

Glass & Heat-Treating Kilns Operating Manual



Building the Finest Kilns for Your Creative Spirit!

www.greatkilns.com

Division of Haugen Mfg.

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CORRECTIONS of ERRORS and OMISSIONS

We have made every effort to ensure the accuracy of the information provided in this manual; however, we reserve the right to correct any errors and/or omissions found in this manual.

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Glass Fusing & Heat-Treating Kilns Operating Manual

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Glass Fusing & Heat-Treating Kilns Operating Manual

ELECTRIC KILN OPERATOR'S MANUAL

Congratulations on your purchase of an Olympic Kiln! You have every reason to be proud and to feel you have the very best kiln. Your kiln, with the proper care, will provide you many years of dependable firings. Enjoy and Happy Firings!

Firing your ware is an art, not a science. You may need several tests and trials to perfect your firings. This book will give you suggestions on how to fire your kiln, but ultimately you will have your own unique firing method.

If you have any additional questions that are not covered in the manual, please contact your distributor or us either by phone (770) 967-4009, e-mail (info@greatkilns.com) and provide **the kiln model number and serial number.**

LOCATING YOUR KILN

1. Adequate space – at least 12 inches of space between the kiln and the wall. (However, for operator comfort, allow room to walk around the kiln if maintenance is required).
2. All flammable materials such as curtains, plastics, etc. in the area of the kiln should be removed.
3. Choose a dry, well-ventilated area with good access to allow easy loading and unloading, yet out of the way of children and other activities.
4. Position the kiln with the observation holes clearly visible and with the electronic controller within easy reach.
5. For kilns equipped with a power cord, place the kiln so that the cord can be plugged in without touching the metal jacket.
6. Because all kilns generate heat the stand or frame should be placed on a concrete or non-combustible floor.
7. If the kiln is to be placed outside make sure it doesn't get wet.
8. Remember to use sheet metal or non-flammable material to shim the legs when leveling the kiln.
9. Before your first firing vacuum the inside of the kiln to remove any dust caused by shipping.

How to determine Kiln Model and Serial Number (SN):

The serial tag is silver in color with black writing and is located on the back or side of the electrical box.

The majority of Olympic Kilns standard studio line of kilns are designated by the model's inside dimensions, width and depth. Letter abbreviations with the model number explain how kiln is equipped.

Studio Line Glass Kilns –

SQ189GFETLC – 18" x 18" wide x 9" deep

SQ – Square Design

GF – Glass fusing (has a lid element)

E – Equipped with an electronic controller

TLC – Top and clam shell loading

Olympic commercial kilns are abbreviated by their design and cubic foot firing space within the model.

Large Capacity Line –

Glass – GF12E

GF – glass fusing with 12 cubic feet of space in the chamber

E – Equipped with an electronic controller

Abbreviations –

Bell – Kiln chamber lifts up with an electronic device

DM – Dual media for firing glass and ceramics, 3" brick; fires to cone 10–2350°F and has a lid element for glass fusing

E – An electronic controller equips the kiln

FL – Front loading

GF – Glass fusing kiln with a lid element

GFTLC – Glass fusing kiln that has duplicate openings, top and clamshell

HB – Hot Box 120 volt small high fire models, fires to 2350°F

Slider – Clamshell opening model with sliding floor for easy access and loading

TLC – Top and clamshell loading capabilities

TopHat – Electric raku designed model for firing high fire ceramics, pottery and glass



HB84E



Hotbox with inside dimensions 8" x 8" wide x 4.5" deep, equipped with an electronic controller

GF214ETLC

20" x 20" wide x 13.5" deep glass fusing model equipped with an electronic controller. Model is designed to be both top and clamshell.



Electrical Requirements

ELECTRICAL HOOK-UP

To provide the performance it was designed to give, your new kiln must have the proper outlet and breaker to supply adequate voltage and amperage. An incorrect connection may cause disappointing or even hazardous results. A qualified electrician needs to be consulted to determine whether your wiring is adequate.

Electric kilns running on 120 volts will plug into a standard outlet if they have a NEMA 5-15 power cord, but require a NEMA 5-20 receptacle if the power cord is 5-20. Studio electric kilns will run on 240 or 208 volts, single phase. If your kiln was ordered three-phase power, it will be noted on the nameplate on the kiln.

Large capacity electric kilns may be wired for 208, 240, 380, or 480 volts; single or three phase.

Any kiln ordered three-phase will be direct wired.

RECEPTACLE, 2 POLE-3 WIRE GROUNDING NEMA CONFIGURATION



R = Receptacle Configuration P = Plug Configuration

Electrical Specifications for Olympic Electric Kilns – National Electrical Code requires breaker size to be 125% of load. Electrical specifications are recommendations only. Please consult with your local power company or electrician before installation.

Electrical Specifications for Olympic Glass Firing Electric Kilns

Volts	Amps	Watts	Breaker	Copper Wire Size	Plug Configuration
120	15	1,800	20	#12, #10 if circuit is longer than 40 ft.	NEMA 5-15
120	16	1,920	20	#12, #10 if circuit is longer than 40 ft.	NEMA 5-20

Volts	Amps	Watts	Breaker – 240/208 volt 1 Phase	Copper Wire Size	Plug Configuration
240/208	13/15	3,120	20	#12, #10 if circuit is longer than 40 ft.	NEMA 6-30
240/208	15/17	3,600	20/30	#12, #10 if circuit is longer than 40 ft.	NEMA 6-30
240/208	20/23	4,800	30	#10, #8 if circuit is longer than 40 ft.	NEMA 6-30
240/208	21/24	5,040	30	#10, #8 if circuit is longer than 40 ft.	NEMA 6-30
240/208	26/28-30	6,240	40	#8, #6 if circuit is longer than 40 ft.	NEMA 6-50
240/208	26.25/30	6,300	40	#8, #6 if circuit is longer than 40 ft.	NEMA 6-50
240/208	29/32	6,960	40	#8, #6 if circuit is longer than 40 ft.	NEMA 6-50
240/208	31/36	7,560	40/50	#8, #6 if circuit is longer than 40 ft.	NEMA 6-50
240/208	34/38	8,160	40/50	#8, #6 if circuit is longer than 40 ft.	NEMA 6-50
240/208	34-35/40	8,400	50	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	36/41	8,600	50	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	38/42	9,120	50/60	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	39/43	9,360	50/60	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	40/46	9,600	50/60	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	41/47	9,840	60	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	42/48	10,080	60	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50

Electrical Specifications for Olympic Glass Firing Electric Kilns

Volts	Amps	Watts	Breaker Required 240/208 volts	Copper Wire Size	Receptacle, 2 Pole-3 Wire NEMA Configuration 240/208
240/208	45/50	10,800	60/70	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50 – Direct Wired
240/208	47/48	11,280/ 9984	60	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	47-48/ 49-55.5	11,520	60/70	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50 – Direct Wired
240/208	54/62	13,080	70/80	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	55/56	13,200	70	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	55/63	13,200	70/80	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	56/63-65	13,440	70/80	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	64/72-73	15,360	80/100	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	65/75	15,600	80/100	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	67/71	16,080	90/100	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	70/80-81	16,800	90/100	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	78/88	18,720	100/120	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	80/92-93	19,200	100/120	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	85/98	20,400	100/130	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	90/104	21,600	120	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	100/115	24,000	150	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	125/144	30,000	200	#4, #2 if circuit is longer than 40 ft.	Direct Wired
240/208	140/162	33,600	200	#2, #1 if circuit is longer than 40 ft.	Direct Wired
240/208	150/173	36,000	200	#1, #1/0 if circuit is longer than 40 ft.	Direct Wired
240/208	160/184	38,400	200	#1, #1/0 if circuit is longer than 40 ft.	Direct Wired
240/208	175/202	42,000	200/250	#1/0, #2/0 if circuit is longer than 40 ft.	Direct Wired

ASSEMBLY & PREPARATION OF YOUR KILN

Glass kilns are ready to fire upon arrival. After the kiln is unpacked or removed from the pallet, place the stand where the kiln is to be located and then place the kiln on the stand.



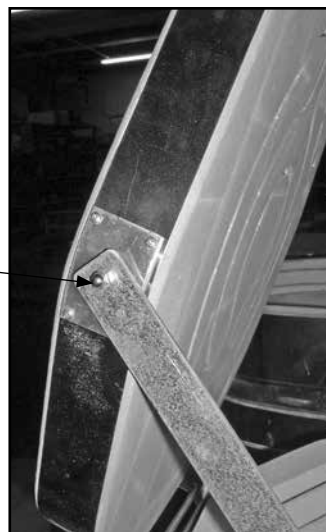
Lid brace arm

If the lid brace of your kiln was disconnected for shipping it should be reconnected. Slide arm through brace pads and secure with nut. When opening the lid, insure the lid brace is locked, by hooking it to the body brace pad. Do not release kiln lid until the brace is locked.



Body brace pad

Nut to secure lid brace arm



Your new kiln is constructed of insulating firebrick which is hand selected for the highest quality. This light weight brick is an efficient insulator, which forms the firing chamber. In Olympic's standard line of electric kilns the bricks are held together by compression of the stainless steel jacket. The wall bricks are not cemented together to facilitate maintenance of your kiln if necessary.

Top and Bottom Slabs

The top of every standard kiln is coated with a thin high temperature coating. This makes the lid more durable and prevents dusting of the brick particles on the pieces in the firing chamber.

The brick for the standard and commercial line of electric kilns is fragile and should always be handled with care. After a few firings, you may notice hairline cracks in the brick. These are simply expansion cracks and do not harm the functioning of the kiln.

How to Take Apart the GF2, 3, 5ETLC Series and Reassemble

Step 1

Remove gas strut with kiln chamber opened.

IMPORTANT: The kiln chamber must be opened when gas strut is removed.



Step 2

Remove bolts on back of kiln with kiln chamber closed.

Kiln lid and chamber can be lifted and turned on its side to move through opening.

The kiln floor will remain on the frame.



Step 3

Attach kiln chamber and lid to kiln frame and floor.
Insert bolts and secure.



Step 4

Open kiln firing chamber and attach gas strut.

IMPORTANT: The kiln chamber must be opened when gas strut is attached.



