Chapter 2

INSTALLATION

Detailed steps for successful installation of an LA-306 furnace. Included 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 sales order or your purchase order to 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 voltage, phase connected power and current. Actual operating values are much lower and can be found in Chapter 11 Specifications.

This label will normally be located near the Power Input either on the side or rear of the Control Enclosure.

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 a 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 Machine Placement

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. Lift the machine at the approximate locations shown on the installation drawing, and slide the shipment skid out from under the machine. Do not attempt to lift the machine at only 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 803-091306 Furnace Arrangement for location.

2.2.5 Removal of Shipping Restraint Brackets

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.

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

Figure 2-2 Shipping Brackets

2.2.6 Leveling Machine

Remove the base covers and using an open-end wrench on the screw flats, adjust the leveling feet to level (Figure 2-3) the frame within 0.06 inch overall. Tighten leveling nuts to lock in place.

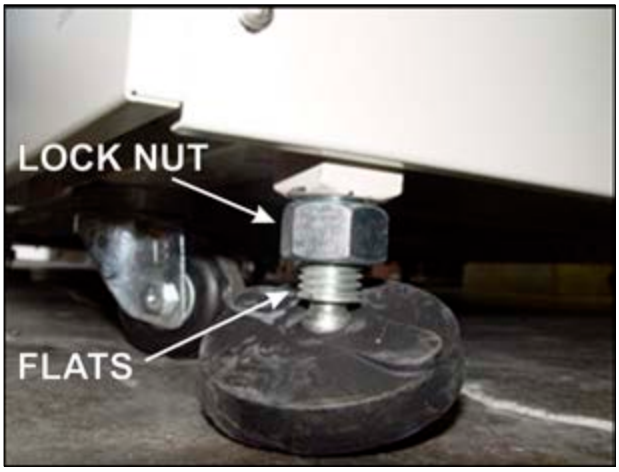

Figure 2-3 Leveling Feet

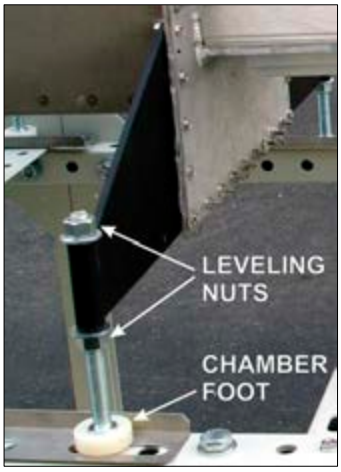

Figure 2-4 Chamber Support Bracket

After the frame is level, adjust the 2 Leveling Nuts (Figure 2-4) on each of the 8 Chamber Support Brackets to 0.06 inch overall. See location of brackets in Figure 2-5. Adjust so that all brackets evenly support the weight of the furnace chamber assembly. Tighten nuts to lock in place.

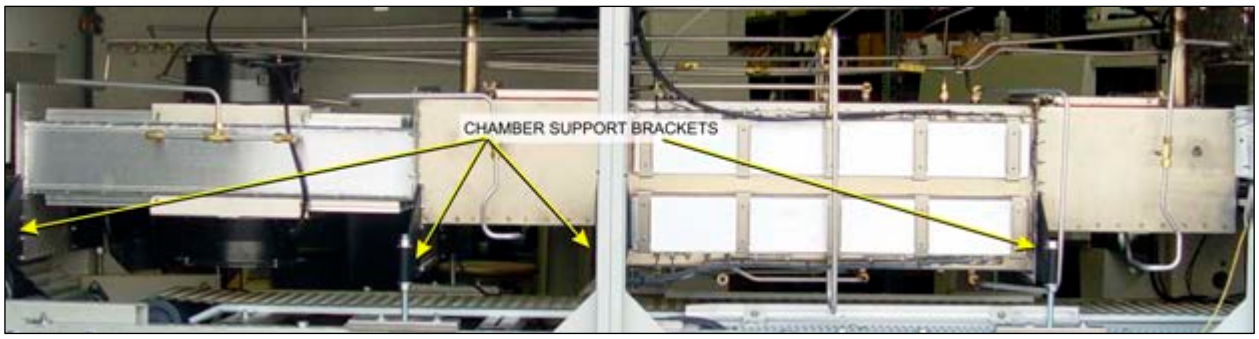

Figure 2-5 Location of Support Brackets

2.2.7 Installation of the Transport Belt

LA-306 furnaces are usually shipped with the belt already properly installed. However, if 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 or for replacing a damaged or worn belt.

