SERVICE REPAIR

MANUAL

Hyster A419 (W45ZHD) Forklift

HYSTER

CONTROLLER DIAGNOSTICS

W45ZHD [A419]

HYSTER

PART NO. 4101970

9000 SRM 1671

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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This section is for the following models:

(W45ZHD) [A419]

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:

Section: This manual consists of one section which is further divided into groups.

- 9030 – Electrical System

Groups: The 9030 Electrical System is divided into two groups that identify specific electrical troubleshooting procedures.

- 03 – General Maintenance/Diagnostic Data
  The General Maintenance and Diagnostic Data group includes general troubleshooting, discharging the capacitors, basic electrical troubleshooting, multiplexing, User Iterface, and status codes and descriptions.
- 20 – Diagnostic Trouble Codes
  The Diagnostic Trouble Codes group includes all troubleshooting procedures for status codes reported by a given Node or system.

For a listing of all Diagnostic Trouble Codes and descriptions, see the section of this manual.

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. Once you begin a troubleshooting procedure, do not skip steps.
3. 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.
4. 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.
5. 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.

SECTION 9030
ELECTRICAL SYSTEM

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Group 03

General Maintenance and Diagnostic Data

GENERAL TROUBLESHOOTING

In the event the lift truck does not operate correctly, a status code is displayed on the display panel. Once the status code is obtained, follow the procedures outlined in this manual only after reviewing the following information regarding the truck's unique electrical system and troubleshooting procedures.

NOTE: Due to the interaction of the traction controller with all truck functions, almost any status code or controller fault could be caused by an internal failure of the traction controller. After all other status code procedures have been followed and no problem is found, the traction controller should be tested and replaced as the last option to correct the problem.

Prior to troubleshooting systems and components on the vehicle, ensure the battery voltage is correct and within specifications. Make sure the battery connector contacts are clean of corrosion and the battery polarity within the connector is correct. Inspect that all fuses are correct and are not the cause of component failure. Ensure the key switch is in the ON position when conducting voltage checks or verifying the operation of a component. Make sure the brake switch is functioning properly and is closed.

Many faults noted by lift truck's electrical system may be the result of loose wiring connections and/or broken or shorted wiring within the lift truck. Begin the troubleshooting process by carefully inspecting the wiring involving the device or devices noted by the onboard diagnostic system. .

The controllers are sealed units with no serviceable components. Troubleshooting is usually limited to accessing status codes and following the diagnostic procedure provided for each status code.

Use standard testing procedures to verify inputs and outputs when necessary.

CAUTION

Never attempt to probe through the back of the connector plugs of the motor controller. These plugs are special sealed plugs. Probing through the back of the plugs will destroy the seal and can cause a short circuit. If a circuit must be tested for voltage, check for voltage at an amp-type plug, a switch, or component. If a circuit is suspect, check the circuit for continuity by disconnecting the plug and testing continuity from the front (pin end) of the plug.

Standard probes are too large to be inserted into the center of female pins (sockets) of the special sealed plugs and can damage or expand the pins. Expanded pins will not provide good connections once the plug is reconnected. The connectors are shaped to allow the insertion of a small flat-blade screwdriver into the connector. After inserting the screwdriver into the connector, attach probes with alligator clips to the shank of the screwdriver to obtain readings.

Refer to **8000 SRM 1512** for wiring diagrams and additional circuit information.

DISCHARGING THE CAPACITORS

When working with the electrical systems of the truck, it is necessary to discharge the internal or external capacitors of the controllers associated with each circuit affected.

WARNING

DO NOT make repairs or adjustments unless you have been properly trained and authorized to do so. Improper repairs and adjustments can create dangerous operating conditions. DO NOT operate a lift truck that needs repairs. Report the need for repairs to your supervisor immediately. If repair is necessary, attach a DO NOT OPERATE tag to the control handle and disconnect the battery.

Disconnect the battery and discharge the internal or external capacitors before opening any compartment covers or inspecting or repairing the electrical system. DO NOT place tools on top of the battery. If a tool causes a short circuit, the high current flow from the battery can cause personal injury or property damage.

Some checks and adjustments are performed with the battery connected. DO NOT connect the battery until the procedure instructs you to do so. Never wear jewelry or other metallic items on your fingers, arms, or neck when working near electrical components. Metal items can accidentally make an electrical connection and cause injury.

Before performing any tests or adjustments, block the lift truck to prevent unexpected movement.

The capacitors in the transistor controllers can hold an electrical charge after the battery is disconnected. To prevent an electrical shock and personal injury, discharge the internal or external capacitors before inspecting or repairing any component in the electrical compartments. Make certain that the battery has been disconnected.

DO NOT short across the motor controller terminals with a screwdriver or jumper wire.

CAUTION

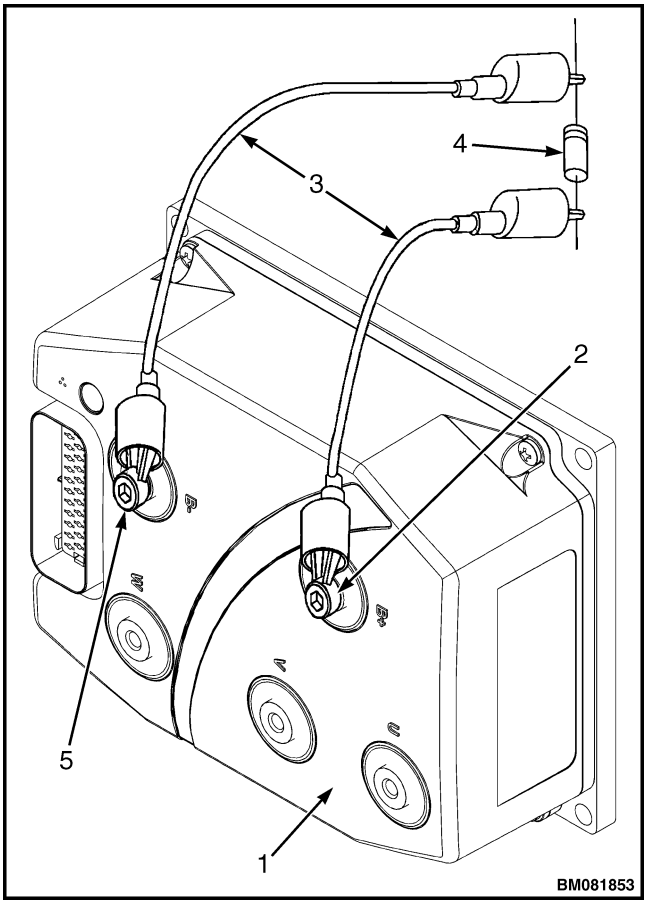
To avoid controller damage, always disconnect the battery, discharge the internal or external capacitors, and never put power to the controller while any power wires are disconnected. Never short any controller terminal or motor terminal to the battery. Make sure to use proper procedure when servicing the controller.

1. Move the lift truck to a safe, level area and completely lower the forks. Turn the key switch to the **OFF** position and attach a **DO NOT OPERATE** tag to the control handle. Block the drive wheel to prevent unexpected movement.
2. Disconnect the battery power cable connector from the truck connector located on the top-left side of the frame. Pull the battery cable connector handle to separate the battery connector from the truck connector.
3. Remove the operator compartment cover.
4. Discharge the internal or external capacitors in the controllers by connecting a 200-ohm, 2-watt resistor across the controller B(+) and B(-) terminals of the combination controller. Remove the resistor after discharging the capacitors. See Figure 9030-03-1.

ELECTRICAL TEST EQUIPMENT

Before beginning intrusive circuit checks, verify the vehicle battery state of charge. Visually inspect suspected connectors for loose, damaged, or corroded terminals. Check for blown fuses and inspect circuits for cause of overcurrent conditions. Physically check mechanical operation to ensure a switch, relay, or solenoid is not sticking or damaged.

NOTE: Measuring continuity between two terminals of a switch while operating the switch will determine its functionality.



1. TRACTION CONTROLLER
2. POSITIVE CONNECTION
3. INSULATED JUMPER WIRES
4. 200-OHM, 2-WATT RESISTOR
5. NEGATIVE CONNECTION

Figure 9030-03-1. Discharging the Capacitors

PC Service Tool

The PC Service Tool is a Windows based service application that is used to communicate with the truck's electrical control system. It can be used to monitor the status and condition of various systems. With this capability, the PC Service Tool can be used to monitor component operation, or determine if abnormal events have occurred in the truck, and assist with diagnostics and troubleshooting.

Digital Multimeter (DMM)

Digital multimeters provide several measurement functions in one tool. A DMM should be capable of accurately measuring voltage, amperage, and resistance. Ensure that the multimeter used in troubleshooting procedures is accurate and that the test leads do not have excessive resistance. A faulty meter or damaged test leads will cause inaccurate readings and incorrect electrical diagnoses.

Jumper Wires, Test Leads, and Test Lights

When using jumper wires, test leads, and test lights, take care not to force tips into connector sockets. Use appropriate clips and adapters to prevent damage to connectors. Expanded or damaged sockets can cause poor continuity between connections.

