

Recommended initial setup and checkout of the LA-306 IR furnace. Perform after the furnace has been moved to a new location or if the furnace has been inactive for longer than 90 days.

### 3.1 Emergency Machine Off Switch (EMO)

Pressing an EMO button, located at each end of the furnace, cuts all power to the machine circuits immediately. Rotating the button CW and pulling outward will reset the button. Both buttons must be reset to connect power to the furnace.

**Note: These buttons are for emergency use only and should not be used for routine shutdown of the furnace.**

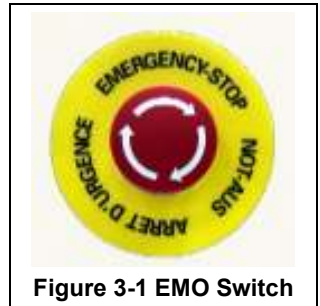


Figure 3-1 EMO Switch

### 3.2 Interlocks

There are three (3) electrical interlocks on the furnace: One on the Control Enclosure Access Door, and one on each of the Lower Entrance Panels, Front and Rear, opposite the heating chamber. During normal operation, all three of these access panels must be in place to allow power to be applied to the furnace. Opening the Control Enclosure Access Door or removing either Lower Entrance Panel causes an interlock to cut all power to the furnace.

The Control Enclosure Top Access Panel is held in place by machine screws and is NOT interlocked. This panel should always be in place while power is being applied to the furnace.

The interlocks are for your protection since both 117 Vac and 208-415 Vac circuitry and connections are inside the control enclosure and heating chamber. Trained personnel with a good understanding of the dangers involved may choose to override the interlocks by pulling outward on the interlock shaft to the “maintenance” position to restore power to the furnace while the interlocked panels are still removed.

**DANGER: Dangerous voltage and current (potentially lethal) may be present in the control box with the interlocks in “maintenance” position.**



Figure 3-2 Lower Panel Interlock

### 3.3 Control Console

During normal operation the user will manage all furnace functions via the Control Console. Figure 3-3 shows an operating Control Console. The elements of the Control Console are described in Section 1.14.



Figure 3-3 LA-306 Control Console ON





## 3.4 Functional Checkout

Before operating the furnace the first time, after moving the furnace to a new location or after a prolonged shutdown (more than 90 days), a functional check of critical machine functions is essential for successful operation.

| Table 3-1 Functional Checkout  |  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
|--|--|-----------|---------------|-------|-----|-------------|-----|--------|------|-------------|------|--------------|-----|-------------|------|-----------|------|
| Action   | Comments / Changes   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <b>1. Replace covers</b>   | Install any covers that are off the machine or that were removed during checkout.  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <b>2. Confirm MAIN POWER light ON</b>  | If not on, turn on power to the furnace.<br><br><b>Caution:</b> Dangerous voltages and current are now present throughout the control enclosure and on lamp wire connections to the furnace lamps.   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <b>3. Turn on the process gas supply valve</b>   | Adjust gas pressure on inlet regulator to between:<br><br>4.5 – 5 bar<br>450 – 500 kPa<br>65 – 70 psig<br><br><b>Note:</b> Exceeding the upper limit could damage the flowmeters.<br><br><b>Note:</b> If there is a pressure regulator at the furnace (recommended) them assure at least 90 psig is supplied to the furnace regulator.   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <b>4. Adjust process gas flowmeters</b>  | Adjust gas flowmeters on GAS FLOW CONTROL panel for the functional checkout per the table below.<br><br>Use same settings for CDA, N2 or FG.<br><br>Final gas flow settings during operation must be adjusted to suit the process and product being fired. The figures below are only a starting point for initial setup.  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <b>4a. Recommended Initial settings for normal processing.</b> Adjust as necessary to improve performance and stability.<br><br>NOTE: The furnace internals must be dry and the furnace must be located in a dry environment. Protect entrance and exit from drafts. Operate for 60 minutes once stable to improve repeatability. Initial, continuous operation with nitrogen at process temperatures may be required for 4 hours or longer to remove residual moisture from furnace internals and all process gas feed lines. | For <b>single or dual gas</b> manifold , Z1-Z3 @ 500C, CDA or N <sub>2</sub> balanced flow:<br><br><table border="1"> <thead> <tr> <th>Flowmeter</th> <th>Setting (L/m)</th> </tr> </thead> <tbody> <tr> <td>STACK</td> <td>4.1</td> </tr> <tr> <td>ENTR BAFFLE</td> <td>5.0</td> </tr> <tr> <td>ZONE 1</td> <td>30.0</td> </tr> <tr> <td>ZONES 2 &amp; 3</td> <td>30.0</td> </tr> <tr> <td>TRANS TUNNEL</td> <td>7.0</td> </tr> <tr> <td>LAMP SEALS*</td> <td>16.0</td> </tr> <tr> <td>COOLING**</td> <td>16.0</td> </tr> </tbody> </table><br>(all settings ± 10%) | Flowmeter | Setting (L/m) | STACK | 4.1 | ENTR BAFFLE | 5.0 | ZONE 1 | 30.0 | ZONES 2 & 3 | 30.0 | TRANS TUNNEL | 7.0 | LAMP SEALS* | 16.0 | COOLING** | 16.0 |
| Flowmeter  | Setting (L/m)  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| STACK  | 4.1  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| ENTR BAFFLE  | 5.0  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| ZONE 1   | 30.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| ZONES 2 & 3  | 30.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| TRANS TUNNEL   | 7.0  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| LAMP SEALS*  | 16.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| COOLING**  | 16.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| *Set LAMP SEALS for minimum 12 L/m up to 400°C plus 2.5 L/m per 100°C above 400°C to prolong lamp life.  |  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| **Set COOLING for minimum 8 L/m up to 200°C (in Zone 3) plus 2.5 L/m per 100°C above 200°C to protect CACT.  |  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |

| Table 3-1 Functional Checkout   |  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
|---|--|-----------|---------------|-------|-----|-------------|-----|--------|------|-------------|------|--------------|-----|-------------|------|-----------|------|
| Action  | Comments / Changes   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <p><b>4b. Flowmeter settings for processing with low oxygen</b></p> <p>NOTE: The furnace internals must be dry and the furnace must be located in a dry environment. Protect entrance and exit from drafts to keep furnace internal oxygen concentration low. Initial continuous operation with nitrogen at process temperatures may be required for 4 hours or longer to remove residual moisture from the inside of the furnace and all process gas feed lines.</p> | <p>For <b>single or dual gas</b> manifold Z1-3@500C, <b>Very Low O2 Firing</b>, slightly positive atmosphere furnace:</p> <table border="1"> <thead> <tr> <th>Flowmeter</th> <th>Setting (L/m)</th> </tr> </thead> <tbody> <tr> <td>STACK</td> <td>1.0</td> </tr> <tr> <td>ENTR BAFFLE</td> <td>7.0</td> </tr> <tr> <td>ZONE 1</td> <td>45.0</td> </tr> <tr> <td>ZONES 2 &amp; 3</td> <td>45.0</td> </tr> <tr> <td>TRANS TUNNEL</td> <td>6.0</td> </tr> <tr> <td>LAMP SEALS*</td> <td>16.0</td> </tr> <tr> <td>COOLING**</td> <td>16.0</td> </tr> </tbody> </table> <p>(all settings <math>\pm</math> 10%)</p>   | Flowmeter | Setting (L/m) | STACK | 1.0 | ENTR BAFFLE | 7.0 | ZONE 1 | 45.0 | ZONES 2 & 3 | 45.0 | TRANS TUNNEL | 6.0 | LAMP SEALS* | 16.0 | COOLING** | 16.0 |
| Flowmeter   | Setting (L/m)  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| STACK   | 1.0  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| ENTR BAFFLE   | 7.0  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| ZONE 1  | 45.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| ZONES 2 & 3   | 45.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| TRANS TUNNEL  | 6.0  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| LAMP SEALS*   | 16.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| COOLING**   | 16.0   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
|   | <p>*Set LAMP SEALS for minimum 12 L/m up to 400°C plus 2.5 L/m per 100°C above 400°C to prolong lamp life.</p> <p>**Set COOLING for minimum 8 L/m up to 200°C (in Zone 3) plus 2.5 L/m per 100°C above 200°C to protect CACT.</p>  |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <p><b>5. Push CONTROLS green button</b></p>   | <p>Powers up the control system.</p> <p>Wait a few seconds for the zone controllers to initialize and display current zone and setpoint temperatures (Main Screen).</p> <p>Check that the cabinet cooling exhaust fans, and optional cooling tunnel exterior fans and product cooling fans are turning</p> <p>If a zone controller displays <b>no Cont</b>, <b>Err LnPE</b>, or <b>Err Progn</b> see Section 4.2.1. of Furnace Alerts and Alarms for possible causes and remedies.</p>   |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |
| <p><b>6. Check transport belt operation.</b></p>  | <p>Vary the conveyor speed from minimum (25 mm/m or 1 ipm) to maximum (508 mm/m or 20 ipm) using the TRANSPORT panel BELT SPEED knob.</p> <p>Check for smooth belt operation at all speeds.</p> <p>As a quick check on the belt speed, set the belt speed to 508 mm/m, 50 cm/min or 20 ipm. Place an object on the moving belt and time it from when it enters the furnace until it exits the furnace. The distance from furnace chamber entrance to chamber exit is 2336 mm (92 in). Divide this distance by the time in minutes (for example: a time of 4 minutes and 36 seconds converts to 4.6 minutes) to get an estimate of the actual belt speed. This estimate will vary with the accuracy of your timing measurement, but assuming a 3-second error over 4.6 minutes, your estimate should be within 1% of the speed shown on the BELT SPEED readout.</p> |           |               |       |     |             |     |        |      |             |      |              |     |             |      |           |      |