Counter Weight Lid System – Lid Lift Assist



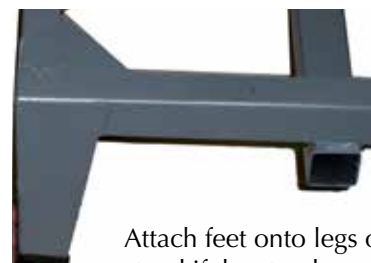
Double Bar



Single Bar

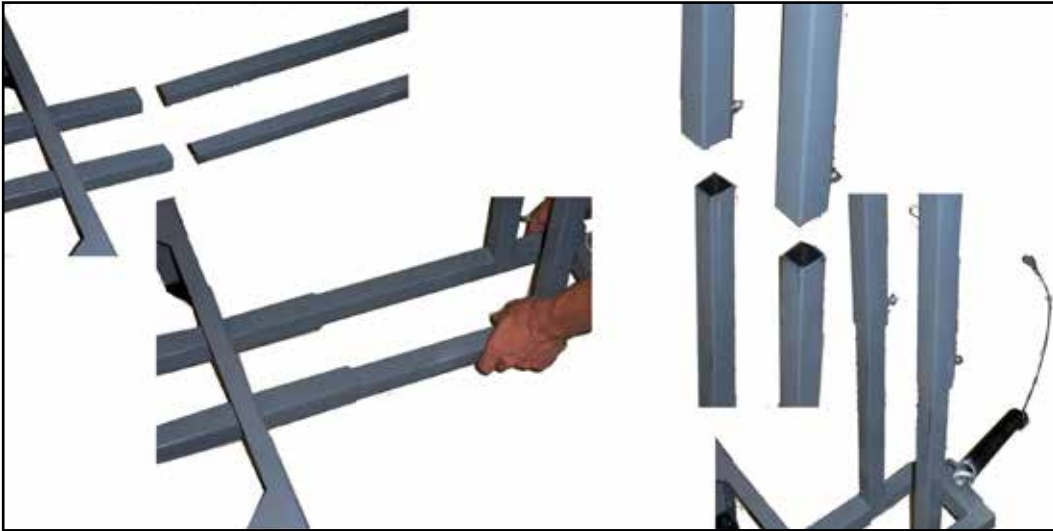
The lid lift assist comes complete with frame pieces for easy, simple installation or removal if there is a need to move the kiln from one location to another. There are two types, 1) double bar for ovals and square GF 2, 3, 5 series kilns; and 2) single bar for all other models. Glass fusing lid lift assist frames are designed with a tall 18" stand. **For kilns ordered with a vent, the vent cup will need to be placed before setting the kiln on top of the frame.**

Double Bar Lid Lift Assist



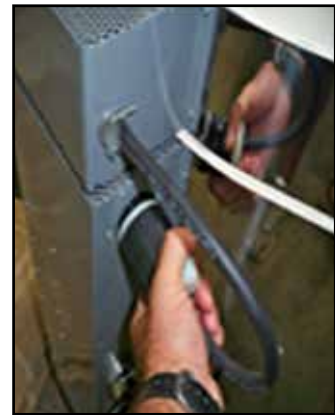
Attach feet onto legs of stand if the stand came with feet.

Double Bar Lid Lift Assist



Insert horizontal back support frame to frame pieces on stand.

Insert vertical back support frame until pieces lock in place.



Position kiln floor and rings on stand with hose clamps on the stainless steel jacket facing the back supports. If your kiln is stackable, plug in twist 'n lock interbox plus and receptacles.



Position armlifter holes to match back of vertical back support holes and holes of lid. Insert stiffening strut through holes and lock in place with cotter pin.

Double Bar Lid Lift Assist



Tighten bolts on back of frame of lid opener. Lift kiln lid straight up and attach ring lock to arm lifter. Slowly lower lid to closed position.

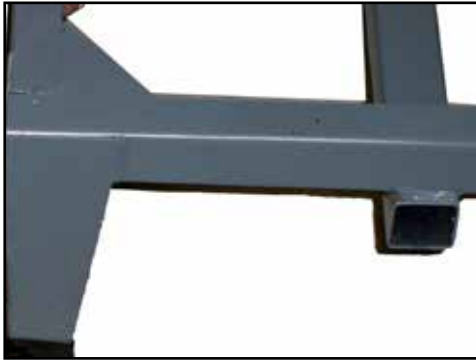


When lid lifter is attached in back, insert bolt into front of bar and screw nut to hold.



Attach lid brace with nut and bolt. Screw locks in place if the kiln is stackable.

Single Bar Lid Lift Assist



Attach feet onto legs of stand if the stand came with feet.



Insert horizontal and vertical back supports to frame until pieces lock in place.

Position kiln floor and rings on stand with hose clamps on the stainless steel jacket facing the back supports.



For stackable or sectional kilns, plug in twist 'n lock interbox plugs and receptacles.

Single Bar Lid Lift Assist



Position armlifter holes to match back of vertical back support holes and holes of lid hinge. Insert stiffening strut through holes and lock in place with cotter pin.



Tighten bolts on back of frame of lid opener.



Lift kiln lid straight up and attach ring lock to armlifter. Slowly lower lid to closed position.



When lid lifter is attached in back, insert bolt into front of bar and screw nut to hold.

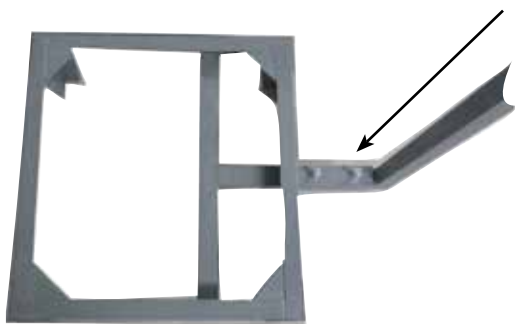


Attach lid brace with nut and bolt. Screw ring locks in place if kiln is stackable.



CRUCIBLE 18 INSTALLATION INSTRUCTIONS

Kiln Setup



1. Upright pulley support must be inserted into receiver at the back of stand and secured with set bolt.

2. Use the handles on each side of the kiln to lift off pallet & place on stand.

3. Run cable over pulley. Add or remove sand to balance lid cover counterweight.



Element Operation



- Four (4) sets of elements can be used for rapid heat up. Two (2) sets are required to maintain temperature, two (2) sets in reserve to prevent unwanted cooling if an element is lost while firing.
- For rapid heating or melting glass, more than two element sets may be used.
- Banks of elements are labeled on the electrical box – 1-3, 2-4, 5-7, and 6-8.

OTHER COMPONENTS

Elements

Your kiln is equipped with iron-chrome Kanthal A-1 type elements, suitable for high fire use. The elements are pinned in place to prevent contraction and intrusion into the firing chamber.

Kiln elements will become brittle after a few firings, so care should be taken if handling is necessary. When your kiln is first turned on, it is normal for the elements to hum for a short time and the clicking sounds you hear are from the relays turning the elements on/off as they go through the firing cycle.

An element is designed to have a very long life and is capable of many firings. The lifespan can be shortened considerably by contact with materials such as bits of bisque, glaze, glass, cones, metal, or kiln wash. Keep your elements clean by vacuuming the inside of your kiln regularly.

Observation Holes/Plugs

The observation holes of the kiln allow viewing of the firing chamber and pyrometric witness cones used in pottery and ceramics. They also provide an escape for water vapor and gases. The tapered shape and mortar coating of the “peep hole” insure a good fit for an observation hole plug, and eliminate abrasion of the brick by the observation hole plug.

Using dark glasses or a number five welders lens when looking through an observation hole can reduce excessive glare from a hot firing chamber. Observation hole plugs are hollow ceramic and should be treated with care.



Observation Hole Plugs

Pilot Light

Electric kilns have a pilot indicator light, which illuminates when the kiln is activated.



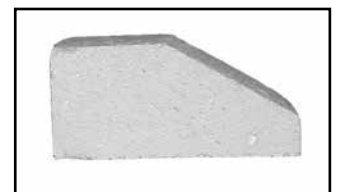
Pilot Light



Lid Prop

Many of the Olympic models come with a brick wedge to prop the kiln lid during the early stages of firing. The wedge is of soft brick and will not abrade the refractory coating of the lid. **DO NOT USE OTHER ITEMS SUCH AS KILN FURNITURE (SHELVES AND POSTS) AS A PROP SINCE THIS WILL DETERIORATE THE LID AND THE KILN BRICK.**

BRICK WEDGES ARE NOT TO BE USED ON OVAL LIDS AND ARE NOT INCLUDED IN KILN ACCESSORY BAGS FOR COMMERCIAL, OVAL, HB64, HOTBOX, HB86, OR FRONT LOADING MODELS.



Lid Wedge

Kiln Stand

Your kiln must be fired only on the metal stand provided. The space beneath the kiln is necessary for air circulation, and prevention of heat build up. **ALWAYS** make sure the stand or frame is level to avoid problems such as glaze flow, kiln sitter activation.

Power Cord

If your kiln is equipped with a power cord, **do not add extension cords** to the kiln's power cord plug. Doing so will void the warranty of the product. The power cord on a kiln is heavily insulated and designed to meet UL requirements. A standard extension cord will not be able to handle the power and may cause a fire hazard.

KILN OPERATION

LID ELEMENT CONTROL

120 Volt Toggle Switches

120-volt glass kilns have two toggle switches if equipped with an electronic controller. The bottom toggle switch turns the kiln on or off. The top toggle switch runs either the lid or body element. Because the combined amperage of both elements is too high to run on 120 volt, only one element may be operated at a time. The lid element is operational when the toggle switch is in the **UP** position and we recommend using it during the fusing segment. The body element is operational when the toggle switch is in the **DOWN** position. **If the toggle switch is in the neutral position, the kiln will not heat.**



120 volt glass kilns – top toggle switch for element operation – must be in the Up or Down position for element to heat



240-208 volt glass kilns – infinite switch for lid element operation

240-208 Volt Infinite Switch

Glass and heat-treating kilns running 240-208 volts have an infinite switch which controls the intensity of heat generated by the lid element. If the infinite switch is in the **OFF** mode, heat will only come from the wall elements. The lid element can be run in conjunction with the body elements – turn the infinite switch knob to the desired intensity for the kiln to heat from the top and sides.

Zone Control

Kilns equipped with electronic controllers have the option of zone control. The standard built electronic control kiln has one zone, one thermocouple senses the kiln's temperature and sends the information back to the controller.

When a kiln is 2-zone or 3-zone, two or three thermocouples are placed in each section of the kiln to regulate temperature.

- A 2-zone control has two thermocouples for the top and bottom section of the kiln.
- A 3-zone kiln has three thermocouples, one in the top, middle and bottom section of the kiln.

Each thermocouple senses the temperature in the particular section it sets and can be read through the controller display by pressing the Options key. To select an individual zone, press 1, 2 or 3 and the temperature of the selected zone will be displayed. Pressing 8 will illuminate indicator lights in the display showing which zone is on.

KILN OPERATION

CHANGING MAXIMUM TEMPERATURE – 240-208 VOLT KILNS

The RTC-1000 controller can be programmed for other end temperatures as follows:

1. Turn on controller – from ErrP press ENTER for IDLE
2. From IDLE press ENTER for ----
3. Enter 298 on the keypad – the programmed end temperature will appear on the display
4. Press 1 for 1700°F
2 for 2000°F
3 for 2400°F
4 for 2401°F
and then press ENTER

If your kiln is equipped with a quartz viewing window, be sure to insulate the quartz from inside with ceramic fiber when firing above 1700°F.

ELECTRONIC CONTROLLER WALL UNITS

Kilns wired for kiln sitters are wired differently from those wired for electronic controllers. An electronic wall unit may be added to a kiln sitter equipped kiln so they may run by controller; however because of the differences in wiring, the controller is placed on the wall and the thermocouple from the wall unit is placed inside the kiln. Wall units are available for 120 volt, 20-30-50-100- amp, and three-phase wired kilns with the choice of the 3 Key-Cone Fire, V6-CF, RTC-1000 or Genesis as the controller. The controller on the wall unit operates the same as if it was attached to the electrical box on a kiln.