Jumper wires allow testing across a suspected open in the circuit. Jumper wires can be used for located opens, shorts, and performing voltage drops. If a circuit operates correctly with the jumper wire in place, and is faulty when the jumper wire is removed, a fault can be found in the bypassed location.

Jumper wires can also be used to eliminate sections of the circuit to diagnose either power or grounds. Using the jumper wire to provide a component a known good ground can help reduce the amount of checks needed to diagnose a circuit.

Jumper wires can be used to bypass components such as switches. If a faulty switch is suspected, removing it from the circuit with a jumper wire can determine if a switch or component is at fault.

Jumper wires can be used to check for open or faulty relay contacts which are often sealed and can take additional steps to properly diagnose.

Test lights can be used when quick voltage or ground checks are necessary. Many features operate on switched voltage, and using a test light as a load device may be helpful. The test light may also be used to verify continuity to B-. Discretion should be used when troubleshooting a circuit using a test light, as the light may illuminate even though there may be an excessive amount of resistance on the ground circuit or when a low voltage or amperage situation exists.

Basic Electrical Troubleshooting

ELECTRICAL CHECKS

The following electrical checks are used to diagnose circuit and component faults on trucks. Review the following information so that it may be applied when diagnosing a fault or status code.

Voltage Checks

Voltage is electrical pressure or force that pushes current through a circuit. The force is measured in volts.

Low voltage to a load device will cause the device to be inoperative or operate poorly. This can be caused by a low battery source, high circuit resistance, poor connections, or an open circuit; the resistance of poor connections or poor ground acts as an additional load in the circuit, causing low voltage pushing current, or amperage, through a device.

A voltmeter is used to perform:

- Measurement of force
- Presence of voltage
- Voltage drops

When using a voltmeter to determine if voltage is present and capable of operating a device, connect the positive meter lead to the power circuit of a device's connector and connect the negative meter lead to the negative battery terminal.

Measuring the voltage drop is performed by connecting the positive test lead to the positive side of the device while simultaneously connecting the negative meter lead to the negative side of the device. The test can also be performed across a section of wire that is faulty and suspected of having excessive resistance. A voltage drop must be performed while the device is operating. In a circuit with a single load device, the device will drop the total voltage of the circuit. If the device drops less than battery voltage, it can be assumed that the circuits are using the remaining voltage as a source of excessive resistance or a poor connection exists, assuming the battery state-of-charge is correct.

1. Verify battery connectors for loose terminals and appropriate crimping. Measure voltage between terminal before FU1 and B(-).

NOTE: Key in ON position.

Is voltage 24 ± 2.5 Vdc?

YES- Proceed to Step 3.

NO- Disconnect battery and proceed to Step 2.

2. Measure resistance between truck frame and each of the following test points:

- Battery postivie wire after FU1
- B(+) and B(-)
- U-Phase cable
- V-Phase cable
- W-Phase cable
- Pump positive cable
- Pump negative cable

Is resistance ≥1M ohm?

YES- Charge battery, perform battery maintenance, for non-maintenance free batteries, read battery Specific Gravity level to be within manufacturer specification.

NO- Inspect for all cable insualtion throughout the truck. Inspect battery corrosion around terminals for proper crimping.

3. Measure battery voltage between terminal after FU1 and B(-).

NOTE: Key in ON position.

Is voltage 24 ± 2.5 Vdc?

YES- Proceed to Step 5.

NO-Proceed to Step 4.

4. Measure continuity of Fuse FU1.

Is resistance <1 ohm?

YES- Proceed to Step 5.

NO- Replace Fuse FU1.

5. Ensure battery disconnect switch in UP position, measure voltage between TS04 and B(-).

Is voltage same as battery voltage?

YES- Proceed to Step 6.

NO- Verify TS04 and TS05 terminal connections. Refer to **ELECTRICAL SYSTEM 2200SRM1508** for battery disconnect switch checks.

6. Measure continuity of Fuse FU2.

Is resistance <1 ohm?

YES- Proceed to Step 7.

NO- Replace Fuse FU2.

7. Measure resistance between key switch terminals TS04 and TS05.

Is resistance <1 ohm?

YES- Inspect CPS 01 socket 1 for appropriate crimping in terminals. Inspect voltage between CPS01 socket 1 and B(-) to be same as battery voltage. If not, inspect circuit 010 for excessive resistance, damage, loose, or open connections.

NO- Inspect key switch terminals to be appropriately connected. If connections are clean and secure and resistance is ≥1 ohm, replace key switch.

Amperage Checks

An ammeter is used to measure amperage or current flow through a circuit. An ampere is the measurement of electron flow, which can be used to measure the amount of electrons that are flowing through a circuit. Ohm's Law states that current flow in a circuit is equal to the circuit voltage divided by total circuit resistance, known as the potential difference. Since amperage is the current in the circuit, increasing voltage also increases the current, or amperage levels.

Measuring amperage is always performed by placing the ammeter in series with the device or circuit. This will cause all current to flow through the protected meter. The circuit must be operating in order to measure amperage. Never measure amperage on high amperage circuits or in parallel to a circuit, this can result in the damage of the meter and the electrical system.

Resistance Checks

The ohmmeter is used to measure a circuit or device's resistance in ohms. Ohmmeters use low internal voltage and current which flow through an isolated circuit or device being tested. The voltage of the meter battery and the amount of current flow in the circuit are used to calculate the circuit's resistance. It is necessary to disconnect or isolate the circuit being test so not to damage the vehicle's electrical system or the ohmmeter.

An ohmmeter is used to perform:

- Resistance of a load device
- Resistance of conductors
- Value of resistors
- Operation of variable resistors
- CANbus termination resistors
- Continuity

Contactor and Contactor Coil Checks

1. Measure voltage between the coil's positive terminal and B(-).

NOTE: Key in ON position.

Is voltage same as truck's battery voltage?

YES- Proceed to Step 2.

NO- Inspect the Coil's battery B(+) input circuit for open or short.

2. Disconnect coil's ground control circuit. Measure resistance between ground circuit terminal and B(-).

NOTE: Actuate coil ground control to determine if controller is sending activation signal to coil.

Is resistance <1 ohm?

YES- Proceed to Step 3.

NO- Inspect ground control circuit. Verify that controller is receiving device input signal.

3. Measure battery voltage between main contactor's battery B(+) terminal and B(-).

NOTE: Key in ON position.

Is voltage same as truck's battery voltage?

YES- Repair or replace faulty contactor.

NO- Inspect main contactor battery cable for loose, damaged, or corroded connections.

Lift and Lower Switch Check

1. Operate lift/lower switch.

Does status code display if truck does not respond to lift and lower command?

YES- Proceed to status code description section within this manual to address the status code.

NO- Inspect lift and lower switches at tiller head.

Lower Function Fault

If the lower function is inoperative and no code has been displayed, perform the following troubleshooting procedures:

1. Open tiller head assembly and inspect tiller card.

Are lower switches connected to tiller card connectors JP12 and JP15?

YES- Proceed to Step 2.

NO- Connect switches.

2. Disconnect JP12 and connect meter probes at switch connector sockets (blue and black leads) and operate switch.

Is resistance <1 ohm?

YES- Proceed to Step 3.

NO- Replace faulty switch.

3. Measure resistance of tiller card switch JP12, pin 1 and pin 3.

Is resistance 2.7K ohms ± 0.27K ohms

YES- Proceed to Step 4.

NO- Replace faulty switch.

4. Measure resistance of tiller card switch JP15, pin 1 and pin 2.

Is resistance 1.4K ohms ± 0.14K ohms

YES- Suspect faulty tiller card.

NO- Replace faulty switch.

Lift Function Fault

If the lift function is inoperative and no code has been displayed, perform the following troubleshooting procedures:

1. Open tiller head assembly and inspect tiller card.

Are lower switches connected to tiller card connectors JP10 and JP14?

YES- Proceed to Step 2.

NO- Connect switches.

2. Disconnect JP10 and connect meter probes at switch connector sockets (blue and black leads) and operate switch.

Is resistance <1 ohm?

YES- Proceed to Step 3.

NO- Replace faulty switch.

3. Measure resistance of tiller card switch JP10, pin 1 and pin 3.

Is resistance 2.7K ohms ± 0.27K ohms

YES- Proceed to Step 4

NO- Replace faulty switch.

4. Measure resistance of tiller card switch JP14, pin 1 and pin 2.

Is resistance 1.4K ohms ± 0.14K ohms

YES- Suspect faulty tiller card.

NO- Replace faulty switch.

Multiplexing

MULTIPLEXING AND THE CANBUS

Controller Area Network (CAN) Bus communication allows multiple modules to communicate with each other using the same digital data on a shared network, this method of communication is known as multiplexing. The CANbus is a pair of twisted insulated wires that interconnect all the modules on the network. The data transmitted is a digital encoded format. Digital means only two states are used to transmit data, High/On and Low/Off. This eliminates the need for each module to be hard wired to each sensor. Using Multiplexing, sensor information that may be received by one module, can then be shared with all other modules. The information is sent out over the CANbus in an encoded form and any other module that requires the information can pick it out from the data stream.

