorrect Lever Installed:
DTC 4112 - Incorrect Lever 1 Installed
DTC 4113 - Incorrect Lever 2 Installed
DTC 4114 - Incorrect Lever 3 Installed
DTC 4115 - Incorrect Lever 4 Installed
DTC 4116 - Incorrect Lever 5 Installed 9030-20-170
VSM 12 Volts Supply OORL/OORH:
DTC 13060 - VSM 12V OORL
DTC 13061 - VSM 12V OORH 9030-20-173



1. TF15 HORN SWITCH NO
2. TF14 HORN SWITCH C
3. CPS78 STEERING WHEEL POSITION SENSOR
4. CPS28 DIAGNOSTIC CONNECTION
5. CPS128 STEER MAKE-UP VALVE
6. CRP132 MAIN HARNESS
7. CRP133 MAIN HARNESS

Figure 9030-03-5. ; ERP15-20VT (ERP030-040VT) (G807); Wire Harness Steering



1. CRP54 MAIN HARNESS
2. CPS52 MLM SEAT HARNESS
3. CPS55 SEAT SENSOR

Figure 9030-03-22. ERC22-35VG (ERC045-070VG) (A968); ERP22-25VL (ERP040-070VL) (A976) Wire Harness Seat E-Hydraulic

Relays

Key Switch Relay: Upon turning on the key or keyless switch located on Display panel, key switch relay gets energized and provides power to components to which it is connected. See Figure 9030-10-19, Page 9030-10-13.

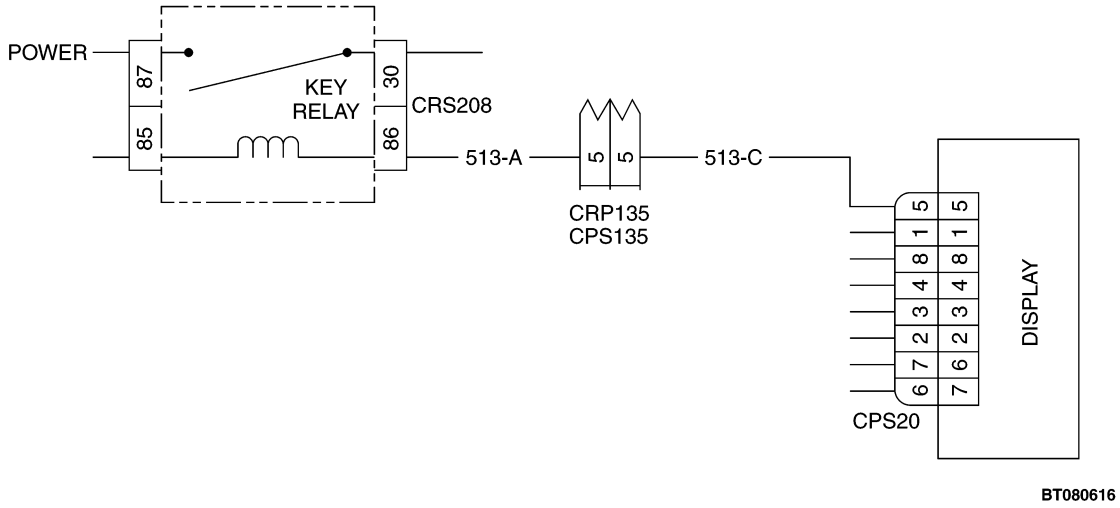


Figure 9030-10-19. Key Switch Relay Diagram ERC22-35VG (ERC045-070VG) (A968) and ERP22-35VL (ERP040-070VL) (A976) Shown

E-Hydraulic Enable Relay: This relay is available on lift trucks with E-Hydraulic option and is controlled by the VSM and gets activated whenever operators send input to VSM via E-Hydraulic input device. It provides 12V power to E-Hyd coils. See Figure 9030-10-20, Page 9030-10-13.

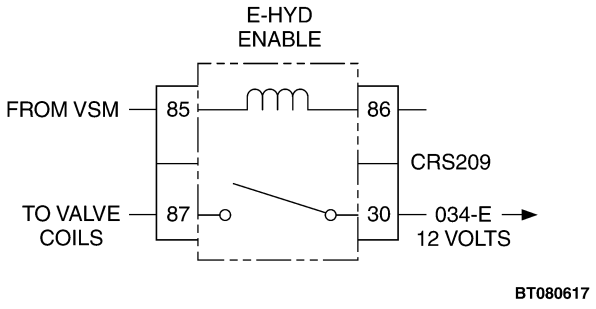


Figure 9030-10-20. E-Hyd Enable Relay Circuit ERC22-35VG (ERC045-070VG) (A968) and ERP22-35VL (ERP040-070VL) (A976) Shown

Backup Light Relay (Optional): This device is controlled by the VSM and gets activated after detecting the selection of reverse direction. See Figure 9030-10-21, Page 9030-10-13.

Brake Light Relay (Optional): This is controlled by the VSM and gets activated after brake is applied. See Figure 9030-10-22, Page 9030-10-13.

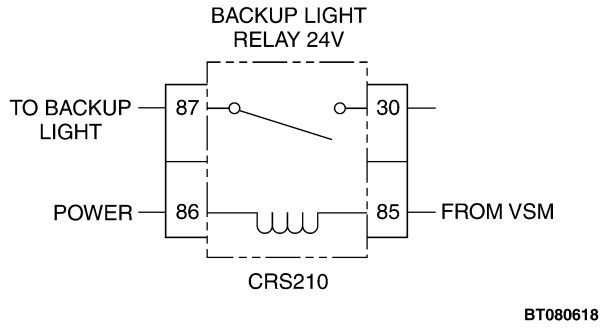


Figure 9030-10-21. Backup Light Relay Circuit ERC22-35VG (ERC045-070VG) (A968) and ERP22-35VL (ERP040-070VL) (A976) Shown

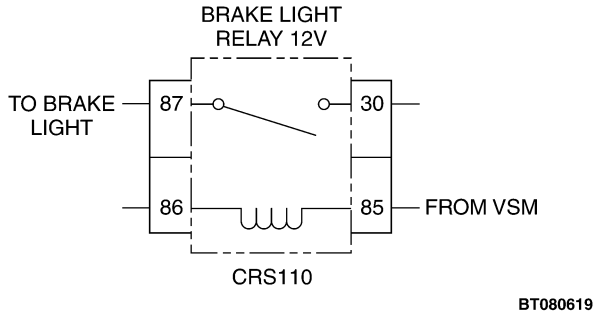
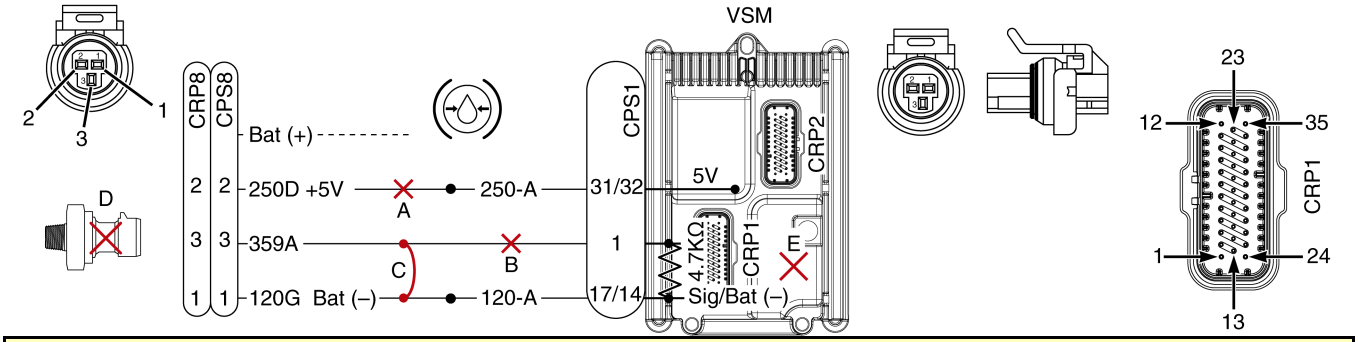


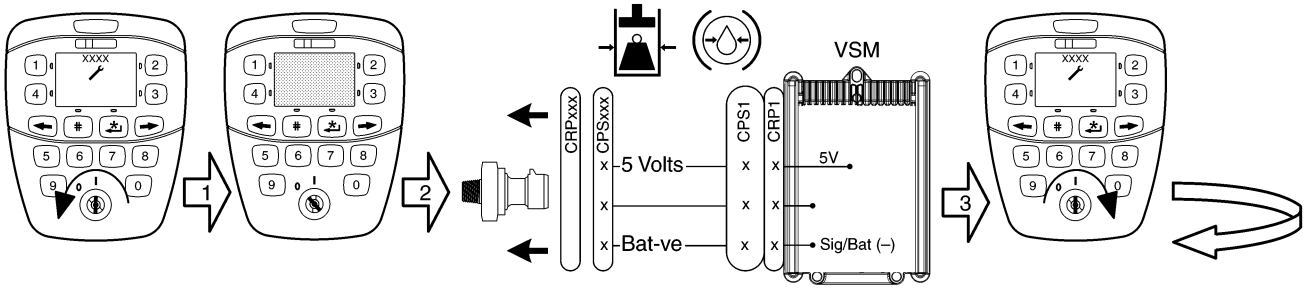
Figure 9030-10-22. Brake Light Relay Circuit ERC22-35VG (ERC045-070VG) (A968) and ERP22-35VL (ERP040-070VL) (A976) Shown

TSP Load Weigh/Service Brake Pressure Sensor Out of Range Low (OORL) (Cont)

SERVICE BRAKE PRESSURE CAUSES A B C D E > ?

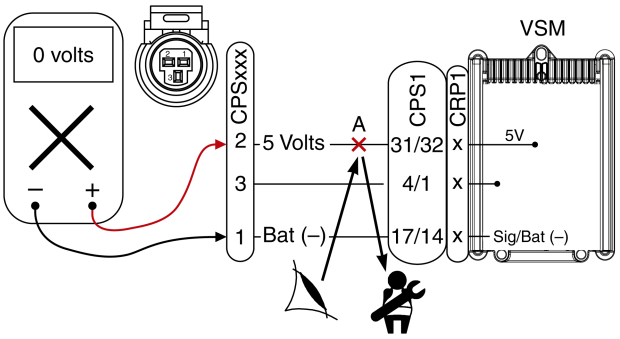


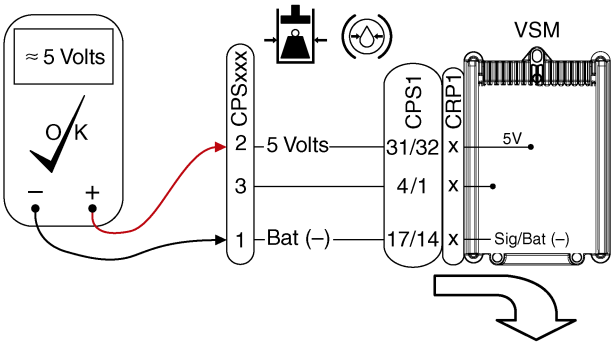
CAUSE A



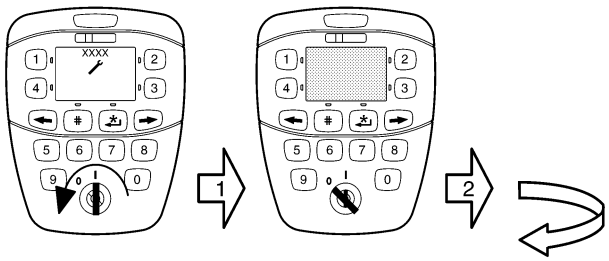
Power **OFF**→ Disconnect sensor→ Power **ON**→ ↴

CAUSE A1 CHECK VOLTAGE





0 Volts = Open circuit→ Find↑ **OPEN** circuit.	≈ 5 Volts =	**OK** For Service Brake Pressure, go to Cause B.
Repair OPEN Circuit. See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369.		For Load Weigh Pressure, go to Cause C.



Power **OFF**→ ↴

(continued on next page)

TSP Accelerator Pedal Position A/B Data Incorrect (Cont)

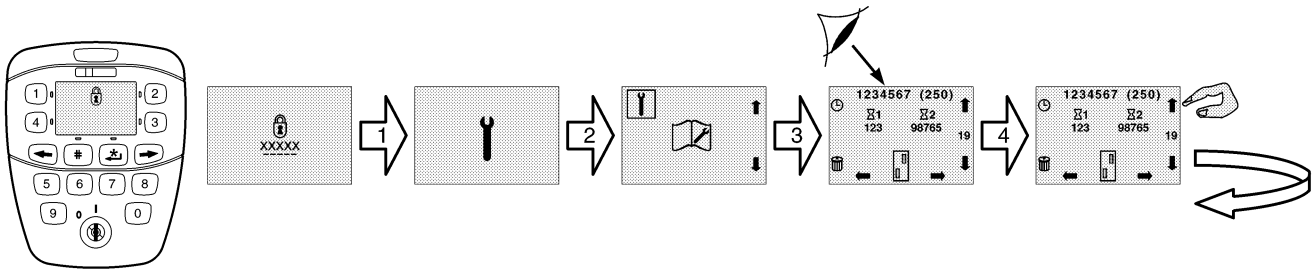
QUICK CHECK X = Open Circuit/Fail) = Short Circuit

Check 1 FAULT LOG CODE Review - Go to Display Menu

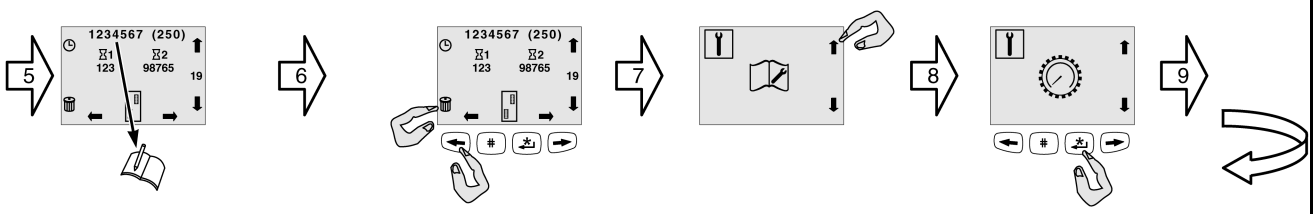
Note: DTC 12812 can be caused by the same conditions that caused DTCs 12808 to 12811

Check VSM Fault Logs→ Go to Check 1↑ Are these codes present?↓

YES→ See Accelerator Pedal Position A/B Out of Range Low (OORL) or Accelerator Pedal Position A/B Out of Range High (OORH)	NO→ Go to Check 1↑



Enter Service Password→ Diagnostic→ FAULT LOGs→ VSM/MLM Fault Logs→ View all VSM/MLM DTCs→ ↴

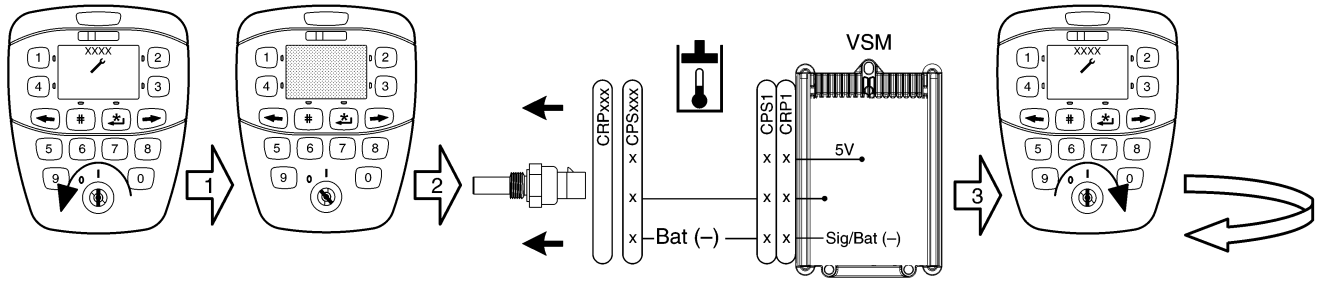


All VSM/MLM DTCs	Erase all VSM/MLM DTCs→ Exit Fault Log→ ↑ ↓ Speedometer *

(continued on next page)

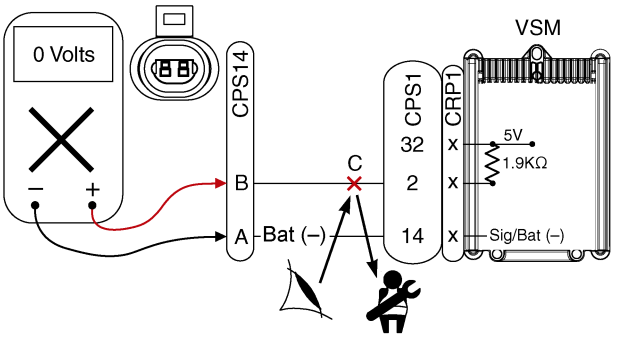
TSP Hydraulic Temperature Sensor Out of Range High (OORL) (Cont)

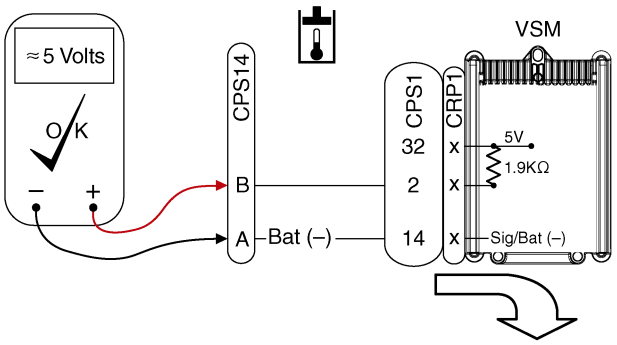
CAUSE C



Power **OFF**→ Disconnect sensor→ Power **ON**→ Go to next step.

CAUSE C1 CHECK VOLTAGE



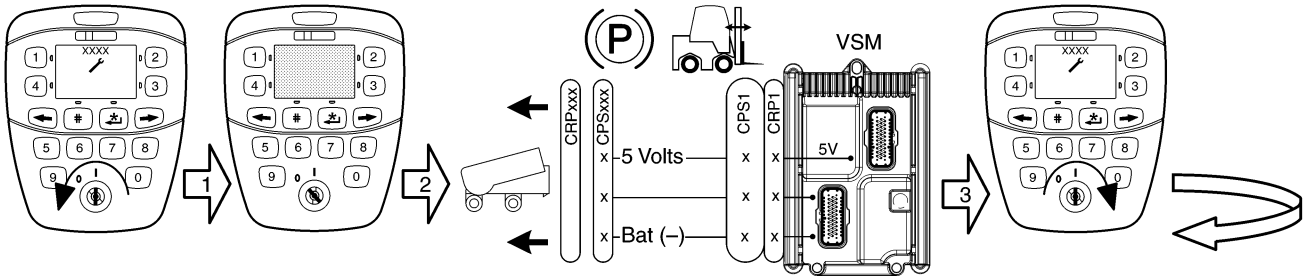


0 Volts = Short circuit→ Find↑ **Short** circuit.	≈ 5 Volts = **OK** Go to Cause D
Repair Short Circuit. See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369.	

(continued on next page)

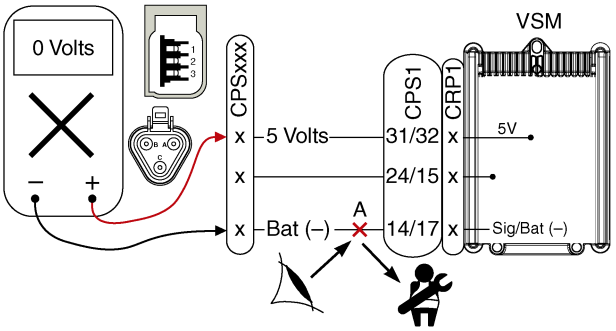
TSP Park Brake/Mast Tilt Position Sensor Out of Range Low (OORL) (Cont)

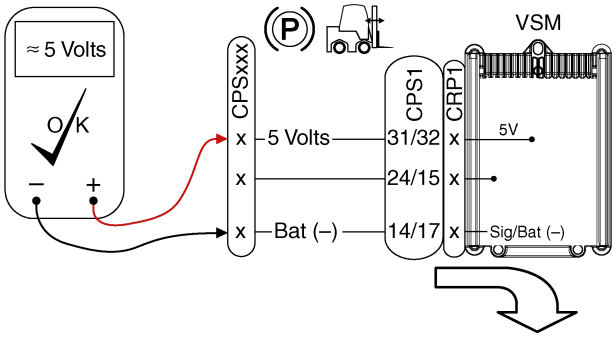
CAUSE A



Power **OFF**→ Disconnect sensor→ Power **ON**→ Go to next step.

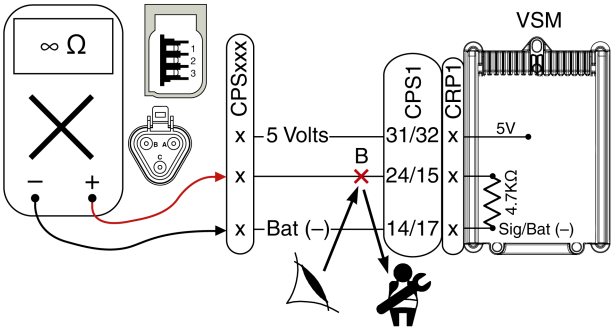
CAUSE A1 CHECK VOLTAGE

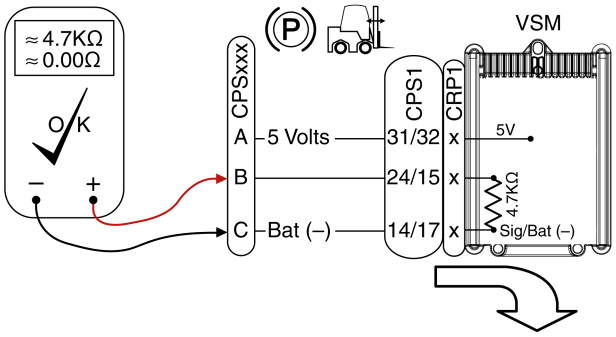




0 Volts = Open circuit→ Find↑ **OPEN** circuit.	≈ 5 Volts = **OK** Go to Cause B.
Repair OPEN Circuit. See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369.	

CAUSE B CHECK RESISTANCE - Ω - OHMS



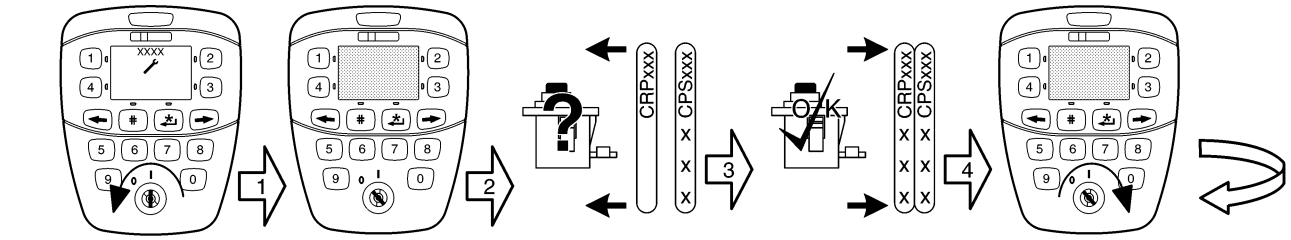


∞ Ω = Open circuit→ Find↑ **OPEN** circuit	≈ 4.7KΩ = **OK** Go to Cause D
Repair OPEN circuit. See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369.	≈ 0 Ω = Go to Cause C

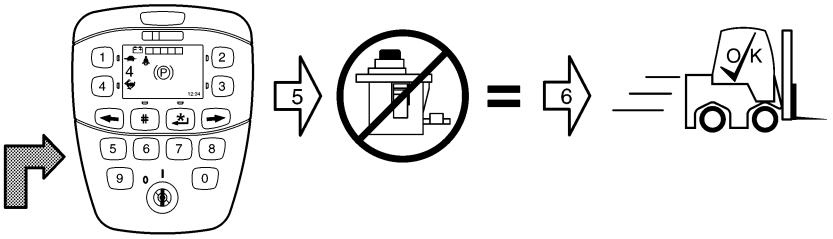
(continued on next page)

TSP Seat Sensor Out of Range Low (OORL) (Cont)

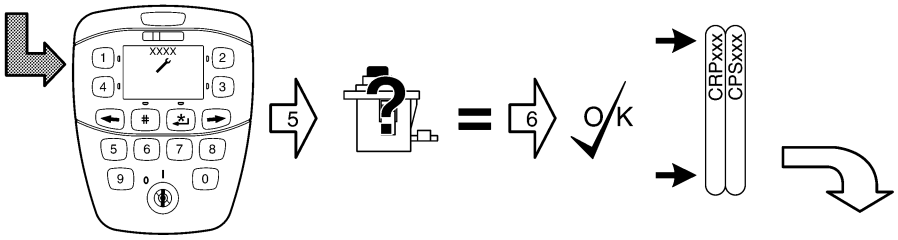
CAUSE D



Power **OFF**→ Disconnect sensor.→ Install new sensor.→ **Do not discard** Power **ON**→ Go to next step.



? Fault DTC gone→ Old sensor faulty→ Resume operation

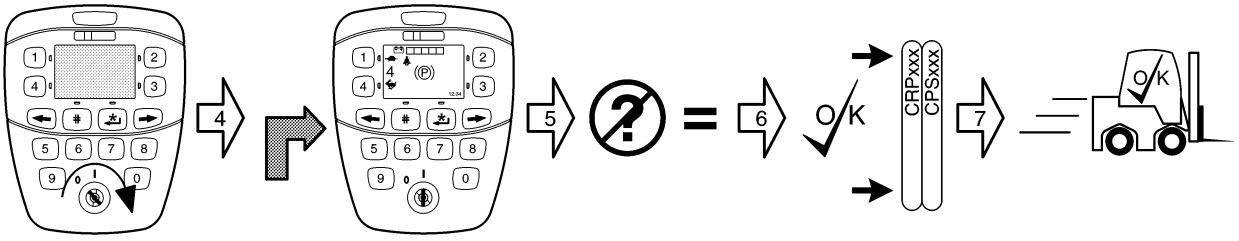


Fault DTC present→ Old sensor OK/Reinstall old sensor→ Go to Cause E.

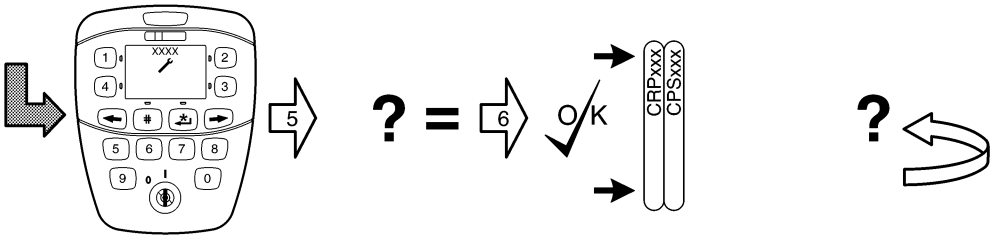
(continued on next page)

TSP VSM 5 Volt Supply (OORL) (OORH) (Cont)

CAUSE D2

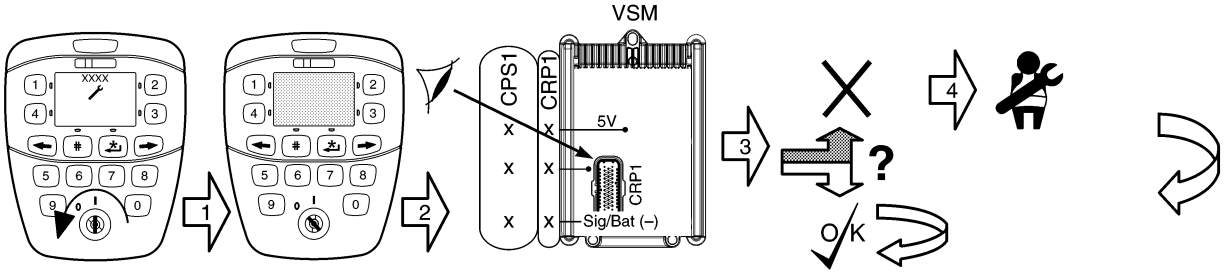


? Power **ON**→ 5 Volt Fault DTC gone→ Old sensor faulty→ Install New sensor→ Resume operation



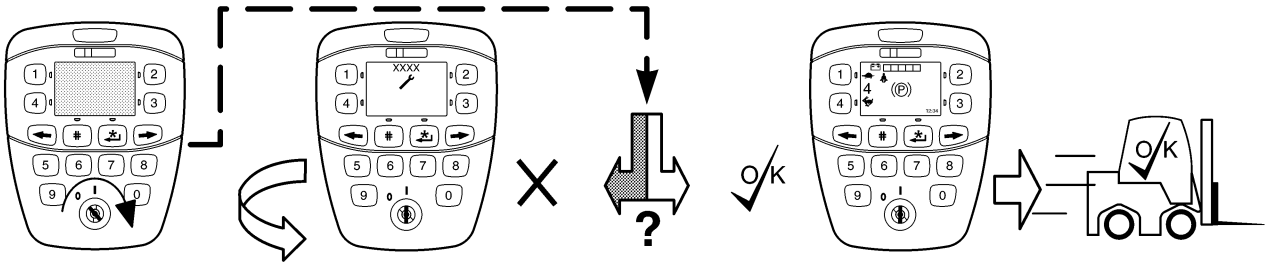
Original Fault DTC present→ Old sensor OK/Reinstall old sensor→ Go to Next Sensor. Repeat Cause D
All Sensors tested OK.
Go to Cause E

CAUSE E



Power **OFF**→ Inspect VSM Connections→ Go to Cause E1. Not OK Correct/Repair→ Go to Cause E1.

CAUSE E1



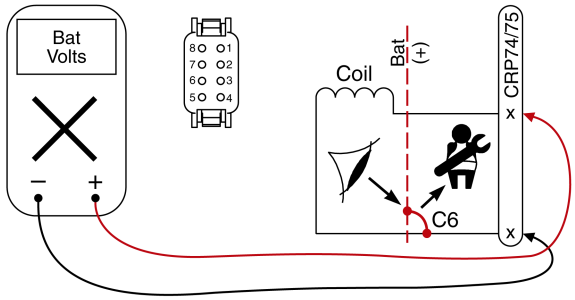
Retest - Power **ON**→ **NO**→ Go to VSM Controller Check Is fault DTC gone? ←**NO YES**→ Fault corrected→ Continue operation.

