

1.1 Unpacking the Equipment

1.1.1 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 any item listed is unaccounted for, immediately notify the carrier and Technical Support.

1.2 Location & Initial Installation Work

1.2.1 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.

1.2.2 Machine Label

The furnace label generally appears as in **Figure 1-1 Name Plate** and indicates the maximum power and current draw. Actual operating values are much lower and can be found in Section 12 Specifications.

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



Figure 1-1 Name Plate

1.2.3 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.

1.2.4 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 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. Ref. drawing 803-091700 Furnace Arrangement for location.

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1.2.5 Machine Adjustment

The base covers are removed and the leveling screws adjusted to level the frame within 0.06 inch overall. Each of the leveling screws should support an equal amount of weight.

After the frame is level, the chamber leveling screws are adjusted to 0.06 inch overall.



Figure 1-2 Leveling Feet



Figure 1-3 Leveling Chamber Supports

1.2.6 Removal of Shipping Restraint Screws

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 bracket and discard.

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



Figure 1-4 Shipping Brackets

1.2.7 Installation of the Transport Belt

The furnace furnaces are usually shipped with the belt in place. However, if the shipment is expected to be exposed to rough handling or irregular terrain during shipment, a portion of the transport belt which goes through the furnace chamber may have been intentionally left uninstalled to protect the furnace interior. When installing the belt, it will be helpful to have an assistant available to help guide the belt into the furnace entrance.

The portion of the belt which goes through the furnace is rolled up and secured at the entrance end of the furnace. Unroll the belt and attach it securely to the pull wire that was left in the furnace chamber. Pull the belt through the chamber from the exit end of the furnace, while an assistant guides the belt into the entrance. Once the belt has been pulled completely through the chamber, remove and discard the pull wire. Splice as shown in Figure 1-5 Belt Splice.

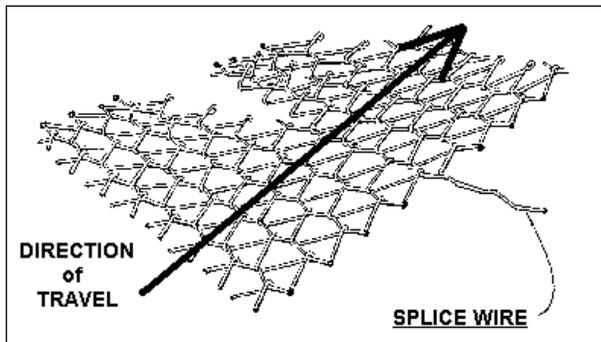


Figure 1-5 Belt Splice

1.2.8 Unpacking and Installation of Belt Weight

Remove one of lower side panel near the furnace exit (below Control Panel 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.



