

SERVICE REPAIR

MANUAL

Hyster B233 (B80ZAC) Forklift

HYSTER

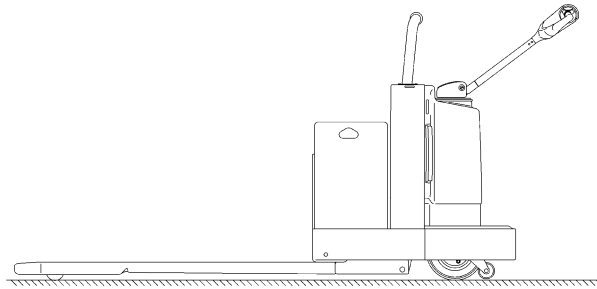
AC MOTOR CONTROLLER

B60Z^{AC} [B230];

B80Z^{AC} [B233];

B60Z^{HD} [A262];

B80Z^{HD} [A257]



HYSTER

SAFETY PRECAUTIONS

MAINTENANCE AND REPAIR

- When lifting parts or assemblies, make sure all slings, chains, or cables are correctly fastened, and that the load being lifted is balanced. Make sure the crane, cables, and chains have the capacity to support the weight of the load.
- Do not lift heavy parts by hand, use a lifting mechanism.
- Wear safety glasses.
- DISCONNECT THE BATTERY CONNECTOR before doing any maintenance or repair on electric lift trucks. Disconnect the battery ground cable on internal combustion lift trucks.
- Always use correct blocks to prevent the unit from rolling or falling. See HOW TO PUT THE LIFT TRUCK ON BLOCKS in the **Operating Manual** or the **Periodic Maintenance** section.
- Keep the unit clean and the working area clean and orderly.
- Use the correct tools for the job.
- Keep the tools clean and in good condition.
- Always use **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 hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

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

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

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TABLE OF CONTENTS (Continued)

This section is for the following models:

B60Z^{AC} [B230];
B80Z^{AC} [B233];
B60Z^{HD} [A262];
B80Z^{HD} [A257]

General

This section describes the Iskra® motor controller and dash display used in B60Z^{AC}, B80Z^{AC}, B60Z^{HD}, and B80Z^{HD} lift trucks. Procedures are outlined for controller programming and troubleshooting.

DISCHARGING THE CAPACITORS

WARNING

The capacitor in the transistor controller can hold an electrical charge after the battery is disconnected. To prevent electrical shock and personal injury, discharge the capacitor before inspecting or repairing any component. Wear safety glasses. Make certain the battery has been disconnected. **DO NOT** use a screwdriver to discharge the traction motor controller.

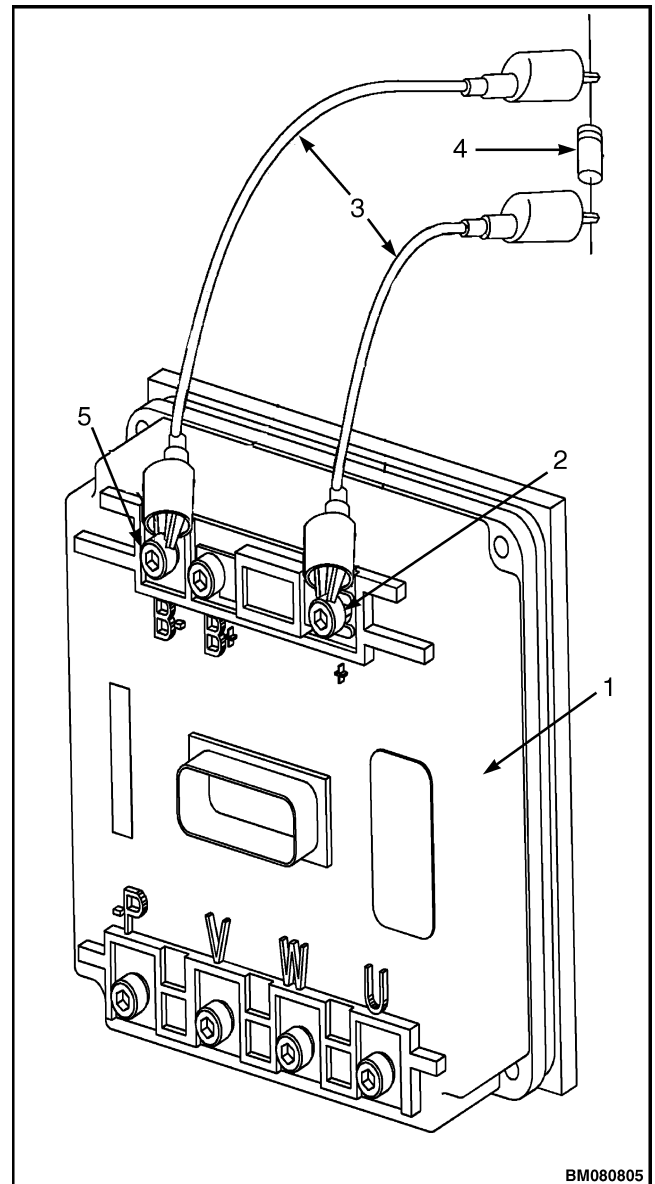
WARNING

To avoid personal injury and prevent electrical shock, perform the following steps before performing any troubleshooting or adjustments, and connecting or disconnecting a handset or PC.

CAUTION

To avoid controller damage, always disconnect the battery. Discharge the capacitor and never put power to the controller with any power wire disconnected. Never short any controller terminal or motor terminal to battery. Make sure to use proper procedures when servicing the controller.

1. Move the truck to a safe, level area. Turn the key switch to the **OFF** position and disconnect the battery.
2. Remove the drive unit compartment cover to access the controller.
3. Discharge the capacitors in the controllers by connecting a 200-ohm, 2-watt resistor across the controller's B+ and B- terminals. See Figure 1. **DO NOT** short across the motor controller terminals with a screwdriver or jumper wire. Remove the 200-ohm, 2-watt resistor before reconnecting the battery.