The CANbus has two termination resistors (120 ohms) that are connected in parallel. When resistance checks are performed, a normal operating system will display 60 ohms between the CAN LO and CAN HI circuits.

The first 120 ohm termination resistor is located inside the Tiller Control Card. To diagnose, proceed to Troubleshooting the Tiller Control Card Termination Resistor.

The second 120 ohm termination resistor is located in the Traction Controller. To diagnose, proceed to Troubleshooting the Traction Controller Termination Resistor.

Troubleshooting the CANbus

NOTE: Refer to the latest Diagram SRM for the most current circuit information.

When the CANbus is active and modules are communicating, CAN HI and CAN LO voltage will be approximately 5 volts when added together. If both CAN HI and CAN LO have consistent 2.5 volt, there is no communication on the CANbus.

If CAN HI is shorted to B(-) or CAN LO is shorted to battery voltage, network communication will stop.

If you measure battery voltage on the data link, there is a short to power in the circuit.

If you measure 0 volts while the CANBus is active, there is a short to B(-) or an open in the circuit.

Internal control module failures can stop the entire network from communicating. If there are no harness problems, disconnect control modules one at a time until CANbus communication returns.

With both 120 ohm termination resistors connected to the CANbus, resistance between the two circuits should read 60 ohms.

If CANbus resistance is 120 ohms, there is an open circuit or a termination resistor is missing.

If resistance is 0 ohms, the two circuits are shorted together.

1. Measure voltage between the diagnostic connector, socket A and B(-).

NOTE: Key in ON position.

Is voltage approximately 2.5 volts?

YES- Proceed to Step 2.

NO- Inspect CAN HI circuit for open or short; if voltage is 0 volts, the CAN HI circuit is shorted to B(-) or open. If voltage is above 5 volts, the CAN HI is shorted to power.

2. Measure voltage between the diagnostic connector, socket B and B(-).

NOTE: Key in ON position.

Is voltage approximately 2.5 volts?

YES- Disconnect the battery and proceed Step 3.

NO- Inspect the CAN LO circuit for open or short; If voltage is 0 volts, the CAN LO circuit is shorted to B(-) or open. If voltage is above 5 volts, the CAN LO is shorted to power.

3. Measure resistance between the diagnostic connector, socket A and socket B.

Is resistance 60 ± 6 ohms?

YES- CANbus communication is operating correctly.

NO- If resistance is 120 ohms; the CANbus has an open circuit, missing, or damaged termination resistor. If resistance is 0 ohms, the CANbus circuits are shorted together. If resistance is open; the CAN HI and/or CAN LO connection to the diagnostic port may be open. Use the wiring diagrams to detect and correct open circuit.

Troubleshooting the Tiller Control Card Termination Resistor

Disconnect all Tiller Control Card connectors and components.

1. Measure resistance between the Tiller Control Card connector CJ2, pin 1 and pin 2.

Is resistance 120 ± 12 ohms?

YES- Reconnect the Tiller Control Card connectors, components, and proceed to Troubleshooting the Traction Controller Termination Resistor.

NO- Replace Tiller Control Card.

Troubleshooting the Traction Controller Termination Resistor

Disconnect all Traction Controller connectors, cables, and components.

1. Measure resistance between the Traction Controller connector CPS01, pin 21 and pin 34.

Is resistance 120 ± 12 ohms?

YES- Reconnect the Traction Controller connectors, cables, components, and proceed to Troubleshooting the CANbus.

NO- Replace Traction Controller.

User Interface

USER INTERFACE, SETUP, AND TROUBLESHOOTING

The dash display has a LCD screen for displaying truck system information. The dash display also contains a battery state-of-charge indicator.

Status Code Indication

This feature indicates if a status code is available. If a status code is present, the fault code number followed by the status code description will be displayed. If other status codes are present, it will display the subsequent status code and description. Two seconds will lapse between display screens before displaying the code sequencing.

PARAMETERS

Utilize the User Interface to access and adjust parameters. Not all parameters will be available and will vary between truck applications.

Speed Steering Reduction

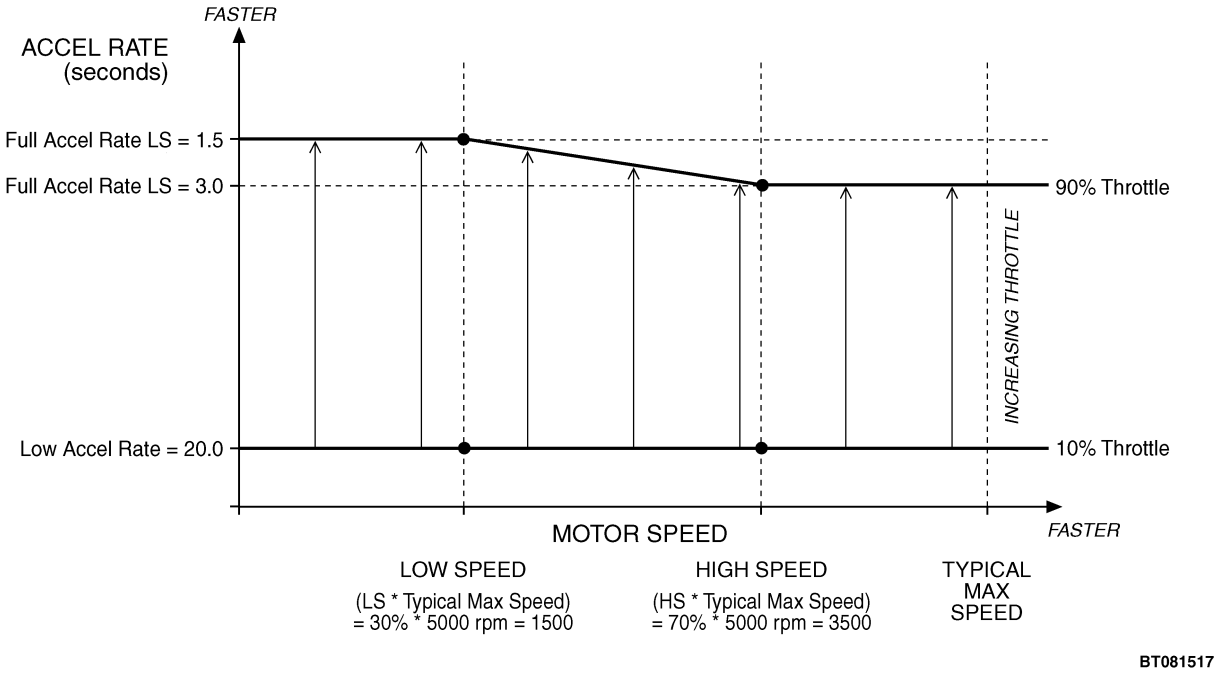
This optional parameter defines the speed reduction that the motor will target from its current level once the speed reduction sensor changes from ON to OFF. If parameter is set at 75%, and the truck was been driven at 1000 RPM, upon steering the motor will decelerate to 750 RPM.

Traction Steering Decel Ramp

This optional parameter will determine the time that it will take the motor to decelerate from current speed to speed determined by Speed Steering Reduction parameter. Larger values represent slower response.

Response-Full Accel Rate HS

This parameter will set the rate (in seconds) at which the speed command increases when full throttle is applied at high vehicle speeds. Larger values represent slower response. See Figure 9030-03-2 for relationship between Full Accel Rate HS, Full Accel Rate LS, and Low Accel Rate.



NOTE: IN THIS EXAMPLE, HS = 70%, LS = 30%, TYPICAL MAX SPEED = 5000 RPM

Figure 9030-03-2. Acceleration Response Rate Diagram

Response-Full Accel Rate LS

This parameter sets the rate (in seconds) at which the speed command increases when full throttle is applied at low vehicle speeds.

Response-Low Accel Rate

This parameter sets the rate (in seconds) at which the speed command increases when a small amount of throttle is applied. This rate is typically adjusted to affect low speed maneuverability.

Response-Neutral Decel Rate HS

This parameter sets the rate (in seconds) that is used to slow down the vehicle when the throttle is released to neutral at high vehicle speeds.

Response-Neutral Decel Rate LS

This parameter sets the rate (in seconds) that is used to slow down the vehicle when the throttle is released to neutral at slow vehicle speeds.

Fine Tuning-Partial Decel Rate

This parameter sets the rate (in seconds) that is used to slow down the vehicle when the throttle is reduced without being released to neutral. Larger values represent slower response.

Fine Tuning-HS (High Speed)

This parameter sets the percentage of the Typical Max Speed above which the “HS” parameters will be used.

Fine Tuning-LS (Low Speed)

This parameter sets the percentage of the Typical Max Speed below which the “LS” parameters will be used.

Fine Tuning-Reversal Soften

This parameter, when set to larger values create a softer reversal from regen braking to drive when near zero speed. The parameter will soften the transition when the regen and drive current limits are set to different values.

