



FOR OVER 50 YEARS... THE KILN TECHNOLOGY LEADER

6B Mt. Pleasant Drive " P.O. Box 2409 " Aston, PA 19014

Phone: (610) 558-3899 " Fax: (610) 558-3698

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# G SERIES "Colorado"

## KILN INSTRUCTIONS

### **INSTRUCTIONS FOR G SERIES GLASS KILNS**

*You are now the proud owner of an L&L "G" Series Glass Kiln, engineered to give you the utmost in performance and results. This is an expensive and potentially hazardous appliance (if not used with proper caution). PLEASE TAKE THE TIME TO READ THESE INSTRUCTIONS. There is important information that you need to understand to operate your kiln safely and properly.*

#### **BASIC DESCRIPTION**

These are front loading glass kilns with a maximum temperature rating of 2000°F. There is a wide opening suitable for most glass working procedures. The kiln can be used for a variety of glass processes including glass slumping & fusing, lamp working, annealing, staining and laminating. In addition the kiln can be used for many other hobby and industrial uses.

#### **FEATURES**

- DYNA-GLOW' Ceramic Element Holders provide easier maintenance and more efficient firing of the kiln, *help prevent dusting!*
  - Spring Loaded Counterbalanced Vertical Door
  - Long Life Low Watt Density Elements
  - Stainless Steel Case; Heavy Duty Steel Base.
  - Elements in the roof and the sides near the top only.
- Door Cut Off Switch shuts power off to the elements when the door is opened - an important safety feature!
- Low power operation.
  - Finest Quality insulating Firebrick with reflective ceramic coating - reduces dusting, aids brick life and increases operating efficiency. 3" firebrick on top (for extra strength), 2-1/2" firebrick on other surfaces.
  - Manual Infinitely Variable Input Switches - 1 for the roof element circuit, and 1 for the side elements circuit - to adjust thermal gradients.

- 50 Amp 240 Volt Power plug included. Wiring is color coded and numbered for easy troubleshooting and repair.
- Optional ceramic hearth plate available.
- Standard Indicating Pyrometer and Thermocouple is included (unless control is ordered).
- Optional Program Control, Digital Type - Controls can be easily added at any time with just three wires!
- Other types of holding or limit type Digital Controls are available.

#### **CHECKING SHIPMENT**

*Your kiln was carefully packed and inspected prior to shipment to make sure that your kiln and accessories were in perfect condition.*

*When carrier makes delivery, you should immediately unpack your kiln and accessories to ascertain whether or not any damage has occurred in transit.*

*If damage has occurred, retain all of the packaging material, and notify the delivering carrier at once, requesting an inspection report. Retain all papers to insure that a proper claim can be filed. We will assist you in any way possible with your claim; however, filing and collecting on freight claims is the receiver's responsibility.*

## **PREPARATION**

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1. Unpack kiln carefully and remove all packing material including the plywood base or skid if included.
2. Install kiln in well-ventilated area.
3. Make certain floor or bench is not flammable and install no closer than 12" to any wall.
4. Make certain the area is free of moisture and is under cover and protected from the weather.
5. Be sure to allow air to ventilate from underneath the kiln base. It is important to the controls and wiring so get good air circulation. Do not operate without the included rubber legs.
6. Install the hearth plate (if you purchased this accessory) on its 1/2" high standoffs supports.
7. LEVEL THE KILN!

## **IMPORTANT CAUTIONS**

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1. **The G Series kilns are rated for use to 2000°F (1093°C). DO NOT FIRE ANY HIGHER THAN THIS.**
2. The kiln is heavy. Be sure to have several people help you when lifting or moving.
3. Have electrical installation performed by an electrician or other qualified technician. There is danger of electric shock.
4. Do not allow children near the kiln at anytime.
5. Kiln surface is extremely hot and will burn you if touched.
6. Do not leave the kiln while firing. **NO AUTOMATIC SAFETY DEVICE IS FOOLPROOF! BE ESPECIALLY CAREFUL ABOUT ATTENDING THE KILN WHILE IT IS SUPPOSED TO SHUT OFF.**
7. Kiln should be located at least 12" from any wall.
8. The floor or bench should be protected from the heat if it is combustible. **IMPORTANT NOTE:** If kiln overfires certain materials such as glass or glazes can reach superhot temperatures because they become electrically conductive and can melt. This can burn through the kiln bottom and, if there is a combustible floor, cause a fire. Be sure to protect against this possibility.
9. Check temperatures around the kiln when it is at high fire to be sure that you are not creating an unsafe condition.
10. Do not let the kiln's power cord or wire connection come in direct contact with the kiln side. The kiln could melt the cord covering and potentially cause a short circuit.
11. Do not put sealed containers or combustible materials in kiln.
12. Keep all flammable and combustibles away from kiln. Examples are solvents, curtains, rags, etc.
13. Operate in a well ventilated area.
14. Read the control instructions as well as these and other general instructions that come with your kiln - **BEFORE OPERATING THE KILN!**
15. Use dark glasses to view inside the kiln through the peephole when firing.