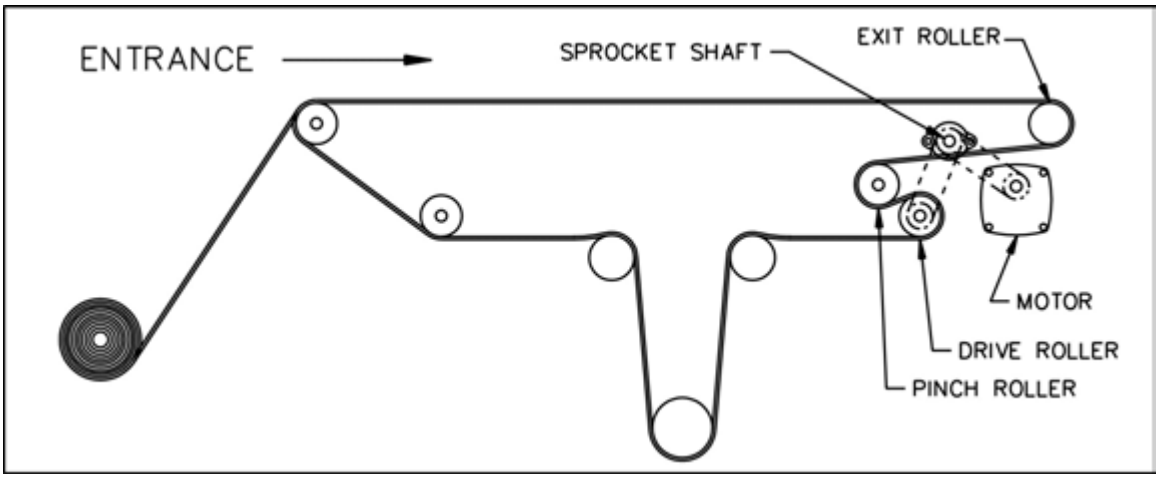

Figure 2-6 Belt Path

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 2-6. Pull the leading edge of the belt to the entrance and splice.

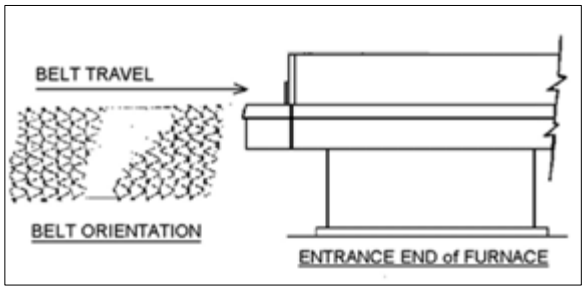

Figure 2-7 Belt Orientation

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 2-8.

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.

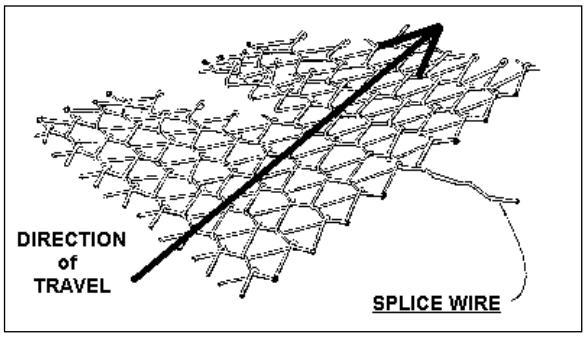

Figure 2-8 Belt Splice

C. Belt Weight

Install belt weight as shown in Section 2.2.8B, Figure 2-11 and Figure 2-12.

2.2.8 Unpacking and Installation of Belt Weight

A. Locate and Unpack Belt Weight

Remove one of lower side panel near the furnace exit (below Control Enclosure). Using a flat screw driver turn the two latches to release and pull off the panel. This panel can be rotated and hung from the upper panel.

Locate the belt weight as shown in Figure 2-35. Unwrap and remove packing.

