



# L&L Special

FURNACE CO., INC

YOUR THERMAL INVESTMENT DESERVES SPECIAL TREATMENT



- Precision
- Uniformity
- Value

• Furnaces • Ovens • Quench Tanks

# What's INSIDE

- 3 Aviation Package
- 4-5 Bench Furnaces XLB / HB / GS1714
- 6-7 Tool Room Furnaces CBH124/ XLE
- 8-9 Medium Production Box Furnaces XLE
- 10-11 Dual Chamber Furnaces QD / QDS / QD29
- 12-13 Large Fiber-Lined Box Furnaces FB / FN
- 14-15 Alloy Retort Box & Shuttle Furnaces XLC / JSC
- 16-17 Hydrogen Control Panels H2 Series & Tube Furnaces TB / TBU
- 18-19 Large, Medium Gas Fired Box Furnaces XLG / XLM
- 20-21 Tempering & Annealing Ovens DV / DR / VB
- 22-23 High Temp Electric Furnaces GLF / GF
- 24-25 High Temp Electric Furnaces GHH/ GHE
- 26-27 Large Fiber-Lined Car Bottom & Shuttle Furnaces FC / FS
- 28-29 Bell Lift Furnaces WB / WQ & Quench Tanks QT
- 30 Special & Custom Equipment & Furnaces DRQ / XLFS / PT / DCA / QTS / ELSF / CB / FNC
- 31 Options

## VISIT OUR WEB SITE

Visit LLFurnace.com and download PDF files of all our Product Bulletins for the models listed in this condensed line sheet plus on-line RFQs and more technical information.

## SERVICE & INSTRUCTIONS

### WORLDWIDE SERVICE

Although L&L designs for easy in-house start up and maintenance, worldwide factory service and start up assistance is always available and sometimes recommended.

### INSTRUCTIONS AND MANUALS

Complete manual includes start up and maintenance instructions, theory of operation, parts list, trouble shooting guide, ladder logic diagram, panel layout, interconnection diagram, atmosphere and pneumatic schematics, general dimension, assembly and subassembly drawings

### WARRANTY

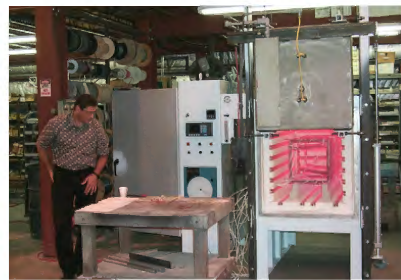
Furnaces are typically warranted for one year. Specific warranty period and terms are quoted.

### TESTING

Controls are burnt in and calibrated at operating temperatures in a test furnace. All equipment is tested for proper operation. Complete in-house testing can include full load test, uniformity test and certification to NIST standards such as in the furnace below.



Model IQV1224



Furnace under factory test



Model FN 436 with QT 362448.

See page 13

**Mission Statement**

L&L Special Furnace Co., Inc. is a family owned manufacturing and service business in operation for over 60 years. We design and build high temperature furnaces, ovens, kilns, quench tanks and heat treating systems, specializing in batch production furnaces and ovens particularly applications requiring high uniformity and controlled atmosphere. L&L sells and services equipment worldwide.

L&L has grown steadily over the years and enjoys a sterling reputation in the ceramics and precision heat-treating markets. Our quality products are used by many of the largest and most prestigious companies in the aerospace, heat-treating, ceramics and automotive industries.

Manufacturing, sales and engineering are integrated in one 17,000 square foot facility just south of Philadelphia, PA. We are close to the I-95 corridor, close to the Philadelphia International Airport, and just 10 miles south of Philadelphia.

L&L Special Furnace Co., Inc., employs approximately 20 total for both office and factory, many with 10 or more years of employment. L&L provides detailed customer service uniquely suited to the markets we serve. Our customers can be assured of professional service throughout the life span of our equipment. The company strives to maintain a consistent level of quality and service consistent with its standing in the industry.

September, 2018

# XLA & FNA SERIES

AEROSPACE HEAT TREATING FURNACES AND OVENS



## The L&L Difference

### Confirmation of Quality

L&L's proprietary element support design system evenly distributes the radiant heat throughout the furnace and promotes the kind of uniformity required for aircraft grade heat treating. L&L's hard ceramic holders support the heating coils for long life, promote even heat transfer, and allow for easy, quick, inexpensive, inhouse maintenance. L&L also uses convection and multi-zone control to guarantee temperature gradients within  $\pm 5^{\circ}\text{F}$  ( $\pm 2.8^{\circ}\text{C}$ ) in the work zone.

### Aircraft Maintenance and Aerospace Manufacturing Confirmed Quality is Essential

#### Problem

Many aircraft maintenance facilities require heat treatment. Hardening of tool steels, annealing fasteners, stress relieving of weldments, and solution heat treatment of aluminum are just some of these processes. Most of these are critical where certifiable uniformity and traceability are fundamental requirements of the job. Old, unreliable equipment can fail or may not meet the requirements of the aircraft industry (See the description of the AMS 2750E Specification in our Aerospace Brochure). Outsourcing wastes time and money and adds another layer of risk to the control of your most precious asset – your reputation. L&L has several proven solutions.

#### Solution

L&L Special Furnace Co., Inc. designs, manufactures, and services a wide variety of heat treat equipment. We have several lines that are specific to the aircraft and aerospace industry. Our FNA and XLA series, specifically designed for aircraft industry, include such standard features as calibrated thermocouples, complete NIST documentation certifications, zone control and optional in-house uniformity survey prior to shipment.

#### Customers

Our USA and international customers include Boeing, NASA Goddard Flight Center, Pratt & Whitney, Rolls-Royce Engine Services, US Air Force, US Airways, Atlantic Southeast Airlines, Northwest Airlines, PCC Airfoils for turbines, Lockheed Martin, Triumph Air Repair, Aero Component Repair, Dallas Airmotive, Chromalloy, and Goodrich Aerostructures, Philippines Airlines, Air Mauritius, China Air, SriLankan Airlines, HAESL, Coopesa, G.E. Aviation, United Airlines and Continental Air Support Group.



Factory uniformity surveys are routinely done to insure certification upon commissioning

"We have had excellent results with the furnace and it has opened up quite a few new possibilities for our shop."

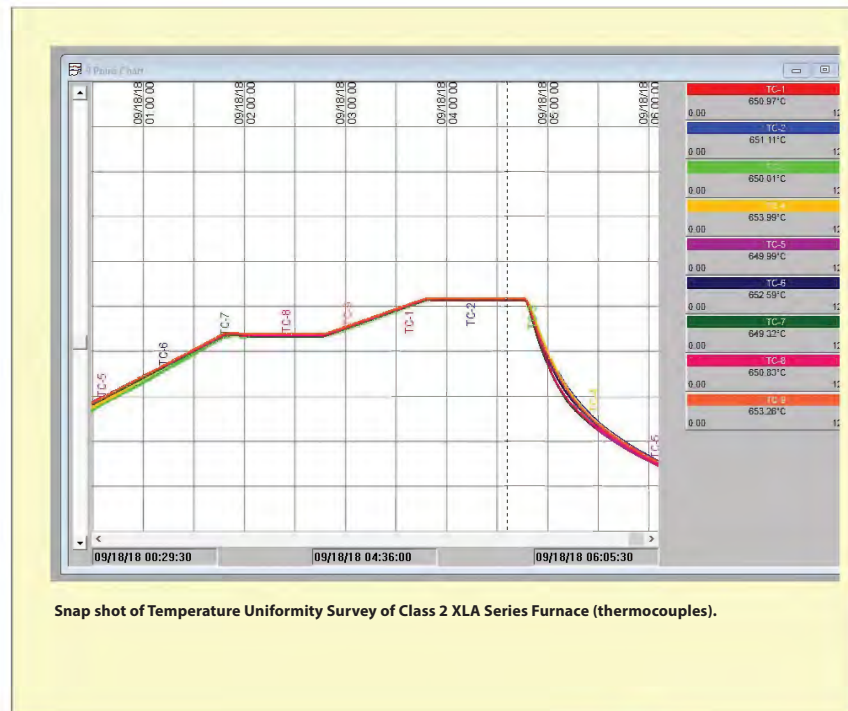
*Curt Wilhelm, Duncan Aviation*

### AVIATION PACKAGE (FOR XLA & FNA SERIES FURNACES) INCLUDED ACCESSORIES & SERVICES

- 4 to 6 element banks with single PID loop and digital biasing for SCRs to adjust temperature gradients
- Digital Program control
- Digital Overtemperature control
- Lot calibrated thermocouples with certification
- Instrument calibration with certification
- (4) 1" NPT uniformity survey ports at each corner of the furnace
- 1875°F (1023°C) air cooled fan
- Pneumatic or electric vertical door operation
- Pneumatic clamps on each corner of the door for the FNA series
- Triple seal door gasket for the FNA Series door

### OPTIONAL ACCESSORIES & SERVICES

- Honeywell HC900 PLC-based control with data logger
- Additional (up to 16) element banks with single PID loop
- Cast alloy hearth
- Agitated quench tanks with or without elevators
- Individually calibrated thermocouples
- Type S thermocouples or Type N thermocouples
- Upgraded insulation for 2190°F / 1200°C operation
- 2200°F (1200°C) water cooled fan
- Reference ports within 3" of control points
- In house testing including furnace profile (up to 24 points)
- In house certification by outside contractor (up to 24 points)
- Start up service
- Atmosphere sealed case and inert flow panel
- Thermocouple jack panel (for work)



Snap shot of Temperature Uniformity Survey of Class 2 XLA Series Furnace (thermocouples).

**YOUR THERMAL INVESTMENT DESERVES SPECIAL TREATMENT**



## 2350°F Premium Bench Mounted Box Furnaces

### APPLICATIONS

The XLB Series Bench Mounted Furnaces achieve high precision by featuring highly accurate microprocessor-based digital PID controls, solid state contactors for fast cycle times, two zone control (top and bottom), and very even spacing of elements. They reach 2350°F (1285°C) with the standard iron-aluminum-chrome elements. The XLB Series is our premium bench furnace combining high uniformity, generous interior space, a spring loaded vertical lift plug door, and industrial grade ruggedness. Many options are available to customize these for your specific application.

### FEATURES

#### TWO ZONE CONTROL AND EVEN ELEMENT PLACEMENT FOR HIGH TEMPERATURE UNIFORMITY

The furnace is uniform to within +/-20°F (+/-11°C) at 1300°F (705°C) within 2/3 of inside dimensions. Optional recirculating systems are available for tighter uniformity of up to +/-10°F (+/-5.5°C). Elements are evenly spaced around the top, bottom and sides. On the 13" wide models there are 12 elements evenly divided on each of these surfaces. The XLB 894 has 5 elements on the top and bottom and 3 on each side. Elements are split into top and bottom zones.

#### CERAMIC ELEMENT HOLDERS

The elements are supported in proprietary ceramic element holders. These provide perfect support for the coiled elements as well as excellent radiating characteristics. The smooth surface prevents premature failure of the element as it expands and contracts. The holders also protect the firebrick.

#### FAST HEAT UP AND COOL DOWN TIMES

An empty XLB furnace will heat up to 2000°F (1095°C) in approximately one hour. The high KW option will trim this. Cool down to 500°F (260°C) is approximately 10 hours.

#### MULTILAYERED INSULATION

The furnace is insulated with 2-1/2" of low K factor refractory firebrick as the primary insulation backed up by 2" of highly insulating mineral wool.

#### HEAVY DUTY BENCH MOUNTED CASE

The case is constructed of heavy gauge steel with stiffeners and lifting rings and is painted with silicone primer and enamel.

#### SPRING LOADED VERTICAL PLUG DOOR

The furnace door is a spring loaded swing up vertical door. The spring holds the door tightly closed, counterbalances it while opening, and holds it up while open. The hot face of the door is kept from the operator.

#### DIGITAL PID CONTROL

The standard control is a microprocessor-based, single set point, digital PID control. All fuses, transformers, contactors, and controls are located in a NEMA 1 panel. Solid state power contactors are standard. The thermocouple is type K. Limit switches shut off furnace power if the door is opened or the power panel back is removed. Control voltage is 120 volts. A NEMA 13 lighted on/off switch is included. The control circuit and each power branch circuit is fully fused.

#### CERAMIC HEARTH INCLUDED

Ceramic standoffs maintain an air space between the hearth and the bottom elements.

### OPTIONS

- **OVERTEMPERATURE SYSTEM**
- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **HIGH K.W.:** See Specifications for amount.
- **INERT ATMOSPHERE CONTROL**
- **RAMP/SOAK PROGRAM CONTROLS**
- **TEMPERATURE RECORDERS:** Round and strip.
- **SCR POWER CONTROL:** For greater precision. It is also possible to put the element circuits on separate SCRs and bias the control output digitally for precision zone control.
- **HIGH TEMPERATURE FAN:** Increases uniformity to +/-10°F. Limited to 1875°F operation.
- **SPECIAL HEARTHS:** Silicon Carbide or alloy hearth increases maximum load capacity by 1-1/2 times.
- **ANGLE IRON FLOOR STAND:** Hearth level is approximately 40" from floor with this stand.



An XLB 124 with standard cordierite hearth plate, single set point temperature controller, two-zone heating elements, and solid state contactors. OPTIONS: high limit control and floor stand.

Model Number	Inside Dimensions			Hearth Dimensions	Outside Dimensions			Standard K.W.	High K.W.	Amps K.W.	Max Load LBS	Ship Weight
	W	H	ID		OW	OH	OD					
XLB 112	13	12	12	11 x 11	50	38	28	6.1	8.0	22.1	75	290
XLB 124	13	12	24	11 x 22	50	38	40	9.8	13.0	35.3	150	350
XLB 126	13	12	36	11 x 33	50	38	52	13.0	17.0	31.2	225	450
XLB 894	18	9	24	14 x 22	55	35	40	12.0	16.0	32.5	250	600
HB 9	12	8	12	11x 11	45	38	28	4.0	6.0	16.7	75	270
HB 29	12	8	24	11x 22	45	38	40	8.0	12.0	33.4	150	400
HB 39	12	8	36	11 x 33	45	38	52	12.0	18.0	50.1	225	550

Dimensions are in inches. Weight is in pounds. Working dimensions should be approximately 2" less in each direction than inside dimensions. 240 or 480 volts are normal. 208, 380 and 575 volts are optional. 3 phase is normal although single phase is available. 480 volt amps are 1/2 of 240 volt amps. Specifications are subject to change without notice.



### APPLICATIONS

The GS1714 Bench Furnace is an excellent general purpose inexpensive laboratory grade box furnace. The spring-loaded vertical door makes loading and unloading effortless. Elements are located uniformly around the sides, top and bottom. A sophisticated program control allows up to 6 programs to be stored. Standardized production makes the price and value of this furnace remarkable. Use for heat treating, tempering, annealing, solution heat treating, glass fusing, glass and quartz annealing, ceramics, enameling and many other applications.

### FEATURES

#### ELEMENT HOLDERS

Ceramic element holders provide easy maintenance and help prevent dusting. Elements won't fall out of roof.

#### 2350°F - 1285°C WITH FAST HEAT-UP

Heats up to 2100°F (1150°C) in less than one hour at 240 volts, less than 2-1/2 hours at 208 volts. Heats to Cone 10 for ceramics.

#### MULTI-PROGRAM CONTROL

There are 6 programs with 8 segments each (2 programs can be linked for a total of 16 segments). In addition there are four special ceramic firing programs that adjust final set point temperature to simulate heat-work measurement of ceramic cones.

#### ELEMENTS ON TOP, BOTTOM AND SIDES RESULTS IN TIGHT UNIFORMITY

A nine point temperature uniformity survey demonstrates better than +/- 7.5°F (a total variation of 15°F/8.3°C) from corner to corner in the chamber from 500°F to 2000°F.

#### COUNTERBALANCED VERTICAL DOOR

The door is counterbalanced with a spring and lifts easily with an air-cooled handle.

#### SLOT IN DOOR

There is a 1-1/2" wide by 2-1/2" high slot in the bottom of the door. You can work through the slot while opening and closing the door. Includes removable insulated plug. The slot is 3/4" above the hearth plate.

#### BENCH MOUNTED

The case is constructed of CNC precision punched and welded heavy gauge steel. The case is powder coated beige textured paint.

#### FIREBRICK & BACK-UP INSULATION

3" firebrick on top (for extra strength), 2-1/2" on other surfaces. Brick is backed up with 2" of mineral wool. It only takes about 850 watts per hour to maintain temperature at 2000°F. Back up insulation keeps case relatively cool to touch. Firebrick is coated with a proprietary reflective ceramic coating which penetrates, binds and hardens the interior surface to reduce dusting.

#### CERAMIC HEARTH PLATE INCLUDED

Hearth is 16" wide by 13" deep by 5/8".

#### SHEATHED TYPE K THERMOCOUPLE

#### FOUR LIFTING HANDLES

#### ON/OFF SWITCH AND CONTROL FUSE

#### DOOR CUT OFF LIMIT SWITCH

#### MULTI-VOLTAGE - EASY TO HOOK UP

The GS 1714 will operate on any single phase voltage from 200 volts to 240 volts, 50 Hz or 60 Hz. 30 amp 14-30P power cord included.

### OPTIONS

- ANGLE IRON FLOOR STAND
- MOTORIZED SIMPLE VENT SYSTEM
- INDUSTRIAL CONTROLS



Small tool room furnace - ideal for heat treating, glass and ceramics

Model Number	Inside Dimensions			Hearth Dimensions	Outside Dimensions			Door Height When Open	240 Volt Watts.	240 Volt Amps	Max Load LBS	Ship Weight
	IW	IH	ID		OW	OH	OD					
GS1714	17	12	14-1/2	16x13	26	32	34	45	6000	25.0	125	375

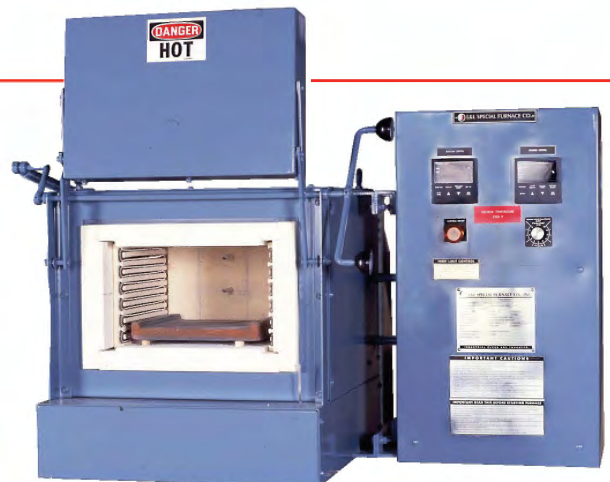
Dimensions are in inches. Weight is in pounds. Working dimensions should be approximately 2" less in each direction than inside dimensions. Firing capacity is approximately 1.7 cubic feet (.048 cubic meters). The GS1714 can operate on 200 to 240 volts single 50 Hz or 60 Hz. 3 phase is not available. At 240 Volts: 6000 watts, 25.0 Amps. At 220 Volts: 5042 watts, 22.9 Amps. At 208 Volts: 4507 watts, 21.7 Amps. At 200 Volts: 4167 watts, 20.9 Amps. 30 Amp, Fuse 30 Amps, 14-30P cord supplied (neutral not used). The furnace is inexpensively shipped by common carrier in a 44" x 44" x 40" high skidded carton (shipping class 85).