To install the wall unit follow the steps below.

1. Attach wall mount control vertically to wall.
2. Plug or direct wire Wall Unit to the power source
3. Plug or direct wire the kiln into the wall unit
4. Drill a hole the size of the wall unit's thermocouple through the kiln wall and insert thermocouple from wall unit into the kiln. Insert thermocouple approximately 1" inside the kiln.
5. Place a junior cone that is one size hotter than you intend to fire into the kiln sitter and activate the kiln sitter.
6. Turn all switches on the kiln to the high setting.
7. Read electronic controller instructions thoroughly and follow programming instructions that best suit your firing requirements.



DUAL MEDIA KILNS

Dual Media kilns are designed to fire ceramics and glass

240-208 volt Dual Media kilns have a lid element for glass fusing. The kiln operator manually activates the lid element with the rotary switch. **The switch is turned to the desired intensity (0 - HI) when the lid element is in use.**



Infinite Switch for Lid Element Activation



KILN OPERATION

ELECTRO SITTER – Available with 3 Key-Cone Fire, V6-CF, RTC-1000 or Genesis Controller



Electro Sitter will replace your obsolete kiln sitter equipped model! It's easy, and best of all, parts are available! The Electro Sitter box is complete with thermocouple attached, and it has the option to fire either cone-fire or ramp/hold programs. The box will fit where the kiln sitter/timer are attached to the kiln. Simply remove the screws from the kiln sitter on front of the kiln, then detach wires connecting to the kiln sitter. Wires will be attached to the back of the Electro Sitter exactly as they were attached to the kiln sitter terminal block.



Kiln with kiln sitter



Detach screws from kiln sitter plate



Remove wires from back of kiln sitter terminal block



Electrical box without kiln sitter



Install Electro Sitter in the same location as the former kiln sitter plate.



Connect wires to back of Electro Sitter just like the connections to the back of the kiln sitter.



Insert thermocouple through kiln sitter hole



Thermocouple will show through brick wall at a maximum of 1". Pack kiln sitter hole with ceramic fiber to seal it.



Install electrical box back on kiln with Electro Sitter installed.

KILN OPERATION

Electronic Controller Operating Overview

Olympic electric kilns are equipped with the Bartlett Instruments 3-Key-Cone-Fire, V6-CF, RTC-1000, or Genesis electronic controller. Please read the manual provided with your kiln for detailed operating instructions for the controller equipping your kiln.

Cone-Fire Firing

Cone-Fire mode is based on pyrometric cones. Although the controller fires the kilns electronically, every ceramic firing should include shelf or witness cones. They measure heat work accurately and give a history of the firing. If you fire the same sized load and type of ware regularly, the shelf cones let you compare one firing to the next and alert you when something is wrong. For example, if the shelf cone bends farther and farther with each consecutive firing, this may indicate thermocouple temperature drift.

Vary Fire – Ramp/Hold Firing

Vary Fire mode on the V6-CF controller or Ramp/Hold on the RTC-1000 controller are designed for heat-treating, glass fusing and enameling firings. Use Vary Fire or Ramp-Hold to fire ceramic pieces that require a custom firing schedule, such as some types of stoneware sculpture or crystalline glaze and all glass firing.



Visit YouTube for video instruction on all of the Bartlett controllers.
<https://www.youtube.com/watch?v=ByB9darhG7w&list=PLEVfwLwmcpYHxyzaqWuj4cb5nr1uDYVg>



V6-CF



RTC-1000



3 Key-Cone Fire



Genesis

Genesis Controller – Refer to Genesis Operating Manual and Bartlett Instruments web site for regular updates for the controller – www.bartinst.com and YouTube.



<https://www.youtube.com/watch?v=j-yqKH5Cpaw>

BARTLETT RTC-1000 CONTROLLER

This controller is used primarily with glass, heat-treating, jewelry and enameling kilns. There are six User programs with eight segments per program. Segment programming is determined by the rate of rise or decline in temperature required per segment with a target point temperature and hold.



The RTC-1000 controller allows the kiln operator to add time or skip a segment during a firing. If you find during a segment that you need to increase your hold time, press ADD TIME (2) and you will be able to increase the HOLD time in that segment. If you find you need to skip a segment in one of the USER programs, when the segment comes up during the firing, press 9 and SStP will appear. Press ENTER and the segment will be skipped during the firing.



Press ENTER if the controller displays ERRP for power failure. The display should then read IDLE and you are ready to begin entering your program.

Press ENTER again and ---- will be displayed. From ---- press Ramp/Hold (4) and USER 1 will appear. There are six programs in the controller identified as USER 1-6 with eight segments per program.

The controller will request how many segments you will need or will already have a number flashing. A segment is a rate of rise in temperature per hour, which reaches a target point temperature and a hold time. Depending on the number of segments you need, press that number and then press ENTER.



The controller will then ask what the rate in rise or decline (change in temperature) is required for the segment. The controller will display rA 1 for segment 1, rA 2 for segment 2 and so forth. Enter the amount of degrees (example 300° F) you want the kiln temperature to rise per hour and then press ENTER. You can also decrease temperature by following the same steps and entering a lower end temperature at the completion of the segment.



For each segment, °F1 or °C1 (°F2 or °C2, etc.) will display. The controller is asking for the end temperature you want the kiln to reach in the designated segment (example 1250°F) and enter the target temperature and press ENTER. The controller will ask if you need to Hold for a certain amount of time during the current segment. Enter the minutes or hours you need and press ENTER.



BARTLETT RTC-1000 CONTROLLER

When you have entered all your segments the controller will display ALAR for alarm. If you do not require an alarm, press 9999 so that the alarm will not go off and press ENTER. If you require an alarm, enter the temperature you want the alarm to sound.



The controller will display CPL for complete, press ENTER if you are ready to fire and then press START for the kiln to begin firing.

The USER programs stay in the controller's memory until new information is entered.

DELAY allows you to delay firing until you are ready. After you have entered your program and the START key, press DELAY, press ENTER, and the number of hours later you want the kiln to begin firing. Enter number of hours and press ENTER.



The controller will ask what end temperature you want the kiln to reach in the designated segment (example 1250°F), enter the temperature and press ENTER. The controller will request a hold time, choose the hours or minutes needed and press ENTER.

When all the segments have been entered for a program the controller display will show ALAR for Alarm. If an alarm is required, enter the number of hours in which you want the alarm to sound. If you do not need an alarm, enter 9999.

The controller will display CPL for complete, press ENTER if you are ready to fire and press START for the kiln to begin firing.

The User programs remain in the controller's memory until new information is entered.

DELAY allows firing to begin at a later time. After a program has been entered and the START has been pressed, press DELAY, press ENTER and the number of hours of delay before the kiln begins firing. Press ENTER.

The RTC-1000 controller has the capability to add time or skip a segment during a firing. If you find during a segment that you need to increase the holding time, press ADD TIME (2) and you will be able to increase the hold time in the segment. If a segment needs to be skipped, press 9 when the segment comes up and SStP will appear. Press ENTER and the segment will be skipped during the firing.

RTC-1000 Cone Fire Programming

Apply power to the kiln and the display will flash WAIT/IDLE. Press ENTER and ---- will appear. Press 1 and Cone will flash. Enter the cone number you wish to fire and press ENTER. SPd for speed will appear press 1 (fast), 2 (medium) or 3 (slow) and press ENTER. HOLD will display on the controller. If a hold time is desired enter the minutes or hours and press ENTER. Press ENTER Idle and flashing temperature will display. Press ENTER again and 4 lines ---- will display, Press ENTER and the display will read ON. The kiln will begin firing the cone fire program.

ERROR CODES

for V6-CF, RTC-1000 & GENESIS

Electronic Controllers

A good general method of trouble shooting is to cut the problem in half and determine which half is causing the problem. Then continue cutting the problem in half until you can diagnose the problem. For example, when a controller display shows fail, the problem can be due to the thermocouple (T/C) or the controller. If we disconnect the T/C and short the controller's T/C input connections together and the problem goes away, we know the problem was the T/C and not the controller.

Another second practical approach is to determine what has changed or what is different. Was anything done differently with the problem firing from previously good firings? For example, has the load increased significantly, is there a new program, have the elements been changed, is there a new thermocouple? Is the program similar to another program that is working properly? Try to determine what differences there are between the two programs.

ERROR CODES for V6-CF, RTC-1000 & GENESIS Controller

Error Condition – Err0

Err0 indicates a software failure caused by hardware or electrical noise. Probable causes are an electrical spike or surge, or arcing across the relay contacts. To correct this error, try resetting the system by disconnecting power for 10 seconds, then reconnecting the power. The controller will display 'ErrP'. Check that your current firing program wasn't cleared from memory by pressing "Review program". If your program reviews correctly, you can restart the kiln. If the error persists, the controller must be serviced or replaced.

Error Condition – Err1

Err1 indicates temperature is rising slowly (less than 12 deg/hr over a 22.5 min period) during a ramping phase.

Causes include:

- Worn or old heating elements
- Low voltage to the kiln
- A broken heating element
- Faulty relay
- Burned or broken wires to the elements or relays
- Electrical noise
- Faulty thermocouple (T/C)

If the kiln reached a temperature greater than 1300°F before getting the Err1 messages, then the most likely cause of the error is worn elements or low kiln voltage. Run a "paper test" to determine which bank of elements is not working. Place pieces of paper in each element trough. Turn the kiln on. Elements are working where the pieces of paper burn.

You can also run a "full power test" and if all the elements heat, check the resistance of the elements according to the kiln manufacturer's guidelines. Also, check the voltage to the kiln to ensure it matches the voltage listed on the kiln's specification plate.

Look for broken wires or broken elements. If the elements have the correct resistance, then a relay is most likely faulty.

ERROR CODES for V6-CF, RTC-1000 & GENESIS Electronic Controllers

A chattering relay can cause excessive noise as well. Boards damaged by electrostatic discharge (ESD or static charges) are more susceptible for electrical noise and a new board may correct the situation.

If the actual temperature appears to be hotter than the indicated temperature when Err1 occurred, the problem is generally related to a faulty or old T/C.

Error Condition – Err2

During a hold segment the temperature is more than 50°F above the hold temperature which was set. The temperature must stay 50°F above this set temperature for 18 seconds before the error is displayed.

The most probable cause of this is either a relay stuck on or a stuck output on the controller. First, stop the kiln. If all the relays remain on, then it is probably a controller problem. If only one section (or relay) remains on, then it is a stuck relay.

Error Condition – Err3

During a hold segment the temperature is more than 50°F below the hold temperature which was set. the temperature must stay 50°F below this set point for 18 seconds before the error is displayed.

Opening the door or lid of the kiln can cause this. However, Err3 is generally caused by a burned-out element or a defective relay. Run the “full power test” to isolate the problem section. If sections are not heating then the controller outputs may be bad. If only one section is not heating, follow the kiln manufacturer’s procedure to test the element. If the elements are all good, then the problem is most likely a defective relay.

