INSTALLATION & SETUP

Detailed steps for successful installation of an IR furnace. Includes both standard and optional equipment.

2.1 Unpacking the Equipment

2.1.1 Un-banding and Verification

Remove the banding from the shipping container and carefully disassemble. Refer to the Equipment List in this manual and verify the model of your furnace system and good receipt of all options, accessories, and special configurations, which were ordered according to the original purchase order or specification. If you cannot locate a listed item, immediately notify the carrier and Technical Support.

2.2 Location & Initial Installation Work

2.2.1 Machine Inspection

Remove the upper and lower side covers from both sides of the machine. Inspect all lamp connections for soundness and for loose hardware that may have become dislodged during shipment. Inspect the lower electrical compartment for shipping damage, loose connections, or components. Finally, inspect the furnace interior, checking for broken lamps, foreign objects, or any components that may have come loose during shipment. Report any shipping damage immediately to the LCI Furnaces or FurnacePros Technical Support Department.

2.2.2 Machine Label

The furnace label generally appears as in **Figure 2-1 Name Plate** and indicates the maximum power and current draw. Actual operating values are much lower and can be found in Section 6.1Power & Current. This label will normally be located near the Power Input either on the side or rear of the Control Enclosure or on either side of the Electrical Pedestal.

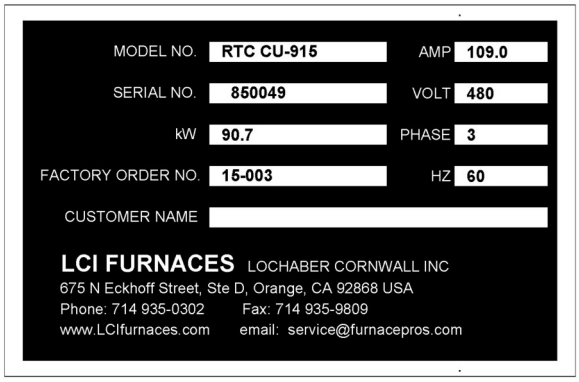

Figure 2-1 Name Plate

2.2.3 Machine Location

Furnace Environment Considerations. Location of the machine is important. The furnace environment should be clean and dry, especially if the furnace is to be used for to create low oxygen or other controlled environment. The lower the moisture levels in the room where the furnace is located, the easier it will be to achieve low oxygen and moisture levels in the furnace. Locate furnace away from fans, blowers or other equipment or drafts that can influence atmospheric conditions inside the furnace.

Installing Through a Wall. If installing the furnace through a wall between two rooms, make sure that the room pressures are equalized to avoid influencing the furnace atmosphere.

2.2.4 Lifting and Moving the Furnace

Lift the machine at the approximate locations shown on the Furnace Arrangement drawing, and slide the shipment skid out from under the machine. Do not attempt to lift the machine at one point or at points other than recommended; failure to follow these instructions invites frame damage and will void the warranty.

NOTE: The lifting device must extend under the machine and support both sides of the frame structure. See drawing 803-091615 Furnace Arrangement for location.

Once the machine has been moved onto a smooth flat floor the furnace can usually be moved on its wheels. Raise the furnace feet above the elevation of the wheels using an open-end wrench on the screw flats (Figure 2-4). Carefully manually push the furnace to the desired location. To secure, lower feet to keep in place. Tighten leveling nuts to lock in place.

2.2.5 Machine Placement

Furnace Environment. Locate the machine on an unyielding floor in the final installation position so that the access panels along the length of the furnace can be removed for calibration, servicing and maintenance.

2.2.6 Removal of Shipping Restraint Brackets (post-2000 furnaces only)

Large furnaces operating at high temperatures experience considerable growth from thermal expansion. All models are equipped with support slides which allow stress free expansion to take place. To secure the process chamber during shipment, restraining brackets (labeled SHIPPING BRACKET) attach directly between the chamber and frame.

Before operating the furnace first remove the top hex nuts and washers which secure each bracket to the frame. Then remove the shipping bracket and discard or store for use when moving the furnace again. To store inside the furnace, turn shipping bracket upside down and reinstall nuts, but leave them loose.

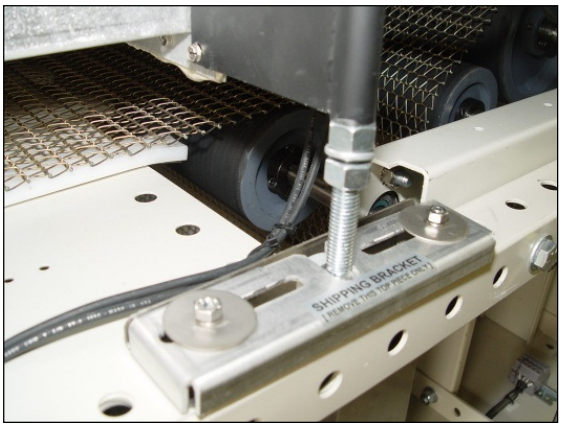

Figure 2-2 Shipping Brackets

WARNING: Failure to remove the top bracket invites structural damage and will void the warranty.

2.2.7 Leveling the Machine

A. Older Model Furnaces (manufactured before 2000)

On older model RTC furnaces, shim pedestals to level furnace chamber area to ¼ inch within 10 feet.

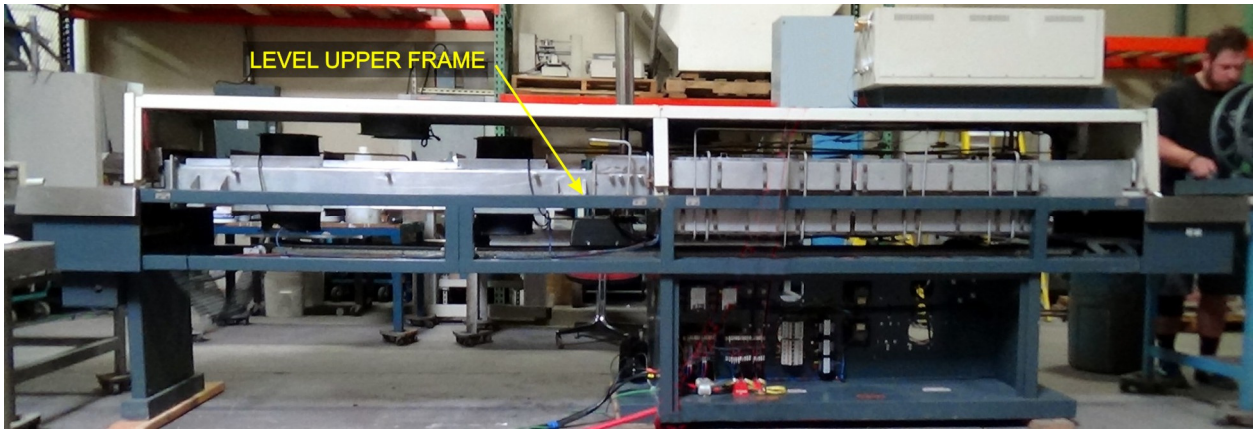

Figure 2-3 CU-915 (1985) Furnace Rear View with panels removed.