# HB SERIES

## 2200°F Basic Bench Top Box Furnaces

### APPLICATIONS

The HB Series furnaces are good general purpose industrial grade Bench Mounted Box Furnaces. The door is an easy to operate spring loaded vertical plug door. They feature a microprocessor-based, single set point digital control for automatic temperature control. They reach 2200°F (1200°C). This series is recommended over the GS 1714 when you need special options and want a more industrial control system but don't need the features of the XLB Series. There are only elements on the sides so the uniformity is not as great as in either the GS 1714 or the XLB Series. The temperature uniformity inside approximately 2/3 of the furnace chamber is in the range of +/-25°F (+/-14°C) above 1300°F (705°C). Mechanical contactors are used although solid state contactors and SCRs are optional. Most of the options available for the XLB Series are available on the HB Series.



Model HB29 with standard single set point temperature controller, input control, and solid state contactors. OPTIONS: silicon carbide hearth plate and high limit control.



## Atmosphere Controlled Neutral Hardening Tool Room Furnace

### APPLICATIONS

The CBH124 Atmosphere Box Furnace is specifically designed for neutral hardening with virtually no decarburization or oxidation. The CBH124 incorporates many features like compact control panel and stand, pneumatic vertical door, silicon carbide hearth, door heat shield, vent hood, peephole, heavy gauge low voltage elements, program control, high limit control, and low mass ceramic fiber insulation that are options on many other furnaces. This makes for a very complete and versatile furnace. Gas levels and resulting carbon levels obtained with the propane or natural gas are set by experience with the manual atmosphere controls. The maximum temperature of 2250°F (1230°C) allows this furnace to be used for high speed tool steels. The CBH 124 is highly uniform in temperature gradient. See page 30 for larger neutral hardening and carburizing furnaces.

### FEATURES

#### APM HEAVY ROD OVERBEND ELEMENTS

Heavy duty low voltage Kanthal APM sintered iron-aluminum-chrome alloy rod/overbend elements are standard. This alloy is highly resistant to carburizing and will take the high temperatures as well. Elements are located on the sides and bottom. These are particularly suited for carbon rich atmospheres. With regular burnout in air they will provide excellent life. They rely on their protection from the atmosphere by forming a thin aluminum oxide coating on the surface of the element. Because they have a thick (6 mm) cross section, they are more resistant to breakage, cracking and embrittlement than thinner gauge wire coiled elements.

#### CERAMIC FIBER INSULATION

2-1/2" of 2600°F (1425°C) low iron ceramic fiber board backed up with 2" of 1900°F (1035°C) board and 4" of mineral wool. This combination of insulation provides very efficient heat up characteristics and low heat loss.

#### HARD BRICK VESTIBULE

A refractory vestibule protects the elements, supports the hearth, minimizes the door opening to promote temperature uniformity and allows for a very efficient interlocking door seal. The door seal includes a fiber gasket.

#### HEAVY DUTY ATMOSPHERE TIGHT CASE

The case is gas tight with full gasketing. An integrated heavy duty stand is included.

#### DOOR HEAT SHIELD

A heat shield is attached to the furnace door. This maintains an external door case temperature of under 120°F (50°C).



The CBH 124 box furnace is specifically designed for neutral hardening. With the Nitrogen/Propane Atmosphere Package the furnace will do neutral hardening with virtually no decarburization or oxidation

#### BUILT IN VENT HOOD

A vent hood is designed into the furnace to collect products of combustion from the burn off and unspent gases when the door opens. This vent hood terminates in a 4" diameter standard duct fitting.

#### PNEUMATIC LIFT DOOR

A pneumatic cylinder lifts and tightly seals the vertical door. The door rides in guide tracks. Door operation is with a pneumatic hand operated valve which allows the door to be raised or lowered with one switch.

#### SILICON CARBIDE HEARTH

Hearth is 1" thick silicon carbide with 1/2" high molded sides. Silicon carbide has excellent heat transfer characteristics, remains flat at high temperatures and is strong.

#### PEEPHOLE

A 3/4" diameter peephole allows viewing inside the furnace without disturbing the atmosphere.

#### NITROGEN/CARBON ATMOSPHERE

The propane or natural gas cracks into hydrogen, carbon monoxide, nitrogen and free carbon. This counteracts the decarburizing effect of trace oxygen and water vapor at high temperatures. The flow system consists of a nitrogen and propane or natural gas line with flowmeters, regulators, gauges, pressure relief valves, solenoids and shut off valves in a self contained flow panel (mounted under the furnace as shown or under the control panel on the side of the unit). An audible alarm indicates any alarm condition. A 1400°F (760°C) alarm shuts off flammable gas. A nitrogen low flow switch prevents flammable gas from flowing unless a minimum flow is achieved. Emergency purge is activated if there is a power failure. This meets NFPA 86 Class C standards.

#### MICROPROCESSOR-BASED DIGITAL PROGRAM CONTROL

The standard control is a microprocessor-based digital program control with multiple ramps and soaks. The power control is a solid state contactor (SCR is optional). A power transformer supplies low voltage to the elements. All fuses, contactors, and controls are located in a NEMA 12 panel with a fused disconnect switch which can be mounted under the furnace or on the side. Thermocouples are heavy-wall inconel sheathed type K. The control voltage is 120 volts. A digital FM approved high limit back up control with manual reset is included with back up contactors and separate thermocouple element. Furnace includes door power cut off switch. Single point power connection. Meets National Electrical Code.

### OPTIONS

- TEMPERATURE RECORDERS
- FLOOR MOUNTED DOOR SWITCH
- SCR POWER CONTROL
- SIDE MOUNTED CONTROLS
- INTEGRATED QUENCH TANK: With pneumatic elevator. (See photo on web site).

### CBH 124 SPECIFICATIONS

- WORK DIMENSIONS: 12" W x 12" H x 24" D
- INSIDE DIMENSIONS: 17" W x 18-1/2" H x 29" D
- HEARTH HEIGHT: 48-1/2" from floor
- OUTSIDE DIMENSIONS: 38" W x 112" H x 70" D
- KW: 12.5
- VOLTS: 208/1/60, 240/1/60 or 480/1/60
- MAX TEMPERATURE: 2250°F (1230°C)
- UNIFORMITY: +/-15°F above 1400°F (760°C)
- MAXIMUM LOAD WEIGHT: 150 Pounds

# XLE SERIES

## Firebrick Lined 2350°F Electric Box Furnaces



### APPLICATIONS

The XLE Series Electric Box Furnaces are highly uniform and controllable and widely adaptable to many applications. In the heat treating field these include hardening, neutral hardening, solution heat treating, stress relieving, annealing, aging, precipitation hardening, and tempering. Ceramic applications include ceramic bisque firing, thin film processing, glazing, and decorating. Other applications include brazing, calcining, drying, melting of glass and metals, glass annealing, fusing and bending, enameling, and sintering. Although standard configurations are made, each furnace is normally fitted with standard and special options to suit specific needs. These include vertical doors, fans, cooling venturis, vents, special hearths, racks, baskets and loading devices, quenching systems, various controlled atmospheres, retorts, viewing ports, special element alloys, special thermocouples, various kinds of alarms, program controls and recorders.

### FEATURES

#### FAST HEAT UP & COOL DOWN

An empty furnace will heat up to 2000°F (1095°C) in approximately 1-1/2 hours. The high KW option will typically trim this to one hour. Cool down to 500°F (260°C) is approximately five hours. Optional venturi will speed cooling dramatically.

#### EXCELLENT UNIFORMITY

The furnace is uniform to within +/-20°F (+/- 11°C) above 1400°F (760°C) within the uniform working dimensions (see specification chart). Optional multi-zone control and fan systems are available for tighter uniformity of up to +/-5°F (+/- 2.8°C) or better.

#### EVEN ELEMENT PLACEMENT

Each element is separately and evenly spaced on the bottom, sides, door and back in rows of ceramic holders. This is the finest method of distributing radiant heat energy at high temperatures and is unique to L&L furnaces.

#### ZONE CONTROL FOR HIGH UNIFORMITY

The elements are divided into top and bottom zones. The control output is routed through two input switches to allow adjustment of the total time on to each

zone. There are thermocouples mounted top and bottom with a selector switch to read the differential. Special designs with up to six zones or more and SCR power controls on separate PID loops can be used to promote even greater temperature uniformity.

#### TEMPERATURES TO 2350°F (1285°C)

Some options such as fans and other alloy components may limit this temperature.

#### LOW WATT DENSITY FOR LONG LIFE

The standard elements are coiled from high grade iron-aluminum-chrome alloy (Kanthal A-1 or the equivalent). Nickel-chrome (80-20), Kanthal AF, APM and other alloys are available for special atmospheres and applications. A watt density normally below 10 watts per square inch maximizes element life. (Watt density is the ratio of watts to square inches of radiating surface area).

#### HEAVY DUTY CASE - INTEGRATED STAND

The furnace case is constructed of 10 gauge steel with external bracing angles welded to the entire case and base assembly. Leveling bolts, anchoring holes and lifting rings are included. The main seams are continuously welded for an attractive appearance. The entire case is primed inside and out with a high temperature silicone based paint. The final coat is a heat resistant machine blue enamel. Custom colors are available. Sealed cases with full gasketing for controlled atmosphere use are optional.



This XLE 3648 features a pneumatic cylinder operated vertical door, NEMA 12 control panel, inert atmosphere control panel, high temperature fan and strip chart recorder.

**YOUR THERMAL INVESTMENT DESERVES SPECIAL TREATMENT**

# XLE SERIES CONTINUED

## Firebrick Lined 2350°F Electric Box Furnaces

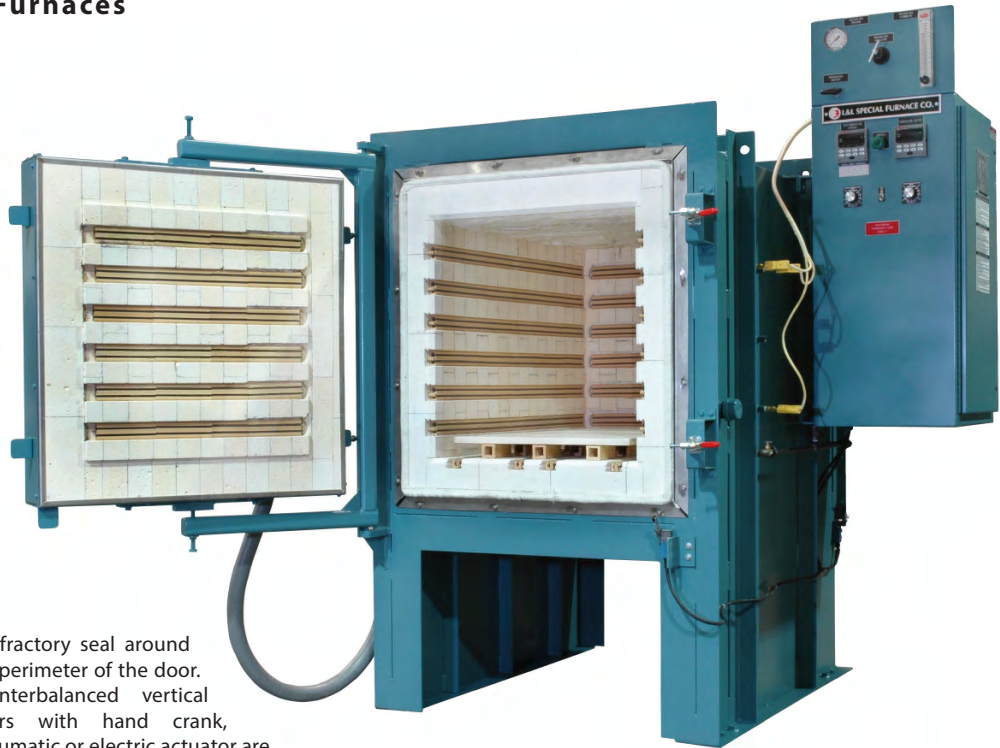


### A WIDE VARIETY OF HEARTH

The standard hearth is one or more ceramic plates elevated on ceramic blocks 1-1/2" above the bottom elements. This air space improves uniformity. Silicon carbide plates, alloy plates, roller hearths, baskets, racks, loaders, castable piers, air cooling tables and many other loading options are available.

### CERAMIC ELEMENT HOLDERS

The elements are supported in proprietary high temperature ceramic element holders. These provide perfect support for the coiled element and excellent radiating characteristics. The smooth surface of the holder prevents premature failure of the element as it expands and contracts. These holders, coupled with a unique all ceramic element terminal, make element replacement easy. Being recessed into the wall of the furnace these elements are not as susceptible to mechanical damage as some other types of element support systems.



This is a very typical XLE 3348 with a standard double pivoted horizontal door, standard cordierite hearth and optional inert atmosphere control panel.



refractory seal around the perimeter of the door. Counterbalanced vertical doors with hand crank, pneumatic or electric actuator are options. Vertical doors lift away from the furnace seal before lifting up. Strong 3/16" thick reinforced door casing prevents door from warping from heat.

### CERAMIC ELEMENT TERMINALS MAKE ELEMENT CONNECTIONS EASY AND TROUBLE FREE

Unique all ceramic element terminal blocks designed by L&L allow the element ends to be clamped without twisting the whole end around a terminal bolt, making it easy to remove an element. The connection wires can be easily removed without disturbing the element termination (which allows you to easily isolate an element for a resistance check). The heavy ceramic terminal block features unusually good electrical isolation and protects the wires.



### DOUBLE PIVOTED PLUG DOOR

#### KEEPS HEAT AWAY FROM OPERATOR AND ALLOWS FOR TIGHT DOOR SEAL

The standard door is a double pivoted horizontal plug door. The double pivoting allows the door to open like a parallelogram which keeps the hot face away from the operator. There are two heavy duty clamps for tight sealing. Because of the completely horizontal motion of the door as it is sealing there is no wear on the seal face. The door has a 3/4" refractory plug which protrudes into the furnace chamber and provides a highly effective heat lock. There is a 3-1/2" refractory to

### PRESHAPED BRICK SECTIONS SAVE ON HEAT LOSS AND MAINTENANCE COSTS

The firebrick is cemented in sections on a very flat table. These sections are then precision cut and routed. All sections fit together with engineered heat locks which improve the insulating integrity of the furnace even after many years of service. Brick sections can easily be installed by in-house maintenance personnel saving on expensive and hard-to-find specialized bricklayer labor. All refractory is coated with a special facing that prolongs firebrick life and helps prevent spalling and dusting.

### EFFICIENT MULTILAYERED INSULATION

The furnace is insulated with 4-1/2" of low K factor refractory firebrick backed up by 2" of mineral wool board on all surfaces except the bottom, which has 2" of hard calcium silicate back up for solid hearth support. This yields an excellent combination of strength, insulating quality, and fast heat up and cool down times. The roof of all models which are 24" wide or wider is made from 2600°F (1425°C) ceramic fiber modules to prevent roof failure.

### SIDE MOUNTED CONTROL PANEL WITH HINGED DOOR HOLDS ALL COMPONENTS

All temperature controls, relays, contactors, power controls, switches, transformers and fuses are located in a side mounted NEMA 1 control panel with a gasketed hinged door. An oil tight NEMA 13 lighted on/off pushbutton switch turns the furnace on. Controls are mounted at eye level for easy visibility. A NEMA 12 panel with fused disconnect switch is optional. A panel cooling fan is included with SCR power controls.

### MICROPROCESSOR-BASED DIGITAL PID TEMPERATURE CONTROL

A microprocessor based digital single set point control is standard. All PID tuning constants (portioning band, reset, rate) plus maximum temperature, scale range, thermocouple type and many other parameters are programmable. Ramp/Soak programming is optional. Multi-zone PLC controls are also available. Other controls are optional.

### DIGITAL HIGH LIMIT CONTROL

A digital high limit control, complete with back up contactors and separate thermocouple, shuts off furnace if temperature or power control fail.

### SOLID STATE CONTACTORS FEATURE FAST CYCLE TIME FOR ACCURATE CONTROL

Other benefits are long contactor life and quiet operation. SCR power controls are optional.

### TYPE K THERMOCOUPLES WITH SHIELDED EXTENSION WIRE

Type S platinum thermocouples are optional.

### MANY SAFETY FEATURES

Thermocouple break protection is included. Limit switches shut off power to furnace if the door is opened or the power panel back is removed. Control voltage is transformed to 120 volts. The control and branch power circuits are fully fused.





## XLE OPTIONS

- **VERTICAL DOORS:** Pneumatic, hand crank or electric gear drive operated. Door is counterbalanced. Special safety latches can be supplied.
- **PROGRAM CONTROLS:** Any make. Multi-program controls. Computer interfaced controls with communications.
- **MULTIPLE HEATING ZONES:** For the utmost in temperature uniformity L&L couples its unique even element design with multi-zoning (four to sixteen in an XLE furnace.) Typically we use a Honeywell HC900 PLC type controller and SCR power controls.



- **FANS:** Various fans for temperatures up to 2200°F for high uniformity and even atmosphere distribution. Motors are air cooled up to 1875°F.
- **TEMPERATURE RECORDERS:** Round chart, strip chart, paperless graphic recorders as well as dataloggers (like the HC900 with CS10 HMI) are available.
- **SCR POWER CONTROLS:** These make control finer with less cycling.
- **ATMOSPHERE CONTROL:** Case is sealed for inert atmospheres. Atmosphere panels with manual or automatic shut off systems are available. Up to 4% hydrogen or other combustible gas can be used.
- **NEMA 12 CONTROL PANEL:** With fused disconnect switch.
- **VIEWING PORTS, SURVEY PORTS**
- **VENTS AND VENTURIS:** Manual or pneumatic dampers, 300, 600 and 1250 CFM venturis for fast cooling and/or venting.

- **SPECIAL HEARTHS AND LOADERS:** Silicon Carbide and alloy, baskets, racks, roller hearths, special loading devices. The one below will handle 2000 pounds. Also see page 31.