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

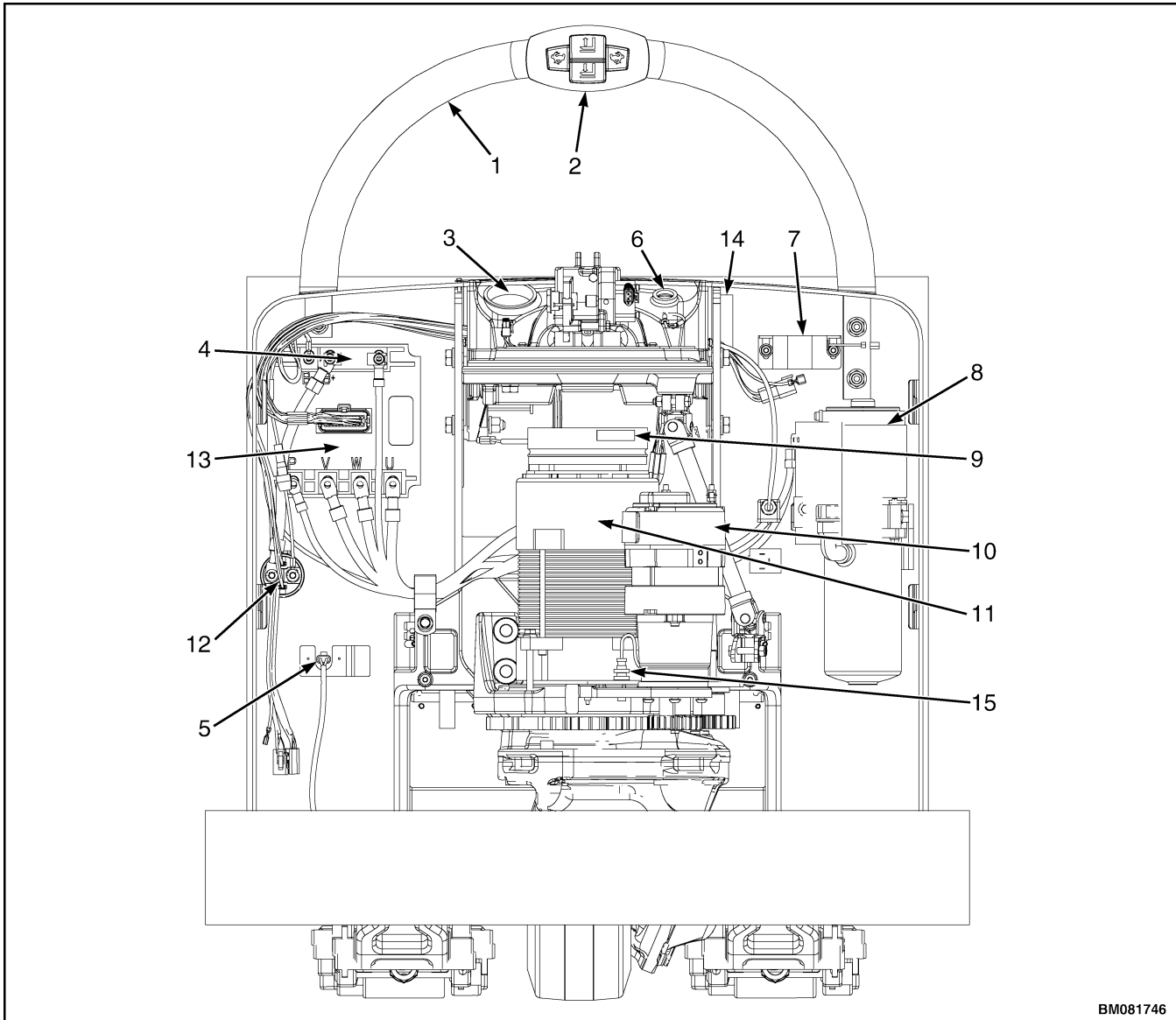
Figure 1. Discharging the Capacitors

Description

ELECTRICAL SYSTEM

The Iskra® AC motor controller controls the AC traction motor and the DC pump motor. The controller can also be used with the optional brushless DC

power steering motor. The controller uses CANbus communication to interact with the dash display and the control handle. See Figure 2.



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- | | |
|--------------------------|------------------------------------|
| 1. GRAB RAIL | 9. BRAKE |
| 2. AUXILIARY CONTROL BOX | 10. STEER MOTOR (POWER STEER ONLY) |
| 3. DASH DISPLAY | 11. TRACTION MOTOR |
| 4. POWER FUSE | 12. CONTACTOR |
| 5. PC CONNECTOR (ETACC) | 13. CONTROLLER |
| 6. KEY SWITCH | 14. CONTROL MODULE |
| 7. HORN | 15. PROXIMITY SWITCH |
| 8. PUMP MOTOR | |

Figure 2. Component Location (Power Steer Shown)

AC Traction Motor

The AC traction motor is a three-phase AC induction motor. The motor does not include motor brushes or a commutator. An AC induction motor operates on three-phase AC power provided directly by the controller. The motor speed is controlled by the motor controller and can be changed by the frequency of the AC power supplied to the motor. A speed sensor has been built into one of the motor bearings which provides feedback to the motor controller allowing software to continually monitor motor direction and revolutions per minute (RPM). Using this feedback system, the AC motor control can provide much better vehicle top speed control than the older DC SEM systems.

Controller

The motor controller converts DC power from the truck battery to three-phase AC power at the frequencies and currents necessary to drive the traction motor. A bearing in the traction motor provides feedback of speed, rotation direction, and temperature directly to the motor controller.

The motor controller receives power through the main contactor which is controlled by the key switch. The controller receives inputs from the control handle and the hand rail switches to control lift truck functions.

NOTE: There are no serviceable parts in the motor controller. No attempt should be made to open repair, or otherwise modify the controller. Doing so may damage the controller and/or lift truck. Removing the cover from the controller will void the warranty.

Service PC Connection

The lift truck is equipped with a connection point to connect a laptop computer with ETACC software installed. This connection can be used to adjust certain lift truck parameters and to assist with troubleshooting the lift truck.

Parameters

GENERAL

A parameter is a measurement or a setting that defines a lift truck function. A specific function parameter works with other function parameters to control the operation of the lift truck.



WARNING

The parameter for each function has a value range so the motor controller can be used on different models of lift trucks. This variation is needed for lift trucks of different sized and operation voltages. Adjustment of a function to the wrong number value for your lift truck model can cause the truck to operate differently than normal. This different operation of the truck can cause an injury.

NOTE: Table 1 shows the factory default setting for each parameter that is adjustable by the user.

Parameters can be adjusted through the dash display. The factory default values listed in Table 1 are the recommended settings for new units. These settings will give satisfactory performance for most applications.



WARNING

If any of the parameter values are changed, the operators must be told the lift truck will operate differently.

NEVER adjust any of the following parameters without using the procedures and settings given in this section.

Function Parameter Descriptions in this section contains descriptions for the different parameters. These parameters can also be accessed using the ETACC PC software.