16. Do not apply kiln wash to the brick sides, element holders or undersides of kiln shelves.
17. If you replace the door counterbalance spring be sure to also reinstall the safety spring that goes inside of this spring. This safety spring is there to protect you in case the main spring breaks while under tension.
18. Do not operate kiln with deteriorated wiring. Be sure to check this periodically.
19. Do not touch elements with any metallic device while the door is closed (for instance when you are inserting something through the slot in the door). Elements operate on high voltage and could electrocute you.
20. Do not use silica sand in the kiln (some people like to use this as a work support medium). The silica sand will attack the elements and thermocouples. It can migrate in the kiln from expansion and movement due to heat. If you must use sand to support or stabilize your load try alumina oxide sand. Also consider ceramic fiber blanket.
21. When replacing infinite zone switches, replace the electrical connectors. These electrical connectors will typically oxidize over time and this can cause overheating of the switch at the connection spade. This can in turn lead to early failure of the switch. Make certain that the new connectors are firmly crimped onto the wire. A crimping tool can be easily purchased from an electrical or hardware store. Evidence of this type of switch failure is discoloration at the spade terminals of the switch. This is not a warranty item.

## **REGULAR KILN MAINTENANCE**

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**To keep your kiln in top operating shape, we recommend the following minimum housekeeping:**

### **WEEKLY OR AFTER EACH FIRING**

1. Check element holders for possible contamination (pieces of clay, glaze, etc.). replace if necessary. Contamination may cause abnormal element failure.
2. Remove any glaze or glass that has splattered on the firebrick or shelves. **(USE SAFETY GLASSES WHEN DOING THIS)** Vacuum afterward.
3. Make sure bottom and shelves are coated with kiln wash. Brush off or vacuum off any loose particles from the kiln shelves.
4. Check each shelf for cracks (you don't want a kiln shelf to break when loaded and cause a disaster in the kiln).
5. Observe thermocouples (if used) for excessive corrosion which could lead to thermocouple failure.

### **MONTHLY(15 FIRINGS)**

1. Vacuum out kiln and element holders, repair any firebrick problems. **USE THE SOFT BRUSH ATTACHMENT ON YOUR VACUUM CLEANER.**
2. Check temperatures around kiln (at the high end of use).



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3. Check kiln plug and outlet box for excessive heat during firing (at the high end of use).
4. Repair any firebrick chips or gouges.

### **SEMI-ANNUALLY (90 FIRINGS)**

1. Check element resistance. Replace elements if resistance is more than about 9% of stated nominal resistance (see chart in back of instructions), or firing time has increased substantially.
2. Check tightness of case and retighten if necessary.
3. Check wires for deterioration or oxidation. Replace any that seem brittle or where the wire insulation has deteriorated or fallen off. Check terminals for oxidation (discoloration).
4. Check power connection terminals in the kiln for tightness. (Be sure to do this with the power disconnected (unplugged) for the kiln). If these terminals connections get loose heat can be generated and cause a fire.

## **SAFETY FEATURES OF G SERIES**

### **SAFETY AUTOMATIC DOOR SHUT-OFF LIMIT SWITCH**

This switch is a limit switch that is designed to shut-off the power to the elements upon door opening of 1" (adjustable by bending sensing rod that controls lid support surface). To test: operate with your door open (also closed) and simulate action of door manually.