This is a special 2000 pound loader with a motorized mover for heavy loads. It runs on a railroad type track. A deadman joystick control operates the drive system. The handle at the back is the hand pump for the hydraulic lift system

## XLE SPECIFICATIONS

Model Number	Working Inside Dimensions			Uniform Working Dimensions			Hearth Dimensions		External Dimensions Horizontal Door			Optional Vertical Door Height	Ratings Stand K.W.	Ratings Super K.W.	K.W. Heat Loss	K.W. Heat Storage	Stand Load Weight LBS	Approx Ship Weight LBS
	W	H	D	W	H	D	W	D	W	H	D							
XLE 524	16	18	25	13	13	20	13	22	54	59	48	99	13.5	18.0	1.3	18.1	175	1,600
XLE 814	19	15	25	16	10	20	16	22	57	56	48	93	14.0	18.0	1.3	18.0	200	1,700
XLE 816	19	15	37	16	10	32	16	32	57	56	60	93	19.0	25.0	1.7	24.5	300	1,900
XLE 824	19	21	25	16	16	20	16	22	57	62	48	105	17.0	22.0	1.6	22.2	200	1,800
XLE 836	19	21	37	16	16	32	16	32	57	62	60	105	22.5	29.0	2.1	29.8	300	2,100
XLE 848	19	21	49	16	16	44	16	44	57	62	72	105	27.0	36.0	2.7	37.4	400	2,500
XLE 214	25	21	25	22	16	20	22	22	63	62	48	105	20.0	26.0	1.8	23.2	300	1,900
XLE 236	25	21	37	22	16	32	22	33	63	62	60	105	27.0	35.0	2.4	30.3	450	2,200
XLE 244	25	27	25	22	22	20	22	22	63	68	48	117	27.0	35.0	2.2	27.9	300	2,100
XLE 246	25	27	37	22	22	32	22	33	63	68	60	117	31.5	42.0	2.8	36.2	450	2,400
XLE 248	25	27	49	22	22	44	22	44	63	68	72	117	38.0	49.5	3.5	44.5	600	2,800
XLE 272	25	27	73	22	22	68	22	66	63	68	96	117	51.0	68.0	4.9	61.0	900	3,500
XLE 448	25	51	25	22	46	20	22	22	63	93	48	N/A	38.0	49.4	3.5	47.0	300	2,900
XLE 3248	31	27	49	28	22	44	28	44	69	68	72	117	48.0	64.0	4.0	50.1	700	3,100
XLE 3260	31	27	61	28	22	56	28	56	69	68	84	117	55.0	71.5	4.7	59.1	850	3,500
XLE 3272	31	27	73	28	22	68	28	66	69	68	96	117	59.0	78.5	5.5	68.2	1000	3,900
XLE 3348	31	33	49	28	28	44	28	44	69	74	72	129	48.5	65.0	4.5	57.7	700	3,400
XLE 3360	31	33	61	28	28	56	28	56	69	74	84	129	60.0	78.0	5.4	67.9	850	3,800
XLE 3372	31	33	73	28	28	68	28	66	69	74	96	129	66.5	88.5	6.2	78.1	1000	4,200
XLE 3436	37	27	37	34	22	32	32	32	75	68	60	117	40.0	52.0	3.7	46.0	600	2,900
XLE 3448	37	27	49	34	22	44	32	44	75	68	72	117	48.0	64.0	4.5	55.8	900	3,400
XLE 3472	37	27	73	34	22	68	32	66	75	68	96	117	66.0	88.0	6.1	75.3	1200	4,200
XLE 3636	37	39	37	34	34	32	32	32	75	80	60	141	51.0	61.3	4.7	60.1	600	3,300
XLE 3648	37	39	49	34	34	44	32	44	75	80	72	141	56.0	66.5	5.6	72.1	900	3,900
XLE 3672	37	39	73	34	34	68	32	66	75	80	96	141	82.0	109.0	7.6	96.3	1200	4,800
XLE 4060	42	39	61	39	34	56	36	56	79	80	84	141	70.0	91.0	7.1	89.2	1000	4,600
XLE 4080	42	39	81	39	34	76	36	76	79	80	104	141	96.0	125.0	8.8	110.2	1500	5,400

Dimensions are in inches. External dimensions include typical control panel mounted on right side. Specify voltage. 480 volts is standard; 208, 240, 380 and 575 volts are optional. 3 phase is standard; single phase is available. 60 or 50 Hertz. Heat Loss is total K.W. lost per hour at 1800°F/968°C. Heat Storage is the total K.W. it takes to heat furnace up to 1800°F/968°C. Multiply K.W. by 3412 to get BTUs. Heavier loading weights are optional. Tighter uniformity can be achieved by using a smaller portion of the work space. Specifications are subject to change without notice.



## Dual Chamber Hardening/Tempering Furnace

### APPLICATIONS

The QD Series Dual Chamber Heat Treating Furnaces feature a 2350°F (1285°C) high heat chamber for hardening and a 1250°F (675°C) recirculating oven for tempering. The over/under configuration saves floor space. The hardening furnace is mounted on top with the tempering oven below. Agitated and heated quench tanks are optional. The furnaces achieve high precision by featuring highly accurate controls, solid state contactors for fast cycle times, two zone control (top and bottom) on the hardening furnace, and very even spacing of elements. The tempering oven features a powerful fan and recirculation muffle for high uniformity. The furnace construction is similar to the XLE Series.

### FEATURES

#### HIGH TEMPERATURE UNIFORMITY

The hardening furnace is uniform to within +/-20°F (+/-11°C) above 1500°F (815°C). The tempering oven is uniform to within +/-10°F (+/-5.5°C) above 300°F (150°C)

#### TWO ZONES AND EVEN ELEMENTS

The elements of each furnace are divided into top and bottom zones. The elements of the hardening furnace are evenly spaced on the door, back, sides and bottom. The elements are supported in proprietary ceramic element holders. These provide perfect support for the coiled element as well as excellent radiating characteristics. The smooth surface prevents premature failure of the element as it expands and contracts. Iron-aluminum-chrome alloy elements are standard.

#### EFFICIENT MULTILAYERED INSULATION

Both chambers are insulated with 4-1/2" of low K factor refractory firebrick as the primary insulation. This is backed up by 2" of very low K factor mineral wool board on all surfaces except the bottom which has 2" of hard calcium silicate back up for solid hearth support. This yields an excellent combination of strength, insulating quality and fast heat up and cool down time. All refractory is coated with a special facing that prolongs firebrick life and helps prevent spalling and dusting. The refractory sections are available completely shaped for easy replacement without cementing.

## QD SPECIFICATIONS

Model Number	Hard Chamber Actual Inside Dimension			Temp Chamber Uniform Inside Dimension			Temp Chamber Inside Recirc Muffle dimension			Outside Dimensions			Hard Chamb K.W.	Temp Chamb K.W.	Max Load Lbs	Apprx Ship Lbs
	W	H	D	W	H	D	W	H	D	W	H	D				
QD 524	16	18	25	12	11	20	11	11	20	54	75	56	13.5	10.0	110	2,000
QD 814	19	15	25	15	9	20	14	8	20	57	72	57	14.0	10.0	125	2,300
QD 824	19	21	25	15	15	20	14	14	20	57	84	57	17.0	12.0	150	2,700
QD 836	19	21	37	15	15	32	14	14	32	57	84	69	22.5	17.5	200	3,300
QD 236	25	21	37	21	15	32	20	14	32	63	84	73	27.0	21.0	300	3,500

Dimensions are in inches. Weight is in pounds. 240 or 460 volts is normal; 208, 380 and 575 volts are optional. Three phase is normal, although single phase is available. Inside tempering chamber dimensions are also working dimensions for that chamber. Specifications are subject to change without notice.



This is a typical QD 836 with (2) standard double pivoted horizontal doors, top chamber with standard cordierite hearth and optional inert atmosphere control panel, bottom chamber with standard fan and T.304 SS recirculation baffle. This unit is equipped with heat shields, and a pyrometry package for AMS2750E.

#### HEAVY DUTY CASE

Both chambers are mounted in an integrated 10 gauge steel case with stiffeners, leveling bolts and lifting ring.

#### DOUBLE PIVOTED DOORS

Both doors are double pivoted horizontal doors with inset refractory plugs for a superb heat lock around the door seal. The double pivoting allows the door to be opened so that the hot face stays away from the operator. Vertical door for hardening furnace is optional.

#### FAN AND RECIRCULATION MUFFLE IN TEMPERING OVEN

The tempering oven features a back mounted alloy fan. It is belt driven with a 3/4 hp motor. A heat dissipator protects the bearings. The removable recirculation muffle is constructed of 304 stainless steel. This has a solid bottom for use as the hearth. The muffle protects the work from direct radiation of the elements and creates a recirculation pattern for the air. The hardening furnace comes with a ceramic hearth.

#### MICROPROCESSOR-BASED DIGITAL PID CONTROLS

Standard controls are microprocessor-based digital PID controls. All fuses, transformers, switches, contactors and controls are housed in a NEMA 1 panel. Quiet, long life solid state power contactors are standard. Limit switches shut off furnace power when doors are opened or the backs are removed. Lighted NEMA 13 on/off switch is included.

#### OPTIONS

- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **HIGH LIMIT CONTROLS**
- **HIGH KW:** Available on hardening furnace.
- **SCR POWER CONTROL**
- **INERT ATMOSPHERE CONTROL**
- **RAMP/SOAK PROGRAM CONTROLS**
- **TEMPERATURE RECORDERS**
- **VERTICAL DOORS**
- **SILICON CARBIDE HEARTHES**

# QDS SERIES

## Small Premium Chamber Hardening/ Tempering Furnaces



### APPLICATIONS

The QDS Series Dual Chamber Heat Treating furnaces feature a 2350°F (1285°C) high heat chamber for hardening and a 1250°F (675°C) recirculating oven for tempering. The over/under configuration saves floor space. The hardening furnace is mounted on top with the tempering oven below. Agitated and heated quench tanks are optional (See pages 29 & 31). The furnaces achieve high precision by featuring highly accurate controls, solid state contactors for fast cycle times, two zone control (top and bottom) on the hardening furnace, and very even spacing of elements. The tempering oven features a fan and recirculation muffle for high uniformity. The QDS 124 is our most popular dual chamber furnace. The furnace chamber construction is similar to the XLB Series.

### FEATURES

#### SIMILAR TO QD & XLB SERIES

The QDS furnaces are similar to the QD Series except that they are smaller and the brick is 2-1/2" thick instead of 4-1/2" thick (like XLB Series on page 4). There are also elements in the top of the

hardening chamber. The fan is belt driven with a 1/6 hp motor. The hardening furnace door is a spring loaded swing up vertical door. The spring holds the door tightly closed, counterbalances it while opening, and holds it up while open. The hot face of the door is kept away from the operator. It has most of the same options as the QD Series.

### HIGH TEMPERATURE UNIFORMITY

The hardening furnace is uniform to within +/-20°F(+/-11°C) above 1500°F (815°C). The tempering oven is uniform to within +/-10°F (+/-5.5°C) above 300°F (150°C).

This is a very typical QDS 124. Top chamber has spring-loaded vertical door, single set point temperature controller, 2 zones of heating elements and solid state contactors. Bottom chamber has horizontal door, high temperature circulation fan and baffles, and single set point temperature controller. Both chambers have optional high limit controllers.



## QD 29

### Small Economical Dual Chamber Hardening/ Tempering Furnace

### APPLICATIONS

The QD 29 Dual Chamber Heat Treating furnace features a 2275°F (1245°C) high heat chamber for hardening and a 1250°F (675°C) recirculating oven for tempering. The over/under configuration saves floor space. The hardening furnace is mounted on top with the tempering oven below. A roll away quench tank is optional. Controls are digital. The tempering oven features a fan and recirculation muffle for high uniformity. This is the most economical dual chamber furnace in the QD line. It is a good basic all purpose heat treating system. The furnace chamber construction is similar to the HB Series.

Model QD 29. Top chamber has spring-loaded vertical door. Bottom chamber has horizontal door and high temperature circulation fan and baffles. Both chambers have single set point temperature controllers with solid state contactors and optional high limit controllers.

### FEATURES

#### SIDE MOUNTED ELEMENTS

The QD 29 furnace has side mounted elements, 2-1/2" brick with 2" back up insulation. The fan is belt driven with a 1/6 hp motor. The hardening furnace door is a spring loaded swing up vertical door. The spring holds the door tightly closed, counterbalances it while opening, and holds it up while open. The hot face of the door is kept away from the operator. It has most of the same options as the QD Series.

#### GOOD TEMPERATURE UNIFORMITY

The hardening furnace is uniform to within +/-25°F (+/-14°C) above 1500°F (815°C). The tempering oven is uniform to within +/-10°F (+/-5.5°C) above 300°F (150°C).



## QDS & QD29 SPECIFICATIONS

Model Number	Hard Chamber Actual Inside Dimension			Hard Chamber Uniform Inside Dimension			Temp Chamber Inside Recirc Muffle dimension			Outside Dimensions			Hard Chamb K.W.	Temp Chamb K.W.	Max Load LBS	Apprx Ship LBS
	W	H	D	W	H	D	W	H	D	W	H	D				
QDS 124	13	12	25	10	10	20	10	12	22	55	78	56	9.8	8.0	125	1,300
QDS 126	13	12	37	10	10	32	10	12	34	55	78	68	13.8	12.0	175	1,600
QD 29	12	8	24	11	6	22	10	6	20	55	70	56	8.0	8.0	100	1,200

Dimensions are in inches. Weight is in pounds. 240 or 460 is normal. 208, 380 and 575 are optional. Single phase is normal although 3 phase is available. Inside tempering chamber dimensions are also working dimensions for that chamber. Specifications are subject to change without notice.

**YOUR THERMAL INVESTMENT DESERVES SPECIAL TREATMENT**



## Large Ceramic Fiber 2200°F Electric Box Furnaces

### APPLICATIONS

The FB Series Electric Box Furnaces are large general purpose ceramic fiber lined furnaces. They achieve high precision by featuring highly accurate digital controls, solid state contactors for fast cycle times, two zone control (top and bottom) and even spacing of elements. They reach temperatures up to 2200°F (1200°C) with 2600°F (1425°C) fiber and up to 2000°F (1095°C) with 2300°F (1260°C) fiber. Insulation is all ceramic fiber except for hearth and hearth support. They are available in standard sizes up to eight feet cubed and even larger in custom sizes.

### FEATURES

#### HIGH TEMPERATURE UNIFORMITY

The furnace is uniform to within +/-25°F (+/-14°C) above 1500°F (815°C). Optional top mounted recirculating fans and multizone power controls are available for uniformity of up to +/-10°F (+/-5.5°C).

#### EVEN ELEMENT PLACEMENT

Each element is separately and evenly spaced on the bottom, sides, door and back in rows of ceramic holders. This is the finest method of distributing radiant heat energy at high temperatures and is unique to L&L furnaces.

#### ZONE CONTROL FOR HIGH UNIFORMITY

The elements are divided into top and bottom zones. The control output is routed through two input switches to allow adjustment of the total time on to each zone. There are thermocouples mounted top and bottom with a selector switch to read the differential. Special designs with up to six zones or more can be used to promote even greater temperature uniformity.

#### CERAMIC ELEMENT HOLDERS

The elements are supported in proprietary ceramic element holders. These provide perfect support for the coiled elements as well as excellent radiating characteristics. The smooth surface prevents premature failure of the element as it expands and contracts. The holders are kept in place on the insulation walls with specially designed ceramic clamps and screws. These fasten to a stainless steel mesh screen which is an integral part of the insulation modules. See web site for details.



This is a custom size FB 4410 which is 4 feet wide by 4 feet high by 10 feet deep. It includes bottom elements and a pneumatic vertical door. Bottom elements are unusual in these big furnaces but can be useful for uniformity and/or adding more KW to the system.

#### CERAMIC FIBER INSULATION FEATURES FAST HEAT UP AND COOL DOWN

The sides of the furnace are insulated with 8" of low density ceramic fiber and mineral wool board. The top is insulated with 10 pound density 8" ceramic fiber modules.

#### HEARTH AND LOADING SYSTEMS

The hearth is typically insulated with ceramic fiber, firebrick sections or light weight but tough insulating castable refractory slabs. The standard hearth is a flat castable floor. Castable piers for forklift load-

ing are optional. An option for a convenient loading system is a serpentine alloy hearth tray which is loaded into the furnace with a hydraulically operated loader (see page 13). Other hearths such as alloy rollers are available.

#### DOOR AND SEAL

The door seal is a folded pad of ceramic fiber blanket which seals against a rigid ceramic fiber board attached to the case front. The standard furnace door is horizontally opening with a double-pivoted hinge which allows parallelogram opening of the door. This keeps the hot face of the door away from the operator and allows tight sealing of the door. Four hand wheels clamp the door tightly against the front seal. Pneumatic or electrically operated vertical doors are optional (these are particularly useful when loading and unloading the furnace hot).

#### DIGITAL PID CONTROL AND HIGH LIMIT

Standard controls include a microprocessor-based digital control and separate high limit back up control. Solid state contactors are standard; SCR power controls optional.

### OPTIONS

- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **RAMP/SOAK PROGRAM CONTROLS**
- **TEMPERATURE RECORDERS**
- **SCR POWER CONTROLS**
- **MULTI-ZONE CONTROL:** with an HC900.
- **HIGH TEMPERATURE FANS**
- **ATMOSPHERE CONTROL**
- **POWERED VENTURI FOR COOLING**
- **PNEUMATIC VERTICAL DOOR**
- **LOADERS:** See pages 9, 13 & 31.
- **HEAT SHIELD:** For 120°F (20°C) case temperatures.
- **BOTTOM ELEMENTS**
- **ALSO SEE XLE OPTIONS:** See page 9

## FB SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			CU Feet	Work K.W.	Load Weight	Ship Weight
	W	H	D	W	H	D	W	H	D				
FB 333	36	36	36	42	42	42	84	88	69	27	64	675	4,200
FB 334	36	36	48	42	42	54	84	88	81	36	76	900	4,900
FB 336	36	36	72	42	42	78	84	88	105	54	100	1,350	6,300
FB 444	48	48	48	54	54	54	96	100	81	64	105	1,200	5,900
FB 446	48	48	72	54	54	78	104	92	102	96	136	1,800	7,300
FB 555	60	60	60	66	66	66	116	104	90	125	157	1,875	7,700
FB 666	72	72	72	78	78	78	128	116	102	216	219	2,700	10,000
FB 888	96	96	96	102	102	102	152	140	126	512	375	4,800	15,800

Dimension are in inches (except for Working Cubic Feet). Weight is in pounds. Standard voltages supplied are 480, 240, 208, 380 and 575. Three phase or single phase is available. Special sizes are commonly made - the above sizes are only representative. Heavier load weights are possible. Outside dimensions are for a horizontal door and include the side mounted control panel. Fans reduce inside working height by 12".



## Atmosphere Box Furnaces with Certifiable Uniformity of $\pm 5^{\circ}\text{F}$ from $300^{\circ}\text{F}$ to $2200^{\circ}\text{F}$

### APPLICATIONS

The FN Series Ultra Uniform Electric Box Furnaces feature extremely uniform temperature gradients over a wide temperature range. The other essential feature is very tight atmosphere construction. Uniform distribution of elements, fan circulation of furnace atmosphere, ceramic fiber insulation, six or more zones of element control, SCR power control, generous extra area inside the furnace to keep direct radiation of elements at a minimum and a very tight gasketed and interlocked door seal make the FN Series unique. Atmospheres may be air, inert or combustible. The uniformity specification is guaranteed from  $300^{\circ}\text{F}$  ( $150^{\circ}\text{C}$ ) to the maximum temperature of the furnace. The maximum temperature rating depends on the type of fan used, type of elements and grade of insulation. Three temperature ranges are offered:  $1800^{\circ}\text{F}$  ( $980^{\circ}\text{C}$ ),  $2000^{\circ}\text{F}$  ( $1095^{\circ}\text{C}$ ), and  $2200^{\circ}\text{F}$  ( $1200^{\circ}\text{C}$ ). These furnaces are ideal for aviation work or any critical heat treating that requires certifiable uniformity. The design details are carefully thought out for convenience of use, service and flexibility.

### FEATURES

- INSULATION & ELEMENTS LIKE FB SERIES
- HEAVY DUTY ATMOSPHERE TIGHT CASE
- EVENLY DISTRIBUTED ALLOY ELEMENTS
- SIX ZONES OR MORE OF CONTROL

The element circuits are broken into six or more separate banks.  $\pm 5^{\circ}\text{F}$  ( $\pm 2.8^{\circ}\text{C}$ ) models are controlled with six separate SCR power controls with biasing from an HC900 PLC-type control.



### CIRCULATING FANS

One or more fans circulate the furnace atmosphere and promote uniformity.