Figure 1-6 Lower Access Panel

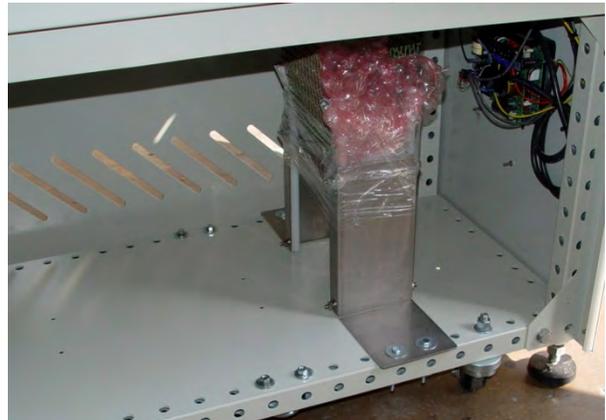


Figure 1-7 Belt Weight with packing



Figure 1-8 Belt Weight in Place

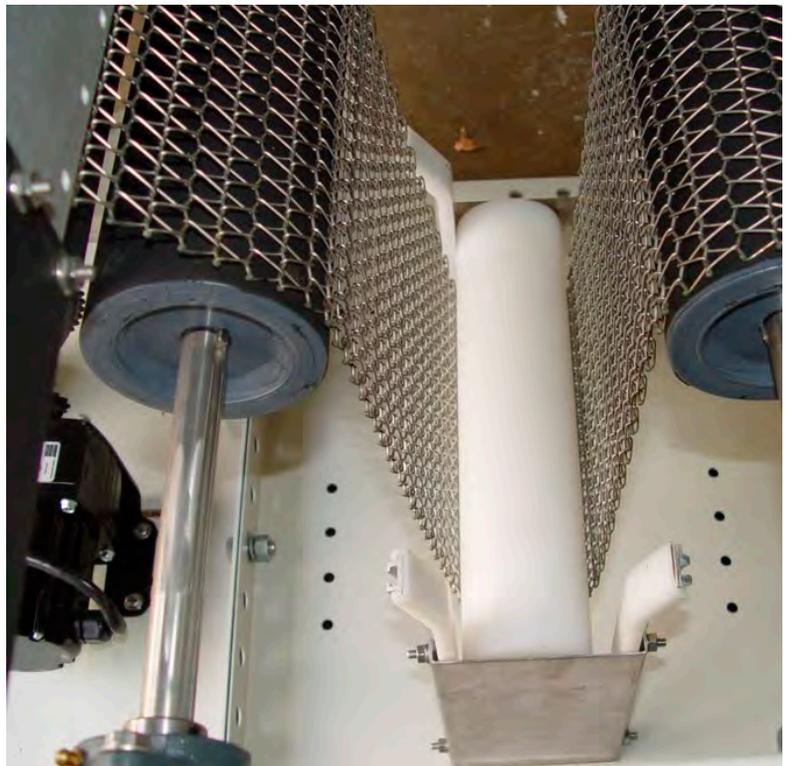


Figure 1-9 Proper Alignment of Belt Weight

Locate the belt weight as shown in Figure 1-7. Unwrap and remove packing. Reinsert belt weight as shown in Figure 1-8. Belt weight should be allowed to move freely as shown in Figure 1-9.

1.3 Providing Power

The furnaces are shipped wired for the voltage specified on the nameplate. Electrical power, matching the specifications on the nameplate shall be connected to the contactor, circuit breaker or 3-phase disconnect switch. The nameplate is located either near where the power is to be connected typically either:

1. Adjacent to the power entrance hole in the lower electrical compartment near the contactor or circuit breaker, or



Figure 1-12 Elapsed Time Meter and Nameplate

2. For power supplied from the top of the furnace, the label shall generally be located on top of the furnace behind the top mounted enclosure closest to the supply power connection.



Figure 1-13 Typical Circuit Breaker Enclosure Location (option)



Figure 1-10 Standard Front Entry Power Port and Elapsed Time Meter



Figure 1-11 Typical Safety Interlock Disconnect Switch Location (option)

Connect electrical power through the Power Port shown on the Furnace Arrangement drawing to the supplier circuit breaker, disconnect switch or directly to the main contactor per drawing 802-101770 POWER CONTROL SCHEMATIC.

A ground terminal is provided for a safety ground. All city and local codes should be followed when wiring this system for power. See Facilities drawing 803-091700 and Engineering and Specifications sections of this manual for power requirements.

The furnaces are shipped wired for the voltage specified on the nameplate. Electrical power, matching the specifications on the nameplate shall be connected to terminal block TB1 via the access panel on the Safety Panel. Remove lower rear entrance panel to access TB1 terminal block through Power Input port on either the entrance panel or top panel of the furnace.

1.3.1 Circuit Breaker (☐ supplied option)

A 3-phase circuit breaker if supplied will be mounted 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 803-091700 and Engineering and Specifications sections of this manual for power requirements.



Figure 1-14 Circuit Breaker (option)



Figure 1-15 Circuit Breaker detail

1.3.2 3-Phase Interlock Disconnect Switch (option, not supplied).

Equipment furnished with an interlock 3-phase disconnect requires connection to the terminal block in the provided disconnect enclosure. Remove the upper and lower panels, numbers 4 and 11 (ref 802-101401-01 PANEL LAYOUT). The disconnect switch must be turned to OFF to remove the lower panel.

Locate the disconnect enclosure behind the lower panel and remove its cover by loosening the two screws. Remove one of the knockouts in the top of the enclosure [use center 1” opening for four (4) #8 AWG wires or larger 1-1/4” knockout for up to four (4) #4 wires]. Pass the 3-phase power lines through the Power Port in the top of the furnace and into the disconnect box.

Connect three phase power lines to the provided terminal blocks. Replace the cover and the panels, making sure to properly engage the disconnect switch with the protruding switch shaft. Startup technician will make final connection at the contactor.