Table 1. Parameter Default Values

Parameter	Default		Range	
	B60Z ^{AC} and B60Z ^{HD}	B80Z ^{AC} and B80Z ^{HD}	Min	Max
Extended Shift	OFF	OFF	ON	OFF
Walk Speed (Both Directions)	3.8	3.8	0.5	4.0
Hi Speed Fwd	9.0	9.0	0.5	9.0
Hi Speed Rev	6.0	6.0	0.5	9.0
Minimum Acceleration	5	5	1	10
Maximum Acceleration	7	7	1	10
Plugging	7	7	1	10
ADS-Neutral	1	1	1	10
ADS-Throttle	1	1	1	10
Pick Acceleration	6	6	1	10
Pick Deceleration	1	1	1	10
Battery Full Voltage ¹	25.300	25.300	24.500	26.500
Lift Interrupt ¹	23.520 ²	23.520 ²	18.000 ³	24.000
PS Fwd Trav	3	3	1	10
PS Rev Trav	3	3	1	10
PS Max Assist	5	5	1	10
NOTE: Certain lift truck models are not capable of operating at the Max range allowed by the Dash Display. If a parameter value higher than the truck's ability is entered, the value will revert to the maximum allowed for that lift truck.				
¹ Values shown in ETACC format. When viewed through the dash display, values will be rounded and formatted as three digit numbers without decimals. Example: A value of 23.520 in ETACC will appear as 235 in the dash display.				
² Maintenance-free battery option uses value 24.000.				
³ This parameter value should not be set below 20 for normal operations. Contact NMHG Service Engineering Contact Management for approval before operating trucks below this value.				

Parameter Description

PARAMETERS



WARNING

If any of the parameter values are changed, the operators must be told the lift truck will operate differently.

NEVER adjust any of the following parameters without using the procedures and settings given in this section.

Parameters can be adjusted through the dash display LCD. These parameters can also be accessed using the ETACC PC software.

Extended Shift

This parameter when on, will reduce traction performance by 15% to provide extended battery shift life. The parameter may be set to the OFF or ON condition.

Walk Speed (Both Directions)

This parameter sets the maximum truck speed for forward and reverse directions when the truck is in “Walk” mode. Increasing the setting will increase the truck speed. Decreasing the setting will decrease truck speed.

Hi Speed (FWD)

This parameter sets the maximum forward speed of the lift truck when the truck is in “Ride” mode. Increasing the setting increases the speed. Decreasing the setting will decrease the speed.

Hi Speed (REV)

This parameter sets the maximum reverse speed of the lift truck when the truck is in “Ride” mode. Increasing the setting increases the speed. Decreasing the setting will decrease the speed.

Minimum Acceleration

This parameter sets the minimum acceleration rate of the lift truck when the truck is in traveling at the lowest throttle. Increasing the setting increases the

minimum rate of acceleration. Decreasing the setting will decrease the minimum rate of acceleration.

Maximum Acceleration

This parameter sets the maximum acceleration rate of the lift truck when the truck is traveling at maximum throttle. Increasing the setting increases the maximum rate of acceleration. Decreasing the setting will decrease the maximum rate of acceleration.

Plugging

This parameter controls the maximum rate of deceleration when the speed control is fully moved to the opposite direction from the direction of travel while the truck is moving. Increasing this setting will increase the rate of deceleration. Decreasing the setting will reduce the rate of deceleration.

ADS-Neutral

This parameter controls the rate of deceleration when the speed control is returned to the neutral position and the ADS-Throttle parameter is set above 1. Setting the value at 1 will result in no effect on the rate of deceleration; the truck will coast until it comes to a stop. Increasing the value will increase the rate of deceleration. Decreasing the value will decrease the rate of deceleration.

ADS-Throttle

This parameter controls the rate of deceleration when the speed control is partially reduced and the ADS-Throttle parameter is set above 1. Setting the value at 1 will result in no effect on the rate of deceleration; the truck will coast until it reaches the lower throttle speed. Increasing the value will increase the rate of deceleration. Decreasing the value will decrease the rate of deceleration.

Pick Acceleration

This parameter controls the rate of acceleration when the coast control switch is activated. Increasing the value will increase the rate of acceleration. Decreasing the value will decrease the rate of acceleration.

Pick Deceleration

This parameter controls the rate of deceleration when the coast control switch is released. Increasing the value will increase the rate of deceleration. Decreasing the value will decrease the rate of deceleration. Setting the value at 1 will result in no effect on the rate of deceleration; the truck will coast until it comes to a stop.

Battery Full Voltage

This is the battery voltage in millivolts at which the battery is considered fully charged. Increasing the

setting increases the voltage. Decreasing the setting reduces the voltage.

Lift Interrupt

This is the battery voltage in millivolts at which the battery is considered 80% discharged. Increasing the setting increases the voltage. Decreasing the setting reduces the voltage.

Troubleshooting

GENERAL

The controllers are sealed units with no serviceable components. Troubleshooting is usually limited to accessing status codes and following the diagnostic procedures listed in the status code charts.

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. The 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 a component. If a circuit is suspect, check the circuit for continuity from the front (pin end) of the plug.

Standard probes are too large to be inserted into the center of the female pins (sockets) of the special sealed plugs and can 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 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. An additional method would be to use a breakout kit.

If the controller detects an issue, a status code is displayed on the display panel.

Once the status code number is obtained, follow the procedures outlined in the status code charts of this manual to determine the problem.

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

Tools and test equipment required are:

- Clip Leads
- Digital Multimeter (20,000 ohms per volt)
- Basic Hand Tools

Check resistance on the proper scale from frame to power and controller terminals. Resistance of less than 20,000 ohms can cause misleading symptoms. Resistance of less than 1000 ohms indicates a short and should be corrected immediately.

The on-board diagnostic system employed on this lift truck can assist in the troubleshooting process. Read and be familiar with the instructions for accessing and using the dash display diagnostic system.

Prior to troubleshooting systems and components on this lift truck, ensure the battery is the correct voltage and is fully charged. Make sure the battery connector contacts are clean of corrosions and the battery polarity within the connector is correct. Inspect to ensure all fuses are correct and have not failed. Ensure the key switch is in the **ON** position when making voltage checks or checking the operator of a component.

Many faults noted by lift truck systems are 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 on-board diagnostics system.

NON-STATUS CODE ERRORS

Powered Black Screen



WARNING

Lift the forklift and block the frame with the drive tire suspended off the floor for safety when performing this check.

NOTE: Use these procedures along with the schematic and wiring diagrams.

In some instances, the dash display screen may power ON showing only a powered black screen. In this state, neither hydraulic nor traction functions will operate. This error can most easily be troubleshooted by connecting an ETACC diagnostic system (available at your local Hyster lift truck dealer) to the lift truck PC Service Tool Connector in the electrical compartment. The ETACC will scan the system and determine the component which is not communicating. However, in the absence of an ETACC tool, the truck systems can be manually checked by a technician with a multimeter. Follow the steps below to troubleshoot this error.

NOTE: Ensure the battery is fully charged before you begin the following tests.

1. Do you have access to an ETACC diagnostic tool?
Yes - Connect ETACC to the forklift PC Service Tool connector following the instructions in the section **Troubleshooting and Adjustments Using the AC Controls Program (ETACC)** 2200 SRM 1058. ETACC will indicate the component not communicating.

No - Proceed to Step 2.

