OLYMPIC KILNS

Pottery, Glass Firing & Heat-Treating Electric Kilns

OPERATING MANUAL

Built Better, Built to Last!

www.olympickilns.com

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Electric Kiln Operating 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 or e-mail (contact@olympickilns.com) and provide **the kiln model number and serial number** located on the silver tag on the kiln.

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.

Electric Pottery, Ceramics, Glass & Heat-Treating Kilns
Operating Manual

CONTENTS Page Number

Model & Serial Number (SN) Identification

How to determine Kiln Model and Serial Number (SN):
The serial tag is silver in color with black writing and is usually located on the back or side of the first electrical box.

Model Designation

Olympic Kiln models signify their interior dimensions or cubic feet on most kilns and letters are abbreviations of how the kiln is built and equipped.

FL20E

- E – Kiln is equipped with an electronic controller
- FL – Kiln is built for front-loading
- Kiln's interior is 20 cubic feet

SQ1414ETLC

- SQ – Kiln is square-shaped & TLC – kiln is built toploading & clamshell loading
- E – Kiln is equipped with an electronic controller
- Kiln's interior width is 14.5" x 14.5" and depth is 13.5"

2327HE

- E – Kiln is equipped with an electronic controller
- Kiln's interior width is 23 3/8" and depth is 27"
- Kiln has 3" brick and fires to cone 10, 2350°F

Electric Kiln Model Abbreviations

Bell –	Kiln chambers lift up with an electronic device
CAR –	Large capacity kiln built with a removable door and floor
CS –	Clamshell loading
DM –	Dual media for firing glass (lid element for fusing) and ceramics and rated to 2350°F – cone 10
E –	Equipped with an electronic digital controller
FL –	Front loading
GF –	Glass fusing
H –	High-fire studio kilns built with 3″ brick rated to 2350°F – cone 10 (large capacity electric kilns are all rated to cone 10 – 2350°F
HB –	HotBox 120 volt small high fire models
Slider –	Clamshell opening model with sliding floor for easy access and loading
SQ –	Square built designed model
TL –	Top loading large capacity electric kilns
TopHat –	Electric raku designed kiln with a lid element for glass fusing and rated to 2350°F – cone 10 for pottery and heat-treating

Positioning Your Kiln

1. Adequate space – at least 12 inches of space between the kiln and the wall. Kilns with Lid Lift Assists may require more space. (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.

Electrical Requirements

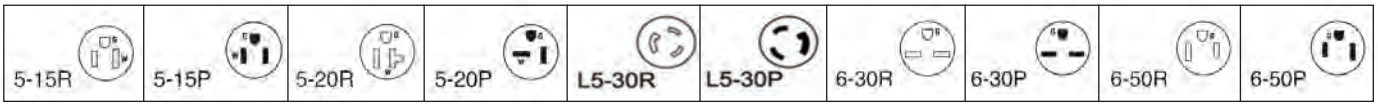
ELECTRICAL HOOK-UP
To provide the performance it was designed to give, your new kiln must have the proper outlet and breaker to supply adequate voltage and amperage. An incorrect connection may cause disappointing or even hazardous results. A qualified electrician needs to be consulted to determine whether 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 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
120	24	2,880	30	#10, #8 if circuit is longer than 40 ft.	NEMA L5-30

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	#10, #8 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

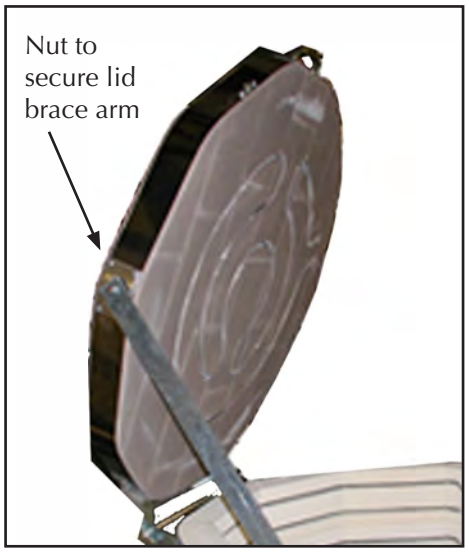
Electrical Specifications for Olympic Electric Kilns

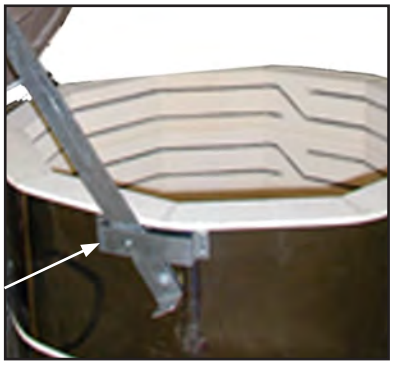
Volts	Amps	Watts	Breaker Required 240/208 volts	Copper Wire Size	Receptacle, 2 Pole-3 Wire NEMA Configuration 240/208
240/208	45/50	10,800	60/70	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50 – Direct Wired
240/208	47/48	11,280/ 9984	60	#6, #4 if circuit is longer than 40 ft.	NEMA 6-50
240/208	47-48/ 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
240/208	200/230	48,000	250/300	#3/0, #4/0 if circuit is longer than 40 ft.	Direct Wired

Assembly & Preparation of Your Kiln

If you purchase an ***Olympic 120-volt, Studio Front Loader, Electric Raku, or Large Capacity*** electric kiln, your kiln is ready to fire upon arrival. After the kiln is unpacked or removed from the pallet, place kiln directly on stand; or in the case of a kiln with attached frame, place the kiln where it is to be located, plug-in and fire away.

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.





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 studio 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.

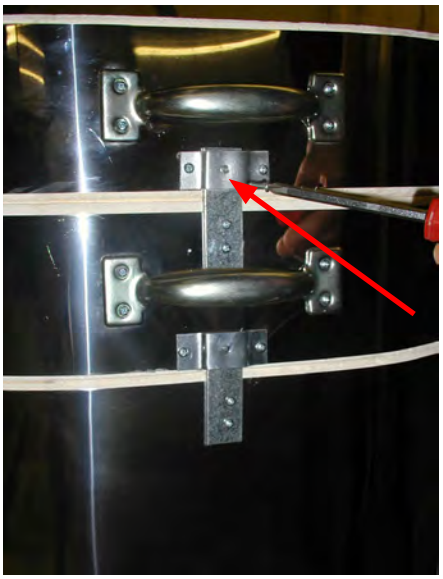
Kilns built in rings and those with counter weight lid systems must be disassembled from the shipping pallet then reassembled on the stand. The proper method is to remove the top ring and place the bottom of the top ring flat on the floor. Repeat for each section until you reach the bottom of the kiln. Place the bottom on the kiln stand with the hose clamps to the back. At this time the stand can be leveled. If shims are required to make the bottom level, or prevent rocking of the bottom on the stand, use only sheet metal under the legs of the stand. Now reassemble the kiln with the observation holes to the front and electrical boxes aligned. Grasp the rings by the outside surface, and not the firebrick, to avoid damaging the kiln.

Olympic Stackable Kilns Assembly

Once the steps have been completed, the kiln will come apart in sections by lifting each ring straight up.

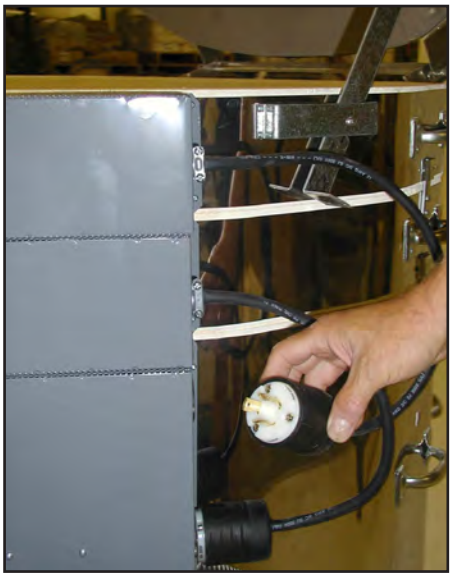
Step 1

Use a Phillips head screwdriver to unscrew screws on the ring lock on the top ring of kiln. There are two ring locks per ring.



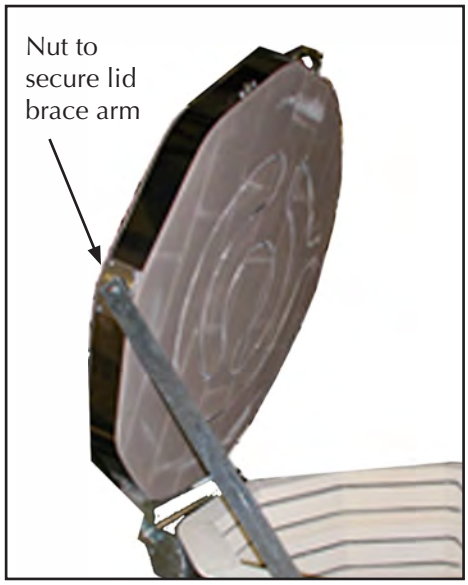
Step 2

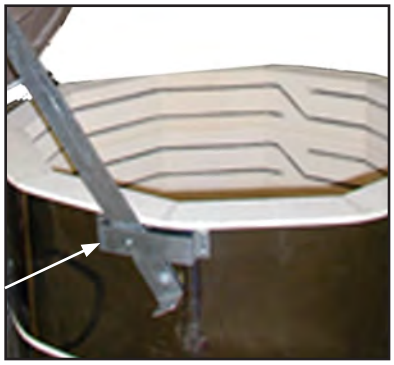
Undo interbox plugs from receptacle of electrical boxes. Twisting and unlocking the plugs achieve this.



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.

Lid Brace Arm





Body Brace Pad

How to Take Apart and Reassemble the GF2, GF3, GF5 Series

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.

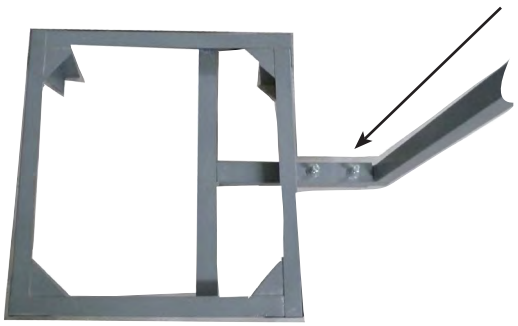
Step 4
Open kiln firing chamber and attach gas strut.