Figure 2-9 Lower Access Panel

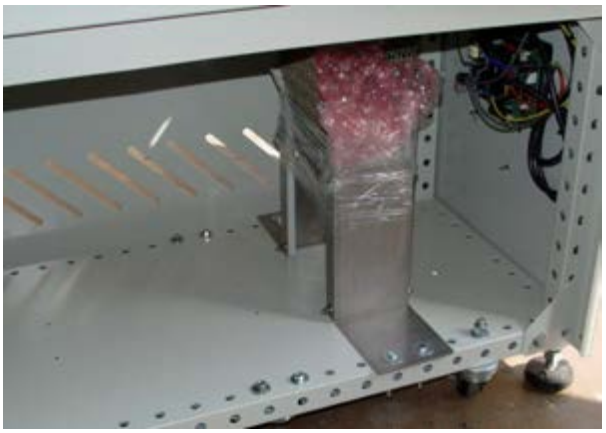

Figure 2-10 Belt Weight with packing

B. Install Belt Weight

Reinsert belt weight as shown in Figure 2-11. 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 2-12.

Figure 2-11 Belt Weight in Place

Figure 2-12 Proper Alignment of Belt Weight

2.3 Providing Power

The furnaces are shipped wired for the voltage specified on the nameplate. For all cases (except when a separate 3-phase circuit breaker is installed) electrical power, matching the specifications on the nameplate shall be connected to terminal block TB1 via the access panel on the Control Enclosure.

Unscrew top fastener using a Philips head screwdriver to open access panel. Connect power to terminal block through Power Input port on back the Control Enclosure.

Verify nameplate voltage and whether the furnace is configured for single phase or 3-phase power.

Figure 2-13 Standard Back Entry Power Port

WARNING: Do not connect power source different than as indicated on the label.

2.3.1 Facility Connections

Single phase 208-240 Vac power source connection

Connect as follows (refer to drawing 802-101779-01):

1. Connect facility power LINE to TB1-01 terminal
2. Connect the NEUTRAL to TB1-02 terminal
3. Connect the Earth ground to the TB1-GND (yellow/green) terminal.

Figure 2-14 1-PH

3-phase 208-240 Vac power source connection

Connect only as a 3-phase with no connection to Neutral (3-phase inside Delta connection) - (refer to drawing 802-101779-01):

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 the Earth ground to the TB1-GND (yellow/green) terminal.

Figure 2-15 208-240Vac, 3-PH, 4 wire

3-phase 380-415 Vac power connection

Connect only as a 3-phase with a Neutral (3-phase "Y" connection) (refer to drawing 802-101779-02):

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 the facility NEUTRAL to TB1-04 terminal
5. Ground:
   a) If a 4-wire system, keep jumper between TB1-04 and Ground.
   b) If a 5-wire system, remove jumper and connect the Earth ground to the TB1-GND (yellow/green) terminal.

Figure 2-16 380-415Vac, 3PH 4-wire

2.3.2 Single Phase Circuit Breaker (CB-1)

On single phase furnaces, a single-phase circuit breaker supplied as standard, will be mounted in the Control Enclosure on top of the furnace at the location shown on the Furnace Arrangement drawing. See example in Figure 2-17. Wire supply power to the terminal block TB1 as instructed in section 2.3. All national, city and local codes should be followed when wiring this system for power.

See Facilities drawing 803-091306 and Chapter 10 Engineering, and Chapter 11 Specifications for power requirements with connected and operating loads.

Figure 2-17 Single Phase Circuit Breaker

2.3.3 Three Phase Circuit Breaker (CB-3 option ☐)

A three-phase circuit breaker, if supplied, will be mounted in a separate enclosure on top of the furnace at the location shown on the Furnace Arrangement drawing. Wire supply power to the terminal block TB1 as instructed in section 2.3. All city and local codes should be followed when wiring this system for power.

See Facilities drawing 803-091306 and Chapter 10 Drawings, and Chapter 11 Specifications for power requirements with connected and operating loads.

Figure 2-18 3-Phase Circuit Breaker (Option)

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 70 psig (except if optional supply gas Mixing System in included. In addition to a supply line filters and condensate traps, and regulators to reduce supply pressure to 70 psig must be installed on the supply line before entering the furnace.

DANGER: The flowmeters on these furnaces are rated at 70 psi maximum. Operating above 70 psi exposes the operator to possible injury.

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 dripping into the furnace.

See 803-091306 Furnace Arrangement drawing for location of process connections. An example of typical process air connection is shown in Figure 2-19.

Figure 2-19 Process Gas Connections – Single Gas

2.4.1 Single Gas Furnace

On single gas furnaces, Gas 1 port is 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. Gas 1 port is a ¼ inch female pipe connection.