### ELECTRIC VERTICAL DOOR WITH FOUR POWERFUL PNEUMATIC CLAMPS

The standard door is a counterbalanced vertical door driven by an electric brake motor. When the door is in the full down position, four powerful pneumatic clamps pull the door horizontally closed tight against the two independent gasket seals and into the heat interlock. The main gasket is a wide pad of ceramic fiber. This is augmented by a tadpole gasket and a precision interlocking hard fiber plug that protrudes from the door into a matching notch in the furnace case seal. This three way seal ensures both the atmosphere and heat seal. Silicone rubber seals are also available for even tighter atmosphere control.

This is an FN545 with a loader and cast alloy hearth. The photo on Page 2 is an FN436 with Quench Tank.

## FN SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			CU Feet	Work K.W.	Load Weight	Ship Weight
	W	H	D	W	H	D	W	H	D				
FN 222	24	24	24	36	48	36	72	185	65	40	60	400	5,500
FN 223	24	24	36	36	48	48	72	185	77	55	80	600	6,000
FN 324	36	24	48	48	48	60	84	185	89	90	125	1,200	7,500
FN 326	36	24	72	48	48	84	84	185	113	125	175	1,800	9,000
FN 434	48	36	48	60	60	60	96	226	89	120	165	1,600	9,000
FN 436	48	36	72	60	60	84	96	226	113	150	225	2,400	10,000
FN 545	60	48	60	72	72	72	108	238	101	155	225	2,500	10,000
FN 546	60	48	72	72	72	84	108	238	113	180	265	3,000	11,000
FN 555	60	60	60	72	84	72	108	240	101	160	225	2,500	11,000
FN 646	72	48	72	84	72	84	120	240	113	225	300	3,600	13,000
FN 666	72	72	72	84	96	84	120	240	113	240	315	3,600	15,000

Dimensions are in inches. Weight is in pounds. Add another 30" to width for control panel and 30" for atmosphere panel. Hearth height is 42". Special sizes are available. 480 or 240 is normal. 208, 380 and 575 are optional. Specifications are subject to change without notice.



## Alloy Retort Furnace ( for Hydrogen and Low Dew Point Inert Atmosphere)

### APPLICATIONS

The XLC Series Atmosphere Retort Furnaces represent an advanced design which emphasizes process quality and control as well as operator safety. The control system, alloy retort and flow system are completely integrated as one unified system. Any application requiring 100% hydrogen or a mix of hydrogen, carbon monoxide, natural gas or any other combustible atmosphere (as well as any purely inert atmospheres) may be used in the XLC Series.

Hydrogen brazing, magnetic steel processing, special coatings and stainless steel annealing are typical examples. Any batch process that cannot tolerate oxygen or that requires a high degree of atmosphere reliability, repeatability and low dew point is a candidate for this furnace. Maximum temperature is

2200°F (1200°C) with Inconel retorts. Depending on the purity of the gas used these furnaces can maintain a dew point as low as -60°F (-50°C).

### FEATURES FURNACE IS BASED ON XLE SERIES

The furnace system is a modified XLE Series electric furnace. (See pages 7-9).

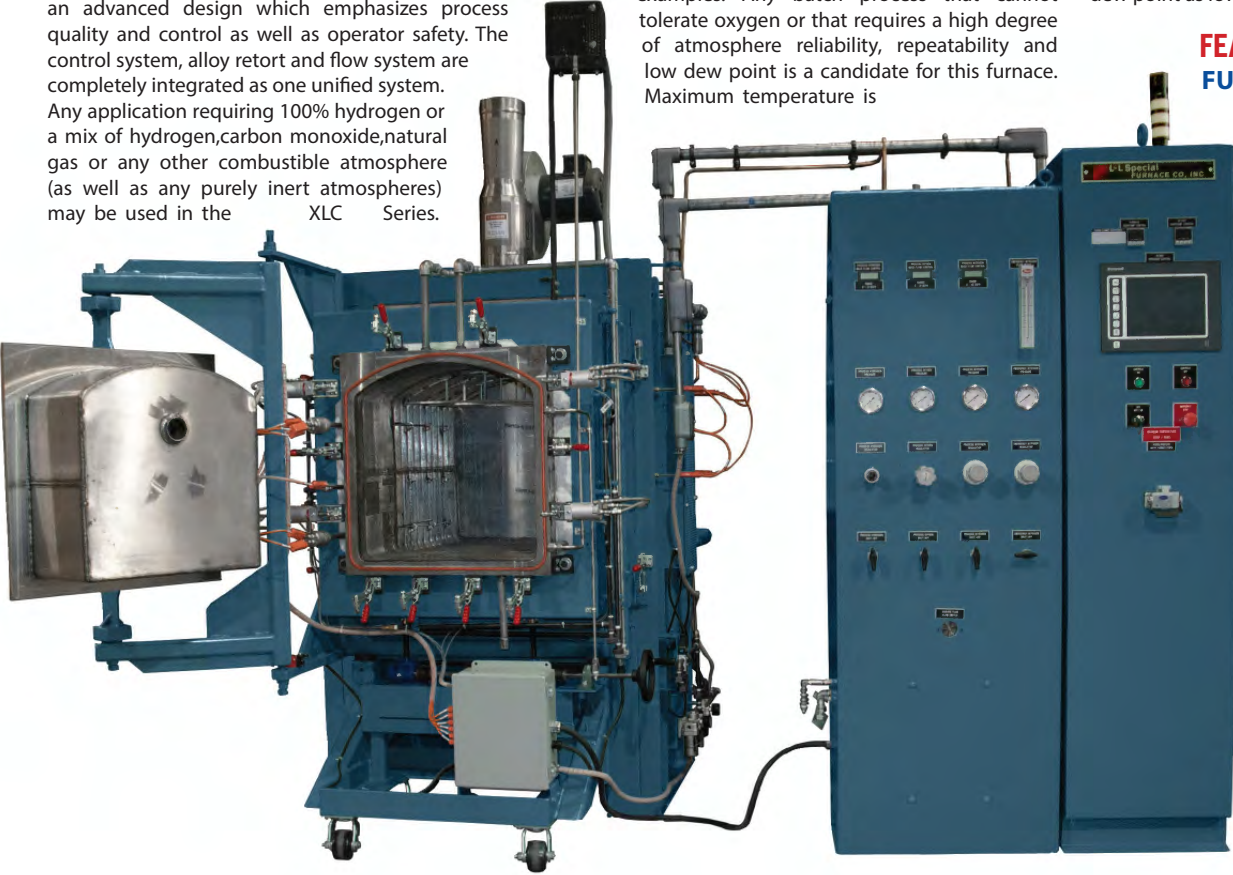
### ALLOY RETORT FOR LOW DEW POINT

The XLC furnaces features an alloy retort to tightly contain the atmosphere. This prevents oxygen infiltration, providing a very low dew point for clean processing and safe operation. Depending on the size and temperature, retorts are "D" shaped and/or corrugated for extra strength. The alloy normally used is 330 alloy, Inconel 600 or 601. Other alloys may be selected for specific applications.

### PLUG RETORT DOOR WITH SILICONE RUBBER "O" RING WATER COOLED SEAL

Retort door is a deep plug (typically 12" deep) that protrudes into the retort cavity. The inside of the plug is insulated with ceramic fiber. The door plug is made of the same alloy as the retort and is com-

CONTINUED



XLC 244 shows a the retort mounted on a cart for extremely fast cool down. Hydrogen control panel with mass flow controllers and process PLC controller. The retort is "D" shaped corrugated Inconel for the highest possible strength.

## XLC SPECIFICATIONS

Model Number	Inside Retort Dimensions			Outside Retort Dimensions			Stand K.W.	High K.W.	Max Load Lbs	Ship Weight
	W	H	D	W	H	D				
XLC 524	10	10	22	34	57	64	13.5	18.0	50	1,500
XLC 824	12	12	22	37	60	64	17.0	22.0	75	1,800
XLC 836	12	12	34	37	60	76	22.5	29.0	100	2,100
XLC 848	12	12	46	37	60	88	27.0	36.0	150	2,400
XLC 244	18	18	22	43	66	64	24.0	35.0	100	2,600
XLC 246	18	18	34	43	66	76	31.5	41.0	175	3,000
XLC 248	18	18	46	43	66	88	38.0	49.5	225	3,500
XLC 272	18	18	70	43	66	112	51.0	68.0	350	4,000
XLC 3348	24	24	46	49	68	88	48.5	65.0	275	3,800
XLC 3372	24	24	70	49	68	112	66.5	88.5	400	5,500
XLC 3448	30	18	46	55	62	88	48.0	64.0	350	4,000
XLC 3472	30	18	70	55	62	112	66.0	88.0	550	6,000
XLC 3648	30	30	46	55	74	88	56.0	66.5	350	4,800
XLC 3672	30	30	70	55	74	112	82.0	109.0	550	7,000

Other sizes are available. Dimensions are in inches. Weight is in pounds. Working dimensions should be approximately 2" less in each direction than inside dimensions, depending on uniformity requirements. Note that the front 6" tends to be cooler and hence less uniform in temperature because of heat losses. 240 or 480 volts is normal; 208, 380 and 575 volts are optional. Three-phase is normal, although single-phase is available. Add 72" to Outside Furnace Dimension width for required floor space for control panels. Specifications are subject to change without notice.



pletely surrounded with the alloy rather than exposing the refractory to the atmosphere as in some competitive designs. This insures that no oxygen gets trapped in the insulation and later reenters the chamber at high temperatures. There is a silicone rubber "O" ring seal around the perimeter of the machined flange of the retort. This is cooled by water which runs in an enclosed channel. A complete water cooling system includes a flow switch which interrupts power to the elements if there is no water flow. The door is closed with quick release turn down latches. This forms an extremely tight seal and allows very low dew point operation. These seals will withstand high pressures. Most doors (except the smallest ones) are standard with a cart that holds the retort door or optionally fitted with a double-pivot hinge (as shown above). Smaller doors are removed by hand.

## ATMOSPHERE SAMPLE PORT

A sample port with a shut-off valve is provided. This is used to sample the atmosphere for oxygen, hydrogen and dew point.

## ATMOSPHERE CONTROL

A variety of atmosphere control systems can be provided. See page 16 for information about hydrogen systems. In addition, simple regulators and flowmeters can be provided for inert gas use. A pressure relief valve and retort pressure gauge are included.

## HC900 CONTROL WITH PLC LOGIC

The standard control for hydrogen systems is a Honeywell HC900 program control with PLC logic control of the safety system. Inert systems use a microprocessor-based digital control. All fuses, transformers, contactors and controls are housed in a NEMA 1 panel. If hydrogen is used then a purged NEMA 12 control panel is standard. Quiet, long life solid state power contactors are standard, but the SCR power control option is recommended for longer retort life. The thermocouple is a sheathed type K inserted into the retort. Limit switches shut off furnace power if the door is opened or the power panel back is removed. A digital high limit back up control with manual

reset, back up contactors and separate thermocouple included. The thermocouple for the high limit control is located between the retort and the elements.

## OPTIONS

- **REMOVABLE RETORT SYSTEM:** Removable retorts allow faster cool down under atmosphere. However, retort life is reduced because of heat shock. This option is available only on the smaller retorts (10" & 12" wide retorts). Includes integrated cart and track.
- **HC900 DATALOGGER:** The HC900 can include a data recorder with up to 96 points of data input.
- **POWERED VENTURI VENT:** A 300, 600 or 1250 CFH motor powered venturi will shorten the cool down rate of the furnace, especially in the lower temperature ranges. The venturi pulls cool air around the outside of the retort without disturbing the atmosphere inside. This is highly recommended for quicker turn-around, higher production rates and lower atmosphere consumption. See page 3.

# JSC SERIES

## Vertical Lift Bell Shuttle Retort Furnaces

### APPLICATIONS & FEATURES

The JSC Series is an Electric Vertical Lift Bell Shuttle Retort Furnace for use with low dew point atmospheres (like the XLC Series). A typical system includes one plug insulated base, one bell shaped round alloy retort, one vertical lift bell furnace, one separate insulated "parking" base, and an overhead hoist and shuttle system. However, it can have multiple retorts and

bases as shown in the photograph. The control system, alloy retort and flow system are completely integrated as one unified system. Any application requiring 100% hydrogen, a mix of hydrogen or any other combustible atmosphere (as well as any purely inert atmospheres) may be used in the JSC Series. Hydrogen brazing, special coatings (such as on turbine blades), magnetic steel processing,

stainless steel annealing and solution treating are typical examples. Any batch process that cannot tolerate oxygen or that requires a low dew point is a candidate for this furnace. Maximum temperature is 2200°F (1200°C) although lower maximum temperatures are recommended for long retort life. The system is ideal for quick cool down under controlled atmosphere conditions. The round retort

holds up well to the stress of heating and cooling and is never moved while hot. The type of alloy used is dependent on the temperature and application. Inlet, outlet and thermocouples are mounted through the bottom base assembly. The base features an insulation plug which is completely covered with alloy so that no water vapor can get trapped in the insulation and outgas to the work chamber. There is a silicone rubber "O" ring seal around the perimeter of the retort. This is cooled by water which runs in an enclosed channel around the perimeter of the base. The retort is secured with quick release bolt down latches. This forms an extremely tight seal and allows very low dew point operation (up to -60°F / -50°C). The most popular size of the retort is 24" diameter by 36" high.



This is a Model JSC 1836 with two retort bases, two hydrogen atmosphere panels and a resting base in the center.



### APPLICATIONS

The H2 Series Flow Control System is designed for introducing and controlling hydrogen in a closed retort batch furnace like the XLC and JSC Series. The safety system exceeds the NFPA 86 Class C (National Fire Protection Association) standards for controlled atmosphere furnaces. With this system hydrogen may be introduced into a furnace retort at any temperature. Hydrogen is used for bright annealing of stainless steel and copper alloys, chemical reductions, magnetic steels, coatings, brazing and many other processes. Flow rates and ranges are engineered for specific systems although typical flow rates are three to ten volume changes per hour.

### FEATURES

#### ATMOSPHERE FLOW CONTROL

There are three separate flow systems, one for hydrogen, one for purge gas and one for emergency purge. All three lines include separate shut off valve, pressure regulator, relief valve, pressure gauge, solenoid for automatic shut off, flowmeter with regulating valve and check valve. In addition the hydrogen line includes a low flow switch which will shut off hydrogen if flow is not sufficient to maintain positive retort pressure. A delay timer temporarily bypasses the switch for hydrogen introduction. A flame arrester is also on the hydrogen line. The two purge lines include pressure switches to monitor the ability of the purge gas to flow in case of an alarm condition. Low pressure opens solenoids from both lines. Purge gas may be nitrogen, argon or helium although argon needs special engineering to work properly. A totally separate emergency inert gas purge line includes a normally open solenoid for automatic actuation. Emergency purge is activated in case of a power failure.

#### INERT PURGE IN ELEMENT CHAMBER

The furnace has a separate inert atmosphere purge between the outside of the retort and the elements. This has its own flowmeter with regulating valve and branches off the inert process gas purge. This protects the system in case of a leak in the retort. It is especially important when operating with hydrogen below 1400°F (760°C). A low flow switch will initiate emergency purge if there is a low flow of purge gas around the retort.

#### ELECTRIC BURN OFF IGNITOR

An electric ignitor maintains a positive ignition source at the gas exit. The system signals an alarm to shut off hydrogen if the ignition source is lost.

#### WATER COOLING SYSTEM & ALARM

On retorts that have water cooled seals a manual ball

valve shut off, flowmeter and regulating valve, relief valve and low flow switch are included plus hook ups for the inlet and outlet. The low flow alarm turns off element power and hydrogen flow and then initiates a purge. Self-contained circulating water cooling systems are also available.

#### VISUAL AND AUDIBLE ALARMS

An audible buzzer with silencer is provided to indicate any alarm condition. In addition, control indicators or pilot lights indicate precisely which alarm conditions are activated and what gasses are flowing. The silencer does not turn off indicators.

#### PURGED CONTROL PANEL

The main electrical control panel is purged with instrument air or nitrogen. A differential switch must be activated for the control system to operate. All electrical components that are in the hydrogen flow area are either explosion proof, intrinsically safe or rendered safe per N.E.C. (National Electrical Code) articles 500 and 501.

#### LOW TEMPERATURE ALARM

A temperature based alarm can be set at any temperature (normally 1400°F / 760°C) below which hydrogen shuts off. This is not strictly necessary when using the purge in, purge out method of hydrogen introduction or removal; however, it is an extra level of safety that can be used when desired.

#### LOSS OF EXHAUST VENTILATION

A differential pressure switch installed in the ventilation system initiates purge and shuts off all power in the case of low ventilation flow.

#### SAFETY REGULATIONS

This atmosphere system meets or exceeds the standards of the National Fire Protection Agency for controlled atmosphere furnaces (NFPA 86 Class C). L&L will provide all necessary information to customer's insurance carrier or other authorities for approval purposes.

#### ATMOSPHERE INSTRUCTIONS

A very complete instruction manual includes theory of operation, full maintenance instructions and schedules, component lists, component instructions, data sheets, emergency procedures, cautions, start up and shut down procedures and a complete flow schematic of the atmosphere system.

#### INTRODUCTION OF HYDROGEN

The hydrogen must be introduced into the furnace manually by activating a switch on the control panel. This is according to the NFPA 86 Class C standards. An automatic purge cycle with automatic introduction

of hydrogen is not allowed. Using the "purge in" method the operator must twice confirm that the oxygen content inside the furnace is below 1% before introducing hydrogen.

#### OTHER GASSES AND PANELS

Other gasses such as ammonia, carbon dioxide, carbon monoxide, oxygen, etc. can be integrated into the gas mixing panel with appropriate safety systems. In addition we make nitrogen/methanol panels and nitrogen/propane or natural gas panels (see page 6). **We only make atmosphere panels for our own furnaces.**

### OPTIONS

- **OXYGEN/HYDROGEN ANALYZER:** Nova 340  
Portable combination oxygen and hydrogen analyzer is commonly supplied. This meets the NFPA requirements for gas analysis when doing the purge in, purge out method of hydrogen introduction and removal. Includes power supply and pump.
- **DELTA F OXYGEN ANALYZER:** Model PA 31525 A-Plus. An alarm prevents hydrogen from flowing and initiating a nitrogen purge at any time if oxygen level rises above 1%.
- **HYDROGEN LEAK MONITOR:** Monitors room air. Calibrated for 1/4 of the LEL (1% hydrogen). An alarm output from this sensor shuts off hydrogen and activates audible alarm.
- **BUBBLER FOR WET HYDROGEN:** A manual or event driven bypass allows the hydrogen to be piped through a bubbler to make wet hydrogen. Automatic PID control is also optional.
- **MASS FLOWMETERS:** One or more of the atmosphere lines can have a mass flowmeter to control the flow rates very precisely. This can be recorded with an output to a datalogger.
- **HYDROGEN HIGH FLOW SWITCH:** A high flow switch shall initiate purge when 150% of process requirements are exceeded.
- **STAINLESS PIPING FOR HYDROGEN:** All flow components in the hydrogen line and all piping and fittings can be made of stainless steel. Compression fittings or all welded connections can be used. Also piping and components can be cleaned for oxygen service.
- **INSTRUMENT AIR FILTERS FOR PANEL PURGE:** Two special Balston filters convert compressed air into instrument quality air for the panel purge.
- **START UP & TRAINING SERVICE:** Two to three days is typical.