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

Step 5
Follow the instructions for Lid Lift Installation on pages 13-16.

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.

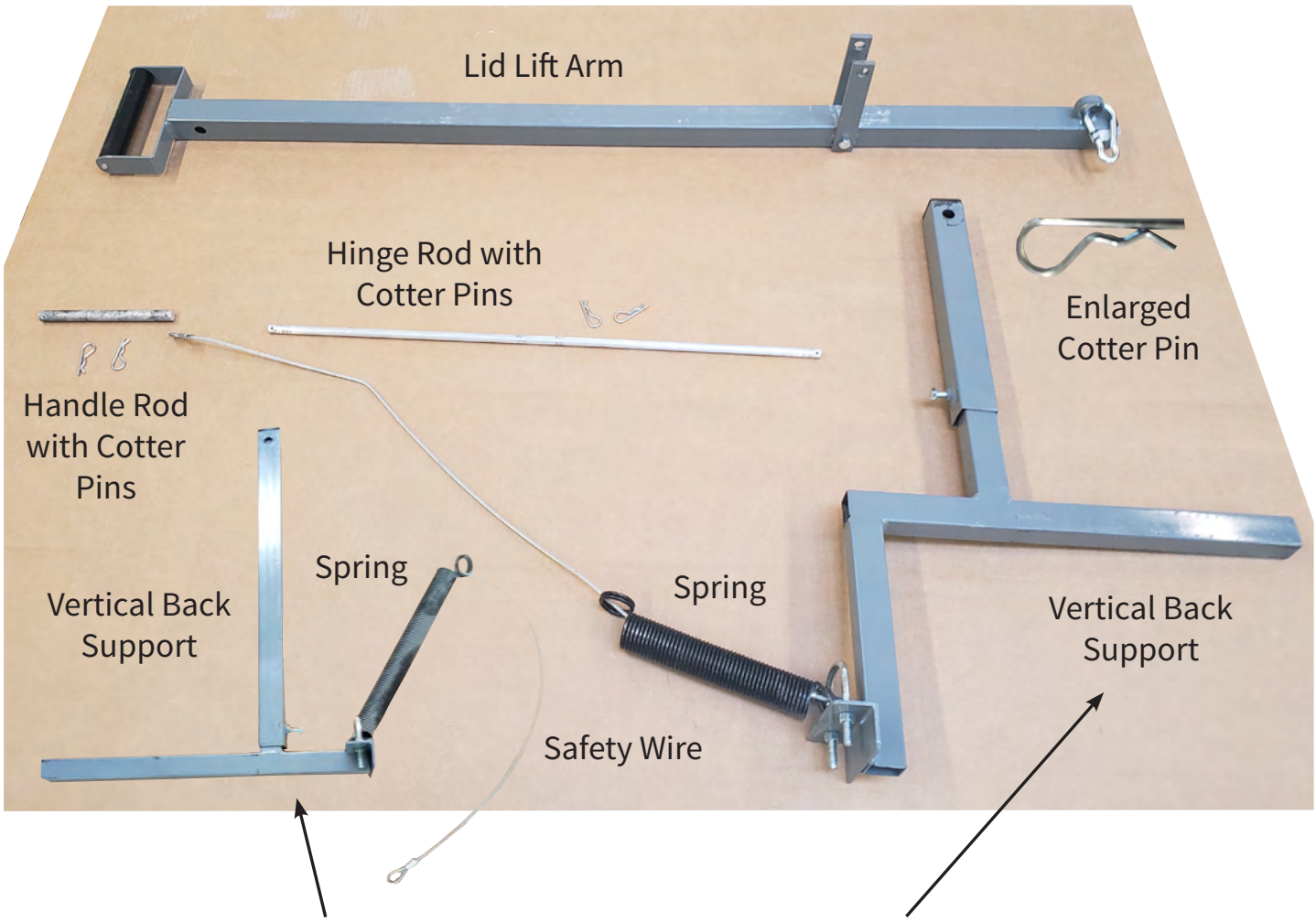
3. Run cable over pulley. Add or remove sand to balance lid cover counterweight.

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.

Lid Lift Installation

These are the parts included with the kiln you received for installing the counterweight lid lift.



The Vertical Back Support will look like one of these shown.

Lid Lift Installation

Putting the Kiln on the Stand & Installing the Lid Lifter

Step 1

The kiln is ready to be set up in its location. Install kiln feet on the stand legs.

Step 2

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

Step 3

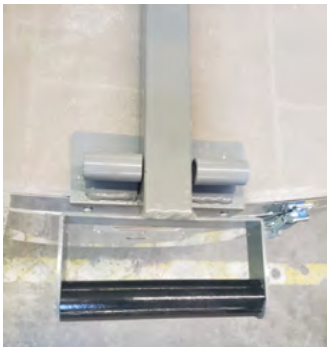
If the kiln has additional rings, plug in the Twist 'N Lock plugs to the receptables on the electrical box.

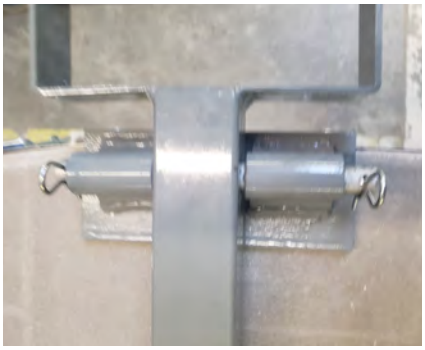
Step 4

Insert the horizontal back support to the frame on the stand. Raise the vertical back support until it lines up with the hinge rod. Finger tighten the set screw.

Lid Lift Installation

Step 5





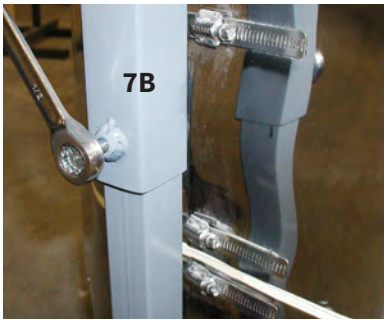
Position lid arm where the holes in arm line up with the holes on the lid bracket. Insert handle rod and secure with cotter pins.

Step 6

Position rear arm lifter holes to match the back of the vertical back support and holes of the lid hinge. Adjust vertical and horizontal pieces as needed to fit.

Step 7

7A Insert hinge rod through the holes and secure with cotter pins.



7B Tighten bolt on the vertical back support on the frame of the lid opener. **Failure to tighten the bolt can cause damage to the hinge.**

7C Tighten the bolt on the lid lift arm.

Lid Lift Installation

Step 8

Attach the lid brace arm by inserting the nut and bolt to the lid brace arm. Lift lid and lock lid brace arm in place.

Step 9

Screw the ring lock in place with a screwdriver.

Step 10

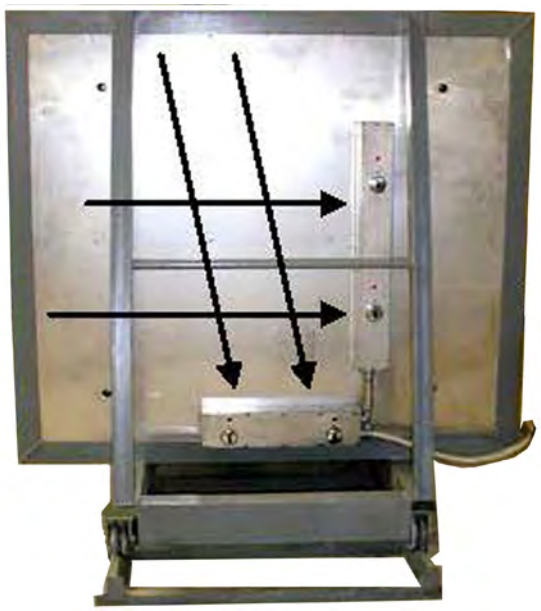
With the lid opened, attach safety wire first and then attach spring by pulling up on the spring.

After completing Steps 1-10, the Lid Lifter will be installed, and the kiln is set and ready to fire. Enjoy the easy opening and closing of your kiln lid!

Olympic Large Capacity Electric Kilns

Olympic Large Capacity models 20 cubic feet or greater require the receiver to have a forklift to remove the kiln from the freight truck. These models are too large to be lowered on a lift gate. Fork extensions may need to be added to the forklift to unload freight from truck.

When you have removed the crating and the plywood packing from your freight you will see the Large Capacity electric kiln completely assembled and bolted to the shipping pallet. Olympic Front Loading and Top Loading Large Capacity models can be unbolted from the pallet, set in their location and ready to fire. The Large Capacity Car kilns require disassembly and reassembly prior to firing.



Infinite Switches – ALWAYS TURN ON WHEN FIRING THE KILN
Large capacity electric kilns which are equipped with floor and door elements have infinite switches which control the heat intensity of the elements in the floor; and the left and right side of the door. Some models have infinite switches to control the heat intensity of the wall elements as well.

Olympic Electric Car Kiln
Installation Instructions

Follow these instructions to avoid damage to your new car kiln as you unpack and setup.

Step 1
Block wood pieces strapped to the pallet beside the kiln and the track strapped to the opposite side. Remove these from the pallet and install track with blocks and bolts provided.

Place the wood under the track and bolt the track to the kiln with the kiln on the pallet. Insure that the track is both level and straight.

Extreme damage to the kiln will result if the car is not level when removed from the firing chamber.

Ensure the the track is both level and straight.

Olympic Electric Car Kiln
Installation Instructions

Step 2
Unlatch the door and unplug the electrical connection from the door to the body of the kiln.

Step 3
Carefully withdraw the door and car from the kiln, lift it over the ends of the rail onto the floor.

Step 4
Detach the rail from the kiln.

Step 5
The bolts securing the kiln to the pallet must be removed.

Step 6
The kiln may now be lifted from the pallet.

Olympic Electric Car Kiln
Installation Instructions

Step 7
When the kiln is in its permanent place, the track needs to be reinstalled and bolted to the kiln.

