

**SERVICE REPAIR**

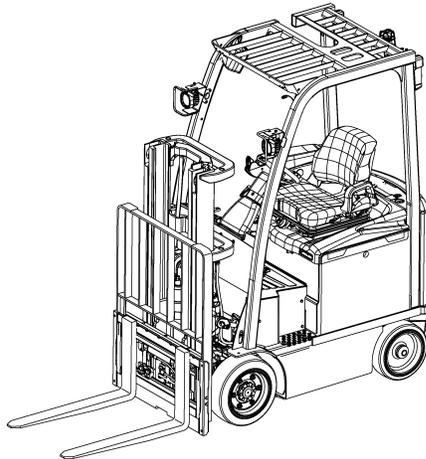
**MANUAL**

Hyster A268 (E45XN, E50XN, E55XN, E60XN, E65XN,  
E70XN) Forklift

***HYSTER***

# DIAGNOSTIC TROUBLESHOOTING MANUAL

E2.2-3.5XN (E45-70XN) [A268];  
E1.6-2.0XN (E30-40XN) [A269];  
J2.2-3.5XN (J45-70XN) [A276];  
J1.6-2.0XN (J30-40XN) [A935];  
J4.0-5.0XN (J80-100XN) [A970];  
A1.3XNT, A1.5XNT (A25XNT, A30XNT) [D203];  
J1.5-2.0XNT (J30-40XNT) [K160];  
E4.0-5.5XN, E5.0XNS (E80-120XV, E100XNS) [A099]



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# ***HYSTER***

# SAFETY PRECAUTIONS

## TROUBLESHOOTING PROCEDURES

- The Service Manuals are updated on a regular basis, but may not reflect recent design changes to the product. Updated technical service information may be available from your local authorized Hyster® dealer. Service Manuals provide general guidelines for maintenance and service and are intended for use by trained and experienced technicians. Failure to properly maintain equipment or to follow instructions contained in the Service Manual could result in damage to the products, personal injury, property damage or death.
- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **HYSTER APPROVED** parts when making repairs. Replacement parts must meet or exceed the specifications of the original equipment manufacturer.
- Make sure all nuts, bolts, snap rings, and other fastening devices are removed before using force to remove parts.
- Always fasten a DO NOT OPERATE tag to the controls of the unit when making repairs, or if the unit needs repairs.
- Be sure to follow the **WARNING** and **CAUTION** notes in the instructions.
- Gasoline, Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG), and Diesel fuel are flammable. Be sure to follow the necessary safety precautions when handling these fuels and when working on these fuel systems.
- Batteries generate flammable gas when they are being charged. Keep fire and sparks away from the area. Make sure the area is well ventilated.

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



### **WARNING**

**Indicates a condition that can cause immediate death or injury!**



### **CAUTION**

**Indicates a condition that can cause property damage!**

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

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E2.2-3.5XN (E45-70XN) [A268];  
 E1.6-2.0XN (E30-40XN) [A269];  
 J2.2-3.5XN (J45-70XN) [A276];  
 J1.6-2.0XN (J30-40XN) [A935];  
 J4.0-5.0XN (J80-100XN) [A970];  
 A1.3XNT, A1.5XNT (A25XNT, A30XNT) [D203];  
 J1.5-2.0XNT (J30-40XNT) [K160];  
 E4.0-5.5XN, E5.0XNS (E80-120XV, E100XNS) [A099]

**Thanks very much for your reading,  
Want to get more information,  
Please click here, Then get the complete  
manual**

**JustClickHere** 

**NOTE:**

**If there is no response to click on the link above,  
please download the PDF document first, and then  
click on it.**

**Have any questions please write to me:  
[admin@servicemanualperfect.com](mailto:admin@servicemanualperfect.com)**

## How To Use This Troubleshooting Manual

### GENERAL INSTRUCTIONS AND SAFETY INFORMATION



#### WARNING

**DO NOT** add to or modify the lift truck. Any modification that affects the safe operation of the truck cannot be undertaken without written authorization of the Hyster company.

Any change to the lift truck, the tires, or its equipment can change the lifting capacity. The lift truck must be rated as equipped and the nameplate must show the new rating capacity.



#### WARNING

The technician must be aware of, and follow, all general safety precautions that are published in the Operating Manual and that are posted as Safety Decals on and in the lift truck.

Before starting, the technician should be familiar with certain policies, requirements, and instructions used in the troubleshooting procedures. Using the troubleshooting procedures correctly helps the technician to perform the procedure safely and prevents damage to the machine and support equipment.

### HOW TO USE DIAGNOSTIC TROUBLESHOOTING MANUAL

#### Manual Layout:

**Sections:** The manual is divided into eight sections, each representing a major system, functional area, or specific operation on the lift truck.

- 9010 – Operational Diagnostic Procedures
- 9025 – Traction Motor
- 9030 – Electrical System
- 9035 – Drive Axle/Unit
- 9050 – Hydraulic Systems

- 9060 – Operator's Station
- 9070 – Front End (Mast) and Chassis
- 9080 – Supplementary Data

**Groups:** The sections of the manual are further subdivided into groups, where applicable, that identify specific functions, operating criteria, or maintenance tasks.

- 01 – Introduction to the Troubleshooting Manual
- 03 – General Maintenance/Diagnostic Data
- 05 – Operational Checkout
- 10 – Principles of Operation
- 20 – Diagnostic Trouble Codes
- 30 – Observed Symptoms
- 33 – Observed Symptoms – Gear Pump
- 43 – Test and Adjustments – Gear Pump
- 50 – Abbreviation and Acronyms
- 55 – Icons and Graphics
- 70 – Fault Mode Indicator Reference

For Diagnostic Trouble Code listings, see Electrical System, General Maintenance and Diagnostic Data, Diagnostic Trouble Codes, Page 9030-03-6.

**NOTE:** Not all groups will appear in all sections.

**Supplementary Data:** The supplementary data section of the manual includes information and data that apply to many sections or groups and is stored here for access by all users of the manual. This data includes, but is not limited to:

- Abbreviations and Acronyms
- Special Tools List
- Fault Mode Indication Reference Table
- Supplier Specification Data

## GENERAL INSTRUCTIONS

1. Become familiar with the content, layout, and access provisions of data in this manual. This will improve your efficiency and decrease the time required to resolve the problems.
2. Use all sections of the manual for relevant information on the subject system.
3. Once you begin a troubleshooting procedure, do not skip steps.
4. If you reach the end of a procedure without resolving the problem and you are not directed to another procedure contact Resident Service Engineering through the Contact Management System.
5. Do not limit yourself, remember to apply your own experience and knowledge to assist in resolving the problems, but do not compromise safety in doing so.
6. Most of the cross-reference data in the manual will be electronically linked for rapid and easy access. Use the links wherever the cursor highlights an item as a linkable option.

As an example of this linking option:

Assume that during a procedure or test, it is necessary to refer to a different section of manual, in this case, the Light Circuit Check in the Operational Check-out part of this manual.

The instruction would read, "refer to, or see" followed by text identifying what the reference is (for hard-copy, paper manual use). When the cursor is placed over the text, it will then indicate that it is active, and left-clicking will direct the system to take you directly to that reference.

Try it using the process below:

See Operational Diagnostic Procedures, Operational Checkout, Page 9010-05-5.

When you have reviewed the reference document or manual, and need to return to the troubleshooting procedure, the "BACK" button will permit you to do this.

## SERVICE MANUAL LOOKUP

The following service manuals are referenced throughout this manual. Be sure to have the correct service manual for your lift truck model.

### AC Motor Repair 0620SRM1385

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)
- J2.2-3.5XN (J45-70XN) (A276)
- J4.0-5.0XN (A970)
- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### AC Motor Repair 0620SRM1515

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Brake System 1800SRM1332

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

### Brake System 1800SRM1359

- E2.2-3.5XN (E45-70XN) (A268)

### Brake System 1800SRM1438

- E1.6-2.0XN (E30-40XN) (A269)

### Brake System 1800SRM1518

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Capacities and Specifications 8000SRM1340

- J1.5-2.0XNT (J30-40XNT) (K160)

### Capacities and Specifications 8000SRM1374

- E2.2-3.5XN (E45-70XN) (A268)

### Capacities And Specifications 8000SRM1375

- J2.2-3.5XN (J45-70XN) (A276)

### Capacities and Specifications 8000SRM1376

- J1.6-2.0XN (J30-40XN) (A935)

### Capacities and Specifications 8000SRM1443

- E1.6-2.0XN (E30-40XN) (A269)

### Capacities and Specifications 8000SRM1527

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Capacities and Specifications 8000SRM1542

- J4.0-5.0XN (A970)

### Capacities and Specifications 8000SRM1578

- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### Cylinder Repair (Mast S/N A270-72, A551, A555, A559, A626, A627, A751-52, B551, B555, B586-91, B749-54, C661-63, C665, D507-09, D515, D562-64, E509, E564) 2100SRM1382

- E2.2-3.5XN (E45-70XN) (A268)
- J2.2-3.5XN (J45-70XN) (A276)
- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### Cylinder Repair (Mast S/N B551, B555, B559) 2100SRM1440

- E1.6-2.0XN (E30-40XN) (A269)

### Cylinder Repair (Mast S/N A270, A271, A272, C661, C662, C663) 2100SRM1521

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Diagrams 8000SRM1341

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

### Diagrams 8000SRM1384

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)
- J2.2-3.5XN (J45-70XN) (A276)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### Diagrams 8000SRM1528

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

## Diagnostic Troubleshooting Manual

### Drive Axle Repair 1300SRM1575

- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### Drive Axle, Speed Reducer, and Differential 1300SRM1366

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)

### Electrical System 2200SRM1337

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

### Electrical System 2200SRM1369

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)
- J2.2-3.5XN (J45-70XN) (A276)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### Electrical System 2200SRM1524

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Frame 0100SRM1329

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

### Frame 0100SRM1342

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)
- J2.2-3.5XN (J45-70XN) (A276)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### Frame 0100SRM1514

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Hydraulic System 1900SRM1333

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

### Hydraulic System 1900SRM1367

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)

- J2.2-3.5XN (J45-70XN) (A276)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

### Hydraulic System 1900SRM1519

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

## ALL LIFT TRUCK MODELS

### Industrial Battery 2240SRM0001

## ALL LIFT TRUCK MODELS

### Load Axle 1300SRM1516

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Main Control Valves 2000SRM1334

- E2.2-3.5XN (E45-70XN) (A268)
- J2.2-3.5XN (J45-70XN) (A276)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)
- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

### Main Control Valves 2000SRM1439

- E1.6-2.0XN (E30-40XN) (A269)

### Main Control Valves 2000SRM1520

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

### Mast Repair (S/N A551, A555, A559, B551, B555, D507, D562, D508, D563, D509, D564, D515, E509, E564) 4000SRM1338

- E2.2-3.5XN (E45-70XN) (A268)
- J2.2-3.5XN (J45-70XN) (A276)

### Mast Repair (S/N A270, A271, A272) 4000SRM1386

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

### Mast Repair (S/N C661, C662, C663, C665) 4000SRM1405

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

**Mast Repair (S/N B551, B555, and B559)**  
4000SRM1441

- E1.6-2.0XN (E30-40XN) (A269)

**Mast Repair (S/N A270, A271, A272, C661, C662, and C663)** 4000SRM1525

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

**Mast Repair (S/N A626-27, A751-52, B590-91, and B749-54)** 4000SRM1540

- J4.0-5.0XN (A970)

**Mast Repairs (S/N A551, A555, A559, A751, A752, B586, B587, B588, B590, B591, B749, B750, B751, B752, and B754)** 4000SRM1576

- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

**Operator's Cab** 0100SRM1446

- E2.2-3.5XN (E45-70XN) (A268)
- J2.2-3.5XN (J45-70XN) (A276)
- J4.0-5.0XN (A970)
- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)
- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

**Periodic Maintenance** 8000SRM1339

- J1.5-2.0XNT (J30-40XNT) (K160)

**Periodic Maintenance** 8000SRM1364

- E2.2-3.5XN (E45-70XN) (A268)

**Periodic Maintenance** 8000SRM1372

- J2.2-3.5XN (J45-70XN) (A276)

**Periodic Maintenance** 8000SRM1373

- J1.6-2.0XN (J30-40XN) (A935)

**Periodic Maintenance** 8000SRM1442

- E1.6-2.0XN (E30-40XN) (A269)

**Periodic Maintenance** 8000SRM1541

- J4.0-5.0XN (A970)

**Periodic Maintenance** 8000SRM1526

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

**Periodic Maintenance** 8000SRM1577

- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

**Steering Axle** 1600SRM1360

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)
- J2.2-3.5XN (J45-70XN) (A276)
- J1.6-2.0XN (J30-40XN) (A935)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

**Steering System** 1600SRM1331

- J1.5-2.0XNT (J30-40XNT) (K160)

**Steering System** 1600SRM1363

- E2.2-3.5XN (E45-70XN) (A268)
- E1.6-2.0XN (E30-40XN) (A269)
- J2.2-3.5XN (J45-70XN) (A276)
- J1.6-2.0XN (J30-40XN) (A935)
- J4.0-5.0XN (A970)
- E4.0-5.5XN, 5.0XNS (E80-120XN, E100XNS) (A099)

**Steering System** 1600SRM1517

- A1.3-1.5XNT (A25XNT, A30XNT) (D203)

**Transaxle** 1300SRM1330

- J1.5-2.0XNT (J30-40XNT) (K160)
- J1.6-2.0XN (J30-40XN) (A935)

**Transaxle** 1300SRM1370

- J2.2-3.5XN (J45-70XN) (A276)

**Transaxle** 1300SRM1539

- J4.0-5.0XN (A970)

**User Interface Service Technician** 2200SRM1336

**ALL LIFT TRUCK MODELS**

**User Interface Supervisor** 2200SRM1335

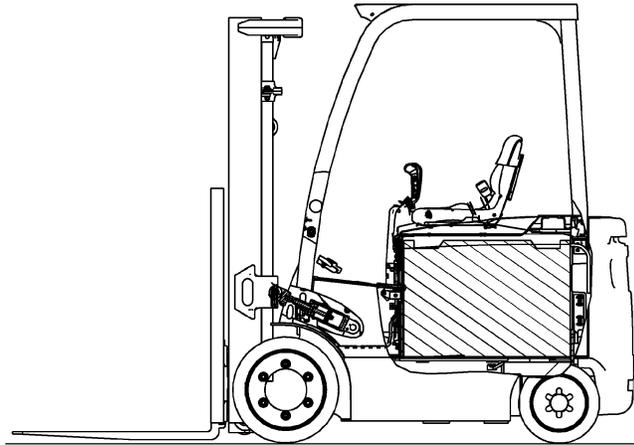
**ALL LIFT TRUCK MODELS**

**Wire Harness Repair** 2200SRM1128

**ALL LIFT TRUCK MODELS**

## CONVENTIONAL BATTERY BOX (CBB) UNITS

The Operator's seat is higher due to the position of the battery box which sits above the axles for these units. See Figure 9000-01-1.



