HLC1 (HIGH LIMIT CONTROLLER

Understanding how HLC1 works. The high temp cutout **thermocouple** lays on the skin of the heater tube, in-between the heater blanket and the heater tube, and the thermocouple wires are routed back into the electrical enclosure through conduit.

If the main heater malfunctions (H1), **(reasons; CR1 fails closed, SCR out 1 fails closed, Heater temp. control thermocouple fails).** Temperature begins to rise. When the temperature on the skin of the heater tube reaches HCL1 setpoint of 275°F, the contacts on HCL1 will switch from the normally open contact 6 (NO) to the normally close contact 8 (NC). Turning off the power to the (CR2) coil. De-energizing the heater and turning on the **PILOT LIGHT HIGH TEMPERATURE** Red light on the electrical enclosure. Refer; H2000E-30-101 Rev 15

After identifying and correcting the cause of the high temperature rise. When the heater cools below HCL1 setpoint 275°F, this will allow HCL1 to be reset. Push the RED-LIGHT button switch SW3, on the front of the electrical enclosure tagged (HEATER HIGH TEMPERATURE ALARM). Refer; H2000E-30-101 Rev 15 & 60304460-20-101 Rev 02.

This allows the contacts to switch back to 6 (NO) and 7 (COM), **re-energizing the CR2 coil**. This closes the CR2 heater cutout contactor, **restoring power to heater H1.**

NOTE1:

CR2 operates independently of CR1.

CR2 loses power, without High Temperature fault, CR1 remains energized and the amber light on the HEATER ON tag of the enclosure will stay illuminated.

CR2 loses power with a high temperature fault 275° F. Amber light on the HEATER ON tag will be off until heater H1 cools down below the main controllers set point of 180° F. Then the AMBER LIGHT will automatically turn back on.

TROUBLESHOOTING HCL1

1. Verify there is power 120 Vac going to the controller on L1 (10) and L2 (9).
2. Verify the **RED LIGHT** is on at the HEATER HIGH TEMPERATURE ALARM tag on the front of the electrical enclosure.
   If the red light is on, check to see what the temperature is on the Main Temperature Controller. If it's at or above the 275° F setpoint, wait for the temperature to go below the 275° F setpoint. Once it does, depress the red-light button (SW3) to verify if the system resets. If successful, the red light will turn off. Then, closely monitor the Temperature on the Main Temperature Controller. If the temperature begins to **exceed normal operating limits 180° F.** Allow the temperature to increase until the High Limit Controller automatically turns off the heater.
   This confirms the High Limit Controller is functioning properly and indicates the problem lies elsewhere.
   - Bad Main thermocouple
   - Bad Main Temperature Controller
   - Bad Heater Control Relay (**CR1**)

   If the temperature is already below the 275° F setpoint. Return to step one.
3. When troubleshooting the **HIGH LIMIT CONTROLLER (HLC1**) always check the coil voltage on (CR2) A1/ A2. HLC1 supplies power to CR2 from terminals 7 (C) & 6 (NO). If HLC1 is functioning properly, confirm 120 Vac on terminals 7 (C) & 6 (NO).
   If HCL1 is not functioning properly, confirm 120 Vac on terminal 7 (C) & 8 (NC). Reference **H2000E-30-101 Rev 15**

3. Resetting HLC1

Depressing (SW3) red button will reset HLC1 so it can operate. In the event it does not reset HLC1, verify the switch is working properly. Conduct a continuity check on the switch.

Using a Multimeter, place it in lowest Ohm's setting (or the beeper setting). Put the black and red probes on 1 & 2 RST of the HLC1. Press the red button (SW3).

If the Multimeter is set to Ohm's. Then it should read 000

If the Multimeter is set to beeper. Then it should make a beeping sound.

This verifies the switch is working.

Bad Reading: An "OL" or infinite resistance (∞). This means the switch is bad.

4. Verify on C/- (7), NC (8), NO/+ (6). which input has 120 Vac.

Using the Multimeter set on AC Voltage. If the red-light button (SW3) is on, Place the black lead on C/- (7). Place the red lead on NC (8), it should read 120 Vac.

If the red-light button (SW3) is off, Place the black lead on C/- (7). Place the red lead on NO (6), it should read 120 Vac.

5. Thermocouple test

Test 1: The Continuity Test.

- Disconnect the thermocouple from HCL1, to avoid false readings.
- Turn your multimeter to the lowest Ohms (Ω) setting (or the beeper setting).
- Place the leads on the two terminal wires of the thermocouple (polarity doesn't matter for this test).
- Good Reading: A very low resistance reading, typically between 1 and 10 Ohms.
- Bad Reading: An "OL" or infinite resistance (∞). This means the internal junction is broken, and the thermocouple must be replaced.

Test 2: The Temperature Test

- Switch your multimeter to DC Millivolts (mV). If your meter doesn't have a dedicated mV setting, use the lowest DC Voltage setting (like 200mV or 2V).
- Connect the multimeter leads to the thermocouple wires.

  Note; on J-Type Polarity: The White wire is positive (+), and the Red wire is negative (-). Connect the red lead to white, and the black lead to red.
- Reading at ambient temperature. It should read a very small millivolt value (typically around 1.0mV to 1.2mV).
- Apply heat to the tip of the thermocouple using the friction of your fingers.
- Watch the meter:

  Good Reading: The millivolt reading should smoothly increase as heat is applied.

  Bad Reading: The voltage stays at 0mV, or fluctuates wildly, or moves in the negative direction (if it goes negative, double-check that your leads aren't reversed).

End of Test's:

- If thermocouple is determined to be bad. "Replace"
- If thermocouple is determined to be bad. "Reconnect to HLC1 circuit.