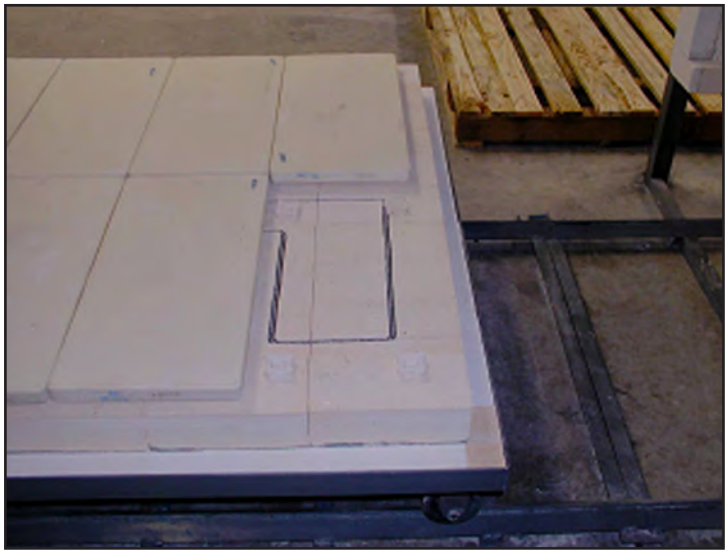
Step 8
Position the car at the end of the rails. First, lift the front of the car onto the track, and then lift the back of the car onto the track. Carefully close the kiln.

Olympic Electric Car Kiln
Installation Instructions

Important Operating Information

The power to the door and floor is through a plug. Do not open the kiln without unplugging the plug.

To protect the floor and floor elements, kiln shelves and posts should be placed before firing the kiln.



Infinite Switches – TURN ON WHEN FIRING
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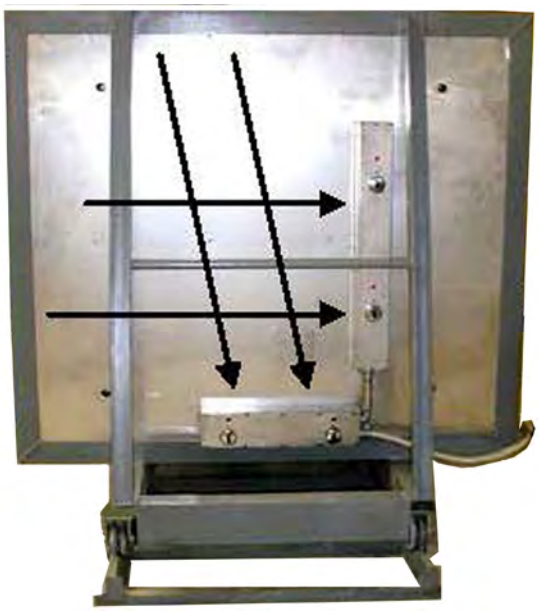


Electric Kilns – Other Components

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.

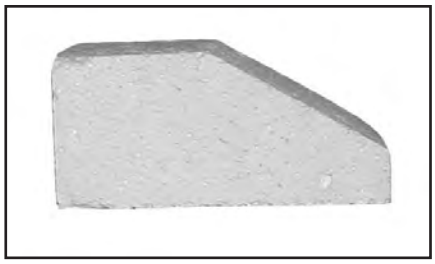
Pilot Light

Electric Kilns – Other Components

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 and/or 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

GLASS FIRING KILNS 120 VOLT
LID ELEMENT CONTROL

120 Volt Toggle Switches

120-volt glass kilns have two toggle switches if equipped with an electronic controller. The bottom toggles 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 Infinite Switch

Glass and heat-treating kilns running 240-208 volts have an infinite switch which controls the intensity of heat geneated 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.

240-208 volt Dual Media & Glass Kilns – infinite switch for lid element operation

Kiln Operation – Pyrometers

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.

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.

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 of the analog pyrometer.

Adjust setscrew for calibration

Analog Pyrometer

The HB86 Vitrigraph kiln may be equipped with a pyrometer or 3K-CF electronic controller. Vitrigraphing is a process in which glass is melted around 1800° - 1900° F. Once melted, the glass can be pulled with tongs through a small hole in the bottom of the kiln, When the stringer is pulled it can be manipulated into different shapes before it is hardened. Glass-working artists will use the stringer in designs that would be difficult to create with cut glass.

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.

Digital Pyrometer

Kiln Operation – Wall Units

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, **KilnStar** 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 high fire (Cone 10) 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. When the lid element is on it is under the operation of the controller. The switch is turned to the desired intensity (0 - HI) when the lid element is in use.

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.

- 2-zone control has two thermocouples for the top and bottom section of the kiln.
- 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. Infinite switches for each zone allow the kiln operator to manually adjust the element output as needed. 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.

Electronic Controller Operating Overview

Sarah says (not Simon, Sarah), *"Learn from me how to operate the electronic controller on your Olympic kiln by watching the videos we've posted on YouTube."*

Go to YouTube, enter Olympic Kilns, and look for the red round logo to find the videos. Or copy and paste the link below into your browser. The link is also available at **olympickilns.com** on the Resources tab under ***Operating Manuals & Helpful Information.***

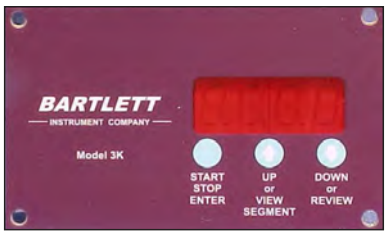
Olympic electric kilns are equipped with the Bartlett Instruments 3K-CF, KilnStar or Genesis electronic controller. Please read the manual provided with your kiln for detailed operating instructions for the controller equipping your kiln.

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. The Orton Ceramic pyrometric cone charts on pages 57-58 show end temperature range for slow and fast cone firings.

Vary Fire – Ramp/Hold Firing

Vary Fire mode on the digital controllers are used 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.



3K-CF

KilnStar

Genesis 2.0

3K-CF, 12 Key and Genesis 2.0 Controller – Refer to Operating Manuals and Bartlett Instruments web site for regular updates for the controller – www.bartinst.com and YouTube.

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

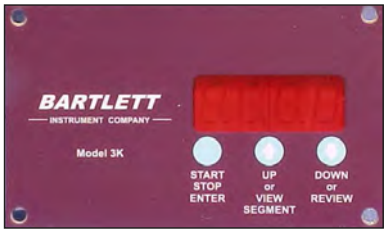
KILN EQUIPPED WITH KILN SITTER

Refer to kiln sitter manual for operating instructions.

Links to Electronic Controller Manuals

Refer to the 3K-CF, KilnStar and GENESIS manuals for complete operating instructions. Or go to the Resources tab at OlympicKilns.com to down the manual you need.

Links to each controller are listed below:



3K-CF Controller

https://www.olympickilns.com/wp-content/uploads/2021/08/Kiln_Assistance_3_Key_Cone_Fire_Manual.pdf

KilnStar Controller

https://www.olympickilns.com/wp-content/uploads/2023/08/MANUAL_KILNSTAR.pdf

Genesis 2.0 Controller

https://www.olympickilns.com/wp-content/uploads/2021/08/GENESIS_CONTROLLER_MANUAL_web.pdf

Electro-Sitter Installation –

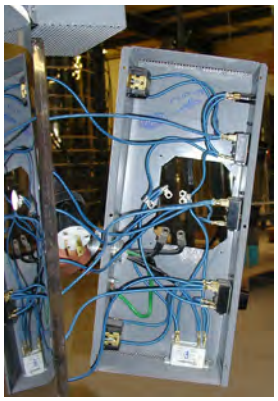
Available with 3K-CF, KilnStar or Genesis Controller

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.

Electric Raku & TopHat Kilns

LOCATING YOUR KILN:
Three things should be considered when locating your Olympic Kiln:
1. Adequate space
2. Proper ventilation
3. Convenience of electric outlets

For the area that has been chosen, allow 12 inches of space between the kiln and the walls. All flammable materials such as curtains, plastics, etc. in the area of the kiln should be removed.

If the kiln is to be placed outside, it must be kept dry. Use a roof over the kiln or some type water resistant tarp when the kiln is not being fired. Because all kilns generate heat, the stand should be placed on a cement floor. Tiles or linoleum could be damaged without this precaution.

RAKUING

Planning –

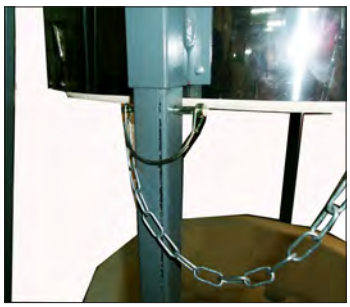
- Reduction containers - (galvanized garbage cans are best) that are the correct size and are arranged for easy access and clear movement around the kiln. Grass, leaves, sawdust or shredded paper work well.
- Combustibles should be at a safe distance from the kiln, yet easy to reach during post firing process
- Helpers that know their job
- Arrange water sources for cooling and emergency situations
- Provide safe, clear avenues for unencumbered movement

Operating the kiln –

- Plug kiln into a receptacle that has an adequate breaker
- To operate kiln pulley system, unlock lever and turn the hand winch. Ensure winch is in a locked position before releasing the handle.
- ***Use only raku clay pottery and raku glaze when rakuing.*** This clay and glaze is designed for thermal shock the ware must go through, other materials may explode and damage the kiln as well as other pottery ware.

Begin heating the kiln with the fire chamber completely closed. The 120-volt electric raku kiln may take approximately 2 hours to reach raku temperature; however, the 240/208-volt electric raku will reach temperature in about 60 minutes. As the kiln reaches approximately 1900º Fahrenheit begin loading your ware. To preheat and avoid thermal shock to your ware, slowly lower the raku-firing chamber. Maintain full power when opening to minimize heat loss between pieces.

When the firing chamber is in the open position use the safety pin to ensure the chamber does not drop to the closed position.



Electric Rakus & TopHats
Equipped with an Electronic Controller

3K-CF Controller

- Choose User 1 - 4 using the **Start, Stop, Enter** button for the program
- Choose one segment when the controller requests how many segments and press ENTER.
- For rate in rise of temperature per hour press 9999 and ENTER. (9999 tells the controller to reach the end temperature as quickly as possible.)
- For end temperature press 1900 - 1950º F and press ENTER.
- For hold time, enter the number of hours you plan to raku and press ENTER.
- The controller will display rEd1 for Ready and you may press START to begin heating your kiln.

The program will be saved in the User program number you selected until new information is entered in the select program.

KilnStar Controller

- Use the Vary Fire Method side of the KilnStar controller to run the raku firing.
- Choose User 1 - 6 for the program and press ENTER.
- Choose one segment when the controller requests how many segments and press ENTER.
- For rate in rise of temperature per hour press 9999 and ENTER. (9999 tells the controller to reach the end temperature as quickly as possible.)
- For end temperature press 1900 - 1950º F and press ENTER.
- For hold time, enter the number of hours you plan to raku and press ENTER.
- The controller will display CPL for Complete and you may press START to begin heating your kiln.