2. Measure voltage in CPS_115, pin 1 of the tiller harness. Is voltage between 12V to 15V?
Yes - Proceed to Step 3.
No - Proceed to Static Checks on Power and Ground Connections.
3. Is the voltage between 12 and 15V?
Yes - Check Traction Encoder connector, pin 1 of CPS03 to have same voltage. Ensure that power is not shorted with ground or signals in encoder connector. Key off the truck, disconnect encoder connector, and measure continuity between pin 1 (14V) and pin 2 (encoder signal), pin 3 (encoder signal) and pin 4 (ground). If wires found shorted, repair connection as needed. If encoder connector tested good, proceed to Step 4.
No - Then the voltage shall be approximately same as voltage seen at B+.
- If yes, proceed to Step 4- If not, Check if there is continuity between battery, key switch and pin 1 of controller.
- If continuity not found, repair connection as needed.
4. Measure voltage at pin 5 of tiller harness. Is voltage greater than 4.5 volts?
Yes - Proceed to Step 5.
No - Test the control card for proper function. See Control Card Functional Test in this section.
5. Measure voltage at CPS_05, pin 30 of main harness. Is voltage between 12 and 15 volts?
Yes - Check the tiller harness and ensure all pins in connectors of tiller harness and main harness are properly seated. See Tiller Harness Shorts and Continuity Checks in this section.
No - Replace controller.
6. Was tiller harness verified ok?
Yes - It is necessary to connect to the ETACC diagnostic tool and check the software versions for control card, dash display, and controller. Refer to the section **Troubleshooting and Adjustments Using the AC Controls Program (ETACC)** 2200 SRM 1058.
No - Repair or replace tiller harness.

Tiller Oscillation and Bias (EPAS Option)

Tiller oscillation (Chattering) and Bias of the Electronic Power-Assist Steering Option is not linked to any electrical failure within the End Rider unit. It is caused by a physical/mechanical issue rather than an electrical one. The replacement of EPAS Motor, Torque Sensors, or Controller is not necessary in this occasion. Certain areas of the truck must be visually and tactically inspected when the oscillation/chattering symptoms occur to identify the cause and eliminate the oscillation or bias of the tiller.

Inspect the following components to troubleshoot chattering or bias in the EPAS (option) system:

1. Casters: adjust casters accordingly to satisfy the currently installed tire size. Using unnecessary shims on the casters takes off the weight from the drive tire making the system susceptible to chattering.
2. Drive tire: shall be in good condition. A worn out tire causes the same effect as having unnecessary shims on the casters. The tire must have sufficient grip against the floor, and if it does not adjust casters as necessary.
3. Loose gears: confirm that the gear of the EPAS motor and the gear mounted on the bracket are not loose and adjust the bracket as necessary to minimize the backlash between the EPAS motor gear and the MDU gear.
4. Uneven pull rods: this misalignment of the truck causes unwanted change in the torque signal, therefore starting the effect of the oscillation.
5. Assist level: assist levels 7 through 10 provide excessive assistance and cause an increase of the backlash in the system, which is a root caused of the chattering. Lower assist level as necessary.

After ensuring all the aforementioned requirements are met, the system must be calibrated as mentioned in the calibration procedure. Refer to **Electrical System** 2200 SRM 1451 or **Electrical System** 2200 SRM 1287, **Calibration, Power Assist Steer Sensor**.

STATUS CODES

Make sure the parameter values are correct for your lift truck to ensure the trouble is not just an incorrect setting. See function settings to set the correct parameter values. If there is no status code display and the lift truck does not operate correctly, there may be a fault in the master controller.

The status codes are numbers for malfunction or lift truck operation that are not correct and that the motor controller can sense. The master controller will indicate this code number on the LCD screen of the display panel.

NOTE: There are identifiers to determine which device generated the code:

Xy = XXXX (Co 23538)

Co = Controller

Ep = PAS Unit

Ti = Steer Handle Card

The controller senses the following types of malfunction:

- Input voltages that are too high or too low
- Input voltages in the wrong sequence or
- Correct input voltages that occur at the wrong time

NOTE: A status code indication does not always mean that there is a malfunction. A temporary operation condition can cause a status code display.

These code numbers are only indicators that may help diagnose a possible malfunction. A short description of the different status codes is shown in Table 2.

The Fault Message charts in this section have a more complete description of the status code, the circuit that has generated the input for the status code, the symptom, and the possible cause.

Table 2. Fault Codes

Code	Description
	To troubleshoot symptoms that do not generate a fault code, refer to Non-Status Code Errors, in this section.
Check Battery	High or low DC link voltage.
High Temp	Thermal cut-back due to high motor temperature or high power bridge temperature.
Overheat	Overheated motor or power bridge.
Overload	Pump in relief.
Release Coast	Coast system engage switch tied down at key ON .
Release Horn	Horn switch tied down at key ON .
Release Lift/Lower	Lift or lower switch tied down at key ON .
Release Rabbit	High speed switch tied down at key ON or activated before throttle.
Reset Handle	Tiller was pulled down at key on or throttle was requested before the steer arm was moved into active region, or open load at regen switch or tiller enable switch.
Stalled	Loss of signal from encoder or encoder is disconnected.
Stalled	Open load at encoder or brake coil.
9024	Controller failure of the traction motor power circuit.
9088	Pump motor shorted.
9089	Pump motor open.
9090	Pump at relief.
9091	Controller failure of the pump motor power circuit.
12808	Error in steer handle card speed/direction sensor.
12813	Steer handle sensor is out of limits.
12814	Steer handle card signaled that a belly switch error has occurred.
12816	Controller internal voltage over 36 volts.
12819	Incorrect voltage battery connected.
12832	Controller internal voltage less than 16 volts.
12835	Incorrect voltage battery connected.
13316	Pump proportional valve (coil) open load or over current.
13317	Horn open load.
13384	Main contactor bridge (coil) open.
16912	Controller power section is over temperature.
16944	Controller is in thermal cutback - high controller temperature.
16945	Controller internal temperature sensor failure.
17168	Traction motor is over temperature.
17169	Controller is in thermal cutback - high traction motor temperature.

Table 2. Fault Codes (Continued)

Code	Description
17170	Traction motor temperature sensor failure.
20756	Key switch open.
21024	Steer handle card failure.
21376	Traction Reversing switch closed at startup.
21378	Controller cannot establish contact with steer handle card.
21379	Controller failed to receive Power Steer PDO message within 3 seconds.
21533	Horn circuit is shorted to B+.
21534	Horn circuit is open.
21535	Horn circuit is shorted to B-.
21539	Digital output driver failure.
21552	Steer handle inputs incorrect at startup.
21553	Hi Speed switch is closed at startup.
21554	Horn switch is closed at startup.
21555	Lift or lower switch is closed at startup.
21556	Coast engage switch closed at startup.
21568	Main contactor circuit is open.
21569	Main contactor circuit is shorted to B+.
21570	Main contactor circuit is open.
21571	Main contactor circuit is shorted to B-.
21588	Internal failure of the power steering unit.
21808	Controller Internal Fault or controller has wrong parameters.
21809	Controller Internal Fault or controller has wrong parameters.
25361	Truck type parameter has not been selected.
28961	Steer assist motor has reached a stop condition.
29445	Traction motor encoder failure.
29448	Steer handle switch closed at startup.
29456	Error in steer handle card speed/direction sensor.
29458	Steer handle sensor is out of limits.
29459	Steer handle card signaled that a belly switch error has occurred.
29472	Failed or maladjusted sensor.
32816	Pump open circuit.
33033	Controller cannot communicate with steer card, dash display, or power steering motor.
33034	Controller cannot establish communication with steer control card.