Fine Tuning-Max Speed Accel

In some applications, the Max Speed value is changed frequently over the CANbus. The Max Speed Accel parameter controls the rate at which the maximum speed setpoint is allowed to change when the value of Max Speed is raised. The rate set by this parameter is the time to ramp from 0 RPM to Typical Max Speed RPM. If Max Speed is raised from 1000 RPM to 3000 RPM, the Typical Max Speed is 3200 RPM and the rate is 10.0 seconds, it will take 10.0 * (3000–1000) / 3200 = 6.25 seconds to ramp from 1000 RPM to 3000 RPM.

Fine Tuning-Max Speed Decel

This parameter is like the Max Speed Accel parameter, except that it controls the rate at which the maximum speed setpoint is allowed to change when the value of Max Speed is lowered. If one changes Max Speed from 300 RPM to 1500 RPM, the Typical Max Speed is 3200 RPM, and the rate is 5.0 seconds, it will take 5.0 * (3000–1500) / 3200 = 2.34 seconds to ramp from 3000 RPM to 1500 RPM.

Interlock Timeout

This parameter will set the time for which the truck can remain at idle condition while the arm is in operational region B. See Figure 9030-03-3.

Mode (1 through 3) -Max Speed

This parameter defines the maximum requested motor rpm at full throttle.

$RPM = V_{\mathbf{Desired}} * 936$

Example: RPM = 2.5MPH * 936 = 2340 rpm

Mode (1 through 3) -Max Accel

This parameter sets the rate (in seconds) at which the motor speed command increases when throttle is applied. Larger values represent slower response.

Mode (1 through 3) -Walk Accel

This parameter sets the rate (in seconds) at which the motor speed command increases when throttle is applied, when truck is not in turtle mode. Larger values represent slower response.

Mode (1 through 3) -Max Decel

This parameter sets the rate (in seconds) that is used to slow down the vehicle when the throttle is reduced. Larger values represent slower response.

Mode (1 through 3) -Neutral Braking

This parameter adjusts how neutral braking occurs progressively when the throttle is reduced toward the neutral position or when no direction is selected.

Mode (1 through 3) -Max Braking

This parameter sets the rate (in seconds) at which the vehicle slows down when full brake is applied or when throttle is applied in the opposite direction.

Max Speed TM2

This parameter defines the maximum requested motor rpm at full throttle when the truck is driven in Advance Turtle mode in region B. See Figure 9030-03-3.

Max Accel TM2

This parameter sets the rate (in seconds) at which the motor speed command increases when throttle is applied. This parameter is applicable only while the truck is driven while in Advance Turtle Mode. Larger values represent slower response.

Max Decel TM2

This parameter sets the rate (in seconds) that is used to slow down the vehicle when the throttle is reduced. Larger values represent slower response.

Neutral Braking TM2

Neutral braking occurs progressively when the throttle is reduced toward the neutral position or when no direction is selected. This This parameter is applicable only while the truck is driven while in Advance Turtle Mode.

Max Braking TM2

This parameter sets the rate (in seconds) at which the vehicle slows down when full brake is applied or when throttle is applied in the opposite direction. This parameter is applicable only while the truck is driven while in Advance Turtle Mode.

Turtle Alarm enable

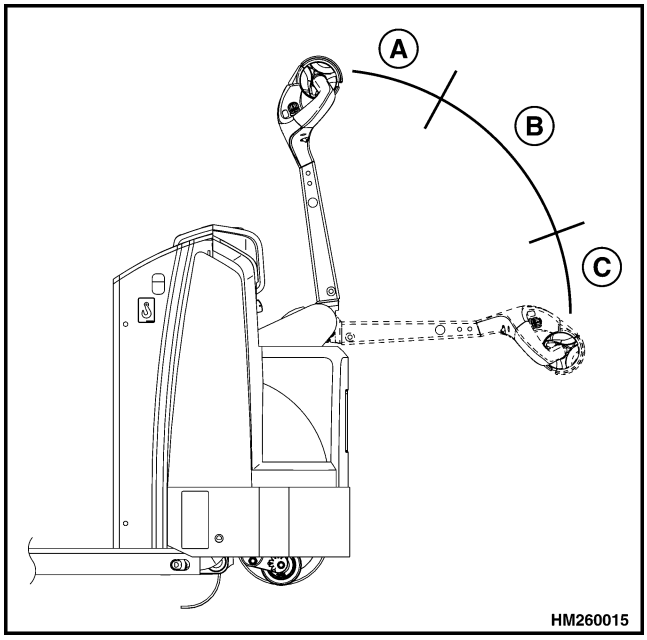
This parameter sets an alarm to indicate when the truck has transition from turtle mode (TM1) to turtle mode 2 (TM2). The truck will transition from TM1 to TM2 when the truck is been driven in TM1 and turtle button is depressed while tiller arm transition from operational region A to operational region B. See Figure 9030-03-3.

Quick Lift Window

This optional parameter defines the minimum amount of time that the lift button needs to be depressed to activate Quick Lift.

Initial Lift Interval

This optional parameter sets the period of time for which the truck will lift upon Quick Lift command. It shall be enough to lift up the load from the ground so that load wheels can move freely.



A. OPERATIONAL REGION A
B. OPERATIONAL REGION B
C. OPERATIONAL REGION C

Figure 9030-03-3. Operational Regions

Full Lift Interval

This optional parameter sets the period of time for which the truck will lift once traction is commanded while Quick Lift mode.

Lift Run Time

This parameter sets the maximum allowable time to have the motor pump running upon lift command.

BDI Warning (Lift Lock) Enable

This parameter enables the truck to lock the lift function when BDI reaches a given percent

Warning BDI (Lift Lock Out Percent)

This parameter will set the battery discharge percentage at which the truck will lock the lift function

Battery-BDI Reset Volts

The reset voltage level is checked only once, when KSI is first turned on. Note that the BDI Reset Percent parameter also influences the algorithm that determines whether BDI Percentage is reset to 100%. Reset Volts Per Cell should always be set higher than Full Volts Per Cell.

Battery- BDI Full Volts

The full voltage level sets the Keyswitch Voltage that is considered to be state-of-charge; when a loaded battery drops below this voltage, it begins to lose charge. The BDI (battery discharge indicator) algorithm continuously calculates the battery state-of-charge whenever KSI is on.

Battery-BDI Empty Volts

The empty voltage level sets the Keyswitch_Voltage that is considered to 0% state-of-charge when the truck is been used (loaded conditions). The BDI (battery discharge indicator) algorithm continuously calculates the battery state-of-charge whenever KSI is on.

Battery-BDI Discharge Time

This parameter has two functions:

- Sets the minimum time for the BDI to count down from 100% to 0%. If upon verification battery voltage is below corresponding BDI percent, BDI percent will decrement by one percentage point.
- Sets the frequency at which the BDI will check the battery voltage. If upon verification battery voltage is below corresponding BDI percent, BDI percent will decrement by one percentage point.

Battery-BDI Reset Percent

When a battery has a high BDI percentage, its float voltage at KSI On can sometimes cause false resets. The BDI Reset Percent parameter addresses this problem by allowing the user to define a BDI Percentage value above which the BDI Percentage variable will not reset.

Undervoltage Cutback Range

Severe Undervoltage = Undervoltage point – Undervoltage Cutback Range or Brownout voltage (15V) whichever is higher. This parameter sets the voltage range between the Undervoltage and Severe Undervoltage points. A Severe Undervoltage fault will be set if the capacitor voltage falls below either the Severe Undervoltage point (drive current limit set to 0) or the Brownout voltage (bridge disabled, motor current set to 0).

User Undervoltage

Undervoltage = Either Min Voltage controller voltage (16.8V) or User Undervoltage × Nominal Voltage, whichever is higher. The User Undervoltage parameter can be used to adjust the undervoltage threshold, which is the voltage at which the controller will cut back drive current to prevent damage to the electrical system. The undervoltage threshold can never be lowered below the controller's power base minimum voltage rating.

Total Maintenance Enable

This parameter will activate BDI maintenance reminder for truck to be serviced after certain amount of total hours have been accumulated in the hour meters.

Traction Maintenance Enable

This parameter will activate BDI maintenance reminder for truck to be serviced after certain amount of Traction hours have been accumulated in the hour meters.

Pump Maintenance Enable

This parameter will activate BDI maintenance reminder for truck to be serviced after certain amount of Pump hours have been accumulated in the hour meters.

Maintenance Interval

This parameter will sets the time interval at which the truck shall receive regular maintenance.

Reset Total Maintenance

This parameter will set back to zero the maintenance interval counter.

Reset Traction Maintenance

This parameter will set back to zero the maintenance interval counter.

Reset Pump Maintenance

This parameter will set back to zero the maintenance interval counter.