The program will be saved in the User program number you selected until new information is entered in the select program.

Around 1900-1950º Fahrenheit the rakuing process will begin to take place. You can tell the ware is ready to remove by its shiny, wet appearance. Raise the firing chamber; remove pieces with tongs and place in reduction containers as quickly as possible. Once ware is inside the container add more reduction material and cover within 15 seconds to ensure efficient smoking. (It is not how much reduction material you use, but how fast you can get pottery ware into the container and covered that provides exceptional raku pieces.) Keep container covered for 15 minutes - 1 hour. After ware has cooled, wash each piece to remove soot and carbon.

Olympic Raku kilns are designed to maintain their temperature (even when the firing chamber is lifted) so that you can continue the rakuing process without interruption. Once ware is removed from the kiln and placed in reduction containers, new items may be loaded in the kiln. You may also want to place items on top of the raku-firing chamber (on the outside) that you will be rakuing next so that they are preheated before placing in the kiln.

TopHat models – Program the controller and use the lid element when the segment in the program for fusing glass is desired. TopHat and Electric Raku model controllers can use the Vary Mode on the controller to create programs or use the Cone Fire table for pottery and ceramic firings.

Loading Kiln for Pottery & Heat-Treating Models

Follow these instructions when loading your kiln:

1. Load only bone-dry greenware (unfired clay shapes) into the kiln. Wet ware may crack on firing or even explode resulting in damage to the other ware or the kiln. Ceramic greenware should be dried for at least two days with larger or thicker pieces requiring even longer. Glazed (painted) ware should dry for six hours before firing.
2. 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.
3. It is best not to load pieces directly on the kiln bottom.
4. The bottom layer should either be stilted or loaded on a shelf supported 1/2 inch from the bottom to allow adequate air circulation and heat distribution.
5. Place small, low pieces on the bottom layer, and taller pieces on the top shelf. This enables loading with shorter posts.
6. Allow at least one element groove between every shelf. If your kiln has a blank ring, let at least two element grooves contribute to the heating of the blank space.
7. Do not jar or shake the kiln after loading has started since ware on a shelf could be knocked down or broken.
8. Keep shelves and ware at least 1 inch from the 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.
9. If large flat pieces are being fired, the edges should be placed between elements. This may eliminate possible cracking from uneven heating.
10. Place the shelves in the kiln carefully so the walls of the kiln will not be bumped and damaged.
11. If a witness cone is being used, the cone should be placed 3 inches behind the observation hole so it will be completely visible.

Loading Low Fire Bisque

Be sure the greenware is dry before loading. Greenware that feels cool is probably still damp. You can compare the temperature of the ware to be fired to an old piece of greenware that you know is dry.

Greenware can touch other greenware as well as the kiln shelves. Kiln washed shelves are not necessary when bisque firing.

It is best to fire a piece in its natural position, however large flat items such as wall plaques or clocks should be fired on a flat side to prevent ware from warping.

Thin cups may be fired upside down or stacked lip-to-lip if the rims are strong enough. Canisters and other pieces with lids should be fired with lids in place for a good fit.

Loading Low Fire Glaze

Do not place greenware and glazed ware in the same load. The gases emitted by the greenware clay body can cause discoloration of the glaze. If it is necessary to mix glaze and bisque in a load, the glazed pieces should be loaded in the lower part of the kiln with the greenware above it.

Do not load red family glazes, green, yellow, or yellow-green glazes, metallic or luster glazes with greenware. Allow a minimum of 2 inches of space around red glaze pieces. Again, if it is absolutely necessary to mix loads, always place the red glazes on a shelf below other items, which may contaminate.

Glazed pieces must not touch or they will stick together. At least 3/4 inch must be allowed between glazed pieces to prevent contamination from the release of bubbles and gases from other glazes.

Loading Kiln for Pottery & Heat-Treating Models

The tops of shelves and kiln bottom must be kiln washed to protect against drops of glaze. The kiln lid and the underside of shelves must be clean to prevent dust particles from falling on the glazed ware.

Glazed ware must be stilted and dry footed to prevent sticking to the shelves. (Dry footing is removing all glaze from the portion of the piece that will rest on the shelf. A wet sponge or piece of cloth can be used for this.) For low fire (cone 04, 05, 06) glazes, stilting is recommended. If a piece wobbles when stilted, it may fall during the firing. Be sure all stilted pieces are solid. Note: Be sure your hands are clean when loading glaze.

Loading Overglaze
(China paints, lusters, metallics applied over a glazed surface and fired.)
Overglaze ware is loaded in the kiln in the same manner as ordinary glazed pieces. Ware must be prevented from sticking by the use of stilts, and care should be taken so pieces do not touch each other.

Plates will fire best when supported by a rack or when placed on edge to permit even heating. Plates fired on edge may be supported at the bottom with stilts.

Spacing is important when firing lusters, to prevent contamination.

China paints should be applied in light coats, and fired between coats until the desired shade is reached. China paints applied too heavily will crack and peel.

Loading Porcelain Bisque
Porcelain is a high fire clay body, which vitrifies (becomes non-porous) when fired. Loading porcelain bisque and glazed ware is similar since both will stick to anything when being fired.

Stilts cannot be used to support porcelain bisque as they will adhere to the porcelain when heated to high temperatures.

Porcelain bisque and glaze are always fired resting flat on surfaces coated with high fire kiln wash. Two pieces of ware that are to be used together must be fired together, such as a piece with a lid. Powdered silica (flint) must be applied at any point where contact is made.

Hollow rolls of porcelain clay shaped to hold up the parts that may sag should support pieces that are likely to warp during firing. Apply silica at the points of contact to prevent the supports from sticking. To prevent distortion due to uneven heating, never place a piece of porcelain closer than 3/4 of an inch from the sidewalls of the kiln.

Loading Porcelain Glaze
Porcelain glaze requires loading which allows good spacing between the pieces with at least 3/4 of an inch between the piece and the kiln wall. All glazed ware should be dry footed since stilts cannot be used on porcelain. It is important to have a good coating of high fire kiln wash on the shelves and bottom of the kiln. Pieces with lids and other items, which have been fired together in the bisque, cannot be fired together in the glaze firing since they will stick together. Shrinking has already occurred in the bisque, so the piece will still fit after the lower temperature glaze fire.

Loading Stoneware
(A non-transparent clay body requiring a high temperature to vitrify – a glassy non-porous state caused by heat or fusion.)
Stoneware greenware items must be bone dry before firing. Stoneware should be handled and loaded in the same manner as porcelain. Stilting of greenware is not required. For glaze firing, the tops of the shelves must be coated with kiln wash, and the ware should be dry footed.

Kiln Firing for Pottery & Heat-Treating Models

Firing is probably the most important part of your ceramic work. All of your previous work on a ceramic piece can be spoiled and your kiln permanently damaged from careless loading or firing.

Firing is usually accomplished by bisque firing followed by a glaze firing. The bisque firing allows the dried clay to harden enough so it can be handled, yet remain porous enough to accept glazes or stains.

The bisque piece having been glazed or decorated is fired a second time to mature the decorative covering. Some pieces may require more than two firings.

Maturity of clays and glazes occurs at different times and temperatures. ***Always check the firing temperature recommended by the glaze manufacturer or clay supplier to be sure.***

If during a firing you suspect something has shifted inside the kiln or something is abnormal, ***shut the kiln off immediately.*** Allow the kiln to cool, check the load, reenter your program and re-fire as usual. The same procedure should be followed if the kiln shuts off by itself prematurely.

Standard Firing Schedules for Full Kilns

Firing times vary based on speed and cone desired. Firing a Slow Bisque to cone 04 may take up to 13 hours versus a Fast Bisque of 9 hours total firing time. A Slow Glaze may take up to 6 hours versus a Fast Glaze may only take 4 hours. Firing profiles for a Slow Bisque to cone 6 may take up to 15 hours, while a Fast Bisque to cone 6 may require 10 hours firing time. A Slow Glaze to cone 6 may require 7 hours firing time compared to a Fast Glaze reaching temperature in 4 hours. Always refer to the manufacturer's recommendations. Keep a record of your firings, so any deviations resulting in good firings may be repeated.

If kiln has a vent, skip numbers 1& 4.

1. If the kiln has a lid wedge, prop the lid after loading the kiln.
2. Plug all observation holes except the top, which should remain unplugged throughout the firing to allow a vent for fumes and vapors.
3. Key in the cone fire method you wish to fire.
4. After approximately 1 hour 45 minutes remove lid wedge and close the lid.
5. Allow kiln to fire until it shuts off.

A partially loaded kiln fires faster than a full one, so when firing partial loads, increase the length on LOW and MEDIUM to extend firing time.

Firing Ceramic Bisque

(A ceramic piece which has been fired, but not glazed.)

Bisque firing allows the clay to mature, and burns out any impurities which may be present. A fired piece is less likely to absorb moisture, which will cause cracking or "crazing" of the glaze during the glaze firing. Bisque should be fired at least one cone hotter than glaze (usually cone 05 or 04). Pieces likely to be subjected to thermal shock, such as cups and plates, should always be fired to cone 04.

Most cast pieces can be fired satisfactorily on a fast firing schedule. Heavy or thick pieces require a much longer firing schedule.

Kiln Firing for Pottery & Heat-Treating Models

Firing Underglaze
If the underglaze is applied directly to the greenware, the cone 05-04 bisque fire will also serve as the underglaze firing. Underglaze applied to bisque, should be fired within a range of cone 019-04 before the application of a glaze.

Firing Low Fire Glaze
(A coating of glass, which is fused to the surface of a clay body during firing. It serves to prevent the penetration of liquids, present a good wearing, easily cleaned surface, and decoration.)
Ceramic glaze fires like ceramic bisque except it should be fired per the manufacturer's specifications. Glaze firing can usually be accomplished faster than bisque firing since the critical moisture release has already occurred.

Check the glaze manufacturer's firing recommendations for the proper firing cone. Some glazes may require modification of the standard firing schedule to obtain satisfactory results. For example, red family glazes tend to come out better if the kiln is vented and fired rapidly.