**Table 3-1 Functional Checkout**

| Action                                       | Comments / Changes   |
|--|--|
| <b>7. Set all zone controllers to 300 °C</b> | <p>Press controller  or  keys to enter the setpoint temperature on the green SV display, and  key to store the value.</p> <p>Notice how the dim setpoint temperature SV display will brighten when the  key stores the value.</p> |
| <b>8. Check zone switches</b>                | <p>On the ENERGIZE LAMPS panel, cycle each zone switch, one at a time, and verify that the zone indicator lamp turns ON (turn CW) and turns OFF (turn CCW).</p> <p>Finally, for the next step in this functional checkout, set <u>all</u> zone switches OFF (CCW).</p>   |

| Table 3-1 Functional Checkout  |  |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
|--|--|--------------------|---------------------|------------|--------|------------|--------|------------|--------|---------------|--------|---------------|--------|---------------|--------|--------------------|---------------------|------------|--------|------------|------------|------------|--------|---------------|--------|---------------|------------|---------------|--------|
| Action   | Comments / Changes   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| <p><b>9. Check zone power and lamps:</b><br/> <b>On the TEST panel, press the CALIBRATE pushbutton (ON).</b></p> <p><b>Note:</b> If the Temperature Deviation alert sounds during this test it can be silenced by turning the SILENCE switch CW on the STATUS panel.</p> <p><b>Note:</b> A 2-minute timer may shut off the CALIBRATE signal (the pushbutton lamp will go OFF if this happens) before you complete this check of zone power and lamps. If this happens, press the CALIBRATE pushbutton again to continue to send the calibration signal to the SCRs.</p> <p><b>Note:</b> Try to perform this lamp check quickly as the zone temperatures rise while the calibration signal is applied to the lamps.</p> | <p>One at a time, turn the zone switches ON (CW) and push the LAMPS green button to turn on power to the lamps. Verify that these LAMP STRINGS indicators on the TEST Panel turn ON when the corresponding zone switch is ON:</p> <p>For standard power LA-306 furnaces,</p> <table border="0"> <thead> <tr> <th><u>Zone Switch</u></th> <th><u>LAMP STRINGS</u></th> </tr> </thead> <tbody> <tr> <td>ZONE 1 TOP</td> <td>T1, T2</td> </tr> <tr> <td>ZONE 2 TOP</td> <td>T3, T4</td> </tr> <tr> <td>ZONE 3 TOP</td> <td>T5, T6</td> </tr> <tr> <td>ZONE 1 BOTTOM</td> <td>B1, B2</td> </tr> <tr> <td>ZONE 2 BOTTOM</td> <td>B3, B4</td> </tr> <tr> <td>ZONE 3 BOTTOM</td> <td>B5, B6</td> </tr> </tbody> </table> <p>For high power LA-306 furnaces,</p> <table border="0"> <thead> <tr> <th><u>Zone Switch</u></th> <th><u>LAMP STRINGS</u></th> </tr> </thead> <tbody> <tr> <td>ZONE 1 TOP</td> <td>T1, T2</td> </tr> <tr> <td>ZONE 2 TOP</td> <td>T3, T4, T5</td> </tr> <tr> <td>ZONE 3 TOP</td> <td>T6, T7</td> </tr> <tr> <td>ZONE 1 BOTTOM</td> <td>B1, B2</td> </tr> <tr> <td>ZONE 2 BOTTOM</td> <td>B3, B4, B5</td> </tr> <tr> <td>ZONE 3 BOTTOM</td> <td>B6, B7</td> </tr> </tbody> </table> <p>If all 2 or 3 lamp strings are ON, that bank of lamps is good.</p> <p>Push the LAMPS red button to shut OFF the lamps. Turn the zone switch OFF (CCW). Repeat this process until all zone switches and lamp strings have been checked.</p> <p>At the end of this check, the LAMPS should be OFF.</p> <hr/> <p>If one of the lamp strings LEDs is OFF, the string may have a burned out lamp that needs to be replaced. See section 4.5.</p> <p>If all lamp strings LEDs are OFF for any pair of zone switches for the same zone (for instance T1 and T2, B1 and B2), it means that the zone has a blown fuse (most likely) or an SCR controller (least likely) that needs to be replaced. See sections 7.5.4 and 7.5.5.</p> | <u>Zone Switch</u> | <u>LAMP STRINGS</u> | ZONE 1 TOP | T1, T2 | ZONE 2 TOP | T3, T4 | ZONE 3 TOP | T5, T6 | ZONE 1 BOTTOM | B1, B2 | ZONE 2 BOTTOM | B3, B4 | ZONE 3 BOTTOM | B5, B6 | <u>Zone Switch</u> | <u>LAMP STRINGS</u> | ZONE 1 TOP | T1, T2 | ZONE 2 TOP | T3, T4, T5 | ZONE 3 TOP | T6, T7 | ZONE 1 BOTTOM | B1, B2 | ZONE 2 BOTTOM | B3, B4, B5 | ZONE 3 BOTTOM | B6, B7 |
| <u>Zone Switch</u>   | <u>LAMP STRINGS</u>  |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 1 TOP   | T1, T2   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 2 TOP   | T3, T4   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 3 TOP   | T5, T6   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 1 BOTTOM  | B1, B2   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 2 BOTTOM  | B3, B4   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 3 BOTTOM  | B5, B6   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| <u>Zone Switch</u>   | <u>LAMP STRINGS</u>  |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 1 TOP   | T1, T2   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 2 TOP   | T3, T4, T5   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 3 TOP   | T6, T7   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 1 BOTTOM  | B1, B2   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 2 BOTTOM  | B3, B4, B5   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| ZONE 3 BOTTOM  | B6, B7   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| <p><b>10. Press the CLEAR button on the ALARM panel</b></p>  | <p>Ends CALIBRATE MODE and returns control of the lamp SCRs to the zone controllers.</p>   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| <p><b>11. Wait for zone temperatures to settle, if necessary</b></p>   | <p>Monitor zone controllers until all zone PV temperatures (red display) are at, or below, 300 °C (green display).</p>   |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |
| <p><b>12. Set all zone switches ON.</b></p>  |  |                    |                     |            |        |            |        |            |        |               |        |               |        |               |        |                    |                     |            |        |            |            |            |        |               |        |               |            |               |        |