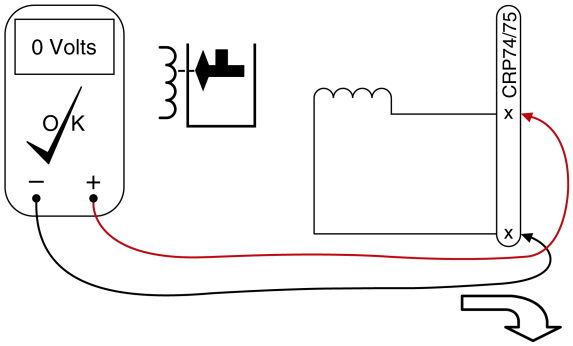
END FAULT

TSP E-Hydraulic Coils Short To Battery Positive (STBP) (Cont)

CAUSE C6 UNSWITCHED VOLTAGES

NOTE: Short to Unswitched Battery



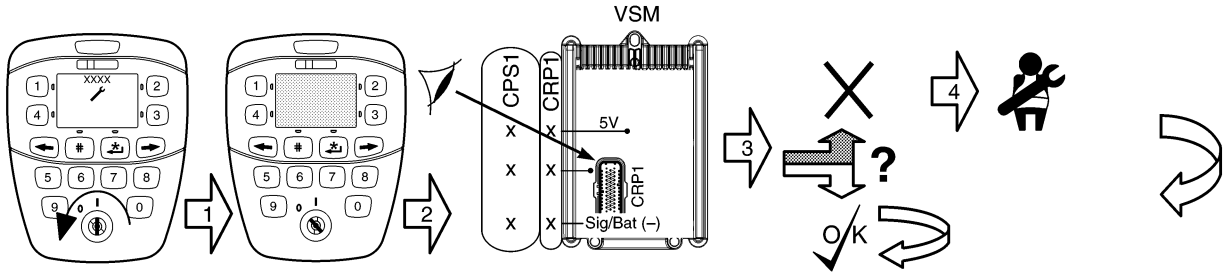


Bat Volts = Short circuit→ Find↑ **SHORT** circuit →	≈ 0 Volts = **OK** Go to Cause E
Repair Open Circuit. See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369.	

CAUSE D

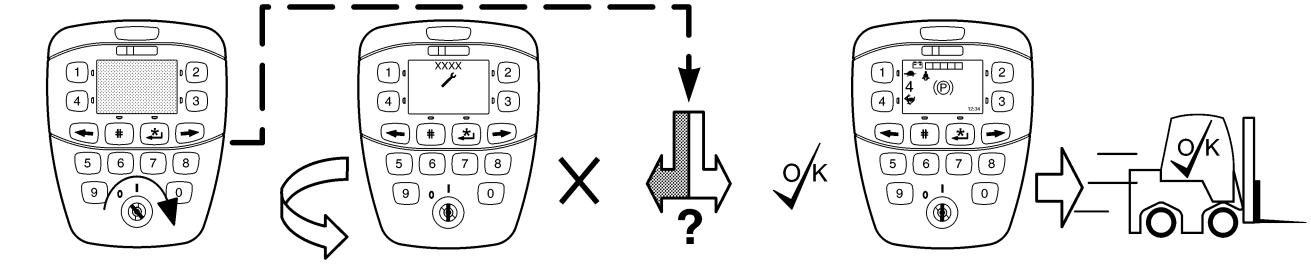
Not Applicable

CAUSE E



Power **OFF**→ Inspect VSM Connections→ Go to Cause E1. Not OK Correct/Repair→ Go to Cause E1.

CAUSE E1

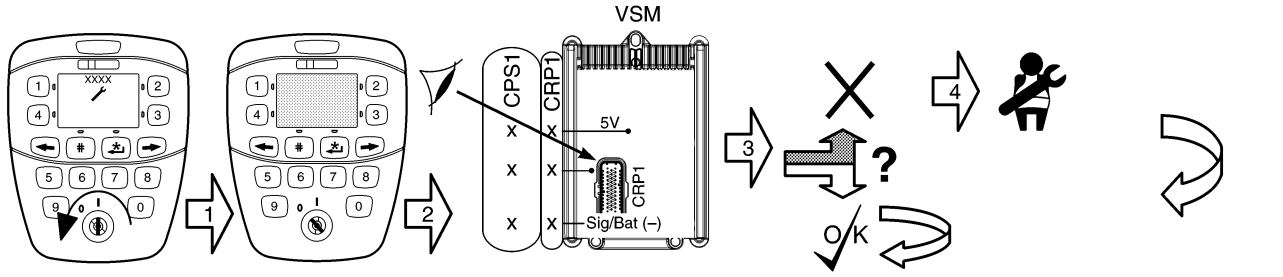


Retest - Power **ON**→ **NO**→ Go to VSM Controller Check Is fault DTC gone? ←**NO YES**→ Fault corrected→ Continue operation.

END FAULT

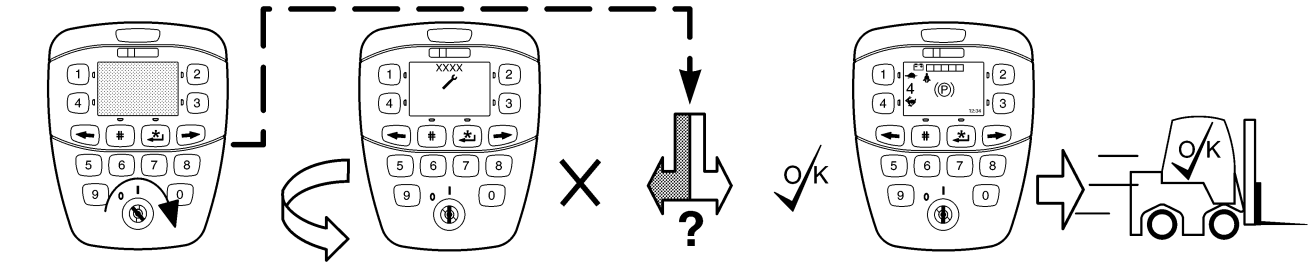
TSP A955 – G807 CAN Communication Failure (Cont)

CAUSE E



Power **OFF**→ Inspect VSM Connections→ Go to Step E1 Not OK Correct/Repair→ Go to Step E1

STEP E1



Retest - Power **ON**→ **NO**→ Go to VSM Controller Check Is fault DTC gone? ←**NO** **YES** Fault corrected→ Continue operation

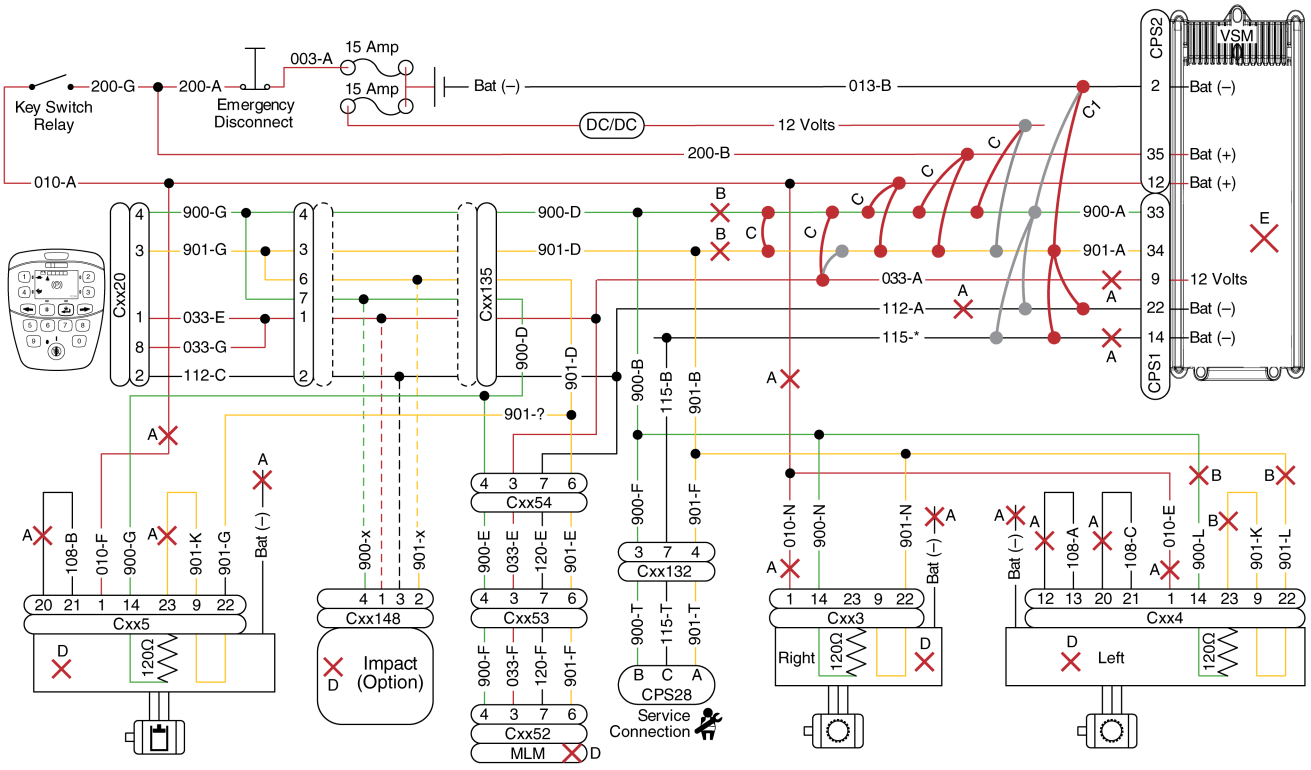
END FAULT

TSP DBB 4 Wheel CAN Communication (Cont)

POSSIBLE CAUSES X = Open Circuit/Fail) = Short Circuit) = No DTC

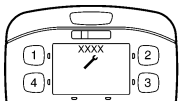
Table 9030-20-5. Main Schematic

Open Circuit – Termination Resistor/CAN Hi/CAN Lo/Key Switch Supply/Device Supply/ CAUSES A, B
CAN Short to – Bat (—)/12volt Bat (+)/Shorted CAN Hi to CAN Lo/Device Failure CAUSES C, D, E
CAUSES A B C D E > ?



(continued on next page)

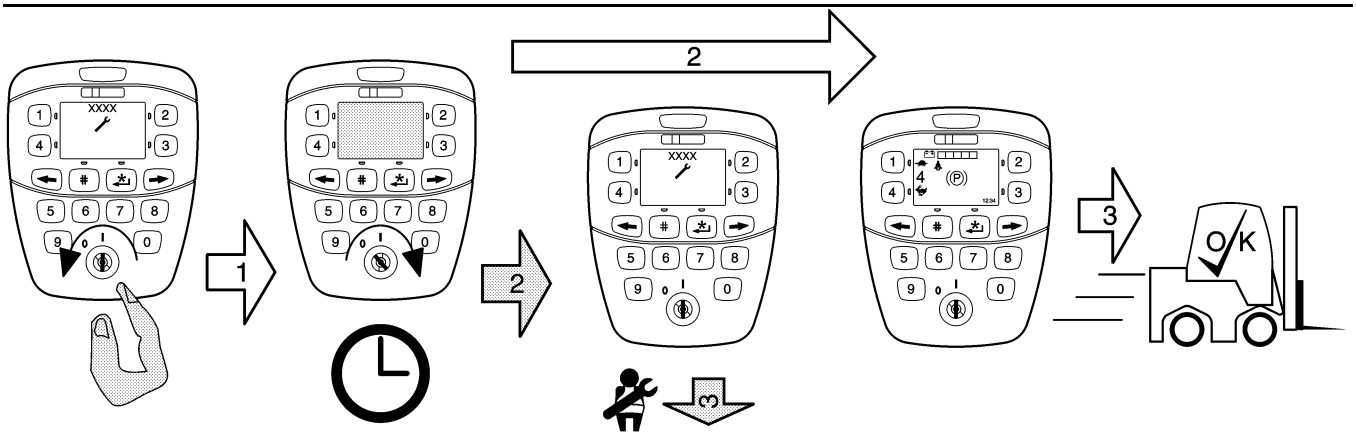
TSP VSM 12 Volts Supply OORL/OORH



DTC 13060
VSM 12V OORL

DTC 13061
VSM 12V OORH

FAULT CODES:



Power **OFF**→

Wait **30 seconds**→

Power **ON**→

Fault remains. Service required. Go to Cause A.

No fault→

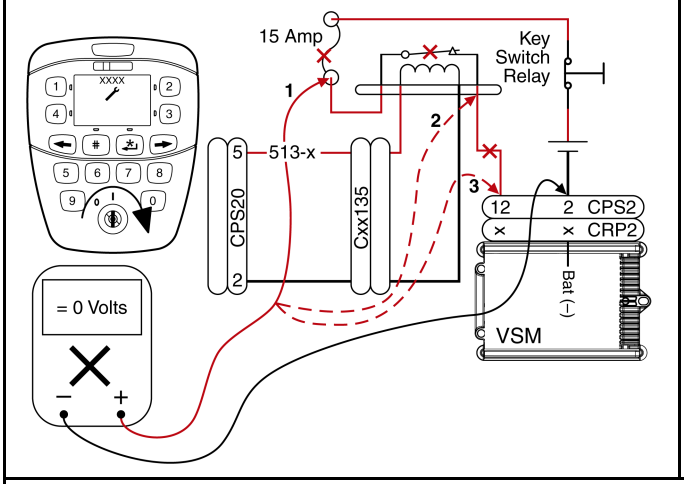
Resume operation

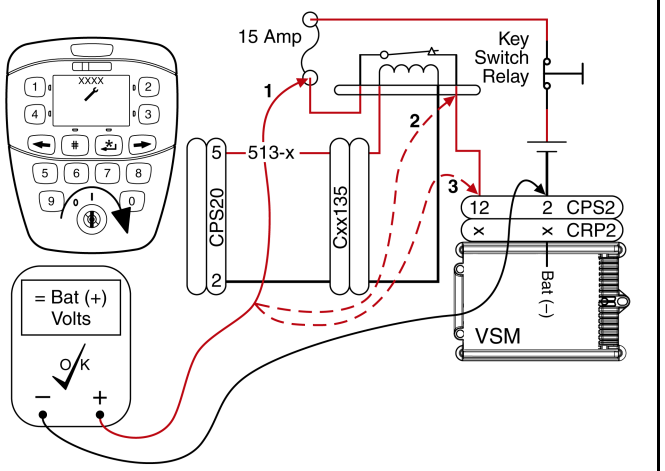
POSSIBLE CAUSES X = Open Circuit/Fail) = Short Circuit

(continued on next page)

TSP Display Failure – Keyswitch Relay Output (Cont)

STEP A4





CAUTION

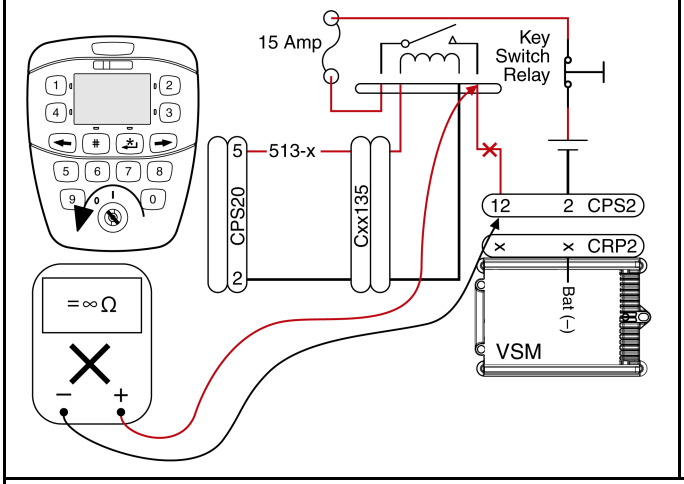
Do not backprobe VSM connector if Breakout Connectors are available. See Step A6 for Alternative to 3.

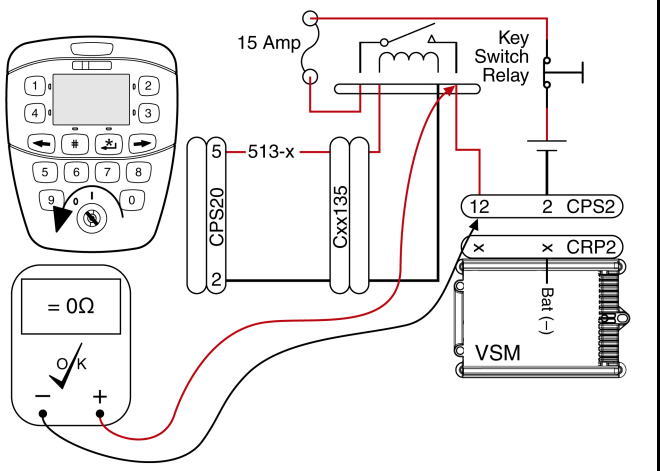
1. Turn Key Switch **ON**→ Measure Volts at 1, 2, and 3→ Go to 2↓

2. 0 Volts→ Open Circuit Fuse/Wiring/Relay Contacts→ Go to 3↓	2. ≈ Bat (+) Volts = OK→ Step A6↓

3. Find/Repair OPEN Circuit See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369→ ReCheck Volts↑ Step A5→ Reconnect→ Step A6↓

STEP A5





Turn Key Switch **OFF**→ Disconnect Relay and VSM CPS 2→ Measure Ω→ Go to 1↓

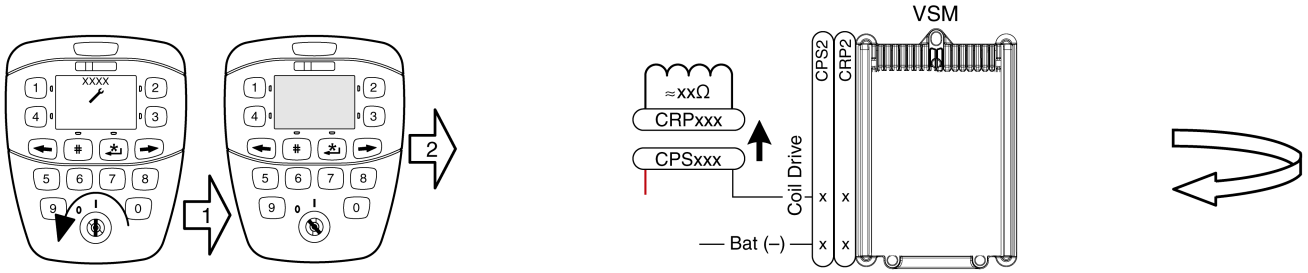
1. = ∞Ω→ Open Circuit Wiring→ Go to 2↓	1. ≈ 0Ω = OK→ Step A6↓

2. Find/Repair OPEN Circuit See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369→ ReCheck Ω↑ Step A1→ Reconnect→ Step A6↓

(continued on next page)

TSP Contactor/Relay/Valve Coil Short to Battery Positive (STBP) (Cont)

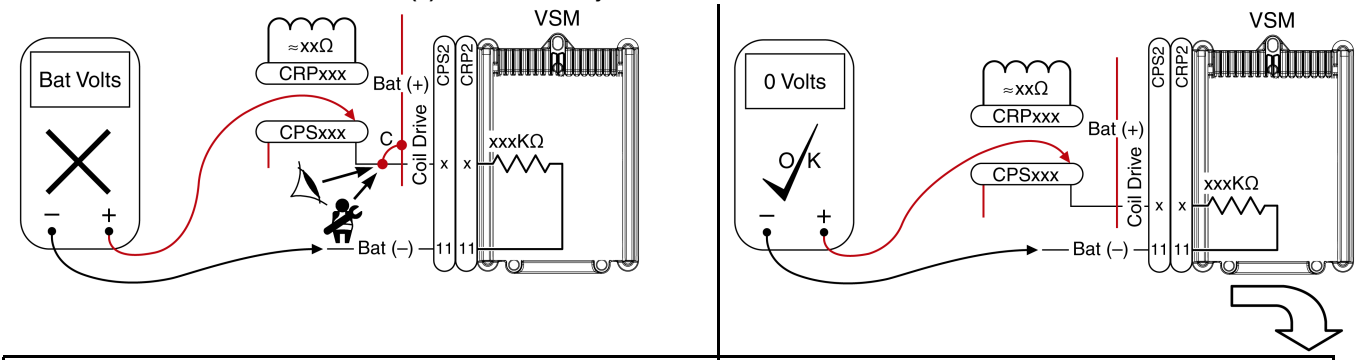
CAUSE C



Power **OFF**→ Unplug/Disconnect Contactor/Relay/Valve Coil Indicated DTC Connection to VSM→ ↴

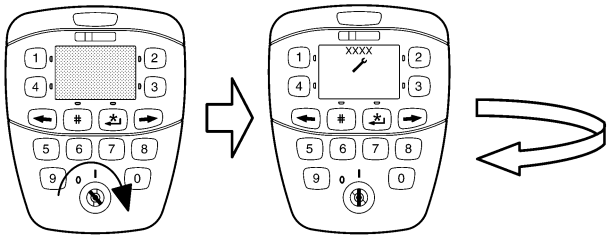
STEP C1 UNSWITCHED VOLTAGES

NOTE: Short Circuit to Unswitched Bat (+) Contactor/Relay/Valve Coil Connection to VSM



Bat Volts = Short circuit→ Find↑ **SHORT** circuit.→	≈ 0 Volts = **OK** ↴
Repair SHORT Circuit. See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369.	
See Schematic for Connection information	

STEP C2

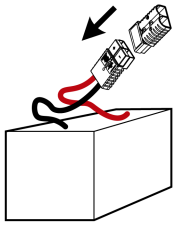


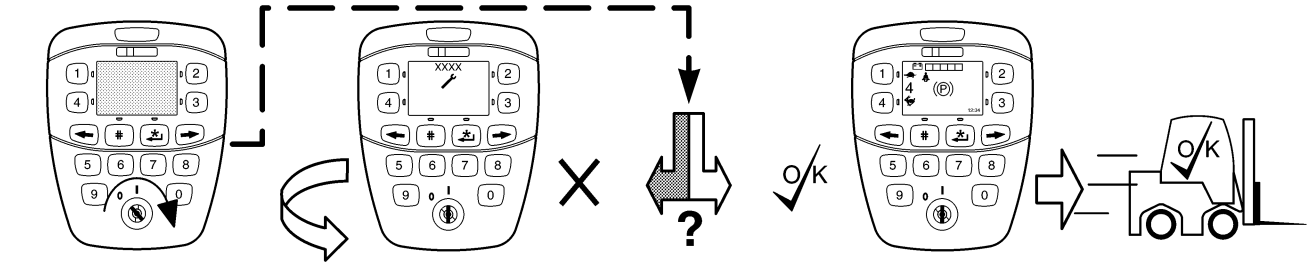
Power **ON**→ ↴

(continued on next page)

TSP A955 – G807 Motor Controller Contactor Failure (Cont)

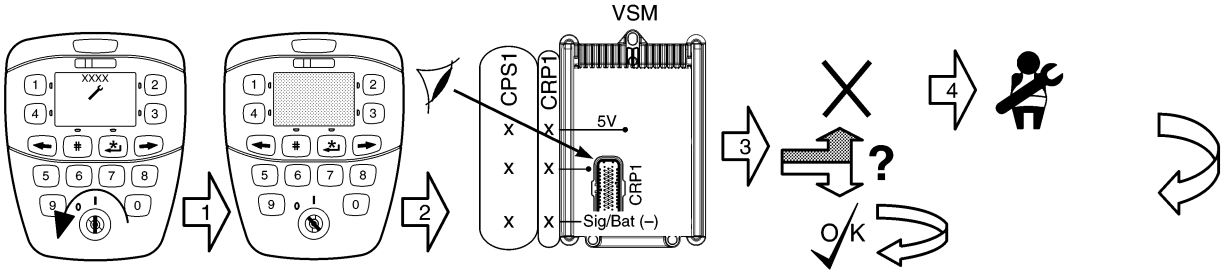
STEP D3





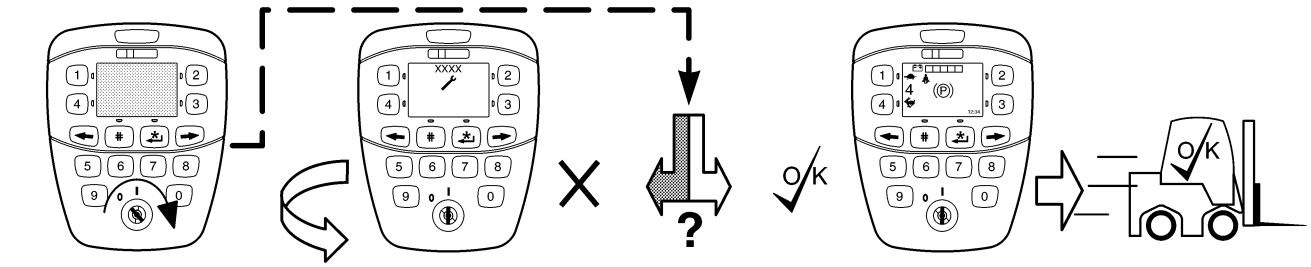
Retest - Power **ON**→ **NO**→ ↴ Is fault DTC gone? ←**NO** **YES** → Fault corrected→ Continue operation.

CAUSE E



Power **OFF**→ Inspect VSM Connections→ OK Step E1 Not OK Correct/Repair→ Step E1

STEP E1



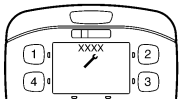
Retest - Power **ON**→ **NO**→ Go to VSM Controller Check Is fault DTC gone? ←**NO** **YES** → Fault corrected→ Continue operation.

DTC LOGS: DTC logs should only be cleared once the data is by the Service Tech. See Display Menu Flowchart **- Clearing DTCs.**

END FAULT

TSP CBB/DBB Motor Speed Sensor Failure

DTC 25104
Sensor Fault

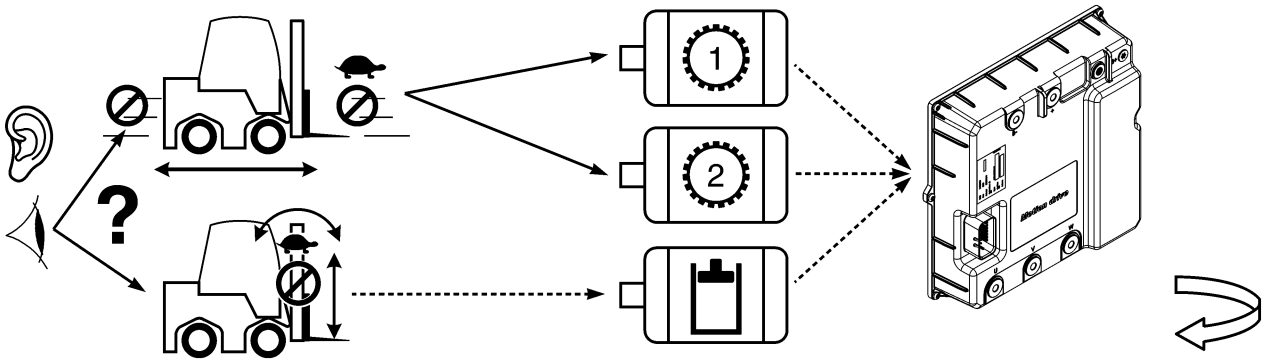


DTC 29456
Sensor Fault

FAULT CODES:

QUICK CHECK X = Open Circuit/Fail) = Short Circuit

Check 1



?No Traction/Hydraulic Truck Operation?

POSSIBLE CAUSES

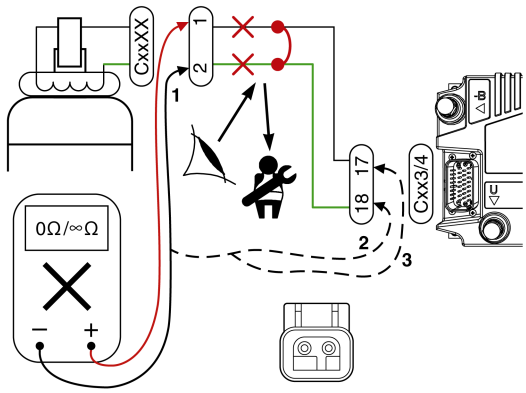
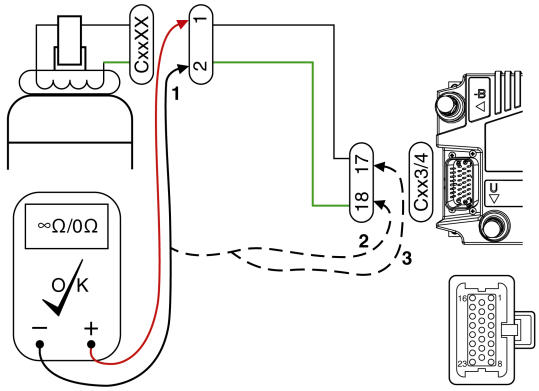
1. Speed Sensor/Motor Controller Connections/Wiring?→
2. Speed Sensor Failure?→
3. Motor Controller(s) Failure ?→
4. Motor Failure ?→

WARNING

The CBB Truck requires the removal of the battery to access the Controllers and Motors

(continued on next page)

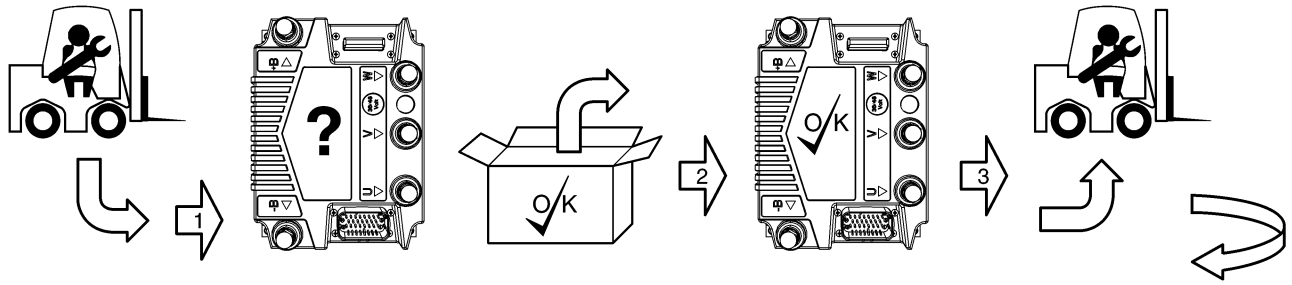
TSP A955 – G807 Motor Auto Brake Failure (Cont)

STEP A4	**CHECK RESISTANCE - Ω - OHMS**
Auto Brake Connections Open/Short Circuit	
	
1. 0Ω = Short Circuit→ Go to 4↓	1. ≈ ∞Ω = OK→ Go to 2↓
2. ∞Ω = Open Circuit→ Go to 4↓	2. ≈ 0Ω = OK→ Go to 3↓
3. ∞Ω = Open Circuit→ Go to 4↓	3. ≈ 0Ω = OK→ Cause D↓
4. Find/Repair Short/Open Circuit See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369 →	
5. Recheck Ω↑ → Reconnect→ Test→ No DTCs→ YES→ Resume Operation No→ Cause D↓	
CAUSE B	
Not Applicable	
CAUSE C	
Not Applicable	

(continued on next page)

TSP A955 – G807 Motor/Motor Controller Failure (Cont)

STEP D1

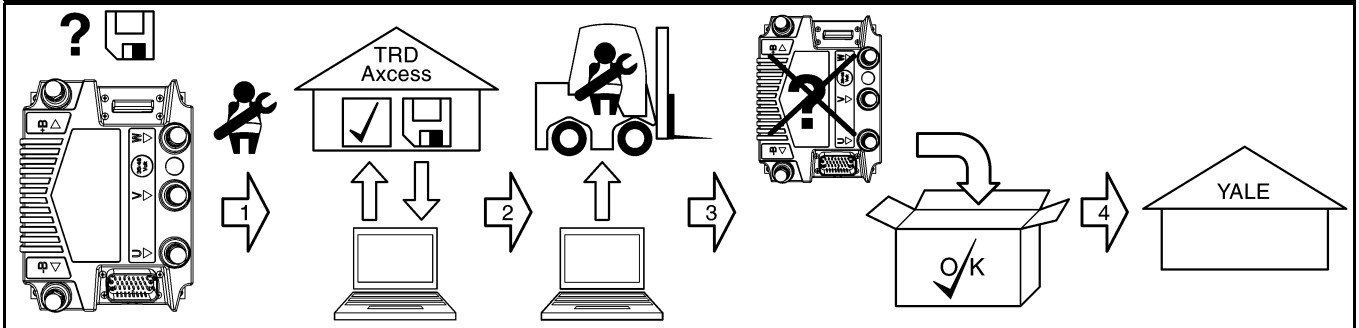


Remove and Replace Faulty Motor Controller↓

See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369↓

Check Replacement Controller 💾 Version→ See Label Information→ Step D2↓

STEP D2

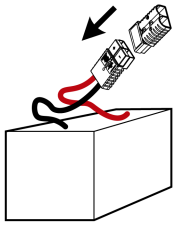


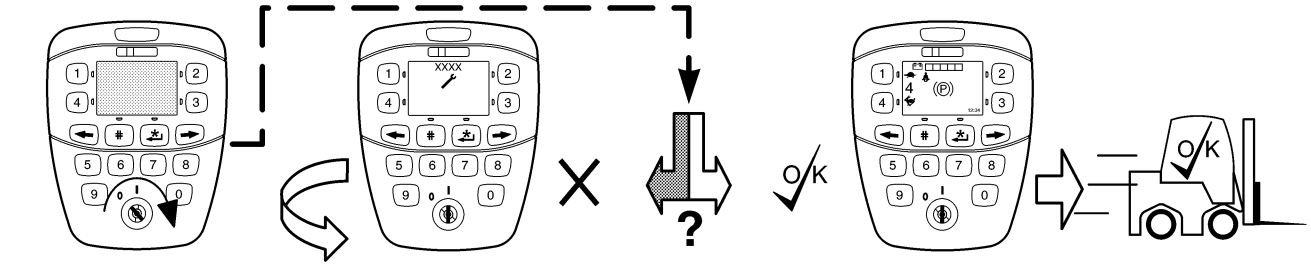
1. Go to TRD/Axcess Online /Software. ?? Is Replacement Controller Application Software Version the Latest Version
2. **NO**→ Download the latest Application 💾 → Install on truck→ ↓
3. **YES**→ Test New Installation→ ↓ Step D3↓
4. Return Faulty Display→ Dealer→ Factory→ Failure Analysis→ ?? Reprogramming

(continued on next page)

TSP CBB/DBB Motor/Motor Controller Failure (Cont)

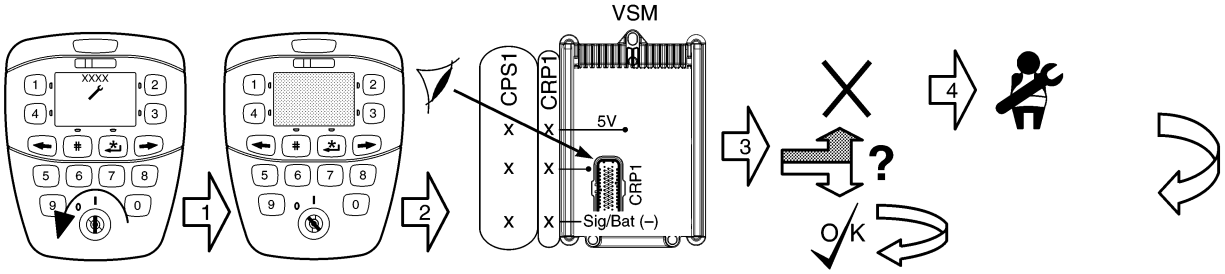
STEP D3





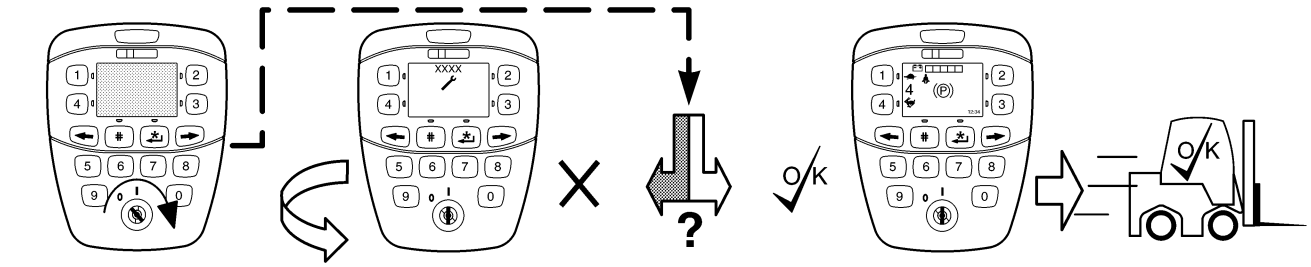
Retest - Power **ON**→ **NO**→ ↴ Is fault DTC gone? ←**NO** **YES** → Fault corrected→ Continue operation.