Firing Overglaze
Overglazes are fired only to the softening point of the glaze, and are fired to lower cones than regular glazes. Most china paints, metallics and lusters are fired from cone 021 to 018.

China Paints
Check the manufacturer's cone recommendations for each color and type of ware being fired. Different china paint colors do not mature at the same cone even when fired on the same piece of ware. It is necessary to fire the colors maturing at the highest temperatures first, and add lower temperature colors and fire again. Colors mature at lower temperatures on ceramic pieces than on porcelain or stoneware due to the lower melting temperature of the host surface.

Firing Porcelain Bisque and Glaze
Porcelain is usually fired to cone 5 or 6. Porcelain bisque should be fired slowly. Porcelain may be bisque fired more than one time or soaked (hold time) for 30 minutes to obtain additional translucence. Porcelain glaze is not fired as high as porcelain bisque. Usually cone 3 is sufficient. Porcelain does not need to be supported to prevent warping during glaze firing but must be dry footed (removing all glaze from the bottom of the piece before firing).

Overglaze fired on porcelain is just like overglaze fired on ceramics only several cones hotter, usually cone 017-015. Overglaze may also be applied directly to porcelain bisque.

Firing Stoneware
Stoneware is usually bisque fired to cone 016-04 before glazing with an extended firing time to allow for the extra thickness of most stoneware pieces. Stoneware glaze applied to a bisque fired piece is fired on a normal heating cycle since the moisture has already been removed. Firing temperatures depend upon the glaze and stoneware body, however cone 1 to cone 8 are the most commonly used.

Kiln Cooling and Unloading
Your kiln is designed to cool best when untouched after it shuts off. Forced cooling such as withdrawing the observation plugs or opening the kiln door while the kiln is still hot, greatly increases the risk of damage to both the ware and the kiln.

The kiln should cool at least twice as long as it fired. Pieces should be removed from the kiln only after they are cool enough to handle with bare hands. If the ware is under fired, it may be fired again to maturity.

Kiln Troubleshooting for Pottery & Heat-Treating Kilns

Color Peels Off – This condition is usually the result of too heavy an application of the glaze, dirty bisque, most likely from oil or grease preventing adhesion of the glaze, or too rapid cooling.

Cracks – Cracks are sometimes caused by uneven or too rapid heating or cooling of the kiln. Check the crack to see if it was caused during the heating or cooling. If the edges of the crack are sharp, it was made during the cooling of the kiln. If the cracks are rounded or smooth, this indicates the crack occurred when heating. To prevent this in future firings, slow the heating rate, do not pull the observation plugs while the kiln is hot and never force cool the kiln.

Cracking sometimes is caused by glazes that are not compatible, such as a mug or vase with clear glaze on the inside and colored glaze on the outside.

Craters – Craters are due to under fired glaze, and can be salvaged by dabbing glaze in the craters and re-firing to a hotter temperature.

Crazing – This is a fine network of cracks on the glazed surface. It is caused by under fired bisque, incompatible thermal expansion between the clay and glaze, or cooling too rapidly. Crazing can be corrected by re-firing the piece one cone hotter than the original firing. Some crazing will not occur for several months after the firing. The solution is still to re-fire the piece.

Faded Decals – Check the decal manufacturer's firing recommendation. Fading is either from over or under firing. If under firing is the problem, re-fire to the proper cone. Little can be done to save an over fired decal.

Glaze Creeps – Bare spots appear in glaze surface after firing. This can be the result of dusty, dirty bisque, or oil and grease from dirty hands. The latter causes the glaze to repel from these spots. Under firing or firing the piece before the glaze dries will also cause creeping. To save the piece, apply additional glaze to the bare spot and re-fire.

Luster Problems – Lusters will flake or peel if too thickly applied, and will frost if over fired. To salvage the piece, fire to cone 06 to burn off the luster. Reapply the luster and re-fire.

Metallic Problems – Metallics will appear dull if applied too sparingly or under fired. Over firing or too heavy an application of glaze will result in cracking. Under fired metallics can be re-fired to the proper cone, while over fired metallics must be burned off at cone 06, reapplied, and re-fired.

Pinholes and Pitting – As glazes and clay bodies mature, volatile materials are released, resulting in boiling and agitation of the glaze. An incomplete firing cycle causes these bubbles to freeze, causing pinholes and craters. Pinholes can be caused by too rapid heating or cooling of the kiln.

Glaze Defects – Problems with fired ceramics can usually be traced to improper firing, poor color application, or some other correctable fault.

Black Specks – Usually the result of contamination from dirt. Contamination can be introduced by several things – a dirty brush, dirty green ware, dirty bisque, a dirty glaze container, or a dirty kiln. Make sure all of the above mentioned are kept clean.

Blistered and Bubbled Glaze – This condition is the result of bubbles frozen in the glaze as the kiln cools. The bubbles are caused by gases released from under fired bisque or glaze. The bubbles and blisters can be sanded down, covered with a thin coat of glaze, and re-fired to a hotter cone. The piece may be soaked (hold time) for 30 minutes at the conclusion of the re-firing.

Glass Firing Kilns

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

Consult your manufacturer's website for firing instructions.

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.oceansidecompatible.com/Pages/Resources
- www.bullseyeglass.com/Index-of-articles
- www.warmglass.com
- www.glasscampus.com
- www.slumpys.com/Company-Information/Company/Slumpys-Firing-Schedule

Kiln Loading for Glass & Heat-Treating Models

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 for Glass & Heat-Treating Models

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).

Smooth ceramic fiberboard shelf has marks or patterns.

Lightly sandpaper mark or pattern with high-grade sandpaper.

Kiln Firing Glass & Heat-Treating Troubleshooting

Glass Thickness & Volume Control

Bullseye white opal 0113 **Bullseye green transparent 1107**

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*

Kiln Firing Glass & Heat-Treating Troubleshooting

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 prefired 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 primered 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*

Kiln Firing Glass & Heat-Treating Troubleshooting

"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*

Electric Kilns 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 pilot light does not light up. If the fuse is in good condition and the pilot light 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 kin 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. Make sure the latch is closed.

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.

Repositioning Lid when Thermal Expansion Occurs

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).

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.

Electric Kilns 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.

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

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 your firing. Also check for any warping or cracks in the kiln shelves that might affect your firing.

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

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.

Repositioning Lid when Thermal Expansion Occurs

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.

Replacing Parts – Brick

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 loosened.
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. Some sanding may be necessary to ensure a proper fit.
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. Re-tighten the stainless steel jacket of kiln again during firing while the kiln is hot.

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

Replacing Parts – Floors & Lids

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.

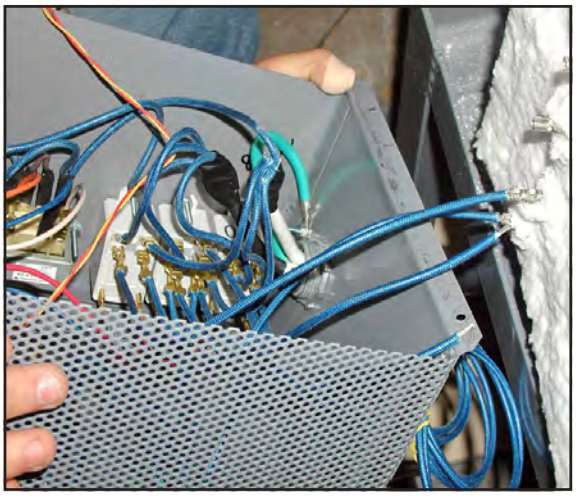
Lid Repairs
If the lid becomes chipped or damaged, simply smooth the surface of the hole with sandpaper and blow or vacuum clean. Kiln mortar may be spread thinly over the exposed brick to seal it and prevent dusting.

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.

Replacing Parts –
Electrical Box & Interconnecting Plug & Receptacle

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.



Replacement of Interconnecting Plugs and Receptacles on Stackable Electric Kilns
The interconnecting plugs and receptacles have changed over the years. To order replacement parts Olympic Kilns requires the model and serial number of the kiln and a description of the type inter-box plug and receptacle your model has.

Remove the electrical box that contains the part that needs replacing. Loosen the screws holding the interconnection to the electrical box. Note the position of the prongs and reinstall the new part in the same position. The interconnecting plug and receptacle can be ordered pre-wired and to replace the old part with new, remove and replace one wire at a time.

Old style Interbox Plug & Receptacle

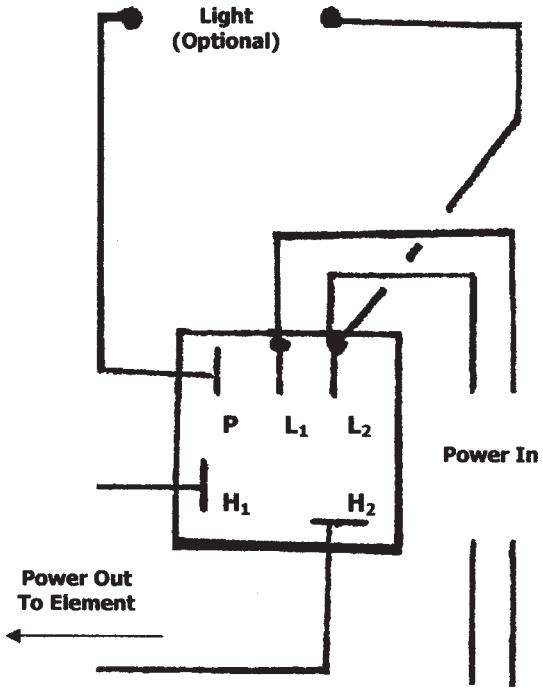
Twist 'n' Lock
Interbox Plug & Receptacle

Replacing Parts – Infinite Switch

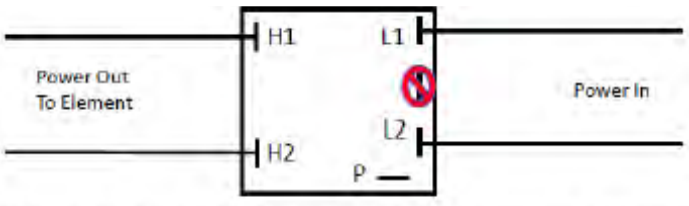
After the electrical box or boxes are removed from the kiln, the following repairs can be accomplished.

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.