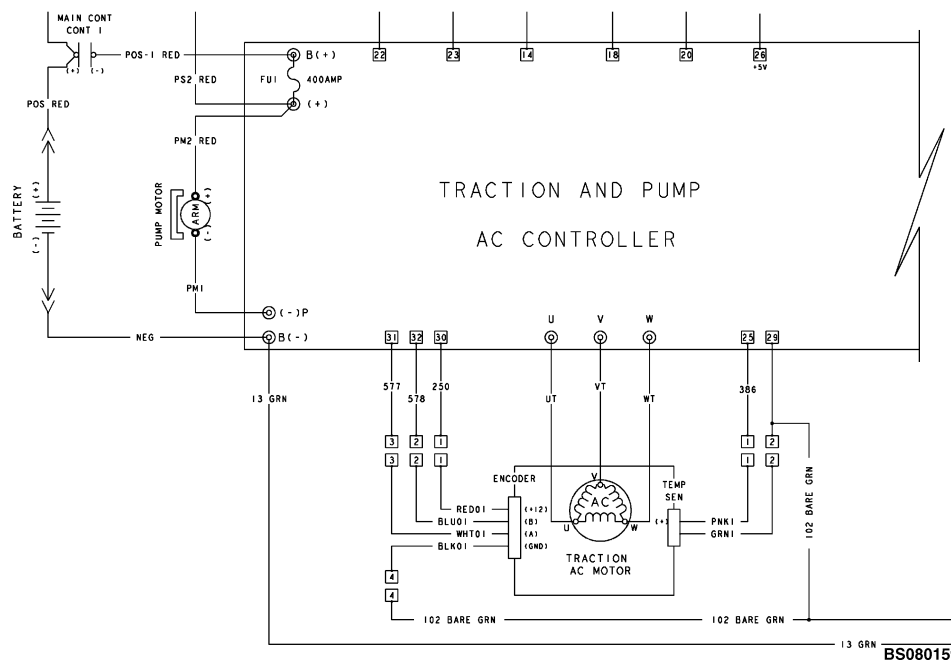
Table 2. Fault Codes (Continued)

Code	Description
33035	Controller cannot establish communication with EPAS.
33056	Controller cannot establish communication with steer handle card.
33057	Controller cannot establish communication the power steering controller.
33072	Controller not responding to Power Steer.
33073	Power Steer not responding to Controller.
33554	Power Steer motor stalled.
36864	Power Steering security line set to LOW.
65280	Controller has detected an abnormal signal from the Position Sensor in the power steering system.
65281	Controller has detected an abnormal signal from the Torque Sensor in the power steering system.
65282	Torsion bar broken, reduction gear broken, mechanical connection lost.

STATUS CODE	DISPLAY MESSAGE	LED	CIRCUIT
Check Battery	Check Battery	Flashing Red	Battery
DESCRIPTION		SYMPTOM	
Controller has detected a battery with less than 16 volts has been connected to the lift truck. Controller has detected a battery voltage in excess of 32 volts at startup.		Traction and hydraulic systems will not operate.	

Probable Causes and Test Procedures

1. Check battery voltage at controller B+ terminal.
2. Verify battery voltage matches voltage listed on the lift truck nameplate. If battery is other than specified, then install correct voltage battery.
3. Check to have battery fully charged, approximately 25.5V ±1V.
4. Condition can be caused by normal operation of the lift truck with a discharged battery. Check battery state of charge on the dash display and measure voltage across B- and B+. Recharge battery if necessary. Install a fully charged battery.
5. Code may occur on overcharged batteries during regen braking. Verify battery is not overcharged.
6. Check condition (includes proper contacts surface between fuse and fuseholder) of fuse FU 1. Verify continuity through the fuse. If there is no continuity, then replace fuse.
7. Check for battery voltage continuous across B+ and B terminals when battery is connected and the key switch is in the ON position.
8. Make sure main contactor is energized and its tips are clean.