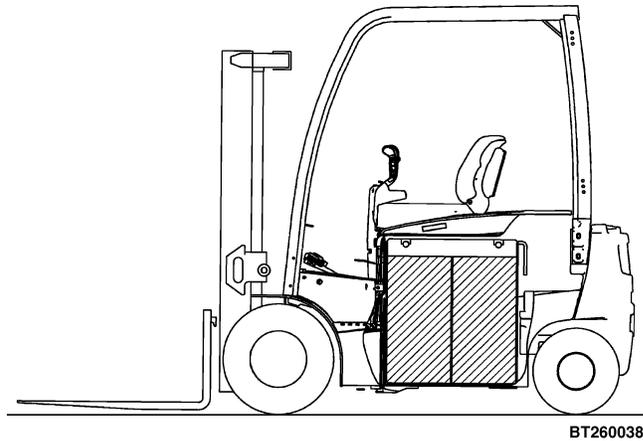
BT260037

**Figure 9000-01-1. Conventional Battery Box**

Hyster Unit Code	European Model Designation	America Model Designation
A269	E1.6-2.0XN	E30-40XN
A268	E2.2-3.5XN	E45-70XN
A099	E4.0-5.5XN, E4.5XNS	E80-120XN, E100XNS

## DROP BATTERY BOX (DBB) UNITS

The battery is “dropped” between the front and rear axles (or wheels) for these units. See Figure 9000-01-2.



**Figure 9000-01-2. Drop Battery Box**

Hyster Unit Code	European Model Designation	America Model Designation
D203	A1.3XNT, A1.5XNT	A25XNT, A30XNT
K160	J1.5-2.0XNT	J30-40XNT
A935	J1.6-2.0XN	J30-40XN
A276	J2.2-3.5XN	J45-70XN
A970	J4.0-5.0XN	J80-100XN

# SECTION 9010

# OPERATIONAL DIAGNOSTIC PROCEDURES

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## Group 05

# Operational Checkout

## Operational Checkout Procedures

These procedures are designed so technicians can make a quick check of the operation of the machine while sitting in operator's seat.

### WARNING

Be sure to read the warnings prior to performing the checkout procedures.

### WARNING

Before operating the lift truck, **FASTEN YOUR SEAT BELT.**

There are a number of operations, if not performed carefully, that can cause the lift truck to tip. If you have not read the **WARNING** page in front of the Operating Manual, do so **NOW**. As you study the following information about how to properly operate a lift truck, remember the Warnings.

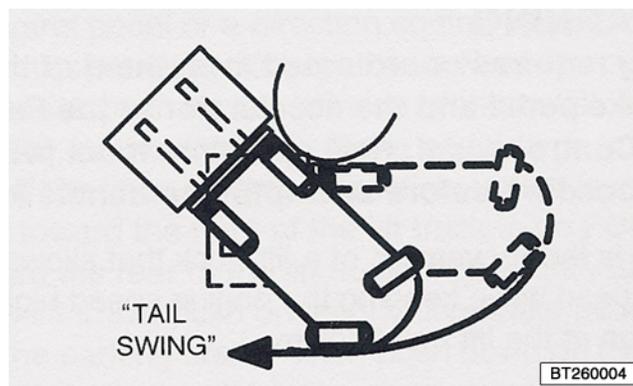
### WARNING

Mast parts are heavy and can move. Distances between parts are small. Serious injury or death can result if part of the body is hit by parts of the mast or the carriage.

- Never put any part of the body into or under the mast or carriage unless all parts are completely lowered or a safety chain is installed. Also make sure the power is OFF and the key is removed. Fasten a **DO NOT OPERATE** tag in the operator's compartment.
- Be careful of the forks. When the mast is raised, the forks can be at a height that may cause an injury.
- **DO NOT** climb on the mast or lift truck at any time. Use a ladder or personnel lift to work on the mast.

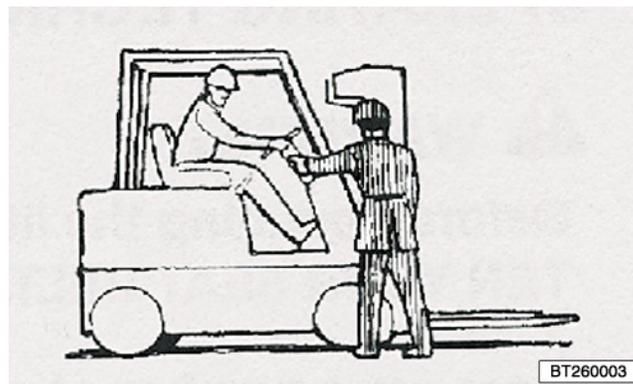
- **DO NOT** use blocks to support the mast weldments nor to restrain their movement.
- Mast repairs require disassembly and removal of parts and can require removal of the mast or carriage. Follow the repair procedures in the correct Service Manual for the mast.

Adequate space is required to do the driving checks. Some checks require the lift truck and other major components to be at operating temperature.



BT260004

Before performing the operational checkout, complete the **INSPECTION BEFORE OPERATION** in the **Operating Manual**.



BT260003

Before starting operational checkout, talk to the operator and check Diagnostic Trouble Codes (DTC) using the Display Panel (DP). See Troubleshooting Guidelines and Procedures. All DTCs must be corrected or cleared before starting this checkout.

No special tools or gauges are needed. Always start sequence from left to right. Before doing check, read each check completely.

At the end of each check, a question is asked:

- If the answer indicates the check is OK, you will be instructed to go to next check.

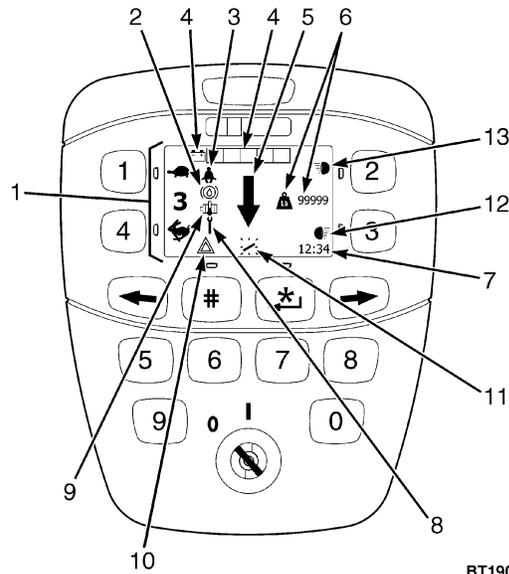
- If the answer indicates that the check is not OK, you will be given a required SRM repair or be linked to the test to perform.

When a problem is found, stop operational checkout and correct it before going to the next check. Repeat check after repair to confirm repair was successful before proceeding with the remaining checks.

CHECK	PROCEDURE	ACTION
<p><b>Key Icon Illuminated</b></p>	<p>Turn Keyless Start Switch or Key Switch to <b>ON</b> position with park brake applied.</p> <p><i><b>Does the Key Icon appear on the Display and remain illuminated?</b></i></p>	<p><b>YES:</b> Shut key <b>OFF</b>. Wait 30 seconds for power cycling then turn key <b>ON</b>. Key icon should not stay lit.</p> <p><b>NO:</b> Display power is OK. Go to next step.</p>
<p><b>Wrench Icon Illuminated</b></p>	<p>Turn Keyless Start Switch or Key Switch to <b>ON</b> position with park brake applied.</p> <p><i><b>Does the Wrench Icon appear on the Display and remain illuminated?</b></i></p>	<p><b>YES:</b> Reinstall newest version of software. See <b>User Interface Supervisor</b> 2200SRM1335 or <b>User Interface Service Technician</b> 2200SRM1336.</p> <p><b>NO:</b> Display power is OK. Go to next step.</p>
<p><b>Display Panel (DP) Check</b></p>	<ol style="list-style-type: none"> <li>1. Turn key or keyless switch to <b>ON</b> position.</li> <li>2. Check display for any DTCs. See Electrical System, General Maintenance and Diagnostic Data, Diagnostic Trouble Codes, Page 9030-03-6.</li> </ol> <p><i><b>Are any DTCs displayed?</b></i></p>	<p><b>YES:</b> Refer to Electrical System, General Maintenance and Diagnostic Data, Diagnostic Trouble Codes, Page 9030-03-6.</p> <p><b>NO:</b> DTCs are OK. Go to next check.</p>



### Display Backlight and Icon Power Check



BT190007

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, STEER 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.

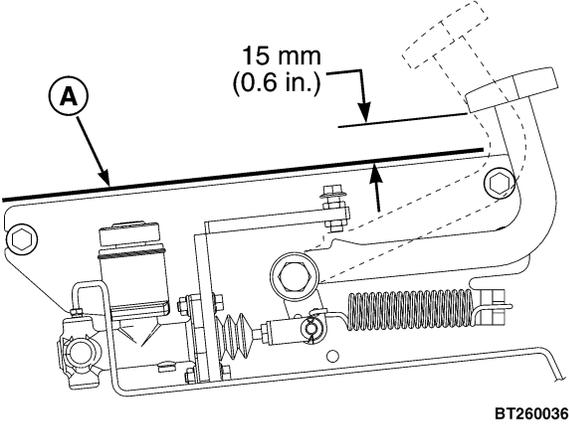
***Do the Display Backlight and icons appear on the LCD screen?***

**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.

<b>Light Circuit Check</b>	<ol style="list-style-type: none"> <li>1. Turn front and rear work light switches ON.</li> </ol> <p><b><i>Do lights turn on?</i></b></p>	<p><b>YES:</b> Go to next check.  <b>NO:</b> Refer to Observed Symptom, Lights Inoperative.</p>
<b>Horn Circuit Check</b>	<p><b>NOTE:</b> There can be up to three horn buttons on the lift truck:</p> <ol style="list-style-type: none"> <li>1. Steering Wheel</li> <li>2. Right Rear Grab Handle</li> <li>3. MLM Armrest</li> </ol> <p>Press horn button.</p> <p><b><i>Does horn sound?</i></b></p>	<p><b>YES:</b> Horn is OK. Go to next check.  <b>NO:</b> Refer to Observed Symptoms, Observed Symptoms, Horn Failure, Page 9030-30-32.</p>
<b>Backup Alarm Check (if equipped)</b>	<ol style="list-style-type: none"> <li>1. With lift truck running, apply service brake.</li> <li>2. Release park brake.</li> <li>3. Select reverse direction.</li> </ol> <p><b><i>Does backup alarm sound?</i></b></p>	<p><b>YES:</b> Back up alarm is OK. Go to next check.  <b>NO:</b> Check wiring connections.</p>
<b>Heater Check (if equipped)</b>	<ol style="list-style-type: none"> <li>1. Turn key switch to <b>ON</b> position.</li> <li>2. Check display for any error codes.</li> </ol> <p><b><i>Are any error codes displayed?</i></b></p>	<p><b>YES:</b> Correct error codes. See <b>Electrical System</b> 2200SRM1337 or <b>Electrical System</b> 2200SRM1369 .  <b>NO:</b> Heater is okay. Go to next check.</p>

<p><b>Brake Pedal Check</b></p>	 <p style="text-align: right;">BT260036</p> <p><b>A. TOP OF FLOOR MAT</b></p> <ol style="list-style-type: none"> <li>1. With lift truck running, release park brake.</li> <li>2. Depress and hold brake pedal with approximately 45.4 kg (100 lb) force.</li> <li>3. Measure pedal distance from floor mat as shown in the illustration.</li> </ol> <p><b><i>Does brake pedal remain at least 15 mm (0.6 in.) off floor mat?</i></b></p>	<p><b>YES:</b> Brake adjustment is OK. Go to next check.  <b>NO:</b> Adjust brakes. see <b>Brake System</b> 1800SRM1332.</p>
<p><b>Park Brake Sensor Check</b></p>	<ol style="list-style-type: none"> <li>1. With lift truck running, release park brake.</li> <li>2. Slowly apply park brake and note when park brake display comes ON.</li> </ol> <p><b><i>Does display come on before park brake reaches first click of engagement?</i></b></p>	<p><b>YES:</b> Park brake sensor is OK. Go to next check.  <b>NO:</b> Adjust park brake, see <b>Brake System</b> 1800SRM1332.</p>

## Park Brake Check



BT260002

**WARNING**

Ensure load is secured so it will not move when mast is tilted fully forward.

1. Stop lift truck in an uphill direction with rated load on 15% grade or less, and apply park brake.
2. Shut lift truck **OFF** and note if machine remains static.
3. Start lift truck and remove rated load.
4. Position lift truck with No Load in a downhill direction, on 15% grade or less, and apply park brake.
5. Shut lift truck **OFF** and note if machine remains static.