2.4.2 Dual Gas Furnace (DGO option ☐)

On Dual Gas furnaces (optional), Gas 1 is the primary gas connection for CDA or nitrogen to all furnace auxiliaries including inlet and transition tunnel baffles, entrance exhaust stack eductor, lamp seals and CACT cooling chamber. Gas 1 port is a ¼ inch female pipe connection.

Gas 2 port is for nitrogen or forming gas supply to the furnace heating chambers. Gas 2 port is a ¼ female pipe connection.

Figure 2-20 Process Gas Connections - Dual Gas

DANGER: Except for furnaces specifically equipped with the hydrogen option, combustible gas should NOT be connect 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.

2.4.3 Supply Gas Mixing System (GSM option ☐)

An option on Dual Gas furnaces, the Supply Gas Mixing System facilitates connection of two process gases which can then be alternatively selected or mixed while the furnace is operating.. In addition, the system includes two pressure regulators that can accept supply line pressures of from 100 psi – 3500 psi (6.5-240 bar). Pressure gauges in both lines allow the user to adjust the pressure on both lines to the pressure the furnace requires: 70 psig (4.8 bar).

Gas 1 is the primary gas connection for nitrogen to all furnace auxiliaries including inlet and transition tunnel baffles, entrance exhaust stack eductor, lamp seals and CACT cooling chamber. In addition, this port feeds the N2 (Nitrogen) supply pressure gauge and flowmeter located on the side of the control console. Gas 1 port is a ¼ inch female pipe connection.

Gas 2 port is for premixed FG (forming gas) supply. This port feeds the FG (N2/H2) premix supply pressure gauge and flowmeter on the side of the control console. Gas 2 port is a ¼ female pipe connection.

Figure 2-21 Process Gas Connections with Supply Gas Mixing System & Sample System

2.5 Analyzers and Sampling

2.5.1 Sampling System (OSS option ☐)

The sampling system option may require connection of an analyzer to the sample port if not already connected internally on the furnace. Figure 2-21 depicts an analyzer connected via Teflon tubing to the sampling system enclosure.

Figure 2-22 Oxygen analyzer on furnace

2.5.2 Oxygen Analyzer (OA option ☐)

An option available on most furnaces, an Oxygen Analyzer can be positioned on the top of the furnace and connect to a sample port or integrated with an OSS Sampling System.

A. Installation

Gently remove the oxygen analyzer from the box and place on the LA-306 furnace near the sample line port located on the side of the Control Enclosure or, if a separate Sample System Enclosure is provided as shown in Figure 2-22.

Connect power cable to power plug on back of analyzer, see Figure 2-23.

Connect sample gas line to oxygen analyzer SAMPLE IN connection. Hand tighten fitting.

If so configured, connect the SAMPLE OUT line the vent line. To isolate the cell when not in use, if not already installed, you may connect a check valve to the SAMPLE OUT vent line. However, make sure that the check valve does not pressurize the cell. The check valve should require less than 23 mbar (1/3 psig) to open.

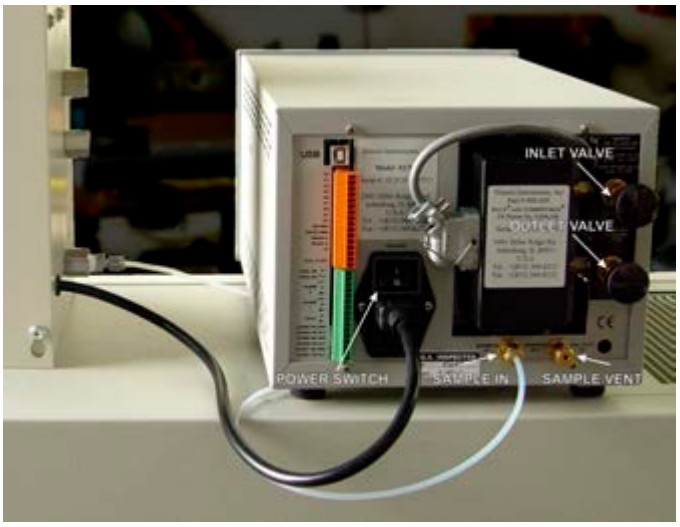

Figure 2-23 Analyzer power & sample line connection

Turn ON power switch located just above power cord on back of analyzer (Figure 2-23).

Open IN valve (top valve) full CCW (Figure 2-23).

With analyzer on, open OUT valve sufficiently to obtain 0.1-0.15 L/min on the flowmeter.