Figure 1-16 Interlock Disconnect Switch Enclosure



Figure 1-17 Enclosure Cover Removed



Figure 1-18 Disconnect Switch and Power Connection Terminal Blocks

1.3.3 Installation of Owner Supplied UPS

If desired a uninterruptable power supply (UPS) can be installed by FurnacePros, or the Owner. See Sections 4 and 5 for information on computer power requirements necessary for sizing the UPS.

To install the UPS, locate the lower access panel located near the entrance of the furnace on the side opposite the Control Console. Install the UPS in this area on the furnace floor panel so that it is well supported. Provide power to the UPS through the standard 117 Vac socket labeled “COMPUTER UNSWITCHED”. Plug the UPS serial or USB connector into the rear panel of the computer tower.



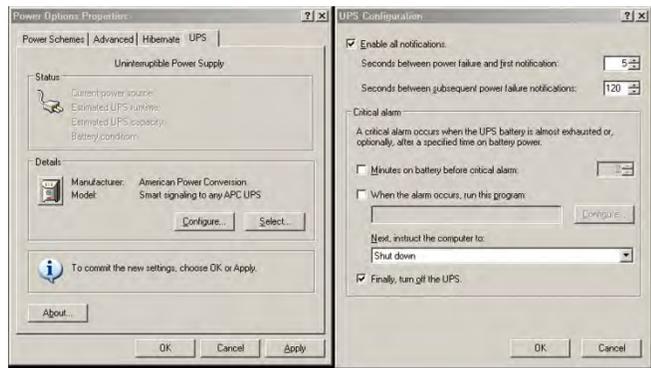
Figure 1-19 Computer “Unswitched”

To install the manufacturer’s software, insert the UPS Installation Disk in the optical drive accessed through the computer access opening below and left of the control console. Follow UPS manufacturer’s instructions for proper installation and configuration of the UPS to allow normal computer system shutdown in the event power is removed from the furnace system.

To install the UPS in Windows®7, start the computer and insert the UPS Installation Disk in the computer optical drive accessed through the computer access door below and to the right of the Control Console and follow the prompts.

To setup the UPS in Windows:

1. Click on Start/Control Panel
2. Select Power Options
3. Select the UPS tab.
4. Select manufacture and model buttons and enter preferences to allow normal computer system shutdown in the event power is removed from the furnace system.