CAUSE E



Power **OFF**→ Inspect VSM Connections→ OK Step E1 Not OK Correct/Repair→ Step E1

STEP E1



Retest - Power **ON**→ **NO**→ Go to VSM Controller Check Is fault DTC gone? ←**NO** **YES** → Fault corrected→ Continue operation.

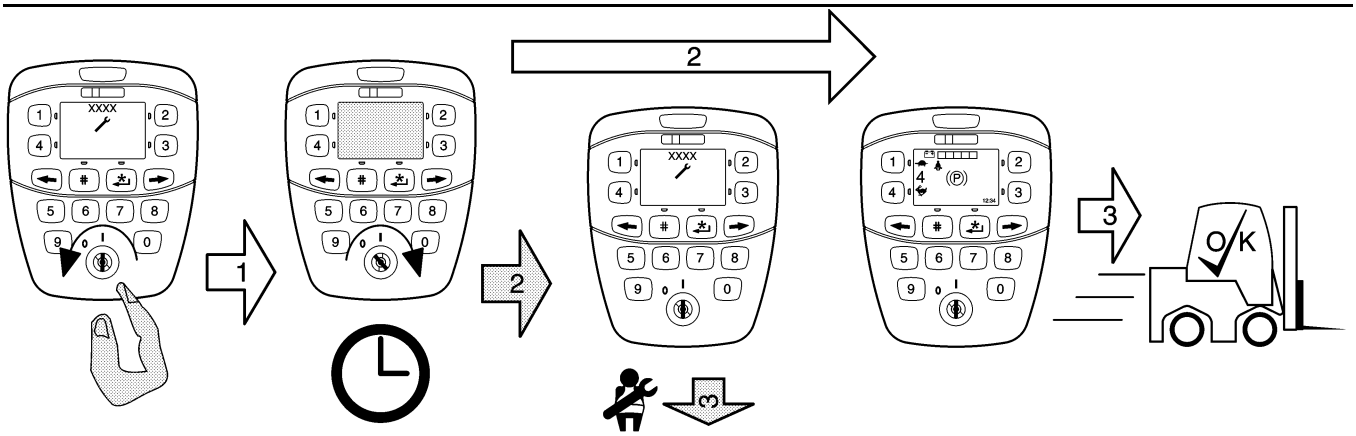
DTC LOGS: DTC logs should only be cleared once the data is by the Service Tech. See Display Menu Flowchart **- Clearing DTCs.**

END FAULT

TSP Travel Direction Select Incorrect

FAULT CODES:

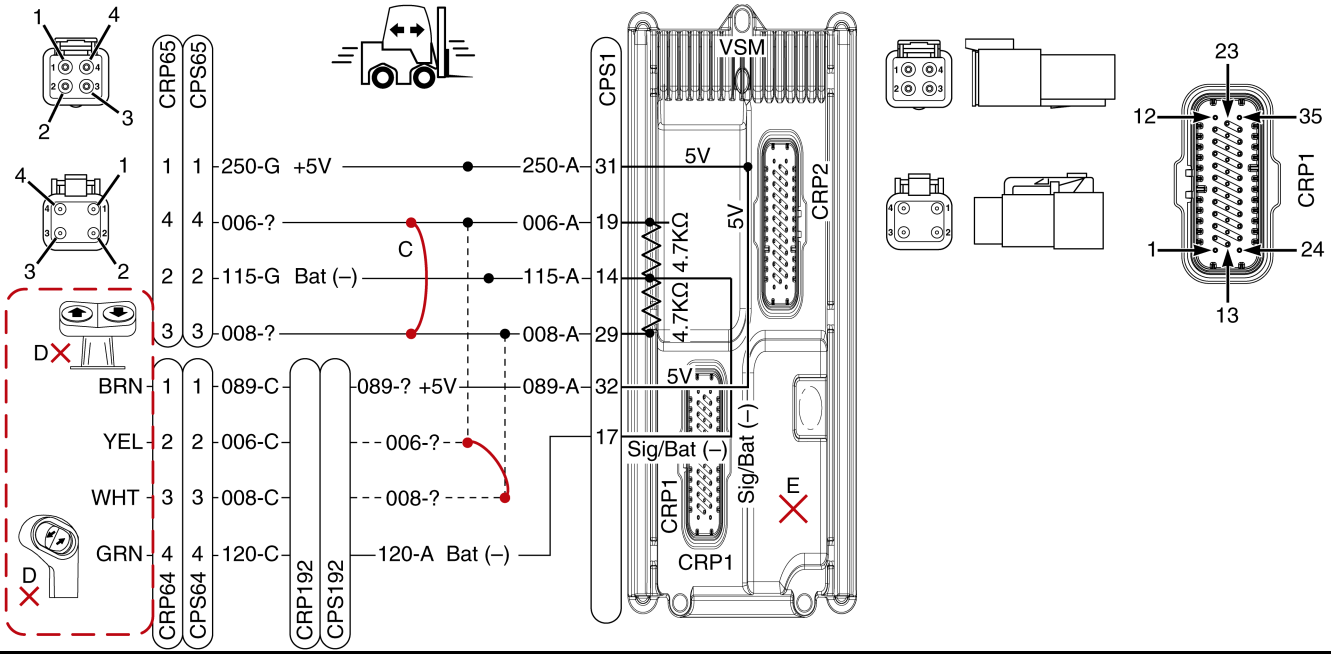
DTC 12802
Direction Select Data Incorrect – Direction Signals Incorrect



Power **OFF**→ | Wait **30 seconds**→ | Power **ON**→ | Fault remains. Service required. Go to Cause C. | No fault→ | Resume operation

POSSIBLE CAUSES X = Open Circuit/Fail) = Short Circuit

TRAVEL DIRECTION SELECT INCORRECT CAUSES A B C D E > ?

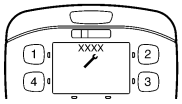


CAUSE A

Not Applicable

(continued on next page)

TSP CBB/DBB Motor/Motor Controller Temperature Sensor Failure



FAULT CODES:

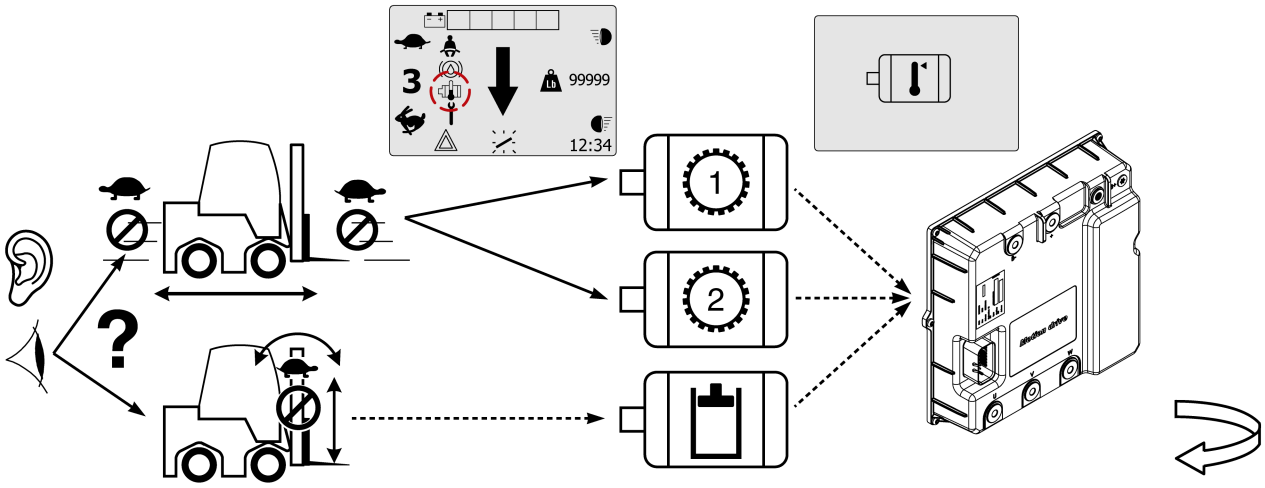
DTC 16912
Motor Temperature High

DTC 17168
Controller/Heatsink Temperature High

DTC 25105
Temperature Sensor Failure

QUICK CHECK X = Open Circuit/Fail) = Short Circuit

Check 1



? Over Temperature Icon Displayed at Power ON?

POSSIBLE CAUSES	
1. Sensor(s) – Motor/Motor Controller – Connections/Wiring?→	Cause A↓
2. Sensor(s) Failure?→	Cause A↓
3. Motor Controller(s) Hardware Failure?→	Cause D↓

Note: Hydraulic Oil Over Temperature and Sensor Issues see Fault Code Hydraulic Temperature Sensor Out of Range High (OORL) Fault Code Hydraulic Temperature Sensor Out of Range High (OORH)

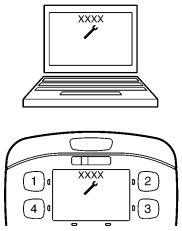
? Over Temperature Icon Displayed during Operation/Reduced Performance/Function Failure?

POSSIBLE CAUSES	
1. Motor/Motor Controller/Hydraulic Fluid Overheating?→	Aggressive Operation?→
2. Sensor – Motor/Motor Controller/Hyd Tank – Connections/Wiring?→	Cause A↓
3. Sensor(s) Failure?→	Cause A↓
4. Motor Controller(s) Failure ?→	Cause D↓

WARNING
The CBB Truck requires the removal of the battery to access the Controllers and Motors

(continued on next page)

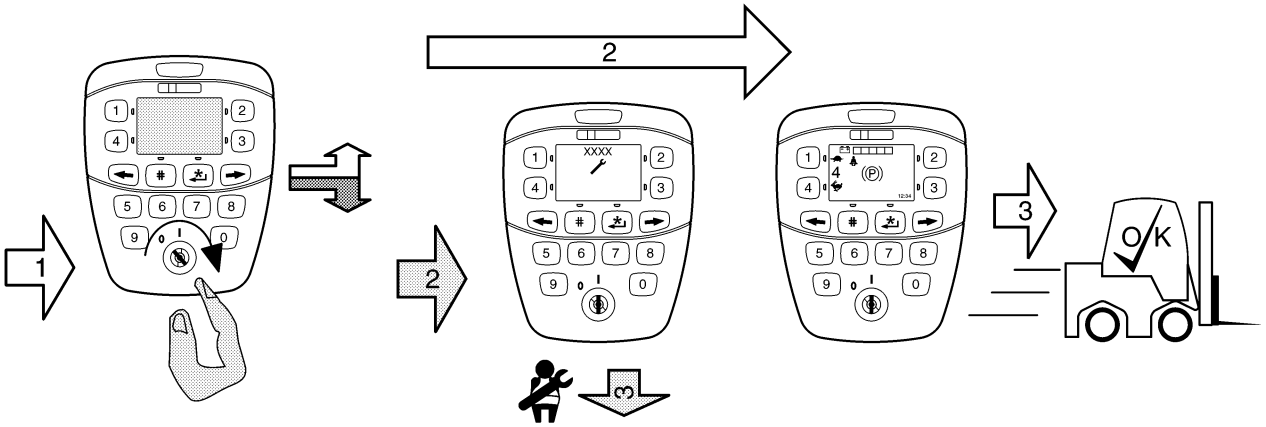
TSP Hydraulic Calibration Required



DTC 4096
Hydraulic Calibration Required

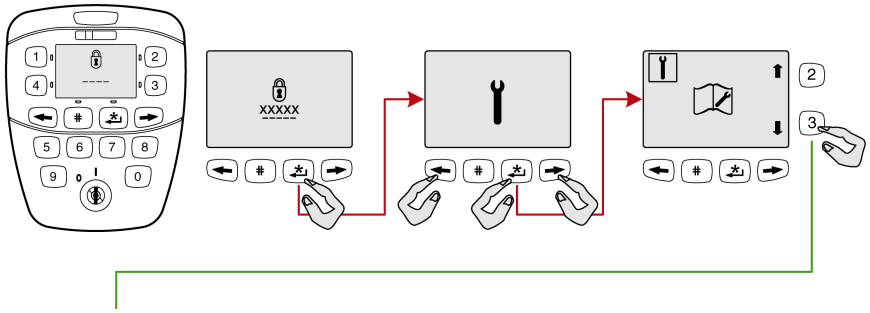
FAULT CODES:

FAULT LOG CODE Review – Go To Display Review



Power **ON**→ Fault Remains Service Required ↴ No Fault→ Resume Operation

Calibration Process - Go to Display Menu

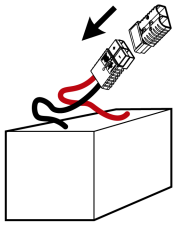


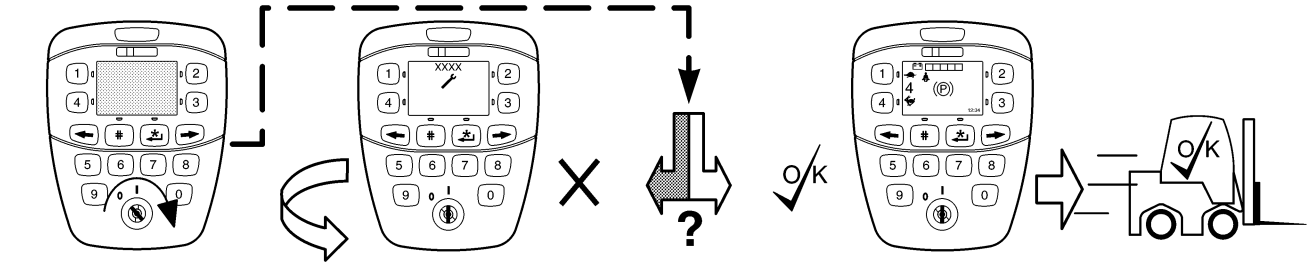
Enter Service Password→ ☞*	⇆ Diagnostics → ☞*	↓↑ Hydraulic Input ↴

(continued on next page)

TSP CBB/DBB Motor Controller DC Bus Low/High (Cont)

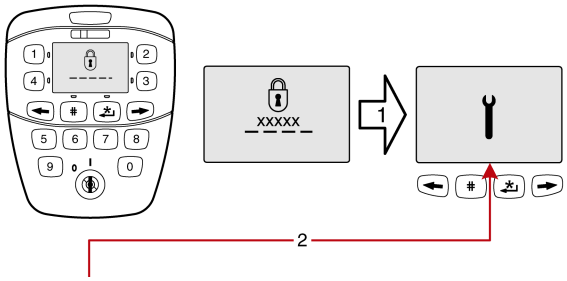
STEP A7





Retest - Power **ON**→ **NO**→ ↴ Is fault DTC gone? ←**NO** **YES** → Fault corrected→ Continue operation.

CAUSE B



Enter SERVICE Password→ Diagnostics↓

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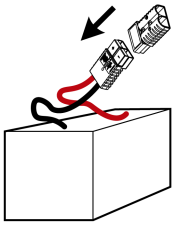
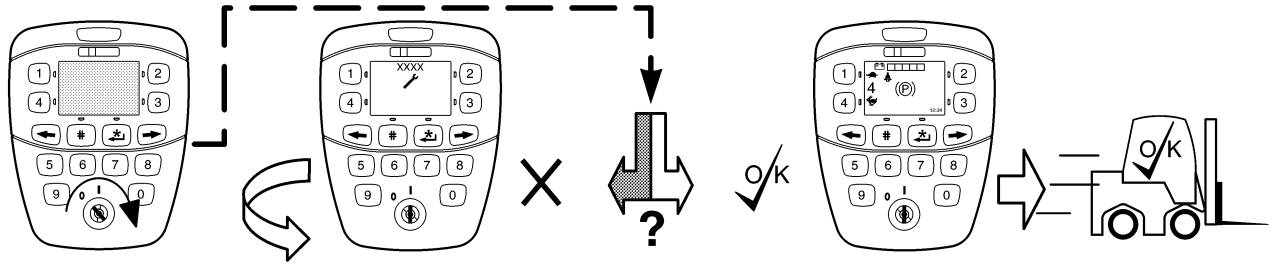
TSP CBB/DBB Motor Aux Driver Failure (Cont)

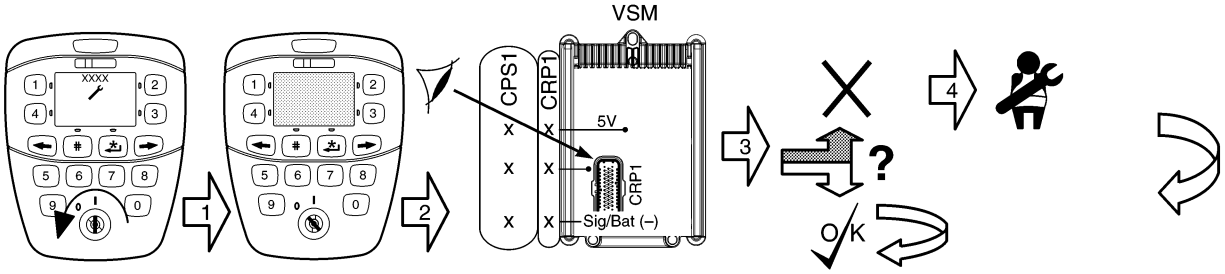
STEP D3





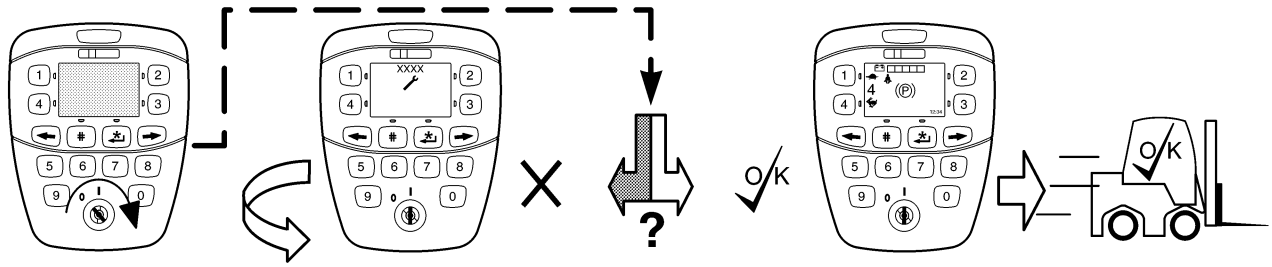
Retest - Power **ON**→ **NO**→ ↴ Is fault DTC gone? ←**NO** **YES** → Fault corrected→ Continue operation.

CAUSE E



Power **OFF**→ Inspect VSM Connections→ OK Step E1 Not OK Correct/Repair→ Step E1

STEP E1



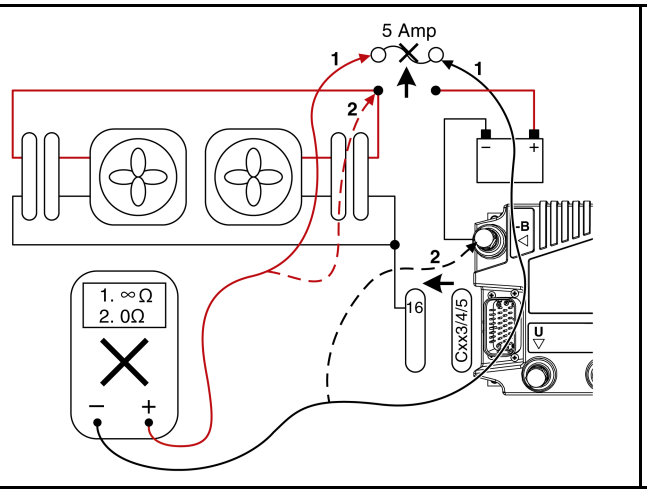
Retest - Power **ON**→ **NO**→ Go to VSM Controller Check Is fault DTC gone? ←**NO** **YES** → Fault corrected→ Continue operation.

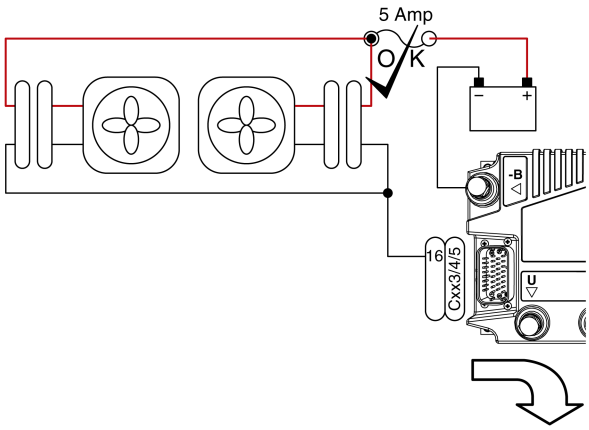
DTC LOGS: DTC logs should only be cleared once the data is by the Service Tech. See Display Menu Flowchart **- Clearing DTCs.**

END FAULT

TSP A955 – G807 Motor Controller Fan Failure (Cont)

STEP A6	**CHECK RESISTANCE - Ω - OHMS**
Fan Operation from Step A1	





1. Remove Fuse→ Measure Ω→ ∞Ω = Fuse Open Circuit→ Go to 2↓
2. 0Ω = Short Circuit→ Go to 3↓
3. Find/Repair Short Circuit→ Go to 4↓
4. See /**Electrical System** 2200 YRM 1337**Electrical System** 2200 YRM 1369→ Go to 5↓
5. Replace Fuse→ Reconnect Controller→ Operate Truck (Traction/Hydraulics) for at least 10 minute↓
6. Fan(s) operate→ Resume Operation
7. Fan(s) Do not operate→ Cause D↓

CAUSE B

Not Applicable

(continued on next page)

Horn Failure (Cont)

CAUSE D - VSM FAILURE

PROCEDURE OR ACTION:

1. Replace VSM. Depending on your lift truck, see **Electrical System** 2200 YRM 1369, or **Electrical System** 2200 YRM 1337.

END SYMPTOM

Noise During Operation That Is Not Normal

POSSIBLE CAUSE

A. MISSING OR LOOSE LUG NUTS
B. LOOSE DRIVE AXLE MOUNTING CAPSCREWS
C. LOW OIL LEVEL
D. BEARING DAMAGE
E. NOISE CONTINUES AFTER CORRECT OIL LEVEL
F. RING AND PINION BACKLASH IS NOT PROPER
G. NOISE CONTINUES

CAUSE A - MISSING OR LOOSE LUG NUTS

PROCEDURE OR ACTION:

1. Check for missing or loose lug nuts.

   Are any lug nuts missing or loose?

   YES: Tighten loose or missing lug nuts. Depending on your lift truck, see **Periodic Maintenance** 8000 YRM 1364, **Periodic Maintenance** 8000 YRM 1372, **Periodic Maintenance** 8000 YRM 1339, **Periodic Maintenance** 8000 YRM 1373, or **Periodic Maintenance** 8000 YRM 1442.

   NO: Go to Cause B.

CAUSE B - LOOSE DRIVE AXLE MOUNTING CAPSCREWS

PROCEDURE OR ACTION:

1. Check for loose drive axle mounting capscrews.

   Are any drive axle mounting capscrews loose?

   YES: Tighten drive axle mounting capscrew. Depending on your lift truck, see **Transaxle** 1300 YRM 1330, **Transaxle** 1300 YRM 1370, or **Drive Axle, Speed Reducer, and Differential** 1300 YRM 1366.

   NO: Go to Cause C

CAUSE C - LOW OIL LEVEL

PROCEDURE OR ACTION:

1. Check level of oil.

   Is oil level low?

   YES: Add oil to correct level. See **Operating Manual**.

   NO: Go to Cause E.

CAUSE D - BEARING DAMAGE

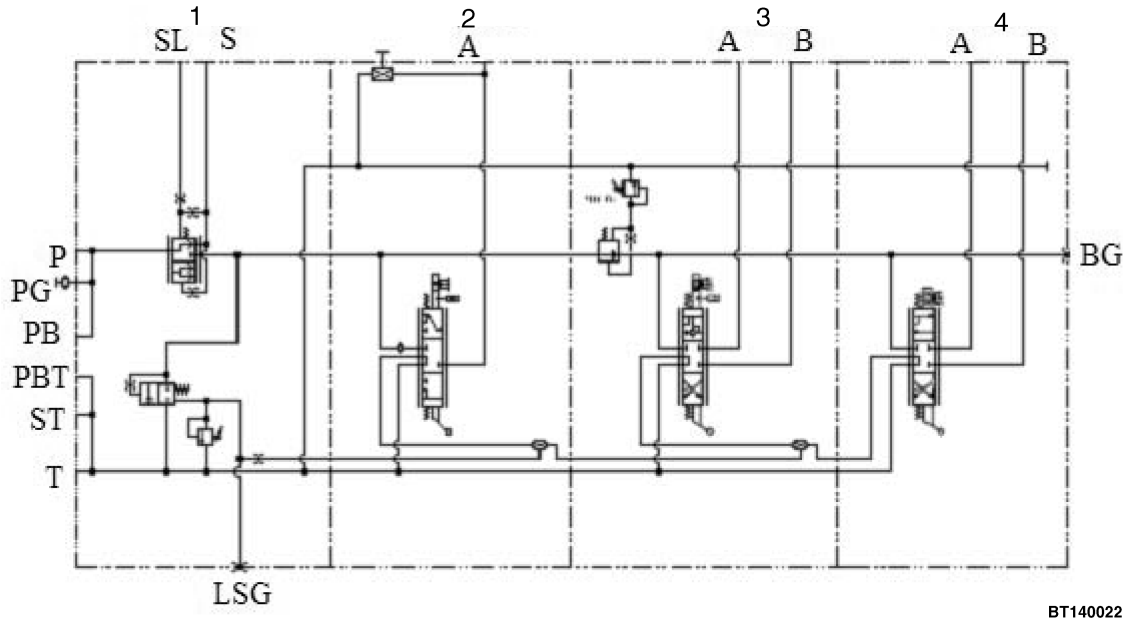
PROCEDURE OR ACTION:

1. Check for damage on bearings.

   Are bearings damaged?

   YES: Repair or replace traction motor. Depending on your lift truck, see **Transaxle** 1300 YRM 1330, **Transaxle** 1300 YRM 1370, or **Drive Axle, Speed Reducer, and Differential** 1300 YRM 1366.

   NO: Go to Cause F.