***Does machine remain static on grade in both directions?***

**YES:** Park brake is OK. Go to next check.

**NO:** Adjust park brake, see **Brake System** 1800SRM1332.

<p><b>Brake and Axle Drag Check</b></p>	<p><b>NOTE:</b> Move truck to level surface before performing the following steps.</p> <ol style="list-style-type: none"> <li>1. Raise lift truck until drive tires are off ground. Support lift truck using suitable shop standard. (See "How to Raise Drive Tire" procedure in <b>Operating Manual</b>.)</li> <li>2. Shut lift truck <b>OFF</b> and release park brake. Handle provided under floor plate to manually release the park brake.</li> <li>3. Check brakes for dragging.</li> </ol> <p><b>Are the brakes dragging?</b></p> <p><i>Continue:</i></p> <p>Manually turn one tire by hand.</p> <p><b>Does the tire turn with moderate force and does the other tire turn in the opposite direction?</b></p>	<p><b>YES:</b> Repair brakes. See <b>Brake System</b> 1800SRM1359.</p> <p><b>NO:</b> Brakes are OK. Continue with this procedure.</p> <p><b>YES:</b> Axle is OK. Adjust park brake back to correct setting. Go to next check.</p> <p><b>NO:</b> If opposite wheel does not turn, differential is damaged. If equipped, remove differential cover and inspect. See <b>Transaxle</b> 1300SRM1330.</p>
<p><b>Priority Flow Divider Valve Check</b></p>	<ol style="list-style-type: none"> <li>1. Turn steering wheel to right axle stop and then back to left axle stop in one continuous cycle while raising lift carriage.</li> </ol> <p><b>Does carriage lift speed decrease while steering?</b></p> <p><i>Continued:</i></p> <ol style="list-style-type: none"> <li>2. Release steering wheel.</li> </ol> <p><b>Does carriage lift speed increase when not steering?</b></p>	<p><b>YES:</b> Continue with this procedure.</p> <p><b>NO:</b> If no steering, flow divider spool is stuck. Remove, clean, and inspect spool. Depending on your lift truck see, <b>Main Control Valves</b> 2000SRM1334 or <b>Main Control Valves</b> 2000SRM1439.</p> <p><b>YES:</b> Flow divider is OK. Go to next check.</p> <p><b>NO:</b> Inspect and clean relief valves. Depending on your lift truck see, <b>Main Control Valves</b> 2000SRM1334 or <b>Main Control Valves</b> 2000SRM1439.</p>



<p><b>Lift/Tilt Mast Adjustment Check</b></p>	<p>Ensure the following before starting procedure:</p> <ul style="list-style-type: none"> <li>• Truck operating on flat surface.</li> <li>• Adequate overhead clearance to raise forks to maximum height.</li> <li>• No load on forks.</li> </ul> <p>1. Raise forks to maximum height.</p> <p><b><i>Does the top sections of mast kick to one side at maximum height?</i></b></p> <p><i>Continue:</i></p> <p>2. Slowly tilt the mast full forward and then full backward at maximum height and observe movement of mast.</p> <p><b><i>Does the top sections of mast make noise during tilting and show excessive movement of mast sections?</i></b></p>	<p><b>YES:</b> Shim lift cylinders. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Mast cylinder is adjusted OK. Continue with this procedure.</p> <p><b>YES:</b> Shim and adjust mast. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Mast shimming is OK. Go to next check.</p>
<p><b>Tilt Function Drift Check</b></p>	<p>Ensure the following before starting procedure:</p> <ul style="list-style-type: none"> <li>• Truck operating on flat surface.</li> <li>• Hydraulic oil at operating temperature.</li> </ul> <p style="text-align: center;"> <b>WARNING</b></p> <p style="text-align: center;"><b>Ensure load is secured so it will not move when mast is tilted fully forward.</b></p> <ul style="list-style-type: none"> <li>• Secured capacity load on forks.</li> </ul> <p>1. Raise mast approximately 300 mm (12 in.) off floor.</p> <p>2. Install angle meter on mast and position mast at approximately 90° angle to ground.</p> <p>3. Ensure lift truck is <b>OFF</b>.</p> <p>4. After 5 minutes, measure mast angle and compare to original reading.</p> <p><b><i>Does mast tilt drift more than 2 degrees in 5 minutes?</i></b></p>	<p><b>YES:</b> Go to Tilt Cylinder Leakage Test to confirm if cylinder or control valve is leaking.</p> <p><b>NO:</b> Tilt drift is OK. Go to next check.</p>

<b>Tilt Racking Check</b>	<p>Actuate mast back tilt function until hydraulic valve goes over relief.</p> <p><b><i>Do both sides of mast stop evenly?</i></b></p>	<p><b>YES:</b> Tilt stops are adjusted OK. Go to next check.</p> <p><b>NO:</b> Adjust tilt stops. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p>
<b>Tilt Function, Tilt Lock Piston</b>	<p> <b>WARNING</b>  <b>Ensure load is secured so it will not move when mast is tilted fully forward.</b></p> <ol style="list-style-type: none"> <li>1. Put secured capacity load on forks and raise forks approximately 1 m (3 ft).</li> <li>2. Tilt load back to tilt stop.</li> <li>3. Move tilt lever to tilt forks forward full stroke and observe speed.</li> </ol> <p><b><i>Can tilt speed be controlled?</i></b></p>	<p><b>YES:</b> Tilt lock is OK. Go to next check.</p> <p><b>NO:</b> Repair tilt lock piston valve in tilt spool. Depending on your lift truck see, <b>Main Control Valves</b> 2000SRM1334 or <b>Main Control Valves</b> 2000SRM1439.</p>
<b>Mast Cushion Check - Main Lift Cylinder</b>	<p>Ensure the following before starting procedure:</p> <ul style="list-style-type: none"> <li>• Truck operating on flat surface.</li> <li>• Adequate overhead clearance to raise forks to maximum height.</li> </ul> <p> <b>WARNING</b>  <b>Ensure load is secured so it will not move when mast is tilted fully forward.</b></p> <ul style="list-style-type: none"> <li>• Secured capacity load on forks.</li> </ul> <ol style="list-style-type: none"> <li>1. Raise forks to maximum height of main lift cylinders.</li> <li>2. Lower forks as fast as possible and observe cylinder rod as main lift cylinders reach bottom of stroke.</li> </ol> <p><b><i>Does fork speed slow and does a hissing sound come from cylinder at bottom of stroke?</i></b></p>	<p><b>YES:</b> Piston ring is OK. Go to next check.</p> <p><b>NO:</b> Inspect and clean piston ring. Depending on your lift truck see, <b>Cylinder Repair (Mast S/N A270-72, A551, A555, A559, A626, A627, A751-52, B551, B555, B586-91, B749-54, C661-63, C665, D507-09, D515, D562-64, E509, E564)</b> 2100SRM1382 or <b>Cylinder Repair (Mast S/N B551, B555, B559)</b> 2100SRM1440.</p>

<p><b>Mast Channel Check</b></p>	<p><b>NOTE:</b> This is a visual check of the mast to determine if parts are worn or out of adjustment.</p> <ol style="list-style-type: none"> <li>1. Raise mast to full height without load and shut lift truck <b>OFF</b>.</li> <li>2. Inspect outer and inner channels for wear pattern and gouging.</li> <li>3. Move forks to lowered position.</li> <li>4. Inspect the inner channel wear pattern for wear or gouging.</li> </ol> <p><b><i>Do channels show signs of excess wear?</i></b></p> <p><i>Continue:</i></p> <ol style="list-style-type: none"> <li>5. Inspect spacing between channels.</li> </ol> <p><b><i>Is the channel spacing even on each side?</i></b></p>	<p><b>YES:</b> Repair mast channels. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Mast wear is OK. Continue with this procedure.</p> <p><b>YES:</b> Channel spacing is OK. Go to next check.</p> <p><b>NO:</b> Adjust or repair mast. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p>
<p><b>Mast Mounting Check</b></p>	<ol style="list-style-type: none"> <li>1. Move mast to lowered position and shut lift truck <b>OFF</b>.</li> <li>2. Inspect the mounting hardware at axle.</li> <li>3. Push the top of mast by hand while off the lift truck and note any movement of lift truck.</li> </ol> <p><b>NOTE:</b> If the mast mounting is loose, mast will move without moving truck frame.</p> <p><b><i>Is the mast mounting loose?</i></b></p>	<p><b>YES:</b> Inspect and repair mast mounting. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Mast mounting is OK. Go to next check.</p>
<p><b>Chain and Header Hose Adjustment Check</b></p>	<p>Ensure the following before starting procedure:</p> <ul style="list-style-type: none"> <li>• Truck operating on flat surface.</li> <li>• Hydraulic oil at operating temperature.</li> <li>• No load on forks.</li> </ul> <ol style="list-style-type: none"> <li>1. Install angle meter on mast and position mast at approximately 90° angle to ground.</li> <li>2. Raise and lower forks through two complete lift cycles.</li> <li>3. Lower forks to lowest position.</li> </ol> <p><b>NOTE:</b> The carriage safety stop does not make contact at full extension, but that a minimum gap of 6 mm (0.25 in.) remains.</p> <p><b>NOTE:</b> The correct fork height adjustment is approximately 6 mm (0.25 in.) off floor.</p>	<p><b>YES:</b> Adjust lift chains. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Chains are adjusted OK. Continue with this procedure.</p>

	<p><b><i>Does the heel of forks touch the floor?</i></b></p> <p><i>Continue:</i></p> <ol style="list-style-type: none"> <li>Look at condition of hoses as they go over sheaves.</li> </ol> <p><b><i>Are the hoses compressed?</i></b></p> <p><i>Continue:</i></p> <ol style="list-style-type: none"> <li>Inspect contact of hoses with any crossmember or load backrest near sheave area.</li> </ol> <p><b><i>Are the hoses contacting any crossmember or the load backrest?</i></b></p>	<p><b>YES:</b> Adjust header hoses. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Hose tension is OK. Continue with this procedure.</p> <p><b>YES:</b> Adjust header hoses.</p> <p><b>NO:</b> Hose adjustment is OK. Go to next check.</p>
<b>Chain Sheave Check</b>	<ol style="list-style-type: none"> <li>Lower forks. Shut lift truck <b>OFF</b>.</li> <li>Inspect wear pattern on chain sheaves.</li> </ol> <p><b><i>Does sheave show a wear pattern without side wear?</i></b></p>	<p><b>YES:</b> Chain sheaves are OK. Go to next check.</p> <p><b>NO:</b> Replace chain sheaves. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p>
<b>Carriage Adjustment Check</b>	<ol style="list-style-type: none"> <li>Lower forks to approximately 50 mm (2 in.) off ground. Shut lift truck <b>OFF</b>.</li> <li>Rock the carriage frame side to side.</li> </ol> <p><b><i>Does carriage move more than 0.5 mm (0.020 in.) at tightest point?</i></b></p>	<p><b>YES:</b> Adjust or repair carriage bearings. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Carriage adjustment is OK. Go to next check.</p>
<b>Carriage Adjustment Check (Standard and Integral Side Shift)</b>	<ol style="list-style-type: none"> <li>Lower forks. Shut lift truck <b>OFF</b>.</li> <li>Inspect wear on carriage stop.</li> </ol> <p><b><i>Does carriage stop show a wear pattern on it?</i></b></p>	<p><b>YES:</b> Chains are out of adjustment. See <b>Mast Repair (S/N A270, A271, A272)</b> 4000SRM1386.</p> <p><b>NO:</b> Checks complete.</p>
<b>Steering Relief Valve Low Pressure Check</b>	<ol style="list-style-type: none"> <li>Turn key switch to <b>ON</b> position.</li> <li>Position steer axle wheels straight to start check.</li> <li>Turn steering wheel stop-to-stop in both directions.</li> </ol> <p><b><i>Does steer axle wheels turn stop-to-stop without stopping?</i></b></p>	<p><b>YES:</b> Relief pressure is OK. Go to next check.</p> <p><b>NO:</b> If steer axle wheels do not turn stop-to-stop, pressure is too low. Adjust steering relief pressure. Go to Steering Relief Pressure Test and Adjustment.</p>



# SECTION 9025

# TRACTION MOTOR

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Poor Tractive Performance.....	9025-30-1
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## Group 10

# Principles of Operation

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## Traction Motor

### PRINCIPLES OF OPERATION

All electric forklift trucks covered by this manual use three-phase alternating current (AC) induction traction motors. AC motors are all very similar motors used across the product line, but do vary in some ways. This Principles of Operation will identify the significant differences.

The AC induction motor is an electrical device which uses an AC current provided to a wire wound stator supplied by a DC to AC inverter to induce north and south magnetic poles to an internal rotating device in a controlled environment. The reaction between the internal rotor and stator creates a push-pull effect on the rotor causing the rotor to turn, creating a force to do mechanical work.

In lift trucks the DC current is provided by the lead acid battery. The DC (direct current) voltage is changed to AC (alternating current) by the traction motor controller. By changing the frequency of the AC power to the motor, the motor speed can be controlled. This job is done by the traction motor controller. The controller also manages the direction of the motor and thus the lift truck. It works in conjunction with the VSM.

A speed sensor is used to detect and communicate the speed and direction of the rotor to the controller. This is done by sending electric pulses on two separate channels to the controller. The controller knows the direction of the motor by which channel's signal it receives first. It knows the speed by the frequency of the pulses. The controller's software continually monitors this information. Using this feedback, the AC motor control system can provide regenerative braking, controlled acceleration and deceleration. By changing the frequency of the AC power to the motor, which is also managed by the motor controller, the motor speed can be controlled.

These AC motors have a temperature sensor built into the stator to monitor motor temperature and provide continual temperature feedback to the thermal management system. That system is designed to protect components from failure due to overheating. If the motor winding temperature reaches its specified limit, the VSM signals the traction controller to reduce the motor performance or may even disable traction to protect the motor. When the traction system components are in thermal management, there is no affect on the hydraulic system performance. The connector for this temperature sensor is serviceable, but the sensor itself is not.

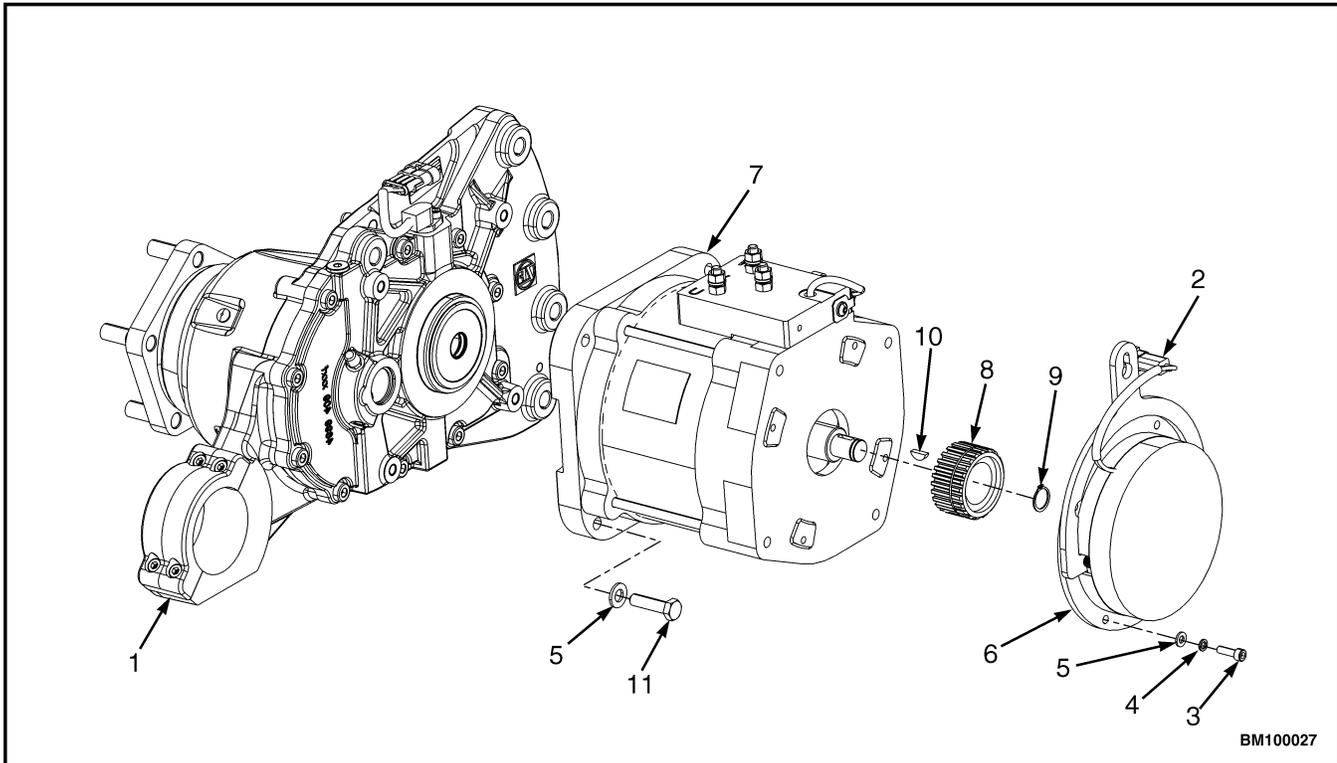
The rotor shaft extends out each side of the traction motor. The drive end head interfaces to the drive unit or drive axle, depending upon configuration. For lift trucks A935, A268, A269, and A099 a short, round section of the shaft protrudes from the non-drive end head of the motor. This end supports the parking brake hub using a woodruff key and a snap ring. There is a bearing between the motor and the parking brake. The parking brake is replaceable.