Status Codes and Descriptions

STATUS CODES

Status codes give an indication to the operator that a possible malfunction or incorrect truck use has occurred. Status codes are a code number of a symptom or malfunction. The wrench symbol will flash and the status code number will be shown on the LCD screen if an incorrect truck use or malfunction occurs during operation. Have an authorized service person check and repair the lift truck if a status code number appears. The symptoms for each status code are shown in this manual. This manual also provides in-depth troubleshooting procedures for each fault broken down into the following system or node:

NODE 30: TRACTION CONTROLLER

NODE 60: TILLER CARD

Status Codes are displayed as four lines. Line one consist of the Node and Code number. The second line consists of the Node name while lines three and four contain code descriptions.

Table 9030-03-1. Status Code Example

DISPLAY	LINE DESCRIPTION
First Display String	Diagnostic Trouble Code
Subsequent Display String	Code Description/Affected Circuit

STATUS CODE DESCRIPTIONS

Table 9030-03-2. Node 30 Status Codes

NODE	STATUS	DESCRIPTION
XX	099	***Internal Fault****
30	001	The Traction Controller has detected a fault in the Lift Coil circuit.
30	003	The Traction Controller has detected a fault in the Lower Coil circuit.
30	033	The Traction Controller has detected a fault in the Main Contactor Coil circuit.
30	035	The Traction Controller had detected a fault in the Brake Coil circuit.
30	037	The Traction Controller has detected a fault in the Audible Alarm circuit.
30	039	The Traction Controller has detected a fault in the Optional Audible Alarm circuit.
30	052	The Traction Controller has detected a fault in the Beverage Handle Option, Thumb Lift/ Lower Switch circuit.

Table 9030-03-2. Node 30 Status Codes (Continued)

NODE	STATUS	DESCRIPTION
30	060	The Traction Controller has detected high current in the traction motor or traction motor circuit.
30	061	The Traction Controller has detected a open/short in the Traction Motor or circuit.
30	062	The Traction Controller has detected a motor encoder fault.
30	067	The Traction Controller has detected that the Main Contactor is stuck closed or has welded tips.
30	068	The Traction Controller has detected that the Main Contactor is not closed or stuck open.
30	069	The Traction Controller has detected a fault in Capacitor charge.
30	080	The Traction Controller has detected the motor operating at high temperatures/Cutback Mode.
30	082	The Traction Controller is operating at high temperatures/Cutback Mode.
30	083	The Traction Controller has detected temperatures above controllers operating range.
30	086	The Traction Controller has detected Low DC Bus Voltage or a fault in the DC Bus circuit.
30	087	The Traction Controller has detected High DC Bus Voltage or a fault in the DC Bus circuit.
30	090	The Traction Controller has detected a fault in the 5 volt/12 volt output supply.
30	106	The Tiller Card is not communicating on the CANbus.
30	201	The Traction Controller has detected a Throttle release fault.
30	227	The Traction Controller has detected that the traction motor has stalled.
30	231	The Traction Controller has set the maintenance reminder.
30	232	The Traction Controller has detected software update request.
30	247	The Traction Controller has detected parameter update request.
30	248	The Traction Controller has detected temperatures below controller operating range.
The Traction Controller and Tiller Control Card can detect an internal fault and is capable of reporting a 099 Status Code. Refer to the XX099 Status Code troubleshooting procedures for all Internal Fault Codes regardless of what Node has reported the fault.		

Table 9030-03-3. Node 60 Status Codes

NODE	STATUS	DESCRIPTION
60	050	The Tiller Control Card has detected a Belly Switch Mismatch fault.
60	210	The Tiller Control Card has detected a Belly Switch release fault.
60	211	The Tiller Control Card has detected a Tiller Arm release fault.

Group 20
Diagnostic Trouble Codes

DTC XX099
Internal Fault

POSSIBLE CAUSE

A. INTERNAL FAULT

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM.
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - INTERNAL FAULT

PROCEDURE OR ACTION:

1. Replace faulty controller or tiller card. Make sure to indicate the Diagnostic Trouble Code on the warranty claim to include an accurate problem description leading to controller replacement.

END POSSIBLE CAUSES

END FAULT

DTC 30001
LiftCoil

POSSIBLE CAUSE

A. LIFT COIL WIRING FAULT

B. LIFT COIL FAULT

C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM ..
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - LIFT COIL WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Disconnect pump coil terminals TS11 and TS12 located on left side of traction controller. Turn key to ON position.

1. Measure voltage between pump coil terminal TS11 and B(-).
   Is voltage 24 ± 2.5 Vdc?
   YES: Disconnect battery and proceed to Step 2.
   NO: Inspect circuit 239 for open or short.
2. Disconnect connector CPS01 and measure resistance between socket 4 and the pump coil terminal TS11.
   Is resistance <1 ohm?
   YES: Connect CPS01, connect battery, and proceed to Step 3.
   NO: Inspect circuit 028 for open, short, or source of excessive resistance.
3. Measure voltage between pump coil terminal TS12 and B(+) while operating tiller card lift switch.
   Is voltage 24 ± 2.5 Vdc?
   YES: Disconnect battery and proceed to Cause B.
   NO: Proceed to Cause C.

DTC 30001 (Cont)
LiftCoil

CAUSE B - LIFT COIL FAULT

PROCEDURE OR ACTION:

1. At the pump coil contacts, measure resistance between the parallel terminal tabs.
   Is resistance 55 ± 5.25 ohms?
   YES: Proceed to Cause C.
   NO: Replace faulty lift coil.

CAUSE C - FAULTY TRACTION CONTROLLER

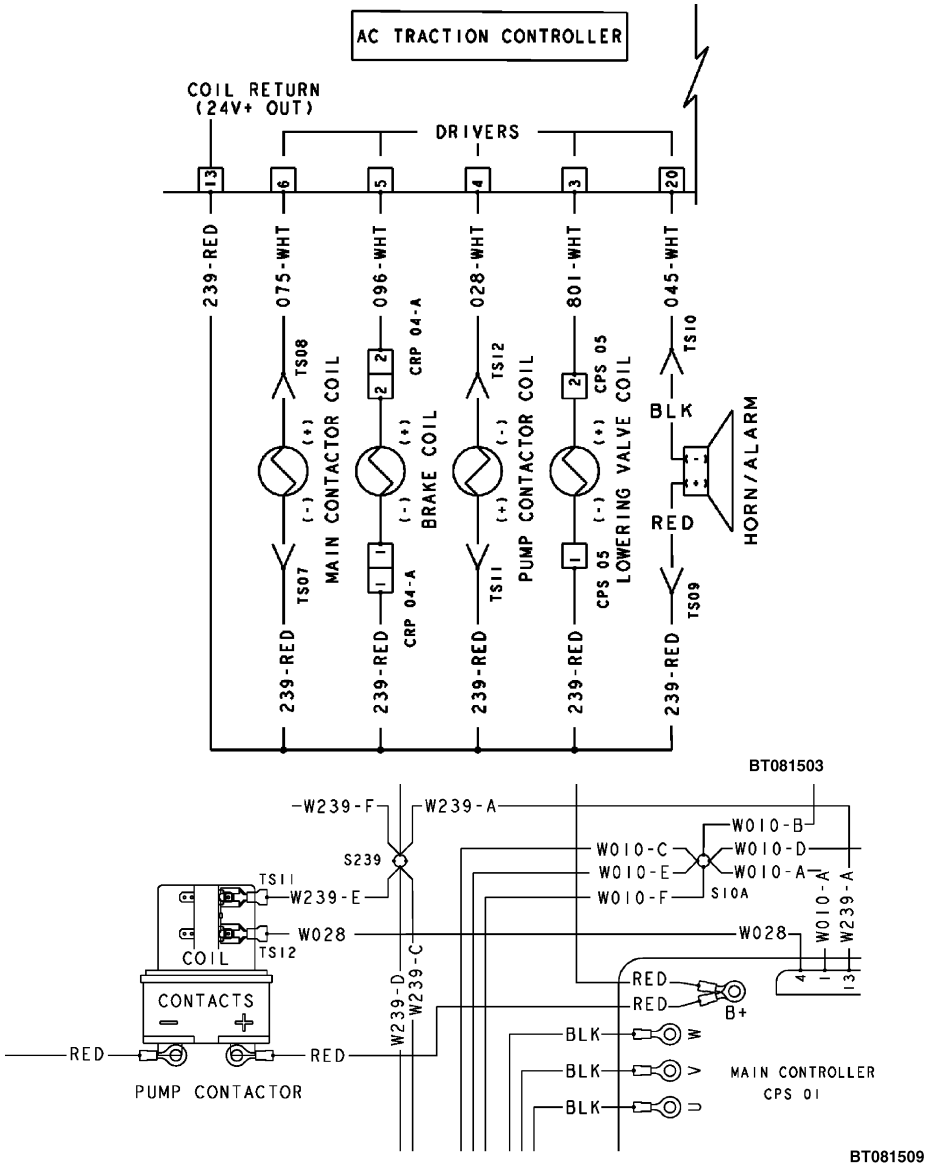
PROCEDURE OR ACTION:

1. If no faults are found, replace controller. Make sure to indicate the DTC code(s) on the warranty claim to include an accurate problem description leading to controller replacement.