### **SERVICE FOR YOUR KILN**

L&L kilns are designed to be as easy to work on and fix as possible. Most of our customers are comfortable doing their own service. The TROUBLESHOOTING GUIDE provides many helpful tips and suggestions. You can also call your local distributor, most of whom service the kilns they sell. If they don't they may be able to direct you to a local kiln service person. Also try your local yellow pages. L&L may also be able to recommend a local service person. If you can't find a person experienced specifically in kiln repair, then a good electrician is often more than adequate to repair most of the types of problems that commonly occur. Some of the more difficult problems occur within the instrument panel. The panel/base can be removed and sent to the factory for repair. We are happy to answer technical questions on the phone. **HOWEVER; PLEASE TAKE THE TIME TO READ THESE INSTRUCTIONS AND THE TROUBLESHOOTING GUIDE BEFORE CALLING THE FACTORY FOR HELP. ALSO WE CAN NOT GIVE YOU ADVICE OVER THE PHONE ON HOOKING UP YOUR KILN TO YOUR ELECTRICAL SYSTEM. YOU MUST HAVE A QUALIFIED ELECTRICIAN WHO CAN PHYSICALLY SEE WHAT YOUR SPECIFIC ELECTRICAL SITUATION IS.**

### **WARRANTY**

See separate warranty for details on warranty. *We can only be responsible for defects in the kiln itself. L&L*

*purchases the shelves used in the kilns, and again, cannot assume any responsibility for defects or imperfections. Note that it is completely normal to experience hairline cracks in the firebrick. As the kiln heats up and expands this does not create a problem with the kiln. See the Troubleshooting Guide for more information.*

*Be sure to read and fill out the warranty form that is given with each kiln. Return the lower portion to our company, for filing purposes.*

### **KILN FURNITURE**

L&L supplies ceramic kiln furniture for all our kilns. Kiln posts of two crosssections are available. The larger, stronger posts are fluted square tubes approximately 1-1/2" square. The smaller posts are triangular posts. The square posts are available in 2", 4", 6" 8" 10" and 12" lengths. The triangular posts are available in 1/2", 1", 1-1/2", 2", 2-1/2", 3", 4", 5", 6", 8", 10" and 12" lengths. Three "post kits" are available which include a selection of posts. Kits for each kiln with a selection of posts and shelves are also available. See the price sheets for more information.

### **REPLACEMENT ELEMENTS**

Replacement Elements made by L&L Kiln Mfg., Inc. are designed for each individual model for long life and superior performance. Good element design is a complex balance of watt density, design voltage, stretch ratio, wire gauge, element length and material. It takes hours and years of experience to design a good element for each model. Do not expect an outside supplier with no interest in your kiln performance or long experience with L&L kilns to spend the necessary time to do this right. In the end you will not save money.

### **ELEMENT HOLDERS**

Any number of element replacements will not affect the hard ceramic element holders or brick walls, unlike other kilns where elements are pinned into the soft firebrick grooves. All pinning problems are eliminated and full firing space is always insured.

Dyna-Glow element holders secure and protect the elements so that the elements can not accidentally come out and cause damage to themselves, the kiln or your ware. Yet, replacement is simple.

Dyna-Glow element holders reflect the infra-red heat instantly into the kiln and therefore operate at a lower temperature relative to the internal kiln temperature. They require less firebrick insulation to be cut out. This means L&L Kilns are more efficiently insulated than other kilns of this type. This results in better, more accurate firing, lower electrical cost, lower case temperatures and, most significantly, longer element life.

Dyna-Glow element holders have a hard smooth sur-

face. This allows the elements to expand and contract freely. No loose particles will fall in the kiln and ruin ware. Element life is longer because elements do not get easily snagged and bunched up (which causes hot spots and burn outs).

**See the TROUBLESHOOTING GUIDE for information on how to replace elements and element holders.**

## **POWER SUPPLY**

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### **VOLTAGE**

G Series kilns are wired to work on either 240 Volt Single Phase, 240 Volt three Phase, 208 Volt Single Phase or 208 Volt Three Phase. (3 Phase is only available of the G2423 models). It is important that the kiln be hooked up to the proper voltage. 208 volt kilns hooked up to 240 volt power supplies will generate too many amps. 240 volt kilns hooked up to a 208 volt power supply will heat up about 25% slower than they should and may not reach the higher temperatures. Although it is possible to hook a single phase kiln to one leg of a three phase supply it will cause an unbalanced load on your electrical supply. **CHECK WITH A QUALIFIED ELECTRICIAN.** It is best to get a three phase kiln for a three phase power supply. In addition to the power wires there is, on all L&L kilns, a ground wire. The ground wire is not used as a neutral (i.e. no electricity normally flows through the ground). **BE SURE TO GROUND THE KILN PROPERLY USING THE GROUND WIRE.**

### **ELEMENT VOLTAGE**

The elements on all G Series kilns work on line voltage (208,220 or 240 volts). Elements may be wired in series or parallel depending on the kiln. See your wiring diagram.