1. INLET
2. LIFT
3. TILT
4. AUXILIARY #1

Figure 9050-10-12. Load Sense Control Valve With Unloader and Priority Steering

FEATURES AND OPERATION

INLET ASSEMBLY

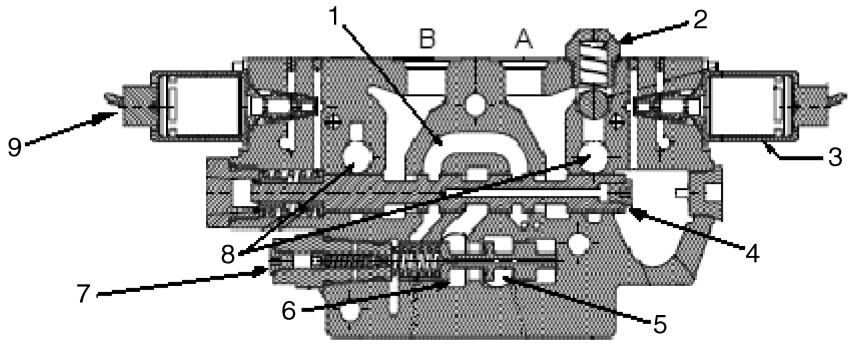
Construction and Purpose

Inlet assemblies provide the majority of the porting connections to connect various lines of the hydraulic circuit. All inlet assemblies for this type of valve include a priority steering spool to control flow to the steer unit, a main relief valve to protect the pump from over pressurization, and an unloading spool to unload (dump to tank) any excess pump flow.

Porting

Port sizes vary based upon flow requirements and features within each inlet assembly. All inlets provide connections for: pump (P), tank (T), steer supply (S), steer return (ST), load sense signal coming from the steering control unit (SL), pump pressure (PG), load sense gage port (LSG) coming from the work section's shuttle circuit, and reduced pressure gage port (BG). If a hydraulic brake option is required, ports are provide for the brake supply (PB) and the brake return (PBT). Be aware that the PB port is exposed to full system pressure.

work port is lower than the pressure in the tank core. This allows oil to pass from the tank core into the work port to keep air out of the lines and the tilt cylinder. See Figure 9050-10-33, Page 9050-10-30.



1. BRIDGE CORE
2. ANTI CAVITY CHECK
3. EH SOLENOID
4. MAIN SPOOL
5. POWER CORE
6. FEED CORE
7. PRESSURE REDUCING LOAD CHECK
8. TANK CORE
9. EH SOLENOID

Figure 9050-10-33. Cross-Section of EH Tilt Section

Main Spool

The main spool is a 4-way type, meaning that flow is available to both the A and B work ports versus only the A port (3-way spool) in a lift section. Energizing the solenoid on the A work port side of the section shifts the spool to power workport A. Energizing the solenoid on the B work port side of the section shifts the spool to power work port B.

- **Tilt Back** Actuating the main spool to the tilt back position (B port pressurized) sends a load-sense signal to the unloading spool located in the inlet cover. The unloading spool in the inlet closes and flow is directed to the power core. Flow from the power core is directed across the pressure reducing/load check spool assembly and travels to the main spool via a feed core. Flow travels across the main spool into the bridge core and is directed out of work port B. Return flow from the tilt cylinder(s) is routed through work port A across the main spool into the tank core of the housing. Flow in the tank core is directed through the valve sections back to the tank (T) port located in the inlet section.
- **Tilt Forward** When the tilt spool is shifted to pressurize work port A, the unloading spool in the inlet closes and flow becomes available to the work sections. Flow travels from the power core across the pressure reducing/load check spool into the main spool feed core. Flow travels across the main spool into the bridge core. Flow passes across the main spool and out the A work port. Return flow from the tilt cylinder(s) is directed into the B work port.

Spacer Sections

Construction and Purpose

Spacer sections are used in certain valve stacks to increase the length of the valve stack to overcome mechanical structure interference on certain vehicle models. They contain drilled passageways to allow oil to pass to the next work section. The only components they contain are common plugs and section seals.

Jump/Delay In Auxiliary Function Actuation After Moving MLM (E-Valve) (Cont)

CAUSE E - PILOT PRESSURE NOT BEING PRODUCED FAST ENOUGH.

PROCEDURE OR ACTION:

1. Inspect filter. Depending on your left truck see, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1334, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1439, or **Electrical System** 2200 YRM 1337.

   Is filter clean and in good condition?

   YES: Go to Cause F.

   NO: Clean or replace filter.

CAUSE F - STICKING VALVE SPOOL.

PROCEDURE OR ACTION:

Inspect spool. Depending on your left truck see, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1334, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1439, or **Electrical System** 2200 YRM 1337.

Is spool clean and in good condition?

YES: Go to Cause G.

NO: Clean or replace spool.

CAUSE G - STICKING UNLOADER SPOOL.

PROCEDURE OR ACTION:

Inspect unloader valve for damage or contamination. Depending on your left truck see, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1334, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1439, or **Electrical System** 2200 YRM 1337.

Is unloader free of contamination and in good condition?

YES: Go to Cause H.

NO: Clean or replace unloader valve.

CAUSE H - VALVE SPOOL END SPRINGS TOO SOFT.

PROCEDURE OR ACTION:

Replace springs. Depending on your left truck see, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1334, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1439, or **Electrical System** 2200 YRM 1337. If problem is still present, see Observed Symptoms-Gear Pump, Auxiliary Function, Tilt Back and/or Tilt Forward Will Not Move With MLM Movement (E-Valve), Page 9050-33-38.

Poor Metering on Lift or Lower Functions (E-Valve)

POSSIBLE CAUSE

A. AIR TRAPPED IN CIRCUIT.
B. RAMP SETTING TOO HIGH FOR FUNCTION.
C. OUTPUT THRESHOLD IS SET TOO HIGH.
D. MAST/ATTACHMENT IS BINDING.
E. MLM CONTROL MALFUNCTION.
F. MAST LOWERING CONTROL VALVE IS STICKING.
G. STICKING UNLOADER SPOOL (LIFT FUNCTION ONLY).
H. MAIN CONTROL VALVE LS (LOAD SENSE) RELIEF LEAKAGE.

CAUSE A - AIR TRAPPED IN CIRCUIT.

PROCEDURE OR ACTION:
Remove air from circuit by cycling function full stroke of hydraulic hoist cylinder at one second intervals. If symptom is still present, go to Cause B.

CAUSE B - RAMP SETTING TOO HIGH FOR FUNCTION.

PROCEDURE OR ACTION:

WARNING

Unexpected movement of hydraulic function can cause injury or death. Do not operate the lift truck until problem has been repaired.

1. Adjust function ramp setting on Display Panel. See **User Interface**, **Service Technician** 2200 YRM 1336. If problem is still present, go to Cause C.

CAUSE C - OUTPUT THRESHOLD IS SET TOO HIGH.

PROCEDURE OR ACTION:
Check current at E-Hydraulic Valve.

Is setting at valve correct?

YES: Go to Cause D.

NO: Decrease setting to specification or until operation is acceptable to operator.

CAUSE D - MAST/ATTACHMENT IS BINDING.

PROCEDURE OR ACTION:
Check for mast or attachment binding.

Is mast or attachment binding?

YES: Repair or lubricate mast or attachment. Depending on your lift truck see, **Mast Repair**, **2- and 3-Stage High Visibility Masts** 4000 YRM 1386, **Mast Repair**, **2-, 3-, And 4-Stage Heavy Duty Masts** 4000 YRM 1405, **Mast Repair**, **2-, 3-, and 4-Stage Masts** 4000 YRM 1338, or **Mast Repair**, **2- and 3-Stage Masts** 4000 YRM 1441.

NO: Go to Cause E.

Auxiliary Function is Slow or Does Not Function (Manual Valve) (Cont)

CAUSE E - SPOOL IS NOT FULLY ACTUATED.

PROCEDURE OR ACTION:
Inspect linkage. Depending on your left truck see, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1334, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1439, or **Electrical System** 2200 YRM 1337.

Does linkage prematurely contact dash?

YES: Repair or replace linkage.

NO: Go to Cause F.

CAUSE F - SECONDARY RELIEF VALVE IS SET TOO LOW.

PROCEDURE OR ACTION:
Test and adjust pressure. See Tests and Adjustments-Gear Pump, Secondary Relief Valve Test and Adjustment, Page 9050-43-4.

Is relief set at specifications?

YES: Go to Cause G.

NO: Adjust pressure to test specifications.

CAUSE G - SECONDARY RELIEF VALVE DAMAGED OR STUCK OPEN.

PROCEDURE OR ACTION:
Remove and inspect relief valve. See **Hydraulic System** 1900 YRM 1333.

Is relief valve damaged or stuck open?

YES: Install new relief valve.

NO: Go to Cause H.

CAUSE H - MAIN RELIEF VALVE SET TOO LOW, DAMAGED, OR STUCK OPEN.

PROCEDURE OR ACTION:

NOTE: This symptom only affects auxiliary functions when hoist function is activated.
Test and adjust pressure. See Tests and Adjustments-Gear Pump, Primary Relief Valve Test and Adjustment, Page 9050-43-1.

Is relief set at specifications?

YES: Go to Cause I.

NO: Adjust pressure to test specifications and retest. If problem is still present, replace relief valve. See **Hydraulic System** 1900 YRM 1333.

CAUSE I - MAST/ATTACHMENT IS BINDING.

PROCEDURE OR ACTION:
Check for mast or attachment binding.

Is mast or attachment binding?

YES: Repair mast or attachment. Depending on your lift truck see, **Mast Repair**, **2- and 3-Stage High Visibility Masts** 4000 YRM 1386, **Mast Repair**, **2-, 3-, And 4-Stage Heavy Duty Masts** 4000 YRM 1405, **Mast Repair**, **2-, 3-, and 4-Stage Masts** 4000 YRM 1338, or **Mast Repair**, **2- and 3-Stage Masts** 4000 YRM 1441.

NO: Go to Cause J.

Actuations Do Not Act Simultaneously

POSSIBLE CAUSE

A. LOW PUMP FLOW.
B. SECONDARY RELIEF VALVE SET TOO LOW.

CAUSE A - LOW PUMP FLOW.

PROCEDURE OR ACTION:
Check cycle times of lift function.

Is lift function speed ok?

YES: Go to Cause B.

NO: Go to Observed Symptoms-Gear Pump, Abnormal Hydraulic Noise and/or Vibration, Page 9050-33-1.

CAUSE B - SECONDARY RELIEF VALVE SET TOO LOW.

PROCEDURE OR ACTION:
Test and adjust secondary relief pressure. See Tests and Adjustments-Gear Pump, Secondary Relief Valve Test and Adjustment, Page 9050-43-4.

Main Control Valve LS Leakage Test (E-Valve)

This test is done to check if there is leakage in the Load-Sense (LS) pressure circuit.

Table 9050-43-10. Test Specifications

Oil Temperature	50 - 65°C (122 - 150 °F)

WARNING

Hot hydraulic oil can cause serious burns to skin. Do not touch hydraulic components or oil during test. Make sure hydraulic oil has cooled to safe temperature before installing or removing test equipment.

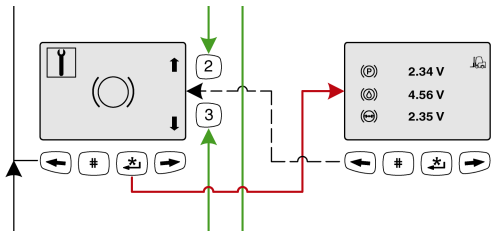
WARNING

Hydraulic oil under pressure can be injected into skin. Lower forks to ground and relieve all circuit pressure before removing test plugs from valve.

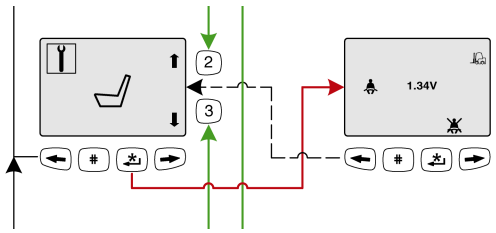
1. Check hydraulic temperature. If not within specifications, see Tests and Adjustments-Gear Pump, Hydraulic Warm-up Procedure, Page 9050-43-1. Operate until temperature is at test specifications.
2. Turn key or keyless switch to **ON** position and apply park brake.
3. Measure and record the lift rate with lift lever fully actuated at:
   - No Load
   - Rated Load
4. If the difference from specified rates in chart, it is likely that the LS passage has an internal leakage within the monoblock section. Replace the valve monoblock section. Depending on your lift truck see, **Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1334 or**Main Control Valves**, **(Manual and E-Hydraulic Valves)** 2000 YRM 1439.

NOTES

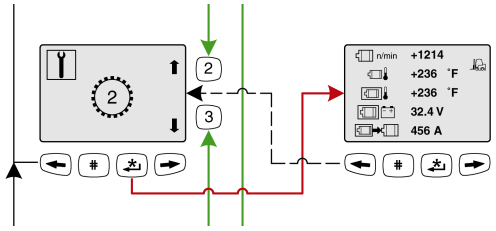
Brakes



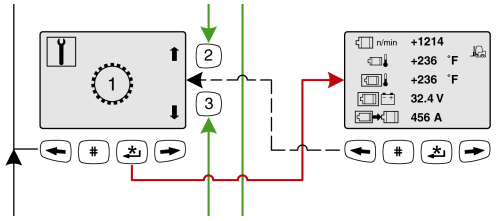
Seat (Operator Presence)



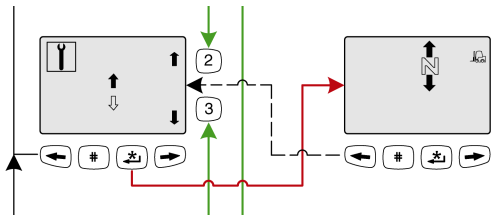
Traction Motor 2



Traction Motor 1



Directional Indication Operation



dome light is powered through an unswitched battery source and will operate with or without system power turned **ON**.

Cab Panels

GENERAL DESCRIPTION

Cab panels are offered as an option with the lift truck. The cab unit consists of individual panels installed on the overhead guard using cap screws. The panels include, a roof, side doors, front and rear windows. Front and rear window wipers, and heater system are available.

Covers and Floor Plates

Various covers and floor plates provide access to components during service and securely cover areas during normal operation. Covers in the floor of the operator compartment allow access to the traction controllers, AC drive motors, service and parking brakes. A cover on the top of the counterweight provides access to the hydraulic tank, hydraulic pump and motor assembly, and the hoist controller.

Hood and Seat

Hood

The hood is a stamped steel battery cover. Two hinges at the back attach to the overhead guard.

The hood is the platform for the seat assembly and is located above the battery. It functions as a battery restraint that completely covers the battery compartment.

Seat

The seat assembly slides on seat rails that are fastened to the hood by four capscrews. A lever at the left front side of the base controls the adjustment of the seat to the forward and backward positions. Optional seats are available in cloth or vinyl with features such as non-suspension, full suspension, and limited swivel.

All seats have a seat switch installed in the bottom cushion that senses operator presence. When the operator is not on the seat, the seat switch opens and interrupts the controller stopping operation of the lift truck.

Cab Heating System

If included, the cab heater is located on the right hand door. The optional cab heater consists of the main plenum assembly, motor, fan, wiring harness, control unit with keypad, primary filter media, secondary filter media, and mounting hardware.

The fan draws outside air through the cab vent and into both filters before finally entering the plenum. A thermostat regulates operation of the electric heating element. Cab air is heated until plenum air temperature reaches a maximum of 35°C (95°F). At this maximum temperature the thermostat will automatically cut power to the element as a protective measure.

Operator keypad inputs command the control unit **ON** or **OFF**, change temperature and fan speed. Temperature settings can be adjusted in 1° increments shown on corresponding LCD screen. Operators can choose to display temperature in Celsius (C) or Fahrenheit (F). Fan speed is also adjusted using the keypad and corresponding displayed on a segmented graph.

By monitoring input voltage and current flow through components this heater will trigger error codes in the event of a malfunction. Basic onboard diagnostics guide service personnel in troubleshooting by displaying a variety of error codes. For details see **Operator's Cab** 100 YRM 1446.

Control Panel

Controls the speed of the heater fan. The operator may choose to have the fan off or select from three fan speeds (low, medium, or high).

Plastic casing 85 x 72 x 25mm, for retractable or standalone mounting. 2 digits indicate selected temperature. The selected fan speed is indicated with a LED ladder.

Quartz crystal controlled microprocessor with program memory of flash type and EEPROM memory for operating parameters.

Operating voltage 12VDC from control board. Communication via RS- 485 interface. Different cable lengths up to 4m are available.

Heater Core

Functions as a heat exchanger allowing air that passes through the core to be heated. Battery power heats the elements within the core.

Cylinder Cushion During Lowering Sequence

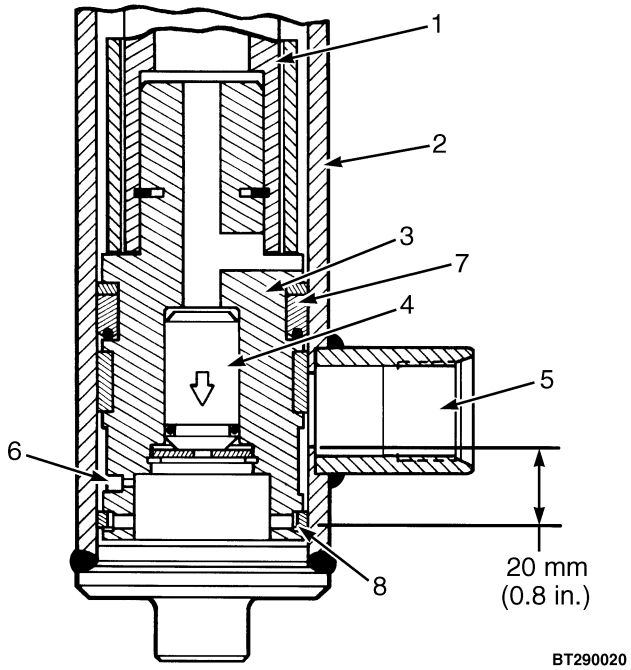
DESCRIPTION

This cushion effect prevents a sudden stop of the main cylinders, which causes smoother operation during lowering. All masts in this section, except Two-Stage Limited Free-Lift Masts, use this design in the main lift cylinders.

PRINCIPLES OF OPERATION

NOTE: An internal check valve is not used on the Two-Stage Full Free-Lift Mast.

When the main lift cylinders retract, the hydraulic oil flows out of the cylinder through the hydraulic port until the cushion ring moves past the hydraulic port. During the last 20 mm (0.79 in.) of the retraction stroke, the hydraulic oil must flow through the orifice. See Figure 9070-10-14, Page 9070-10-15. This action causes the cylinder rod to move much more slowly at the end of the retraction stroke.



NOTE: LEFT-HAND LIFT CYLINDER SHOWN.

1. CYLINDER ROD
2. CYLINDER SHELL
3. PISTON
4. INTERNAL CHECK VALVE
5. HYDRAULIC PORT
6. ORIFICE
7. PISTON SEAL
8. CUSHION RING

Figure 9070-10-14. Main Lift Cylinder Operation

Tilt and Sideshift Cylinders

DESCRIPTION

Tilt Cylinder

The tilt cylinders are used to move the mast forward and backward. To extend the cylinder rod (tilt forward), oil enters the tilt cylinder port behind the piston. The oil pressure pushes the cylinder rod out of the cylinder. Oil in front of the piston returns to the hydraulic tank. To retract the cylinder rod (tilt backward), the oil enters the port in front of the piston. The oil pressure pushes the cylinder rod into the tilt cylinder. The oil behind the piston returns to the hydraulic tank.

Sideshift Cylinder

The sideshift cylinder is removable for service. It is a double-acting, non-differential, piston-type cylinder, which allows the sideshift to attain the same speed moving either left or right. The cylinder also has flow restricting orifices in the ports.

Hoses Not Tracking Correctly

POSSIBLE CAUSE

A. MAST DAMAGED
B. IMPROPER HOSE TENSION
C. IMPROPER HOSE ROUTING
D. HOSES WORN

CAUSE A - MAST DAMAGED

NOTE: See **Operating Manual**.

PROCEDURE OR ACTION:
Visually inspect mast for damage.

Is the mast in good condition?

YES: Go to Cause B.

NO: Repair or replace damaged components. Depending on your lift truck see, **Mast Repair**, **2- and 3-Stage High Visibility Masts** 4000 YRM 1386, **Mast Repair**, **2-, 3-, And 4-Stage Heavy Duty Masts** 4000 YRM 1405, **Mast Repair**, **2-, 3-, and 4-Stage Masts** 4000 YRM 1338, or **Mast Repair**, **2- and 3-Stage Masts** 4000 YRM 1441.

CAUSE B - IMPROPER HOSE TENSION

PROCEDURE OR ACTION:
Check hose tension. Depending on your lift truck see, **Mast Repair**, **2- and 3-Stage High Visibility Masts** 4000 YRM 1386, **Mast Repair**, **2-, 3-, And 4-Stage Heavy Duty Masts** 4000 YRM 1405, **Mast Repair**, **2-, 3-, and 4-Stage Masts** 4000 YRM 1338, or **Mast Repair**, **2- and 3-Stage Masts** 4000 YRM 1441.

Is hose tension correct?

YES: Go to Cause C.

NO: Adjust hose tension.

CAUSE C - IMPROPER HOSE ROUTING

PROCEDURE OR ACTION:
Inspect lift cylinder hoses. Depending on your lift truck see, **Mast Repair**, **2- and 3-Stage High Visibility Masts** 4000 YRM 1386, **Mast Repair**, **2-, 3-, And 4-Stage Heavy Duty Masts** 4000 YRM 1405, **Mast Repair**, **2-, 3-, and 4-Stage Masts** 4000 YRM 1338, or **Mast Repair**, **2- and 3-Stage Masts** 4000 YRM 1441.

Are the hoses in good condition and adjusted correctly?

YES: Go to Cause D.

NO: Adjust or replace hoses as required.

CAUSE D - HOSES WORN

PROCEDURE OR ACTION:
Inspect hoses for uneven or excessive wear.

Are hoses wearing evenly?

YES: Locate cause of hoses wear. See Observed Symptoms, Abnormal Hose Wear, Page 9070-30-3.

NO: Adjust or replace hoses as required. Depending on your lift truck see, **Mast Repair**, **2- and 3-Stage High Visibility Masts** 4000 YRM 1386, **Mast Repair**, **2-, 3-, And 4-Stage Heavy Duty Masts** 4000 YRM 1405, **Mast Repair**, **2-, 3-, and 4-Stage Masts** 4000 YRM 1338, or **Mast Repair**, **2- and 3-Stage Masts** 4000 YRM 1441.

END SYMPTOM

Wheel Studs Breaking

POSSIBLE CAUSE

A. ATTACHING HARDWARE IS LOOSE
B. WHEEL STUDS ARE OVER TORQUED

CAUSE A - ATTACHING HARDWARE IS LOOSE

PROCEDURE OR ACTION:
Visually inspect wheel studs for damage and loose or missing hardware. Depending on your lift truck see, **Periodic Maintenance** 8000 YRM 1364, **Periodic Maintenance** 8000 YRM 1372, **Periodic Maintenance** 8000 YRM 1339, **Periodic Maintenance** 8000 YRM 1373, or **Periodic Maintenance** 8000 YRM 1442.

Do wheels and attaching hardware appear to be in good condition?

YES: Go to Cause B.

NO: Repair or replace damaged components. Depending on your lift truck, see **Transaxle** 1300 YRM 1330, **Transaxle** 1300 YRM 1370, **Steering Axle** 1600 YRM 1360, or **Drive Axle, Speed Reducer, and Differential** 1300 YRM 1366.

CAUSE B - WHEEL STUDS ARE OVER TORQUED

PROCEDURE OR ACTION:
Check wheel stud torque. Depending on your lift truck see, **Periodic Maintenance** 8000 YRM 1364, **Periodic Maintenance** 8000 YRM 1372, **Periodic Maintenance** 8000 YRM 1339, **Periodic Maintenance** 8000 YRM 1373, or **Periodic Maintenance** 8000 YRM 1442.

Are the wheels studs at correct torque?

YES: Check maintenance records to see what repairs were made that may have caused problem.

NO: Replace all studs and torque correctly. Depending on your lift truck, see **Transaxle** 1300 YRM 1330, **Transaxle** 1300 YRM 1370, **Steering Axle** 1600 YRM 1360, or **Drive Axle, Speed Reducer, and Differential** 1300 YRM 1366.

END SYMPTOM

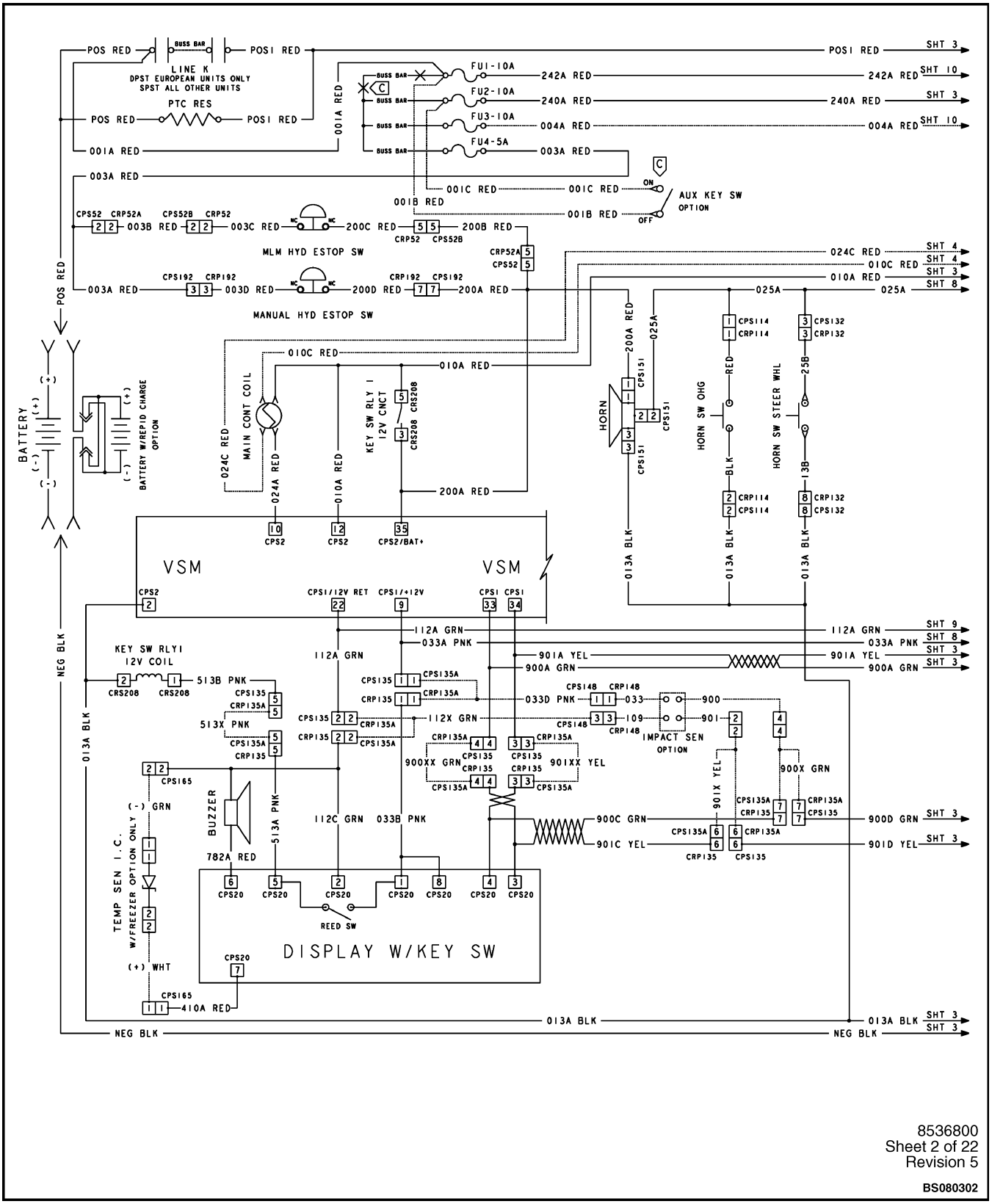


Figure 1. Wiring Diagram/Schematic for ERP15-20VT (ERP030-040VT) (G807) ERP16-20VF (ERP30-40VF) (A955) (Sheet 2 of 22)

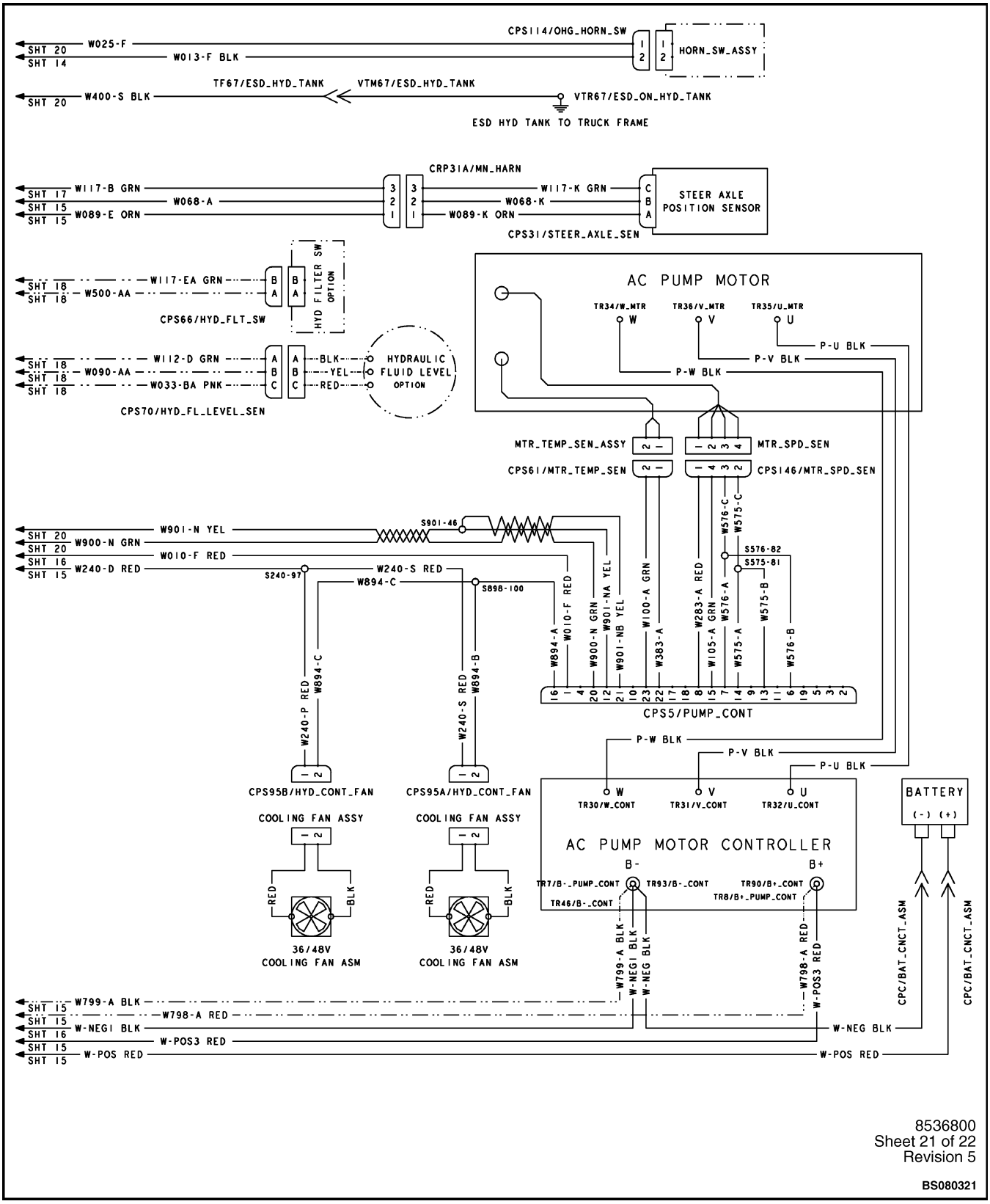


Figure 1. Wiring Diagram/Schematic for ERP15-20VT (ERP030-040VT) (G807) ERP16-20VF (ERP30-40VF) (A955) (Sheet 21 of 22)

Electronic and Manual Hydraulic Controls

GENERAL

WARNING

Before replacing any part of the electronic or manual hydraulic control assembly, 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 accidently moved.