END POSSIBLE CAUSES

DTC 30001 (Cont)
LiftCoil

DIAGRAMS



Lift Coil and Pump Contactor

END FAULT

DTC 30003
LwrCoil

POSSIBLE CAUSE

A. LOWER COIL WIRING FAULT

B. LOWER COIL FAULT

C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM ..
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - LOWER COIL WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Disconnect lower coil connector CRS05 located within hydraulic pump motor and turn key to ON position.

1. Measure voltage between lower coil connector CRS05, socket 1 and B(-).
   Is voltage 24 ± 2.5 Vdc?
   YES: Disconnect battery and proceed to Step 2.
   NO: Inspect circuit 239 for open or short.
2. Disconnect lower coil connector CPS01 and measure continuity between CRS05, socket 2 and CPS 01, socket 3.
   Is resistance <1 ohm?
   YES: Connect CPS01, connect battery, and proceed to Step 3.
   NO: Inspect circuit 801 for open, short, or source of excessive resistance.
3. Measure voltage between CRS05, socket 2 and B(+) while operating tiller card lower switch.
   Is voltage 24 ± 2.5 Vdc?
   YES: Disconnect battery and proceed to Cause B.
   NO: Proceed to Cause C.

DTC 30003 (Cont)
LwrCoil

CAUSE B - LOWER COIL FAULT

PROCEDURE OR ACTION:

1. Measure resistance between the parallel terminal tabs at the valve coil contacts.
   Is resistance 19 ± 2.0 ohms?
   YES: Proceed to Cause C.
   NO: Replace faulty lower coil.

CAUSE C - FAULTY TRACTION CONTROLLER

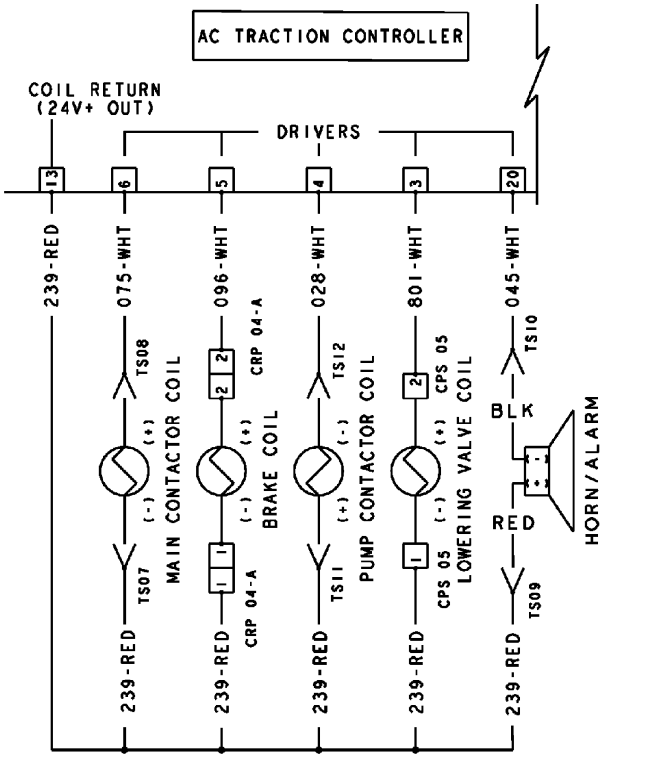
PROCEDURE OR ACTION:

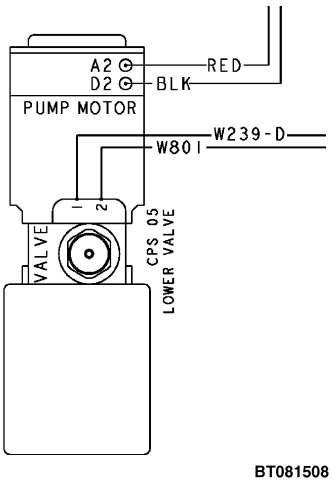
1. If no faults are found, replace controller. Make sure to indicate the DTC code(s) on the warranty claim to include an accurate problem description leading to controller replacement.

END POSSIBLE CAUSES

DTC 30003 (Cont)
LwrCoil

DIAGRAMS





Lower Coil and Pump Motor

END FAULT

DTC 30033
Main Cont

POSSIBLE CAUSE

A. MAIN CONTACTOR COIL WIRING FAULT
B. MAIN CONTACTOR COIL FAULT
C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM .
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - MAIN CONTACTOR COIL WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Key in ON position.

1. Disconnect the main contactor coil's positive socket terminal TS007 and measure voltage between socket terminal TS007 and B(-).
   Is voltage 24 ± 2.5 Vdc?
   YES: Proceed to Step 2.
   NO: Inspect circuit W239-B for open or short.

NOTE: Key in OFF position.

2. Disconnect traction controller connector CPS001 and the contactor coil's negative socket terminal TS008. Measure resistance between the main contactor coil negative socket terminal TS008 and the traction controller connector CPS001, socket 6.
   Is resistance <1 ohm?
   YES: Proceed to Cause B.
   NO: Inspect ground control circuit 075 for open or source of excessive resistance.

DTC 30033 (Cont)
Main Cont

CAUSE B - MAIN CONTACTOR COIL FAULT

PROCEDURE OR ACTION:

NOTE: Key in OFF position.

1. Measure resistance between the main contactor's coil terminals.
   Is resistance 30 ± 3.0 ohms?
   YES: Proceed to Cause C.
   NO: Replace faulty main contactor coil.

CAUSE C - FAULTY TRACTION CONTROLLER

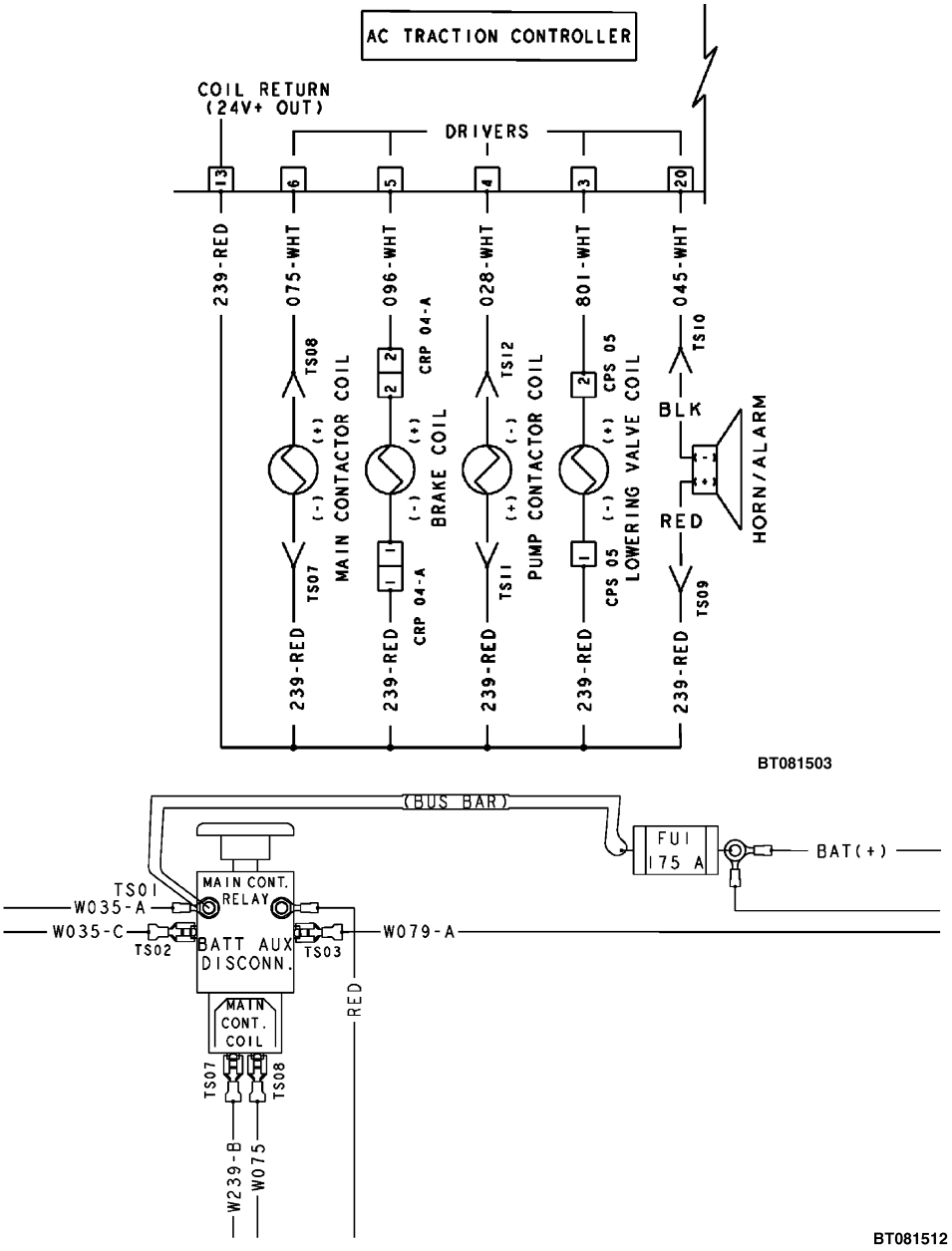
PROCEDURE OR ACTION:

1. If no faults are found, replace controller. Make sure to indicate the DTC code(s) on the warranty claim to include an accurate problem description leading to controller replacement.