Error Condition – Err4

The firing is in a ramp segment where the temperature is programmed to decrease and the temperature is more than 50°F above the previous hold temperature. The temperature must remain 50°F above the hold temperature for 18 seconds before the error is displayed. Err4 is the same as Err2 except that Err4 occurs during a ramp phase rather than a HOLD.

The most probable causes of Err4 are either a stuck relay or stuck output on the controller. If all the relays remain on while Err4 is displayed, then probably the controller output is stuck on. If only one section (or relay) remains turned on then the problem is a stuck relay.

It is also possible to get an Err4 message if you use the skip step feature. If you get Err4 after skipping to the next ramp phase, press a key to clear the error, allow the kiln to cool to within 50°F of the next hold temperature, restart the kiln and skip steps until you get to the segment you want.

Error Condition – Err5

The temperature is more than 50°F below the local set point during a ramp segment where the temperature is programmed to decrease. The temperature must stay 50°F below this set point for 18 seconds before the error is displayed.

This can be caused by opening the door or lid. However, it is generally caused by bad element or relays. Run the “full power test” to isolate the problem section. If no sections are heating then the controller outputs may be bad. If only one section is bad, follow the kiln manufacturer’s procedure to test the non-heating element. If the element tests good, the relay is most likely the cause of the problem.

ERROR CODES for V6-CF, RTC-1000 & GENESIS Electronic Controllers

Error Condition – E22 or E26

A negative temperature is displayed. This can be caused by using the kiln in temperatures below 0°F (or 0°C). If this is the case, warm the T/C manually before starting the kiln.

Other reasons for Err6 are the T/C connected backwards (red and yellow leads reversed), the board has been damaged by static electricity or ESD (electrostatic discharge), or electrical noise. If the T/C was not just changed and previous firings have been OK, then the problem is either a defective circuit board or electrical noise. Do the “T/C by-pass test”. If the temperature reading is negative, the board has been damaged and needs service. If room temperature is displayed with the T/C screws shorted together then the thermocouple (T/C) is the problem.

Error Condition – Err7 Error 7 is not implemented at this time.

Error Condition – Err8

When using the Cone Fire Method, the temperature is decreasing during the last ramp segment, usually indicating the kiln sitter has turned the kiln off.

Error 9 – E9

Software does not match the hardware.

Error Condition – ErrE

A hardware error has been detected by the controller’s software. The controller must be returned for service.

Error Condition – ErrA

ErrA indicates that the controller failed the self-check of the non-volatile memory chip where all the programs are stored. You need to reprogram all 6 user programs. Turn the controller off then back on. If you do not get the error again, continue as normal. However, if you continue to get ErrA then the board needs to be serviced.

Error Condition – ErrH

ErrH indicates that the Analog to Digital Converter did not pass the self-check diagnostic test on reset. If you get this error, then the board will need to be serviced.

Error Condition – EBD

EBD indicates that the controller is reading a board temperature above 250°. This means the actual temperature is above 250° or the board needs to be serviced. Check the board to see if there is enough air circulation to keep it cool. Check to see if there is enough insulation around the thermocouple inside the kiln chamber.

Error Condition – Errt

An Errt indicates that a write cycle to the non-volatile memory chip took too long. The board will need to be serviced.

Error Condition – ERRP or P-F

A continuous ERRP or PF in the display indicates a long-term power outage. The kiln has been shut down. Press “1” to clear the display.

ERROR CODES for V6-CF, RTC-1000 & GENESIS Electronic Controllers

If ERRP and the current temperature are alternately flashing, this indicates a short-term power outage. To clear the display, press the “1” key. If a firing was in progress, it will continue.

If you are getting an ERRP message during a firing without having a power loss, this indicates the controller is being reset by radio frequency (RF) noise. This electrical noise can be generated by the relay. When a relay drives an inductive load (i.e., mercury displacement contactor) it generates electrical noise; to suppress this noise, varistors (MOVs or Metal Oxide Varistors) must be placed across the contacts of the relay. Locating the controller circuit board away from the relay, contactor, and high voltage wiring will also reduce the effects of the electrical (RF) noise.

Error Condition – StUC

If ‘StUC’ appears on the display, one of the keys is stuck. The controller needs to be returned for service.

Error Condition – FAiL

Fail indicates that the controller is not getting a thermocouple (T/C) input; therefore, it cannot determine the temperature. The first thing you will need to do is disconnect the thermocouple (or thermocouples if you have more than one) and perform the “T/C By-pass test”. If the controller displays room temperature with the T/C bypassed then you will need to replace the thermocouple.

If you are getting Fail during a firing and the “T/C By-pass test” is successful, but a new thermocouple does not fix the problem, then you will need to watch the temperatures during a firing to see if they are erratic. You could be having interference due to electrical noise.

Other Controller Related Firing Symptoms:

Stuck display

No display

Overfire

Underfire

Does not heat when start is pressed

Temperature does not cool

Jumpy display

To troubleshoot zone control kilns, first set the display to read Idle, tc 1, and temperature. Apply heat to the top T/C. If the temperature increases then T/C 1 is connected correctly to the top section of the kiln. If the temperature does not rise, apply heat to the other two T/Cs to see which is connected to T/C 1. Check all of the thermocouples and move them to the correct positions if needed.

If a thermocouple is in the correct location but it does not register a temperature increase then the T/C is faulty or its lead wires are shorted together.

If all of the T/Cs are in the correct positions and register temperature increases, proceed to testing the outputs.

ERROR CODES for V6-CF, RTC-1000 & GENESIS Electronic Controllers

To test the outputs on controllers without the diagnostics routine in software, you will first have to disconnect power from the kiln. Remove the controller and run the “full power test”. Only the top section should heat up. If another section is heating up instead, then remove the wire from Output 1 and put it on the output that corresponds to the section that is heating.

Repeat this procedure for Outputs 2 and 3 as well. If the problem persists, look for electrical noise sources or defective T/Cs.

To test the outputs on the controller using the diagnostics routine in software, press the “OTHER” button until ‘rSEt’ is displayed. Press “4”, “4”, “3” and “notC” will be displayed. Press the “OTHER” key until ‘diAG’ is displayed. Press “ENTER”. ‘OUt1’ will be displayed and Output 1 will come on; the top section of the kiln should start to heat. If the display and section heating do not match then remove the wire from Output 1 and place it on the correct output for the section that is actually heating. After about 1 minute, ‘OUt2’ will be displayed and the middle section of the kiln should heat. Similarly, Output 3 will come on after another minute and the bottom section of the kiln should heat. Make sure that the correct kiln section is heating compared to the output that is displayed.

Error Condition – Err–

The Err with a dash indicates there was a power loss to the controller while writing a program to the non-volatile memory chip. Check the selected program, and reprogram if necessary. If you get this error on a regular basis, the board may need to be serviced.

Error Condition – Errd

This error is triggered when the temperature is more than 100°F above the traveling set point. On a single or zone board this can be caused by a stuck relay or electrical noise. On zone control kilns, Errd is generally caused by crossed wiring of the T/Cs or the outputs.

BARTLETT 3 KEY-CONE FIRE CONTROLLER

The 3 Key-Cone Fire controller provides ramp/hold and cone-fire programming.

- When power is applied, the display will flash rC-A, Idle, the room temperature; example 77 for 77°F.
- The rC indicates the controller is programmed for ramp/hold and cone-fire.
- The letter (A) indicates the software version.
- If ErrP (means a loss in power) is displayed, press any key to clear this message.
- If StOP or IdLE is alternating with the current temperature, you are ready to begin programming.



BARTLETT 3-KEY CONTROLLER

Turn the kiln on. If the message ErrP is displayed, hit any key and Enter to remove. If StOP is displayed, you can begin entering your program.

Press the START STOP ENTER button.

dELa will be displayed asking if you want to delay firing of the program. If the answer is yes and you want the kiln to begin firing 5 hours and 30 minutes after you key in the program, press the up or down arrow until 530 is displayed and press START STOP ENTER. If you want the kiln to begin firing immediately, make sure four zeros are displayed and press the START STOP ENTER button.



SEG is the next message asking how many segments you desire to have throughout the firing. A segment is raising or decreasing of the temperature to a certain temperature in a period of time. Example: You have a piece that needs three segments:

- 1st segment raise temperature 150 degrees per hour to reach 900 degrees
- 2nd segment raise temperature 200 degrees per hour to reach 1800 degrees
- 3rd segment decrease temperature 150 degrees per hour to reach 1000 degrees

For a three segment program, use the up and down keys to reach the number 3 and press the START STOP ENTER button. rA1 is then being displayed (rate in rise/decline of temperature) to determine what the increase or decrease in temperature is. Use the up/down keys to enter the desired temperature and then press the START STOP ENTER button. F2 will display and you will use the up/down keys to select the end temperature of the segment and press the START STOP ENTER button.





HLd is displayed requesting how long you want the end temperature of the segment to hold. If minutes, scroll up or down to the desired time. The number should display after the decimal point. If hours, scroll up or down to reach the time. The numbers should display before the decimal point.

rEdl is displayed after all the segments in a firing have been entered. Press the START STOP ENTER button to begin the firing. Once the kiln has fired, the display CPLt will show the kiln has completed the firing process. After the kiln has cooled down, your ware can be unloaded.



Cone Fire Programming

STEP DESCRIPTION

1. Start with the display reading IdLE, Press "enter".
2. **Select cone fire.** If "C-Fr" (cone-fire) is displayed, press "enter", if "r-Hd" (ramp/hold) is displayed, press an arrow key $\uparrow\downarrow$ to display "C-Fr" and then press "enter".
3. **dELA will display for Delay Start – Set delay start** The beginning of the firing can be delayed from the time you press "start". This allows the firing to start later and end when you can supervise the end. Use the arrow keys to adjust the amount of delay and press enter. If you do not wish to delay the firing, enter all 0000 and press enter.
4. **PrH will display for preheat.** Enter the preheat time. The first segment of a cone fire program ramps to 200 F. The preheat time is the length of time you will hold at 200 F. Thin, dry clay may not need any preheat time and thick hand-built items may require several hours of preheat. Use the arrow key to adjust the preheat time and then press "enter" to store the value. REMEMBER the time is displayed in the form HH.mm. H= hours, m=minutes, so anything after the decimal point represents minutes and in front of the decimal point represents hours. If you do not need to preheat your items, scroll to 0000 and press enter.
5. **Enter Cone #.** Use the arrow keys to display the desired cone number. The up arrow moves toward a hotter cone number. Press "enter" to store the displayed cone number.
6. **Slo, nnEd, FAS will be displayed for Slow, Medium and Fast. Select heating rate.** Use arrow keys to display Slow, Medium or Fast.
7. **HLd is displayed for Hold Time. Enter hold time.** A hold at the top temperature adds heat work and can help produce a more even firing from top to bottom. Typical hold times are in the 10-15 minute range (00.15). Use the arrow keys to display the desired hold time and then press "enter" to store the value. If you do not need hold time scroll to 0000 and press enter.
8. **rEdl will display for Ready.** Press "enter" to start the firing.