WARNING

Discharge capacitors as directed in Discharging the Capacitors in General section of this manual.

Disconnect the battery before doing any work on the electrical system. Serious injury to personnel and/or damage to lift truck components can occur if battery is not disconnected.

WARNING

Never wear any metallic items on your fingers, arms, or neck. Metal items can accidently 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 metal 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 lift trucks covered in this service manual come standard with manual hydraulic control levers, but have the option of using electronic-hydraulic (E-Hydraulic) mini-lever controls. In each hydraulic control arrangement, there are several electronic component parts that can be replaced if they are no longer working properly. These components are:

- **Direction Control Switch** - The direction control switch is an optional feature and is used to select the direction of travel when the lift truck is equipped with a standard accelerator pedal.
- **Emergency Disconnect Switch** - The emergency disconnect switch is used to disconnect all electrical power to the lift truck. The switch is operated by pushing the button down until it clicks. To reset (re-connect) the emergency disconnect switch and energize the electrical circuits, turn the switch clockwise until button pops up.
- **Clamp Button** - The lift trucks covered in this service manual may be equipped with a clamp function. On lift trucks equipped with manual hydraulic control levers, If lift truck is equipped with three levers, the button for the clamp function is located on the top of the third lever. If lift truck has four levers, the clamp button is on the top of the fourth lever.
  For lift trucks equipped with E-Hydraulic mini-levers, If lift truck is equipped with three mini-levers, the momentary switch for the clamp function is located behind the third lever on the palm rest. If lift truck has four levers, the momentary switch is located behind the fourth lever on the palm rest.

When removing and replacing sensors or switches, be sure to tag connectors to aid in correct installation.

MANUAL HYDRAULIC CONTROLS

Upper Front Cover

NOTE: To replace the direction control switch, emergency disconnect switch, and the clamp button, the upper front cover must be removed first from the manual hydraulic control lever assembly as described below.

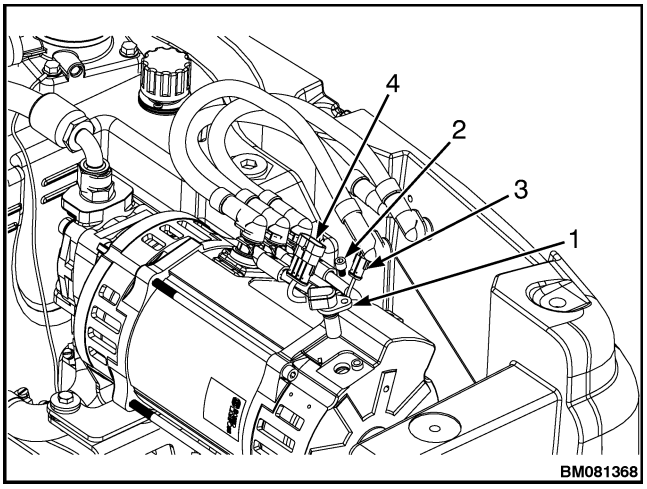
1. Read and follow the **WARNING** and **CAUTION** section in the General section above.

2. Remove four capscrews and front cover from hydraulic lever assembly. See Figure 8.

HYDRAULIC MOTOR SPEED SENSOR

Remove

1. Read and follow the **WARNING** and **CAUTION** in the General section above.
2. Remove the cover from the counterweight.
3. Disconnect hydraulic speed sensor wire harness.
4. Remove the socket head screw, speed sensor, and connector from hydraulic motor. See Figure 29.



NOTE: LIFT TRUCK MODEL ERP15-20VT (ERP030-040VT) (G807) SHOWN. HYDRAULIC MOTOR SPEED SENSOR IN SAME LOCATION ON LIFT TRUCK MODELS ERP16-20VF (ERP30-40VF) (A955).

1. HYDRAULIC MOTOR SPEED SENSOR
2. SOCKET HEAD SCREW
3. HYDRAULIC MOTOR TEMPERATURE SENSOR
4. SPEED SENSOR CONNECTOR

Figure 29. Hydraulic Motor Speed Sensor

Install

1. Install new sensor and connector into hydraulic motor. See Figure 29.
2. Attach sensor to hydraulic motor with socket head screw.
3. Connect hydraulic speed sensor to hydraulic wire main harness.
4. Install counterweight cover and connect the battery.

HYDRAULIC MOTOR TEMPERATURE SENSOR

The hydraulic motor temperature sensor is heat welded and sealed onto the winding coils in the stator housing in the hydraulic motor. It is a non-replaceable part and cannot be replaced separately from the hydraulic motor. See Figure 29.

TRANSMISSION SPEED SENSOR

NOTE: There are two transmission speed sensors. The procedures below describe how to replace one sensor. The procedures are the same for both sensors.

Remove

1. Read and follow the **WARNING** and **CAUTION** in the General section above.
2. Remove the floor mat. Lift the floor plate up enough to disconnect the accelerator pedal or Foot Directional Control pedal, (see Figure 30 or Figure 35). Remove floor plate with the accelerator pedal or Foot Directional Control pedal still attached.

5. Remove four socket head capscrews and motor controller from motor controller mounting bracket. See Figure 50.

Fan, Remove

1. Remove bolts and fan air duct housing from motor controller mounting bracket. See Figure 51.

2. Remove four nuts, washers, capscrews, and fans from air duct housing.

Fan, Install

1. Insert new fan into air duct housing. Make sure fan labels are visible and facing downward. See Figure 51. Secure fan to air duct housing with four capscrews, washers and nuts.

2. Install fan air duct housing to controller mounting bracket with two bolts. See Figure 51.

Install

NOTE: Before installing new hydraulic pump and motor controller, inspect and replace fans if necessary. See Fan, Remove and Fan, Install for procedures.

1. Using four socket head screws, install new motor controller to motor controller mounting bracket.

2. Using two bolts, install motor controller bracket and motor controller assembly to counterweight. See Figure 50.

3. Connect the fans and other electrical connections as noted during removal. Connect power cables at the power terminals of the motor controller as identified during removal. Tighten power cables to 13 to 15 N•m (115 to 133 lbf in). Connect the battery.

NOTE: Perform Step 4 for lift truck models ERP15-20VT (G807).

4. After install complete, perform ground test. See **Frame** 100 YRM 1329, Ground Test.

TRACTION MOTOR CONTROLLERS

NOTE: The lift truck models covered in this service manual are equipped with two traction motor controllers. The procedures below are the same for both traction motor controllers.

Remove

1. Read and follow the **WARNING** and **CAUTION** in the General section above.

2. Remove the floor mat. Lift the floor plate up enough to disconnect the accelerator pedal or Foot Directional Control pedal. See Figure 30 or Figure 35. Remove floor plate with the accelerator pedal or Foot Directional Control pedal still attached.

NOTE: Make sure all power cables and electrical connections are clearly marked before disconnecting them to aid in reconnecting.

3. Disconnect the electrical connector plug for the control wires. Disconnect the fan from cowl harness. See Figure 52.

4. Disconnect the power cables from traction motor controller. See Figure 53.

Legend for Figure 65

NOTE: LIFT TRUCK MODELS ERP15-20VT (ERP030-040VT) (G807) SHOWN. LIGHTS ARRANGEMENT FOR LIFT TRUCK MODELS ERP16-20VF (ERP30-40VF) (A955) IS THE SAME.

A. FRONT VIEW

B. REAR VIEW

1. FRONT WORK LIGHTS
2. FRONT MARKER/TURN SIGNAL LIGHTS*
3. STROBE LIGHT
4. LED TAIL, BACKUP, AND BRAKE LIGHTS
5. REAR WORK LIGHTS

* FRONT MARKER/TURN SIGNAL LIGHTS USED ONLY ON ERP16-20VF (A955) AND ERP15-20VT (G807) LIFT TRUCK MODELS.

WORK LIGHTS (FRONT AND REAR)

Halogen Bulb Lights

Remove

1. Read and follow the **WARNING** and **CAUTION** section in the General section above.

CAUTION

Do not touch the Halogen bulb surface or inside reflectors with your bare hands. Oils from skin can lead to breakage or shorten the life of the lamp. Use clean gloves or lint free cloth for installation and removal.

Clean any dirt or oil, from the lamp surface with alcohol and a lint free cloth or tissue. Any foreign particles or materials on the bulb surface can cause hot spots on the bulb and result in lamp failure.

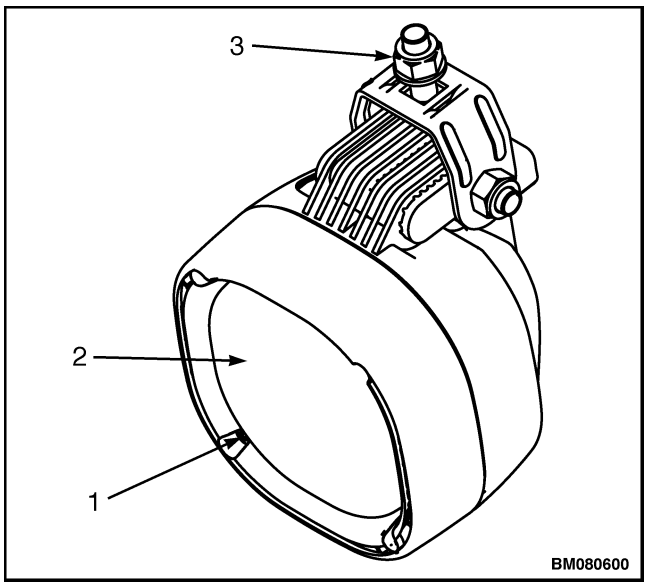
2. To replace the bulb, remove the lens assembly by removing the four capscrews. See Figure 66. Replace the bulb and reinstall the lens assembly.

3. To replace the work light assembly, disconnect the overhead guard harness from the light and remove the capscrew, washer, and nut attaching the work light to the overhead guard for front work lights, or to the mounting bracket for rear work lights.

Install

1. Install work light on overhead guard using the capscrew, washer, and nut. See Figure 66. Tighten nut to 20 N•m (177 lbf in). Connect overhead guard harness to work light.

2. Connect the battery.



NOTE: REAR WORK LIGHT SHOWN, FRONT WORK LIGHT IS SIMILAR.

1. CAPSCREWS (LENS ASSEMBLY)
2. LENS ASSEMBLY
3. NUT (ATTACHES LIGHT TO OVERHEAD GUARD)

Figure 66. Halogen Bulb Work Lights

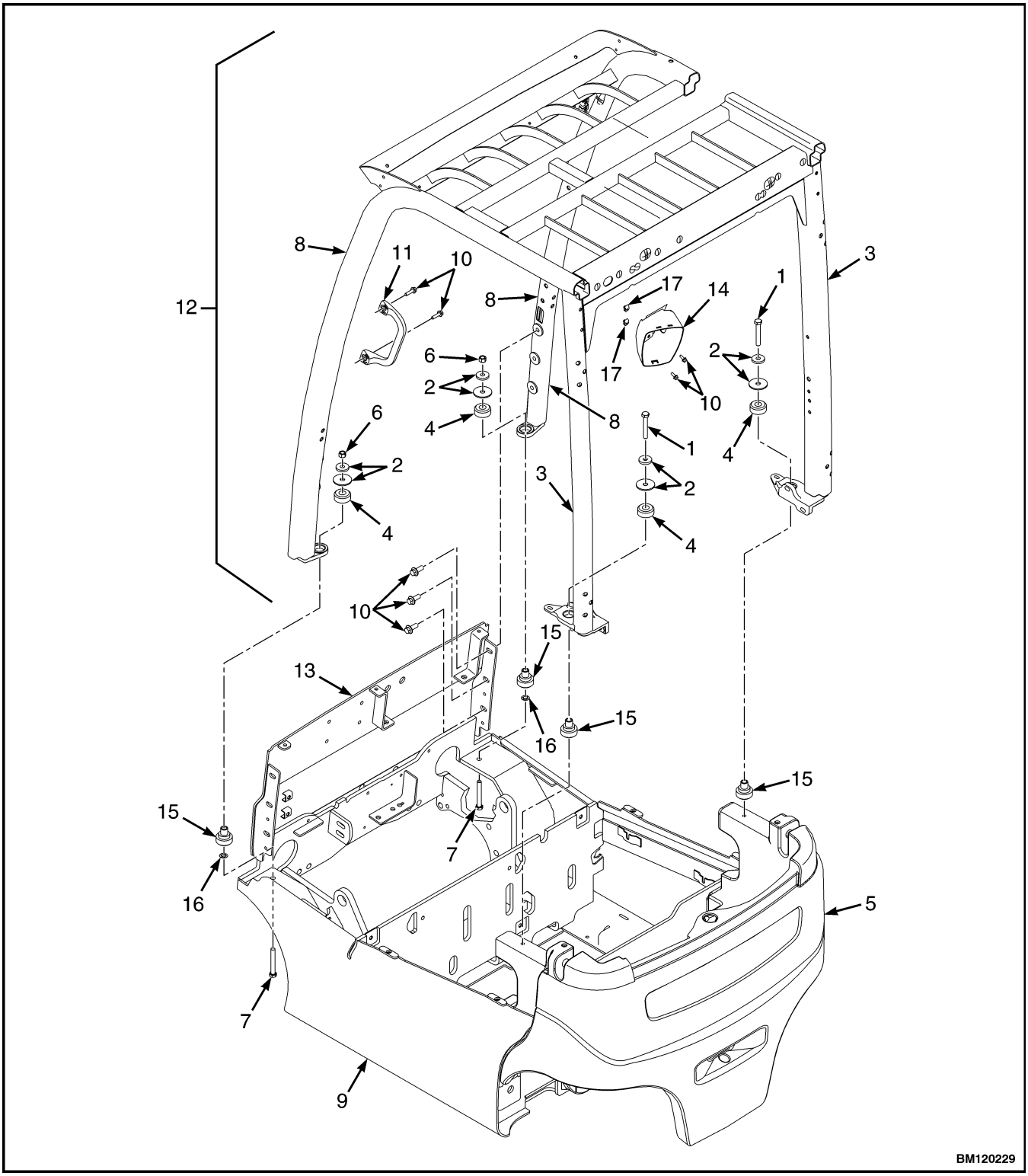


Figure 6. Overhead Guard for Lift Truck ERP16-20VF (ERP30-40VF) (A955)

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

1900 YRM 1333

11/10 (2/10)(8/08)(7/08) Printed in U.S.A.

BATTERY CONNECTORS

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

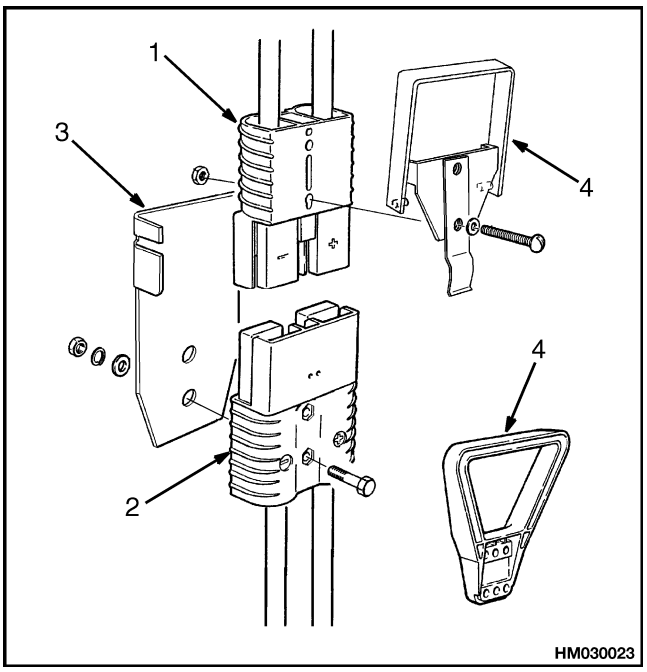


Figure 22. SB Battery Connector

Legend for Figure 22

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

BATTERY CARE

1. Keep batteries clean. Remove any spilled electrolyte.

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

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

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

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

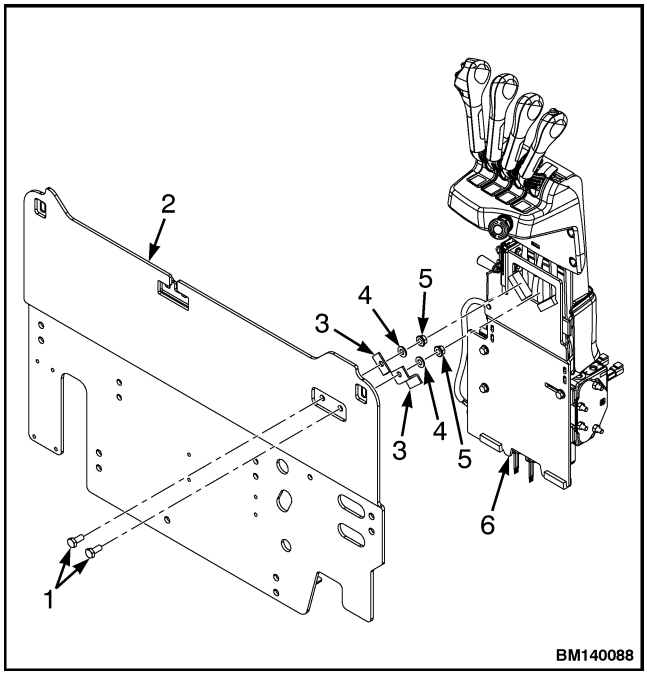
6. Prevent batteries from freezing.

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

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

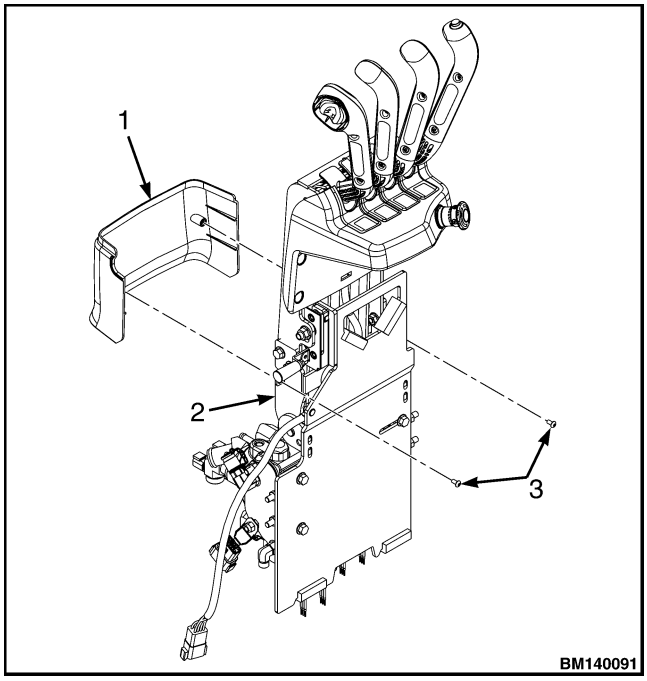
9. When batteries are moved, make sure a short circuit does not occur. See the Safety Procedures in Battery Maintenance of this section.

STEP 5.
Remove two nuts, two washers, two brackets, and two capscrews from mounting plate and front bulkhead.



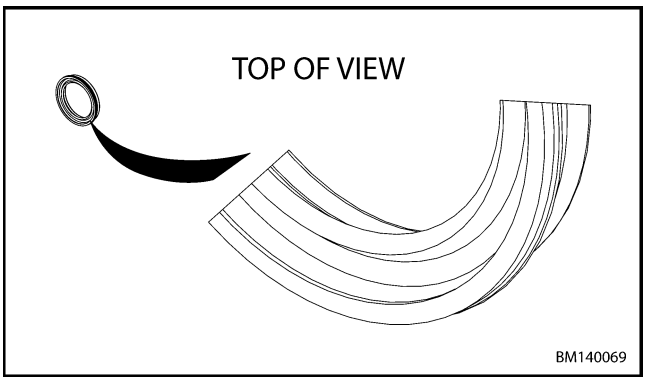
1. CAPSCREW
2. FRONT BULKHEAD
3. BRACKET
4. WASHER
5. NUT
6. MOUNTING PLATE

STEP 6.
Remove two button-head capscrews and lower cover from lower frame plate or remove captive screw and lower cover from plate.



1. LOWER COVER
2. LOWER FRAME PLATE
3. BUTTON-HEAD CAPSCREW

cup side of seal to be facing inward toward the section body. See Figure 17.



CAUTION

To ensure proper assembly, lip of spool seal should point "in" toward valve housing on both ends.

Figure 17. Spool Seal Installation

7. Carefully run your finger around exposed edge of seal. You should have a smooth precise ridge with no kinks or twists.

CAUTION

Pulling the spool's meter edges across the spool seals can result in damaging the spool seal.

8. Slide spool assembly back into section body to keep spool seal in place.

9. Push spool assembly into section body far enough to expose the spool seal on OPS end of section body.

NOTE: Lubricate new spool seal with clean hydraulic oil prior to installation.

10. Using O-ring pick or similar device remove and discard spool seal from spool assembly. Lightly lubricate new spool seal and install onto spool assembly. U cup side of seal to be facing inward toward the section body. See Figure 17.

CAUTION

Pulling the spool's meter edges across the spool seals can result in damaging the spool seal.

11. Slide spool assembly back into section body to keep spool seal in place.

12. Carefully run your finger around exposed edge of seal. You should have a smooth precise ridge with no kinks or twists.

NOTE: Perform Step 13 for tilt section.

13. Install small spool and spring inside spool assembly to be held in position by spool extension. See Figure 16 and Figure 15.

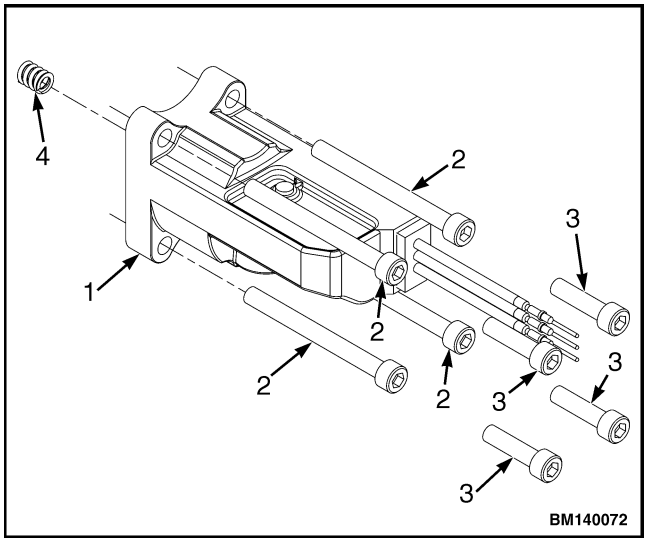
CAUTION

Spool lock body must be placed with orientation dot up and toward section body for correct fit. If not installed correctly damage to manual control valve may result.

14. Install spool extension and spool lock body onto spool assembly. See Figure 16 and Figure 15.

NOTE: Apply Loctite® 262 on capscrew threads prior to installation.

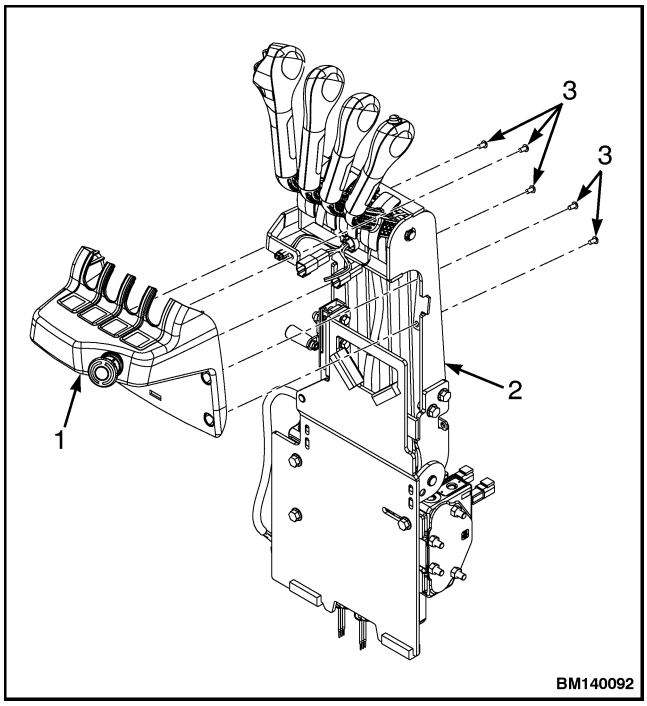
15. Install spring, position sensor, and capscrews onto lift section, tilt section, and auxiliary with OPS section. See Figure 18. Tighten capscrews to 4.7 N•m (42 lbf in).



1. POSITION SENSOR
2. CAPSCREW FOR SECTIONS WITH SPOOL LOCKS
3. CAPSCREW FOR SECTIONS WITHOUT SPOOL LOCKS
4. SPRING

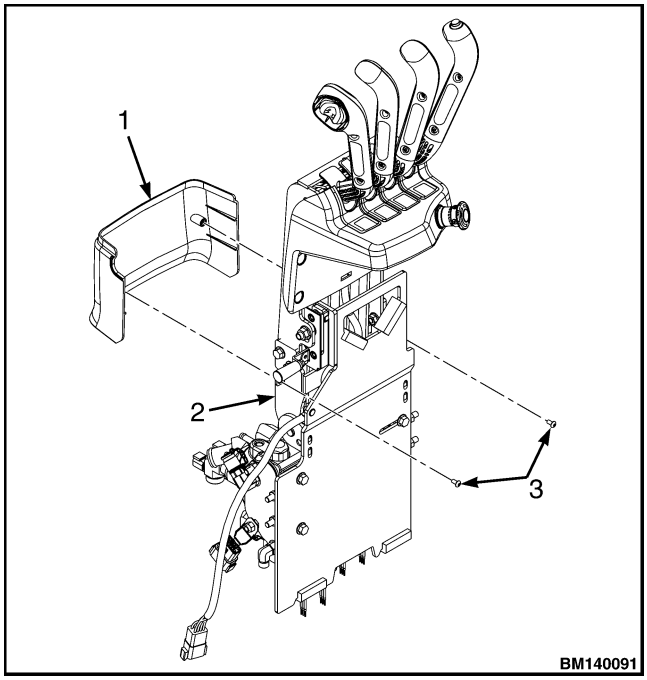
Figure 18. Position Sensor Assembly

STEP 9.
Install rear cover and four button-head capscrews onto upper bracket.



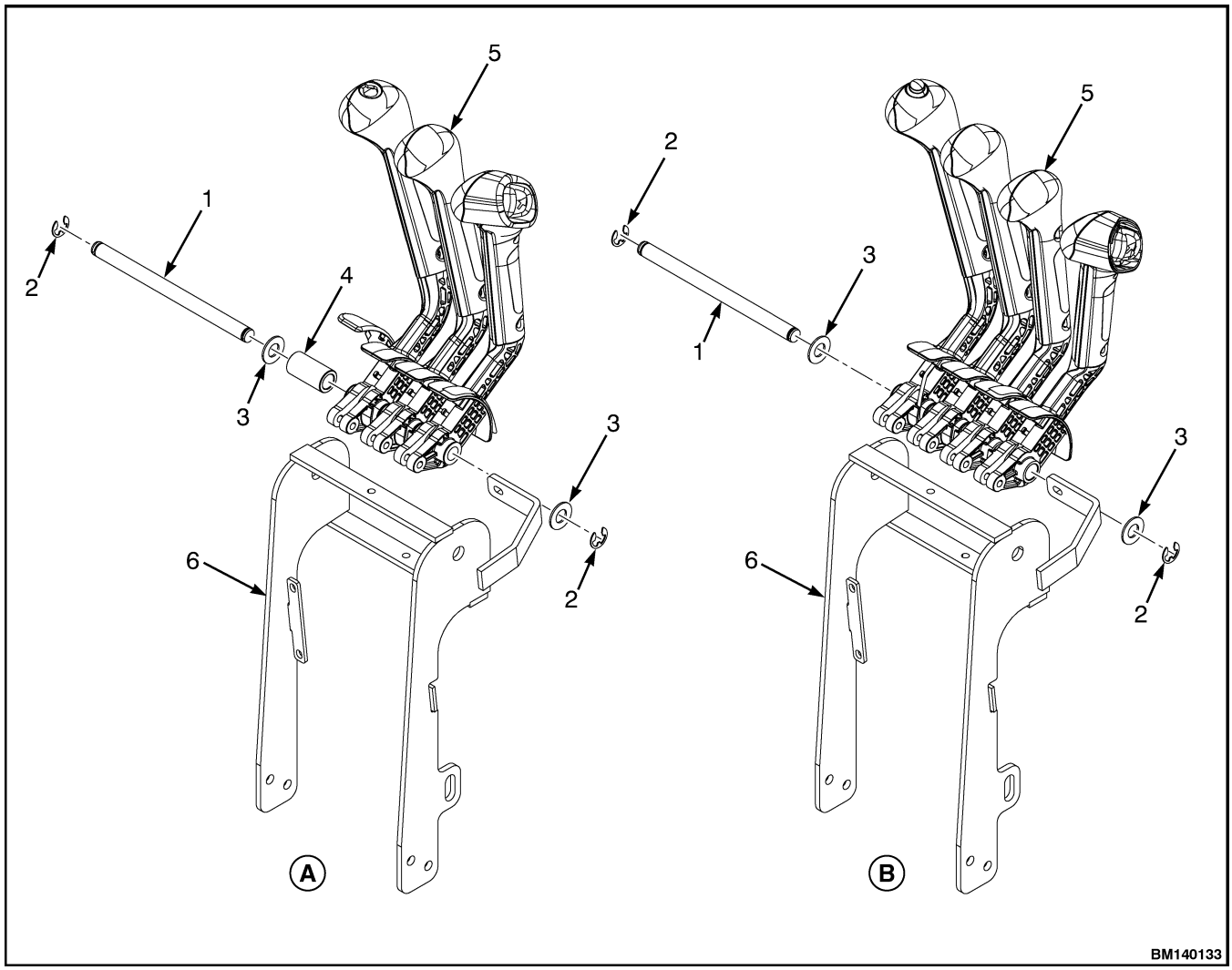
1. REAR COVER
2. UPPER BRACKET
3. BUTTON-HEAD CAPSCREW

STEP 10.
Install lower cover and two button-head capscrews onto lower frame plate or install lower cover and captive screw on plate.



1. LOWER COVER
2. LOWER FRAME PLATE
3. BUTTON-HEAD CAPSCREW

STEP 15.
Remove e-clip at both ends of pivot pin. Slide pivot pin from levers and upper bracket. Remove nylon washers, lever spacer if present, and levers from upper bracket.