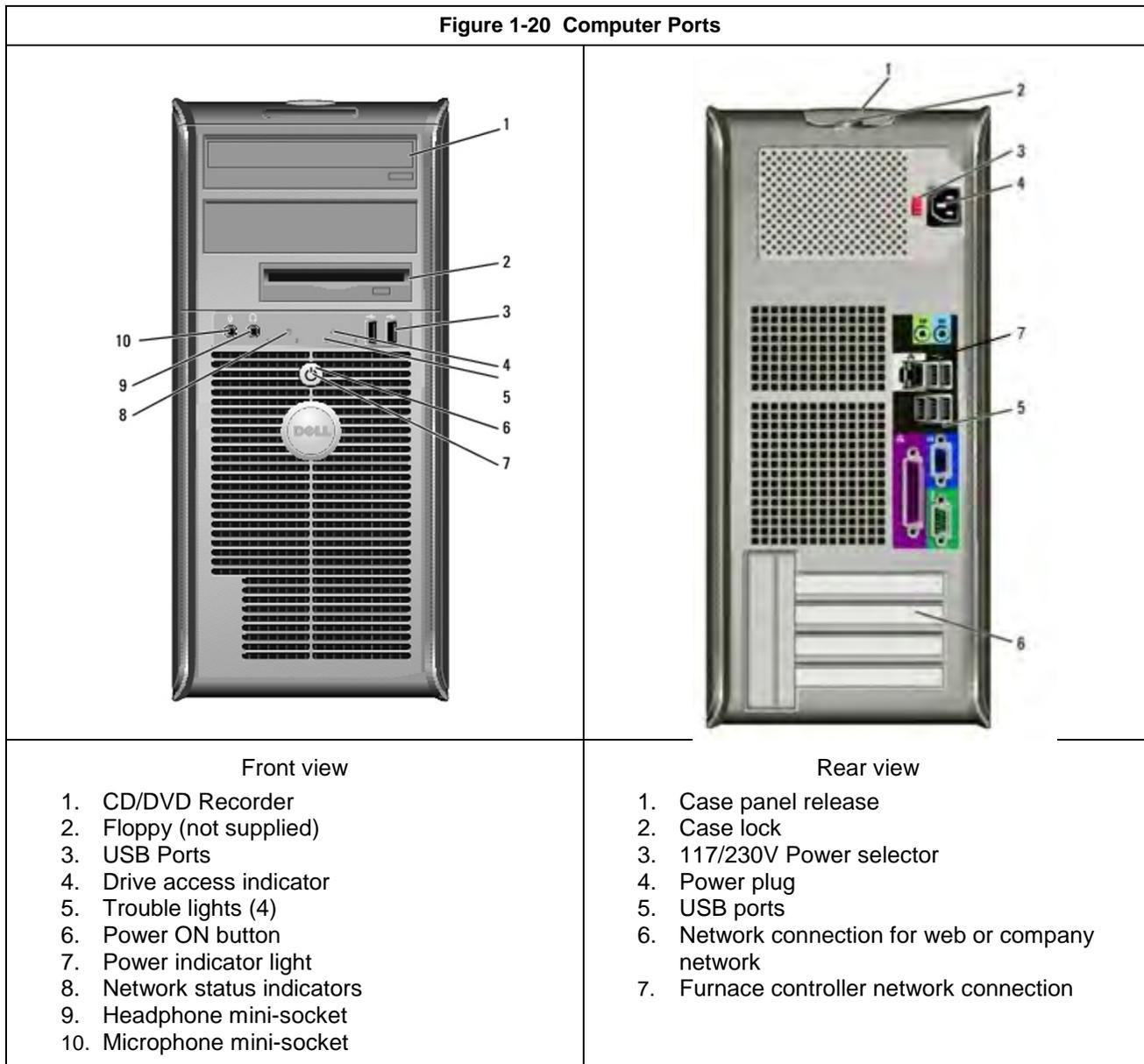
1.3.4 Product Handling (SMEMA) and Handshake (HSK) Connections

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

If so equipped, refer to 803-101777 for handshake relay NO/NC connections at entrance and/or exit of the furnace.

1.3.5 Computer Connections and Power Options

The furnace is shipped with the computer powered through an unswitched connection labeled **Computer Unswitched**. In this mode the computer is prevented from inadvertent power down when the Furnace Power OFF button is pressed. However, if the computer has been powered down, Operator must open computer access door and start the computer by pressing the power on button just before restart of the furnace.



Owner may connect a network enabled 10/100/1000 Ethernet cable to the 2nd network port (6) on the furnace computer. Note: The motherboard Ethernet connection is reserved for the furnace controller.

1.3.6 Furnace USB Connections

The furnace is equipped with two (2) USB 2.0 ports installed at the entrance of the furnace to facilitate hookup of profiler equipment. Two (2) additional USB ports are located on the left-hand side of the Professional LCD monitor located above the control console. The USB ports can be used to archive or copy files to the furnace computer.

1.4 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 the supply line before entering the furnace.

The supply temperature of both gas and 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 Furnace Arrangement drawing for location of process connections. An example of typical process air connection is shown in Figure 1-22 shows typical Nitrogen and Hydrogen gas connections to a mixing enclosure.

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

1.4.1 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.

The furnace exhaust stacks are 1.50 inch diameter inside a 3.00 inch diameter insulated shroud. Insulated exhaust tubing and an 8 inch inside diameter or larger collector hood is routinely used for non-combustible process gas.

Do not make any direct connections to the chamber exhaust stacks. A minimum 2.0 inch clearance between the 3.00 inch diameter exhaust stack shroud and the venting device is required. Figure 1-24 Exhaust Connection and Figure 1-25 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. 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 is 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.

WARNING: 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 803-091700 Furnace Arrangement drawing for location of process connections. An example of typical process air connection is shown in Figure 1-21.

1.4.2 Single Gas Furnaces

On single gas furnaces, Gas 1 is a 3/4 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 as well as providing pressure to the transport tensioning system.



Figure 1-21 CDA Connection



Figure 1-22 H2 & N2 Connections

1.4.3 Dual Gas Furnaces (option, not supplied)

On Dual Gas furnaces (optional), Gas 1 is a $\frac{3}{4}$ inch female pipe connection. 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 also provides pressure to the transport tensioning system.