UL safety rated EE traction motors are available as an option on these forklifts. These motors have covered vent holes and are only a part of the necessary equipment required for the EE safety rating.

Traction motors are long life components and very low maintenance. They have no motor brushes. The motor bearings, rotor, stator and speed sensor are serviceable.

The traction motors vary depending upon the configuration of your forklift. Lift truck model D203 uses a traction motor vertically mounted to the drive unit. The drive unit is referred to as the Master Drive Unit (MDU). For further information on the MDU see MASTER DRIVE UNIT. The model designation K160,

A935, A276 and A970 use two traction motors and two motor controllers. A motor is mounted to a drive unit on each side of the vehicle and powers the drive tires. The speed sensor for these motors is physically located on the drive unit housing, not on the motor. See Figure 9025-10-1.



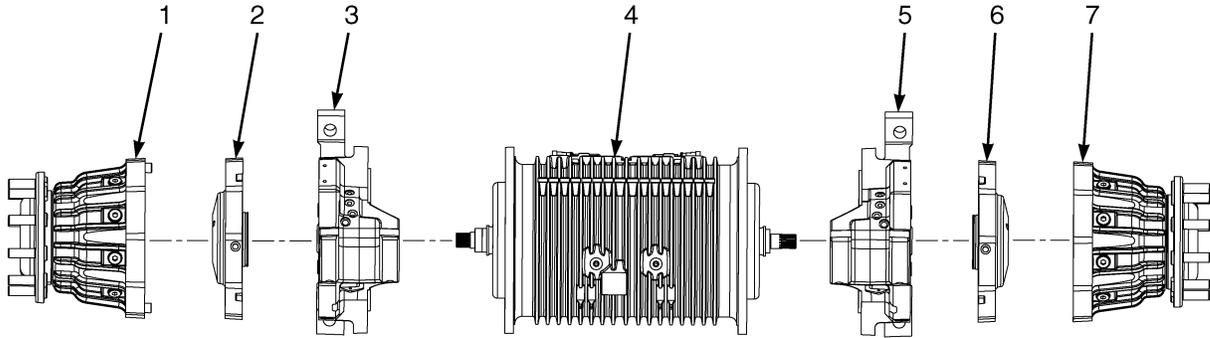
BM100027

- |                               |                                      |
|-------------------------------|--------------------------------------|
| 1. TRANSMISSION               | 7. TRACTION MOTOR                    |
| 2. PARKING BRAKE WIRE HARNESS | 8. SPLINED HUB                       |
| 3. SOCKET HEAD CAPSCREW       | 9. SNAP RING                         |
| 4. LOCKWASHER                 | 10. WOODRUFF KEY                     |
| 5. WASHER                     | 11. TRACTION MOTOR MOUNTING CAPSCREW |
| 6. PARKING BRAKE              |                                      |

**Figure 9025-10-1. Transaxle Assembly J1.5-2.0XNT (J30-J40XNT) (K160) J1.6-2.0XN (A935)**

## Traction Motor

## Principles of Operation

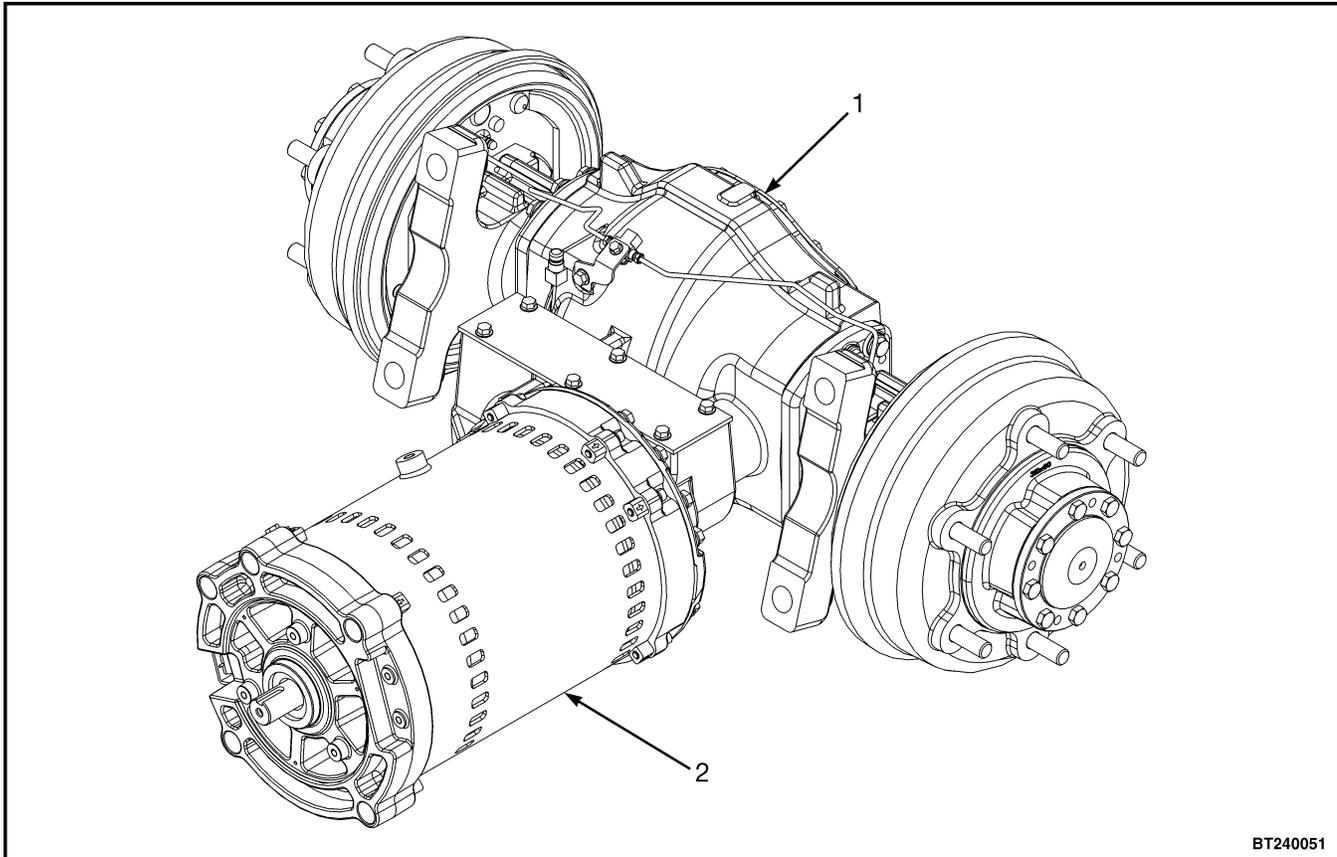


BT070006

1. RIGHT SIDE TRANSMISSION OUTPUT
2. RIGHT SIDE GEARBOX
3. RIGHT COVER HOUSING
4. TRACTION MOTORS
5. LEFT COVER HOUSING
6. LEFT SIDE GEARBOX
7. LEFT SIDE TRANSMISSION OUTPUT

**Figure 9025-10-2. Transaxle Assembly J4.0-5.0XN (A970)**

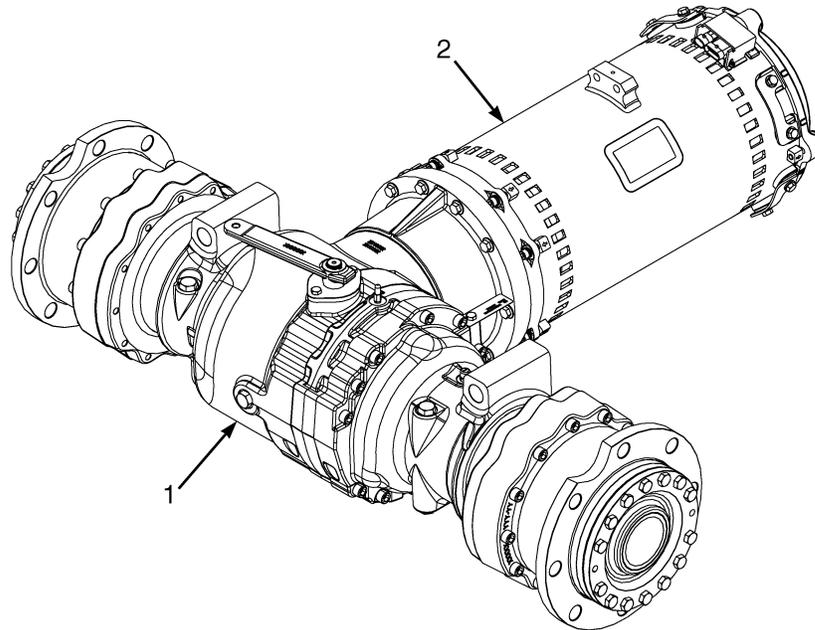
The model designation A268, A269 and A099 uses only one traction motor and one traction controller. It is mounted perpendicular to the drive axle. The speed sensor for this motor is located on the motor itself. See Figure 9025-10-3.



1. TRANSMISSION

2. TRACTION MOTOR

**Figure 9025-10-3. Transmission Mounting for Lift Truck Models E2.2-3.5XN (E45-70XN) (A268) and E1.6-2.0XN (E30-40XN) (A269)**



BT100000

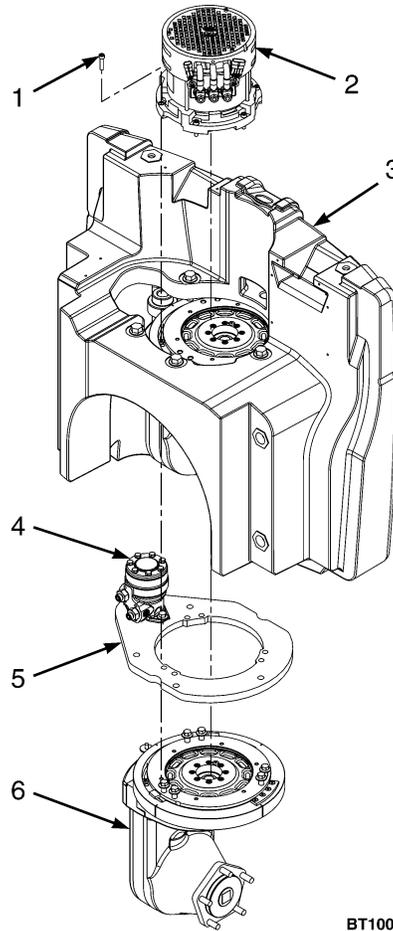
1. DRIVE AXLE

2. TRACTION MOTOR

**Figure 9025-10-4. Transmission Mounting for Lift Truck Models E4.0-5.5XN (E80-120XN) (A099)**

## MASTER DRIVE UNIT

The heart of the traction system is the master drive unit (MDU). A stationary traction motor eliminates the power cables from the traction motor to the traction controller from rotating or flexing. The MDU features an integrated pinion with a splined motor to MDU coupling. The support bearings and pinion are integral to the MDU eliminating the potential of damaging the gears when assembling the motor to the MDU. By integrating the pinion, the gear mesh can be better controlled resulting in a quieter MDU. The splined coupling allows for quick removal and installation of the traction motor.



BT100001

1. CAPSCREW
2. TRACTION MOTOR
3. COUNTERWEIGHT
4. STEER MOTOR
5. PLATE
6. MASTER DRIVE UNIT

**Figure 9025-10-5. Master Drive Unit**

## Group 30

# Observed Symptoms

---

## Poor Tractive Performance

### POSSIBLE CAUSE

- A. INCORRECT SPEED LIMIT SET.
- B. SPEED LIMITING ENABLED.
- C. FAILED CHECKLIST ITEM.
- D. INCORRECT STEER POSITION SENSOR CALIBRATION.
- E. INCORRECT MOTOR CONTROLLER SETTINGS IN CONFIGURATION DATA FILE (CDF).
- F. E-BOOST ACTIVE.
- G. MOTOR PHASE SHORTED TO FRAME.
- H. INCORRECT MOTOR INSTALLED.

### CAUSE A - INCORRECT SPEED LIMIT SET.

#### PROCEDURE OR ACTION:



#### **WARNING**

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

1. Adjust speed limit setting on Display Panel. If problem still present go to Cause B.

### CAUSE B - SPEED LIMITING ENABLED.

#### PROCEDURE OR ACTION:

1. Verify optional speed limiting is correctly set on Display Panel. See the appropriate **User Interface, Service Technician SRM** . If problem is still present, go to Cause C.

### CAUSE C - FAILED CHECKLIST ITEM.

#### PROCEDURE OR ACTION:

1. Review checklist history and run check as required. Lift truck will not operate correctly until all checklist item requirements have been satisfied.

***Have all checklist requirements been satisfied?***

**YES:** Go to Cause D.

**NO:** Perform necessary actions to fulfill checklist requirements. If checklist requirements have been satisfied and the problem is still present, go to Cause D.

### CAUSE D - INCORRECT STEER POSITION SENSOR CALIBRATION.

#### PROCEDURE OR ACTION:

1. Rerun calibration procedure on the steering position sensor. Refer to the appropriate **Calibration SRM** .

***Did re-calibrating steering position sensor resolve issue?***

**YES:** Problem resolved. Resume operation.

**NO:** Go to Cause E.

**CAUSE E - INCORRECT MOTOR CONTROLLER SETTINGS IN CONFIGURATION DATA FILE (CDF).****PROCEDURE OR ACTION:**

1. Go to Hypass Online and download a new CDF from the software options.
2. Install new CDF into lift truck's controller and test drive lift truck.