B. New Model Furnaces (manufactured after 2000)

On a new furnace, remove the base covers and using an open-end wrench on the screw flats, adjust the leveling feet to level (Figure 2-4) the frame within 0.06 inch overall. Tighten leveling nuts to lock in place.

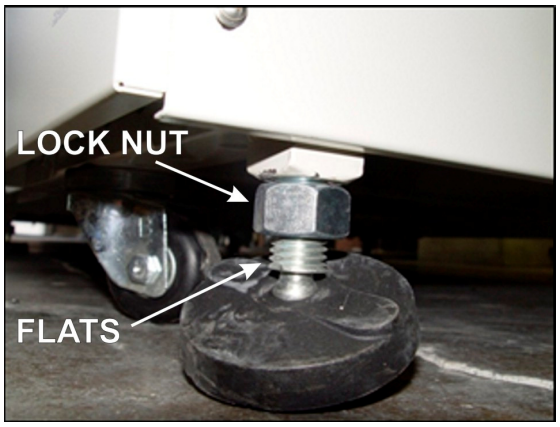

Figure 2-4 Leveling Feet

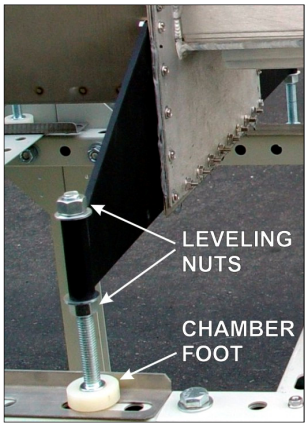

Figure 2-5 Chamber Support Bracket

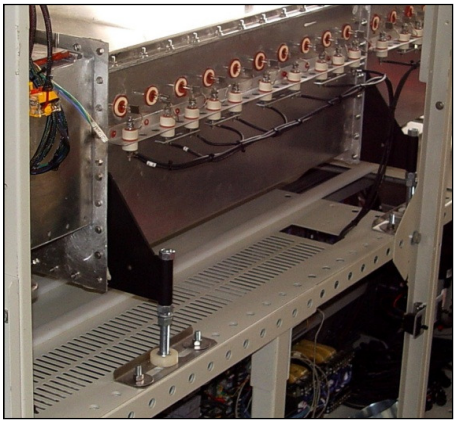

Figure 2-6 Chamber Support Brackets

After the frame is level, adjust the 2 Leveling Nuts (Figure 2-5) on each of the 8 Chamber Support Brackets to 0.06 inch overall. See location of brackets in Figure 2-7. Adjust so that all brackets evenly support the weight of the furnace chamber assembly. Tighten nuts to lock in place.

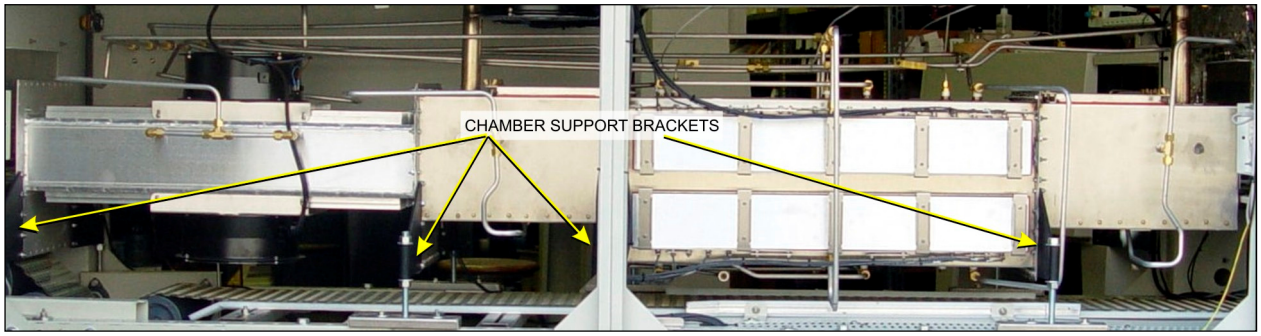

Figure 2-7 Location of Support Brackets on post-2000 model furnaces

2.2.8 Installation of the Transport Belt

CU-915 furnaces are usually shipped with the belt already properly installed. However, if the furnace is shipped SPLIT or the shipment is expected to be exposed to rough handling or irregular terrain during shipment, the transport belt may have been intentionally left uninstalled to protect the furnace interior. This section can be used for installing the belt on a new furnace. See 4.7.5 Transport Belt Replacement or for replacing a damaged or worn belt.

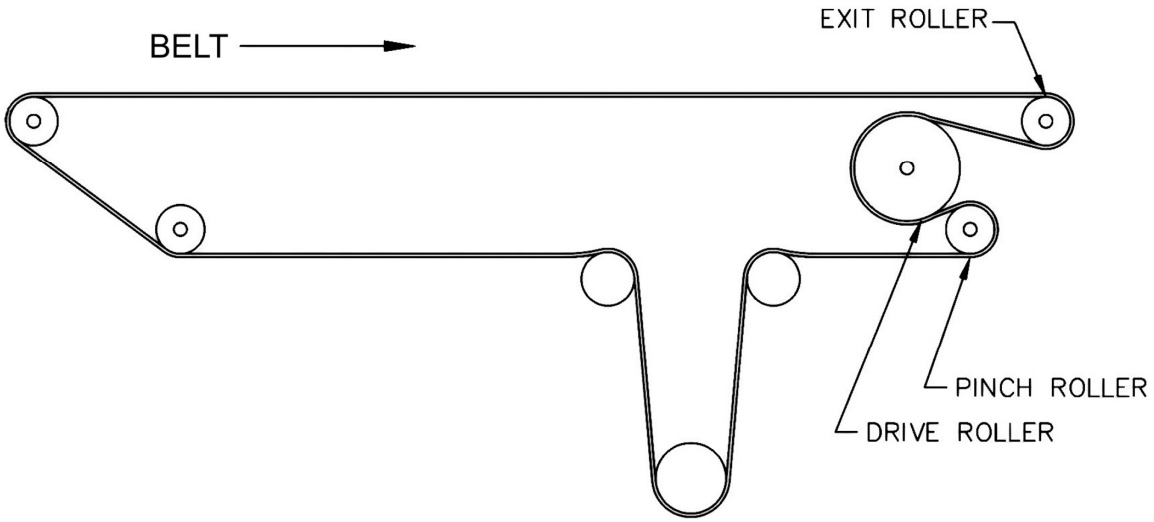

Figure 2-8 Belt Path

When installing the belt, have an assistant ready to help guide the belt into the furnace entrance.

A. Threading Belt

Extend a long wire or stick (to act as a pull rod) through the furnace chamber, being careful not to damage the lamps or insulation.