**Table 3-1 Functional Checkout**

| Action   | Comments / Changes  |
|--|---|
| <p><b>13. Push LAMPS green button</b></p>                                  | <p>Turns lamps ON again.</p> <p>The K1 lamp contactor will close with an audible click sending power to the zone switches. Each zone controller OUT1 LED indicator (red) will be on.</p> <p>Zone PV temperatures will start to rise as increasing heat is reported by the zone thermocouples.</p> <p>The “soft start” controls will increase power gradually for the first 20 seconds of the warm up to limit the in-rush current to the lamps.</p> <p>The zone controllers will now drive the SCRs to produce just the correct amount of lamp power to keep the PV display from the thermocouple as close as possible to the SV setpoint temperature in each zone.</p> |
| <p><b>14. Wait for the green READY light</b></p>                           | <p>The furnace is now stabilized at 300 °C.</p> <p>When the READY light appears during normal operation (this may take several minutes), the furnace is ready to process parts.</p>   |
| <p><b>15. Start of Shut Down Test:<br/>Push COOL DOWN START button</b></p> | <p>COOL DOWN blue indicator turns ON. The red CLEAR pushbutton will light as well.</p> <p>Lamps turn OFF. The red PV zone temperatures will start to fall as the zones cool. All fans, the transport belt, and the zone controllers stay on. See section 1.4.2 for more information.</p> <p>To speed the COOL DOWN process, the user may increase belt speed and gas flow in the zones.</p>   |
| <p><b>16. Push CONTROLS red button while still in COOL DOWN mode.</b></p>  | <p>Turns console controls OFF.</p> <p>The COOL DOWN Mode will keep the fans, transport belt, and the zone controllers ON until COOL TIME expires.</p> <p>When all zone temperatures are &lt;100°C, all fans, the belt and the PLC and zone controllers shut off automatically.</p>  |
| <p><b>17. When all zones are below 100 °C ...</b></p>                      | <p>Shut off the process gas supply valve.</p> <p>The functional test is complete.</p>   |