

P-01c: Troubleshoot Furnace (Carborizer Area)

SAFETY FIRST

- Follow all Caterpillar facility safety standards when performing this task.
- Be aware of the hazards that are associated with quenching fluids. Wear appropriate protective clothing.
- Be aware of the hazards presented by motors, actuators and loading/unloading equipment associated with furnace operation.
- Combustion gases can be explosive. Ensure that the area is adequately ventilated.

EQUIPMENT

- Electrician's hand tools
- wiggly

RESOURCES

- manufacturer's specifications and manuals for all equipment
- design specifications for the furnace and quench processes
- temperature controls inspector

Troubleshoot Furnace (Carborizer Area)

Note: This troubleshooting procedure has five parts.

Part I: Troubleshoot Part and Tray Loader

Part II: Troubleshoot Furnace Door

Part III: Troubleshoot Furnace Temperature Control

Part IV: Troubleshoot Tray Transfer System

Part V: Troubleshoot Quench Coolant Pump

Before beginning to troubleshoot, ask the Operator or Electrician, if necessary, to read the Operator interface console.

Go to the section involving the problem area indicated on the display.



Part I: TROUBLESHOOT PART AND TRAY LOADER**A: Actuator Drive Motor Operation:**

1. Check to see if the drive motor is running. If it is, visually check the part loading mechanism for broken or slipping mechanical drive components.
2. If the motor is not running, check the motor starter controlling the AC motor that powers the actuator. If the motor starter is energized, go to step 3. If not energized go to step 10.
3. Check for normal line voltage at the starter output terminals. If no voltage, go to step 4. If there is normal voltage, go to step 7.
4. Check for voltage at the starter input terminals. If no voltage, go to step 5. If normal voltage, go to step 6.
5. Check the branch circuit for blown fuses or open disconnects.
6. Check the starter contacts and armature mechanism.
7. Check voltage at the motor. If no voltage, go to step 8. If there is voltage, go to step 9.
8. Check all connections for loose, broken, or shorted wires.
9. Check the motor winding continuity.
10. Check the PLC output that is supposed to send power to the motor starter coil. If the PLC output is active, go to step 11. If not active, go to step 15.
11. Check the fuse in the control line to the motor starter coil. If fuse is good, go to step 12.
12. Check for control voltage at the motor starter coil. If no voltage, go to step 13. If there is voltage, go to step 14.



13. Check the PLC to coil wiring.
14. Check coil for continuity.
15. Check the limit switches on the actuator for damage or misalignment. If there is no damage, go to step 16.

Caution: Do not manually actuate a home, overtravel, or any other limit switch unless the system is in manual mode and you know what affect an actuated switch will have on the system.

16. Verify that the corresponding PLC inputs activate with the limit switches. If inputs are okay, go to step 17.
17. Check the PLC program for faults. If the program is all right, go to step 18.
18. Check the parts definition to the PLC through FAMS or FIMS.

Part II: TROUBLESHOOT THE FURNACE DOOR

A. Pneumatic Actuator System:

1. Check the pneumatic solenoid valve. If it is not operating, go to step 2.
2. Check for voltage at the solenoid input terminals. If no voltage, go to step 3.
3. Check for output voltage at the PLC and corresponding output indicator light. If no voltage, go to step 4.
4. Check to see if the output fuses from the PLC are blown. If not, go to step 5.
5. Check all connections for loose, broken, or shorted wires.



Part III: TROUBLESHOOT FURNACE TEMPERATURE CONTROL**A. Temperature Controller:**

- Determine the reason for incorrect temperature in furnace.
- Go to the furnace temperature monitoring panel.
- Observe readings on Barber Coleman 560 PID temperature controllers.
- Find the controller displaying the incorrect temperature.

- 1. Check controller for proper operation and reading.**
- 2. Using the Beta calibration meter, check the thermocouple readings at the test jacks below the controller; compare it with reading on B.C. It should be +/- 3 degrees. If the thermocouple is not reading, go to section B. If reading, go to step 3.**
- 3. Check for loose, broken, or shorted thermocouple wires to controller.**
- 4. Check for polarity at the thermocouple.**
- 5. Disconnect thermocouple and test controller operation with a spare thermocouple or thermocouple simulator. If controller reads properly, go to the next section.**

Note: Disconnecting TC or driving BC into overtemp may cause furnace to shut down, which requires immediate actions by operator and / or checker.