# TB & TBU SERIES

Ceramic Fiber Lined Tube Furnaces for 2100°F



## APPLICATIONS

The TB Series Electric Tube Furnaces and TBU Series High Uniformity Three Zone Tube Furnaces are sold as highly customized special furnaces. They feature even heating around the perimeter of the tube, ceramic fiber insulation, and split tube construction for easy maintenance. A variety of tubes may be used or supplied by L&L depending on the application. The TB and TBU Series are normally limited to 2100°F (1150°C). Elements are rated for 2200°F (1200°C). Complete atmosphere systems are typically supplied. A few examples of L&L's special work are shown below. The TBU Series feature at least three zones of heating and sometimes more depending on the uniformity requirements. Complete specifications of standard sizes are available in separate technical bulletins. Custom sizes are available.



This is a special tube furnace with a hydrogen and oxygen control system and a cooling chamber with a heater. It is used for modeling steel processing cycles.

## FEATURES

### A WIDE VARIETY OF SIZES

Element diameters from 1" to 16" and even larger can be made. Almost any length can be made. See our web site for more information.

### LOW MASS INSULATION

The furnace is typically insulated with 6" of ceramic fiber and mineral wool insulation. The insulation has a very low thermal mass and hence heats up and cools down very quickly.

### CERAMIC FIBER MOLDED ELEMENTS

Elements are embedded in ceramic fiber and are made of iron-aluminum-chrome alloy. Element sections are replaced easily. The elements are evenly spaced along the entire surface of the interior and hence will provide the maximum in temperature uniformity by uniformly radiating along the entire surface of the tube. The insulation is fitted with molded vestibules at both ends. These protect the elements and hold the tube in place.

## OPTIONS

- **MORE THAN THREE ZONES**
- **MULTI-ZONE HC900 CONTROL**
- **OVERTEMPERATURE SYSTEM**
- **PUSHERS**
- **COOLING CHAMBERS**
- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **ATMOSPHERE CONTROL:** Inert atmosphere and combustible atmosphere systems are both available (See pages 16).
- **TUBES AND RETORTS:** Alloy retorts made of 304, 330 or 601 alloys, typically with water cooled "O" ring seals, as well as ceramic and quartz tubes are available.
- **TEMPERATURE RECORDERS**
- **ANGLE IRON STANDS**
- **HEAT SHIELDS**



This hydrogen tube furnace is used for processing monochromatic glass. It is uniform to within +/- 2°F.



This is a TBU 1424 with a hydrogen retort and H2 Atmosphere panel.

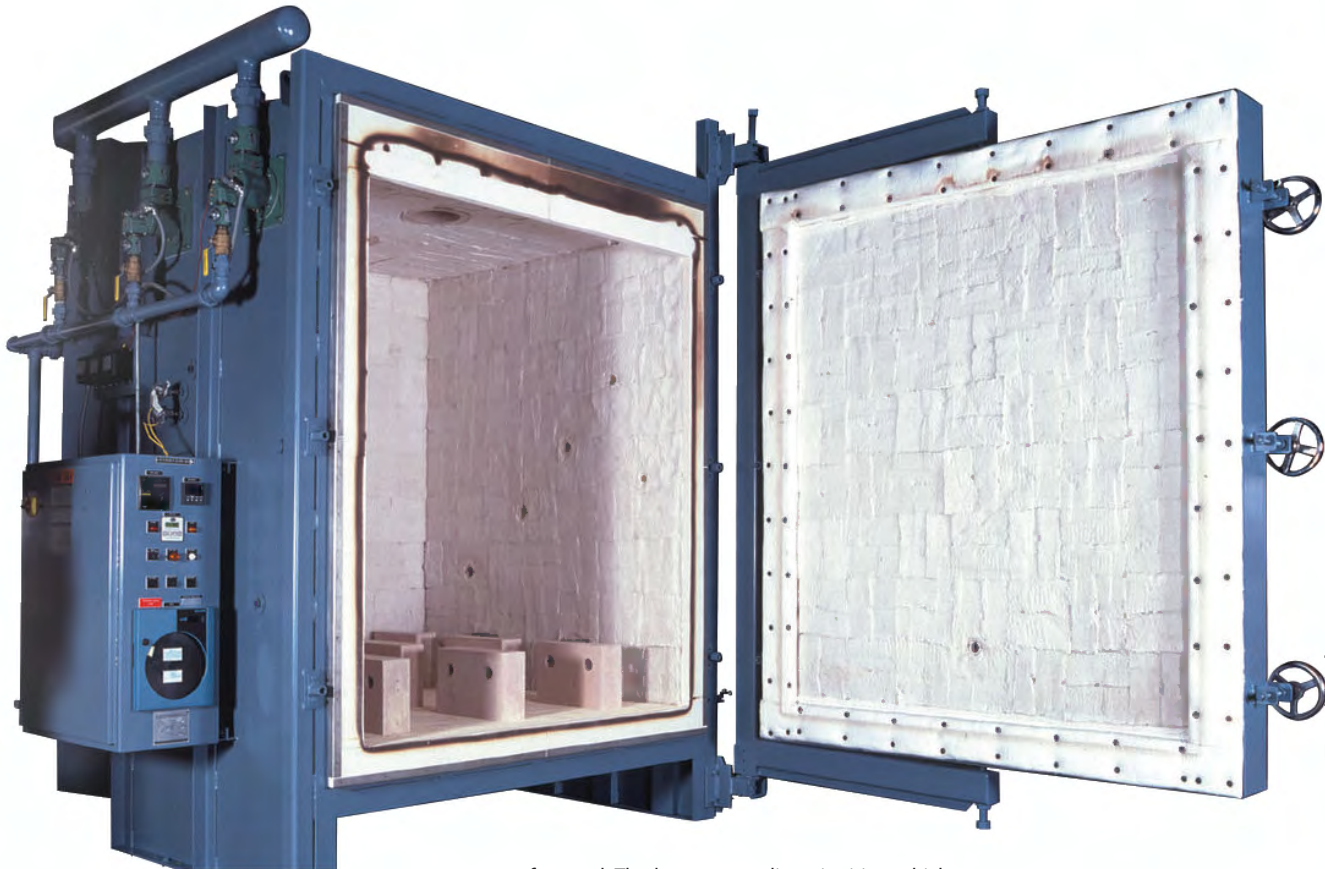


This is a simple TB 224 with a ceramic tube open on both ends.

**YOUR THERMAL INVESTMENT DESERVES SPECIAL TREATMENT**

# XLG SERIES

## Multi-Burner High Velocity Gas Fired Box Furnaces



This is model XLG 666 with five ThermJet 1,000,000 BTU burners

### APPLICATIONS

The XLG Series Furnaces are multi-purpose Gas Fired Box Furnaces. They are highly uniform in temperature and feature accurate digital controls and multiple medium or high velocity Eclipse "Thermjet" or equal proportionally controlled burners with an independent combustion blower. The XLG furnaces can be rated as high as 2400°F (1315°C) although the typical rating is 2000°F (1095°C). Connected gas pressure can be as low as one psi. The circulation of the hot gases, especially with multiple velocity burners, promotes good temperature uniformity without the use of high temperature fans. The burners can be adjusted to run lean to provide a slightly reducing atmosphere (although this cannot be precisely controlled). These furnaces are excellent for ceramics processing and most metallurgical work where precise atmosphere control is not required. Systems can be designed with excess air for high uniformity at low temperatures.

### FEATURES

#### MEDIUM OR HIGH VELOCITY BURNERS

The furnace is heated with two or more Eclipse "Thermjet" or equal medium or high velocity burners. These typically fire over the load with burner placement balanced to maximize circulation of the combustion gasses. In larger units they may be configured to fire over and under the load. These are sized for the proper BTU requirements for your load and fuel type. In addition the choice of high or medium velocity is an engineering choice dependent on load configuration and furnace size. The burners feature low NOX emissions, integral gas and air orifice plates (for precise gas and air balancing), high velocity for good temperature uniformity in the furnace and excellent turndown ratio of 50:1 for a wide

range of control. The burners are direct ignition which eliminates the need for a bypass pilot.

#### FM GAS TRAIN & COMBUSTION BLOWER

The gas system includes two hydraulic mechanical shut off valves, manual shut off valve, pressure regulator and pressure gauges. Each burner has gas and air adjustments and shut off valves. A proportionating valve, controlled by the combustion air, maintains stoichiometric air/gas ratio. Systems can be designed to fire with excess air for high uniformity at low temperatures. Combustion air is provided by a centrifugal blower. An air pressure gauge and switch monitor performance. IRI rated gas train is optional.

#### ELECTRONIC FLAME SAFETY SYSTEM, SPARK IGNITOR AND PURGE TIMER

Each burner is ignited with a spark plug automatically actuated from an integrated flame safety system. UV (ultra violet) sensors monitor each burner. Before ignition the system goes through a timed purge with the combustion air. Safety interlocks include a combustion air pressure switch and high/low gas pressure switch. The digital flame monitoring system indicates the status of the burners and gas train. It includes running time along with voltage signal from each UV sensor. It will alert the operator of any problem with the burners, air flow or gas pressure and will provide "first out" information to actually pinpoint a problem. The operator only needs to press the RESET key to restart the burner firing sequence.

#### HIGH TEMPERATURE UNIFORMITY

The furnace uniformity is +/-15°F (+/-8.3°C) above 1200°F (650°C) within the working dimensions. High uniformity at lower temperatures can be achieved with excess air.

#### EFFICIENT CERAMIC FIBER INSULATION

The sides, back, door and top surfaces are typically insulated with 2300°F (1260°C) ceramic fiber modules, 8" thick, 10 LB density, although this is easily modified for different temperature ranges and applications. The bottom is insulated with a combination of castable and firebrick. Loads can be directly placed on this strong bottom. Optional castable piers (as shown above), ceramic, silicon carbide, serpentine or flat alloy hearth plates are available.

#### HEAVY DUTY CASE

The furnace case is constructed of heavy gauge steel with structural stiffeners, lifting rings and leveling bolts.

#### COUNTERBALANCED VERTICAL DOOR

The standard furnace door is a counterbalanced vertical door with a pneumatic opener and hand or foot operated valve. (See page 12). Double pivoted horizontal doors are optional (standard on 6 and 8 foot high models as shown above).

#### DIGITAL CONTROL WITH HIGH LIMIT

The standard control is a microprocessor-based digital PID tuning control. A digital high limit control is also included. All fuses and controls are located in a NEMA 12 panel. The thermocouples are type K with Inconel protection tubes. A limit switch turns down the burners when the door is opened. Control voltage is 120 volts.

#### MEETS NEC, NFPA, OSHA AND FM CODES

The furnace is designed to NFPA 86 standards. The wiring meets the National Electrical Code. The combustion system meets FM standards. IRI standards are available. Furnace drawings can be submitted to FM or IRI for approval.



## OPTIONS

- **BLOWER FILTERS**
- **RAMP/SOAK PROGRAM CONTROLS**
- **TEMPERATURE RECORDERS:** Round and strip chart.
- **SPECIAL HEARTHS AND LOADERS:** Castable piers, silicon carbide, alloy hearths, load baskets and serpentine alloy hearths are available. Hydraulic forklift-type loaders are available.
- **SPECIAL DESIGNS:** Car Bottoms, Shuttle Types, Elevator Types, Tip Up Types.

Burner blocks are along the top side; flues are at top.



The gas and air train is all neatly hard piped.



## XLG SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			Typical BTUS	Max Load Lbs	Ship Weight
	W	H	D	W	H	D	W	H	D			
XLG 324	36	24	48	48	48	48	120	148	112	1,200,000	1,800	5,400
XLG 334	36	36	48	48	60	60	120	172	112	1,200,000	1,800	5,800
XLG 336	36	36	72	48	60	84	120	172	136	1,500,000	2,700	7,300
XLG 444	48	48	48	60	72	60	132	196	112	1,500,000	2,400	6,800
XLG 446	48	48	72	60	72	84	132	196	136	2,500,000	3,600	8,200
XLG 556	60	60	72	72	84	84	144	220	136	3,500,000	4,500	9,600
XLG 666	72	72	72	84	96	84	156	150*	136	4,000,000	5,400	11,000
XLG 668	72	72	96	84	96	108	156	150*	160	5,000,000	7,200	13,200
XLG 888	96	96	96	108	120	108	180	174*	160	6,000,000	9,600	16,600
XLG 8810	96	96	120	108	120	132	180	174*	184	7,000,000	12,000	19,300

\*The models with 72" and 96" inside height must have horizontal doors. Dimensions are in inches. Weight is in pounds. BTUS are sized for a particular application. Voltage can be 208, 240, 460, 575 or 380, three-phase. Larger sizes are available; however, loading is best accomplished with a car bottom or other special design version of this furnace. Heavier loading is available. Special sizes are available. Specifications are subject to change without notice.

## XLM SERIES

### Single Burner 2100°F Gas Fired Box Furnaces

The XLM Series are multi-purpose Gas Fired Box Furnaces. They are uniform in temperature and feature accurate microprocess-based digital controls and a single proportionally controlled burner with a high turn down ratio for accurate control. The burner maintains stoichiometric gas/air ratios. The XLM furnaces reach 2100°F (1135°C). Connected gas pressure can be as low as 4" W.C. The circulation of the hot gases promotes good temperature uniformity without the use of high temperature fans. The furnace is uniform to within +/-25°F (+/-14°C) above 1200°F (650°C) within the working dimensions. The burner can be adjusted to run lean to provide a slightly reducing atmosphere (although this can not be precisely controlled). These furnaces are excellent for ceramics processing and most metallurgical work where precise atmosphere control is not required. They are particularly useful where fumes need to be vented from the furnace, such as in wax burn out work. The single "package" type burner makes them an economical choice in a small to medium size furnace. The burner is mounted in the furnace with a special 2100°F (1150°C) burner block and holder. The burner is located in the back of the furnace at the top, firing over the load. There is one flue at the back bottom on the opposite side as the burner.

This location vs the location of the burner makes the burner flame circulate all the way around the inside of the chamber for maximum efficiency.

## XLM SPECIFICATIONS

Model Number	Working Dimensions			BTU/HOUR	Max Load LBS
	W	H	D		
XLM 224	24	22	24	500,000	500
XLM 246	24	22	36	500,000	750
XLM 248	24	22	48	500,000	1,000
XLM 272	24	22	72	500,000	1,500
XLM 3336	30	28	36	500,000	900
XLM 3348	30	28	48	500,000	1,250
XLM 3372	30	28	72	500,000	1,875
XLM 3636	36	34	36	500,000	1,125
XLM 3648	36	34	48	500,000	1,500
XLM 3672	36	34	72	500,000	2,500



This is a model XLM 3672.

# DV & DVR SERIES

1300°F Floor Standing Batch Tempering & Annealing Ovens (Gas or Electric)



## APPLICATIONS

The DV and DR Series Floor Standing Recirculating Heat Treating Ovens feature high volume air recirculation for high temperature uniformity, a stainless steel interior and plenum chamber, and a precision digital control system. They are designed for heavy duty production heat treating applications such as tempering, annealing and solution heat treating, although they find many other uses. They are rated to 1300°F (700°C). 1400°F (760°C) is optional. Horizontal doors (DV Series) or vertical doors (DR Series) are available. They are available in electric or gas fired versions.

## FEATURES

### RECIRCULATION FOR GRADIENT UNIFORMITY OF +/-10°F (+/-5.5°C)

A heavy duty, high volume, high velocity, air cooled alloy fan is mounted in the top with a full recirculation duct (plenum chamber). The duct features adjustable vents to control the recirculation pattern of the air. A minimum of 40 volume changes per minute of the entire interior is achieved. The fan is dynamically balanced and engineered for long life at high temperatures.

### HEAVY GAUGE STAINLESS STEEL INTERIOR

The entire interior is made of stainless steel for heat and corrosion resistance. The bottom is 10 gauge while the liners and baffles are 18 gauge. They are designed to expand and contract with the heat. Each piece of the liner is anchored in one place and then allowed to expand without restriction. This unique construction differentiates this oven from the typical construction found in lower temperature cabinet and walk in ovens.

### HEAVY DUTY CASE CONSTRUCTION

The oven case is constructed of reinforced 10 gauge steel with an integrated floor stand with leveling bolts and mounting holes.

### SEVEN INCHES OF INSULATION

1" of 2300°F (1260°C) ceramic fiber insulation is backed up with 6" of mineral wool sandwiched between the interior and exterior of the oven.

The bottom insulation is non-compressible firebrick and calcium silicate.

### HORIZONTAL OR VERTICAL DOORS

The DV Series doors are deep plug horizontal doors. The models that are 36" wide (or wider for custom sizes) feature two doors that meet in the middle. The

horizontal doors feature woven fiber tadpole seals. Pneumatic and electric vertical doors are also available (DR Series). The DR Series feature a front vestibule of reinforced castable refractory and ceramic fiber lined doors which seal against this rigid vestibule. The DR Series can be supplied with rollers that travel on the vertical doors to match roller hearths inside the oven. Special hydraulic forklift loaders are also available for loading heavy loads. (See pages 9,13 & 31).

### INCOLOY ELEMENTS FOR ELECTRIC OVENS

Electric ovens feature elements located in the recirculating plenum chamber away from the work zone. These are incoloy sheathed elements which are rated for 1600°F.

### PACKAGED BURNER FOR GAS OVENS

The gas fired ovens feature packaged gas burner with a high turn-down ratio. The gas system includes a proportional motor control which adjusts both gas and air to maintain stoichiometric firing (proper ratio of gas to air), a gas regulator, lubricated gas cock, combustion air pressure switch, high/low gas pressure switch, pilot solenoid, pilot regulator, two main shut off solenoids, UV flame safety, air purge system (4 volume changes) and integrated combustion blower. The system meets NFPA and FM standards. The gas burner fires into the plenum chamber, avoiding flame impingement on the load. These may be specified for natural gas or propane.

### DIGITAL PID CONTROL AND HIGH LIMIT

The standard control is a microprocessor-based digital control. All fuses, transformers, contactors and controls are located in a NEMA 1 panel.

Quiet, long life solid-state power contactors are standard on electric ovens (SCRs are optional).

The thermocouples are Inconel sheathed type K. The control voltage is transformed to 120 volts. A digital high limit back up control with manual reset, back up contactors and separate thermocouple is included.

This is a DR 3648 with a vertical door and roller hearth system. You can see the recirculation muffle inside with adjustable air louvers. These allow you to adjust the pattern of high velocity air inside the oven to achieve maximum temperature uniformity.



## DV & DR SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Door Model Height	Stand K.W.	Max K.W.	Fan H.P.	Max Load LBS	Ship Weight
	W	H	D	W	H	D						
DV 244 DR 244	24	24	24	70	91	50	148	21.6	48.0	3	400	1,600
DV 246 DR 246	24	24	36	70	91	62	148	24.0	48.0	3	600	1,800
DV 248 DR 248	24	24	48	70	91	74	148	32.4	72.0	3	800	2,200
DV 272 DR 272	24	24	72	70	91	98	172	43.2	96.0	5	1,200	2,600
DV 3636 DR 3636	36	36	36	84	103	62	172	43.2	96.0	7.5	900	2,500
DV 3648 DR 3648	36	36	48	84	103	74	172	48.0	144.0	7.5	1,200	2,800
DV 3672 DR 3672	36	36	72	84	103	98	172	72.0	144.0	10	1,800	3,200

Dimensions are in inches. Weight is in pounds. Working dimensions have clearances of a minimum of 3" extra in each dimension. Add about 12" to the depth for gas fired ovens. Special sizes and load weights are available. 240 or 460 volts are normal. 208 volts decreases power by 25%. Other voltages are optional. Three phase is normal although single phase is available. Gas ovens typically have one 500,000 BTU burner, which will yield 250,000-300,000 BTU/hour net (higher BTU ratings are available.) Gas fired ovens should be flued to the outside. Specifications are subject to change without notice.