120 volt Infinite Switch Schematic

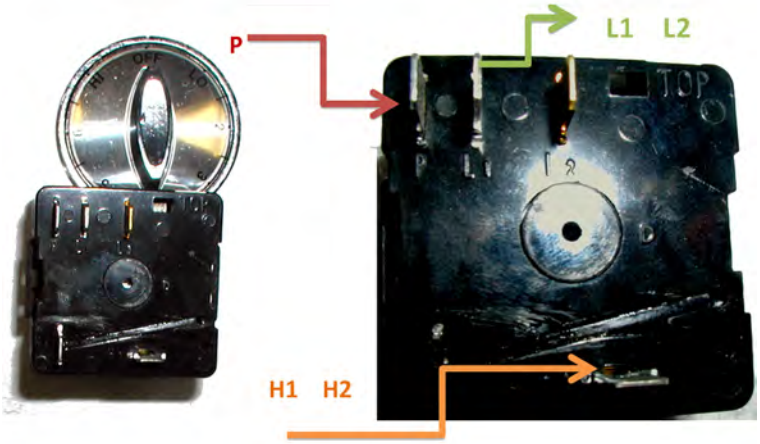


240 Volt Infinite Switch Schematic

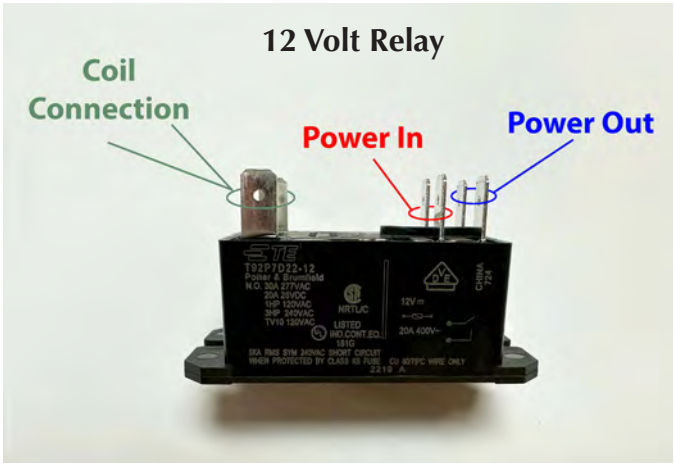


POWER IN: L1 IS THE TOP PIN (SILVER), L2 IS THE BOTTOM PIN (BRASS)

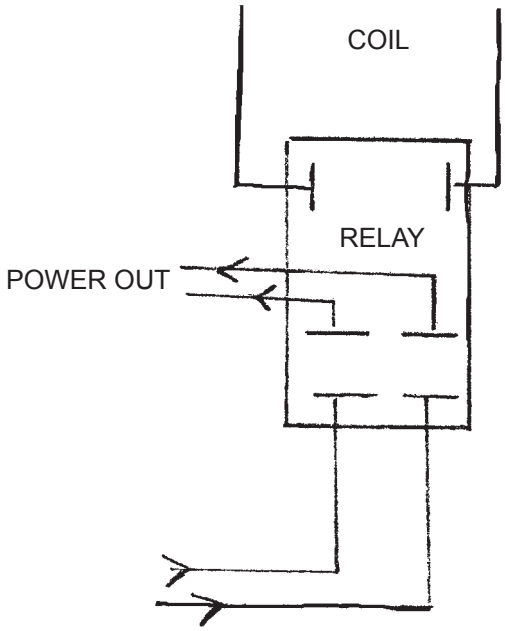
Infinite Switch with Wiring Diagram



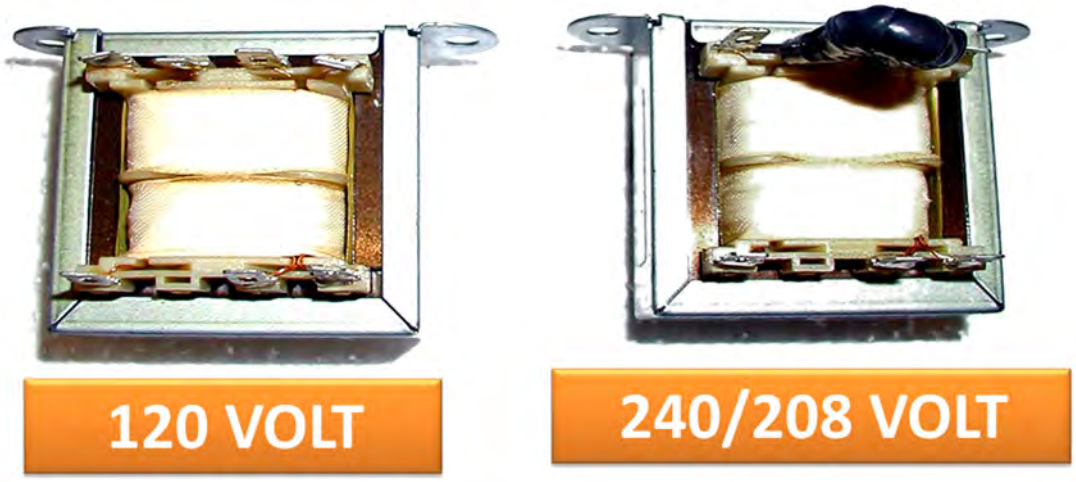
12 Volt Relay



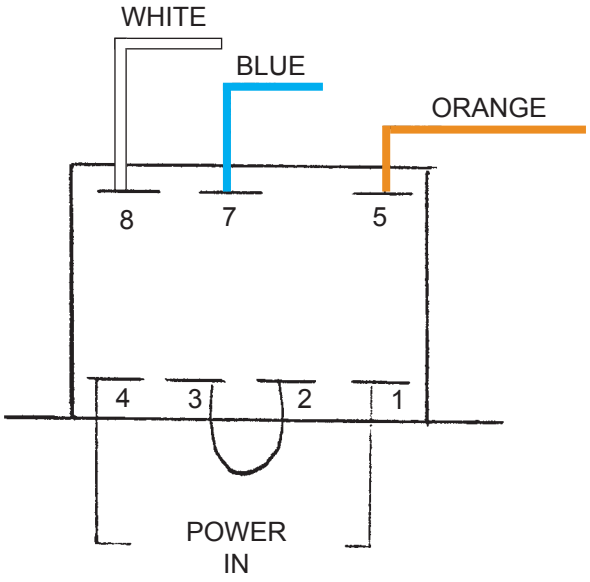
Wiring Schematic for 12, 120 & 240 Volt Relay



Replacing Parts – Transformer



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



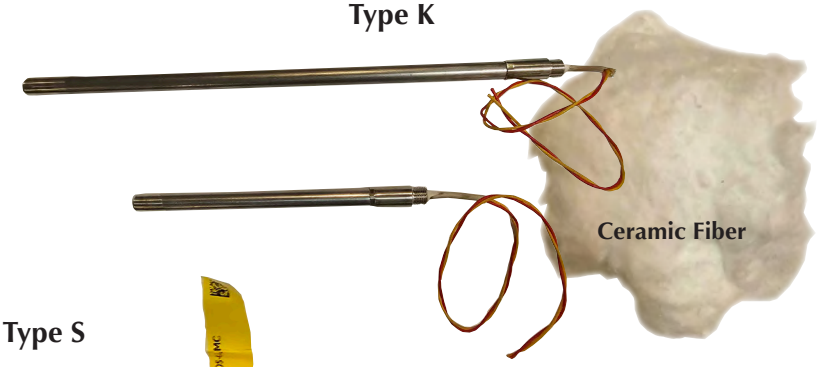
Replacing Parts – Thermocouple

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

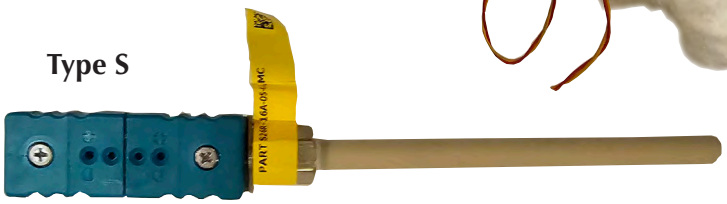
It is extremely important that the ceramic fiber enclosed with the thermocouple be used to eliminate any air space in the hole where the thermocouple is inserted. Failure to comply will result in a defective thermocouple. The thermocouple must be insulated from the inside of the firing chamber to avoid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