Securely attach the leading edge of the belt to the pull rod. Carefully pull the belt through the furnace from the exit end, while an assistant at the entrance unrolls and guides the belt into the furnace.

When the belt has been pulled through the furnace chamber, remove the pull rod and thread a pull wire through the rollers and drive drum, as shown in Figure 2-8. Pull the leading edge of the belt to the entrance and splice.

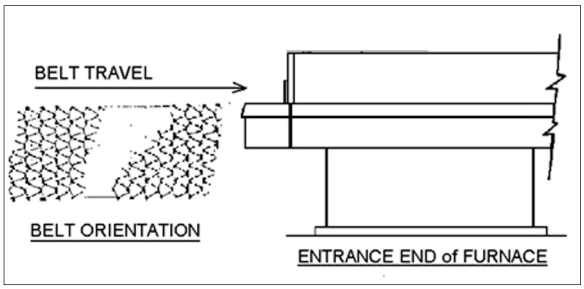

Figure 2-9 Belt Orientation

B. Splicing the Belt

Line up the ends of the belt so they are parallel and slightly overlapping.

Splice the belt by inserting one of the cross-section wires through the belt mesh across the width of the belt as shown in Figure 2-10.

The wire should be even and parallel and aligned with the belt edges. The cross-section wire will stay in place without any finishing at either end.

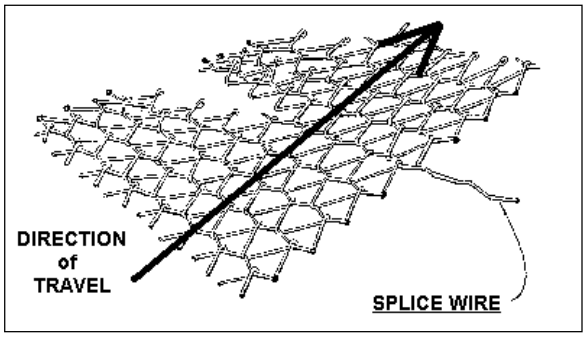

Figure 2-10 Belt Splice

C. Belt Weight

Install belt weight as shown in Figure 2-12 and Figure 2-13.

2.2.9 Unpacking and Installation of Belt Weight

A. Locate and Unpack Belt Weight

Find the belt weight packed with the furnace. On new furnaces the belt weight may be located as shown in Figure 2-11 . Unwrap and remove packing.

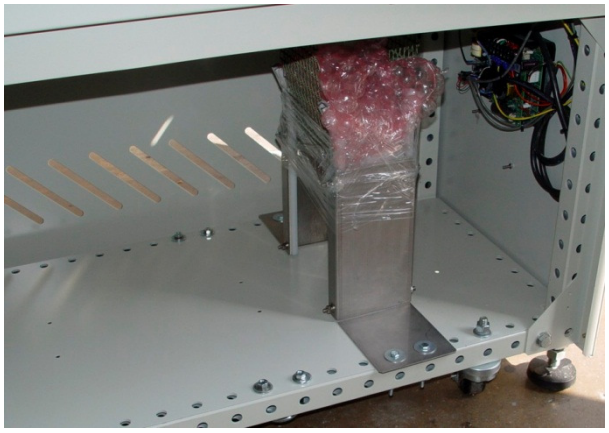

Figure 2-11 Belt Weight in guide with packing

B. Install Belt Weight (furnaces with belt guide)

On newer model furnaces the belt weight is placed in the belt guide. Reinsert belt weight as shown in Figure 2-12. If necessary, pull belt to the left or right to align Belt so that Belt Weight is allowed to move freely as shown in Figure 2-13.

Figure 2-12 Belt Weight in guide

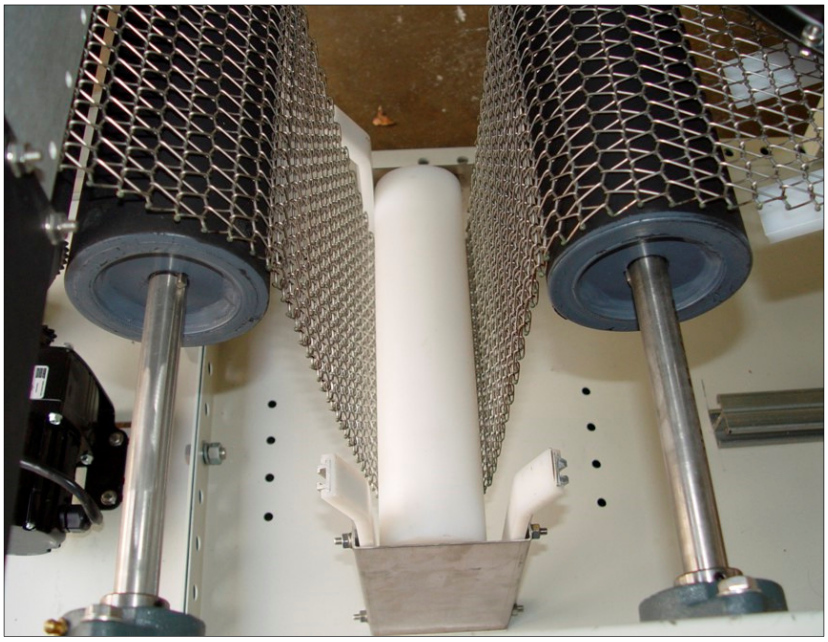

Figure 2-13 Proper Alignment of Belt Weight in guide

C. Install Belt Weight (furnaces without belt guide)

On older model furnaces the belt weight may just be placed in the belt loop if a guide is not present. Remove tie and make sure belt weight is inserted as shown in Figure 2-14. If necessary, pull belt to the left or right to align Belt so that Belt Weight is allowed to move freely as shown in Figure 2-15.

Figure 2-14 Belt Weight without guide

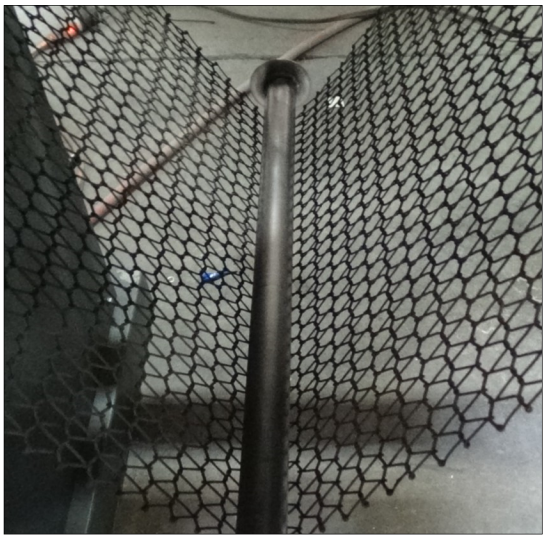

Figure 2-15 Proper Alignment of Belt Weight

D. Installing Belt Weight with UCD option (only on systems with UCD)

If an ultrasonic cleaner is installed on the furnace, the belt weight is installed the same manner as above, except in the UCD tank.