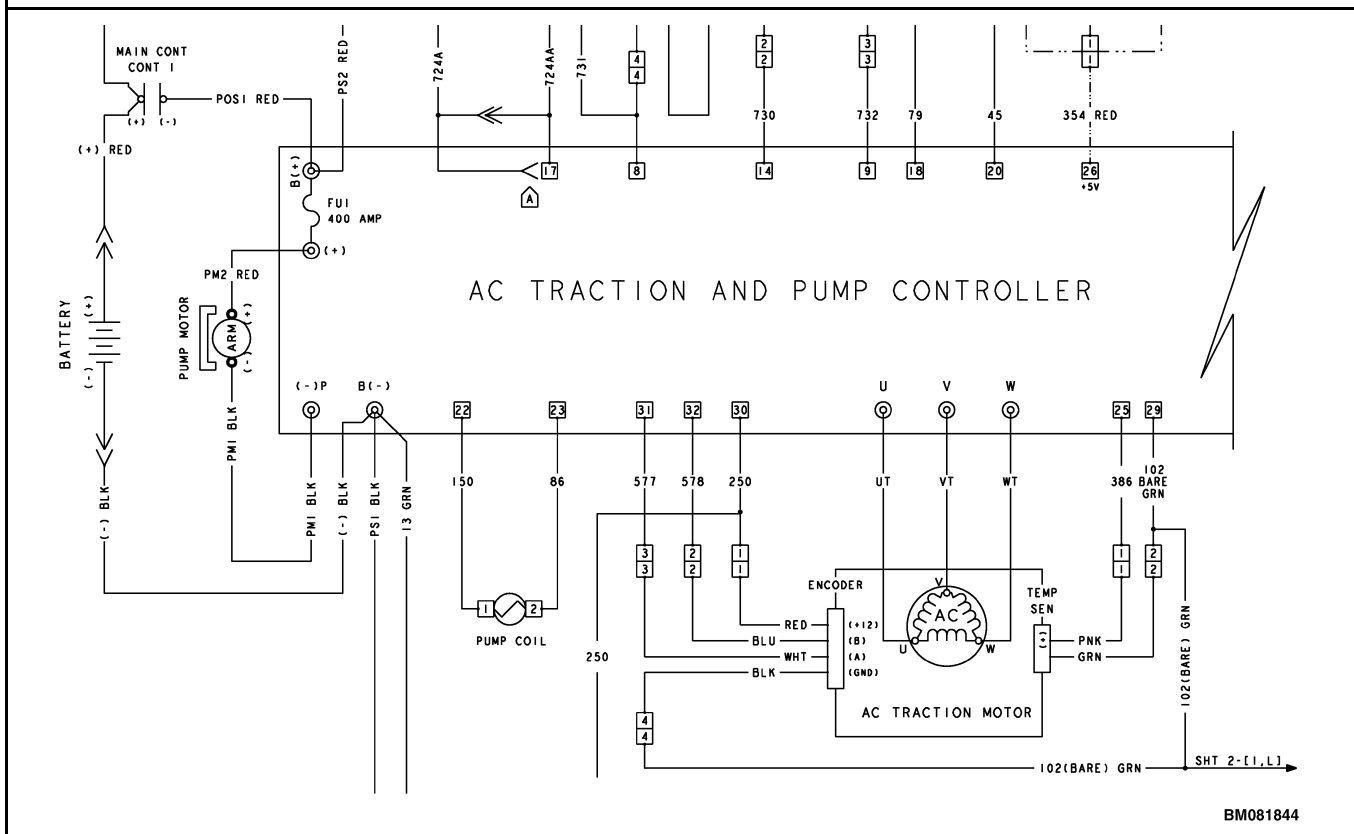


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STATUS CODE	DISPLAY MESSAGE	LED	CIRCUIT
High Temp (cont)	High Temp	Solid Green	Motor
DESCRIPTION		SYMPTOM	
Thermal cut-back due to high motor temperature or high power bridge temperature.		Traction system is operating at a reduced performance level.	

Probable Causes and Test Procedures

6. Check the resistance through the main contactor coil. Refer to the section **Electrical System** 2200 SRM 1451 or **Electrical System** 2200 SRM 1287, Contactor Coil Check.
 - a. The resistance should measure approximately 22 ohms \pm 10%.
 - Replace the coil.
7. Check for shorts with truck frame.
 - a. Check resistance between the following points for greater than 1Mohm:
 - CANH and truck frame
 - CANL and truck frame
 - B+ and truck frame
 - B- and truck frame
 - UT wire (traction motor) to truck frame
 - VT wire (traction motor) to truck frame
 - WT wire (traction motor) to truck frame
 - PS2 wire (steer motor) to truck frame (if applicable)
 - PM2 wire (pump motor) to truck frame
 - PM1 wire (pump motor) to truck frame



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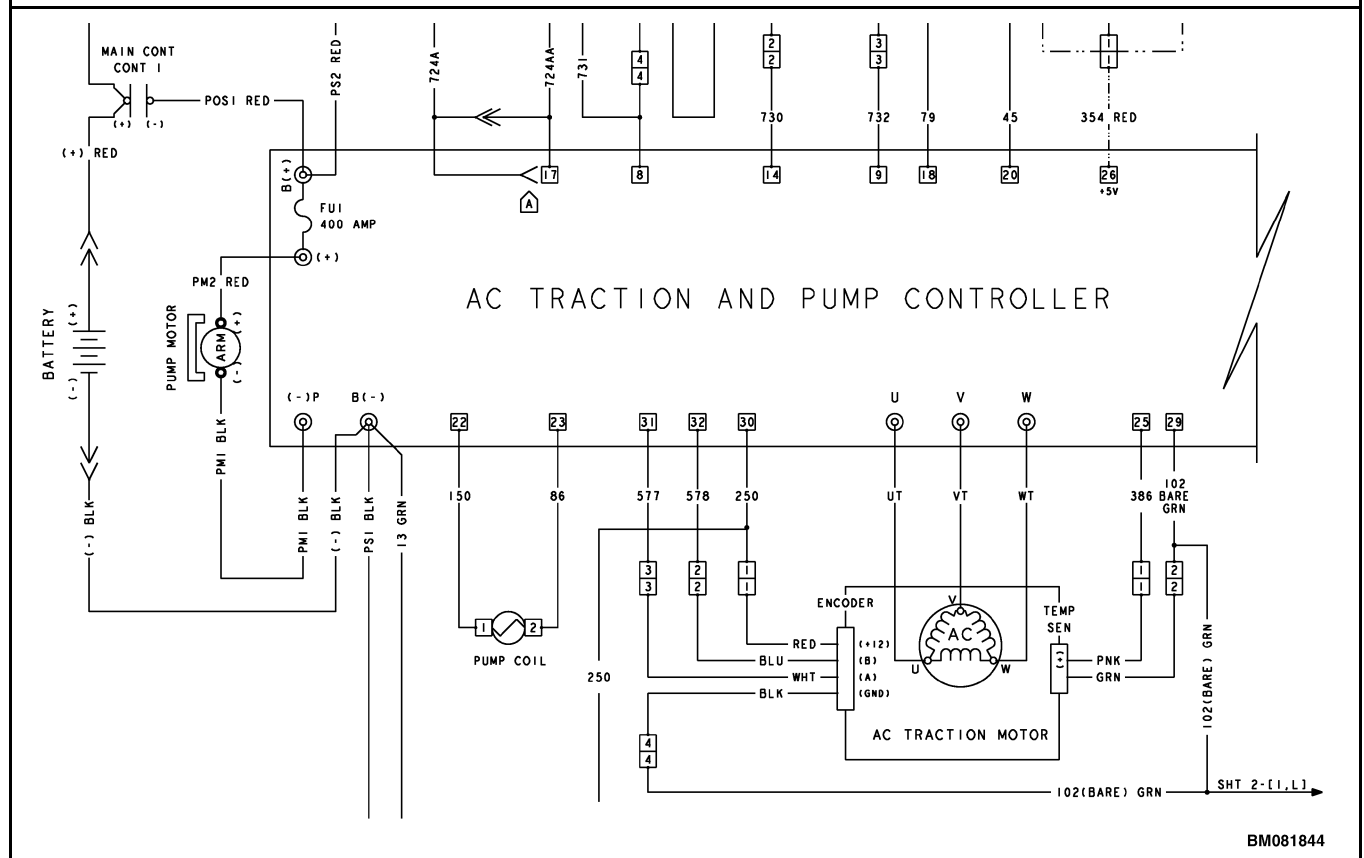
STATUS CODE	DISPLAY MESSAGE	LED	CIRCUIT
High Temp (cont)	High Temp	Solid Green	Motor
DESCRIPTION		SYMPTOM	
Thermal cut-back due to high motor temperature or high power bridge temperature.		Traction system is operating at a reduced performance level.	

Probable Causes and Test Procedures

7. Check for shorts with truck frame (Continued).

NOTE: Excessive current draw will cause a component to heat up and this is usually caused by shorts in the system allowing current to follow paths that are not intended. Sometimes excessive current draw can be caused by mechanical malfunctions such as worn bearings, misaligned parts, improper lubrication, and brake adjustments. Other factors include operator misuse such as overloading the truck and pushing loads.