3 KEY-CONE FIRE CONTROLLER ERROR CODES

ERR 1: Element or Voltage Problem (Conduct a paper test and make sure voltage is correct for kiln; i.e. 240 volts needs 240 not 220 volts.) Paper test - Turn the kiln on, place scrap pieces of paper in each element trough and see if the paper burns. Elements need replacing where the paper doesn't burn.

ERRP: Indicates a long-term power outage. Press any key to clear display.

FAIL or a Negative Temperature is Displayed: Check to see that thermocouple is properly connected; (lead wires may need reversing) or may need thermocouple replacement.

tC FAIL

tC alternating with FAIL: Indicates the thermocouple has failed. Replace the defective thermocouple. To clear the error, press any key.

ErrP ErrP is displayed whenever there is a power interruption that is long enough to stop the firing. If the power interruption is brief the kiln will continue to fire when power is restored; in this case there will not be any indication of a power failure. To clear the error, press any key.

tC- - The red and yellow thermocouple wires are reversed.

Messages

CPLt Firing Cycle Complete (firing time is alternately displayed).
dELA Delay. Displays when entering the delay time (hour:minutes) until the start of the firing.

°F #

°C # Segment temperature in °C – Set temperature for a user program. A decimal point will

Edit

ErrP There has been a power interruption that has stopped the firing. Press any key to clear.

FULL Beeps continuously at end of firing until a key is pressed.

Hld# Soak time in hours:minutes at a hold temperature.

OFF No beeping when firing is complete.

On

rA # Ramp Number (rate per hour of temperature increase or decrease).

rEdl Ready to fire

SEG Number of segments desired in a program

SStP Skip Step (used to advance to the next ramp)

STOP The kiln is at idle and ready to be programmed. Stop alternates with the current kiln temperature.

USr # User program number displayed

GLASS & HEAT-TREATING KILNS WITH PYROMETERS

An infinite switch controls the heating rate and power flowing through the kiln. The pyrometer shows the kiln temperature in the firing chamber. It can be used to help you control the heating or cooling rate of your kiln. It is the kiln operator's responsibility to monitor the kiln at all times. These kilns do not have a shut-off device and must be turned off by the kiln operator.

If your kiln has the pyrometer installed on the kiln, you will adjust the temperature in the kiln by turning the infinite switch either up or down. The kiln operator must turn the kiln off when the firing is complete. Do not leave the kiln unattended while firing.

Wall-mounted pyrometer

1. Most Olympic kilns have a hole punched through the stainless steel jacket that allows you to drill a hole through the exposed brick for insertion of the thermocouple. The thermocouple should be inserted so it extends into the firing chamber 1 inch.



Adjust setscrew for calibration

2. The pyrometer needs to be wall mounted away from the kiln since the heat will damage the instrument.

The pyrometer should register around 100°F at room temperature. If you need to calibrate the pyrometer, adjust the instrument by turning the setscrew on the face below the meter.



WARM GLASS PROCESS TABLE

WARM GLASS PROCESS	FAHRENHEIT/CELSIUS*	DEFINITION
Draping	1200°F to 1250°F 650°C to 675°C	Shaping glass by heating it until it bends over a mold, under its own weight.
Fire Polishing	1300°F to 1400°F 705°C to 760°C	Heating glass to the point where the edges round off and are left with a shiny appearance.
Slumping	1300°F to 1450°F 705°C to 790°C	Shaping glass by heating it until it stretches and drops (slumps) into a mold.
Tack Fusing	1350°F to 1450°F 730°C to 790°C	Heating the glass to the point where the individual components begin to stick together, with each piece retaining its individual shape and character.
Full Fusing	1450°F to 1550°F 790°C to 845°C	Merge two or more layers of glass by heating and temperature soaking until the glass is fully combined.
Frit Casting	1480°F to 1600°F 805°C to 870°C	Small crushed pieces of glass (called frit) are placed inside a dam mold to control the shape and fired to full-fuse.
Pate de Verré	1500°F to 1600°F 815°C to 870°C	Finely ground glass is emulsified, placed into a special mold and kiln-fired to form a solid glass sculptural shape.
Combing	1650°F to 1750°F 900°C to 955°C	Glass is softened to almost-molten state and is manipulated by "raking" a metal tool across the surface to "comb" the colors into various patterns.
Glass Casting	1700°F to 1800°F 925°C to 980°C	Glass is melted in a crucible to a liquid state then it is poured into a specially prepared mold.

(Warm Glass Processes Table from *Introduction to Glass Fusing* by Petra Kaiser)

*Final temperatures may vary based on type of glass and project.

PMC, Art Clay, BRONZclay™ and COPPRclay™

FIRING SCHEDULES for Art Clay, PMC, Bronze & Copper Clay

Please consult the list of online resources for firing schedules for metal clays

- www.artclayworld.com/Articles.asp?ID=257
- www.cooltools.us/Metal-Clay-Firing-Guides/782.htm

FIRING SCHEDULES for Glass

Consult your glass manufacturer's web site or glass forum for firing programs. Listed below are a few sources but there are many more to help you.

- www.system96.com/resources/firing-schedules-info/
- www.bullseyeglass.com/images/stories/bullseye/PDF/TechNotes/technotes_04.pdf
- www.wissmachglass.com/firingschedules.html
- www.uroboros.com/firing_annealing.php
- www.armstrongglass.com/floatfirebook.pdf
- www.warmglass.com
- www.glasscampus.com
- www.slumpys.com/Company-Information/Company/Slumpys-Firing-Schedule

Kiln Loading

Follow these instructions when loading your kiln:

1. Plan the load before starting. Arrange the load so that thick and thin walled pieces will be mixed throughout the kiln to give a uniform mass or density.
2. It is best not to load pieces directly on the kiln bottom.
3. Do not jar or shake the kiln after loading has started since ware on a shelf could be knocked down or broken.
4. Keep shelves and ware at least 1 inch from thermocouple, and 1/2 inch from the wall of the kiln. At least one element groove must be between the top shelf and the top of the kiln.
5. If large flat pieces are being fired, the edges should be placed between elements. This may eliminate possible cracking from uneven heating.
6. Place the shelves in the kiln carefully so the walls of the kiln will not be bumped and damaged.
7. Load pieces so that they do not touch one another.

Glass work for slumping, sagging or draping may be done in shelf layers; however, fuse work is mostly done on one layer of shelving. Protect the kiln shelves by covering with ceramic paper or kiln wash before firing the kiln.

Glass sagging involves placing a piece of glass such as a sheet or a bottle in a mold and heating it until the glass softens and takes the shape of the mold. Molds can either be purchased, or you can make your own from terra-cotta clay. Be sure to dust the mold with whiting or some recognized separation material or the glass will stick to the mold.

Kiln Firing

Fiber wall kilns and fiber shelves will emit odors and smoke during the first firing. Make sure the area is well ventilated for the first firing. Fiber may become discolored but it will eventually burn off and will not impact the glass pieces. Subsequent firings will not be effected.

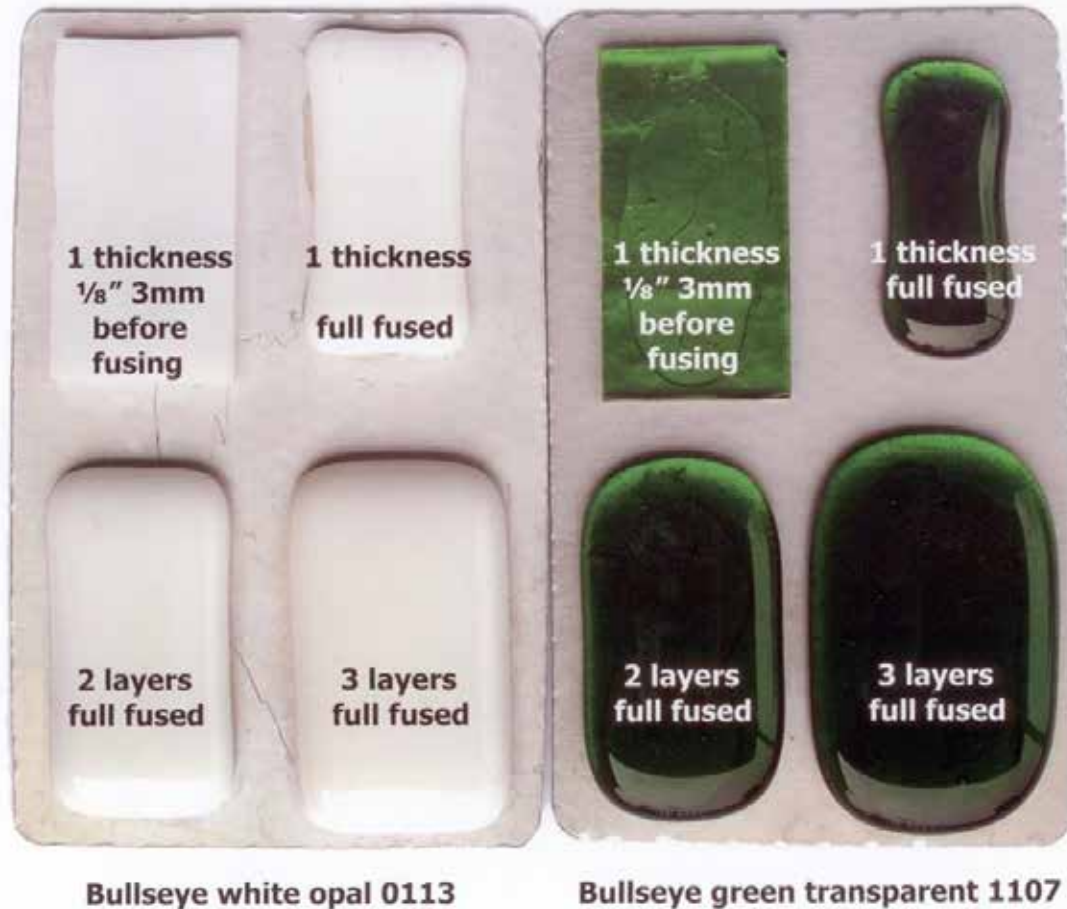
Firing is probably the most important part of your glass work. All of your previous work on a glass piece can be spoiled and your kiln permanently damaged from careless loading or firing. Always consult with your glass manufacturer for proper firing programs. Less firing time is required for glass than ceramics and temperature uniformity is important.

Painted glass should not be fired higher than 1085°F – 1112°F since it will soften and distort above this temperature.

Glass sagging requires firing to 1300°F - 1450°F to completely soften glass, allowing it to take the shape of the mold. The end temperature varies with the type of glass being fired, and only experimentation or recommendation from the glass manufacturer will determine the exact endpoint. When decorating or sagging glass, the end point is critical. To prevent continued heating of the glass when the kiln shuts off, the lid should be wedged open 2 1/2" for 10 minutes (use a flash arm on oval kilns).

We found Richard LaLonde's book *"Fused Glass Art and Technique"* to be an excellent resource and pages 35-37 are taken from the book to discuss bubbles in glass firings.