Figure 2-16 Belt weight in Tank on UCD system

2.3 Providing Power

The furnaces are shipped wired for the voltage specified on the nameplate. The nameplate is located near where the power is to be connected on the exit side of the large pedestal, toward the rear.

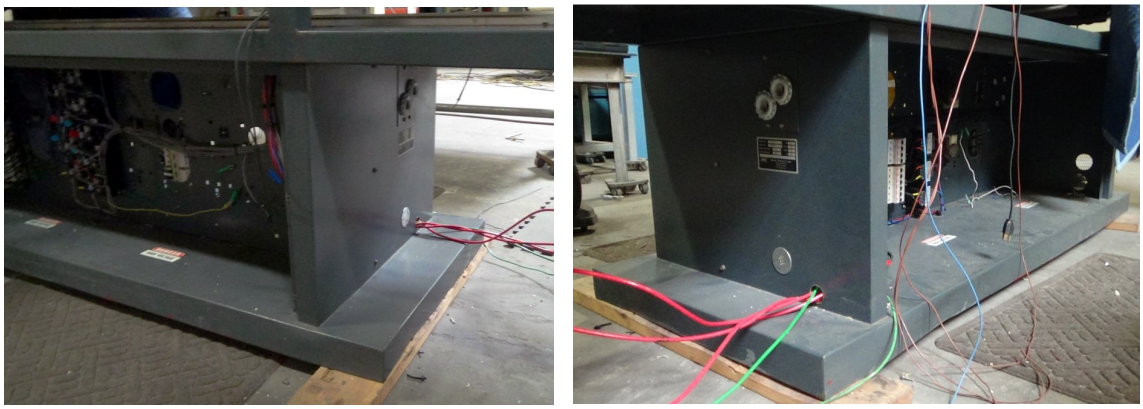

Figure 2-17 Facility Power Port and Nameplate

Depending on options supplied, Connect electrical power, matching the specifications on the nameplate to the circuit breaker, 3-phase disconnect switch, or TB-1 (on Safety Panel accessed via the furnace lower rear access panel through the Power Port shown on the Furnace Arrangement drawing 803-091615. Wire per drawing 802-101779 SAFETY PANEL ANALOG.

A ground terminal is provided for a safety ground. All city and local codes should be followed when wiring this system for power. See Furnace Arrangement drawing 803-091615 and Engineering and Specifications sections of this manual for power requirements.

3-phase 480 Vac power connection

Connect only as a 3-phase with a ground (refer to drawing 802-101779):

1. Connect facility Leg 1 to TB1-01 terminal
2. Connect facility Leg 2 to TB1-02 terminal
3. Connect facility Leg 3 to TB1-03 terminal
4. Connect facility earth ground to TB1-G terminal.

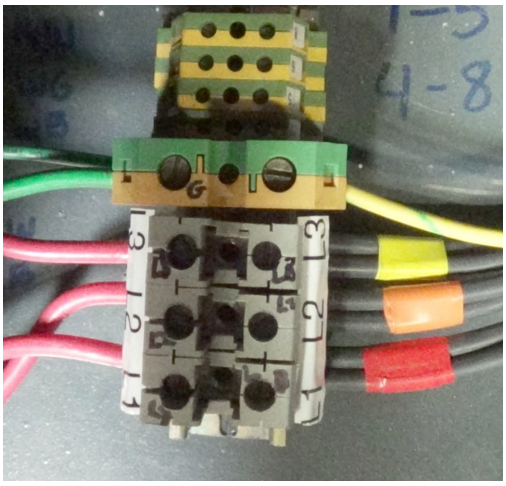

Figure 2-18 480 Vac, 3PH 4-wire

2.3.1 Circuit Breaker (Option not supplied)

A 3-phase circuit breaker if supplied will either be mounted on the rear side of the Load station or in an enclosure on top of the furnace at the location shown on the Furnace Arrangement drawing. Wire supply power through one of the knockouts on the enclosure. All city and local codes should be followed when wiring this system for power. See Facilities drawing 803-091309 and Engineering and Specifications sections of this manual for power requirements.

Figure 2-19 Circuit Breaker panel

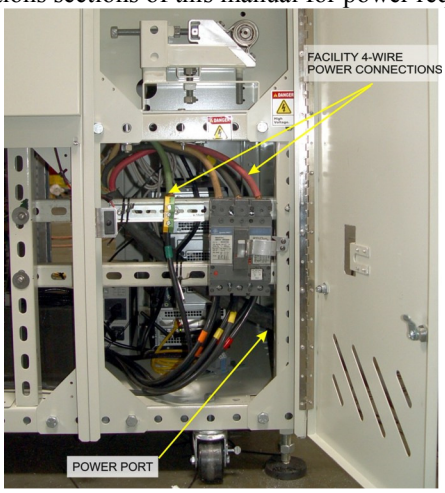

Figure 2-20 Circuit breaker

2.3.2 Product Handling (SMEMA) Connections (Option not supplied)

If so equipped, refer to drawing 803-101951 for SMEMA pin out information for connections at the entrance and exit.

2.3.3 Handshake (HSK) Connections (supplied Option)

Refer to 803-101777 for Furnace Ready NO/NC signal connections at entrance and/or exit of the furnace.

2.3.4 Factory Standard UPS (Option not supplied)

A small uninterruptable power supply (UPS) has been installed at the factory to provide 6 minutes for orderly shutdown of the furnace computer and PLC in the event of power failure or inadvertent disconnect of the furnace. Computer, monitor and Opto22 PLC stay on for 5-6 minutes. This UPS is located behind the computer access door next to the furnace computer.

Figure 2-21 Factory Standard UPS

2.4 Providing Process Gas

Oil-free dry process gas at a maximum recommended dew point of 15°C (59°F), shall be brought to the machine through a customer supplied lines with a minimum inside diameter of 3/4 inch. Initial supply pressure shall not exceed 175 psig. In addition to a supply line filters and condensate traps, regulators to reduce supply pressure to **70 psig must be installed on each supply line just before entering the furnace.**

The supply temperature of all gases should be above the dew point of the room air to prevent condensation from forming on the feed lines and dripping into the furnace.

See Furnace Arrangement drawing for location of process connections. Process gas connections are shown in Figure 2-24

DANGER: The flowmeters on these furnaces are rated at 70 psi (5 bar) maximum. Operating above 70 psi exposes the operator to possible injury, may cause damage to the furnace internals and insulation and voids the furnace warranty

Figure 2-22 Process Gas Supply location

2.4.1 Single Gas Furnaces

On single gas furnaces, Gas 1 is a ¾ inch female pipe connection for connecting CDA (clean dry compressed air) or nitrogen or other process gas to supply all furnace flowmeters on the front of the control console. See 2.5.1for process gas requirements.

2.4.2 Dual Gas Furnaces (Option not supplied)

On dual gas furnaces, Gas 1 is a ¾ inch female pipe connection for connecting CDA (clean dry compressed air) or nitrogen or other process gas to supply all aux flowmeters on the front of the control console. Gas 2 can be either nitrogen or non-combustible forming gas to supply furnace chambers and plenums. The owner can install a crossover valve if single gas operation id desired as well as dual gas modes. See 2.5.1for process gas requirements.