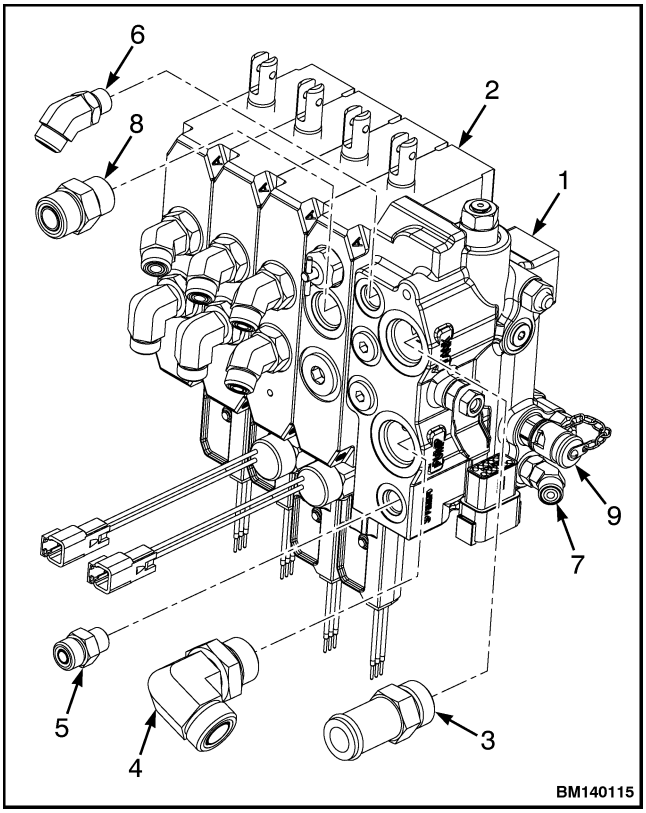


A. 3-FUNCTION LEVERS

1. PIVOT PIN
2. E-CLIP
3. WASHER

B. 4-FUNCTION LEVERS

4. LEVER SPACER
5. LEVER
6. UPPER BRACKET



NOTE: 4-FUNCTION MANUAL CONTROL VALVE SHOWN.

1. INLET SECTION
2. LIFT SECTION
3. RETURN LINE FITTING
4. PRESSURE LINE FITTING
5. STEER SUPPLY FITTING
6. STEER RETURN FITTING
7. STEER LOAD SENSE FITTING
8. HOIST LINE FITTING
9. DIAGNOSTIC FITTING

Figure 60. Manual Control Valve Fittings, Inlet and Lift Sections

19. Install new O-rings onto steer return fitting, return line fitting, and steer supply fitting. Install steer return fitting, return line fitting, and steer supply fitting into inlet section as noted during disassembly. See Figure 60.

20. Install new O-ring onto pressure line fitting. Install pressure line fitting into inlet section as noted during disassembly. See Figure 60 and Figure 58.

21. Install new O-ring onto diagnostic fitting. Install diagnostic fitting into inlet section as noted during disassembly. See Figure 60. Tighten diagnostic fitting to 16 N•m (142 lbf in).

NOTE: Steer load sense fitting contains special internal features and **CANNOT** be replaced with standard hydraulic fitting.

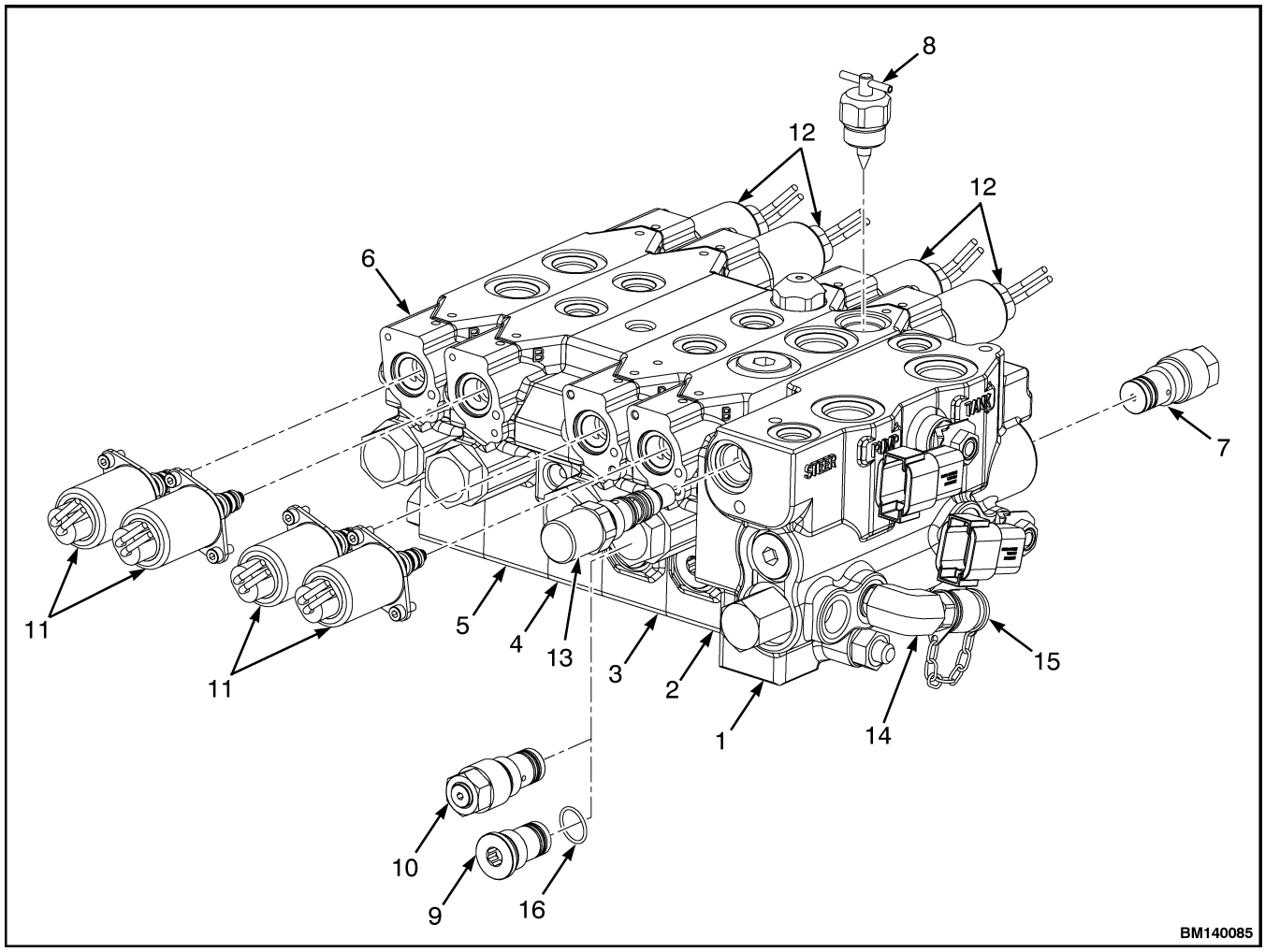
22. Install new O-ring onto steer load sense fitting. Install steer load sense fitting into inlet section as noted during disassembly. See Figure 60 and Figure 61. Tighten steer load sense fitting to 16 N•m (142 lbf in).

DISASSEMBLE

NOTE: Disassemble the e-hydraulic control valve only as necessary for repairs. Most repairs to the e-hydraulic control valve will be to replace O-rings and seals. Spools and valve sections are not serviceable individually and must be replaced as a complete valve section with spool.

NOTE: The 3-function E-hydraulic control valve is not equipped with a first auxiliary section.

1. Remove lower solenoid assemblies from the lift, tilt, and auxiliary sections. See Figure 67.
2. Remove upper solenoid assembly from lift, tilt, and auxiliary sections. See Figure 67.
3. Remove nuts from tie rods on outlet side of E-hydraulic control valve. See Figure 68 and Figure 69.
4. Remove outlet cover from tie rods and second auxiliary section.



1. INLET SECTION
2. LIFT SECTION
3. TILT SECTION
4. SPACER SECTION (OPTIONAL)
5. FIRST AUXILIARY SECTION (OPTIONAL)
6. SECOND AUXILIARY SECTION
7. PRIMARY RELIEF VALVE
8. MANUAL LOWERING VALVE
9. COMPENSATOR PLUG
10. OPTIONAL SECONDARY RELIEF VALVE
11. LOWER SOLENOID ASSEMBLY
12. UPPER SOLENOID ASSEMBLY
13. PILOT CARTRIDGE
14. ELBOW FITTING
15. DIAGNOSTIC FITTING
16. O-RING

Figure 67. E-Hydraulic Control Valve

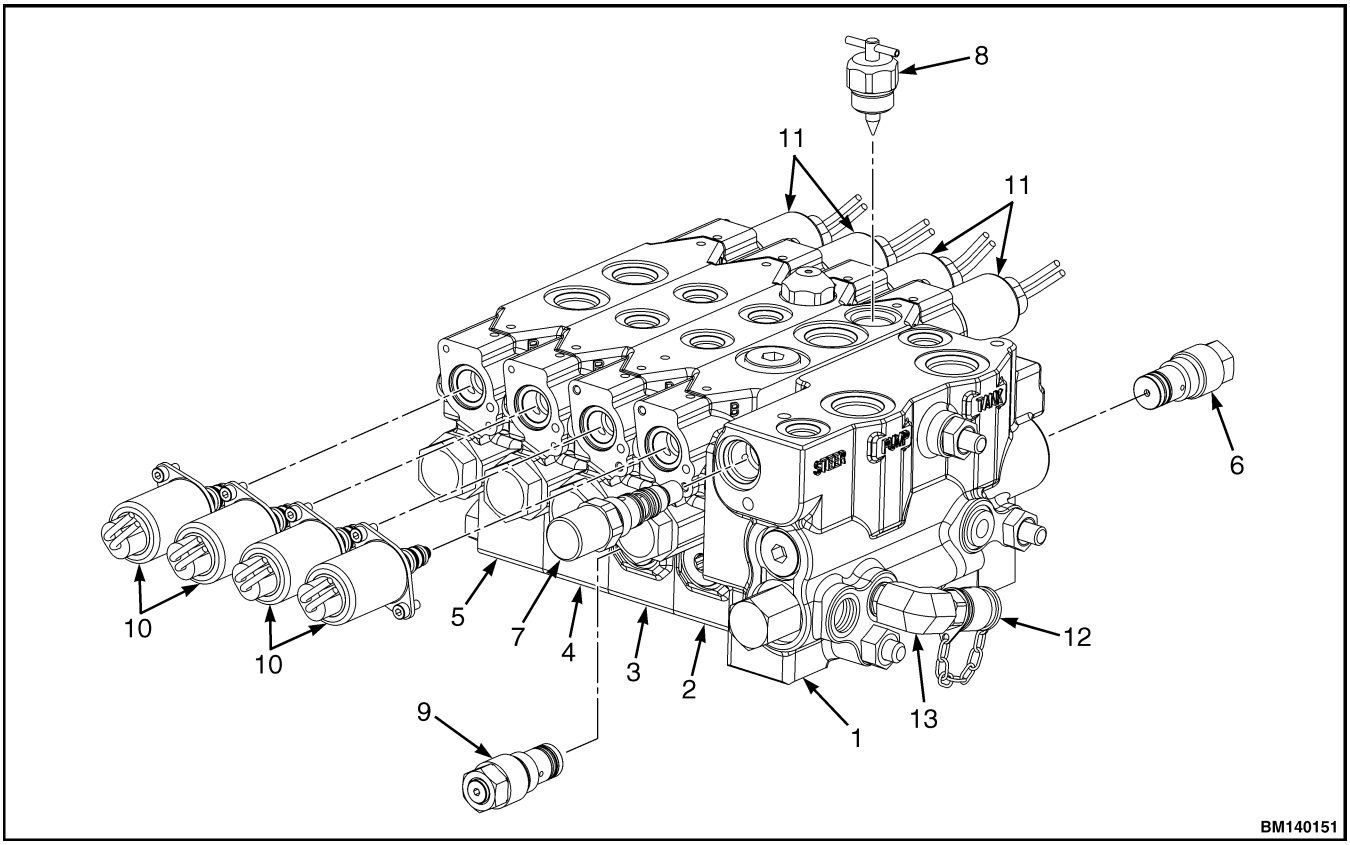
DISASSEMBLE

NOTE: The 3-function E-hydraulic control valve is **not** equipped with a first auxiliary section.

1. Remove lower solenoid from the lift, tilt, and auxiliary sections. See Figure 90.
2. Remove upper solenoid from lift, tilt, and auxiliary sections. See Figure 90.
3. Remove nuts from tie rods on outlet side of E-hydraulic control valve. See Figure 91.
4. Remove two jam nuts, upper solenoid connector, and lower solenoid connector from tie rods on inlet side. See Figure 88.

NOTE: Note placement of section seals in retaining grooves of each section prior to removal to aid in installation.

5. Remove each section from tie rods and adjacent section starting with the second auxiliary section, followed by the first auxiliary section if present, the tilt section, and the lift section. See Figure 92 for example.



1. INLET SECTION
2. LIFT SECTION
3. TILT SECTION
4. FIRST AUXILIARY SECTION (OPTIONAL)
5. SECOND AUXILIARY SECTION
6. PRIMARY RELIEF VALVE
7. PILOT CARTRIDGE
8. MANUAL LOWERING VALVE
9. SECONDARY RELIEF VALVE
10. LOWER SOLENOID
11. UPPER SOLENOID
12. DIAGNOSTIC FITTING
13. ELBOW FITTING

Figure 90. E-Hydraulic Control Valve

NOTE: Perform Step 5 and Step 6 for hoist valve air bleed. This is required if the carriage moves slightly (approximately 25.4 mm (1 in.)) alternating between lifting and lowering.

5. Activate lift control from neutral to full lift and back to neutral at a rate of one to two times per second. Repeat until lift function is operating smoothly with no uncommanded mast movements.

6. Lift carriage to maximum height and run over hydraulic relief for 15 to 30 seconds.

NOTE: Perform Step 7 for cylinder air bleed. This is required if the cylinders have not been previously cycled, or if the lift function is not operating smoothly.

7. Cycle function completely two or three times; repeat if necessary.

It is not necessary to turn the lift truck **ON** or **OFF** if you are performing other procedures.

Checks and Adjustments for Lift Truck ERC22-35VG (ERC045-070VG) (A968) and ERP22-35VL (ERP045-070VL) (A976)

MANUAL CONTROL VALVE

External Leakage

1. If leaking between sections, loosen mounting bolts, loosen tie rod nuts and re-torque tie rod nuts to 19 to 21 N•m (168 to 192 lbf in). Tighten mounting bolts and check for leaks. If leakage continues, replace section seals, see **Assemble Manual Control Valve** section in this manual.

2. If relief cartridges, lowering valves, plugs, or fittings are leaking, tighten to measurements indicated in **Assemble Manual Control Valve** section of this manual. If leakage continues, replace O-rings.

Primary Relief Cartridge

1. Remove cap and Install pressure gauge capable of reading 250 bar (3625 psi) on diagnostic fitting in inlet section. See Figure 109.

2. Run lift truck to ensure oil temperature has stabilized to 65 to 70°C (150 to 160°F).

3. Lift mast high enough for forks to clear when fully tilted forward.

4. Tilt forks either forward or backward until they reach end of travel, and record pressure reading.

5. If pressure is outside of range, follow procedure below to adjust primary relief valve cartridges:

   a. Remove plug at end of large hex of cartridge and insert hex wrench into adjustment plug.

   b. Turning adjustment plug **CLOCKWISE** increases spring compression (higher pressure setting); turning adjustment plug **COUNTER-CLOCKWISE** decreases spring compressions (lower pressure setting).

6. Lower forks to the ground and turn **OFF** lift truck.

CAUTION

Hydraulic fluid may be hot, allow lift truck to cool down sufficiently prior to any work that may expose hydraulic fluid.

7. To replace primary relief valve, unscrew cartridge from inlet cover and replace with new cartridge. See **Parts Manual** for replacement part information.

8. Repeat Step 3 through Step 6 to verify new primary relief valve is set properly.

9. Remove pressure gauge and replace cap on diagnostic fitting in inlet section.

Fork Repair

The forks are held on the carriage by hooks. The forks are kept in position by pins that fit through the top fork hooks and into slots in the top bar carriage. If pin does not remain engaged in carriage slot, replace with new pin. Always check that the pins for the forks keep the forks in position on the carriage. Replace damaged fork pin parts. The forks can be removed from the carriage by aligning the forks with the fork removal notch. The fork removal notch is in the bottom bar of the carriage. See Figure 3.

REMOVE

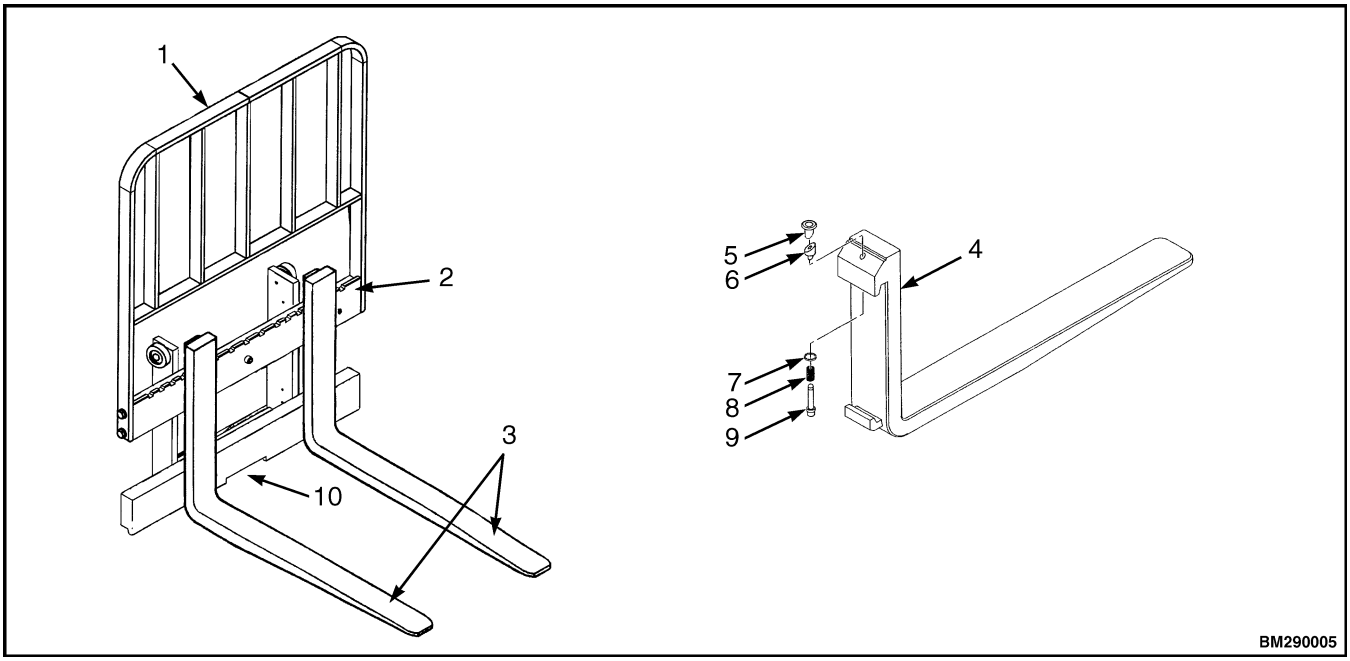
WARNING

DO NOT try to remove a fork without a lifting device. Each hook fork for these lift trucks can weigh 45 to 115 kg (99 to 254 lb).

A fork can be removed from the carriage for replacement of the fork or other maintenance. Slide the fork to the fork removal notch in the bottom bar of the carriage. See Figure 3. Lower the fork onto blocks so the bottom hook of the fork moves through the fork removal notch. See Figure 4. Lower the carriage further so the top hook of the fork is disengaged from the top carriage bar. Move the carriage away from the fork or use a lifting device to move the fork away from the carriage.

INSTALL

Move the fork and carriage so the top hook on the fork can engage the upper carriage bar. Raise the carriage to move the lower hook through the fork removal notch. Slide the fork on the carriage so both upper and lower hooks engage the carriage bars. Engage the latch pin with a notch in the upper carriage bar.



1. LOAD BACKREST
2. CARRIAGE
3. FORKS
4. FORK
5. KNOB
6. WEDGE
7. WASHER
8. SPRING
9. PIN
10. FORK REMOVAL NOTCH

Figure 3. Carriage and Forks

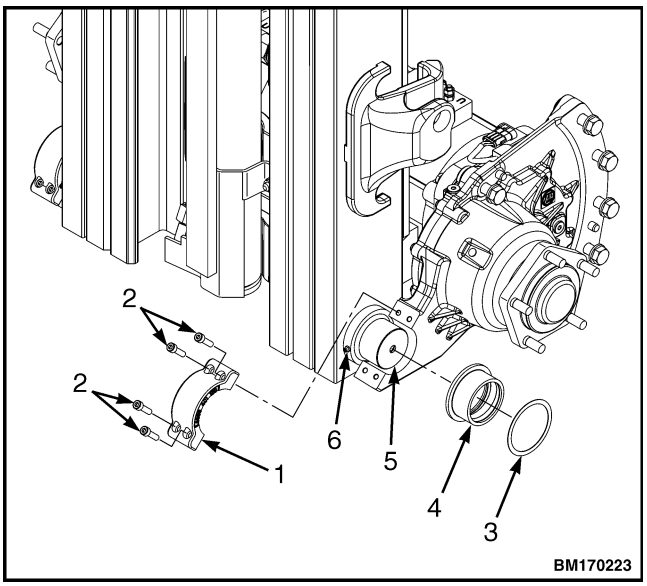
Legend for Figure 19

A. HOSE SHEAVE ASSEMBLY

1. SNAP RING
2. SHIM
3. LOAD ROLLER
4. INNER MAST
5. LOWERING CONTROL VALVE
6. LOWERING CONTROL VALVE MOUNTING BRACKET
7. LOWERING CONTROL VALVE HOUSING
8. SPRING AND LOWERING CONTROL VALVE WASHER
9. RIGHT MAIN LIFT CYLINDER
10. NUT
11. WASHER
12. SPACER

B. CHAIN SHEAVE ASSEMBLY

13. CAPSCREW
14. OUTER MAST
15. CHAIN ANCHOR
16. COTTER PIN
17. CHAIN ANCHOR PIN
18. O-RING
19. STRIP BEARING
20. CHAIN SHEAVE
21. BEARING
22. LEFT MAIN LIFT CYLINDER
23. HOSE GUARD
24. STUBSHAFT
25. HOSE SHEAVE
26. SPECIAL WASHER



1. RETAINER CAP
2. BOLTS
3. SHIM
4. BUSHING
5. MAST MOUNTING STUBSHAFT
6. GREASE FITTING

Figure 20. Mast Mounting

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.

The 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.

NOTE: If only the lift cylinders need to be removed and repaired, see **Cylinder Repair** 2100 YRM 1382 for procedures. For header hose installation and adjustment, see the section Header Hose Installation and Adjustment.

1. Clean the area around the hydraulic fittings for the lift cylinders. Remove the cylinder restraint brackets at the top of the outer mast. Disconnect the fittings at the lift cylinders and put caps on the open lines. See Figure 19.

2. Remove the header hoses, if equipped.

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.

3. Remove the capscrew, washers, spacer, and nut at the mount near the top of each main lift cylinder. Remove the snap rings, washers, and shims from the top of each main lift cylinder. Disconnect the main lift chains at the chain anchors.

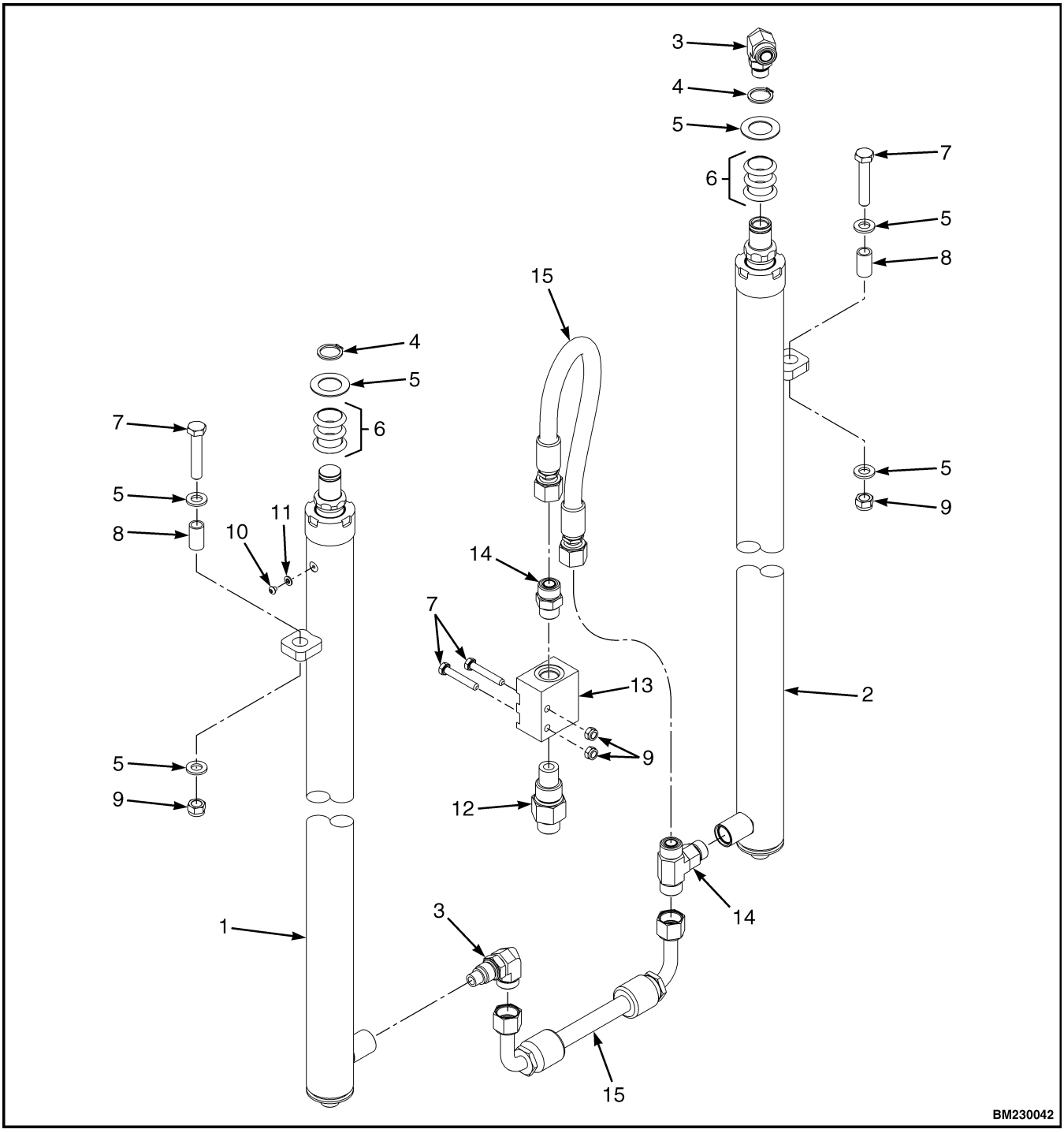


Figure 35. Main Lift Cylinders and Lowering Control Valve

Legend for Figure 50

NOTE: BACK VIEW OF MAST SHOWN.

A. HEADER HOSE
B. HEADER HOSE
C. HEADER HOSE
D. HEADER HOSE

1. FOURTH FUNCTION HOSES
2. LIFT CHAIN
3. CHAIN ANCHOR
4. FREE-LIFT SUPPLY TUBE
5. THIRD FUNCTION HOSES
6. MAIN LIFT SUPPLY HOSE
7. LOWERING CONTROL VALVE

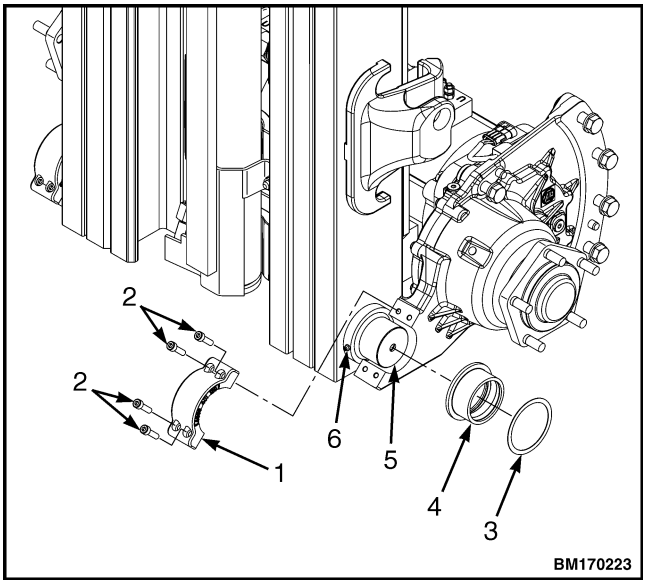
13. Use the lifting device and move mast into vertical position.

NOTE: Make a note of each shim arrangement. The shim arrangement will be approximately the same during assembly.

14. Remove the bolts that hold the retainer caps to the mast mount stubshafts. Remove the shims and bushings. See Figure 51.

NOTE: When placing mast on wooden beams, do not lay mast with main lift cylinders resting on wooden beams.

15. Use lifting device or crane to lift mast assembly from lift truck. Position the outer mast across wooden beams on the floor with the carriage side up.



1. RETAINER CAP
2. BOLTS
3. SHIM
4. BUSHING
5. MAST MOUNTING STUBSHAFT
6. GREASE FITTING

Figure 51. Mast Mounting

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.

CAUTION

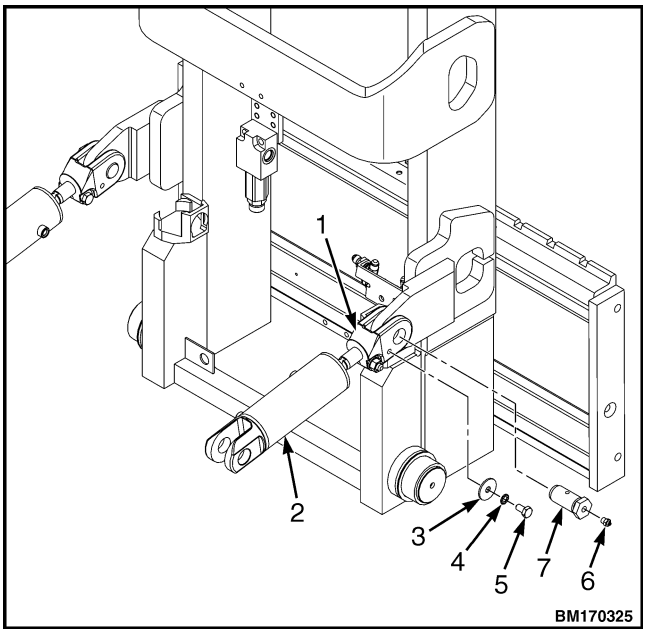
Protect the hydraulic system from dirt and contaminants when servicing the hydraulic system.

NOTE: If only the main lift cylinders, tilt cylinders, or free-lift cylinder need to be repaired, the mast does not need to be removed from the lift truck. See the section **Cylinder Repair** 2100 YRM 1382 for procedures. For header hose installation and adjustment procedures, see the section Header Hose Installation and Adjustment.

1. Clean the area around the hydraulic fittings for the main lift cylinders. Disconnect the fittings at the main lift cylinders and put caps on the open lines. Disconnect the free-lift chains from the chain anchor. See Figure 52.