Gas 2 is a $\frac{3}{4}$ inch female pipe connection for nitrogen or forming gas supply to the furnace heating chambers.



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.

1.4.4 Supply Gas Mixing System (option, not supplied)



Figure 1-23 Supply Gas Mixing System

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 a $\frac{3}{4}$ inch female pipe connection for connecting 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 also provides pressure to the transport tensioning system.

Gas 2 port is a $\frac{3}{4}$ inch female pipe connection 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.

1.5 Exhaust Requirements

1.5.1 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. 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.

See 803-091700 Facility Arrangement for suggested duct and hood location.

1.5.2 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 tubing and a collector hood, is routinely used for non-combustible process gas. Do not make any direct connections to the furnace exhaust stacks. 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 1-24 Exhaust Connection and Figure 1-25 Exhaust Connection Detail show typical exhaust connections.

See 803-091700 Facility Arrangement for suggested duct and hood location.



Figure 1-24 Exhaust Connection



Figure 1-25 Exhaust Connection Detail



Figure 1-26 Cabinet Exhaust Example



Figure 1-27 Cabinet Exhaust Examples

1.5.3 Combustible Process Gas Exhaust Requirements (hydrogen option)

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 1-28 for example of a typical hydrogen furnace exhaust connection.



Figure 1-28 Typical Hydrogen Furnace Process Gas Exhaust Connection

1.6 Water and Drain Connections

1.6.1 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 rectangular opening in lower panel similar as shown in Figure 1-. 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 803-091700 for connection locations, sizes and maximum and typical flow rates.



Figure 1-29 UCD Water Connections with Air Purge

1.6.2 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 1-. 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 803-091700 for connection locations, sizes and maximum and typical flow rates.



Figure 1-30 CAWC Water Supply & Drain Connections

1.7 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 pulling outward will reset the button. Both buttons must be in the set position for power to enter the furnace.

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

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1.8 Interlocks

There are electrical interlocks on the furnace on the entrance furnace lower side covers opposite the heating chamber.

Both the furnace side covers should be in place for power to enter the furnace in normal operation. Removing one of the panels will cause the interlocks to cut all power to the furnace. This is a safety precaution for your protection as both 117 Vac and 3-phase power circuitry and connections are inside the cavity.

Except when in placed into maintenance mode by qualified technicians, the lower panels should always be in place while power is being applied to the furnace. 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 which will restore power to the furnace with the control box covers removed.

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

1.9 Installation Responsibilities

1.9.1 Owner's Responsibility

Prior to Startup, it is the Owner's responsibility to accomplish the Installation tasks described in sections 0.1 Furnace Description through 1.3.3 Installation of Owner Supplied UPS, as applicable. For larger furnaces, 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 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.

1.9.2 Installation Tasks by Manufacturer

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

- Reassemble split furnace sections.
- Seal furnace enclosure
- Reinstall (split machines only) and align belt
- Remove shipping restraints.

1.9.3 Installation Tasks by Owner

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

- Connect furnace power
- Connect process gas piping
- Connect water and drain lines
- Locate and install exhaust system
- Locate and install upstream and downstream process equipment (optional)

1.10 Startup Tasks

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

- Checkout before first operation.
 - Verify transformer settings for customer supply power. Connect disconnect switch to main contactor to engage customer supply power.
 - Verify gas supply and water hookup and regulator pressure settings.
- Apply power, run through the installation checkout and test procedure.
 - Check/confirm voltages.
 - Verify all fans are operating
 - Re-calibrate all SCR's
 - Re-calibrate belt. Verify tracking.
 - Check operation of cooling system
 - Leak check water system
 - Verify flowmeter settings
 - Leak check process gas system.
- Troubleshoot and systems test:
 - Process Gas systems check
 - Rapid Purge system
 - verify flowmeter settings
 - verify valve sequencing
 - O2 & Moisture analyzer check (option)
 - OSS check (gas sampling system option)
 - SMEMA product handling check (option)
 - Transport motion alarms check
 - Software integration test
- Cycle machine to a fully operational state.
- 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.
- Owner preferences:
 - Archive furnace profile default settings.
- Replace Covers. Before operation for production, install any covers that were removed during the functional checkout.

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

- Turn over the machine and documentation to the customer.