### **POWER HOOK UP**

From the wiring diagram, have your electrician install the proper receptacle and safety switch at your kiln location. Note that L&L has available 50 Amp NEMA 6-50F receptacles from stock if you can't find them locally. Have receptacle placed in such a manner that the plug-in cord can in no way touch the body of the kiln. 3 Phase models hook up permanently to power supply. Be sure that your fuse ampere capacity is enough to carry the electrical load required. Also, ensure that your power lines are heavy enough to carry the required electrical load. If this is being used in an industrial application or environment be sure to follow lock out/tag out requirements and procedures. Be sure to ground kiln properly.

### **WHY PROPER GROUNDING IS IMPORTANT**

All electrical appliances should be properly grounded. This can be to either a cold water pipe or proper system ground in your building. (NOTE: Grounding is normally provided in NEMA 6-50 type hook ups). If there is ever a short circuit (where the electricity flows through to the case or control panel and where you

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might touch it) you could be electrocuted if the kiln is not grounded. This is especially important with the high line voltage used on kilns. The higher the voltage the more easily it could flow through your body. In addition, because of the heat generated in a kiln, wires are subject to potential deterioration over time and expansion and contraction can move insulators and cause short circuits. **BE SURE TO REPLACE ANY DETERIORATED WIRES!**

## **ZONE SWITCHES**

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The top elements and side elements are on separate heating zones with a separate input control switch provided on the instrument panel. This type of switch will give you infinite control over the rate of speed of the firing. You can fire as slowly as you like, or as fast as the kiln is capable of attaining a certain temperature. Since this switch controls the amount of electrical current coming into the kiln, you can maintain a desired temperature manually. You use the pyrometer to see what degree or temperature the kiln is has reached. At the desired temperature, you simply turn the switch knob until the needle on the pyrometer is stationary. This is the procedure to balance out the heat input against the heat loss. **LOW** means a 22 1/2% on time setting, **MEDIUM** means a 50% on time setting and **High** a 100% on time setting on the infinite control switch. 240 Volt Switches are L&L Part No L-J-INF0/30 and 208 Volt switches are L-J-INF0/20. They can not be interchanged! The voltage rating of the switch is marked on the switch itself.

### **REPLACING INFINITE ZONE SWITCHES**

Often when an INFINITE ZONE switch burns out it exhibits overheating on the switch body at one of the spade connectors. When this occurs the mating female connector on the wire may not give good electrical contact if reused (due to oxidation which acts an electrical insulator). A bad electrical connection can lead to localized heating at this point. To reduce the possibility of the new switch we recommend replacing the female connector with a new connectors. You may also need to replace the wires (check to see if they look oxidized or burnt). If the switch body looks O.K. then you normally do not need to replace the female spade connectors. To replace the female spade connector simply cut off the old connector with wire cutters, strip the end of the wire, insert the stripped end of the wire into the new female spade connectors and squeeze very tightly with a squeeze tool such as pliers or an electrical squeeze connector tool (available at the hardware store).

## **PILOT LIGHTS**

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There is a pilot light for each switch. The red light will flicker on and off at all switch settings except **HIGH**. This is a normal operating characteristic of the switch and actually shows that it is functioning properly. The switch and light operate just like an oven control on the average electric range. The switches are designed to

maintain the temperature that you desire. When heat is required, the switch is on; when not required, it is off. The light simply shows when the switch is on or off. When your firing schedule calls for the switches to be set on HIGH, the switch will always be "on" and the light always stays illuminated. The red "pilot lights" are warning lights to guard against over-firing the kiln. At a glance you can check whether the kiln is on or off. If they are still on beyond the expected firing time, then check the kiln carefully.

### **PYROMETER**

The standard G Series kiln includes a pyrometer. To check thermocouple polarity place a match at the thermocouple to see that it reads up-scale. If the needle reads down-scale, reverse the thermocouple lead wires.