Glass Thickness & Volume Control



The above glass samples are from my 1983 teaching kit and show the effect of volume control. The white and green samples were fired in the same kiln, right next to each other at the same time. You will see the original size in the upper left hand corner for both the white and green glass.

Observe the effect of surface tension and gravity.

One thickness tries to pull up to the magic 1/4 in. (6 mm)-plus thickness and, in the process, rounds the corners and thins the middle. The surface tension is greater than the pull of gravity and consequently pulls on glass.

Two layers stacked one on top of the other full fuse to almost the same size as the original piece except the corners are rounded. Surface tension and gravity are equal.

Three layers stacked on top of each other full fuse to a larger size than the original piece, trying to achieve that 1/4 in. (6 mm)-plus thickness. Gravity is greater than surface tension, and the glass flows until tension and gravity are equal.

Note that the green transparent is more rounded and that it moved more than the white; the green glass is less viscous than the white.

Richard La Londe *"Fused Glass Art and Technique"* – Used by permission



Big hole from a popped bubble.

Big bubbles are not caused by wet kiln shelves!

When I was first trying to figure out what fused glass could do, huge bubbles, some as big as 3" (7.5 cm), appeared when the glass reached full fuse temperature. Getting angry didn't eliminate bubbles, so I turned the mistake into a technique: I opened the kiln and popped the bubbles with a pointed metal rod; the glass pulled back, and the edges of the hole became round.

I backed the holes with surplus titanium that I purchased at Boeing Surplus (the airplane manufacturer in Seattle). I colored the titanium by heating it with a torch. This became a series of glass art.

At the time, I thought that wet kiln shelves were the bubble-creating culprits. I pre-fired the kiln shelves, but bubbles continued to form. Finally, I eliminated the bubbles by firing on 1/8 in. fiber paper.

Eventually, I reasoned that the bubbles formed because air, trapped between the shelf (covered with the shelf primer) and the glass, expanded as the heat increased; the air couldn't escape because, as the temperature rises in the kiln, the glass becomes soft, sealing against the primed kiln shelf. As the temperature continues to rise, the thin layer of trapped air begins to expand and to move toward the area where surface tension has begun to pull and thin the glass. The expanding air forms a bubble. Fiber paper allowed the air to escape. Later, I figured out how to use chips of glass under one edge instead of fiber paper.

Richard La Londe *"Fused Glass Art and Technique"* – Used by permission



“Shift Right,” 1981, H. 21 in. (53 cm) x W. 19 in. (48 cm). Fused multiple layers of Bulleye glass with glass threads pulled in a small glory hole and backed with torch treated titanium surrounded by a gold anodized aluminum fram. I created a series of 10 of these panels.

Air must be the bubble culprit – water, at sea level, turns to steam at 212°F (100°C) and couldn’t exist inside of a kiln at 1400°, around the temperature at which the glass seals to the shelf. This proves that bubbles aren’t caused by a wet kiln shelf or water trapped between the glass and the shelf. It all had to do with volume control and not wet kiln shelves.

My suspicions about volume control issues are confirmed by studying my art piece, “Shift Right.” The large holes happen only in the area with one layer of a very soft black glass. Where there are

second layer elements, bubbles are less likely to occur. Also, notice the pink glass where it meets the black on the top and right side; these started out with a flush edge, but the single layer black pulled away trying to get to that magic 1/4 in. (6 mm)-plus thickness, which is the same as two 1/8 in. (3 mm) pieces of glass stacked on top of each other. The edges of the single layer black glass also have a sharp saw-toothed edge, rather than the rounded edge and corner of the pink glass.

It’s all about volume control!

Richard La Londe “Fused Glass Art and Technique” – Used by permission

Kiln Maintenance

The life of the kiln can be extended for many extra trouble-free years of service if routine maintenance is performed. This maintenance should include, but not limited, to the following suggestions.

Every Firing

Examine the interior of the kiln to insure it is clean and free of dust. Check the lid and wall brick for loose fragments, which might fall on the ware. If possible, vacuum the interior to remove all dust and foreign material from the elements.

Check the floor of the kiln, and the kiln shelves to be sure the coating of the kiln wash is adequate for glass firings. Also check for any warping or cracks in the kiln shelves that might affect your firing.

Remove any glass from the walls, bottom or shelves of the kiln prior to the next firing. If this is not done, glass will melt and spread with each firing, causing contamination to the elements, thermocouple and deterioration of the firebrick.



Protect your ware by vacuuming kiln to remove dust particles and debris

Studio Models

Expansion and contraction of the kiln during firing will eventually cause the stainless steel jacket/rings to loosen and cause the kiln to get out of alignment. To prevent this, the clamps on the jacket, lid and bottom of the kiln should be tightened occasionally with a screwdriver **when the kiln is warm**. Care should be taken not to strip the clamps. By following this procedure you will eliminate wires being stretched and burned out requiring you to purchase new parts.



*Digital multi-meter
volt-ohm ammeter*

Repairs

Many repairs can be accomplished on your kiln simply by removing an old or damaged part and inserting a new one. For more complex repairs, and certainly for troubleshooting, a volt-ohm meter (VOM) is a valuable tool. A VOM can check the continuity of your kiln, pick out weak elements, reveal faulty switches, or check for proper voltage from the wall receptacle. The VOM allows the troubleshooter to proceed in a logical sequence through the kiln for the source of an electrical problem.

When doing replacement repairs, install the new part in the same position as the old part. Transfer wires one at a time from the old to the new part. Discolored wires and lugs must be replaced or cleaned with sandpaper or steel wool until clean and bright. If this is not done, a bad connection will result.

NOTE: To insure you receive the correct element or part, order from Olympic Kilns. Elements and parts ordered from other sources may not function correctly in your kiln.



Tighten stainless steel bands on a regular basis to keep kiln aligned. Use a flathead screwdriver to tighten hose clamps when the kiln is warm.

REPLACING PARTS

Removal of Electrical Box

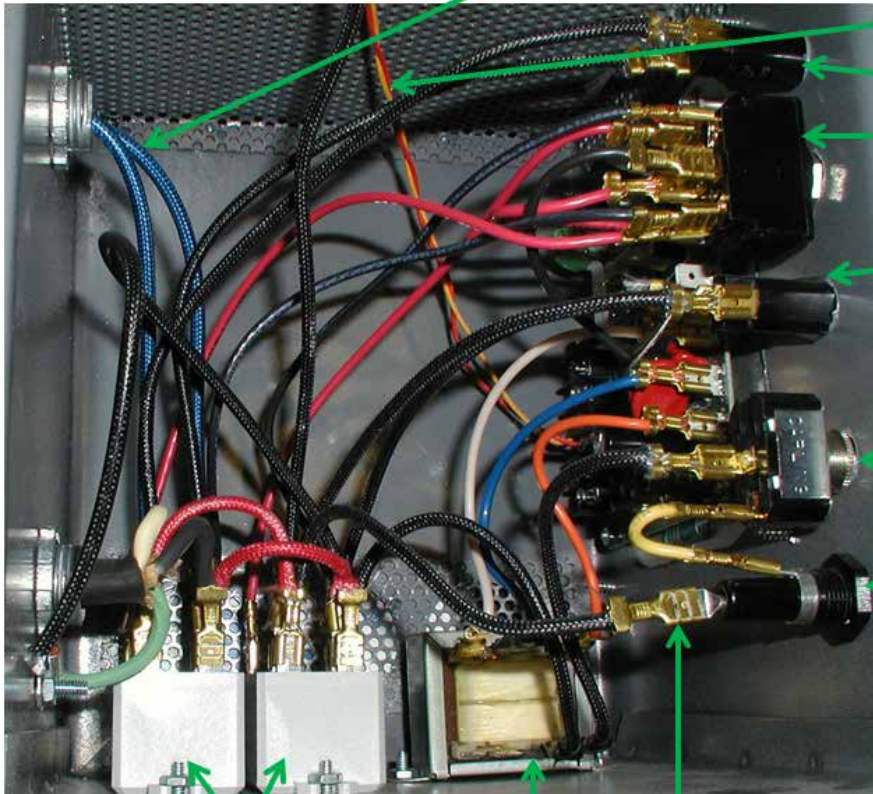
1. Unplug or unwire kiln if direct wired
2. Remove the screws attaching the electrical box to the heat shield
3. Pull the box away from the kiln. When removing the electrical box that contains the pyrometer or electronic controller, be careful to pull the box straight out so that the thermocouple does not break the brick.



REPLACING PARTS

INSIDE 120 VOLT RTC-1000 ELECTRICAL BOX

High Temp Wire (blue wires) – attaches elements to relays



- Thermocouple Wire
- Pilot Light for Lid/Body Element
- Lid/Body Element Toggle Switch
- Pilot Light for Kiln
- On/Off Toggle Switch
- Fuse

- Relays
- Transformer
- Slip-on Connector

INSIDE 204-208 VOLT RTC-1000 ELECTRICAL BOX

High Temp Wire (blue wires) – attaches elements to relays



- Thermocouple Wire
- Pilot Light for Lid Element
- Lid Switch
- On/Off Toggle Switch
- Fuse

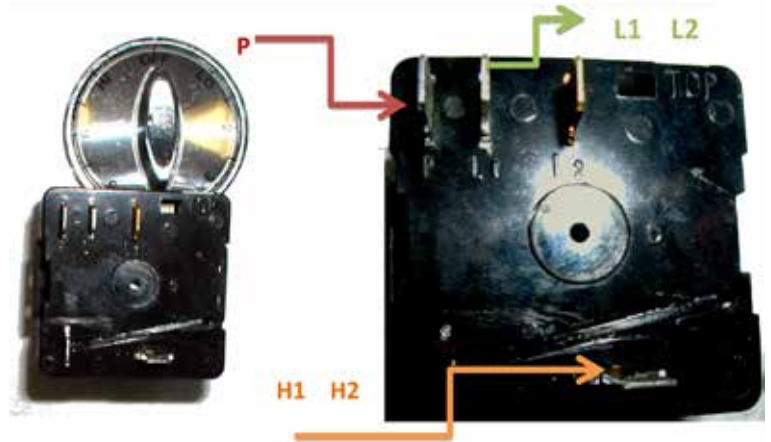
- Relays
- Transformer
- Slip on Connector