The condition of the battery can contribute greatly to excessive current draw. When the battery charge and voltage are low, more current is needed to perform the same task. Since the power required to move a load is $Power = Volts \times Amperage$, as the battery voltage goes down, the amperage must increase to maintain power.

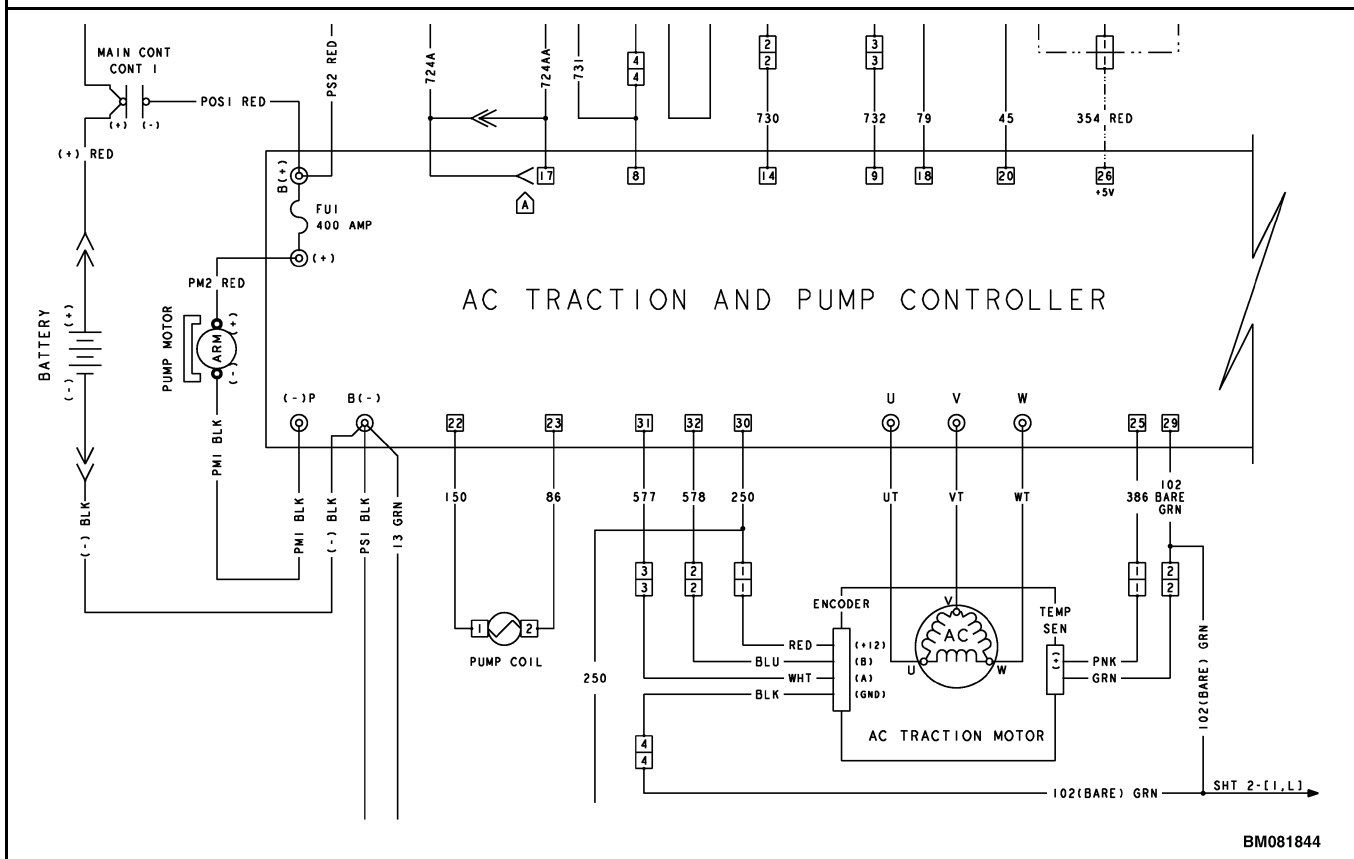


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STATUS CODE	DISPLAY MESSAGE	LED	CIRCUIT
Overheat	Overheat	Flashing Red	Traction Motor
DESCRIPTION		SYMPTOM	
Controller has detected an over temperature condition in the traction motor or power bridge.		Traction and hydraulic systems will not operate.	

Probable Causes and Test Procedures

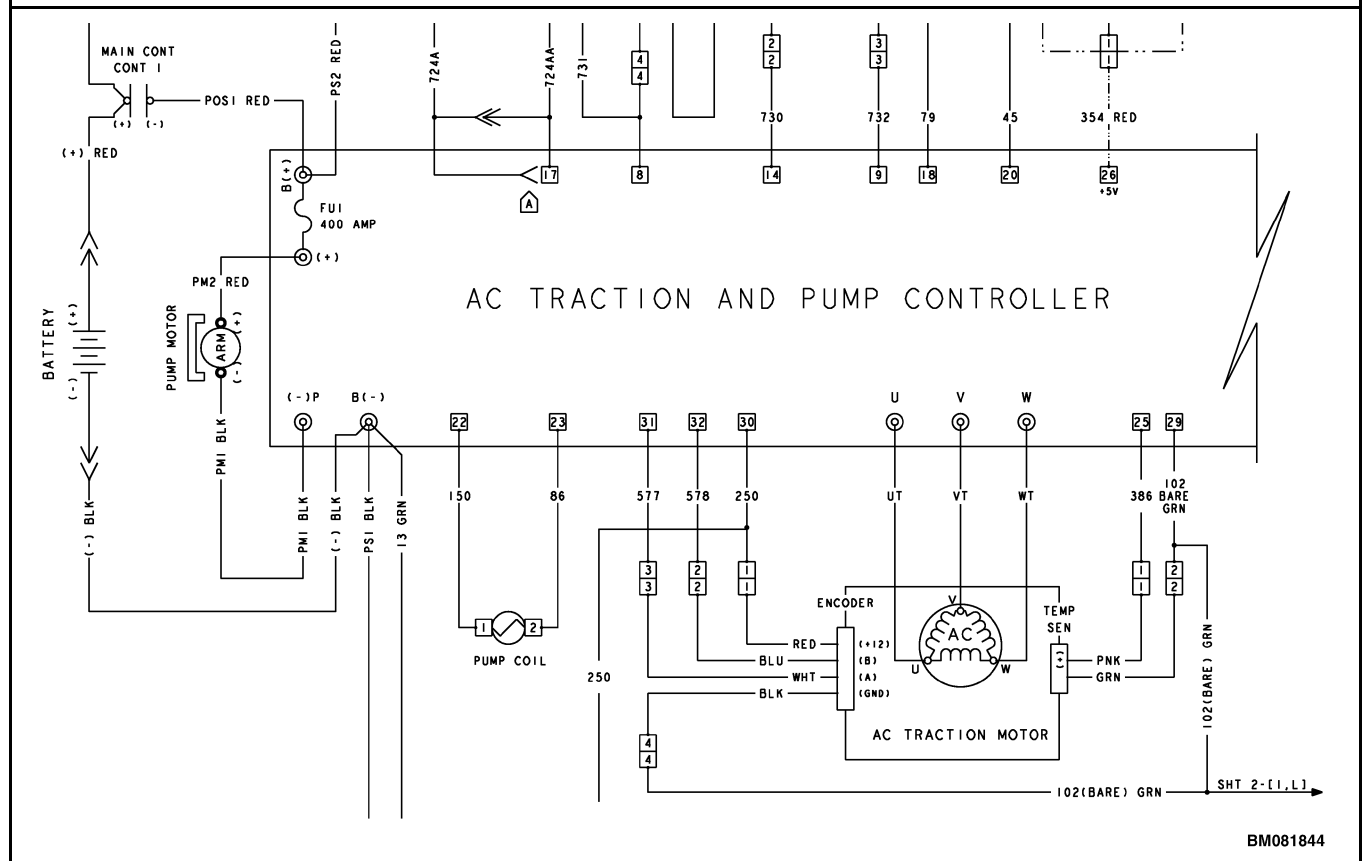
- Internal temperature of controller has exceeded 140°C (284°F).
 - Reduce truck usage and allow the controller to cool. System will recover once the truck is able to achieve a temperature below 125°C (257°F).
- Clear fault log in dash display. See the section **User Interface, Service Technician Functions On-Board Dash Display** 2200 SRM 1324.
- With the traction motor at room temperature, turn the key switch to the OFF position then back to the ON position and operate the lift truck briefly.
- Check the dash display to verify fault does not repeat.
- If fault repeats, check resistance between pin #1 and pin #2 at the motor temperature sensor connector.
 - Resistance should measure approximately 5.9 ohms ±10% at 25°C (77°F).
 - Replace sensor.