A DV 3648 with double horizontal doors is shown above. DV ovens that are 36" or wider (custom sizes) have double doors like this. Models that are 24" wide have a single door.

## OPTIONS

- **1400°F (760°C) OPERATION:** Interior is 316 Stainless Steel.
- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **INERT ATMOSPHERE BLANKETING:** On electric units only.
- **RAMP/SOAK PROGRAM CONTROLS**
- **TEMPERATURE RECORDERS**
- **SCR POWER CONTROL:** For electric units.
- **MANUAL OR POWERED VENTURI VENT:** A manual vent or motor powered venturi can be provided for venting the oven.
- **SHELVES AND SPECIAL HEARTHS:** Perforated stainless steel shelves, roller hearths



This is a Model VB 1824 with standard NEMA 1 panel, single set point control and high limit control, plus optional stand.

## VB SERIES

The VB Series Bench Mounted Electric Recirculating Heat Treating Ovens feature air recirculation for high temperature uniformity, simple, clean, electric operation, a stainless steel interior and a precision digital control system. These are ideal for laboratory or small production use such as tempering or annealing in heat treating applications. They are rated to 1300°F (700°C) with an option for 1400°F (760°C) operation. An alloy fan is mounted in the top. The motor is 1/6 hp.

The entire interior is made of stainless steel for heat and corrosion resistance. The liner is designed to expand and contract with the heat. The oven case is constructed of heavy gauge steel with an integrated bench stand. There is 7" of insulation, a gasketed door, digital microprocessor-based controls and solid state contactors. Options include stand, SCR power controls, recorders, atmosphere controls, and a NEMA 12 control panel.

## VB SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			Stand K.W.	High K.W.	Load Weight	Ship Weight
	W	H	D	W	H	D	W	H	D				
VB 124	12	12	24	21	17	30	52	44	44	4.0	7.2	150	425
VB 126	12	12	36	21	17	42	52	44	56	6.0	10.8	225	675
VB 1824	18	18	24	27	23	30	58	50	44	6.0	10.8	300	600
VB 1836	18	18	36	27	23	42	58	50	56	8.0	14.4	450	900

Dimensions are in inches. Weight is in pounds. Working dimensions have an extra 1" clearance for all dimensions. 240 or 460 volts are normal; 208 volts will reduce power by 25%. Other voltages are optional. Single phase is normal, but all ovens can be supplied in three phase (although some models will have unbalanced phases). Note that larger-size ovens are available in the heavy-duty floor standing DV/DR SERIES oven line. Specifications are subject to change without notice.



## 2500°F SILICON CARBIDE ELEMENT BOX FURNACES

### APPLICATIONS

The GLF Series Electric Silicon Carbide Element Floor Standing Box Furnaces feature continuous 2500°F (1370°C) operation. These are ideally suited for applications where temperatures between 2000°F (1095°C) and 2500°F (1370°C) need to be reached under normal operating conditions or for very long high heat cycles. The silicon carbide elements also have important advantages with certain atmospheres such as carbon rich atmospheres.

### FEATURES

#### SILICON CARBIDE HEATING ELEMENTS

Silicon carbide heating elements are mounted over and under the hearth for even heating. All element connections are on the sides. They permit the 2500°F (1370°C) maximum temperature under continuous operating conditions. Watt density is between 27 and 39 watts per square inch. Elements are rated for 3000°F (1650°C).

#### GOOD TEMPERATURE UNIFORMITY

Temperature uniformity of +/-25°F (+/-14°C) is normal above 1600°F (870°C) within 2/3 of the working dimensions.

#### TIGHT PLUG DOOR WITH A VESTIBULE

The double pivoted hinge allows parallelogram opening of the plug door which keeps the hot face away from the operator and allows tight sealing of the door. The door features a 1" deep plug with heat locks. A vestibule around the perimeter of the door reduces heat loss when the door is opened. This also aids temperature uniformity while protecting the elements from physical damage. Vertical doors are optional.

#### FLOOR STANDING CASE CONSTRUCTION

The case is reinforced 10 gauge and 3/16" steel with an integrated floor stand, lifting rings and leveling bolts.

#### 1-1/2" THICK SILICON CARBIDE HEARTH

This hearth plate is strong with excellent heat transfer. Hearth is typically 30" from floor.

#### MULTILAYERED INSULATION WITH CERAMIC FIBER ROOF

There is 4-1/2" of 2800°F (1535°C) insulating firebrick backed up with 4" of ceramic fiber. The roof is made from 2600°F (1425°C) ceramic fiber modules. Completely shaped firebrick sections install easily for replacement. As an option, the entire insulation except for the door vestibule can be fiber modules for fast heat up and cool down.

#### DIGITAL CONTROL AND HIGH LIMIT

The standard control is a microprocessor-based digital control. All fuses, contactors and controls are located in a NEMA 1 panel. The thermocouples are type S. The control voltage is transformed to 120 volts. A NEMA 13 lighted on/off switch and NEMA 13 door power cut off

switch are included. A digital high limit back up control with manual reset, back up contactors and separate thermocouple is included.

#### SCR POWER CONTROL AND TAP TRANSFORMER

The power control has a 6 position tap transformer with taps that are changed inside the control panel and a phase angle fired SCR. The SCR adjusts for most voltage changes automatically as needed, eliminating the need to manually change taps while operating the furnace. The resistance of silicon carbide elements changes with temperature and so needs this voltage adjustment. The taps are used occasionally to raise voltage as elements age.



Model GLF 814 with pneumatic vertical door, heat shield for lowering case temperature and NEMA 12 panel. The tap transformer is not visible but typically sits behind the control panel or the furnace.

## OPTIONS

- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **INERT ATMOSPHERE CONTROL:** These furnaces can be fitted for use with inert or combustible atmospheres. Inlet of the atmosphere is through the element connection chamber to maintain cool element connections. This system includes special all aluminum element hardware inside the sealed boxes. The door features a special tadpole gasket.

- **HIGH DENSITY ELEMENTS:** These will provide greater element life than the standard silicon carbide elements, especially in atmosphere applications. Check with factory for specific atmosphere limitations with these elements.
- **RAMP/SOAK PROGRAM CONTROLS**
- **TEMPERATURE RECORDERS**
- **HIGH KW:** See specifications.
- **VENTURI VENT**
- **VERTICAL DOORS:** Available with pneumatic operation

# GF SERIES



## 2800°F Silicon Carbide Element Box Furnaces

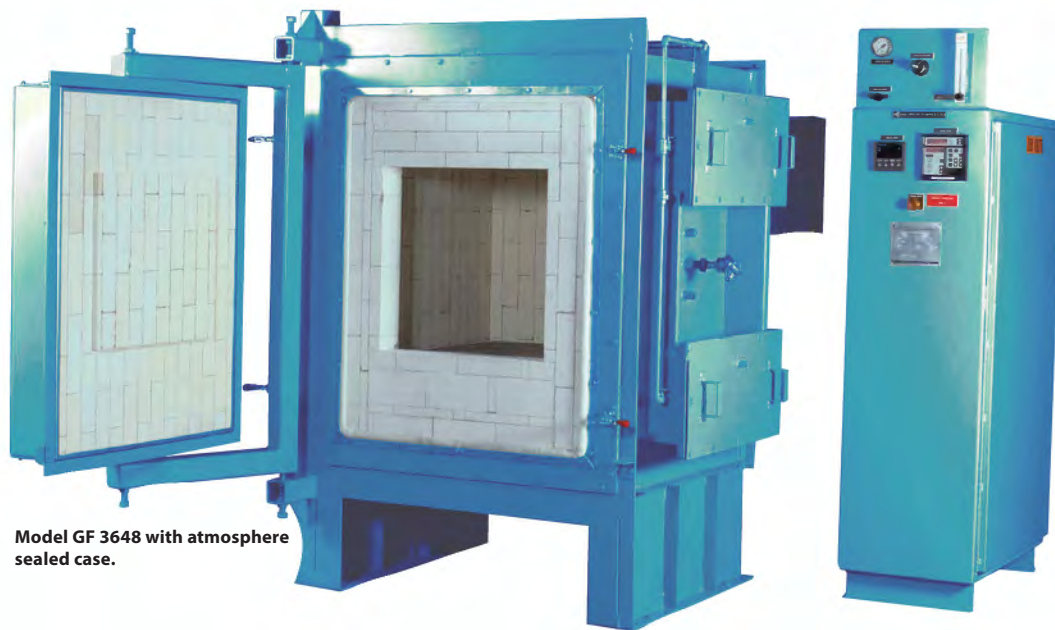
### APPLICATIONS

The GF Series Electric Silicon Carbide Element Floor Standing Box Furnaces feature 2800°F (1535°C) operation. Silicon carbide elements are controlled with a phase angle fired SCR and tap transformer. The door features a deep plug for minimal heat loss around the door. Because this door must be opened horizontally the furnace can not be loaded and unloaded easily at high temperatures. These furnaces are excellent for long high temperature cycles. They are used mostly in ceramics but find application in chemical processing and other fields.

### FEATURES

#### MOST FEATURES ARE THE SAME AS THE GLF SERIES

Insulation is a higher grade. Power supply is more robust but is a similar 6 position tap transformer and phase angle fired SCR. The GF Series furnaces have higher KW ratings than the GLF Series. Most GLF Series options, except for vertical doors, are available on the GF Series.



Model GF 3648 with atmosphere sealed case.

### MULTILAYERED INSULATION; CERAMIC FIBER ROOF AND DOOR PLUG

There is 4-1/2" of 3000°F (1650°C) insulating firebrick backed up with 4" of 2300°F (1260°C) ceramic fiber. The

roof and door are made from 2850°F (1565°C) ceramic fiber modules. The door plug is 2" deep.

### SILICON CARBIDE HEATING ELEMENTS

Silicon carbide heating elements are mounted over and

under the hearth for even heating. All element connections are on the sides. Watt density is between 30 and 39. Elements are rated for 3000°F (1650°C).

## GL/GF/GLF SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			GL/GLF KW	GF K.W.	GL / GLF Max Load Lbs	GF Max Load LBS	Ship Weight	
	W	H	D	IW	IH	ID	OW	OH	OD						
GL 9	11	8	10	13	16	13	42	42	30	10	-	75	-	900	
GL 29	11	8	20	13	16	23	42	42	40	20	-	150	-	1400	
GL 39	11	8	30	13	16	33	42	42	50	30	-	225	-	1900	
GF 9	12	8	10	14	15 ½	11 ½	36	62	28	-	10	-	50	1400	
GF 29	12	8	20	14	15 ½	21 ½	36	62	38	-	20	-	100	1800	
GF 39	12	8	30	14	15 ½	31 ½	36	62	48	-	30	-	150	2200	
GLF 524	GF 524	15	15	24	17	26 ½	26	70	61	50	30	33	175	125	2000
GLF 814	GF 814	18	12	24	21	23 ½	26	73	58	50	30	38	225	150	2200
GLF 824	GF 824	18	18	24	21	29 ½	26	73	64	50	37	41	225	150	2700
GLF 836	GF 836	18	18	36	21	29 ½	38	73	64	62	47	52	325	225	3400
GLF 236	GF 236	24	18	36	27	29 ½	38	79	64	62	54	60	450	300	4100
GLF 244	GF 244	24	24	24	27	35 ½	26	79	70	50	50	54	300	200	3900
GLF 246	GF 246	24	24	36	27	36 ½	38	79	70	62	65	66	450	300	4300
GLF 248	GF 248	24	24	48	27	35 ½	50	79	70	74	80	86	600	400	5900
GLF 3636	GF 3636	36	36	36	39	47 ½	38	91	82	62	95	106	675	450	7400
GLF 3648	GF 3648	36	36	48	39	47 ½	50	91	82	74	114	127	900	600	8600
GLF 3672	GF 3672	36	36	72	39	47 ½	74	91	82	98	150	164	1350	900	10000

All dimensions are in inches. Weight is in pounds. Hearth height is 30" on floor mounted units (all but GL9, GL29, GL39 which are bench mounted furnaces). Hearth dimensions are the same as working width and depth. Typical floor standing control panel is 24" wide by 66" high by 36" deep. Standard voltages supplied are 480, 240, 208, 380 and 575. Three phase or single phase is available. Larger sizes are available by special quote. The same KW rating used on the GF furnaces can be obtained in the GLF line as an option. All specifications are subject to change.



### APPLICATIONS

The GHH Series Ultra High Temperature Front Loading Box Furnaces feature a unique lightweight ultra high temperature ceramic fiber insulation system for fast heat up and low BTU input requirements. The GHH series achieves 1700°C (3100°F) under continuous operation. The insulation system, which is the most fragile and difficult aspect of this type of furnace, is uncompromised in quality and construction detail. It is guaranteed for one full year – an important consideration with this type of furnace.



### FEATURES

#### MULTILAYERED FIBER INSULATION

The furnace is insulated with multi-layered high alumina and alumina-silicate ceramic fiber board. The hot face is pre-fired high alumina board made by Zircar or Rath. The insulation is segmented and supported by a series of splines, alumina rods and sapphire clips. This is the most critical part of the furnace design in terms of longevity. Triple heat locks are designed into the system for extra protection at high temperatures. A vestibule protects the molybdenum disilicide elements and prevents excessive heat loss when the front door is opened.

#### MOLYBDENUM DISILICIDE ELEMENTS

The elements are Kanthal Super 33 U-shaped molybdenum disilicide elements. These will withstand 1800°C (3275°F) in air. All electrical connections are at the top, and the elements are suspended from the roof. The electrical resistivity of these elements remains constant over time with little aging. This allows replacement of one element without changing all elements, a distinct advantage over silicon carbide elements. Low watt density is designed into the elements for maximum element life. All aluminum element connection hardware is used to prevent galvanic corrosion.

#### DOUBLE WALL CASE CONSTRUCTION

The insulation module has its own rigid nonwarping refractory board exterior. This insulation module is inserted into a ventilated steel casing leaving an air space between the exterior case and the insulation module. This allows for cooling of the insulation, important in long insulation life, and helps maintain a cool external case temperature. Larger furnaces feature integral cooling fans to insure good cold face strength of the insulation. The GHH 5 and GHH 8 are bench mounted while all others are floor mounted with an integrated stand.

#### DEEP PLUG DOOR CONSTRUCTION

The horizontally opening door features a deep plug type seal with triple heat locks. Two pivots, one on the left and one in the center of the door, insure very tight

sealing. A vestibule around the door opening further reduces heat loss and helps protect the elements.

#### GOOD TEMPERATURE UNIFORMITY

Uniformity of +/-10°C (+/-18°F) is normal above 1200°C (2200°F) within 2/3 of the working dimensions.

#### ALUMINA HEARTH

The hearth is a flat alumina plate (or series of plates) supported by a series of insulating alumina posts which transfer the weight of the hearth all the way to the bottom of the cold face of the bottom insulation.

#### FAST HEAT UP AND COOL DOWN

The all fiber insulation and Kanthal Super 33 elements provide extremely fast heating and cooling response.

#### PID DIGITAL CONTROL, HIGH LIMIT CONTROL AND SCR POWER CONTROL

The standard control used is a microprocessor-based digital PID tuning control. A matched transformer and phase angle fired SCR controls power to the elements. The thermocouples are type B. Included is a digital high limit back up control with manual reset, back up contactors and separate type B thermocouple.

### OPTIONS

- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **ATMOSPHERE CONTROL:** The GHH furnaces can be fitted for use with inert atmospheres. This is accomplished by having a secondary atmosphere casing that contains the insulation module. This casing has its own gasketed door. Inlet of the atmosphere is through the element connection chamber to maintain cool element connections. A completely piped flowmeter and regulator with ball valve, pressure gauge and pressure relief valve is included. Maximum furnace use temperature is limited to 1600°C (2910°F) in nitrogen, argon or helium. Combustible atmospheres are not allowed.
- **RAMP/SOAK PROGRAM CONTROLS**
- **TEMPERATURE RECORDERS**
- **STANDS FOR BENCH MOUNTED UNITS**





## GHH SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			Element No & Size	K.W.	Max Load Weight	Ship Weight
	W	H	D	W	H	D	W	H	D				
GHH 5*	5	5	5 ½	7 ½	6 ¼	6 ½	18	28	18	(6) 3/6	3.5	10	350
GHH 8*	8	8	10	13	9	12	26	36	30	(10) 3/6	4.5	30	650
GHH 12	12	12	14	16	14	16	36	51	60	(8) 6/12	8.0	60	1,100
GHH 14	14	10	20	18	11 ¼	23	38	48	66	(12) 6/12	12.7	100	1,400
GHH 24	24	20	23	28	22	26	47	72	46	(18) 6/12	40.0	200	2,100
GHH 36	30	30	46	35	33	48	51	86	66	(21) 9/18	80.0	500	2,900

\*Bench models. Weight is in pounds. All dimensions are in inches except size of elements, which are in millimeters (i.e., 3/6 means 3mm for main body of element and 6mm for terminal end). Outside dimensions shown do not include control panels. On bench models, height to hearth is 10" from bench. Other models are 30" from floor to hearth. Control panel for bench models is 17" wide by 48" high by 30" long. Control panel for floor standing models is 17" wide by 60" high by 36" long. 240 or 460 volts is normal; 208, 380 and 575 volts are optional. Larger sizes are available by special quote. Load weight must be evenly distributed. Specifications are subject to change without notice.

## GHE SERIES

### 1700°C CERAMIC FIBER LINED ELEVATOR FURNACES

#### APPLICATIONS

The GHE Series Ultra High Temperature Bottom Loading Elevator Furnaces feature lightweight ceramic fiber insulation system for fast heat up and low BTU input requirements. The load is placed on a motorized elevator that moves up into the bottom of the fixed furnace. Elements on all four sides provide superior uniformity. The GHE series achieves 1700°C (3100°F) under continuous operation. The insulation system, which is the most fragile and difficult aspect of this type of furnace, is uncompromised in quality and detail. It is guaranteed for one full year - an important consideration with this type of furnace. It is hard to damage the insulation or elements when loading one of these furnaces.

#### FEATURES

##### HIGH ALUMINA FIBER INSULATION

The insulation is made of high alumina fiber made by Zircar or Rath. The hotface is constructed with an edge mounted butcherblock method with spline support rods.

##### DOUBLE WALL CASE CONSTRUCTION

The insulation module has its own rigid refractory board exterior. This module is inserted into a ventilated steel casing leaving an air space between the exterior case and itself. This allows for cooling of the insulation, important in long insulation life, and helps maintain a cool external case.

#### ELEMENTS

Elements are Kanthal Super 33 U-shaped molybdenum disilicide elements.