REPLACING PARTS

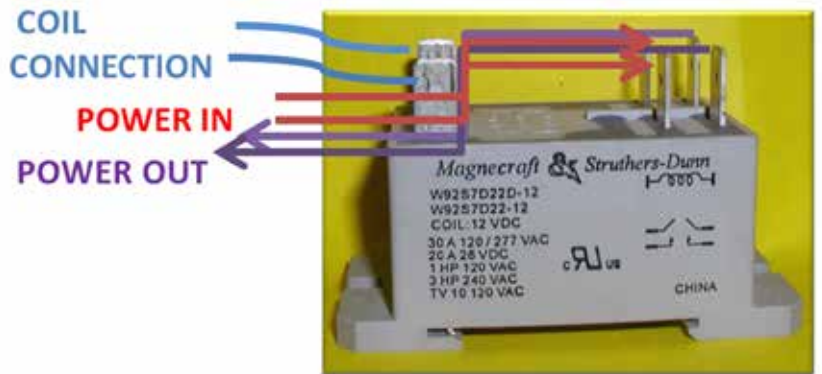
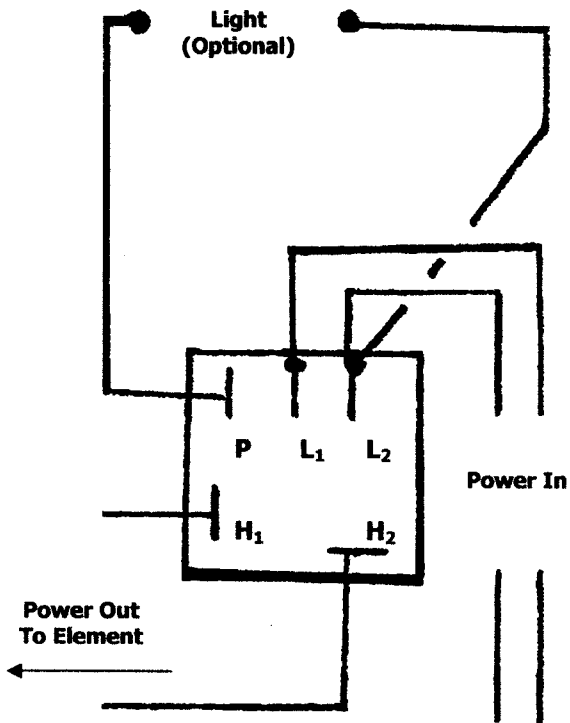
After the electrical box or boxes are removed from the kiln, the following repairs can be accomplished.

Switches, Relays & Transformers – These parts are all replaced by removing the slip-on connection from the old part and replacing slip-ons to the new part.

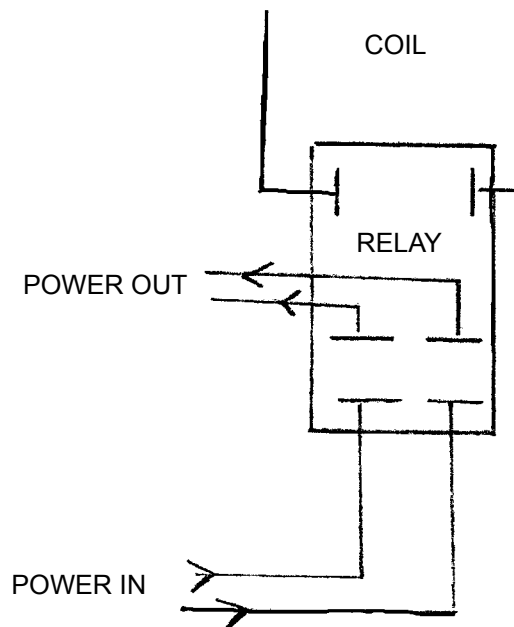
Infinite Switch with Wiring Diagram



120 volt – 240 volt Infinite Switch Schematic



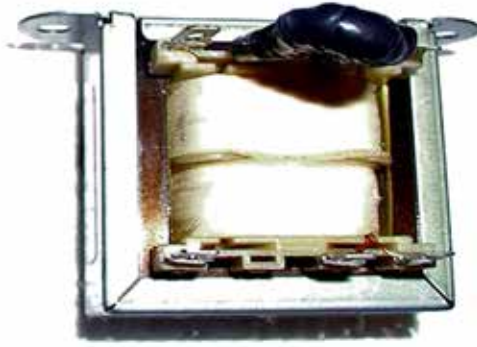
Wiring Schematic for 12, 120 & 240 Volt Relay



REPLACING PARTS

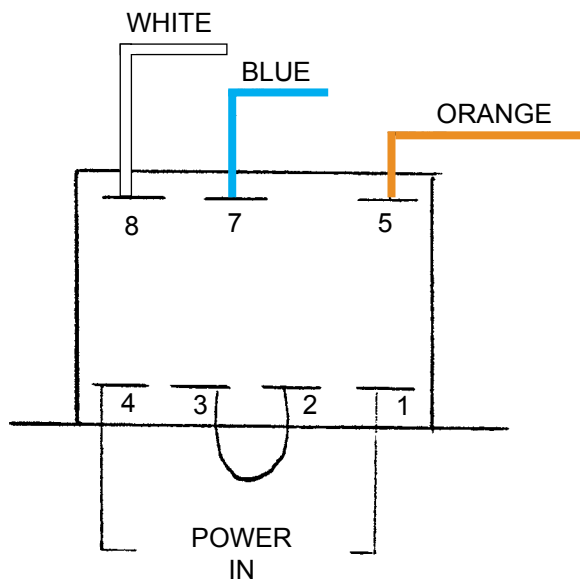


120 VOLT



240/208 VOLT

Transformer Wiring Schematic
208/240 Volt Transformer
120 Volt – Power in 4 & 3 or 1 & 2



REPLACING PARTS

Element Re-Pinning

Elements become very brittle after a few firings; so if re-shaping or re-pinning is necessary, heat the element either by turning on the kiln, or with a torch to a dull red glow. Unplug or unwire the kiln, and reposition the hot element using needle nose pliers. A brittle element normally will not break if it is above 500 degrees F.



As a kiln ages, the element will begin to bulge. At this time the number of pins will not help keep the element in the lid. Your best solution is to replace the element with a new element.



U-shaped pins are used to pin elements in the lid element troughs of the glass kilns.

Replacing Elements

1. Turn off kiln and unplug or unwire if direct wired and remove all pins holding the defective element in the grooves.
2. Gently remove the old element taking care not to break or chip any bricks. Long needle nose pliers can help in this job.
3. Insert one twisted pigtail of the new element through the terminal brick and then work toward the other end by carefully placing the new element in the trough of the brick. Make a slight bend at each corner so that the element takes the shape of the kiln. When the entire element is in the trough, it may be necessary to slightly stretch or compress it to obtain the length necessary to allow the pigtail to pass through the brick.
4. Re-pin the element at each corner with Kanthal pins. **The pins should hold the element down while the lip of the element groove holds the element in.**



REPLACING PARTS

5. Reinstall the porcelain insulators over the twisted pigtail.
6. Pull the pigtail out gently until it is tight, then clip it 5/16 inch beyond the insulator.

Hi Temp Connectors



7. Place a high temperature connector in the jaws of the crimping tool and hold it lightly. Reach inside the kiln with the other hand and push the pigtail out. Slip the connector on the pigtail and crimp firmly in two spots.



Crimping Tool

8. Strip 5/16 inch from the wires connecting the switch or relay to the elements. Polish with fine sandpaper if the wires are discolored, then firmly re-crimp.

It is important to stress that the wire in a crimped connection be clean and bright. All crimps must be firmly applied.

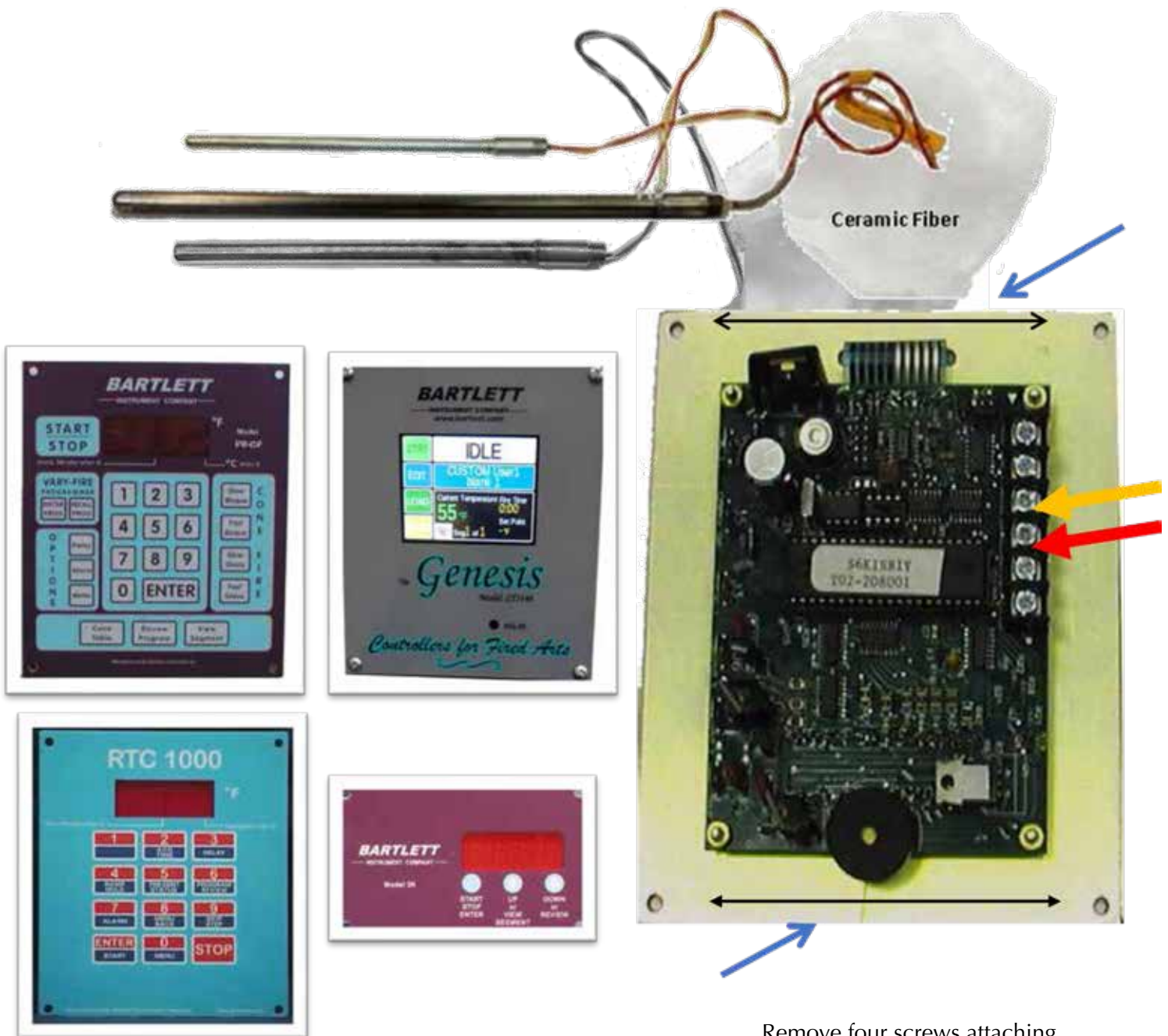


REPLACING PARTS

Thermocouple Replacement –

Thermocouple designs can vary based on the age of the kiln. This is the current design for the Type K thermocouple. You may need to enlarge the hole in the kiln where the thermocouple is inserted to accommodate the new thermocouple.

It is extremely important that the ceramic fiber enclosed with the thermocouple be used to eliminate any air space in the hole where the thermocouple is inserted. Failure to comply will result in a defective thermocouple. The thermocouple must be insulated to avoid excess heat.