***Is problem still present?*****YES:** Go to Cause F.**NO:** Issue resolved. Resume operation.**CAUSE F - E-BOOST ACTIVE.****PROCEDURE OR ACTION:**

1. Make sure the service brakes are not locked up or dragging. See the appropriate **Brake System** SRM . Use the Display Panel to verify e-Boost is not interfering with the traction motor. If e-Boost is active, deactivate it.

***Is the problem still present?*****YES:** Go to Cause G.**NO:** Issue resolved. Resume operation.**CAUSE G - MOTOR PHASE SHORTED TO FRAME.****PROCEDURE OR ACTION:**

1. Turn lift truck power **OFF**.
2. Disconnect battery.
3. Disconnect power cables to tractions motor.
4. Change DMM to ohms scale. Verify zero reading.
5. Measure continuity between each power terminal of the traction motor and ground.

***Is resistance low or close to zero ohms?*****YES:** Replace traction motor with new traction motor.**NO:** Go to Cause H.**CAUSE H - INCORRECT MOTOR INSTALLED.****PROCEDURE OR ACTION:**

1. Check that the part number of traction motor is the correct part number for the lift truck. If the part number is not correct, use the correct traction motor.

---

**END SYMPTOM**

# SECTION 9030

# ELECTRICAL SYSTEM

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## Group 03

# General Maintenance and Diagnostic Data

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## Troubleshooting Guidelines and Procedures

### TROUBLESHOOTING GUIDELINES

The troubleshooting procedures that will be encountered in this manual require that the individual be familiar with certain policies, requirements, and instructions before starting any of the procedures. These are included to assure the safety of the technician performing the tasks, simplify the procedures, and prevent damage to the machine and supporting equipment.



#### WARNING

**All safety precautions for working on and around powered vehicles must be observed and maintained. (Refer to Operating or Repair Manual.)**

1. Initial conditions will be with the vehicle power OFF and park brake set, unless directed otherwise.
2. The Diagnostic Trouble Code (DTC) Chart includes:
  - Diagnostic Trouble Code
  - A brief description of the fault/symptom
  - Page number of applicable Troubleshooting Procedures

This number is the number displayed in the Liquid Crystal Display (LCD) section of the Display Panel (DP). In addition to active faults that will be displayed on the LCD, the system is capable of displaying fault history data that is stored in the VSM and other controller units, if equipped.

- VSM Fault Log
- Traction Controller 1 and 2 Fault Log
- HYDR PUMP Controller Fault Log
- LIGHT Controller Fault Log
- MLM Fault Log
- IMPACT Fault Log

- DISPLAY Fault Log

These fault history logs are accessible to service level technicians. See Troubleshooting Procedures for directions on how to access fault history logs.

3. Abbreviations and Acronyms will be defined when first used in a procedure. They are also listed and defined in Abbreviations and Acronyms that accompanies this document.
4. Most procedures will require the use of a Digital MultiMeter (DMM) and associated probes. The service technician should be familiar with the operation, range scales, polarity selection, and measurement techniques.
  - a. Unless otherwise directed, the **RED** probe of the DMM will always be connected to the point indicated as **(+)** and the **BLACK** probe will always be connected to the point indicated as **(-)**.
  - b. When performing a continuity check, all signal circuits should be equal or less than 0.5 ohms. At the start of troubleshooting procedures, verify that the DMM will display 0 ohms when the resistance scale is selected and the probes are shorted together. If the DMM display indicates a value less than 1 ohm and that value is consistently repeated, it may be considered as the zero value. Resistance readings during testing will require correction by this small value. If the DMM display is not correct or is greater than 1 ohm, have the meter calibrated/serviced.
  - c. In some improved DMMs, when the test probes are shorted together, a momentary push-button switch will re-zero the meter scale and maintain that zero position as a reference until the meter is turned off. If this feature is available, be sure to re-zero each time meter power is cycled.

- d. Probing the back of connectors for obtaining in-line voltage measurements requires a special probe extension for the meter probes. Failure to use this tool can result in damage to the integrity of the connector seal and may cause a failure in the harness/connector assembly. See **Wire Harness Repair** 2200SRM1128.
5. Most electrical problems will be harness related:
- Connectors not fully engaged and locked
  - Connector pins not fully inserted
  - Circuit repairs incorrectly wired at connectors
  - Damaged connector pins
6. Major component service tips:
- a. Vehicle System Manager (VSM):
- Connectors are keyed and color coded
  - Non-serviceable part
  - Last replaceable item in troubleshooting procedures
  - Do not transfer VSMs or Display Panel from other trucks
  - Always confirm VSM/Display Panel and lift truck serial numbers match before doing any servicing
7. When troubleshooting electrical/electronic faults and symptoms:
- a. Verify that the connector is properly engaged and that connector security clips, tabs, and other locking devices are properly attached.
- b. Visually examine the connectors and harness termination points for “pushed” or “recessed” pins or sockets.
- c. The Electric Truck Battery Negative and Positive are isolated from the Vehicle Frame. Unless directed in a Procedure, no measurements will be made using the vehicle frame as an electrical path.
- d. Before opening any connector or removing any wires from their termination point, disconnect the circuits from the battery as directed in the procedure. Trucks are equipped with a Emergency Disconnect Switch. Pushing the emergency disconnect switch in until it clicks, disconnects the power supply to the lift truck.

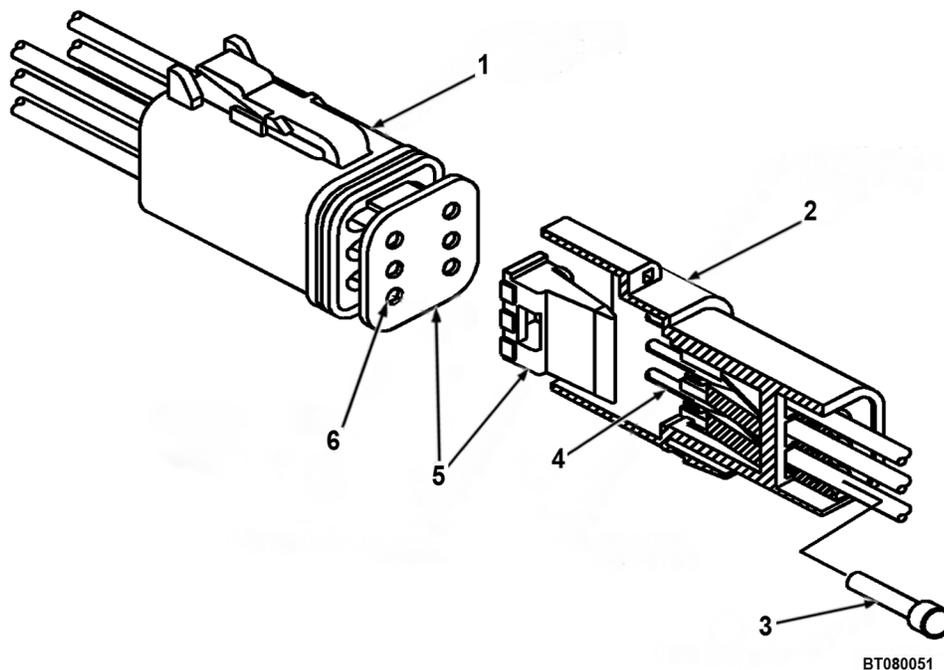
**NOTE:** The Electrical System Schematic referenced in this manual will be supplied in Diagrams. Verify that this data is current and the revisions are up to date before making any changes or alterations to the truck wiring.

Prior to making any corrections or changes to the wiring, verify that the wire number and color coincide with the information on the referenced schematics, wiring diagrams, or special instructions, if any.

**NOTE:** There may be customer options and equipment installed on the lift trucks by third-party services that do not comply with the standard wiring specifications and standards. Suppliers are encouraged to follow these standards for circuits when possible.

8. The chassis wiring used in these vehicles conforms to the electrical circuit identification standard ES-1359 and in addition to surface marked ID circuit numbers, generally utilizes the colors that are indicated below.
- a. Red = Battery level power circuits
- b. Black = Heavy current grounds
- c. Green = Signal Grounds
- d. White = Other circuits
- e. Twisted Pair (preferred CAN option)
- Yellow = CANbus Hi
  - Green = CANbus Lo
- f. Twisted Pair (non-preferred CAN option)
- White = CAN-Hi
  - White = CAN-Lo
- g. Orange = 5 volt
- h. Pink = 12 volt
9. Connectors used on schematics and reference drawings are identified as follows: See Figure 9030-03-1 in this section.
- a. **CPSXXX -- Connector Plug Socket (CPS)**, with **XXX** being the identity number.
- b. **CRPXXX -- Connector Receptacle Pin (CRP)**, with **XXX** being the identity number.
10. At the completion of a Troubleshooting Procedure, verify the following:

- a. All components removed for replacement, test or access purposes have been correctly re-installed.
- b. All electrical connections are restored.
- c. If operational test or checkout is to be performed, make sure operating area is free of personnel, obstructions, and ground hazards.
- d. Vehicle is in proper location and configuration for safe operation.
- e. Support equipment and tools are removed and properly stored.
- f. If operation is complete and the lift truck is to be stored or shut down, verify:
  - (1) Mast/Carriage/Forks are properly positioned.
  - (2) By pushing the emergency disconnect switch down until it clicks, disconnects the power supply to the lift truck.
  - (3) Cab (if equipped) is closed and secured.



- 1. PLUG TYPE CONNECTOR BODY
- 2. RECEPTACLE TYPE CONNECTOR BODY
- 3. CAVITY PLUG
- 4. PIN-TYPE TERMINAL
- 5. SECONDARY LOCK
- 6. SOCKET TYPE TERMINAL

**Figure 9030-03-1. Typical DT Series Connector**

## TROUBLESHOOTING PROCEDURES

This section describes the general process of identification, location, structure, and performance of the troubleshooting procedures that are included in this manual.

### Troubleshooting Procedures, Identification

The various procedures are identified by the fault characteristic.

### Troubleshooting Procedures, Location

Once a DTC number has been displayed, indicating a fault has been detected, the operator/service technician can review the DTC chart in this section to determine where the appropriate troubleshooting procedure is located.

The reported DTCs are listed in numerical order, along with the DTC title description of the detected fault. DTCs are also stored in the Fault Logs, where a history of repeat failures is maintained, until cleared by an authorized service technician.

When working from an Integrated Electronic Technical Manual (IETM) format, clicking on the DTC index number, or the page in the Table of Contents, will link you to the applicable procedure in section 9030-20. If working from a hardcopy (paper) manual, this capability is not available.

**NOTE:** Access to the following Fault Log menus requires Service password.

**NOTE:** The only Fault Logs available for display are those for the controllers installed in your lift truck, as defined in the VSM's Configuration Data File (CDF)

Access to Fault History Codes — Fault Logs store a history of DTCs within a specific controller file. These fault logs are accessible through the Display Panel main menu. At the Display Panel menu enter the supervisor password, scroll to Diagnostics, **ENTER**, and scroll to appropriate fault log. See Display Menu Flowchart.

### Troubleshooting Procedures, Structure

The structure or makeup of the troubleshooting procedures is generally the same for all entries. The procedures are graphical in nature with some text explanation

below the relevant graphic. In the text explanation symbols are used wherever possible. See Icon Glossary for definitions.

Minor differences in the beginning of a procedure are determined by whether the procedure has:

- A single fault code with a single schematic diagram
- A single fault code with multiple schematic diagrams  
In this instance, the technician will have to select the appropriate schematic based on the DTC and the lift truck type/configuration.
- Multiple fault codes with a single or multiple schematic diagram(s)
- A single fault code with no schematic diagrams, used when only the operational check and replacement procedures are employed in the procedure.

Troubleshooting procedures include several elements.

- **DTC** number(s) which this procedure applies to.
- **DTC** Identification e.g. Seat Sensor.
- **CHECK** List - Determines if the Fault is still active and helps identify the Possible Cause.
- **POSSIBLE CAUSES**
- **MAIN SCHEMATIC**
- **OPERATIONAL CHECKS**

**NOTE:** If key icon remains illuminated after software is installed, shut key **OFF**. Wait 30 seconds for power cycling then turn key **ON**. Key icon should not stay lit.

- Verify the DTC is still a valid fault. If the DTC is cleared during the power cycling, it may not have been a hard failure and if it does not reoccur on the display, there is no method of identifying or troubleshooting the problem. If this situation occurs randomly or reoccurs frequently with the same DTC, access and review the fault history log for that group to determine the frequency of failure and the last reported time it occurred. This information can be helpful in isolating intermittent problems when known conditions under which it occurred can be repeated.

- The operational check will also direct the technician to the proper cause in the procedure, based on truck/system configuration, other symptoms, and advise the user if any special conditions are required (i.e. Operate the truck until it has reached normal temperature, re-charge the battery before proceeding etc.).
- The operational check is also performed to verify that the problem has been corrected and that the components and devices have been restored to an operating condition.

The next item that appears in the procedure is the **CAUSE A**. This introduces the troubleshooter to the first sequence of tests or measurements to follow. Continuing through the procedure in the step-by-step directions will lead the user to:

- Additional possible causes
- Replacement/repair instructions
- Correction of the fault
- Operational check of the repaired/replaced device

It must be noted that Service Manual factory directions discourage probing of the connectors using any type of wire or pin and that resistance or continuity measurements of these connections should only be done with the appropriate service tool and breakout connectors.

Following through the procedure, the next items are the **DIAGRAMS** that support the troubleshooting and provide relevant data for wiring, connectors, power, signal and other reference data. These will enable the troubleshooter to measure, verify, and make critical decisions leading to the root cause. The diagrams may include:

- A mini-schematic of the suspect circuit
- Wire identification and circuit function
- Connector pin-out locators
- Special reference data for device or component

### Troubleshooting Procedures, Performance

It is important to remember the basics of troubleshooting when checking the electronically reported faults. Prior to starting any of the listed procedures, it is recommended that the items listed below be reviewed.