STATUS CODE	DISPLAY MESSAGE	LED	CIRCUIT
Over-heat (cont)	Overheat	Flashing Red	Traction Motor
DESCRIPTION		SYMPTOM	
Controller has detected an over temperature condition in the traction motor or power bridge.		Traction and hydraulic systems will not operate.	

Probable Causes and Test Procedures

6. Check for shorts with truck frame
 - a. Check resistance between the following points for greater than 1Mohm:
 - CANH and truck frame
 - CANL and truck frame
 - B+ and truck frame
 - B- and truck frame
 - UT wire (traction motor) to truck frame
 - VT wire (traction motor) to truck frame
 - WT wire (traction motor) to truck frame
 - PS2 wire (steer motor) to truck frame (if applicable)
 - PM2 wire (pump motor) to truck frame
 - PM1 wire (pump motor) to truck frame



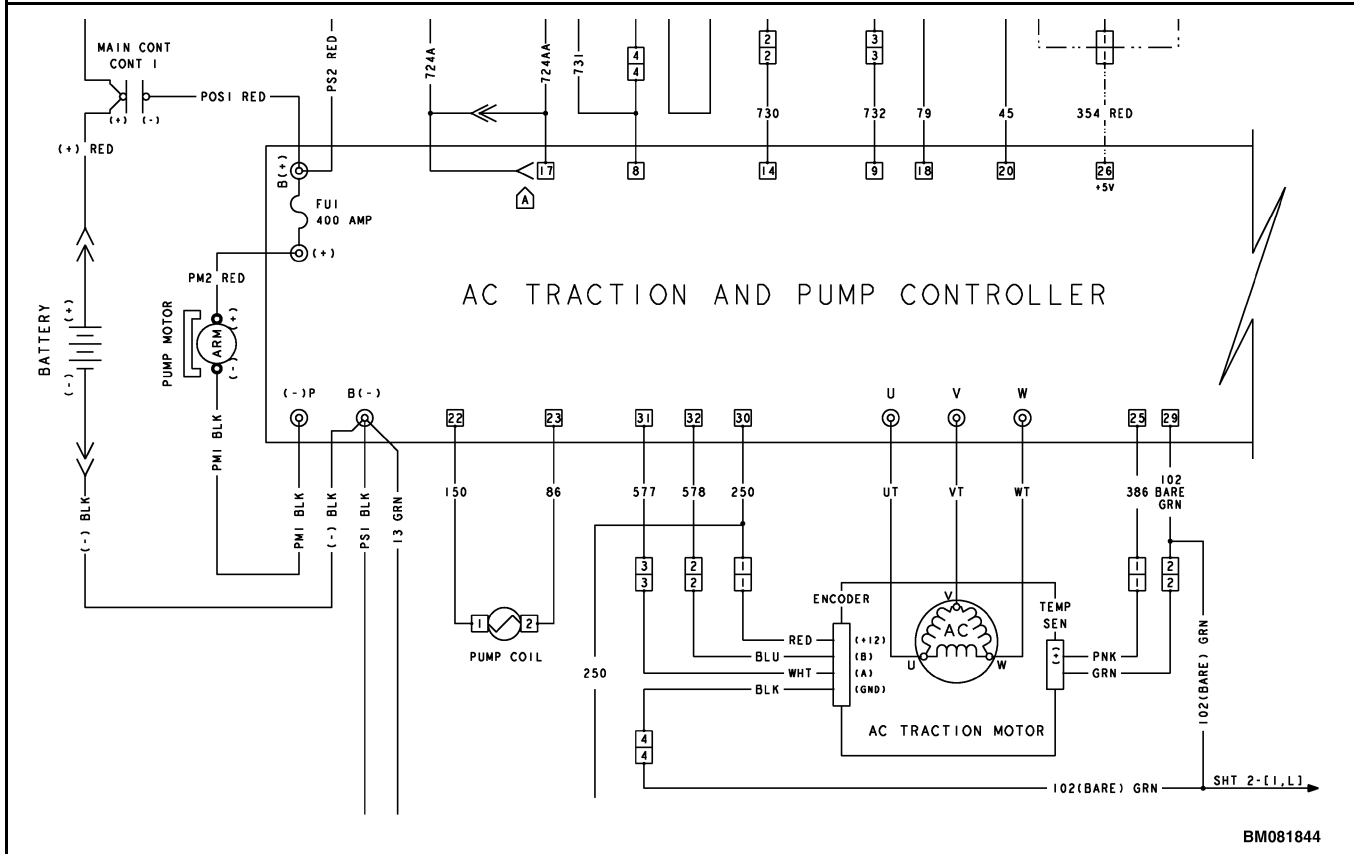
STATUS CODE	DISPLAY MESSAGE	LED	CIRCUIT
Over-heat (cont)	Overheat	Flashing Red	Traction Motor
DESCRIPTION		SYMPTOM	
Controller has detected an over temperature condition in the traction motor or power bridge.		Traction and hydraulic systems will not operate.	

Probable Causes and Test Procedures

6. Check for shorts with truck frame (Continued).

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