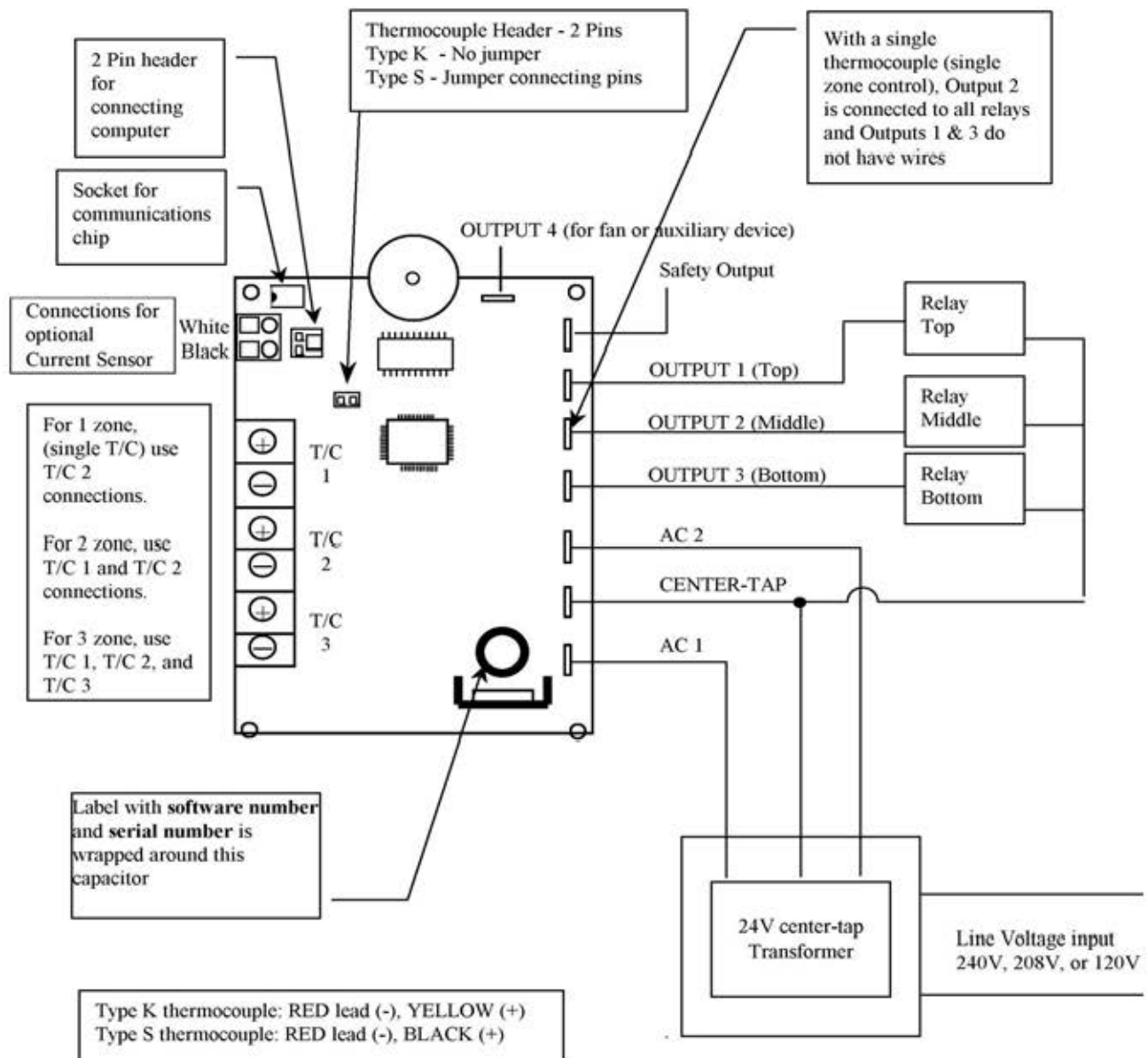


Remove four screws attaching board to electrical box.

REPLACING PARTS

Thermocouple Replacement –

Remove the four screws attaching the controller board to the electrical box. Strip the thermocouple's yellow and red wires 3/8 of an inch. Disconnect defective thermocouple and insert the new thermocouple with the fiber through the opening in the kiln brick. Set the thermocouple approximately 1" inside the kiln firing chamber. Attach thermocouple's yellow wire to the positive connection on the electronic board and the red wire to the negative connection.



REPLACING PARTS

Element Replacement – Tips for Electric Rakus – TopHats

The best way to replace elements in an electric raku kiln is to remove the firing chamber from the frame. Once the firing chamber has been removed from the frame, loosen the stainless steel band, remove the top from the firing chamber and follow the steps for element replacement. After the elements have been installed, replace the lid of kiln on the firing chamber and reinstall the firing chamber to the kiln frame.

Brick Repairs

The bricks used in your kiln will withstand many firings without deteriorating. Brick replacement is complicated by the risk of breaking a brittle element. Often temporary repairs can be made until the time that an element needs replacing.

It is difficult to cement bricks together when they break, however, large pieces such as the element groove lip, can be pinned with Kanthal pins to hold it in position. If the brick cannot be pinned, the element may be held in position with pins, even if the supporting brick below the element is missing.

Foreign material such as glass spots on the brick can be dug out with a screwdriver or knife.

Brick Replacement

Make sure you order the correct brick(s) that need replacing.

Straight Notched - bricks that elements run through

Terminal – the brick that the element runs through to the electrical box

Observation – the brick that has the observation hole

Blank – brick that is not grooved for element placement

Terminal bricks are best replaced when elements need replacing as well.

1. Remove the Kanthal pins securing the element at each end of the damaged brick.
2. One section kilns and brick being repaired in the top section of stackable kilns, requires the lid to be removed by unscrewing the large hinge parts attached to the kiln jacket.
3. If the kiln is built in sections, place the ring with the broken brick on a flat surface with the damaged side up.
4. Loosen the hose clamps until the bricks are loose. If the kiln is in one section and the repair is being made on other than the top row, the entire stainless steel jacket must be opened.
5. Gently lift the elements from the trough with needle nose pliers, and carefully bow them far enough into the firing chamber to allow removal of the brick. Insert the new brick with the element trough to the bottom of the kiln.
6. Set the elements into the groove and pin down.
7. Tighten the jacket clamps taking care to align observation holes. Replace all screws and replace the lid if it was removed.
8. Use sandpaper over a wooden block to sand the brick down until it is even with the adjoining brick.
9. Vacuum the kiln.
10. Retighten the stainless steel jacket of kiln again during firing while the kiln is hot.

Olympic commercial electric kiln bricks are mortared together and replacement requires cutting out the brick. Please contact Olympic Kilns for additional instructions.

REPLACING PARTS

Floor Repairs

The easiest repair to make when the floor is damaged is simply to turn it over. A one-piece kiln must be turned upside down and the hose clamps on the jacket loosened, allowing the floor to be lifted out of the kiln. The floor can then be turned over and reinstalled.

Holes in the floor can be patched with kiln wash mixed to the consistency of paste, then scraped flush, and allowed to dry before firing. Kiln mortar can also be used by spreading it thinly over the area to keep it sealed.

Lid Repairs

If the lid becomes chipped or damaged, simply smooth the surface of the hole with sandpaper and blow or vacuum clean. Kiln mortar may be spread thinly over the exposed brick to seal it and prevent dusting.

Large Capacity Electric Kilns and Car Kilns are built differently from the studio line of electric kilns. Please contact Olympic Kilns for repair troubleshooting for these models.

Kiln Troubleshooting

Kiln does not start.

Check to see that kiln is plugged in and the pilot light turns on. Kilns equipped with electronic controllers, the controller must read Idle to begin programming the kiln. Electronic controller equipped kilns are protected by a fuse that must be checked if the controller display does not light up. If the fuse is in good condition and the controller display does not light up, then the transformer may need replacing. The toggle switch on 120 volt glass fusing kilns with a lid and body element must be in either the UP or DOWN position for the kiln to operate. The kiln will not fire in the NEUTRAL position.

Gap appears between lid and kiln when firing.

This is a common occurrence in oval and some top loading kilns when the kiln is heated and thermal expansion occurs. Lightly sandpaper the area on either side of the gap.

If the sandpaper does not correct the problem, while the kiln is firing, loosen the hinge screws to the kiln to allow repositioning.

The holes for the screws attaching the hinge are larger than the screws. If you will loosen the screws attaching the hinge to the lid, while the kiln is warm, then the lid can reposition itself. Once the lid is repositioned, tighten the screws, and the lid will be flush with the body (chamber).



Repositioning Lid when Thermal Expansion Occurs

Fuse or breaker fails after the kiln has been on for some time.

Check chart to insure the correct breaker size is being used with the kiln. Replace breaker or fuse if necessary.

Smooth ceramic fiberboard shelf has marks or patterns.

Lightly sandpaper mark or pattern with high-grade sandpaper.

Recommended Reading:

Introduction to Glass Fusing by Petra Kaiser

Contemporary Warm Glass by Brad Walker

Fused Glass Art and Technique by Richard La Londe

This Warranty Is Applicable to All Kilns Manufactured by Olympic Kilns That Are Used for Ceramics, Pottery and Glass. Cone 10 Kilns Have a One-Year Warranty and All Other Kilns Have a Two-Year Warranty. Certain Parts, Thermocouple, Kiln Sitter Tube Assembly, Are Not Covered Under Warranty, Nor Is Kiln Furniture.

LIMITED KILN WARRANTY

Haugen Manufacturing, Incorporated guarantees to the original purchaser that any defects in OLYMPIC KILNS which become apparent within two years (one year for the Dawson Kiln Sitter and safety timer which is covered by warranty from W. P. Dawson, Inc. and kilns rated at cone 10) will be remedied as specified below.

Our warranty, of course, does not cover any kiln damaged or altered by you or others after it leaves our factory. Our warranty does not cover damage due to reduction or salt firing, over-firing, exceeding the maximum cone or temperature ratings, improper installation, use of electrical voltages different than those specified, or firing material other than ceramics.

If a defect of manufacturer becomes apparent, and your retailer does not resolve it to your satisfaction, we will in the following manner: Within (6;) days of the first indication of a defect, tell us in writing of defect, and the date, place and proof of the your purchase. We will contact you to determine what parts seem to warrant repair and to instruct you as to shipment of the kiln parts. You will dismantle, package, and ship the parts we request (and no others), to us at your cost, freight prepaid. If the kiln has a defect of manufacture we will repair, replace or refund as is appropriate, within (30) days. We will ship to you at our cost in your package, for you to reinstall at your cost. If the parts shipped by you to us are in need of repair or replacement for something which is not covered by this warranty, we will not perform the work until you have authorized the work and made arrangements for payment. If substantially an entire kiln is returned for repair under warranty, you will prepay the cost of packaging and shipping both to and from the factory.

We shall in no event be liable for injuries to persons or property or for incidental, contingent, special or consequential damages arising from the use of our products. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HAUGEN MANUFACTURING, INC.
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FLOWERY BRANCH, GA 30542

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