END POSSIBLE CAUSES

DTC 30033 (Cont)
Main Cont

DIAGRAMS



Battery Disconnect / Main Contactor and Contactor Coil

END FAULT

DTC 30035
Brake

POSSIBLE CAUSE

A. WIRING FAULT
B. BRAKE COIL FAULT
C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM .
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Fault may be intermittent.

CAUSE A - WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Perform Step 1 with key in ON position.

1. Disconnect CPS01 and measure voltage between CPS01, socket 1 and B(-). Note voltage reading, reconnect CPS01, cycle key switch. Disconnect brake coil connector CRP04-A and measure voltage between CRP04-A, socket 1 and B(-).
   Is voltage same as key switch input?
   YES: Disconnect battery and proceed to Cause B.
   NO: Inspect circuit 239 for open or short.

CAUSE B - BRAKE COIL FAULT

PROCEDURE OR ACTION:

1. Measure resistance between CPS01, socket 5 and CRP04-A, socket 1.
   Is resistance 23 ± 2.3 ohms?
   YES: Proceed to Cause C.
   NO: Replace faulty brake coil.

DTC 30035 (Cont)
Brake

CAUSE C - FAULTY TRACTION CONTROLLER

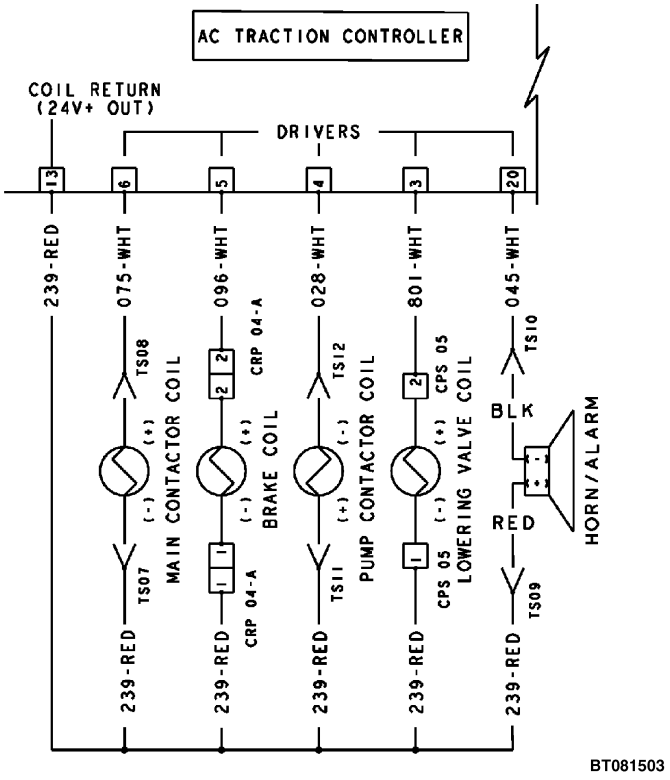
PROCEDURE OR ACTION:

1. If no faults are found, replace controller. Make sure to indicate the DTC code(s) on the warranty claim to include an accurate problem description leading to controller replacement.

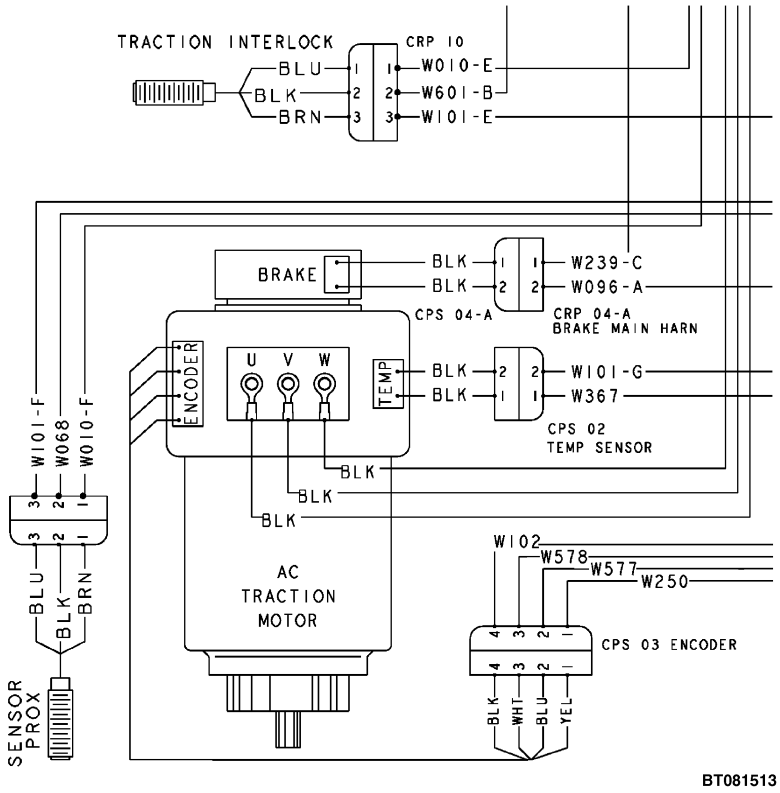
END POSSIBLE CAUSES

DTC 30035 (Cont)
Brake

DTC 30035 BRAKE DIAGRAMS



DTC 30035 (Cont)
Brake



Brake Coil

END FAULT

DTC 30037
AlrmCoil

POSSIBLE CAUSE

A. ALARM WIRING FAULT

B. ALARM FAULT

C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM .
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - ALARM WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Perform Step 1 with key in ON position.

1. Disconnect alarm connector TS09 and measure voltage between socket 1 and B(-).
   Is voltage 24 ± 2.5 Vdc?
   YES: Disconnect battery and proceed to Step 2.
   NO: Inspect circuit 239 for open or short.
2. Disconnect the traction connector CPS01. Measure resistance between the traction connector CPS01, socket 20 and the alarm connector TS09.
   Is resistance <1 ohm?
   YES: Connect traction controller connector CPS01 and proceed to Cause B.
   NO: Inspect ground control circuit 045 for open or short.

DTC 30037 (Cont)
AlrmCoil

CAUSE B - ALARM FAULT

PROCEDURE OR ACTION:

NOTE: Key in ON position.

NOTE: Operate alarm.

1. Measure continuity between the alarm connector TS09 and B(-).
   Is continuity present?
   YES: Replace faulty alarm.
   NO: Proceed to Cause C.

CAUSE C - FAULTY TRACTION CONTROLLER

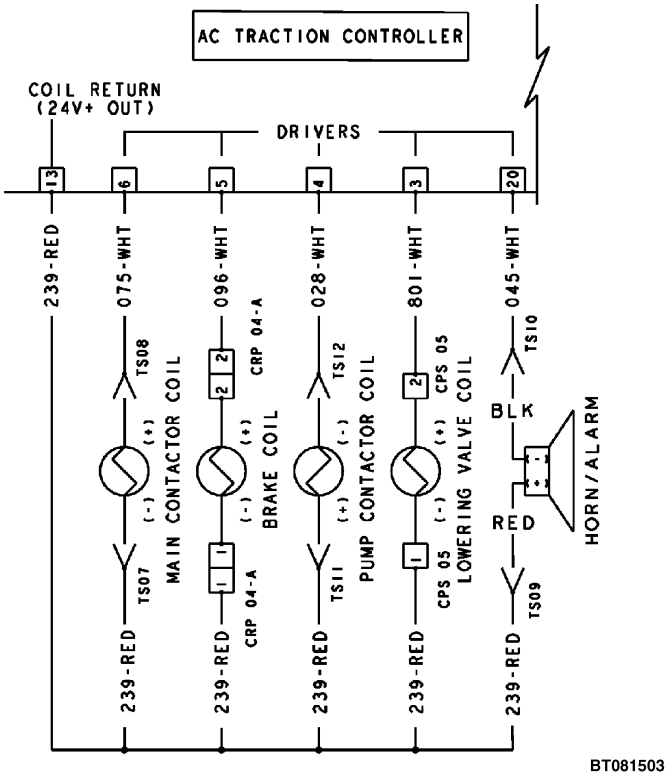
PROCEDURE OR ACTION:

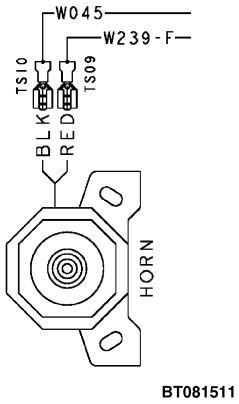
1. If no faults are found, replace controller. Make sure to indicate the DTC code(s) on the warranty claim to include an accurate problem description leading to controller replacement.