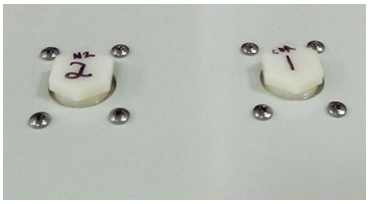

Figure 2-23 Dual Gas Connections

2.4.3 Three Gas, Dual Mode Furnaces (■ supplied option)

On three gas, dual mode furnaces, Gas 1 has two ¾ inch female pipe connections. Gas 1 is the primary gas connection for CDA and nitrogen to all furnace auxiliaries including entrance exhaust stack eductor and transition stack eductors, baffles and cooling.

Gas 2 is a ¾ female pipe connection for forming gas supply connects to furnace heating chambers and lamp plenums

See 2.5.1for process gas requirements.

Figure 2-24 3-Process Gas connections

Note: The supply line to the furnace can be plumbed to provide the same gas to both Gas 1 and Gas 2, if desired.

The supply temperature of any gas including air should be above the dew point of the room air to prevent condensation from forming on the feed lines and being introduced into the furnace.

See 803-091615 Furnace Arrangement drawing for location of process connections.

2.4.4 Source Gas Type

This furnace is configured for connection of three (3) process gas supply lines:

1. clean dry air (CDA),
2. nitrogen (N_2), and
3. non-combustible forming gas (FG).

DANGER: Except for furnaces specifically equipped with the hydrogen option, combustible gas should NOT be connected to the furnace. Forming gas or other gas mixtures which have a combustible gas component can be safely introduced into furnace provided the delivered concentration is below its lower flammable limit (LFL) in air.

2.4.5 Furnace Process Gas requirements

Filtered, oil-free dry process gas at a maximum recommended dew point of 15°C (59°F), shall be brought to the machine through a customer supplied lines with a minimum inside diameter of 3/4 inch.

Plant supply process gas must be dry, filtered and regulated to 4.8 bar (70 psi) before the furnace is started to assure consistent clean dry process gas is supplied during furnace operation. Initial supply pressure shall not exceed 70 psig (except if optional supply gas Mixing System in included. In addition to each supply line, filters and condensate traps, and regulators to reduce supply pressure to 70 psig must be installed by the owner on each line before connecting to the furnace.

If the process gas supply pressure drops below the set point during operation, the operator should put the furnace into Cool Down. The operator can reset the system to Warm Up when air pressure is again over 70 psig.

Table 2-1 Gas Supply Pressure

Location	Default Setting	
Plant Process Gas Regulator supply to furnace	68 - 70 psig	4.7 - 5.0 bar
Low Gas Pressure Alarm Switch	55 - 60 psig	3.8 - 4.1 bar

See Section 3 for information calibration and service of the pressurized gas system.

DANGER: The flowmeters on these furnaces are rated at 70 psi (5 bar) maximum. Operating above 70 psi exposes the operator to possible injury, may cause damage to the furnace internals and insulation and voids the furnace warranty.

WARNING: NEVER RUN THIS FURNACE WITHOUT PROCESS GAS. Assure an adequate supply of process gas is available at 70 PSIG at the furnace before energizing the lamps to avoid damaging the furnace chamber, seals, and/or heating elements. Operating the furnace without adequate supply of process gas voids the warranty.

2.5 Exhaust Requirements

2.5.1 Non-combustible Process Gas Exhaust Requirements

In most applications, process exhaust and heat is vented to the outside atmosphere. It is the customer's responsibility to review the process, local laws, and facility in deciding on an exhaust system.

We recommend a 4-inch diameter insulated exhaust duct with a 4 to 6-inch diameter insulated hood for exhausting hot non-combustible process gas.

Do not make any direct connections to the chamber exhaust stacks. A minimum 2.0 inch clearance between the 3.0 inch diameter exhaust stack shroud and the venting device is required. Figure 2-25 Exhaust Connection and Figure 2-26 Exhaust Connection Detail show typical exhaust connections for nitrogen, CDA and forming gas applications. Collector hoods are typically 8-10 inches diameter connected to a 4-6 inch diameter duct. Ducts from multiple stacks can be connected above. Butterfly dampers (shown) can be used to balance exhaust flow and to minimize facility exhaust system influence on the furnace atmosphere.

Figure 2-25 Exhaust Connection and Figure 2-26 Exhaust Connection Detail show typical exhaust connections.

See 803-091615 FURNACE ARRANGEMENT drawing duct and hood location.

Figure 2-25 Exhaust Connection

Figure 2-26 Exhaust Connection Detail

2.5.1 Cabinet Exhaust Requirements (Non-combustible furnaces)

Heat transmitted to the outside of the furnace chambers and the cooling sections exits the furnace enclosure via cabinet fans. In some applications, cabinet fans exhaust this heat to the room. In others, all process heat emitted from the furnace must be exhausted via ducts to the outside atmosphere.

A 4-inch round duct with rectangular hood can be installed above the 10-inch diameter cabinet cooling exhaust fans to reduce the additional heat load the furnace can add to its environment. The duct generally does not need to be insulated. As the cabinet fan only cools the cabinet interior, if the furnace is installed in an adequately ventilated room, this exhaust duct may not be required. Duct hoods that capture heat from the furnace cabinet fans can be sealed to the top of the furnace provide that no load is imparted to the furnace cabinet

See 803-091615 FURNACE ARRANGEMENT drawing for suggested duct and hood locations.

It is the customer's responsibility to review the process, local laws, and facility in deciding on an exhaust system.

Figure 2-27 Cabinet Exhaust Example

Figure 2-28 Cabinet Exhaust Examples

2.5.2 Combustible Process Gas Exhaust Requirements (hydrogen option only □)

In most applications, process exhaust and heat must be vented to the outside atmosphere. It is the user's responsibility to review the process, local laws, and facility in deciding on an exhaust system. If combustible gases are present, a wide collector hood suitable for 300°C operation with a 30-inch inside diameter, or larger, is routinely used. The hoods are typically located a minimum of 24 inches above each igniter stack. See Furnace Arrangement drawing for suggested sizes and locations.

Do not make any direct connections to any chamber exhaust stack. Clearance between the exhaust stacks and venting device is required. See Figure 2-29 for example of a typical hydrogen furnace exhaust connection.

Figure 2-29 Typical Hydrogen Furnace Process Gas Exhaust Connection

2.6 Gas Analyzers & Sampling

2.6.1 OA and OSS Location

The OA/OSS system provides for sampling furnace zones 1, 2, or 3 and analysis of the sampled zone for oxygen content in parts per million (ppmv) or percent (%) O2.

On the CU-915 furnace, the OA oxygen analyzer is placed on top of the furnace next to the OSS Sample System enclosure.