#### DEEP PLUG BOTTOM CONSTRUCTION

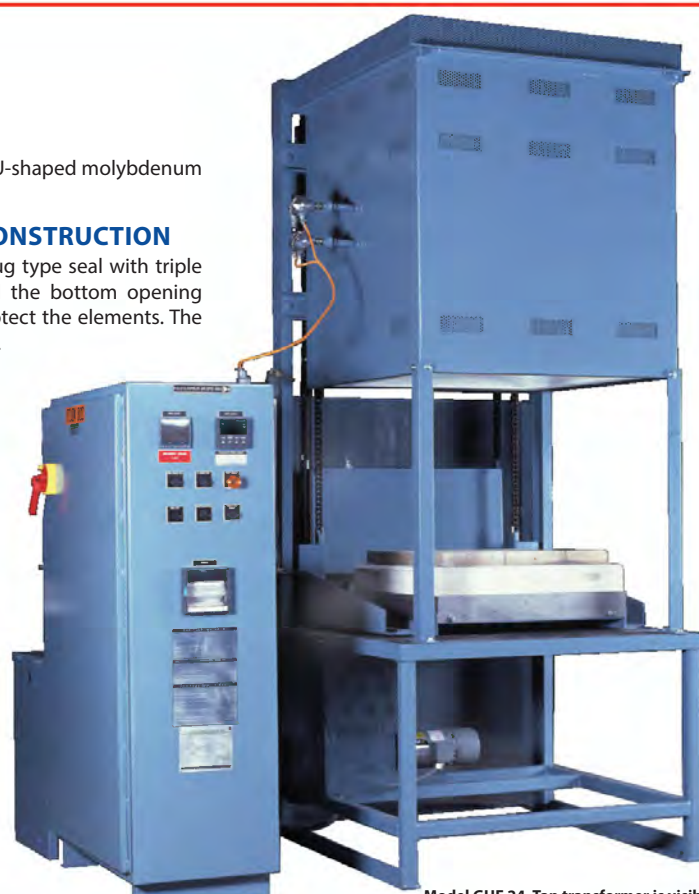
The bottom features a deep plug type seal with triple heat locks. A vestibule around the bottom opening reduces heat loss and helps protect the elements. The floor is 1785°C (3250°F) firebrick.

#### ELECTRIC ELEVATOR

The bottom rises into the furnace by means of an electric gear motor. A foot switch is optional.

#### CONTROLS ARE THE SAME AS GHH SERIES TEMPERATURE UNIFORMITY

Uniformity of +/-10°C (+/- 18°F) is normal above 1200°C (2200°F) within 2/3 of the work dimensions. The fact that the elements are on all four sides makes the gradient uniformity particularly good.



Model GHE 24. Tap transformer is visible behind the NEMA 12 control panel.

## GHE SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			Element No. & Size	K.W.	Max Load Weight	Ship Weight
	W	H	D	W	H	D	W	H	D				
GHE 12	12	12	12	16	14	16	33	90	39	(8) 6/12	8	60	1,500
GHE 15	15	15	15	19	17	19	36	96	42	(12) 6/12	16	100	2,000
GHE 24	24	24	24	28	26	28	45	114	51	(16) 6/12	40	200	3,000
GHE 36	36	36	36	40	38	40	57	138	63	(24) 6/12	80	500	5,000

Weight is in pounds. All dimensions are in inches except size of elements, which are in millimeters (i.e., 6/12 means 6mm for main body of element and 12mm for terminal end). Outside dimensions shown do not include control panels. Hearth height is 42" from floor. Control panel is 17" wide by 60" high by 36" long. 240 or 460 volts is normal; 208, 380 and 575 volts are optional. Larger sizes are available by special quote. Heavier hearth loading is optional. Load weight must be evenly distributed. Specifications are subject to change without notice.



## Ceramic Fiber Lined Car Bottom Furnace

### APPLICATIONS

The FC Series Car Bottom Furnaces feature tight pneumatic car seals, electric car drives and a wide range of custom options including vertical doors, program controls and custom hearths. The car bottom makes these furnaces extremely easy to load. They achieve high precision by featuring highly accurate controls, solid state contactors or SCR power controls, fans, multi-zoning, and very even spacing of elements for uniformity. They reach 2200°F (1200°C) with iron-aluminum chrome elements. Insulation is all ceramic fiber except for hearth and hearth support. These furnaces can be designed for extremely heavy loads. Gas fired units are also available.

### FEATURES

#### EVEN ELEMENT PLACEMENT AND ZONE CONTROL FOR HIGH UNIFORMITY

The elements are normally divided into top and bottom zones. The control output is routed through two percentage timers which allow adjustment of the total time on to each zone. If SCR power controls are used these can be zoned using digital biasing switches or can have separate PID loops to control them. Coiled alloy elements are evenly spaced along the sides, back and door creating an even wall of radiation. The standard furnace is uniform to within +/-25°F (+/-14°C) or better at 1500°F (815°C). Optional fan systems and multiple control zones are available for uniformity of up to +/-10°F (+/-5.5°C).

#### CERAMIC ELEMENT HOLDERS

The elements are supported in proprietary ceramic element holders. These provide perfect support for the coiled elements as well as excellent radiating characteristics. The smooth surface prevents premature failure of the element as it expands and contracts. The holders are kept in place on the insulation walls

with specially designed ceramic clamps and screws which fasten to a stainless steel mesh screen, which is an integral component of the insulation module.

#### LOW DENSITY FIBER INSULATION

The furnace, except for the car, is insulated with low density, highly insulating ceramic fiber and mineral wool for fast heat up and cool down. The total insulation thickness is typically 8". 2600°F (1425°C) fiber is used for 2200°F (1200°C) furnaces and 2300°F (1260°C) fiber is used for 2000°F (1095°C) or below.

#### HEAVY DUTY CASE

The case is made of strongly reinforced 3/16" thick steel with an integrated base fabricated of heavy square tube and angle sections. Very large models can be made in

#### CAR BOTTOM FEATURES ELECTRIC DRIVE

The car bottom is made with heavy plate steel and structural members. The perimeter of the car is cast with a reinforced and anchored castable suitable for heat shock. Inside this perimeter, the car is insulated with insulating firebrick and surfaced with 2" cast slabs of castable for heavy duty wear resistance. Alternately, cast piers for easy forklift loading can be provided. Low mass cars are also available depending on the load configuration and weight. The car is driven in and out of the furnace with a car mounted AC brake motor drive. A cable reel feeds power to the car. Railroad type rails are provided with mounting plates. Rails can be

mounted in troughs in the floor or on top of the floor. Detailed installation drawings are provided.

#### TIGHT PNEUMATIC CAR SEALS

The car seals feature a wide pad of ceramic fiber blanket. These are pushed by pneumatic cylinders against the castable edge of the car. They retract when the car is about to be moved. Limit switches prevent car movement unless the seals are fully retracted. This seal



is extremely tight and features low wear because there is no rubbing on the seal.

#### DOOR AND SEAL

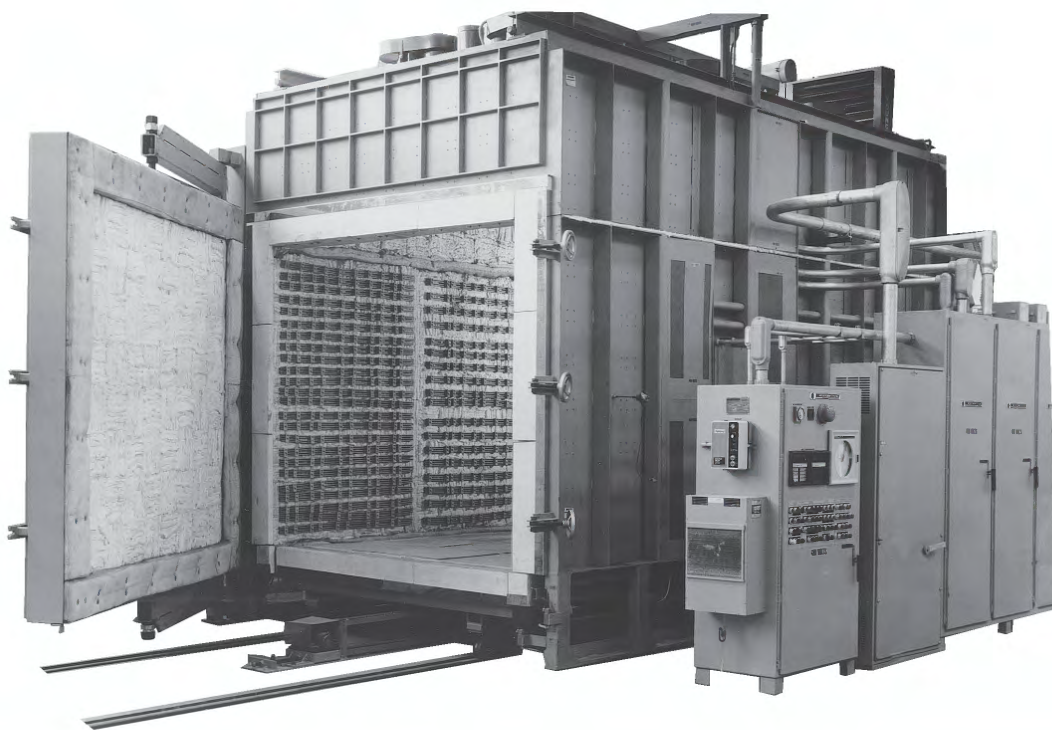
The door seal is also a wide pad of ceramic fiber, which seals against a rigid ceramic fiber board attached to the case front. Car mounted doors and double pivoted horizontal doors are available.

#### DIGITAL PID CONTROL AND HIGH LIMIT

Standard controls include a microprocessor-based digital control and high limit back up. Solid state contactors are standard; SCRs optional.

### OPTIONS

- RAMP/SOAK PROGRAM CONTROLS
- TEMPERATURE RECORDERS
- SCR POWER CONTROLS
- MULTI-ZONE HC900 CONTROL
- HIGH TEMPERATURE FANS
- VENTURI COOLING & VENT SYSTEMS
- GAS FIRED UNITS: (See XLG on page 18).



This is a model FC 8820 with six fans and a load capacity of 40,000 pounds.



## FC SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			CU Feet	Work K.W.	Load Weight	Ship Weight
	W	H	D	W	H	D	W	H	D				
FC 444	48	48	48	54	60	55	90	108	82	76	114	2,400	10,500
FC 448	48	48	96	54	60	103	90	108	130	120	180	4,800	15,000
FC 556	60	60	72	66	72	79	102	120	106	125	188	4,500	15,000
FC 5512	60	60	144	66	72	151	102	120	178	205	307	9,000	21,000
FC 5524	60	60	288	66	72	295	102	120	322	364	546	18,000	35,000
FC 666	72	72	72	78	84	99	114	132	106	155	232	5,400	17,000
FC 6612	72	72	144	78	84	151	114	132	178	248	372	10,800	24,000
FC 6624	72	72	288	78	84	295	114	132	322	435	652	21,600	40,000
FC 8812	96	96	144	102	108	151	138	156	178	342	513	14,400	31,000
FC 8824	96	96	288	102	108	295	138	156	322	584	876	28,800	50,000

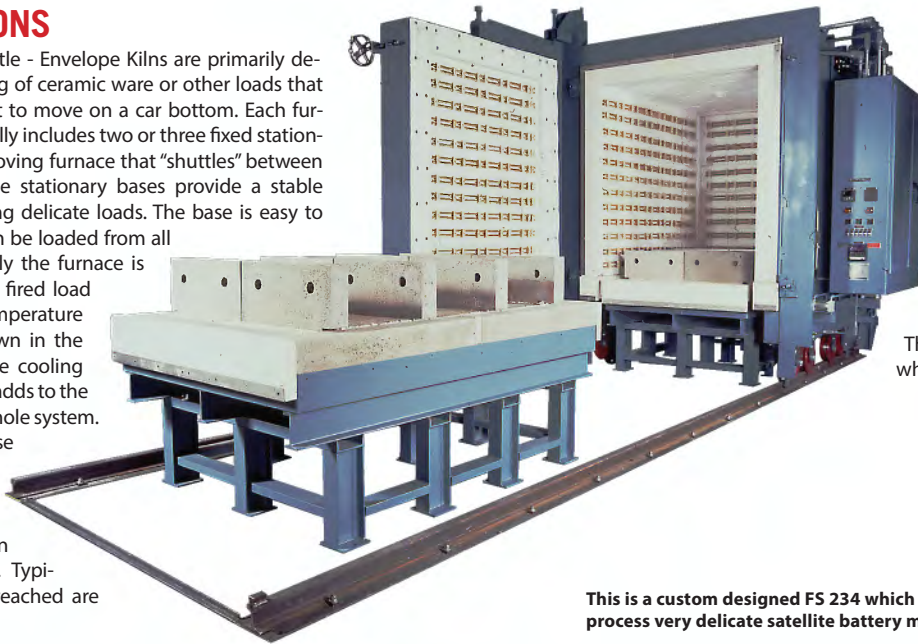
Dimensions are in inches. Weight is in pounds. Add another 30" to width for control panel. Hearth height is 28". OH dimension is with horizontal door. Add IH dimension to OH for approximate height with vertical door. Special load weights for extremely heavy loads can be designed. Special sizes are common. 240 or 480 volts is normal. 208, 380 and 575 volts are optional. Specifications are subject to change without notice.

# FS SERIES

## CERAMIC FIBER LINED SHUTTLE - ENVELOPE FURNACES

### APPLICATIONS

The FS Series Shuttle - Envelope Kilns are primarily designed for the firing of ceramic ware or other loads that one wouldn't want to move on a car bottom. Each furnace system typically includes two or three fixed stationary bases and a moving furnace that "shuttles" between the two bases. The stationary bases provide a stable platform for loading delicate loads. The base is easy to load because it can be loaded from all four sides. Normally the furnace is removed from the fired load at a fairly high temperature for a fast cool down in the slowest part of the cooling curve. This greatly adds to the efficiency of the whole system. We have made these for use with atmosphere retorts which are quick to cool down and easy to load. Typical temperatures reached are 2200°F (1200°C).



This is a custom designed FS 234 which was designed to process very delicate satellite battery materials

### FEATURES

**MOST FEATURES ARE SIMILAR TO THE FC SERIES CAR BOTTOM FURNACES KILN MOVER**

Electric or manual kiln movers are offered.

#### SHUTTLE CASE DESIGN

One to three bases are included along with tracks above or below floor level.

#### HORIZONTAL OR VERTICAL DOORS

There are one or two doors which can be vertical or horizontal.

## FS SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			Total Length	Work Cubic FT	K.W.	Load Weight	Ship Weight
	W	H	D	W	H	D	W	H	D					
FS 224	30	48	48	38	54	56	88	92	80	196	40	86	750	7,400
FS 246	30	48	72	38	54	80	88	92	104	244	60	113	1,125	9,300
FS 2412	30	48	144	38	54	152	88	92	176	388	120	192	2,250	15,300
FS 2424	30	48	288	38	54	296	88	92	320	676	240	351	4,500	27,200
FS 4512	48	60	144	56	66	152	106	104	176	388	240	267	3,600	19,600
FS 4524	48	60	288	56	66	296	106	104	320	676	480	478	7,200	34,800

NOTES: Dimensions are in inches, weight in pounds. Other sizes are available. Total length is for one kiln with two bases. Gas fired units are available. Inside dimensions increase for the same load size. All voltages are available. Hearth height is 24" from the floor. Specifications are subject to change without notice.

# WB & WQ SERIES



Bell-Lift Annealing & Preheat Ovens for Glass, Quartz and Steel (Up to 2200°F)

## APPLICATIONS

The WB Series Glass Annealing Oven is designed for the purpose of annealing borosilicate glass although it may be used for other applications such as metal annealing and weld pre-heating. The heated oven portion is a counterbalanced rectangular "bell" that lifts entirely out of the way when loading the oven. The oven features proprietary ceramic element holders for easy low cost replacement of elements and maximum element life, low density ceramic fiber and mineral wool insulation and a digital programmable temperature control for automated cycling. Maximum temperature is 1500°F (815°C). The WQ Series are similar but rated to higher temperatures 2200°F (1200°C) for annealing quartz, firing ceramics and other high temperature applications.

## FEATURES FOR BOTH CERAMIC ELEMENT HOLDERS

The elements are supported in proprietary ceramic element holders located on all four sides of the oven. Element replacement is easy; elements just lift out of the holders without affecting the fiber hot face

## EFFICIENT MULTILAYERED INSULATION

The furnace is insulated with 1-1/2" of low K factor ultra high temperature ceramic fiberboard as the primary insulation. This is backed up by 2" of 2,300°F ceramic fiber blanket and 1" of very low K factor mineral wool board. This extremely efficient insulation will heat up and cool down quickly. The fiberboard sections are available completely shaped for easy replacement without cementing. No asbestos or vermiculite is used.



Model WB2 with tadpole gasket.

available completely shaped for easy replacement without cementing. No asbestos or vermiculite is used.

## COUNTERBALANCED BELL LIFT CONSTRUCTION

The oven is a rectangular bell that lifts vertically from the rigid base. The bell is supported by two heavy channels from the back, leaving the entire hearth area exposed without obstruction for easy loading. The oven section is counterbalanced in the rear. Roller bearings insure smooth operation. A hand crank is included as standard for easy raising and lowering. An optional power lifting drive system is available. The entire case is designed to fit through a 32" wide doorway.

## CERAMIC FIBER HEARTH

Ceramic fiber blanket provides a soft surface for glass or quartz annealing. Brick hearth is optional for heavier loads.

## EASY TO VIEW SLIDEOUT CONTROL PANEL

All controls are located in a NEMA 1 panel mounted under the furnace to save floor space. This slides out on tracks for maintenance.

## PROGRAM CONTROL

Microprocessor based temperature control with multiple ramps and soaks, and 'auto-tune'.

## FEATURES FOR WB SERIES

### EFFICIENT MULTILAYERED INSULATION

1-1/2" of ceramic fiber board is backed up by 2" of mineral wool board on the sides and 4" on top. This extremely efficient insulation will heat up and cool down quickly. The fiber board sections are available completely shaped for easy replacement without cementing.

### NICHROME ELEMENTS

### TYPE K SHEATHED THERMOCOUPLES



Model WQ8 with NEMA12 panel, program control, overtemp, SCR and chart recorder.

## FEATURES FOR WQ SERIES

### EFFICIENT MULTILAYERED INSULATION

1-1/2" of ceramic fiber board is backed up by 2" of 2300°F (1260°C) ceramic fiber blanket and 1" of mineral wool board. The fiber board sections are available completely shaped for easy replacement without cementing.

### IRON-ALUMINUM-CHROME ELEMENTS TYPE S SHEATHED THERMOCOUPLES SCR POWER CONTROL

## OPTIONS

- **OVERTEMPERATURE SYSTEM**
- **BRICK BOTTOM:** The bottom can be made from 4-1/2" thick firebrick for heavier hearth loading.
- **POWER LIFT:** A gear motor lifts the furnace up and down. Limit switches are included.
- **SOLID STATE CONTACTORS OR SCR POWER CONTROL FOR WB SERIES**
- **ATMOSPHERE SEALED CASE:** See gasket on the bottom of the WB2 case shown in photo.

## WB & WQ SPECIFICATIONS

Model Number	Inside Dimensions			Outside Dimensions			K.W.	Load Weight With Firebrick Bottom	Ship Weight
	W	H	D	W	H	D			
WB 2	24	24	19	37 1/2	92 3/4	35 1/4	3.5	300	1,100
WB 5	60	24	19	73 1/2	92 3/4	35 1/4	7.0	750	1,800
WB 6	72	24	19	85 1/2	92 3/4	35 1/4	8.0	900	2,000
WB 8	96	24	19	109 1/2	92 3/4	35 1/4	10.5	1,200	2,500
WB 10	120	24	19	133 1/2	92 3/4	35 1/4	11.0	1,500	2,900
WQ 2	20	24	17	37 1/2	92 3/4	35 1/4	8.0	300	1,100
WQ 5	56	24	17	73 1/2	92 3/4	35 1/4	17.0	750	1,800
WQ 6	68	24	17	85 1/2	92 3/4	35 1/4	18.0	900	2,000
WQ 8	92	24	17	109 1/2	92 3/4	35 1/4	22.0	1,200	2,500
WQ 10	116	24	17	133 1/2	92 3/4	35 1/4	28.0	1,500	2,900

Dimensions are in inches. Weight is in pounds. Hearth height is 31". Special sizes are available. 240 or 480 volts is normal; 208, 380 or 575 are optional. Three-phase or single-phase hookup. Specifications are subject to change without notice.