END POSSIBLE CAUSES

DTC 30037 (Cont)
AlrmCoil

DIAGRAMS





Horn / Alarm

END FAULT

DTC 30039
Audible Alarm (Opt)

POSSIBLE CAUSE

A. ALARM WIRING FAULT

B. ALARM FAULT

C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM .
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - ALARM WIRING FAULT

PROCEDURE OR ACTION:

NOTE: Perform Step 1 with key in ON position.

1. Disconnect optional alarm connector CPS13 and measure voltage between socket 1 and B(-).
   Is voltage 24 ± 2.5 Vdc?
   YES: Disconnect battery and proceed to Step 2.
   NO: Inspect circuit 010 for open or short.
2. Disconnect the traction connector CPS01. Measure resistance between the traction connector CPS01, socket 2 and the alarm connector CPS13, socket 2.
   Is resistance <1 ohm?
   YES: Connect traction controller connector CPS01 and proceed to Cause B.
   NO: Inspect ground control circuit 728 for open, short, or source of excessive resistance.

DTC 30039 (Cont)
Audible Alarm (Opt)

CAUSE B - ALARM FAULT

PROCEDURE OR ACTION:

NOTE: Key in ON position.

NOTE: Operate optional alarm.

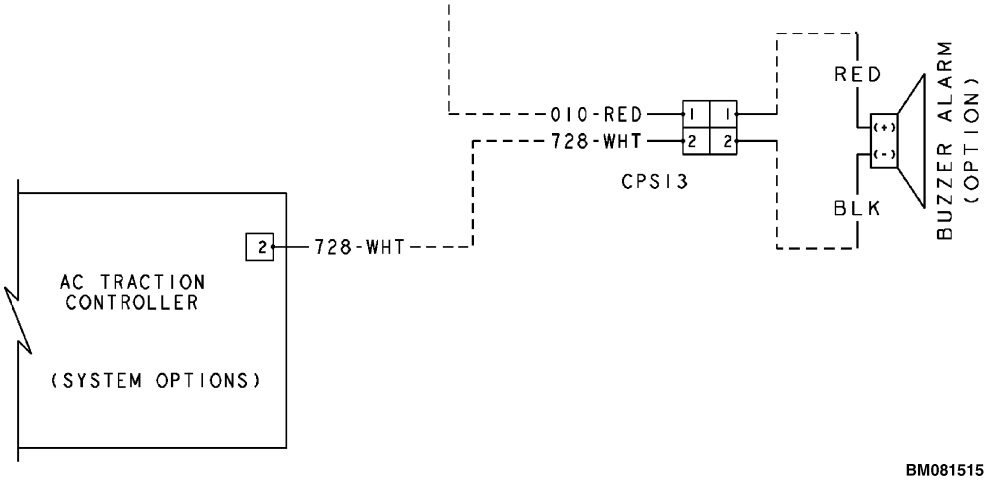
1. Measure continuity between the optional alarm connector CPS13, socket 2 and B(-).
   Is continuity present?
   YES: Replace faulty optional alarm.
   NO: Proceed to Cause C.

CAUSE C - FAULTY TRACTION CONTROLLER

PROCEDURE OR ACTION:

1. If no faults are found, replace controller. Make sure to indicate the DTC code(s) on the warranty claim to include an accurate problem description leading to controller replacement.

END POSSIBLE CAUSES



END FAULT

CODES

DTC 30060 - Mtr Curr
DTC 30061 - Mtr Open

POSSIBLE CAUSE

A. TRACTION MOTOR CABLE FAULT
B. TRACTION MOTOR FAULT
C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM .
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - TRACTION MOTOR CABLE FAULT

PROCEDURE OR ACTION:

1. Inspect controller phase cable terminals for proper torque and connections.
   Are phase cables properly secured?
   YES: Proceed to Step 2.
   NO: Repair and properly torque cables.
2. Disconnect the traction motor cables from the traction controller and traction motor. Measure continuity of individual cables to isolate fault.
   Is continuity present?
   YES: Disconnect battery and proceed to Cause B.
   NO: Repair or replace faulty phase cable.

CAUSE B - TRACTION MOTOR FAULT

PROCEDURE OR ACTION:

1. Measure continuity between the traction motor terminals U and V.
   Is continuity present?
   YES: Proceed to Step 2.
   NO: Repair or replace faulty traction motor.

(Cont)

2. Measure continuity between the traction motor terminals U and W.
   Is continuity present?
   YES: Proceed to Step 3.
   NO: Repair or replace faulty traction motor.
3. Measure continuity between the traction motor terminals W and V.
   Is continuity present?
   YES: Proceed to Cause C.
   NO: Repair or replace faulty traction motor.

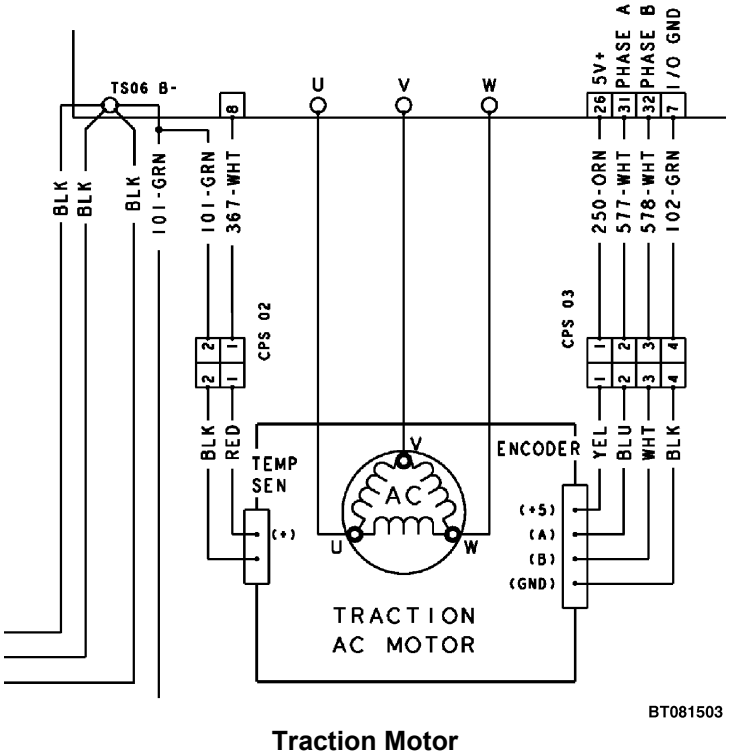
CAUSE C - FAULTY TRACTION CONTROLLER

PROCEDURE OR ACTION:

1. If no faults are found, replace controller. Make sure to indicate the DTC code(s) on the warranty claim to include an accurate problem description leading to controller replacement.

END POSSIBLE CAUSES

DIAGRAMS



Traction Motor

END FAULT

DTC 30062
Encoder

POSSIBLE CAUSE

A. ENCODER WIRING FAULT

B. ENCODER FAULT

C. FAULTY TRACTION CONTROLLER

NOTE

Please refer to the end of this procedure for supporting diagrams.

COMPONENT OPERATIONAL CHECK

NOTE: Always check battery condition and state of charge before performing electrical troubleshooting. A faulty or low charged battery will cause electrical features to not operate as designed and give incorrect readings while performing electrical tests.

PROCEDURE OR ACTION:

1. Conduct a visual inspection of all connectors/wiring associated with the fault code.
   Are any faults detected/observed?
   YES: Repair/replace connector or wiring associated with faults found. Refer to the appropriate **Electrical System** SRM .
   NO: Proceed to Step 2.
2. Re-key the vehicle.
   Is the code still present?
   YES: Proceed to Cause A.
   NO: Problem may be intermittent.

CAUSE A - ENCODER WIRING FAULT

PROCEDURE OR ACTION:

1. Disconnect the traction motor encoder connector CPS03 and measure voltage between socket 1 and B(-).
   Is voltage 5 ± 0.5 Vdc?
   YES: Proceed to Step 2.
   NO: Inspect circuit 250 for open or short.
2. Measure voltage between the encoder connector CPS03, socket 1 and socket 4.
   Is voltage 5 ± 0.5 Vdc?
   YES: Disconnect battery and proceed to Step 3.
   NO: Inspect ground circuit 102 for open or short.
3. Disconnect the Combination controller connector CPS01. Measure resistance between socket 32 of the Combination controller connector and socket 3 of the encoder connector CPS03.
   Is resistance <1 ohm?
   YES: Proceed to Step 4.
   NO: Inspect signal circuit 578 for open or source of excessive resistance.
4. Measure resistance between socket 31 of the Combination controller connector CPS01 and socket 2 of the encoder connector CPS03.
   Is resistance <1 ohm?
   YES: Reconnect the encoder connector CPS003, battery, and proceed to Cause B.
   NO: Inspect signal circuit 577 for open or source of excessive resistance.