2. Remove the header hoses.

3. Disconnect and remove the free-lift supply tube. Remove the free-lift cylinder guard brackets. Remove free-lift cylinder from mast. If lift truck is equipped with a four function mast, remove header hose roller brackets and mini rollers (see Figure 53) and remove the hose and chain sheaves from free-lift cylinder and disassemble them as necessary for cleaning, inspection, and repair.



NOTE: SEVERAL MAST COMPONENTS OMITTED FOR CLARITY.

1. TILT CYLINDER ROD END
2. TILT CYLINDER SHELL
3. SPECIAL WASHER
4. LOCK WASHER EXTERNAL TOOTH
5. CAPSCREW
6. GREASE FITTING
7. ROD END PIN

Figure 67. Tilt Cylinder Mounting

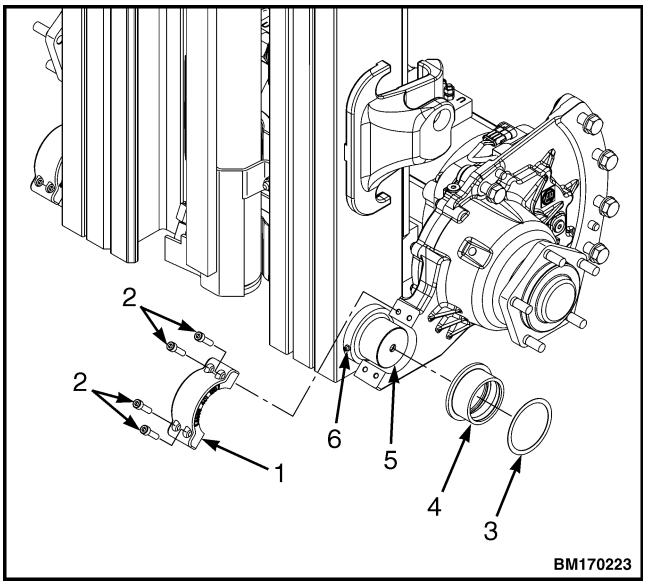


Figure 68. Mast Mounting

Legend for Figure 68

NOTE: THREE-STAGE FFL MAST SHOWN. FOUR-STAGE FFL MAST IS MOUNTED THE SAME WAY.

1. RETAINER CAP
2. BOLTS
3. SHIM
4. BUSHING
5. MAST MOUNTING STUBSHAFT
6. GREASE FITTING

DISASSEMBLE

WARNING

Hydraulic oil is hot after system operation and can cause burns. DO NOT disconnect any hydraulic hoses until the oil in the system has cooled.

Completely lower forks to relieve hydraulic pressure before disconnecting any hydraulic hoses.

WARNING

The mast is heavy. The mast can weigh approximately 1100 kg (2385 lb). Make sure all lifting devices (hoists, cables, chains, slings, etc.) are suitable and of adequate capacity to lift the mast. Serious injury can occur if the mast falls.

CAUTION

Protect the hydraulic system from dirt and contaminants when disconnecting hydraulic hoses from the mast. If hydraulic system becomes contaminated, damage to the hydraulic system can occur.

NOTE: Before disassembling the mast, remove the forks, carriage, and load backrest. See the sections Fork Repair and Carriages Repair for procedures. If the free-lift cylinder or tilt cylinders need to be repaired, the mast does not need to be removed from the lift truck. See the section **Cylinder Repair** 2100 YRM 1382 for procedures. For header hose installation and adjustment procedures, see the section Header Hose Installation and Adjustment.

1. Remove main lift cylinder from mast. See the section **Cylinder Repair** 2100 YRM 1382 for procedures.

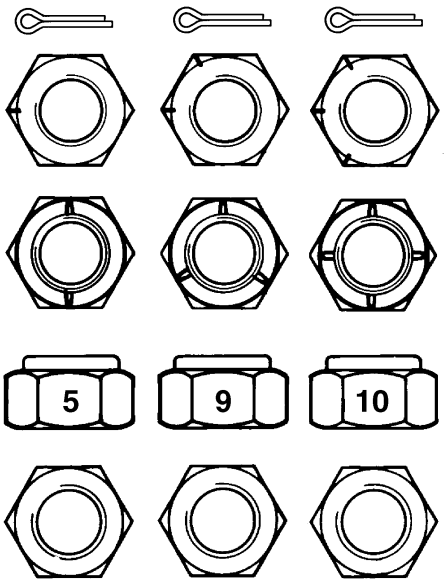
NOTE: Tag chains prior to removal to aid in reassembly.

2. Remove free-lift chain anchors and chains from inner mast crossmember.

3. Disconnect free-lift cylinder hose from tube and remove tube assembly. See Figure 69.

METRIC AND INCH (SAE) FASTENERS

ALL MODELS



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Legend for Figure 11

1. ROOF PANEL
2. TOP PANEL ASSEMBLY
3. GROMMET
4. SCREEN
5. PIN
6. HINGE
7. WASHER
8. NUT
9. PLATE
10. GRIP MOUNTING PLATE
11. NUT COVER
12. GRIP
13. SPRING
14. SCREW
15. SEAL

Clean

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 yes.

1. Using compressed air, blow dirt and debris from all components as needed.
2. Using warm soapy water, clean plastic, rubber, and vinyl components. Wipe dry with a lint free cloth.

Inspect

1. Inspect hinges, rod, spring and grip for damage or cracks. Replace as needed.

Install

1. Install grip mounting plate, two washers, two nuts, and two nut covers on screen. See Figure 11.
2. Install grip, spring, and screw on screen. See Figure 11.
3. Install plate, two washers, two nuts, and two nut covers on screen. See Figure 11.
4. Install pin, two hinges, four washers, and two nuts on screen. See Figure 11.
5. Install seal on screen. See Figure 11.
6. Install roof panel, four washers, four capscrews, and four nuts on top panel assembly. See Figure 11.
7. Install two grommets to top panel assembly. See Figure 11.

NOTE: Perform Step 8 for lift truck model ERP22-35VL (ERP045-070VL) (A976).

8. Install front light wiring. See **Electrical System** 2200 YRM 1369 Light Assemblies Replacement section for proper procedures.

Cab Door Assembly

DOOR ASSEMBLY

Remove

WARNING

The door assemblies are heavy, verify the lifting device being used during repairs can lift the weight of the parts and assembly.

1. Disconnect gas spring from top of door assembly.

   See Figure 12 for lift truck models
   - ERP22-35VL (ERP045-070VL) (A976)

   See Figure 13 for lift truck models
   - ERP15-20VT G807)

NOTE: Perform Step 2 for lift truck model ERP22-35VL (ERP045-070VL) (A976).

2. Remove three capscrews from upper hinge. Remove three capscrews from lower hinge. See Figure 12.

NOTE: Perform Step 3 for lift truck model ERP15-20VT (G807).

3. Remove two screws from mounting plate and hinge in two places. Remove three bolts from mounting plate and overhead guard leg in two places. See Figure 13.

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Table 1. Maintenance Schedule (Continued)

Item No.	Item	8 hr/ Daily	500 hr or 3 Months	2000 hr or 1 Year	4000 hr or 2 Years	Procedure or Quantity	Specification
11	Carriage Assembly	X				Inspect for visible damage/ check operation.	
	Forks	X				Check condition/ replace if necessary.	
	Fork Guides and Pins	X	L			Lubricate as required. See NOTE 1.	Use multipurpose grease. See NOTE 2.
	Integral Sideshift Carriage		L			Lubricate 2 fittings. See NOTE 1.	Use multipurpose grease. See NOTE 2.
	Integral Sideshift Carriage (Upper and Lower Bearings)		X			Check wear, 4 bearings. See NOTE 1.	2.50 mm (0.09 in.) Minimum thickness.
				C		Replace bearings.	See **Parts Manual.**
12	Transaxle						
	Oil Level			X		Check oil level.	Use Dexron III.
	Breather			X		Clean and check operation/ replace as necessary.	
	Electrical Circuits						
	Battery Disconnect Switch	X				Check operation.	
	Horn, Lights, Alarms, and Seat Switch	X				Check operation/ repair as required.	
	Display Panel	X				Check operation.	
	Contactors		X			Check condition/ repair as required.	
	Direction and Speed Control Pedal	X	L			Check operation/ lubricate as needed.	Use silicone spray lubricant, Yale P/N 504236201.
X = Check, C = Change, L = Lubricate, CIL = Check Indicator Light during operation.							
NOTE: *Never use steam to clean electrical parts.*							

Maintenance Procedures Every 500 Hours or Three Months

NOTE: Perform the checks in the Maintenance Procedures Every 8 Hours or Daily section prior to performing the procedures in this section.

TIRE AND WHEEL ASSEMBLIES

Inspect the wheel rims for rust and cracks. **DO NOT** weld a cracked wheel rim or straighten a bent rim. Welding, heating, or bending a wheel rim can weaken its capacity. Always replace damaged tires or wheel rims immediately. **DO NOT** operate a truck with a broken stud or missing lug nuts.

MAST AND CARRIAGE

Mast Sliding Surfaces

WARNING

Use special safety precautions when working on or near the mast or carriage. See Safety Procedures When Working Near Mast.

DO NOT work under a raised carriage. Lower the carriage or install a safety chain to prevent the carriage from lowering when performing maintenance on the mast and lift chains.

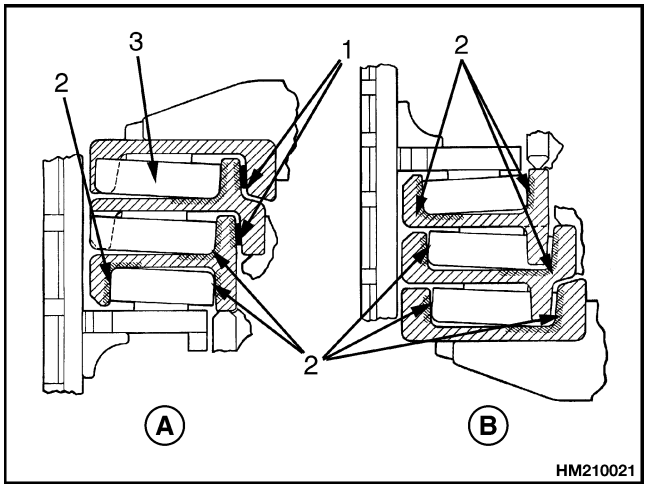
Cleaning solvents can be flammable and toxic and can cause skin irritation. When using cleaning solvents, always follow the recommendations of the manufacturer.

CAUTION

DO NOT use steam or high-pressure water to clean the load rollers or the lift chains. Steam and high-pressure water can remove the lubrication from the bearings in the load rollers. Water in the bearings of the sheaves and the link pins of chains can also shorten the service life of these parts.

NOTE: The load rollers and sheaves have sealed bearings that do not need additional lubrication.

Lubricate the sliding surfaces and the load roller surfaces along the full length of the channels of the mast and carriage as shown in Figure 27 and Figure 28. Apply lubricant only to the indicated surfaces.



A. UPPER LOAD ROLLERS
B. LOWER LOAD ROLLERS

1. LUBRICATE STRIP BEARINGS SURFACES
2. LUBRICATE SURFACES WHERE LOAD ROLLERS TRAVEL
3. LOAD ROLLER

Figure 27. Mast Lubrication

Close the gate valve. If the carriage or mast weldments lower slowly, the seals in the lift cylinders are worn.

4. If the carriage and mast weldments do not move, open the gate valve and check for movement again. If the carriage lowers when the gate valve is open, check for leaks in the hydraulic lines or fittings. If no leaks are found, the main control valve may have a defect. Remove the load from the forks.

TILT CYLINDER LEAK CHECK

To check the tilt system for hydraulic leaks, see the service manual section **Cylinder Repair** 2100 YRM 1382 for the procedures.

Battery Maintenance

HOW TO CHARGE BATTERY

WARNING

The acid in the electrolyte can cause injury. If electrolyte is spilled, use water to flush the area. Make the acid neutral with a solution of sodium bicarbonate (soda) and water. Acid in the eyes must be immediately flushed with water.

Batteries generate explosive fumes when they are being charged. Keep fire, sparks, and burning material away from the battery charger area. Prevent sparks from the battery connectors.

Charge batteries only in the special area for charging batteries. When charging the batteries, keep the vent caps clean. The battery charger area must have ventilation so that explosive fumes are removed. Open the hood over the battery or remove the cover if the battery has a cover.

Disconnect the battery when doing cleaning and maintenance.

CAUTION

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

Use only battery chargers approved by the battery manufacturer or dealer.

CAUTION

Always make sure the color in the window of the charger connector is the same as the color in the window of the battery connector.

NOTE: This series of trucks can have one of two types of batteries. One type has removable cell caps. A green key for battery voltage shows in the window of the battery connector for batteries with cell caps. The other type has sealed cells and the electrolyte cannot be checked. A gray key for battery voltage shows in the window of the battery connector for sealed batteries. These sealed batteries also require a different charger.

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

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

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

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1400 Sullivan Dr., Greenville, NC 27834-2011

8000 YRM 1339

11/10 (6/10)(2/10)(4/09) Printed in U.S.A.

NOTE: Check that clips are attached to cover prior to installation. Replace clips if missing.

9. Install steering column upper cover by pressing from both sides and pushing against lower cover until snapped in place. See Figure 13.

10. Install steering wheel and hex nut on steering column. Tighten nut to 40 to 54 N•m (30 to 40 lbf ft). See Figure 12.

11. Install rod, nut, and horn button in steering wheel. See Figure 11.

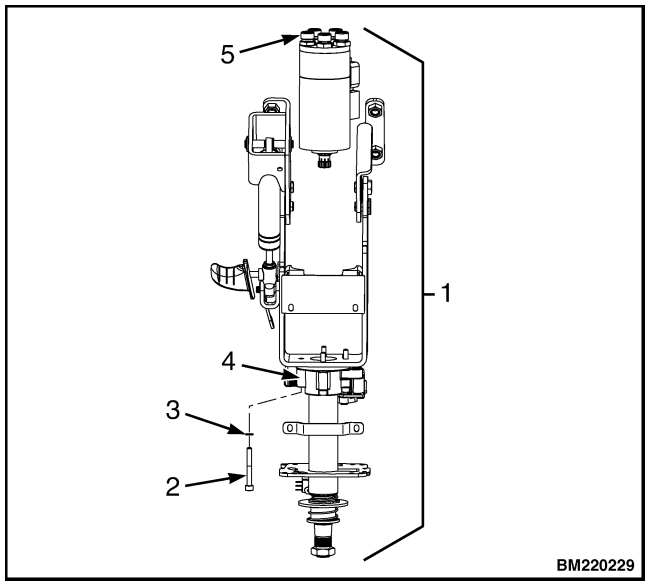
12. Connect the battery connector.

FIXED STEERING COLUMN GEAR REPLACEMENT

1. Follow steps outlined in Remove section, then perform steps below.

2. Place steering column upside down in stand.

3. Remove four capscrews and washers from pump mount and steering control unit. See Figure 22.



1. FIXED STEERING COLUMN
2. CAPSCREW
3. WASHER
4. PUMP MOUNT
5. STEERING CONTROL UNIT

Figure 22. Fixed Steering Column SCU Remove/Install

4. Remove steering control unit. See Figure 22.

NOTE: The column shaft is not easily removed due to the location of the snap ring holding the shaft under the upper bearing. The best way to remove the gear is to split the gear using a hammer and chisel, allowing it to slide off.

5. Remove lower snap ring. See Figure 23.

6. Split column gear using hammer and chisel. Remove and discard gear. See Figure 23.

7. Using a press, install new column gear onto knurled shaft until against upper snap ring. See Figure 23.

8. Remove any displaced material from the snap ring groove area.

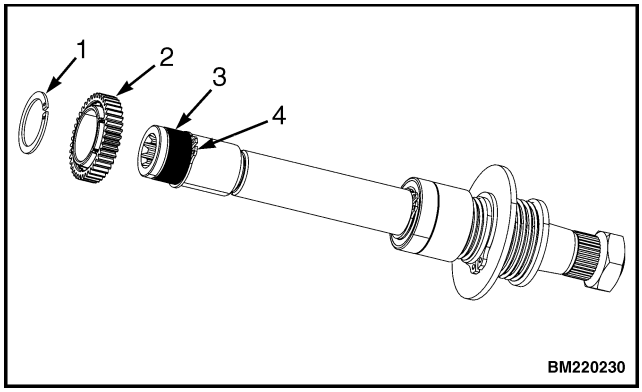
9. Install lower snap ring. See Figure 23.

10. Install steering control unit onto tilt base bracket. See Figure 22.

11. Install four washers and capscrews onto pump mount and steering control unit. See Figure 22.

12. Return steering column to upright position.

13. Follow steps outlined in Install section to complete steering column installation.



NOTE: STEERING COLUMN PLATES, BRACKETS, AND MOUNT FIXTURES NOT SHOWN FOR CLARITY.

1. LOWER SNAP RING
2. COLUMN GEAR
3. KNURLED SHAFT
4. UPPER SNAP RING

Figure 23. Column Gear

NOTE: Bearing cones are to be replaced as sets. If one bearing cone has been determined to be unserviceable, then both must be replaced.

13. Remove bearing cone, shim, snap ring, and seal from top of upper housing. See Figure 39.

NOTE: For correct orientation during installation, note the position of the seal during removal.

14. Remove nilosring, bearing cone, wear ring, and seal from bottom of upper housing. See Figure 39.

15. If bearing cones are to be replaced, use a brass drift pin to remove bearing cups from upper housing. See Figure 39.

16. Remove plug from upper housing. See Figure 39.

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.

WARNING

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

1. Clean bearing cones by placing them in a wire basket and immersing in a container of fresh solvent. Agitate the bearing cones in the solvent to remove all traces of old lubricant.

2. Clean all remaining components, except seals, with solvent.

3. Clean seals in warm soapy water. Rinse with clean warm water and allow to air dry.

4. After cleaning, dry bearing cones with compressed air. Take care to prevent spinning the bearing cones when using a compressed air jet.

5. Immediately wrap bearing cones in a lint-free cloth to protect them from dust and other foreign matter.

Inspect

1. Inspect bearing cones for burned or damaged rollers. If either condition exists, replace both sets of bearing cones and bearing cups.

2. Inspect bearing cups for signs of overheating or scoring. If either condition exists, replace both sets of bearing cones and bearing cups.

3. Inspect the remaining components for damage. Repair or replace as necessary.

Assemble

1. Prior to installation, pack bearings, seals, and rings with grease. See **Periodic Maintenance** 8000 YRM 1339 or **Operating Manual** for recommended grease.

2. Install plug in upper housing. See Figure 39.

3. If removed, use a press to install new bearing cups into upper housing. See Figure 39.

4. Install seal, wear ring, bearing cone, and nilosring into bottom of upper housing. See Figure 39.

5. Install seal, snap ring, shim, and bearing cone into top of upper housing. See Figure 39.

6. Install nilosring, shims, lockwasher, and slotted nut into top of upper housing. See Figure 39.

7. Install steering direction sensor with magnet and socket-head screw into upper housing. See Figure 39.

8. Install cover plate, two lockwashers, and two socket-head screws onto upper housing. See Figure 39.

9. Install wheel hubs; follow procedures in Wheel Hub Assembly section.

10. Install steering pinion onto axle support. See Figure 39.

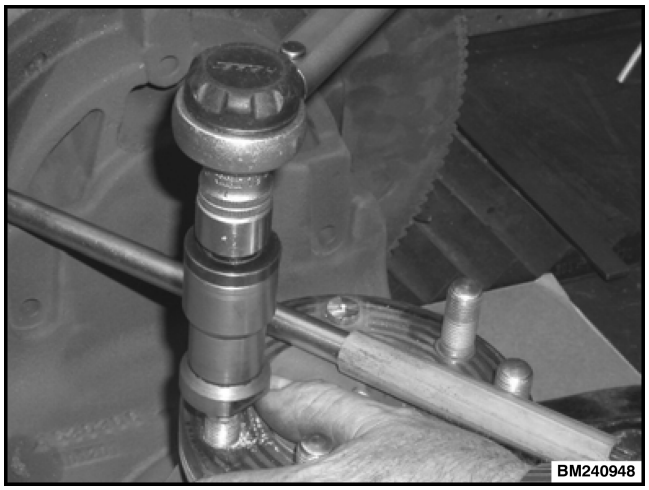


Figure 13. Stud Installation

BRAKE CYLINDER REPAIR

WARNING

Always wear eye protection and use the proper tools when installing/removing snap rings.

The service brake pedal in the operator compartment actuates the master cylinder sending pressurized fluid to the brake pistons in the transaxles through the service brake lines.

1. Remove the transaxle from the lift truck. Disassemble the parking brake and traction motor from the transaxle. See Remove Transaxle From Frame in this section.
2. Drain the oil from the transaxle.
3. Remove the snap ring in the brake cylinder. See Figure 14.

CAUTION

Cover the cap with a cloth to control it in case it is ejected from the piston.

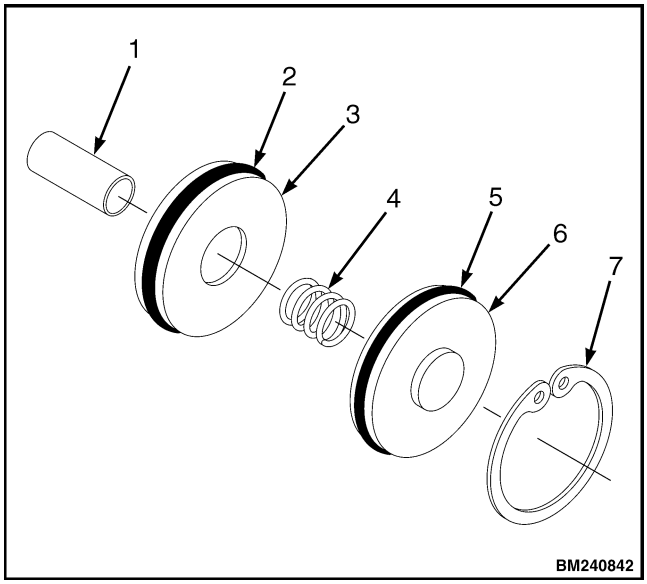
NOTE: Make note of the piston and cap orientation as well as the orientation of the seal on the piston before removal.

4. Direct pressurized air into the service brake line port in the cover to force the cap out of the cylinder. Recover the spring from beneath the cap. Remove the seal from the cap and cut it in two to prevent accidental reuse. See Figure 15.
5. Using a grind stone, slightly bevel the end of a 7/16 x 2 inch roll pin. Allow the pin to cool.
6. Carefully position the roll pin to the piston. Drive the roll-pin into the cavity of the piston with a nylon faced hammer.

NOTE: It may be helpful to apply compressed air to the service brake line port (as with removing the cap) **AFTER** the piston has been pulled to the top end of the brake cylinder.

NOTE: Make note of the piston and seal orientation during removal.

7. Pull the roll-pin (and piston) from the cylinder using pliers.



1. CYLINDRICAL PIN
2. PISTON SEAL
3. PISTON
4. SPRING
5. O-RING
6. CAP
7. SNAP RING

Figure 14. Brake Piston Assembly

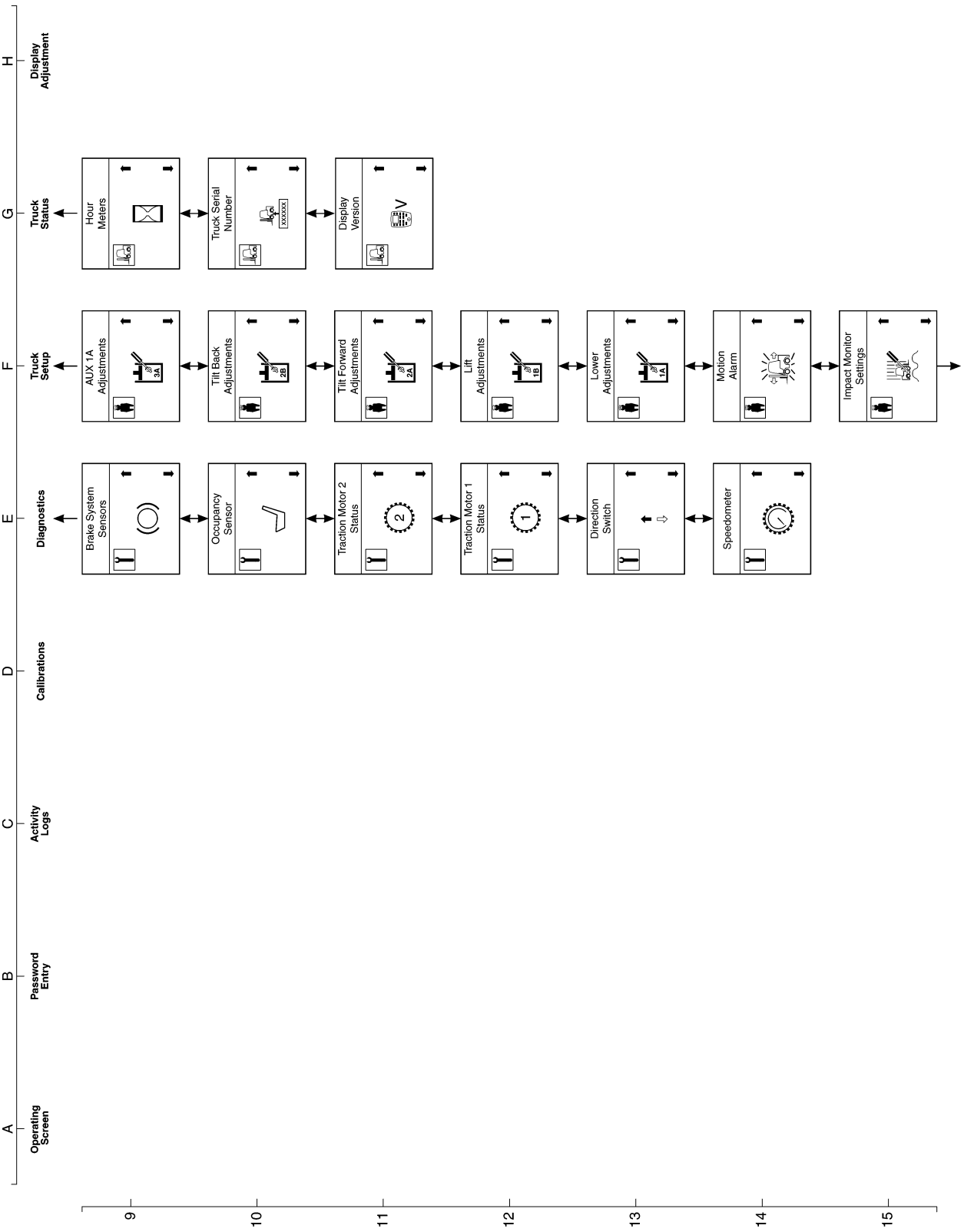
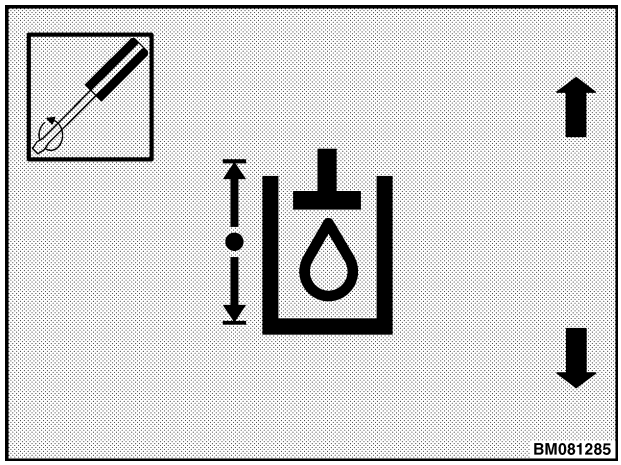
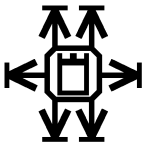


Figure 3. Technician Flowchart (Sheet 2 of 4)

Table 9. Calibration Submenus and Icons (Continued)

Icon	Description
Manual Hydraulics Submenu	
	
	Main Manual Hydraulic End Point Calibration Prompt Icon
	This icon points to the * key and is used for manual hydraulic end point calibration in this submenu.

Display Submenu Icons

Table 10 presents the icons that appear on the Display Submenus. Refer to Display Menu for more information.

Table 10. Display Submenus and Icons

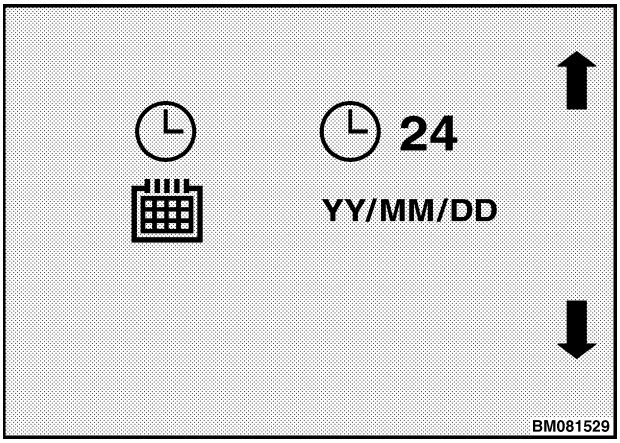
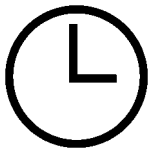
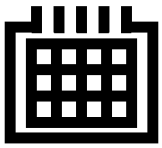
Icon	Description
Set Date and Time Format Submenu	
	
	Clock Icon for setting time
	Calendar Icon for setting date
	24-Hour Clock Icon
	12-Hour Clock Icon
DD/MM/YY	DD/MM/YY (Europe) Date Format Icon
MM/DD/YY	MM/DD/YY (USA) Date Format Icon

Table 13. Diagnostic Submenu Icons (Continued)

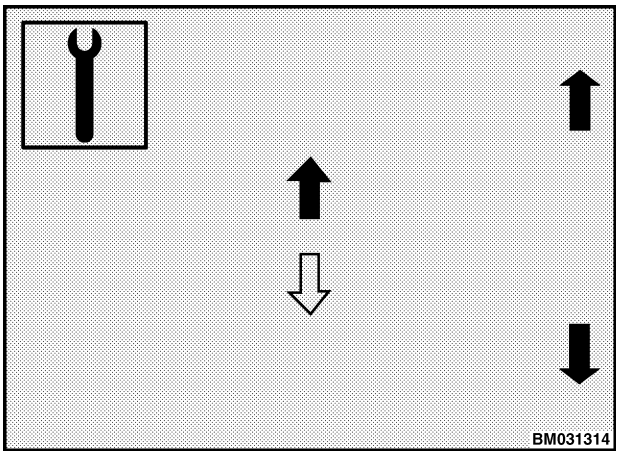
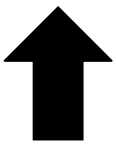
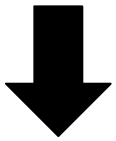
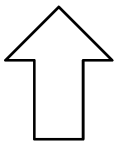
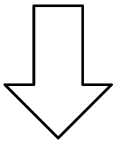
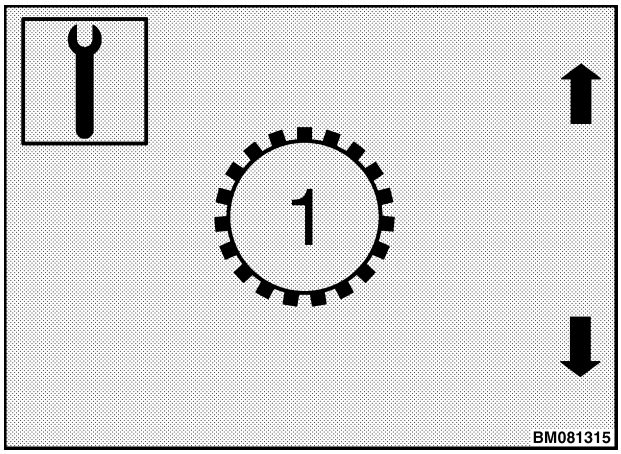
Icon	Description
	Forklift Truck Enabled Icon
	Forklift Truck Disabled Icon indicates that traction and hydraulics are disabled.
Direction Select Submenu 	
	Forklift Truck Enabled Icon
	Forklift Truck Disabled Icon indicates that traction and hydraulics are disabled.
	Direction Indicator Icon. Filled up arrow means forward direction is selected.
	Direction Indicator Icon. Filled N indicates truck is in neutral.