#### **PYROMETER ACCURACY**

You can check out the pyrometer against the cones: remember the most accurate readings are the cones. If your pyrometer is inaccurate do not make any adjustments, as the inaccuracy does not vary. When a cone goes over, simply note where the needle of the pyrometer is reading, draw a line at that point on the glass and mark the cone equivalent. From that point on, you are reading accurately with the cone.

#### **THERMOCOUPLES**

L&L Sells mostly Type K Chromel-Alumel thermocouples. These work by creating a slight millivoltage at the junction of the two dissimilar metals. This millivoltage varies proportionately with temperature. The thermocouple ends insert into a junction block. Into this junction block is also inserted precisely calibrated lead wire of varying lengths. The wires must touch with nothing in between and each wire must be of the correct polarity. See the Troubleshooting Guide for more information. Note that 8 gauge thermocouples (heavier duty than the standard 14 gauge thermocouples) are available if you are experiencing frequent thermocouple burn out.

### **KILN WASH**

Kiln wash the floor of the kiln and the upper sides of the shelves only. Apply the kiln wash to the thickness of a post card or 1/16th of an inch. The only purpose of kiln wash is to prevent any glaze that drips from a piece from sticking to the floor or shelves. This saves both the piece and the floor or shelves. If dripping should occur, simply remove dripping and cover the spot with new kiln wash. Kiln wash is a powder mixed with water to a light creamy consistency.

### **FIRST FIRING OF THE KILN**

On the first firing of the kiln fire it empty except for shelves and posts. Fire the kiln on low for two hours to bake out any moisture. Then set to medium for two hours and then increase enough to reach final tem-

perature. There is no need to fire the kiln to a higher temperature than you intend to use the kiln at. This first firing will bake out the brick, oxidize the elements and act as a final test of the kiln's operation before real use. Keep note of how long it takes to fire your first load under normal conditions. This will give you a benchmark to determine when the elements begin to "slow down."

### **OPTIONAL AUTOMATIC CONTROLS**

A variety of automatic temperature controls are available for the G Series. Please request separate bulletin for these controls. They can be added at any time. They easily plug into the four prong receptacle inside the panel. The control comes with a face plate to match the plate that the pyrometer is on. If one of these controls is included with your purchase you will receive a separate instruction manual for the control.

### **SPARE PARTS**

If you are operating in a production environment it is imperative that you stock certain spare parts if you must prevent down time. Do not rely on L&L to be your emergency supplier. While we do our best to ship parts quickly and to keep all parts in stock we can not be responsible for your downtime. We recommend the following parts be kept on hand:

- Complete set of elements
- Complete set of fuses
- One power contactor
- One Zone Switch
- Spare program control (if used)
- Spare thermocouple
- Several element holders
- 1/2 pint firebrick cement
- 1/2 pint grout
- 1/2 pint facing

### **TROUBLESHOOTING**

See the separate **TROUBLESHOOTING GUIDE** included with these instructions. **BE SURE TO READ THIS ALONG WITH THE SUGGESTIONS FOR IMPROVING ELEMENT LIFE. THERE ARE MANY HELPFUL POINTERS AND SUGGESTIONS.**

### **REMOVING THE CONTROL ASSEMBLY FOR REPAIR OR EXCHANGE**

1. Remove the four screws that hold the control assembly onto the control panel. (Do not remove the control itself from the assembly plate).
2. Unplug the four wire connector from the plug.
3. Plug in a new control assembly (if you are installing a new one) All wires and plugs are the same.

**ELECTRICAL SPECIFICATIONS**


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MODEL NO	VOLTS	PHASE	WATTS	AMPS	OHMS PER TOP ELEMENT	OHMS PER SIDE ELEMENT	FUSE SIZE
G1714 (208V)	208	1	3500	14.6	5.8	21.6	20
G1714 (240V)	240	1	3500	16.9	7.7	28.8	20
G2423 208V 1Ph)	208	1	7000	33.7	5.8	10.8	40
G2423 (240V (1Ph)	240	1	7000	29.2	7.7	14.4	40
G2423 (208V 3Ph)	208	3	7000	20.9	5.8	10.8	30
G2423 (240V 3Ph)	240	3	7000	18.3	7.7	14.4	30