These may help to isolate the problem, eliminate some steps or enforce the procedure that has been identified. These items are:

- **LOOK** — Are there any observable symptoms, visual evidence or obvious conditions that could result in, or contribute to, the reported fault.  
Are the displayed Icons due to Interlocks? See **User Interface Supervisor 2200SRM1335** or **User Interface Service Technician 2200SRM1336**.
- **LISTEN** — If the lift truck can be operated with the reported problem, are there any unusual noises or vibrations that could result in, or contribute to, the reported fault.
- **TOUCH OR SMELL** — High operating temperatures and excessive wear can sometimes produce an odor or visual evidence that can be linked to other faults or conditions.
- In general, let your senses and your experience assist you in resolving the problem in the most efficient manner. Ask yourself:
  - What is required for this device or operation to function correctly?
  - Where are the devices/parts located?
  - Has this problem been reported before? If so, how frequently? Use the fault history logs to help identify repeated problems. This can be very helpful in analyzing faults of an intermittent nature which may be difficult to duplicate.
  - Has repair work, disassembly or other maintenance work been performed on suspect device or system recently?
- Once these questions have been considered, proceed with the DTC resolution as per the procedure, using any additional information to assist in resolving the discrepancy.

### Troubleshooting Procedures, Final

DTCs are stored in the FAULT CODE LOGS, where a history of repeat failures is maintained, until cleared by an authorized service technician. All DTCs are to be cleared prior to operating the lift truck. Fault code logs should only be cleared once the data is recorded by a authorized service technician. See Display Menu Flowchart.

**NOTE:** Motor/Motor Controller Fault Logs cannot be cleared. Once the Motor Controller Log is full, DTCs are removed on a First In, First Out (FIFO) basis.

play Panel or other Controllers. They will be displayed via the Display Panel upon detection and will remain in the applicable fault history logs until service intervention clears the logs.

**DIAGNOSTIC TROUBLE CODES**

The Diagnostic Trouble Codes that appear in the table that follows are those codes that have been stored in the memory of the VSM or in certain cases the Dis-

The DTC list is comprised of the DTC number and a brief description of the fault item.

*Diagnostic Trouble Code (DTC) Chart*

<b>DTC</b>	<b>DESCRIPTION</b>	<b>PAGE NO.</b>
12332	Data Incorrect.....	9030-20-108
12545	Battery OORH.....	9030-20-85
12546	Battery OORL.....	9030-20-85
12576	Motor Voltage Not OK.....	9030-20-296
12576	DC Bus Charging Timeout.....	9030-20-388
12592	Capacitor Charge.....	9030-20-249
12800	Directional Select A.....	9030-20-67
12801	Directional Select A.....	9030-20-71
12802	Direction Select Data Incorrect – Direction Signals Incorrect.....	9030-20-341
12804	Directional Select B.....	9030-20-67
12805	Directional Select B.....	9030-20-71
12806	Direction Select – Data Incorrect 2 + Direction Devices Installed.....	9030-20-349
12807	Direction Select Data Incorrect - No DCS Source.....	9030-20-353
12808	Accelerator Pedal Position A.....	9030-20-11
12809	Accelerator Pedal Position A.....	9030-20-15
12810	Accelerator Pedal Position B.....	9030-20-11
12811	Accelerator Pedal Position B.....	9030-20-15
12812	Accelerator Pedal Position A to B.....	9030-20-20
12813	Foot Brake Position Rationality.....	9030-20-552
12816	Seat Sensor.....	9030-20-76
12817	DC Bus Hi – Software Detected.....	9030-20-388
12818	DC Bus Hi – Hardware Detected.....	9030-20-388
12819	Seat Sensor.....	9030-20-80
12820	Steering Wheel Position.....	9030-20-25
12821	Steering Wheel Position.....	9030-20-30
12824	Steering Axle Position.....	9030-20-25
12825	Steering Axle Position.....	9030-20-30
12831	Park Brake Position.....	9030-20-62
12832	Park Brake Position.....	9030-20-57
12833	DC Bus Low – Hardware/Software.....	9030-20-388
12834	Aux Driver Short to Bat (-) Brake Coil Open Circuit.....	9030-20-279
12835	Aux Driver Open Circuit Excess Current.....	9030-20-279
12836	Service Brake Pressure.....	9030-20-1
12836	Brake Pedal Sensor A OORL.....	9030-20-552
12837	Service Brake Pressure.....	9030-20-6
12837	Brake Pedal Sensor A OORH.....	9030-20-552
12840	Mast Tilt Position.....	9030-20-57
12841	Mast Tilt Position.....	9030-20-62
12844	Load Weigh Pressure.....	9030-20-1
12845	Load Weigh Pressure.....	9030-20-6

*Diagnostic Trouble Code (DTC) Chart (Cont)*

<b>DTC</b>	<b>DESCRIPTION</b>	<b>PAGE NO.</b>
12852	Hydraulic Temperature.....	9030-20-39
12853	Hydraulic Temperature.....	9030-20-43
12856	Manual Hyd 1.....	9030-20-99
12857	Manual Hyd 1.....	9030-20-103
12860	Manual Hyd 2.....	9030-20-99
12861	Manual Hyd 2.....	9030-20-103
12864	Manual Hyd 3.....	9030-20-99
12865	Manual Hyd 3.....	9030-20-103
12868	Manual Hyd 4.....	9030-20-99
12869	Manual Hyd 4.....	9030-20-103
12872	Hydraulic Fluid Level.....	9030-20-48
12873	Hydraulic Fluid Level.....	9030-20-53
12876	Brake Pedal Sensor B OORL.....	9030-20-552
12877	Brake Pedal Sensor B OORH.....	9030-20-552
12928	Display Temperature Sensor (Freezer Option Only).....	9030-20-221
12929	Display Temperature Sensor (Freezer Option Only).....	9030-20-221
12934	Display Internal LCD Backlight.....	9030-20-188
12935	Display Internal LCD Backlight.....	9030-20-188
12936	Display Internal LCD Heater.....	9030-20-188
12937	Display Internal LCD Heater.....	9030-20-188
12938	Display Buzzer Output.....	9030-20-221
12939	Display Buzzer Output.....	9030-20-221
12940	Display Keyswitch Output.....	9030-20-195
12941	Display Keyswitch Output.....	9030-20-195
13056	5V OORL.....	9030-20-92
13057	5V OORH.....	9030-20-92
13058	5V Internal Supply Out of Range.....	9030-20-504
13060	VSM 12V OORL.....	9030-20-179
13061	VSM 12V OORH.....	9030-20-179
13070	Keyswitch Data Incorrect.....	9030-20-195
13104	Sensor Ground Current OORH.....	9030-20-505
13312	Lift.....	9030-20-118
13316	Lower.....	9030-20-118
13320	Tilt Forward.....	9030-20-118
13324	Tilt Back.....	9030-20-118
13328	Aux 1A.....	9030-20-118
13332	Aux 1B.....	9030-20-118
13336	Aux 2A.....	9030-20-118
13340	Aux 2B.....	9030-20-118
13344	Synch Steering Coil Open Circuit.....	9030-20-418
13352	Diverter Valve.....	9030-20-232
13356	Hyd Enable.....	9030-20-232
13360	Acc 1 Relay.....	9030-20-232
13364	Acc 2 Relay.....	9030-20-232
13368	Motion Relay.....	9030-20-232
13372	Reverse Relay.....	9030-20-232
13376	Spare 1 Relay.....	9030-20-232
13380	Brake Light Relay Short to B(-) or Open.....	9030-20-232
13384	Main Contactor.....	9030-20-232
13388	2nd Contactor.....	9030-20-232

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*Diagnostic Trouble Code (DTC) Chart (Cont)*

<b>DTC</b>	<b>DESCRIPTION</b>	<b>PAGE NO.</b>
16912	Motor Temperature High.....	9030-20-361
16912	Motor Temperature OORH.....	9030-20-517
16913	Motor Temperature Sensor Open Circuit.....	9030-20-509
16914	Motor Temperature Sensor Short Circuit.....	9030-20-513
17168	Controller/Heatsink Temperature High.....	9030-20-361
20753	15 Volt Supply Low Voltage.....	9030-20-383
20755	5 Volt Supply Low/High Voltage.....	9030-20-383
21008	Current Sensor Offset Calibration Error.....	9030-20-373
21520	Aux Driver Current High.....	9030-20-405
21521	Fan Driver Current OORH.....	9030-20-523
21522	Automatic Park Brake Driver Current OORH.....	9030-20-528
21569	Contactator Open.....	9030-20-238
21570	Contactator Closed.....	9030-20-238
21760	VSM BOOT_BLOCK Checksum failure.....	9030-20-207
21761	CDF_Checksum_failure.....	9030-20-207
21762	VSM APPLICATION_SOFTWARE Checksum failure/Error.....	9030-20-207
21764	VSM EEPROM Checksum failure/Error.....	9030-20-207
21766	VSM EEPROM Cell failure Write Error.....	9030-20-207
21776	Internal Error - Hardware.....	9030-20-526
21792	VSM Serial Number Error.....	9030-20-207
21830	MLM EEPROM Write Error.....	9030-20-170
21834	MLM Sensor 1 Out of Range.....	9030-20-170
21835	MLM Sensor 2 Out of Range.....	9030-20-170
21836	MLM Sensor 3 Out of Range.....	9030-20-170
21837	MLM Sensor 4 Out of Range.....	9030-20-170
22032	Display EEPROM Checksum Error.....	9030-20-188
22033	Display Cell Write Error.....	9030-20-188
22528	Display Button *.....	9030-20-188
22529	Display Button #.....	9030-20-188
22530	Display \ Arrow.....	9030-20-188
22531	Display ] Arrow.....	9030-20-188
22532	Display Button 1.....	9030-20-188
22533	Display Button 2.....	9030-20-188
22534	Display Button 3.....	9030-20-188
22535	Display Button 4.....	9030-20-188
22536	Display Button 5.....	9030-20-188
22537	Display Button 6.....	9030-20-188
22538	Display Button 7.....	9030-20-188
22539	Display Button 8.....	9030-20-188
22540	Display Button 9.....	9030-20-188
22541	Display Button 0.....	9030-20-188
25104	Sensor Fault.....	9030-20-267
25105	Temperature Sensor Failure.....	9030-20-361
25106	Park Brake Solenoid and Fan Driver Current High.....	9030-20-405
25344	MLM Checksum Error.....	9030-20-170
29216	Speed Sensor High Current.....	9030-20-530
29217	Speed Sensor Not Connected.....	9030-20-532
29232	Sensor Supply Reference voltage Out of Range.....	9030-20-527
29233	Sensor Supply Circuit Out of Range.....	9030-20-534
29456	Sensor Fault.....	9030-20-256

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*Diagnostic Trouble Code (DTC) Chart (Cont)*

<b>DTC</b>	<b>DESCRIPTION</b>	<b>PAGE NO.</b>
29456	Sensor Fault.....	9030-20-267
29536	Loss of Speed Sensor Channel A.....	9030-20-536
29552	Loss of Speed Sensor Channel B.....	9030-20-538
33024	CAN Communication Failure.....	9030-20-332
33025	VSM to Display.....	9030-20-123
33025	VSM to Display.....	9030-20-137
33025	VSM to Display.....	9030-20-155
33026	VSM to Traction 1 (Right).....	9030-20-123
33026	VSM to Traction 1 (Right).....	9030-20-137
33026	VSM to Traction 1 (Right).....	9030-20-155
33027	VSM to Traction 2 (Left).....	9030-20-123
33027	VSM to Traction 2 (Left).....	9030-20-137
33027	VSM to Traction 2 (Left).....	9030-20-155
33029	VSM to Pump.....	9030-20-123
33029	VSM to Pump.....	9030-20-137
33029	VSM to Pump.....	9030-20-155
33034	VSM to MLM (DCS).....	9030-20-123
33034	VSM to MLM (DCS).....	9030-20-137
33034	VSM to MLM (DCS).....	9030-20-155
33035	VSM to Impact.....	9030-20-123
33035	VSM to Impact.....	9030-20-137
33035	VSM to Impact.....	9030-20-155
33036	VSM to CAN Reserved 1.....	9030-20-123
33036	VSM to CAN Reserved 1.....	9030-20-137
33036	VSM to CAN Reserved 1.....	9030-20-155
33037	VSM to CAN Reserved 2.....	9030-20-123
33037	VSM to CAN Reserved 2.....	9030-20-137
33037	VSM to CAN Reserved 2.....	9030-20-155
33038	VSM to CAN Reserved 3.....	9030-20-123
33038	VSM to CAN Reserved 3.....	9030-20-137
33038	VSM to CAN Reserved 3.....	9030-20-155
33040	Various CAN Errors.....	9030-20-556
33050	E-Steer CAN Communications Failure Right.....	9030-20-499
33051	E-Steer CAN Communications Failure Left.....	9030-20-499
33056	Display Internal CAN Failure.....	9030-20-188
33057	Display to VSM.....	9030-20-123
33057	Display to VSM.....	9030-20-137
33057	Display to VSM.....	9030-20-155
33057	Display Communications Error with VSM.....	9030-20-188
4096	Hydraulic Calibration Required.....	9030-20-379
4098	Steer Axle Calibration.....	9030-20-35
4112	Incorrect Lever 1 Installed.....	9030-20-176
4113	Incorrect Lever 2 Installed.....	9030-20-176
4114	Incorrect Lever 3 Installed.....	9030-20-176
4115	Incorrect Lever 4 Installed.....	9030-20-176
4116	Incorrect Lever 5 Installed.....	9030-20-176
4117	FOC Configuration Mismatch.....	9030-20-554
65280	Controller Failure.....	9030-20-306
65288	Loss of Communication Between the Primary and Secondary Controller.....	9030-20-422
65293	EEPROM Checksum Failure.....	9030-20-423

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*Diagnostic Trouble Code (DTC) Chart (Cont)*