Figure 2-30 shows the Oxygen analyzer in place next to the OSS Enclosure.

Figure 2-30 Oxygen analyzer next to OSS system

The analyzer can be disconnected from the furnace and used elsewhere.

2.6.2 OA and OSS connections

After Analyzer is in place next to the OSS Enclosure, connect the Analyzer to the furnace as follows (refer to Figure 2-31 through Figure 2-33for connection detail).:

Figure 2-31 Locate oxygen analyzer next to OSS

Power. Plug black O2 ANALYZER POWER cord from control enclosure to socket in back of analyzer.

Sample Line. Connect sample line tube from control enclosure port labeled TO O2 ANALYZER SAMPLE IN to corresponding Sample In port on analyzer.

Exhaust Line. Connect exhaust line tube from control enclosure port labeled FROM O2 ANALYZER SAMPLE OUT to corresponding SAMPLE OUT port on analyzer.

Alarm connection. Plug connector on grey alarm wire from control enclosure to connector on wire attached to normally open (NO) analyzer terminals 10 and 11.

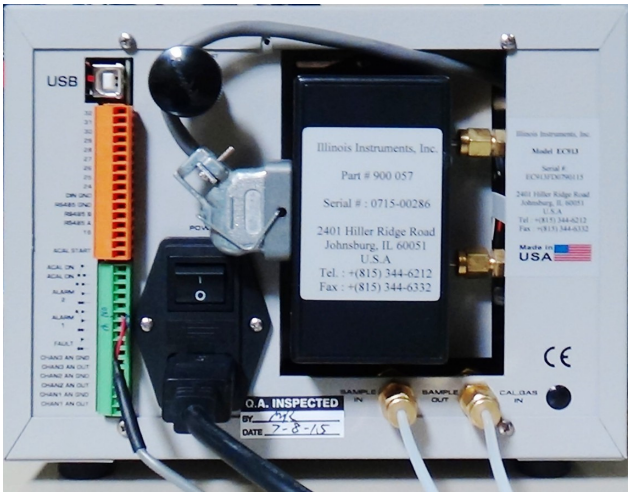

Figure 2-32 Oxygen Analyzer connections

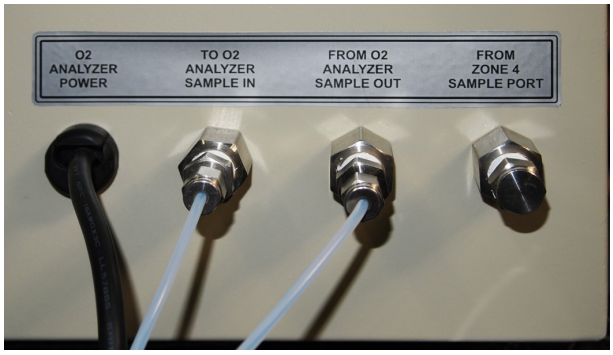

Figure 2-33 OA furnace control enclosure connections

2.6.3 Analyzer Initial Setup (with OSS)

Enable analyzer by turning Power Switch on back of analyzer (Figure 1-39) to ON position.

Open IN valve full CCW (on back of analyzer, (Figure 1-39).

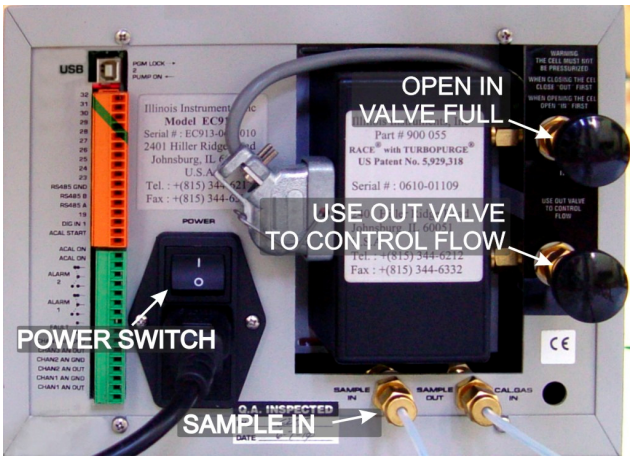

Figure 2-34 EC913 Oxygen Analyzer Rear Controls

2.6.4 OA Operation (with OSS)

On the control panel:

1. Start furnace.
2. Select sample port S using Port Select switch.
3. Turn Analyzer ON switch to energize system and start analyzer.
4. Run furnace until system stabilizes.
5. Select sample port 1, 2 or 3 to be sampled for analysis of O2 content.

During initial startup, adjust OUT valve (Figure 2-34) until Sample Flow flowmeter on front of analyzer reads 0.1-0.15 L/min. On subsequent startups, the flow rate does generally not need to be adjusted.

2.6.5 Zone 4 Port

A capped connection to a sample port in furnace heating zone 4 is provided on the side of the furnace Control Enclosure Figure 2-33.

Connections to this port should be with Teflon and/or stainless steel tubing and stainless steel Swagelok® fittings.

In order to extract a sample from this port , a sample pump must be installed or be integral to the analyzer connected to Sample Port 4.

2.7 Water and Drain Connections

2.7.1 Water Supply and Drain Connections for UCD (option not supplied)

Furnaces equipped with an ultrasonic cleaner dryer (UCD) system will require the customer to connect clean water supply lines to the connections provided.

Pipe water supply connection through pipe connections under panel or through rectangular opening in lower panel similar as shown in Figure 2-. Supply pressure shall not exceed 100 psig. The furnace shall include a water pressure regulator to reduce water pressure to a maximum of 30 psig.

Drains. For UCD systems a drain line capable of intermittent flows of 40 gpm at 40 psi (5-10 minute durations) must be connected to the water drain connection. See Furnace Arrangement drawing 803-091309 for connection locations, sizes and maximum and typical flow rates.

Figure 2-35 UCD Water Connections and Air Purge (Reservoir option only)

2.7.2 Water Supply and Drain Connections for CAWC (option not supplied)

Optional Controlled Atmosphere Water Cooling (CAWC) systems require clean water supply supplied to the connections provided. Water cooling systems generally operate best when connected to a recirculating deionized water (DI) cooling system. Pipe water connection through rectangular opening in lower panel similar to Figure 2-36. Supply pressure shall not exceed 100 psig. Furnace includes dual pressure regulators to reduce water pressure to a maximum of 25 psig. . See Furnace Arrangement drawing 803-091309 for connection locations, sizes and maximum and typical flow rates.