B. Analyzer Relocation

The analyzer can be removed and used on other devices. To remove the analyzer :

1. Close sample gas valves.
2. Unplug power to analyzer.
3. Remove sample line at analyzer.
4. Gently relocate analyzer.
5. Install as in 2.5.2A , except:

   a) Use power cable with finished with plug and socket to connect to 117 Vac at an alternate location.

   b) Use alternate Teflon line with fittings to connect to alternate sample source.

2.6 Product Alert Sensors

2.6.1 Laser Product Alert (SENSLAS option ☐)

Furnaces equipped with a SENSLAS laser product sensor may require installation of the sensor if shipped separately. To install the SENSLAS sensor:

1. Insert bracket threaded legs through holes on Unload Station and fasten each leg with a washer and hex nut below the Unload Station table (see Figure 2-24.

Figure 2-24 Install SENSLAS bracket

2. Level bracket by loosening and tightening nuts above and below Unload Station table (see Figure 2-25).

Figure 2-25 Adjust SENSLAS bracket height

3. If sensor is not already attached to bracket, install sensor to bracket using supplied fasteners. Adjust to center laser over product lane and tighten. See single lane example in Figure 2-26.

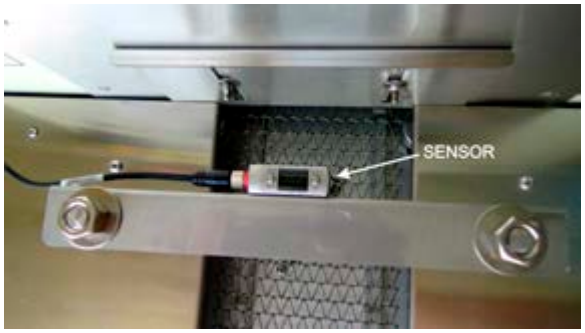

Figure 2-26 Install SENSLAS sensor over center of product lane

4. Connect sensor cable to sensor and hand tighten. See Figure 2-27.

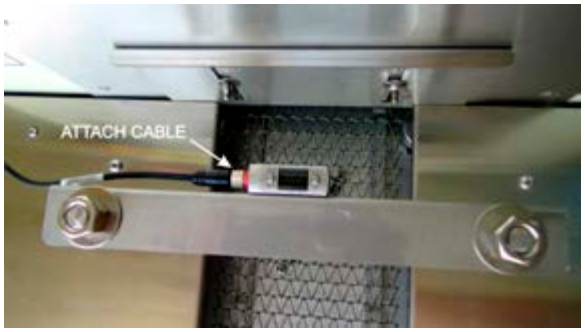

Figure 2-27 Connect SENSLAS cable

2.7 Exhaust Requirements

2.7.1 Cabinet Gas Exhaust Requirements

A 4-inch round duct with 8x12 inch rectangular hood can be installed above the 10-inch diameter cabinet cooling exhaust fan to reduce the additional heat load the furnace can add to its environment. This duct generally does not need to be insulated. Since 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.

See 803-091306 Facility Arrangement for suggested duct and hood location.

2.7.2 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. Insulated exhaust duct and a collector hood is routinely used for non-combustible process gas. Do not make any direct connections to the furnace exhaust stacks or apply any load to the furnace itself. A minimum 2.0 inch clearance between the 3-inch diameter exhaust stacks and venting hood or device is required. We recommend a 4-inch diameter insulated exhaust duct with an 8-inch diameter insulated hood.

Figure 2-28 Exhaust Connection and Figure 2-29 Exhaust Connection Detail show typical exhaust connections.

See 803-091306 Facility Arrangement for suggested duct and hood location.

Figure 2-28 Exhaust Connection

Figure 2-29 Exhaust Connection Detail

2.7.3 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 or apply any load to the furnace itself. Clearance between the exhaust stacks and venting device is required. See Figure 2-30 for example of a typical hydrogen furnace exhaust connection.

Figure 2-30 Typical Hydrogen Furnace Process Gas Exhaust Connection

2.8 Water and Drain Connections

2.8.1 Water Supply and Drain Connections for UCD (option ☐)

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 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 803-091306 for connection locations, sizes and maximum and typical flow rates.

Figure 2-31 UCD Water Connections with Air Purge

2.8.2 Process Gas Reservoir (option ☐)

If a CDA reservoir tank is supplied, it may be desirable to connect a drain line to the purge valve to accommodate low pressure discharges of water. See Figure 2-31 for air purge connection example.