<b>DTC</b>	<b>DESCRIPTION</b>	<b>PAGE NO.</b>
65296	Motor U-W Phase Voltage Measurement Fault.....	9030-20-427
65297	Motor U-V Phase Voltage Measurement Fault.....	9030-20-429
65299	Controller Logic Failure.....	9030-20-213
65310	VMN Low.....	9030-20-548
65311	VMN High.....	9030-20-548
65312	Motor Phase Voltage Out of Range.....	9030-20-433
65317	Contactors Closed.....	9030-20-238
65318	Contactors Open.....	9030-20-238
65333	Standby Current Too High.....	9030-20-435
65333	Standby Current High.....	9030-20-548
65340	DC Bus Capacitor Charge Timeout.....	9030-20-436
65341	Controller Temperature Above Limit.....	9030-20-439
65341	Controller Internal Temperature OORH.....	9030-20-521
65341	Controller Internal Temperature OORL.....	9030-20-522
65342	Thermal Protection / Motor Temperature High.....	9030-20-521
65345	Motor Temperature Above Limit.....	9030-20-440
65346	Battery Low.....	9030-20-540
65350	Controller Internal Error.....	9030-20-443
65350	Motor Phase W Current OORL.....	9030-20-459
65351	Motor Phase V Current OORL.....	9030-20-461
65352	Motor W-V Phase Voltage Measurement Fault.....	9030-20-431
65353	Motor Phase U Current OORL.....	9030-20-463
65354	Driver Shorted High.....	9030-20-238
65355	Driver Shorted Low.....	9030-20-238
65362	Encoder Error.....	9030-20-536
65362	Encoder Error.....	9030-20-538
65378	Steering Wheel Position Error.....	9030-20-472
65481	Wrong Slave Version.....	9030-20-547
65486	Initial VMN High.....	9030-20-548
65487	Controller Internal Error.....	9030-20-444
65488	Controller Internal Error.....	9030-20-445
65489	Controller Internal Error.....	9030-20-458
65490	Primary and Secondary Controller Version Mismatch.....	9030-20-446
65491	TFD Current within Range but Lower than Expected.....	9030-20-474
65492	Controller Internal Error.....	9030-20-447
65493	Default Parameter Restore.....	9030-20-448
65494	Rapid Change in Steering Wheel Position.....	9030-20-468
65495	Controller Internal Error.....	9030-20-449
65496	Controller Internal Error.....	9030-20-450
65496	TFD Resistance Out of Range.....	9030-20-476
65498	Controller Software Mismatch.....	9030-20-457
65500	Steering Motor Locked.....	9030-20-482
65501	Controller Internal Error.....	9030-20-451
65503	Rapid Change in Steer Axle Position.....	9030-20-494
65504	Waiting for Node.....	9030-20-550
65505	Controller Internal Error.....	9030-20-452
65508	Steer Axle Position Mismatch.....	9030-20-486
65511	No Slave Enabled.....	9030-20-547
65512	Wrong Encoder Set.....	9030-20-536
65512	Wrong Encoder Set.....	9030-20-538

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*Diagnostic Trouble Code (DTC) Chart (Cont)*

<b>DTC</b>	<b>DESCRIPTION</b>	<b>PAGE NO.</b>
65513	Power MOS Shorted.....	9030-20-288
65515	TFD Short to battery Negative.....	9030-20-478
65516	TFD Stand-by Current OORH.....	9030-20-480
65517	Controller Internal Error.....	9030-20-453
65519	Controller Mismatch.....	9030-20-547
65521	Steer Axle Slow Response.....	9030-20-484
65522	Parameter Transfer.....	9030-20-547
65524	Primary and Secondary Parameter Mismatch.....	9030-20-498
65525	Controller Internal Error.....	9030-20-454
65526	Aux Driver Open.....	9030-20-420
65527	No CAN Communication.....	9030-20-324
65527	Loss of CAN Communication.....	9030-20-499
65528	Steer Wheel Sensor Output Mismatch.....	9030-20-470
65529	Check Up Needed.....	9030-20-542
65530	Controller Internal Error.....	9030-20-455
65531	Controller Initialization Test Failed.....	9030-20-465
65532	Steer Axle Sensor Output Mismatch.....	9030-20-490
65533	Controller Internal Error.....	9030-20-456
65534	Aux Driver Short.....	9030-20-420
8704	Display Internal LCD Backlight.....	9030-20-188
8705	Display Internal LCD Heater.....	9030-20-188
8786	Brake Coil Shorted.....	9030-20-279
8960	Lift.....	9030-20-113
8964	Lower.....	9030-20-113
8968	Tilt Forward.....	9030-20-113
8972	Tilt Back.....	9030-20-113
8976	AC Current – Over Current.....	9030-20-313
8978	Aux 1A.....	9030-20-113
8980	Aux 1B.....	9030-20-113
8984	Aux 2A.....	9030-20-113
8988	Aux 2B.....	9030-20-113
8992	Synchronous Steering Coil Current.....	9030-20-417
9000	Diverter Valve.....	9030-20-227
9004	E Hyd Enable.....	9030-20-227
9008	Clamp Solenoid (Optional).....	9030-20-227
9012	Acc 2 Relay.....	9030-20-227
9012	ACC 2 Current OORH.....	9030-20-420
9016	Forward Relay.....	9030-20-227
9020	Reverse Relay.....	9030-20-227
9024	AC Current – Short Circuit.....	9030-20-313
9026	Spare 1 Relay.....	9030-20-227
9028	Spare 2 Relay.....	9030-20-227
9032	Main Contactor.....	9030-20-227
9036	2nd Contactor.....	9030-20-227
9040	Display Buzzer Output.....	9030-20-221
9041	Display Keyswitch Output.....	9030-20-195
9045	Internal Error - Software.....	9030-20-503
95360	Forw + Back.....	9030-20-543
95520	Key Switch Voltage OORL.....	9030-20-424
None	No Display/No Truck Operation.....	9030-30-1

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**Diagnostic Trouble Code (DTC) Chart (Cont)**

DTC	DESCRIPTION	PAGE NO.
None	Motor Controller Fan Failure.....	9030-30-8
None	Motor/Motor Controller Temperature Sensor Failure.....	9030-30-21

**Wiring Reference Data**

**NOTE:** When troubleshooting the electrical wiring harness for your lift truck, the wire connectors may be different but the pin numbers for the connectors are the same between the different connectors.

**Function/Circuit Identification** — A standard numbering and color-coding system is used in the lift truck wiring. This system will simplify repairs. The Electrical Circuit Identification Specification is ES-1359. The ID data is described in Table 9030-03-1.

Each circuit Function ID has a number from 1 through 999, as indicated in the Table 9030-03-1.

- A circuit labeled with a single numerical Function ID shall be electrically equivalent throughout the harness (physically connected through splices or connectors).

- Wires which are connected only through an internal connection in a controller shall have separate Function ID numbers.
- Wire Function ID numbers will be stamped at 50mm intervals along the wire length.
- The Function IDs are assigned into groups as shown in the table. Unless noted otherwise, specific functions are to be preassigned to unique Function IDs.

If a circuit function does not meet one of the preassigned numbers, and its function is unique within the truck series and option, then a number from the “Non-Standard Functions” range may be used.

**Table 9030-03-1. Circuit Group Identification**

Function/Group	Number Range
Grounds (IDs not preassigned within this range)	101-149
Current sense ground	150-199
Switched B+ (IDs not preassigned within this range)	200-239
Fused B+ (IDs not preassigned within this range)	240-249
Regulated Power 5V (IDs not preassigned within this range)	250-279
Regulated Power 12V	280-299
Analog Inputs – hydraulics / mast	300-319
Analog Inputs – chassis	320-339
Analog Inputs – powertrain	340-399
Analog Inputs – CAB / OHG	400-419
Reserved for additional analog inputs	420-499
Digital inputs – hydraulics / mast	500-509

**Table 9030-03-1. Circuit Group Identification (Continued)**

Function/Group	Number Range
Digital inputs – chassis	510-539
Digital inputs – powertrain	540-559
Digital inputs – CAB / OHG	560-569
Encoder inputs	570-599
Reserved for additional digital inputs	600-699
Digital outputs – hydraulics / mast	700-719
Digital outputs – chassis	720-749
Digital outputs – powertrain	750-779
Digital outputs – CAB /OHG	780-799
PWM outputs – hydraulics / mast	800-829
PWM outputs – chassis	830-839
PWM outputs – powertrain	840-889
PWM outputs – CAB / OHG	890-899
Communications (eg., CANbus)	900-909
Non-Standard functions	910-999

**Wiring Color Codes** — The colors used to identify the lift truck wiring, in addition to the surface marked circuit ID data, are identified in Table 9030-03-2. Many Diagrams and Schematics in this book can be viewed and printed in color. If not printed or viewed in color refer to the electrical circuit identification located on schematic circuits. When viewing a color version of the diagrams and schematics, the white chassis wires are seen as yellow. Other wires are shown in colors similar to actual colors, i.e., tan shows as yellow. Use circuit identification for true wire color. MONOTROL<sup>®</sup>, wiring to sensors and other applications vary with respect to wire colors.

**Table 9030-03-2. Hyster Wiring Color Codes**

Color	Use/Function
Red	Battery-level power circuits
Black	Heavy current grounds
Green	Signal grounds
White	Other circuits
Twisted Pair (Yellow/Green) Yellow Green	Preferred CAN Option CAN-Hi CAN-Lo
Twisted Pair (Yellow/Green) White White	Non-Preferred CAN Option CAN-Hi CAN-Lo

**Symbol Definitions**

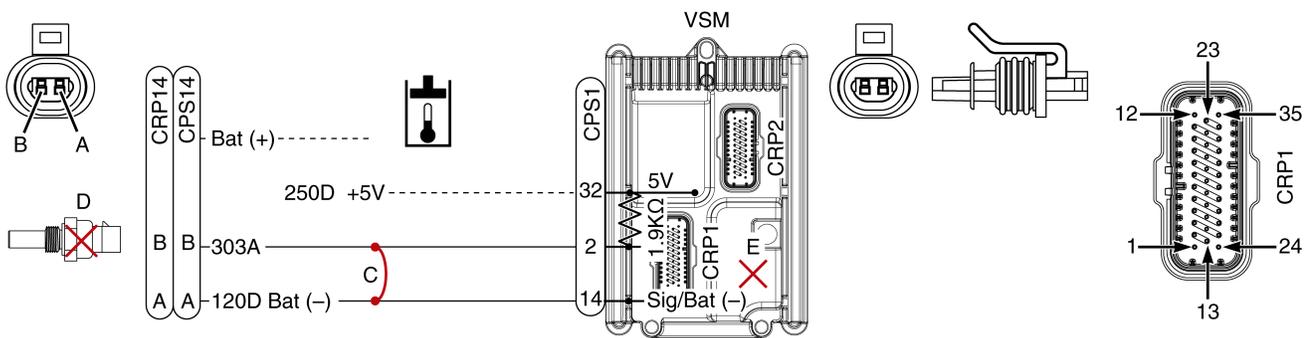
Type "S", Identifies information for UL Safety rated trucks.

Arrow Symbols, Go to specified page of schematic. Page number is located in the "hexagon symbol" on schematic.

--x, Go to specified sheet of diagram. Sheet number is located in lower right corner of figure.

**Circuit Segment Suffix Letter** — A circuit ID has a segment suffix letter as required (splices or passing through a connector). Each circuit ID is unique and

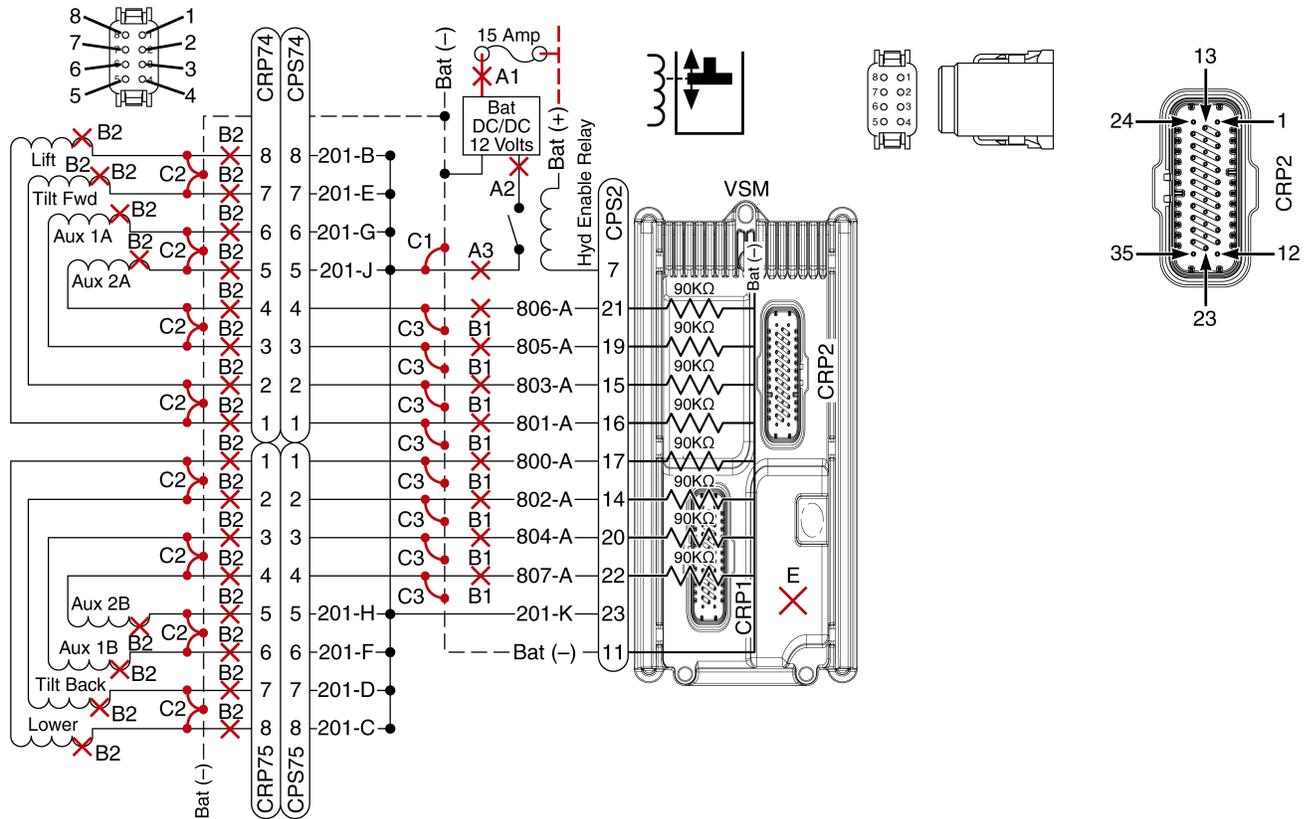
each circuit ID has a suffix. The circuit connects to all other wires in the vehicle with the same circuit ID number. For example, 42-A will be connected to 42-B, 42-J, etc. Function ID numbers appear with suffix letters, the base number is not used by itself. For example, when labeling a circuit #42, start with "42-A" rather than "42". Suffix letters should be assigned from "A" to "Z" (but "Q" and "V" are not used). Additional branches beyond "Z" to be assigned as "AA", "AB", etc. If a Suffix is used, the parts of the circuit identification number will be separated by dashes. For example:



WIRE # 751 (RED), SEGMENTED, SUFFIX LETTERS A, O, P  
 WIRE # 870 (WHITE), NON-SEGMENTED, SUFFIX LETTER A

WIRE #S 383, 384 (WHITE), NON-SEGMENTED, TWISTED PAIR, SUFFIX LETTER A (SHOWN WITH SHIELD THAT TERMINATES AT PIN B2)