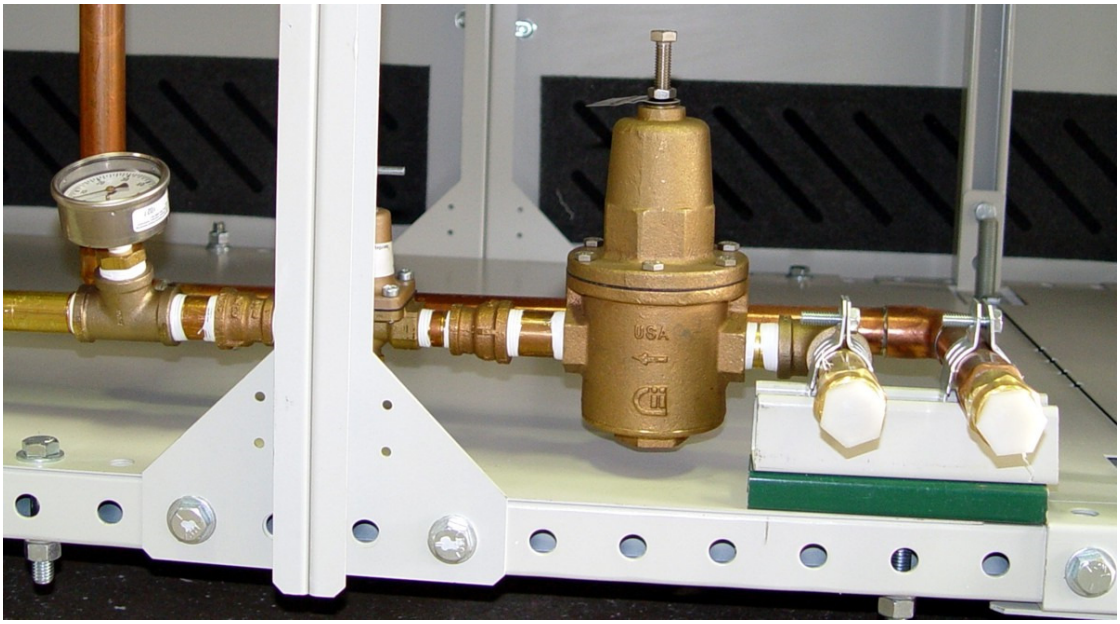

Figure 2-36 CAWC Water Supply & Drain Connections

2.9 Installation Responsibilities

2.9.1 Owner's Responsibility

Prior to Startup, it is the Owner's responsibility to accomplish the Installation tasks described in sections 2.9.2 and 2.9.4 as applicable.

For larger furnaces, LCI FurnacePros shall reassemble, re-install the belt and level the furnace once it has been located at the site before any utilities can be connected.

When the LCI FurnacePros Technical Support or Service technician visits the user's plant, the technician will require the help of at least one customer representative who will be responsible for the operation and maintenance of the furnace system.

2.9.2 Pre-Installation Tasks by Owner

Tasks typically performed by the customer after furnace is assembled in place:

- Uncrate Furnace.
- Remove packing materials.
- Inspect for damage.
- Move furnace or furnace sections and accessories to operating location.
- Provide utilities to general furnace location and/or location of connections (gas, power, exhaust ducting as well as water and drains, as required).

2.9.3 Installation Tasks Performed by Installer

Tasks typically performed by the LCI FurnacePros Field Service representatives before customer utilities can be connected include:

- Level furnace (shim pedestals on CU-series to level chamber within ½ inch in 15 feet).
- Level furnace chamber sections (not required on CU-series).
- Remove side panels.
- Remove all shipping restraints.
- Reassemble split furnace sections (split furnaces only).
- Check for loose fasteners and fittings.
- Install belt weight in belt loop, tank or guide.
- Reinstall and align belt (split machines only).

2.9.4 Installation Tasks by Owner

Tasks typically performed by the customer after the furnace is assembled in place:

- Connect furnace power (lockout furnace, do not energize).
- Connect process gas piping (forming gas, nitrogen and CDA as required).
- Connect water and drain lines (if required).
- Locate and install exhaust system.
- Locate and install upstream and downstream process equipment (optional).
- Install network line (option not available on this model).

2.10 New Installation Startup Tasks

Tasks typically performed during startup by the LCI FurnacePros Field Service representatives include:

- Checkout before first operation.
  - Verify transformer settings for customer supply power. Energize breaker to engage customer supply power.
  - Verify gas supply and water hookup including required pressure regulators. Verify regulator pressure settings.
- Apply power, run through the installation checkout and test procedure:
  - Check/confirm voltages.
  - Verify all fans are operating
  - Verify belt tracking.
  - Check operation of water system.
    - Leak check water system.
  - Leak check process gas system.
- Troubleshoot and systems test:
  - Process Gas systems check
  - O2 & Moisture analyzer check (options)
  - OSS check (gas sampling system option)
  - SMEMA or SENSLAS product alert and handling check (option)
  - Transport motion alarms check
  - Element monitoring system check
  - UCD Systems check (option)
  - Software integration test (computer models only)
- Cycle machine to a fully operational state & Calibrate:
  - Power up.
  - Check heating and cooling sequence.
  - Check standard alarm systems.
  - Verify belt speed. Re-calibrate belt as necessary.
  - Check all SCR's. Adjust to 450 Vac max if required.
  - Run furnace READY stabilization check.
- Report to the customer any deficiencies noted in the installation of the machine.
- Instruct the appropriate personnel in the customer's plant how to operate the furnace system.
- If training has been included, a manufacturer's representative shall train the appropriate personnel in the customer's plant on furnace operation and necessary preventive maintenance.
- Replace Covers. Before operation for production, install any covers that were removed during the functional checkout.
- Owner preferences:
  - Archive furnace profile default settings.

NOTE: All functions must operate properly before proceeding. Refer to the Service Information section and correct any malfunctions before completion.

- Archive software (if any) and settings.
- Turn over the machine and documentation to the customer.

2.11 Initial Setup

2.11.1 Low Pressure Alarms (IPS)

Gas Supply Pressure Switches are installed on each process gas manifold. These switches are normally closed. They open when proper pressure is present in the process gas supply lines.

The pressure switches are factory set to open when pressure falls below the pressure set points in Table 2-2 for Gas 1 and Gas 2.

Figure 2-37 Pressure Switch

Table 2-2 Initial Pressure Alarm Settings			
Manifold	**Process Gas**	**Pressure Set Points**	
Gas 1	Nitrogen and/or CDA	55-60 psi	3.8-4.1 Bar
Gas 2	CDA, Nitrogen, Forming Gas and/or other (Dual Gas option only)	55-60 psi	3.8-4.1 Bar

The pressure switch set points can be adjusted manually. Locate the switch in the process gas supply line. To increase the set point turn the wheel clockwise. Turn the top of the switch counter clockwise to decrease the pressure set point so the alarm will not occur until the pressure drops to a lower point.

Recommended initial setup and checkout of the 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.

2.11.2 Emergency Machine Off (EMO)

Pressing these buttons, located at each end of the furnace, cuts all power to the machine circuits immediately. Rotating the button CW and/or pulling outward will reset the button. All EMO buttons must be in the SET position for power to enter the furnace.

Figure 2-38 EMO buttons at Entrance

Note: These buttons are for emergency use only and are not recommended for routine shutdown of the furnace.

2.11.3 Control Console

During normal operation the user will manage all furnace functions via the Control Console. Figure 2-39 shows an operating Control Console ON. The elements of the Control Console are described in Section 1.5.