Set Screw

Type K



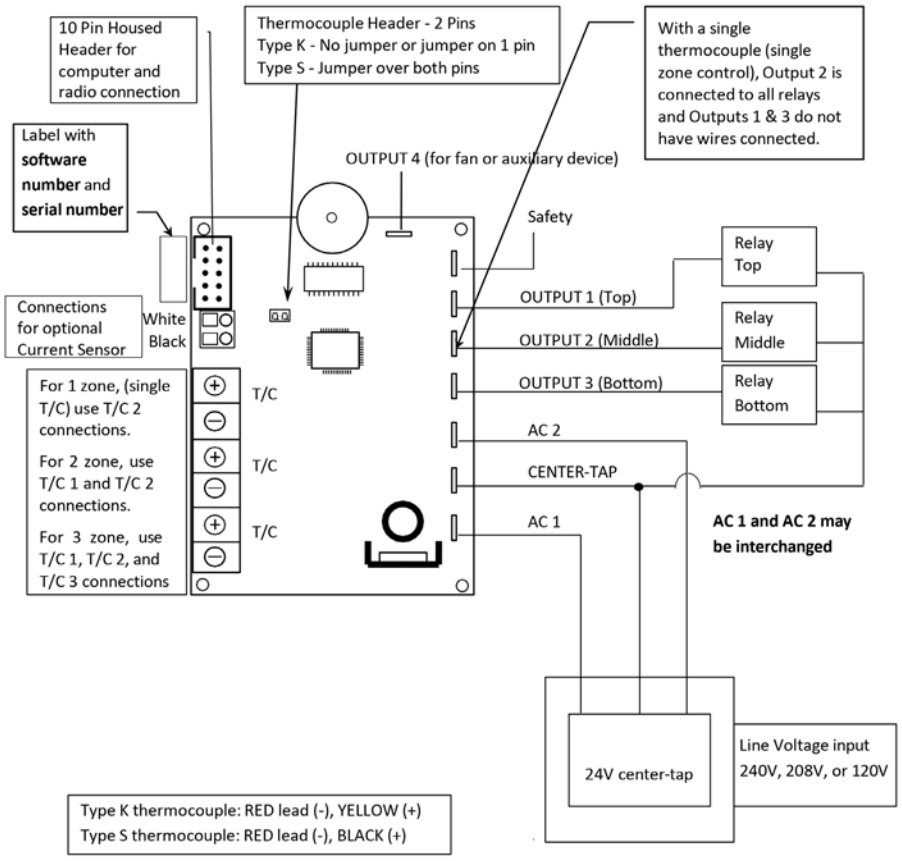
Type S



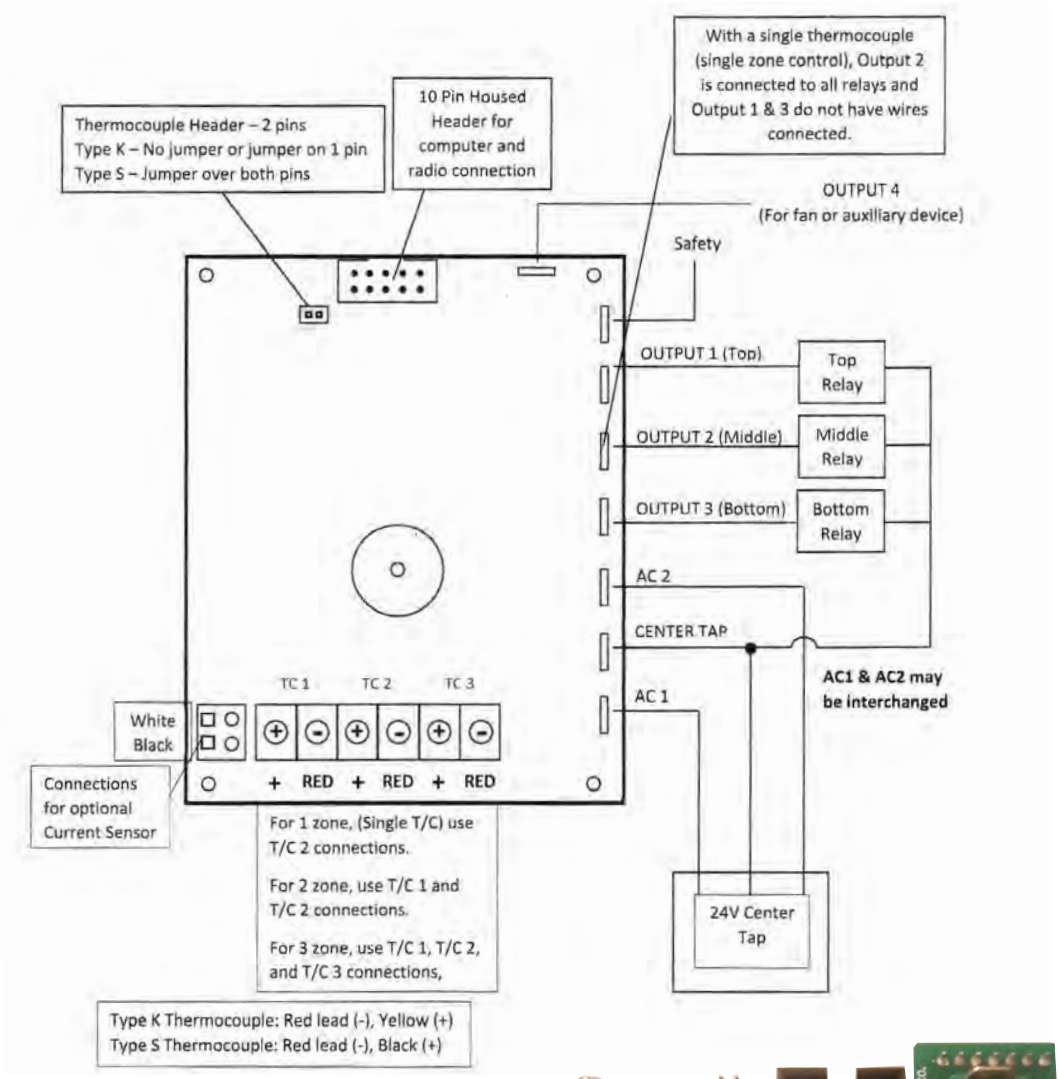
Steps to Replacing Thermocouple

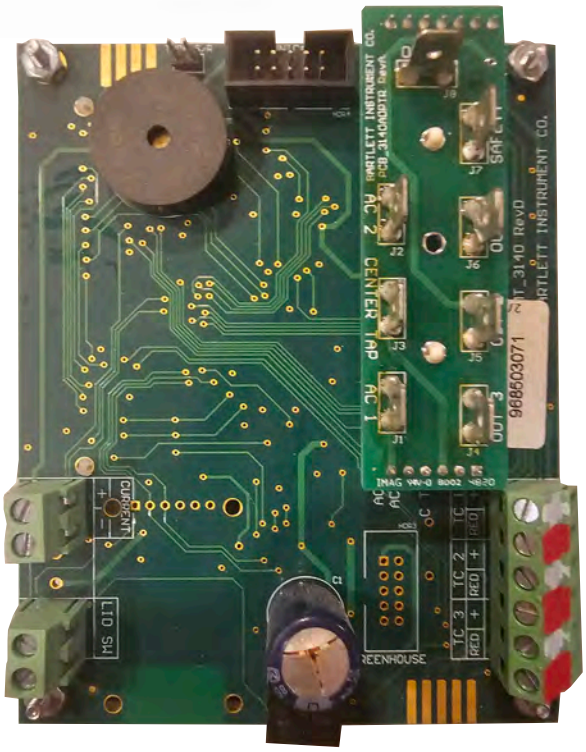
1. Remove the electrical box attaching the controller board to the kiln.
2. Loosen the set screw holding the defective thermocouple in the kiln and disconnect from the board.
3. Strip the new thermocouple's yellow and red wires (Type K) red and black wires (Type S) 3/8 of an inch.
4. Insert the new thermocouple approximately 1 inch inside the kiln firing chamber and tighten the set screw.
5. Attach Type K thermocouple yellow wire and Type S black wire to the positive connection on the electronic board and the red wires Type K & S to the negative connection on the electronic board. Each board has three connections for thermocouples. One thermocouple, one zone, if 2 or 3 zone, attach thermocouples for each zone.
6. Reattach electrical box to the kiln.

KilnStar Electronic Controller
Connection Diagram



Genesis Electronic Controller
Connection Diagram

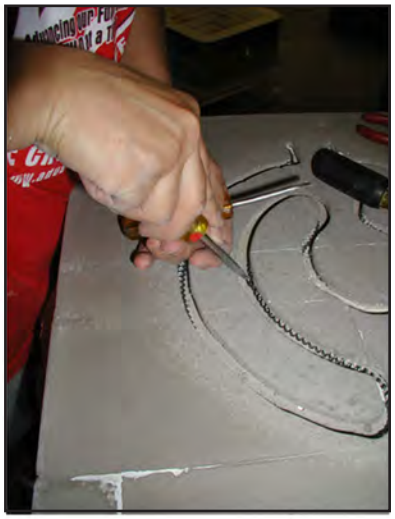




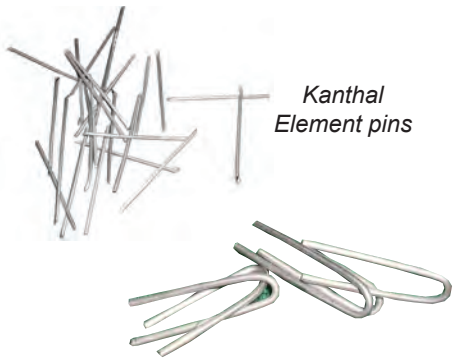
Replacing Parts – Elements

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.



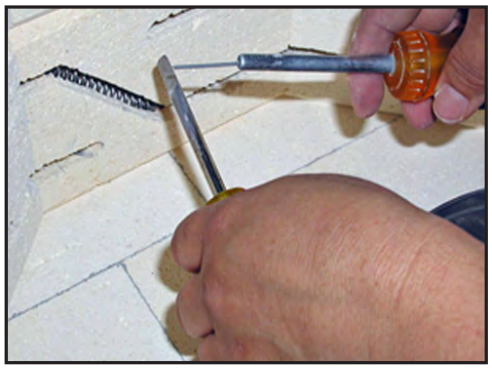
As a kiln ages, the element will begin to bulge. At this time the number of pins will not help keep the element in the lid. Your best solution is to replace the element with a new element.



U-shaped pins are used to pin elements in the lid element troughs of the Dual Media and Glass Fusing kilns.

Replacing Elements

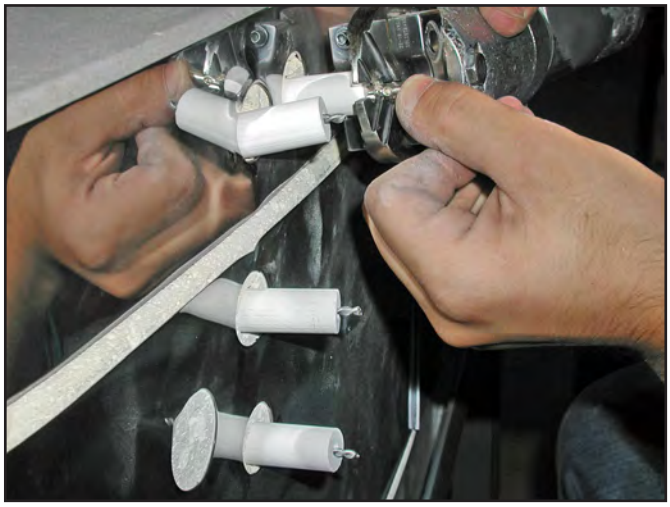
1. Turn off kiln and unplug or unwire if direct wired and remove all pins holding the defective element in the grooves. Cut the electrical connections inside the box at the high temperature connector.
2. Gently remove the old element taking care not to break or chip any bricks. Long needle nose pliers 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 and the element to sit properly in 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 – Elements

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

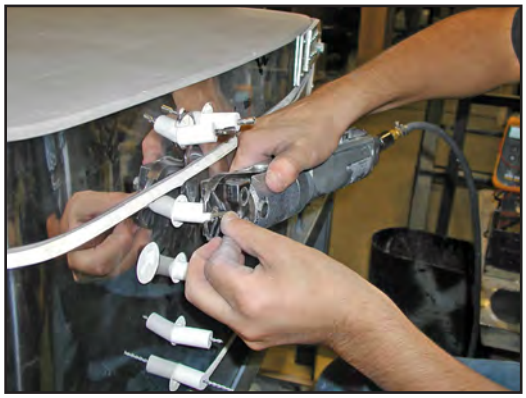
7. Place a high temperature connector in the jaws of the crimping tool and hold it lightly. Reach inside the kiln with the other hand and push the pigtail out. Slip the connector on the pigtail and crimp firmly in two spots.