# QT SERIES



## Agitated and Heated Heavy-Duty Quench Tanks

### APPLICATIONS

The QT Series Quench Tanks are used for the uniform quenching of hot steels. They may be used with water, light weight polymer or oil. They are not designed for use with brine. Water or polymer must have rust inhibitors (or tank must be stainless steel). They feature proper agitation which insures uniform quench temperatures and disperses the bubbles of vaporized quenchant that form on the surface of the hot parts being quenched. These bubbles, if not dispersed, can cause uneven quenching times which would result in a unevenly and poorly quenched part. The agitation also prevents localized overheating which, in the case of oil quench media, could cause a fire. The QT Series Quench Tanks also feature integrated controlled heaters and large inlet and outlet taps for optional cooling systems. An optional hinged lid provides a means to extinguish any potential quench oil fires and to keep quench media clean parts are added. There are 3" above, below and to each side of the work dimensions to allow for good agitation.

### FEATURES

#### DOUBLE WELDED CONSTRUCTION

The tank is made from 3/16" steel (1/4" on Model QT 3648 and larger) and is completely reinforced. All seams are welded on both sides. The tank includes lifting provisions. A base coat of zinc chromate primer is covered with heavy duty two-part epoxy paint that resists mechanical and chemical attack.

#### HIGH WORK CAPACITY

Without optional external cooling these quench tanks are capable of quenching as many pounds per hour as there are gallons capacity in the tank. There are 6" extra in height above the nominal fill level to allow for fluid rise when parts are added. There are 3" above, below and to each side of the work dimensions to allow for good agitation.

#### STANDARD AGITATOR MOTOR IS TEFC

The standard agitator motor is a TEFC motor. This is specified for water or polymer quench media. Oil quench media requires the optional explosion proof motor.

### CONTROLLED HEATER

A removable heater is included to heat the quench media to proper quenching temperatures. Typically this is in the 120°F (50°C) to 140°F (60°C) range. The thermostat is integral to the heater.

### IMPELLER TYPE AGITATION

An impeller type agitator insures proper agitation of the quench media. The horse- power and impeller of the agitator are generously sized for vigorous agitation.

### COOLING INLET AND OUTLET DRAIN

An NPT fitting (with pipe cap) is welded near the bottom to drain and clean the tank. Large NPT fittings are welded at opposite corners for potential attachment of a quench cooler.

### SEPARATE CHAMBER FOR IMPELLER TEMPERATURE GAUGE

### NEMA 4 ELECTRICAL CONNECTION BOX

Includes on/off switch, fuses, contactors for heater, motor control for agitator and control transformer. Control circuit is 120 volts.

## OPTIONS

- **STAINLESS STEEL CONSTRUCTION**
- **NEMA 12 PANEL OPTION:** Includes a fused disconnect switch.
- **EXPLOSION PROOF MOTOR:** Specified if the quench tank is going to be used with oil.
- **HINGED SAFETY LID:** Includes a fusible link for automatic closing in event of fire.
- **OVERTEMPERATURE CONTROL:** This shuts off heater. Preset for 175°F (80°C).
- **QUENCH MEDIA COOLERS:** A cooler allows greater work load through-put per hour.
- **ELEVATORS:** The quench tanks can be fitted with a pneumatically operated elevator for lowering the work into the tank. The elevator platform can have rollers to accept cast alloy trays directly from a furnace. See front cover and page 2.



Model QT 2436 shown with optional lid held in place by fusible link for fire protection.



## QT SPECIFICATIONS

Model Number	Working Dimensions			Inside Dimensions			Outside Dimensions			Gal	K.W.	H.P.	Ship Weight
	D	H	W	D	H	W	D	H	W				
QT 1224	24	12	12	30	24	28	44	44	31	65	4.5	½	400
QT 1824	24	18	18	30	30	34	44	50	37	100	7.9	½	450
QT 2424	24	24	24	30	36	40	44	64	44	150	10.5	¾	600
QT 2436	36	24	24	42	36	41	56	64	44	220	15.0	¾	750
QT 2448	48	24	24	54	36	40	72	64	44	280	18.0	1	1,000
QT 3648	48	36	36	54	48	56	72	72	61	475	30.0	2	1,600
QT 3672	72	36	36	78	48	60	96	72	67	730	50.0	3	2,600
QT 4848	48	48	48	54	60	72	72	84	79	810	50.0	3	2,600
QT 4872	72	48	48	78	60	72	96	84	79	1,170	64.0	5	3,300
QT 7272	72	72	72	78	84	96	96	108	105	2,340	140.0	10	5,100

Working dimensions have clearances approximately 3" extra in width and depth. Inside tank dimensions include the separate agitation/heating chamber. Outside dimensions include control panel and agitator motor but does not include the height of the raised lid. Tank is 6" deeper than fluid level to allow for work displacement. Special sizes are available. 240 or 460 volts are normal. 208, 380 and 575 volts are optional. 208 volts reduces KW to 75% of rated power. 3 phase is normal although single phase is available.

**YOUR THERMAL INVESTMENT DESERVES SPECIAL TREATMENT**



### DRQ SERIES

Tempering System For Aluminum Alloy



The DRQ Series features a high uniformity annealing furnace with semiautomated quench tanks and quench media cooler. The annealing process occurs when the parts are evenly heated to 1,100°F/530°C and held for a predetermined amount of time. Temperature uniformity is critical for this process, and both ambient and load temperature must maintain ±10°F throughout the cycle. The furnace is manufactured in accordance with the pyrometry specifications of ASM2750E. All thermocouple reference ports along with TUS survey ports and recording devices are included.

### QTS SERIES

Small, Portable Agitated Quench Tanks Tempering System For Aluminum Alloy



The QTS 124 quench tank is used for the uniform quenching of hot steels. The standard model, QTS124, may be used with either water or lightweight polymer, with rust inhibitor in the solution. An optional configuration, the QTO124, may be used with quenching oil. This includes the slide-on lid (which is an option for the other two configurations) and an explosion-proof motor. The QTW124 is used for plain water without rust inhibitors. It features stainless steel construction and a TEFC motor for the agitation. Neither configuration is designed for use with brine. All configurations feature proper agitation, which ensures uniform quenching and disperses the bubbles of vaporized quenchant that form on the surface of the hot parts being quenched. An optional slide-on lid provides a means to extinguish any potential quench oil fires and keep quench media clean. Casters are included to make the tank easily portable.

### XLFS SERIES

Precision Inert Atmosphere Furnace With Fast Heating & Cooling



The XLFS Series features efficient, light weight insulation, multiple element banks with separate SCR controllers and PLC based control system for any sensitive process requiring quick heating and cooling under inert atmosphere. Temperature uniformity is critical for these processes. With L&L's proprietary element support system, and our 'Dyna-Pro' Multizone Control System, furnace temperature is maintained at ±5°F or better throughout the cycle. A cooling draft inducer pulls fresh air around the outside of the case, allowing the furnace interior to be continuously purged with inert gas. Temperature ratings to 2200°F (1200°C).

### ELSP SERIES

Light Production and Laboratory Electric Box Furnaces



The ELSP Series is designed for light duty general heat treating of metals and ceramics. These furnaces feature multi-layer brick & backup insulation, heavy duty elements, and heavy hinges for the door. Available options are fan, inert atmosphere, cooling vent and various controllers. The maximum temperature is 2350°F (1290°C).

Model Number	W	H	D	Stand K.W.	Max Load
ELSP2424	22	22	22	15	300
ELSP2436	22	32	22	19	300
ELSP2448	22	44	22	24.2	300
ELSP2848	28	44	24	27	420
ELSP3048	28	44	28	31.5	530

Dimensions are working dimensions.

### PT SERIES

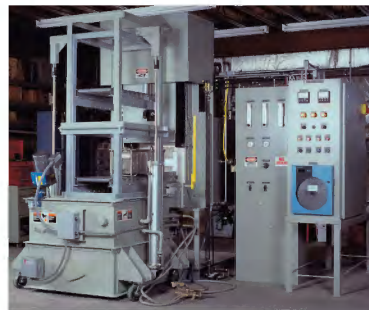
Top Loading Pit Furnaces



The PT Series are round furnaces typically installed in pits for processing of long parts that must be kept vertical. They often have powerful bottom mounted fans and recirculation baffles for high uniformity. They may be designed for annealing, neutral hardening, carburizing, carbonitriding or a variety of other applications. Electric or gas radiant tube fired. Sizes, temperature range and design are customized for the application.

### CB SERIES

Carburizing And Neutral Hardening Furnaces



The CB Series is designed for carburizing, carbonitriding and neutral hardening. These furnaces feature endothermic or nitrogen/methanol atmospheres, automatic carbon control, fan, and heavy gauge low voltage rod overbend elements or gas fired radiant tubes. The maximum temperature is 2000°F (1095°C).

Model Number	W	H	D	Stand K.W.	Max Load
CB5 124	12	12	24	12.5	150
CB 222	24	24	24	51	400
CB 223	24	24	36	63	600
CB 224	24	24	48	74	800
CB 324	36	24	48	89	1200
CB 326	36	24	72	115	1800

Dimensions are working dimensions.

### DCA SERIES

DUAL CHAMBER FURNACES FOR HEAT TREATING ALUMINUM



Electric dual chamber heat treat furnace, specifically designed for performing a wide variety of aerospace and precision aluminum heat treating applications. The system is designed to perform annealing, aging and solution aluminum heat-treating. The bottom chamber is a high temperature chamber designed to operate between 400°F and 1100°F, and is primarily designed for solution heat treating and annealing. The top chamber is designed to operate between 200°F and 500°F for aluminum aging. A roll away quench tank is located under the furnace which allows for quickly quenching loads in water.

### FNC SERIES

Inert Atmosphere Furnaces for Pyrolysis



FNC Series Furnaces are used in ceramic matrix composite and powdered metal processing in the pyrolysis of work pieces under an inert atmosphere such as nitrogen or argon. Various products are released during this process, such as CO, H<sub>2</sub>, CH<sub>2</sub>, etc, some of which are volatile. Tight uniformity is achieved using multiple banks of heating elements controlled with separate power controllers and a PLC-based control system. Proprietary SCADA systems are available and recommended for facilities with multiple pyrolysis chambers. Pictured is a large chamber unit with a gear-motor driven loader.



## A Wide Range of Options Customize the Furnace or Oven for your Specific Application

### HIGH UNIFORMITY OPTIONS

#### HIGH TEMPERATURE FANS

Fans are one good way to increase the gradient uniformity in the furnace. Fans will normally provide a gradient uniformity within the furnace chamber of +/-15°F (+/-8.3°C) or better with appropriate loading of the furnace. Recirculation muffles are used to direct air flow at lower temperatures. The maximum continuous temperature of the standard air cooled fan system is 1875°F (1025°C). Water cooled fans can be used to 2200°F (1200°C).

#### MULTI-ZONING

Multi-zone control, either with manual biasing of SCRs or with multiple PID loops, is another important tool that L&L has perfected over the years. We were a beta test sight for Honeywell's UMC800 multi-loop control and continue to take advantage of its successor's (the HC900) capability. We have put up to 30 zones in a box furnace.

### ATMOSPHERE OPTIONS

#### ATMOSPHERE SEALED CASE WITH FLOWMETER/REGULATOR

The furnace case is tightly sealed for use with a protective inert atmosphere. Argon, nitrogen and gases enriched with up to 4% combustible gas can be used. No safety systems are required for inert gas.

#### COMBUSTIBLE ATMOSPHERE OPTIONS

Some furnaces are available with hydrogen or carbon enriched neutral atmospheres. Automatic burn offs, gas mixing systems, automatic purging and safety systems are available. NFPA-86 Class C (National Fire Protection Agency) standards for special atmosphere furnaces are met or exceeded. See pages 16 & 30.

#### ALLOY MUFFLES AND RETORTS

Alloy muffles and retorts are designed for specific temperature and atmosphere conditions. Alloy retorts have a much better dew point than the more commonly used atmosphere sealed case. See pages 14-17 & 30.

### DOOR OPTIONS

#### COUNTERBALANCED VERTICAL DOORS

The furnace door rides in a guillotine type vertical track which pulls the door away from the furnace seal as soon as it begins to open vertically. The door is attached to the counterbalance by heavy roller chain. The most common lifting device is a pneumatic cylinder with hand or foot valve but hand cranks and electric operators are also used.

### HEARTHES & LOAD SYSTEMS

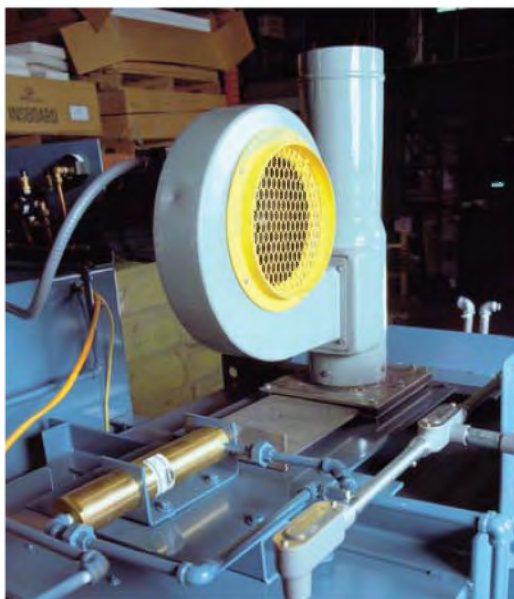
#### SILICON CARBIDE HEARTHES

These are standard on higher temperature furnaces like the GLF and GF. They are available as an option on XLE furnaces. The optional hearths often feature molded sides. The silicon carbide hearths are normally 1-1/2" thick and are typically fixed in place with cemented firebrick. Silicon carbide features high strength at high temperatures, a non-warping flat surface, and excellent heat transfer (which is especially important if there are elements under the hearth).

### VENTURI SYSTEMS

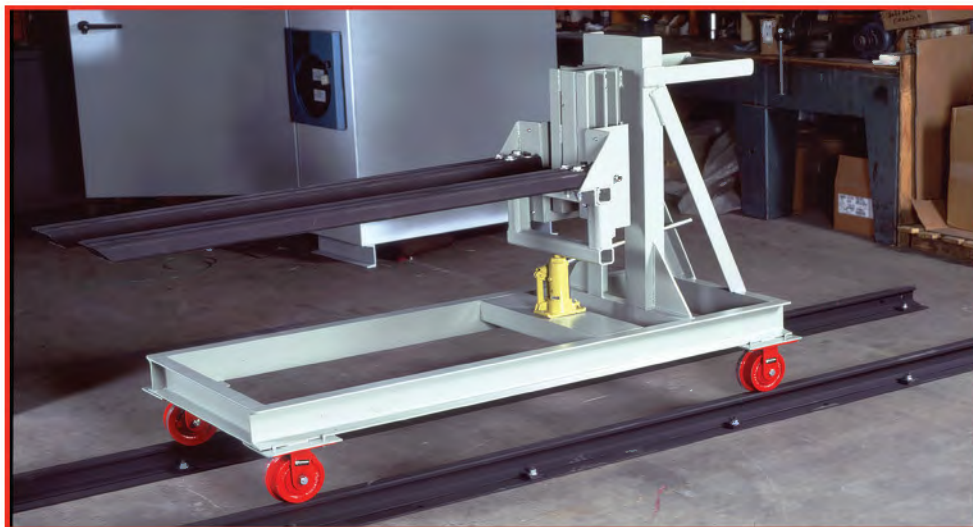
#### MOTOR DRIVEN VENTURI SYSTEM

A motor driven venturi vent system is available. This system sucks air out of the furnace and pulls in fresh air. Air inlets are located per customer requirements, typically on the bottom. This creates a draft while controlling the cold air going into the furnace to minimize heat shock. Capacity is 300, 600, 1250 CFM or greater, depending on need. Programmable systems with pneumatic dampers as shown below are typical.



#### FORKLIFT LOADER SYSTEMS

Forklift type loaders are designed to lift a large tray or loading basket into the furnace and set it down on piers. A self contained hydraulic cylinder and hand pump do the lifting. The loaders can work with swivel casters or on tracks with fixed wheels. These are available in a variety of capacities. Larger loaders can be motorized and include deadman controls (see page 9). Our smallest 500 pound loader is shown below with its included tracks.



### ALLOY HEARTHES

Furnaces that operate below 2200°F (1200°C) are available with fabricated alloy hearths. These have welded sides (normally 1" high) and reinforced bottoms. The alloy is dependent on temperature and weight.

### ROLLER HEARTHES AND TRAYS

Cast alloy hearths with matching roller rails are often used for loading of heavy loads. External roller assemblies, either fixed or movable on casters, are also available.

### SERPENTINE HEARTHES

Fabricated "serpentine" hearth trays can be designed for almost any size and load. They are made from a series of corrugated strips of alloy and heavy flatbars tied together with alloy rods. Serpentine hearths have good resistance to warpage because they can expand and contract with heating and cooling.

### CASTABLE PIERS

Castable piers for forklift loading are available. They are cast in sections that are easy to handle. They are fully cured for strength. Holes for lifting during maintenance are cast into the piers. See photos on page 13, 18 and 27.

### LOADING RACKS & BASKETS

Alloy loading racks can be quoted. These can have several shelves which are removable or can be positioned at different heights. Racks can be made to roll into furnace on roller rails for quick loading and unloading. Alloy loading baskets with mesh liners are also supplied.

### MISCELLANEOUS OPTIONS

#### OUTER CASE HEAT SHIELD

The furnace is provided with a series of sheet metal shields attached to the outside of the primary furnace case. These shields keep the case temperature below 120°F (50°C). Ventilated shields with eductor fans are available for air conditioned rooms.

#### PEEPOLES, VENTS & SURVEY PORTS

A variety of survey ports, vents, probe ports, peepholes and viewing windows are available.



## A SPECIAL COMPANY

**L&L SPECIAL FURNACE COMPANY IS THE LEADER IN HIGH UNIFORMITY BATCH FURNACES.**

### **L&L SPECIALIZES IN**

- **PRECISION FURNACES & OVENS**
- **HIGH UNIFORMITY**
- **BATCH SYSTEMS**
- **ATMOSPHERE CONTROL**
- **HEAT TREATING FURNACES**
- **GAS & ELECTRIC FURNACES**
- **CUSTOM DESIGN**



Since 1946 L&L Special Furnace Co., Inc. has designed special furnaces, ovens, kilns, quench tanks, and heat treating systems. All manufacturing and engineering is done in-house from one location just south of Philadelphia, PA. L&L sells and services its equipment all over the world, offering start up service as well as repair service. An extensive parts department offers quick response. Great care and attention is given to instructions, wiring diagrams, assembly drawings and support information. L&L is continually updating its product offerings and improving quality. A reputation for sophisticated engineering, quality workmanship and professional service has resulted in a large and growing base of satisfied customers, many of them larger and very particular customers. Above is our 18,000 square foot factory ten miles south of Philadelphia.