Figure 2-39 Control Console ON

2.12 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 2-3 Functional Checkout

Action	Comments / Changes
1. Replace covers	Install any covers that are off the machine or that were removed during checkout.
2. Confirm main power is ON	If not on, turn on power to the furnace. **Caution**: **Dangerous voltages and current are now present throughout the control enclosure and on lamp wire connections to the furnace lamps.**
3. Turn on the process gas supply valve **WARNING: NEVER RUN THIS FURNACE WITHOUT PROCESS GAS. Assure an adequate supply of process gas is available at 70 PSIG at the furnace before energizing the lamps to avoid damaging the furnace chamber, seals, and/or heating elements.**	Adjust gas pressure on inlet regulator to between: 4.5 – 5 bar 450 – 500 kPa 65 – 72 psig **Note: Exceeding the upper limit could damage the flowmeters.**
4. Adjust process gas flowmeters	Adjust gas flowmeters on GAS FLOW CONTROL panel for the functional checkout per the table below. Use same settings for CDA, N2 or FG. 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.
RTC CU-915 - **dual gas** manifold, **(800-850C firing)**	Flowmeter — Setting (SCFH) ENTRANCE STACK 25 ENTRANCE BAFFLE 50 ZONE 1 190 ZONES 2 - 4 190 LAMP PLENUMS 80 TRANSITION TOP 180 TRANSITON BOTTOM 90 TRANSITION STACK 30 COOLING 300 (all settings ± 10%)
Set LAMP PLENUMS for minimum 80 SCFH at temperatures greater than 400 °C to prolong lamp life. Adjust CACT for adequate cooling.	

Table 2-3 Functional Checkout

Action	Comments / Changes
4a. Flowmeter settings for processing with low oxygen (800-850C firing) 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. Initially, 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.	For **dual gas** manifold **Low O2 Firing**: Flowmeter — Setting (SCFH) ENTRANCE STACK 13 ENTRANCE BAFFLE 50 ZONE 1 360 ZONES 2 - 4 500 LAMP PLENUMS 100 TRANSITON TOP 180 TRANSITION BOTTOM 90 TRANSITION STACK 12 COOLING 300 (all settings ± 10%)
Set LAMP PLENUMS for minimum 80 SCFH at temperatures greater than 400 °C to prolong lamp life. Adjust CACT for adequate cooling.	
5. Push POWER ON white button 	Powers up the control system. 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. Wait a few seconds for the zone controllers to initialize and display current zone and setpoint temperatures (Main Screen). Check that the cabinet cooling exhaust fans, and optional cooling tunnel exterior fans and product cooling fans are turning If a zone controller displays no Cont, Err InPt, or Err Prod see Section 4.2.1. of Furnace Alerts and Alarms for possible causes and remedies.
6. Check transport belt operation. 	Vary the conveyor speed from minimum (0.3 ipm or 4 ipm) to maximum (4 ipm or 75 ipm, varies depending on motor installed) using the TRANSPORT panel BELT SPEED knob. Check for smooth belt operation at all speeds. As a quick check on the belt speed, set the belt speed to mid-range (turn BELT SPEED 5 turns CW from full CCW). Place an object on the moving belt and time it from the time it enters the furnace until it exits the furnace. The distance from furnace chamber entrance to chamber exit is (153 inches). 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 a 4.6 minute time, your estimate should be within 1% of the speed shown on the BELT SPEED readout.

Table 2-3 Functional Checkout	
Action	**Comments / Changes**
7. Set all zone controllers to 300 °C	Press controller ▼ or ▲ keys to enter the setpoint temperature on the green SV display, and SET key to store the value. Notice how the dim setpoint temperature SV display will brighten when the SET key stores the value.
8. Check zone switches 	On the Control panel, cycle each zone switch, one at a time, and verify that the zone indicator lamp turns ON (push once) and turns OFF (push again). Finally, for the next step in this functional checkout, set all zone switches OFF.
9. Check zone power and lamps: **Start furnace with all lamps disabled.** Note: If the Temperature Deviation alert sounds during this test it can be silenced by pressing the SILENCE button on the STATUS panel. Note: Try to perform this lamp check quickly as the zone temperatures can rise and stabilize during this process shutting off the energize lamps signal being applied to the lamps.	One at a time, press each white zone top or zone bottom pushbutton to power to the bank of lamps in that area. Verify that the corresponding LAMP STRINGS indicators on the Element Monitor Panel turn ON when the corresponding zone button is pressed ON: For RTC CU-915 furnaces, Zone Switch — LAMP STRINGS ZONE 1 TOP — T1, T2, T3 ZONE 2 TOP — T4, T5, T6, T7 ZONE 3 TOP — T8, T9, T10, T11 ZONE 4 TOP — T12, T13, T14 ZONE 1 BOTTOM — B1, B2, B3 ZONE 2 BOTTOM — B4, B5, B6, B7 ZONE 3 BOTTOM — B8, B9, B10, B11 ZONE 4 BOTTOM — B12, B13, B14 If all 3 or 4 lamp strings are ON, that bank of lamps is good. After each bank of lamps is tested, push the white zone pushbutton again to shut OFF the lamps in that area. Then repeat this process until all zone buttons and lamp strings have been checked. At the end of this check, the LAMPS should be OFF. --- If one of the lamp strings LEDs is OFF, the string may have a burned out lamp that needs to be replaced. See section **Error! Reference source not found.**. If all lamp strings LEDs are OFF for any single zone switches

Table 2-3 Functional Checkout	
Action	**Comments / Changes**
	(for instance T1 – T3 or B1 – B3), it means that the zone top or bottom has a blown fuse (most likely) or an SCR controller (least likely) needs to be replaced. See sections 7.5.4 and 7.5.5. If all lamp strings LEDs are OFF for any pair of zone switches for the same zone (for instance T1 – T3 & B1 – B3), it means that the zone is at or above setpoint temperature, or a temperature controller (least likely) needs to be replaced. See sections 7.5.4 and 7.5.5.
10. Press the SILENCE button on the STATUS panel 	At end of test make sure the alarm buzzer is enabled.
11. Wait for zone temperatures to settle, if necessary	Monitor zone controllers until all zone PV temperatures (red display) are at, or below, 300 °C (green display).
12. Set all zone pushbuttons ON. 	Turns lamps ON again. Zone PV temperatures will start to rise as increasing heat is reported by the zone thermocouples. 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. 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.
13. Wait for the furnace to stabilize for 5-10 minutes after reaching setpoint temperatures in all zones	The furnace is now stabilized at 300 °C. The furnace is ready to process parts.
14. Start of Shut Down Test: **Push each zone white pushbutton to de-energize lamps.**	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. To speed the COOL DOWN process, the user may increase belt speed and gas flow in the zones. **Do not shut off Process Gas or press red POWER OFF button before all zones are at or below 100 ºC**
15. When all zones are below 100 ºC …	Shut off the process gas supply valve. The functional test is complete.