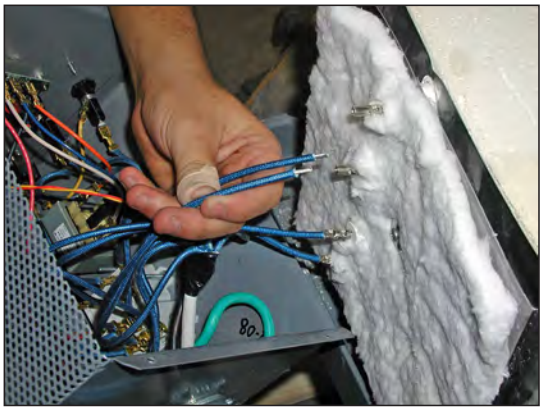
Crimping Tool

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

Replacing Parts – Elements

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.



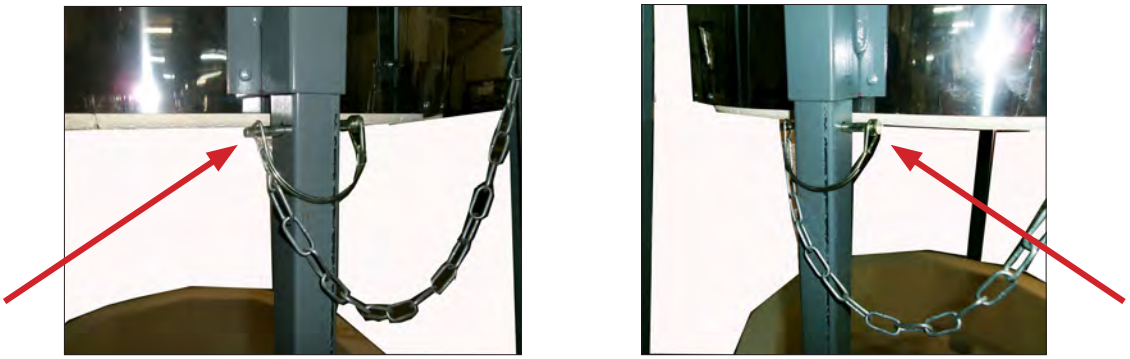


Lead wires from relay or switch strip and ready to crimp to high temp connectors

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.

If the chamber is in the open position, make sure the safety pin is in position to keep the chamber from dropping to the closed position.



Safety pin to hold chamber open and in place

Temperature Equivalent Chart for Orton Pyrometric Cones (°F) Cone Numbers 022-14

	Self Supporting Cones						Large Cones				Small
	Regular			Iron Free			Regular		Iron Free		Regular
	Heating Rate °F/hour (last 180°F of firing)										
Cone	27	108	270	27	108	270	108	270	108	270	540
022		1087	1094				N/A	N/A			1166
021		1112	1143				N/A	N/A			1189
020		1159	1180				N/A	N/A			1231
019	1213	1252	1283				1249	1279			1333
018	1267	1319	1353				1314	1350			1386
017	1301	1360	1405				1357	1402			1443
016	1368	1422	1465				1416	1461			1517
015	1382	1456	1504				1450	1501			1549
014	1395	1485	1540				1485	1537			1598
013	1485	1539	1582				1539	1578			1616
012	1549	1582	1620				1576	1616			1652
011	1575	1607	1641				1603	1638			1679
010	1636	1657	1679	1600	1627	1639	1648	1675	1623	1636	1686
09	1665	1688	1706	1650	1686	1702	1683	1702	1683	1699	1751
08	1692	1728	1753	1695	1735	1755	1728	1749	1733	1751	1801
07	1764	1789	1809	1747	1780	1800	1783	1805	1778	1796	1846
06	1798	1828	1855	1776	1816	1828	1823	1852	1816	1825	1873
05½	1839	1859	1877	1814	1854	1870	1854	1873	1852	1868	1909
05	1870	1888	1911	1855	1899	1915	1886	1915	1890	1911	1944
04	1915	1945	1971	1909	1942	1956	1940	1958	1940	1953	2008
03	1960	1987	2019	1951	1990	1999	1987	2014	1989	1996	2068
02	1972	2016	2052	1983	2021	2039	2014	2048	2016	2035	2098
01	1999	2046	2080	2014	2053	2073	2043	2079	2052	2070	2152
1	2028	2079	2109	2046	2082	2098	2077	2109	2079	2095	2163
2	2034	2088	2127				2088	2124			2174
3	2039	2106	2138	2066	2109	2124	2106	2134	2104	2120	2185
4	2086	2124	2161				2120	2158			2208
5	2118	2167	2205				2163	2201			2230
5½	2133	2197	2237				N/A	N/A			N/A
6	2165	2232	2269				2228	2266			2291
7	2194	2262	2295				2259	2291			2307
8	2212	2280	2320				2277	2316			2372
9	2235	2300	2336				2295	2332			2403
10	2284	2345	2381				2340	2377			2426
11	2322	2361	2399				2359	2394			2437
12	2345	2383	2419				2379	2415			2471
13*	2389	2428	2458				2410*	2455*			N/A
14*	2464	2489	2523				2530*	2491*			N/A

Pyrometric cones have been used to monitor ceramic firings for more than 100 years. They are useful in determining when a firing is complete, if the kiln provided enough heat, if there was a temperature difference in the kiln or if a problem occurred during the firing.

Cones are made from carefully controlled compositions. They bend in a repeatable manner (over a relatively small temperature range - usually less than 40° F). The final bending position is an indication of how much heat was absorbed.

Behavior of Pyrometric Cones

Typically, it takes 15 to 25 minutes for a cone to bend once it starts. This depends on the cone number. The cone bends slowly at first but once it reaches the half way point (3 o'clock), it bends quickly. When the cone tip reaches a point level with the base, it is considered properly fired. This is the point for which temperature equivalents are determined. Differences between a cone touching the shelf and a cone at the 4 o'clock position are small, usually 1 or 2 degrees.

Temperatures shown on the charts were determined under controlled firing conditions in electric kilns and an air atmosphere. Temperatures are shown for specific heating rates. These heating rates are for the last 100°C or 180°F of the firing. Different heating rates will change the equivalent temperature. The temperature will be higher for faster heating rates and lower for slower heating rates.

Cone bending may also be affected by reducing atmospheres or those containing sulfur oxides. Orton recommends the use of Iron-Free cones for all reduction firings (cones 010-3). If a cone is heated too fast, the cone surface fuses and binders used to make cones form gases that bloat the cone. If cones are to be fired rapidly, they should be calcined (pre-fired) before use. Cones should be calcined to about 850°F (455°C) in an air atmosphere.

If a cone is soaked at a temperature near its equivalent temperature, it will continue to mature, form glass and bend. The time for the cone to bend depends on several factors and as a general rule, a 1 to 2 hour soak is sufficient to deform the next higher cone number. A soak of 4 to 6 hours will be required to deform two higher (hotter) cones.

for more information on pyrometric cones, contact Orton or visit us at www.ortonceramic.com

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These tables provide a guide for the selection of cones. The actual bending temperature depends on firing conditions. Once the appropriate cones are selected, excellent, reproducible results can be expected. Temperatures shown are for specific mounted height above base. For Self Supporting - 1¾"; for Large - 2"; for Small - 15/16". For Large Cones mounted at 1¾" height, use Self Supporting temperatures. * These Large Cones have different compositions and different temperature equivalents.

Temperature Equivalent Chart for Orton Pyrometric Cones (°C) Cone Numbers 022-14

	Self Supporting Cones						Large Cones				Small
	Regular			Iron Free			Regular		Iron Free		Regular
	Heating Rate ˚C/hour (last 100˚C of firing)										
Cone	15	60	150	15	60	150	60	150	60	150	300
022		586	590				N/A	N/A			630
021		600	617				N/A	N/A			643
020		626	638				N/A	N/A			666
019	656	678	695				676	693			723
018	686	715	734				712	732			752
017	705	738	763				736	761			784
016	742	772	796				769	794			825
015	750	791	818				788	816			843
014	757	807	838				807	836			870
013	807	837	861				837	859			880
012	843	861	882				858	880			900
011	857	875	894				873	892			915
010	891	903	915	871	886	893	898	913	884	891	919
09	907	920	930	899	919	928	917	928	917	926	955
08	922	942	956	924	946	957	942	954	945	955	983
07	962	976	987	953	971	982	973	985	970	980	1008
06	981	998	1013	969	991	998	995	1011	991	996	1023
05½	1004	1015	1025	990	1012	1021	1012	1023	1011	1020	1043
05	1021	1031	1044	1013	1037	1046	1030	1046	1032	1044	1062
04	1046	1063	1077	1043	1061	1069	1060	1070	1060	1067	1098
03	1071	1086	1104	1066	1088	1093	1086	1101	1087	1091	1131
02	1078	1102	1122	1084	1105	1115	1101	1120	1102	1113	1148
01	1093	1119	1138	1101	1123	1134	1117	1137	1122	1132	1178
1	1109	1137	1154	1119	1139	1148	1136	1154	1137	1146	1184
2	1112	1142	1164				1142	1162			1190
3	1115	1152	1170	1130	1154	1162	1152	1168	1151	1160	1196
4	1141	1162	1183				1160	1181			1209
5	1159	1186	1207				1184	1205			1221
5½	1167	1203	1225				N/A	N/A			N/A
6	1185	1222	1243				1220	1241			1255
7	1201	1239	1257				1237	1255			1264
8	1211	1249	1271				1247	1269			1300
9	1224	1260	1280				1257	1278			1317
10	1251	1285	1305				1282	1303			1330
11	1272	1294	1315				1293	1312			1336
12	1285	1306	1326				1304	1324			1355
13	1310	1331	1348				1321*	1346*			N/A
14	1351	1365	1384				1388*	1366*			N/A

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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, Thermocouples and Kiln Furniture are not covered under warranty.

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Haugen Manufacturing, Incorporated guarantees to the original purchaser that any defects in OLYMPIC KILNS which become apparent within two years (one year for the Kiln Sitter and Safety Timer equipped kilns 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.

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