**Figure 9030-03-2. Single Wiring Sample Circuit**



WIRE # 751 (RED), SEGMENTED, SUFFIX LETTERS A, O, P  
 WIRE # 870, 871 (WHITE), NON-SEGMENTED, SUFFIX LETTER A

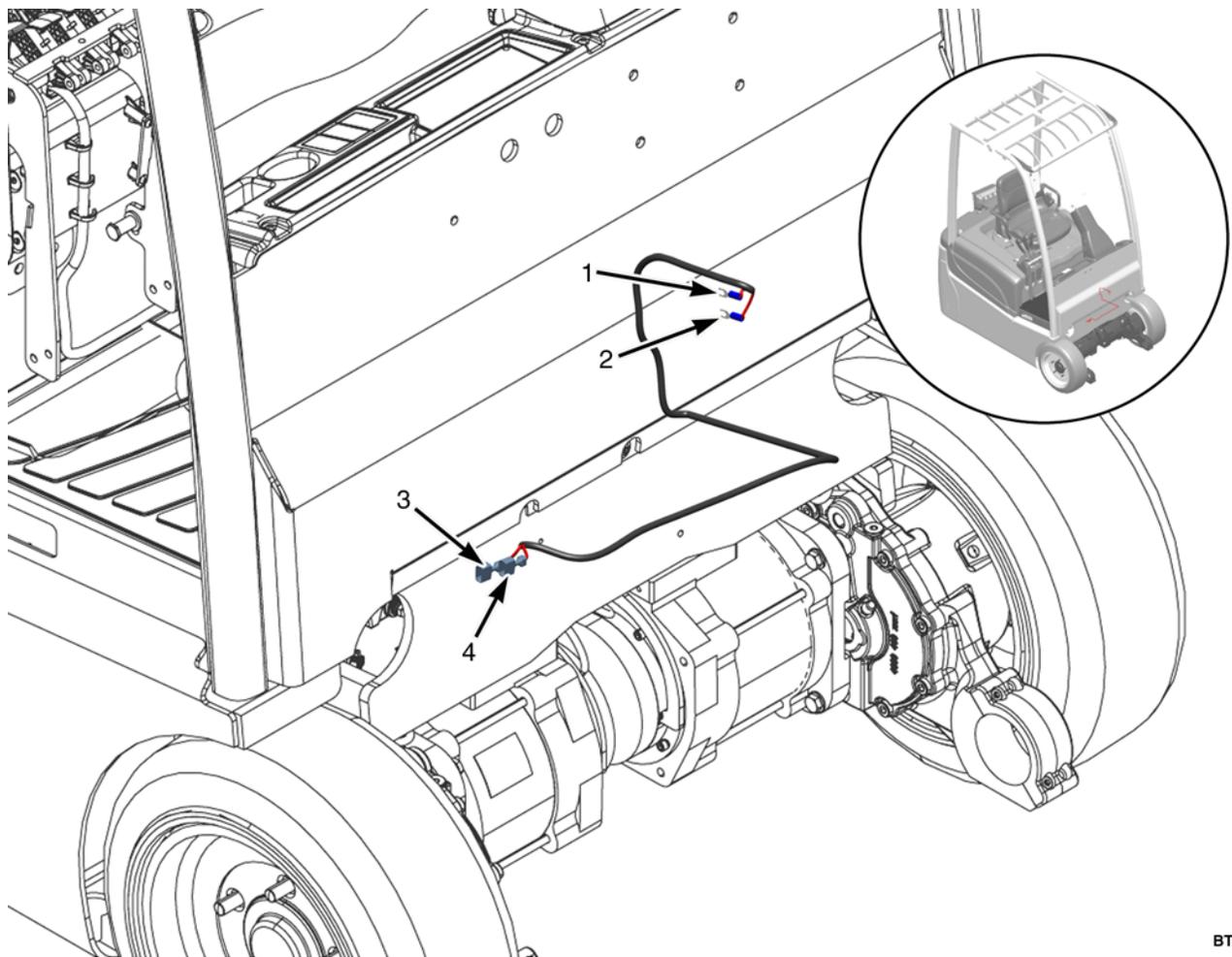
WIRE #S 383, 384, 387, AND 388 (WHITE), NON-SEGMENTED, TWISTED PAIR, SUFFIX LETTER A (SHOWN WITH SHIELD THAT TERMINATES AT PIN B2)

**Figure 9030-03-3. Dual Wiring Sample Circuit**

## Harness Assembly Data

This section depicts the lift truck harness assemblies with their respective connector identifications. The harnesses are arranged as follows:

- Wire Harness – Auxiliary Key Switch Figure 9030-03-4
- Wire Harness Steering Figure 9030-03-5
- Display Wire Harness Standard Figure 9030-03-6
- Display Wire Harness Freezer Figure 9030-03-7
- Wire Harness Main Electro – Hydraulic Figure 9030-03-8
- Wire Harness Main Manual – Hydraulic Figure 9030-03-9
- Wire Harness Front Switch Figure 9030-03-10
- Wire Harness Back Up Alarm Strobe w/o Conv. Figure 9030-03-11
- Wire Harness Lights LH - OHG Figure 9030-03-12
- Wire Harness Manual Hydraulics Figure 9030-03-13
- Wire Harness Display Freezer Figure 9030-03-14
- Wire Harness Turn Signal Figure 9030-03-15
- Wire Harness Synchro Steer Figure 9030-03-16
- Wire Harness Park Brake Figure 9030-03-17
- Wire Harness LH OHG w/Turn Signals Figure 9030-03-18
- Wire Harness Steering Column Figure 9030-03-19
- Wire Harness Lights w/OHG - RH Figure 9030-03-20
- Wire Harness Lights Chassis Main Figure 9030-03-21
- Wire Harness Seat E-Hydraulic Figure 9030-03-22
- Wire Harness Seat Manual-Hydraulic Figure 9030-03-23
- Wire Harness Main w/Manual – Hydraulic Figure 9030-03-24
- Wire Harness Main w/E – Hydraulic Figure 9030-03-25

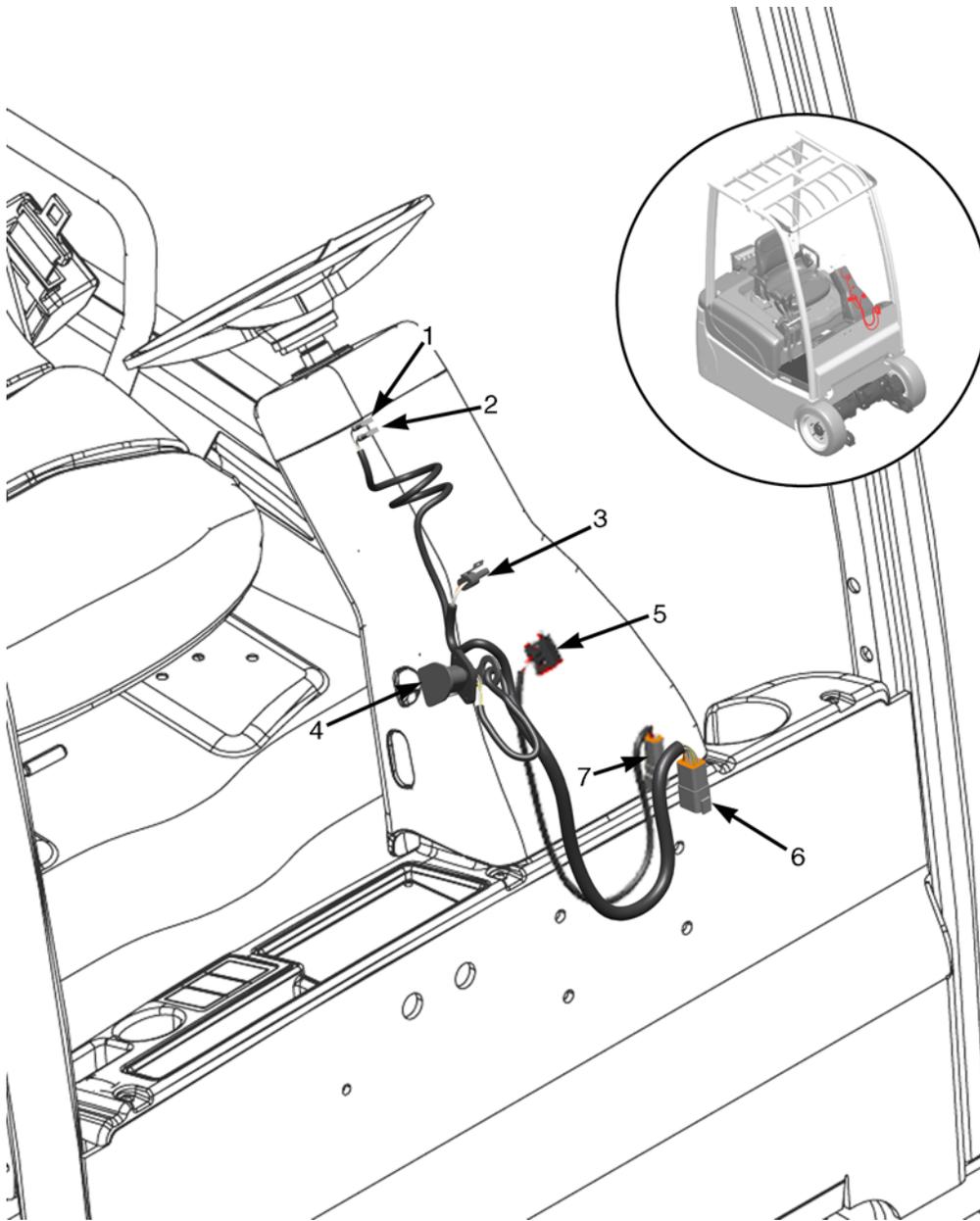


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- 1. T115 FUSE BLOCK
- 2. T116 FUSE BLOCK

- 3. T114 KEY SWITCH
- 4. T113 KEY SWITCH

**Figure 9030-03-4. J1.5-2.0XNT (J30-40XNT) (K160) ; Wire Harness – Auxiliary Key Switch**

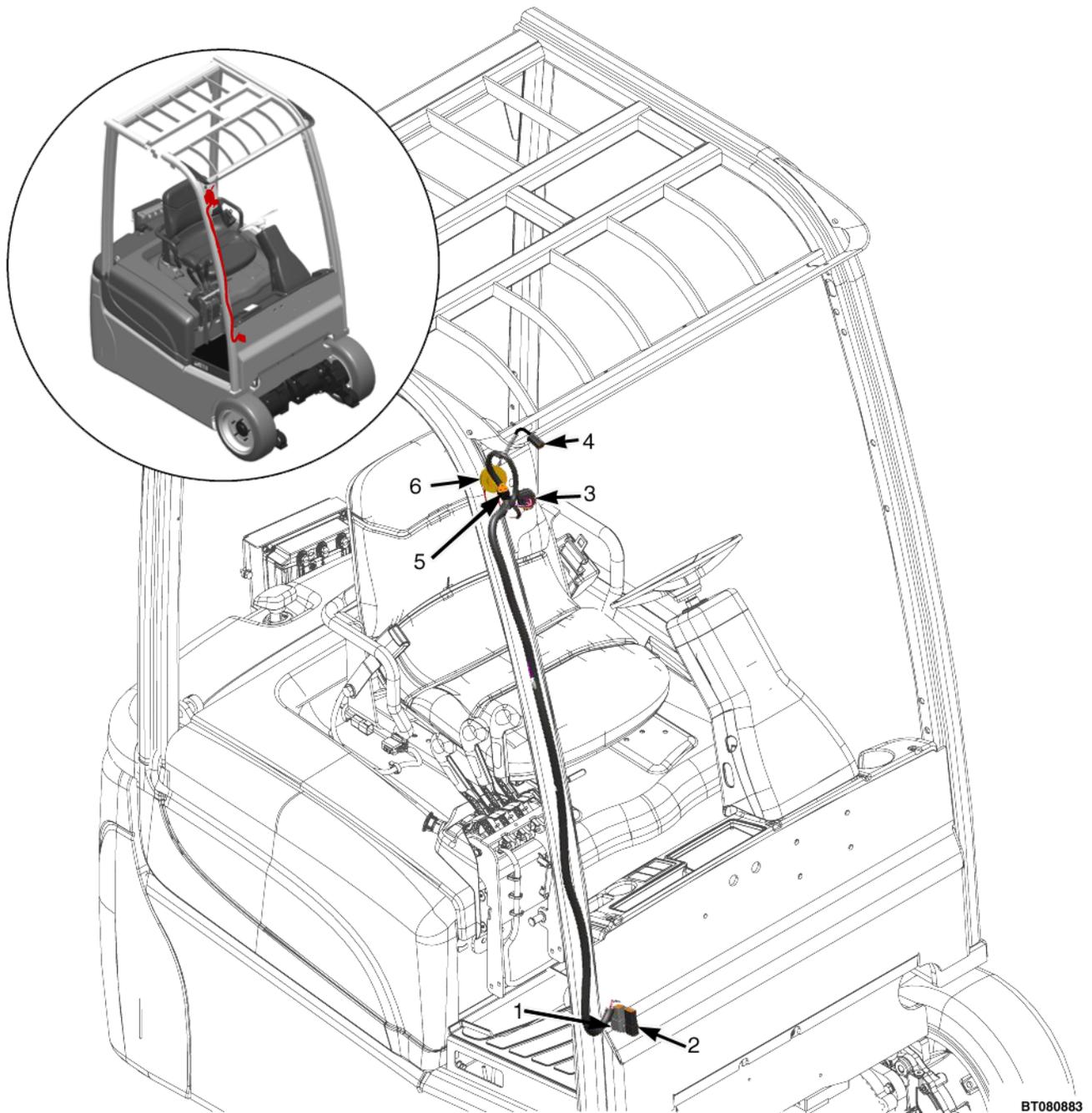


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- |                                         |                               |
|-----------------------------------------|-------------------------------|
| 1. TF15 HORN SWITCH NO                  | 5. CPS128 STEER MAKE-UP VALVE |
| 2. TF14 HORN SWITCH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

**Figure 9030-03-5. J1.5-2.0XNT (J30-40XNT) (K160) ; Wire Harness Steering**

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- 1. CRP135 MAIN HARNESS
- 2. CRP180 MAIN HARNESS
- 3. CPS20 DISPLAY

- 4. CPS103 RIGHT FRONT WORK LIGHT
- 5. CPS166 RIGHT FRONT MARKER LIGHT
- 6. BUZZER

**Figure 9030-03-6. J1.5-2.0XNT (J30-40XNT) (K160) ; Display Wire Harness Standard**

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