Note: Safety and quality hazard: If the furnace has an Endo atmosphere applied, the furnace temperature must not drop below 180 degrees F. If furnace temperature could drop during troubleshooting, the Furnace Operator must be informed immediately.

B. Thermocouple Malfunctions:

- 1. Check for loose, broken, or shorted wires from controller to remote thermocouple location.**
- 2. Check to see if the thermocouple is mounted properly.**



3. Determine if the thermocouple is damaged or defective, and if it needs to be replaced.

C. PID Controller Output to Burner Actuator:

1. Check for 4-20mA output signal to the burner actuator. If 4-20mA signal is not present, go to step 2.

Note: In some cases, this may not be a 4-20mA signal but a relay contact in the actuator circuit.

2. Check all connections for loose, broken, or shorted connections.

D. Main Gas Supply Valve Shut-off:

1. Inspect the indicator on main combustion gas valve supplying the burners. If it is off, go to step 2.

2. Check high pressure switch for excess pressure. If pressure is not too high, go to step 3.

3. Check the low pressure switch for indication of inadequate pressure.

4. Check for power failure to the valve.

E. Combustion Air Circulator:

1. Check for blower drive motor operation. If motor is not operating, go to step 2.

2. Check for required motor voltage at blower drive motor connections. If no voltage is present, go to step 3.

3. Check all connections for loose, broken, or shorted terminals.

4. Check the motor starter circuit to the blower drive motor. If no voltage is present, go to step 5.

5. Determine if the motor on the blower needs replaced.





6. **Observe mercury pressure switch to determine if blower is drawing in air.**
7. **Check blower intake filter for damage or blockages.**
- F. **Burner Exhaust Blower on Roof:**
 1. **Check to see if blower is turning. If not, got to step 2.**
 2. **Determine if blower has a broken drive belt.**
 3. **Check for blockages on the blower. If none, go to step 4.**
 4. **Check for required motor voltage at blower drive motor connections. If no voltage is present, go to step 5.**
 5. **Check all connections for loose, broken, or shorted terminals.**
 6. **Check motor starter circuit. If no voltage is present, go to step 7.**
 7. **Determine if the motor on the blower needs replaced.**

Part IV: TROUBLESHOOT TRAY TRANSFER MECHANISM

- A. **AC Drive Motor Operation:**
 1. **Check to see if motor is operating. If not go to step 2.**
 2. **Check for required motor operating voltage at the motor terminals. If required voltage is not present, go to step 3.**
 3. **Check all motor line fuses to see if they are blown.**
 4. **Check all connections for loose, broken, or shorted wires.**
 5. **Check for output voltage at the PLC, if not present, go to step 6.**
 6. **Check for blown output fuses.**

B. Limit Switches:

1. **Inspect limit switches for visible damage.**
2. **Check PLC logic to see that proper inputs and outputs are active.**

Caution: Do not manually actuate a home, overtravel, or any other limit switch unless the system is in manual mode and you know what the effect an actuated switch will have on the system.

Part V: TROUBLESHOOT THE QUENCH COOLANT PUMP**A. Coolant Pump Motor:**

1. **Check to see if the coolant pump motor is running.**
2. **Check for indication of motor rpm on the quench pump readout. If no readout, go to step 3.**
3. **Check all connections for loose, broken, or shorted wires.**
4. **Check the motor power line fuses to see if they are blown.**

B. Coolant Temperature:

1. **Check for correct coolant temperature on redipanel or overhead displays.**
2. **When quench fluid temperature exceeds specified temperature limits, check the mill water supply valve to the heat exchanger. If the valve does not operate, go to step 3.**
3. **Check for loose, broken, or shorted connections to the pneumatic flow control valve to the heat exchanger.**
4. **Inspect the valve for mechanical damage.**
5. **If temperature is low, check for proper heater operation.**