Table 13. Diagnostic Submenu Icons (Continued)

Icon	Description
	Direction Indicator Icon. Filled down arrow means reverse direction is selected.
	Direction Indicator Icon. Unfilled up arrow means forward direction is not selected.
	Direction Indicator Icon. Unfilled N indicates truck is not in neutral.
	Direction Indicator Icon. Unfilled down arrow means reverse direction is not selected.
	Park Brake On Icon.
Traction Motor 1 Status Submenu 	
°C	Temperature in degrees Celsius
°F	Temperature in degrees Fahrenheit

Pressing the **Scroll Back Key** or **Scroll Forward Key** while anywhere in this submenu will return the Activity Log main menu title screen to the Operating Screen.

Figure 26 shows an example Password Log screen and indicates the available controls.

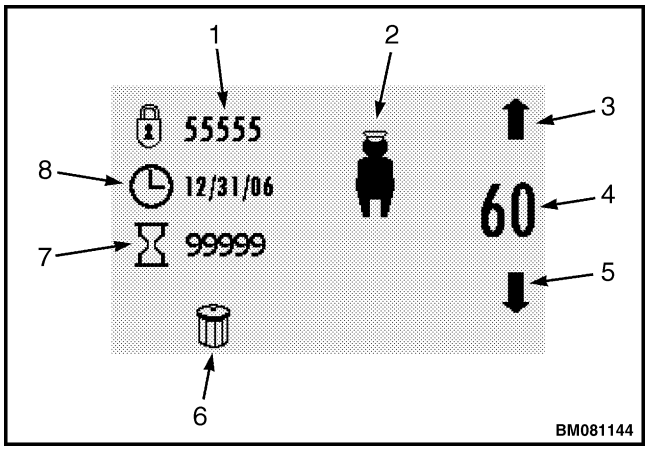


Figure 26. Password Log Screen

Legend for Figure 26

1. PASSWORD VALUE AT LOG OCCURRENCE
2. OPERATOR/SUPERVISOR/SERVICE TECHNICIAN ICON
3. UP ARROW SOFT KEY ICON
4. CURRENT LOG ENTRY (OR "EMPTY" SYMBOL)
5. DOWN ARROW SOFT KEY ICON
6. "TRASH CAN" SOFT KEY ICON
7. TRACTION HOURS AT LOG OCCURRENCE
8. SYSTEM DATE AT LOG OCCURRENCE

The process for viewing and removing password logs from the system is shown in Table 18.

A person viewing the password log cannot see the passwords of other operators or Supervisors who have access privileges higher than their own. This means that a Supervisor viewing the Password Log cannot see a Service Technician's password. When viewing the log entry of a person with a higher access level, the password is displayed as *****.

After removing a log entry, an "Empty" symbol replaces the former log entry number until the next entry has been scrolled into view. If there are no remaining log entries, an "Empty" log screen is displayed, as shown in Figure 24.

BDI ADJUSTMENT SETTING

NOTE: This submenu is available to logged in Service Technicians only.

Figure 52 shows how the Battery Discharge Indicator (BDI) adjustment setting is displayed on the screen. The Parasitic Current Icon and the present value are located in the middle of the screen.

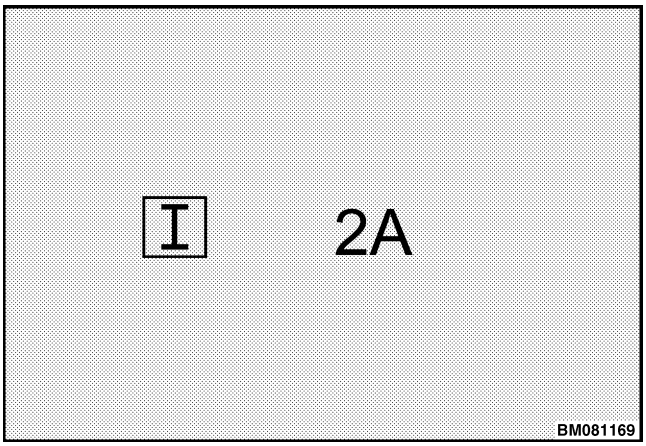


Figure 52. BDI Adjustment Setting

The BDI Adjustment Setting menu provides a way to adjust the Parasitic Current so it is well suited to current truck conditions. If extra hardware or equipment that draws significant power, such as heater vests, have been installed on the truck since it went into service, a BDI adjustment should be made to compensate for the additional power draw.

The factory setting accounts for the DC-DC converter and other normal loads. Increase this setting as required if additional items have been added to the truck. When items are added that have an intermittent duty cycle average the current based on the duty cycle.

To adjust the Parasitic Current, use the number keys to enter the new value and press the **Enter Key** to save it.

Acceptable values for Parasitic Current range from 0 to 200 Amp, in 1 Ampere increments.

ACCELERATION RATES

NOTE: This submenu is available to logged in Service Technicians only.

Use this menu to set Acceleration Rate 1 or Acceleration Rate 2 or to select either Standard or Extended Shift mode.

Figure 53 shows how the Acceleration rates and type are presented on the screen.

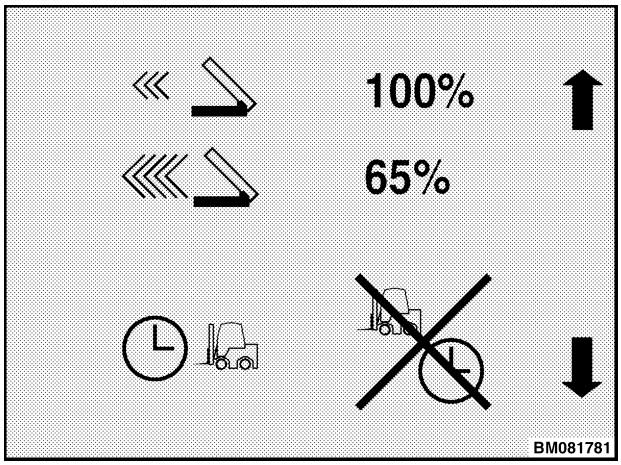


Figure 53. Acceleration Setup

The icon at the top left of the screen is for Acceleration Rate 1 and the icon below it is for Acceleration Rate 2.

- Acceleration Rate 1 is used to limit the acceleration of the traction system at low speeds. A setting of 100% is the maximum available acceleration, below this the vehicle acceleration will be reduced.
- Rate 2 is used to limit the acceleration of the traction system at high speeds. At higher motor speeds the maximum acceleration of the vehicle is limited by the traction motor(s), thus the default setting is the maximum available acceleration.
- Standard Performance Mode has a greater acceleration and higher speeds on grades as compared to Extended Shift Mode but at the cost of increased power consumption and shorter battery shift lift.

To change an acceleration rate setting, use the **2** and **3** soft keys to select the value for Acceleration Rate 1 or Acceleration Rate 2. When there is a box around the current value, press the **Enter Key**. Next, use the number keys to enter the new value desired. Acceptable values range from 5 to 100%. A 100% setting produces maximum acceleration at slow speeds. After entering the new value, press the **Enter Key** to save it.

The third icon down from the top is for Acceleration Type. An X over the setting icon in Figure 53 means the truck is currently set to operate in Standard shift mode, not Extended Shift mode. To change the acceleration type, use the **2** and **3** soft keys to move to the current value for the acceleration type. Press the **Enter Key** to select it, then use the **2** or **3** soft key to select either Standard or Extended Shift mode and press the **Enter Key** to save your selection.

USER INTERFACE

SUPERVISOR

ERP15-20VT (ERP030-040VT) [G807];
ERP16-20VF (ERP30-40VF) [A955];
ERC22-35VG (ERC045-070VG) [A968];
ERC16-20VA (ERC030-040VA) [A969];
ERP22-35VL (ERP045-070VL) [A976]

PART NO. 524319497 2200 YRM 1335

Table 4. Alert Screen Icons (Continued)

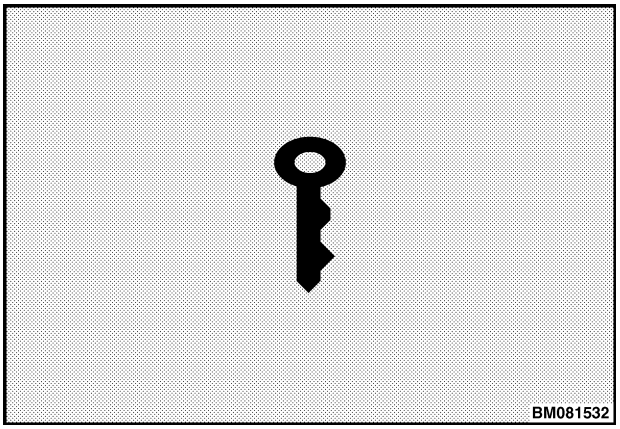
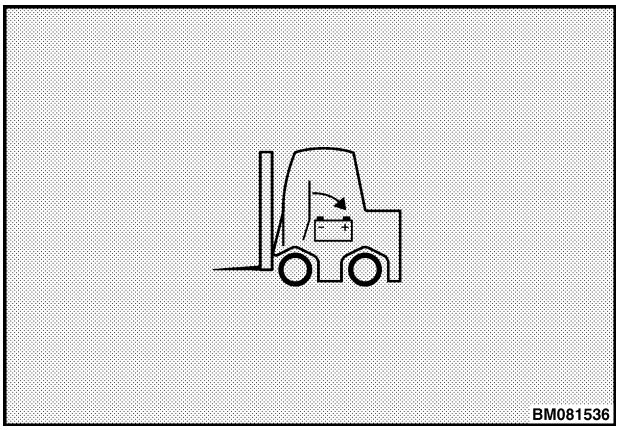
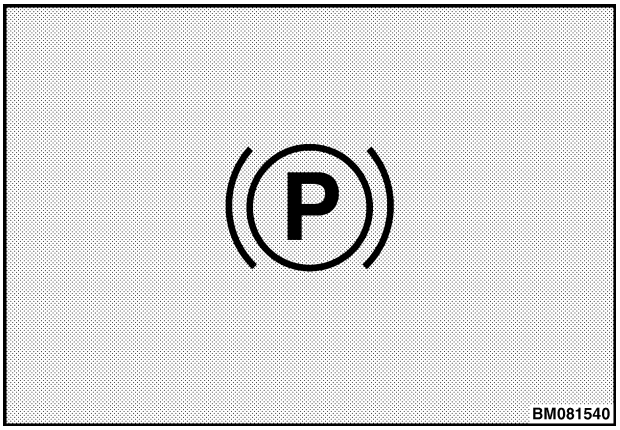
Icon	Description
Alert	
Alert Screens	
 BM081532	Cycle the Key
 BM081536	Secure Battery
 BM081540	Release Park Brake

Table 4. Alert Screen Icons (Continued)

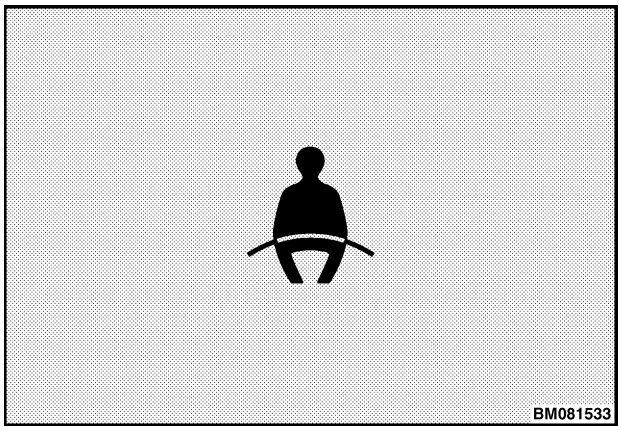
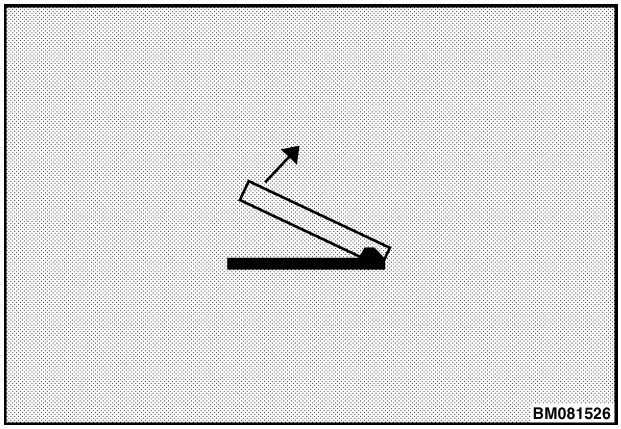
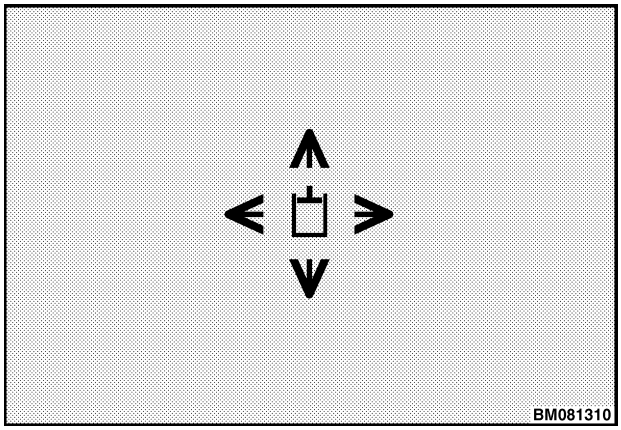
Icon	Description
Alert	
 BM081533	Operator Out of Seat
 BM081526	Release Pedal
 BM081310	Release Hydraulic Input

Table 12. Truck Setup Submenu Icons (Continued)

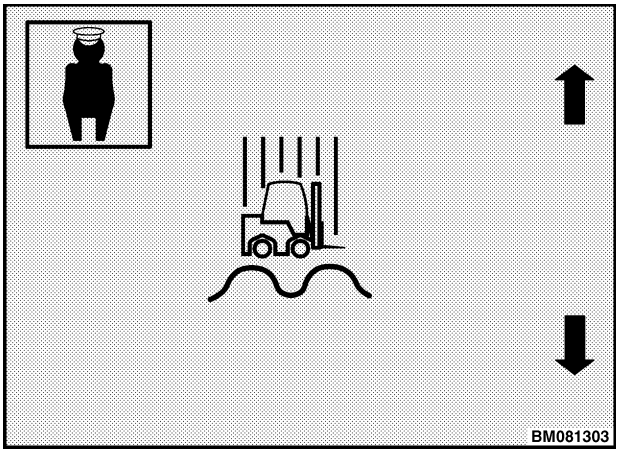
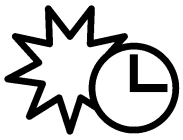
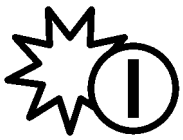
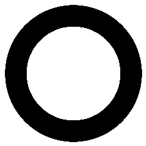
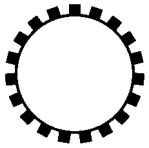
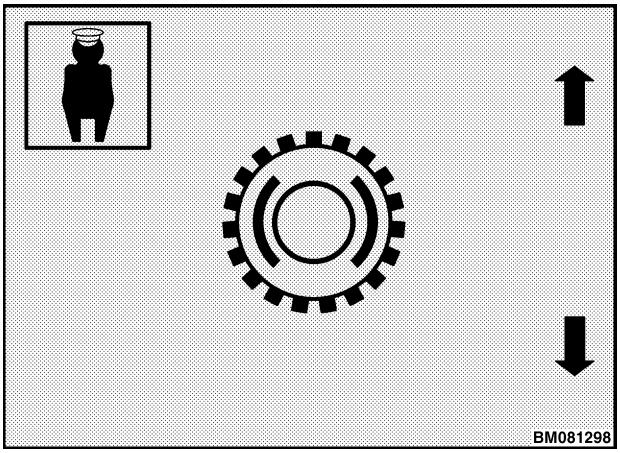
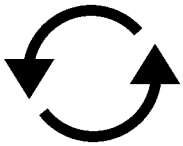
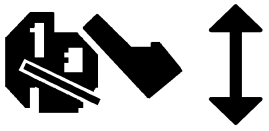
Icon	Description
	Press the * key (**Enter Key**) below this icon to indicate proper operation of the current checklist item.
	Press the * key below this icon to indicate improper operation of the current checklist item (to indicate a problem with it).
Impact Monitor Shutdown Submenu 	
	Impact Shutdown Delay icon
	Impact Shutdown Type icon
	Impact Detection icon
	ON icon

Table 12. Truck Setup Submenu Icons (Continued)

Icon	Description
	OFF icon
	Disable Traction icon
	Disable All icon
Motor Braking Submenu 	
	Regenerative Braking Indicator icon
	Automatic Deceleration Rate Indicator icon
	Deceleration Type Indicator icon

E-HYDRAULIC AND MANUAL VALVE THRESHOLD CALIBRATION

NOTE: This calibration must be done by a supervisor or service technician.

Figure 32 shows how the E-Hydraulic Valve calibration sequence starts with the 1A function, followed by the 1B function, and so on. The screen display changes from one function to the next as the user calibrates these control valves.

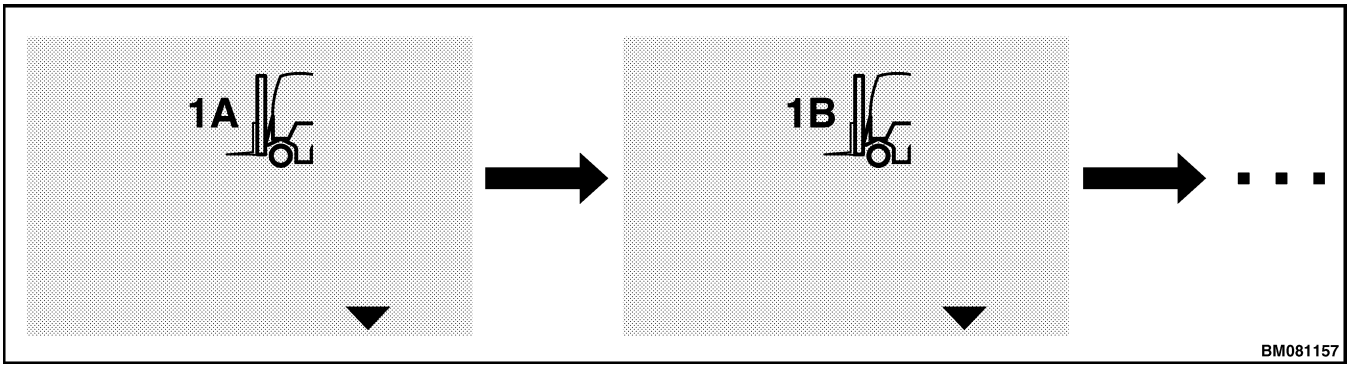


Figure 32. E-Hydraulic Valves

To calibrate the E-Hydraulic and manual valves:

1. Start the truck and let it run for a few minutes to warm up to normal operating temperature.
2. Perform an air bleed operation by exercising all functions until they operate smoothly.
3. Starting from the Calibration Menu, scroll to the E-Hydraulic Valves screen and press the **Enter Key**.
4. With no load on the forks, raise them, if they are not already raised.
5. When prompted, move the lever toward the mast, the A direction, until the forks begin to creep. Creep means moving the forks as slowly as possible. Press the **Enter Key** and the system records the valve reading.
6. When prompted, move the lever toward the rear of the truck, the B direction, until the forks begin to creep and press the **Enter Key**. The system records the valve reading. Steps 5 and 6 provide the hydraulic input for function 1.

   NOTE: If a valve reading is not within the acceptable range, an abort message appears. Press any key to continue.

7. Continue the process for functions 2, 3, and 4 as prompted by the system. The system records the valve readings for each function, and when this calibration process is completed, returns to the Calibration Menu.

STEERING WHEEL KNOB CENTER POINT CALIBRATION

The steering wheel knob center point is the position to which the system adjusts the steering wheel while the lift truck is being driven straight ahead.

NOTE: This calibration must be done by a supervisor or service technician and is only available on trucks equipped with the Synchronized Steering function.

Figure 33 shows the screen display during a Steering Wheel Knob Center Point calibration.

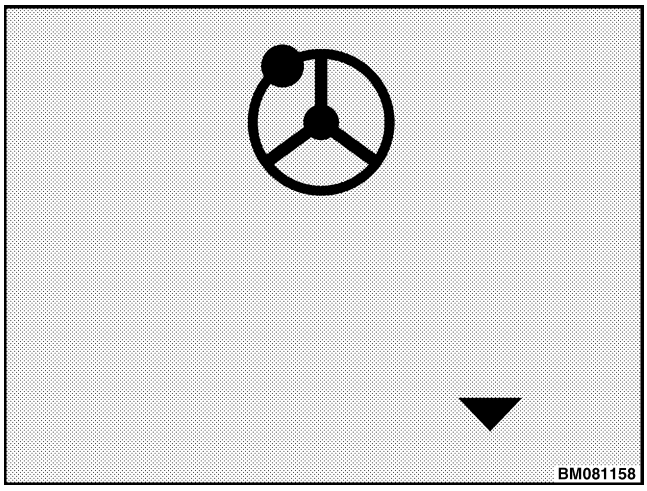
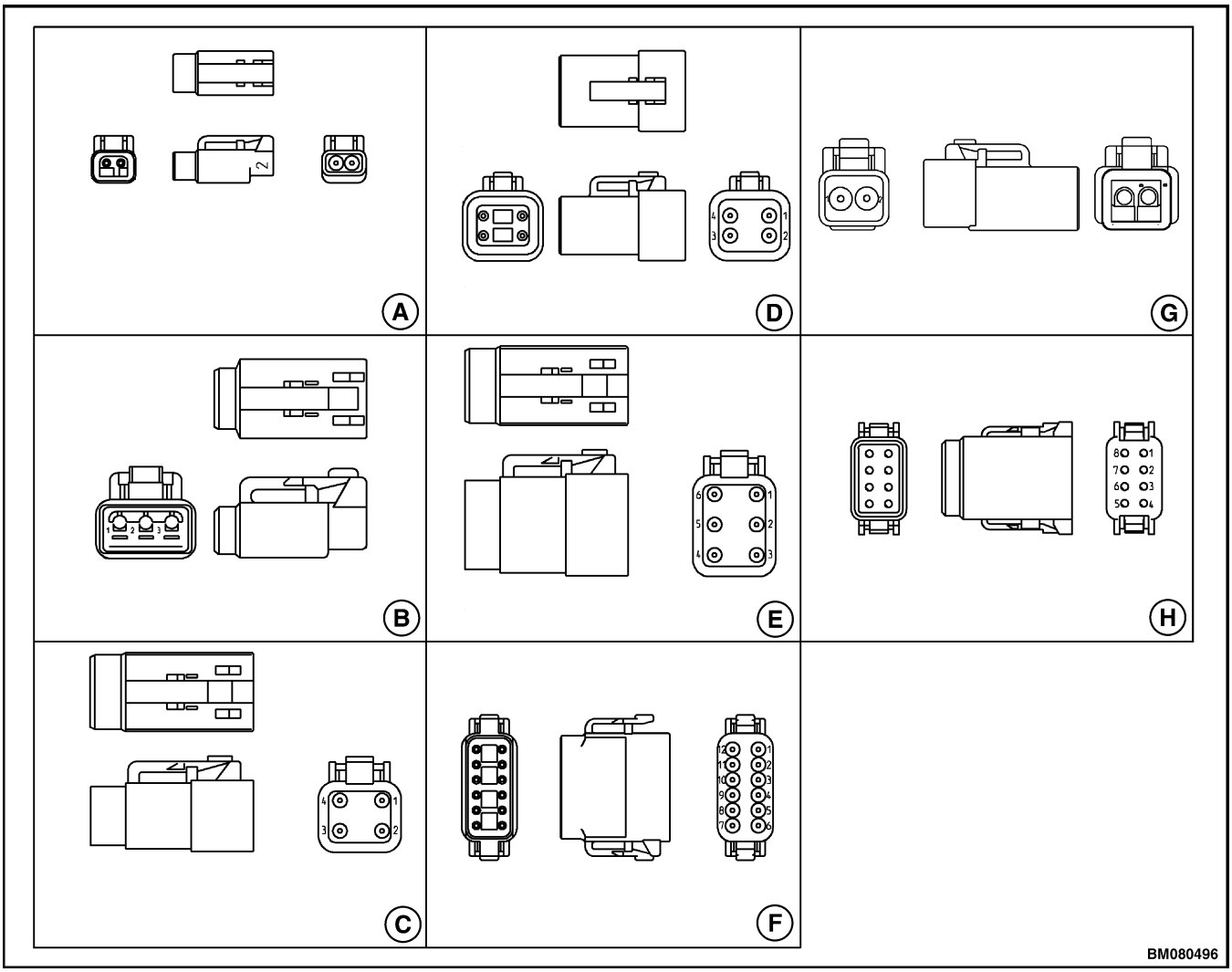


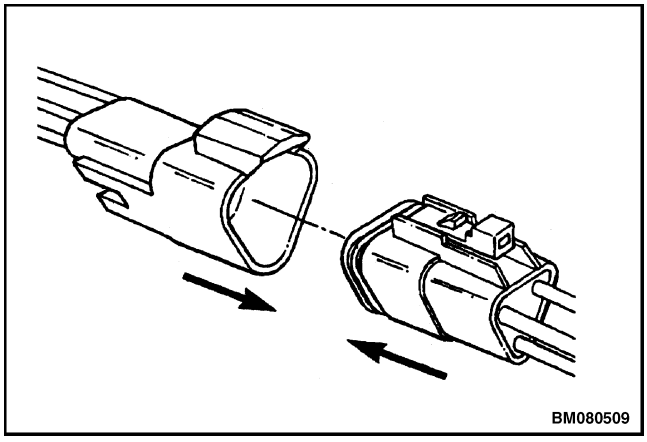
Figure 33. Steering Wheel Knob Center Point



A. DTM CONNECTOR TYPE GA
B. DTM CONNECTOR TYPE GB
C. DTM CONNECTOR TYPE GC
D. DTP CONNECTOR TYPE GD
E. DTM CONNECTOR TYPE GF
F. DTM CONNECTOR TYPE GE
G. DTP CONNECTOR TYPE GG
H. DTM CONNECTOR TYPE GH

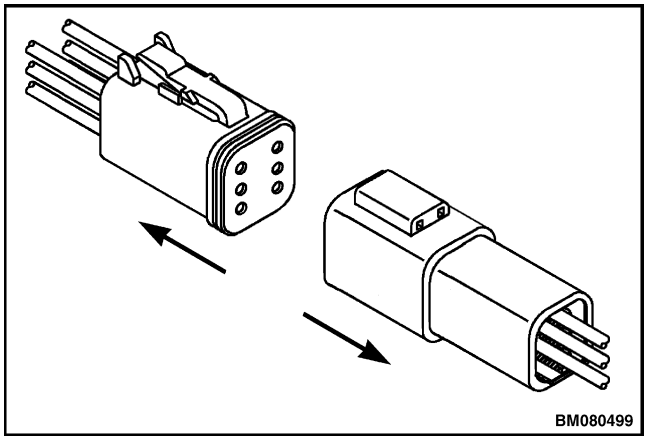
Figure 20. DTM and DTP Connector Plugs

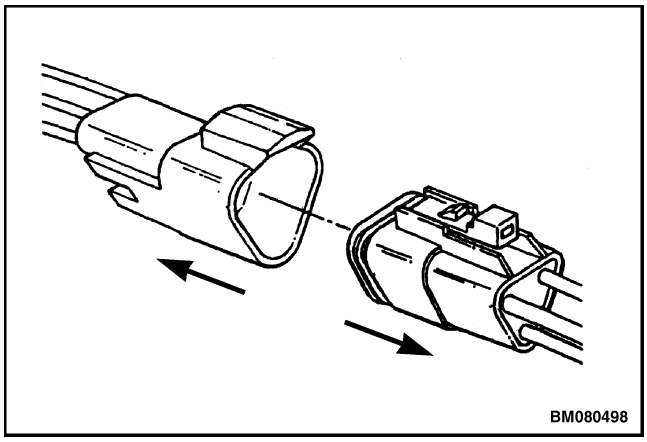
Step 11. (Cont)



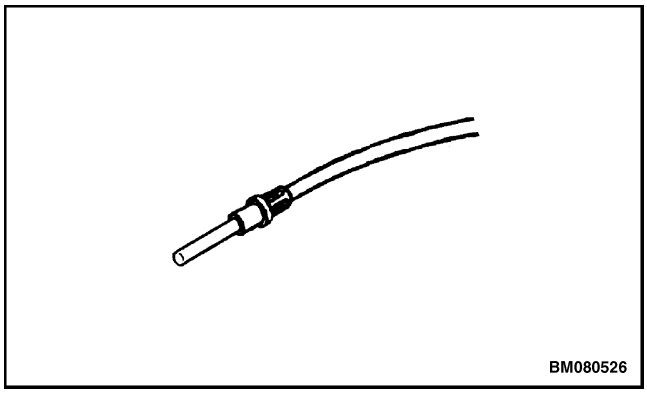
Connector Plug Socket Replacement

STEP 1.
Release the external locking clip(s) and separate the connector plug from the connector receptacle.



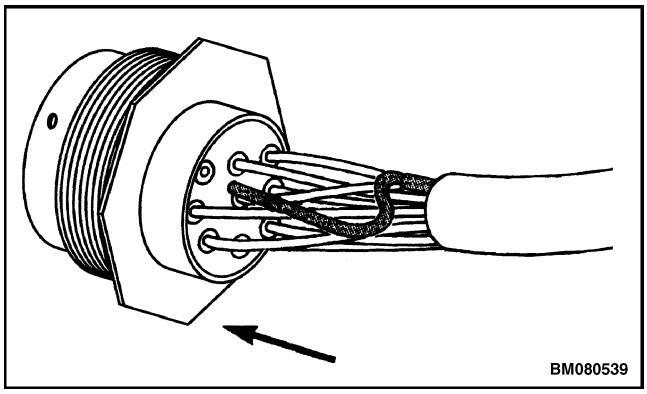


STEP 9.
Using the Deutsch Crimping Tool (Yale Part No. 150121900), crimp the new pin on the wire as shown in How to Crimp With the Deutsch Crimping Tool.



NOTE: The rear seal/grommet must be seated properly before inserting wires.

STEP 10.
Insert the wires into the back of the new connector receptacle according to the number or letter on the tag and connector receptacle. Push the wire straight into the back of the receptacle until a click is felt. Slightly tug each wire to verify the wire is properly locked in place. Remove tags.



STEP 11.
Install receptacle into mounting structure. Install the lock nut and washer to retain the receptacle to the mounting structure.