



FOR OVER 50 YEARS... THE KILN TECHNOLOGY LEADER

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R SERIES

KILN INSTRUCTIONS

INSTRUCTIONS FOR R SERIES FRONT LOADING KILNS

You are now the proud owner of an L&L "R" Series Front Loading 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 kilns with a maximum temperature rating of 2350°F (1287°C). The kiln can be used for a variety of purposes including enameling, glass bead work, fusing, annealing, staining, ceramics, metal heat treating and melting as well as a variety of other industrial uses.

BASIC FEATURES

- **DYNA-GLOW' CERAMIC ELEMENT HOLDERS:** Provide easier maintenance and more efficient firing of the kiln, *help prevent dusting!*
- **LONG LIFE LOW WATT DENSITY ELEMENTS**
- **PULL DOWN COUNTERBALANCED DOOR.**
- **STAINLESS STEEL CASE;** Heavy Duty Steel Base.
- **ELEMENTS IN THE SIDES.**
- **DOOR CUT OFF SWITCH:** On models with an automatic temperature control built in there is a door cut off switch to shut power off to the elements when the door is opened - an important safety feature!
- **LOW POWER OPERATION.**
- **FIREBRICK CONSTRUCTION:** Finest quality insulating firebrick with reflective ceramic coating - reduces dusting, aids brick life and increases operating efficiency, 2-1/2" firebrick thick.
- **MANUAL INFINITELY VARIABLE INPUT SWITCH.**
- **120 VOLT POWER PLUG INCLUDED.**

- **OPTIONAL CERAMIC HEARTH PLATE AVAILABLE.**
- **STANDARD INDICATING PYROMETER AND THERMOCOUPLE:** included (unless control is ordered).
- **OPTIONAL PROGRAM CONTROLS** and single set point digital temperature controls.

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

1. Unpack kiln carefully and remove all packing material.
2. Install kiln in well-ventilated area.
3. Make certain floor or bench top 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.



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5. Be sure to allow air to ventilate from underneath the kiln base. It is important to the controls and wiring to 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

1. **The R Series kilns are rated for use to 2350°F (1287°C) or 2300°F (1260°C) on some models. DO NOT FIRE ANY HIGHER THAN THIS.** The element holders, elements and firebrick could melt.
2. Do not allow children near the kiln at anytime.
3. Kiln surface is extremely hot and will burn you if touched.
4. 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.
5. Kiln should be located at least 12" from any wall.
6. 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.
7. Check temperatures around the kiln when it is at high fire to be sure that you are not creating an unsafe condition.
8. Do not let the kiln's power cord come in direct contact with the kiln side. The kiln could melt the cord covering and potentially cause a short circuit.
9. Keep all flammable and combustibles away from kiln. Examples are solvents, curtains, rags, etc.
10. Operate in a well ventilated area.
11. Before opening kiln make sure that all switches are in the OFF position (so there is no power to elements). Make sure kiln is cooled down so you won't get burned.
12. Do not put sealed containers or combustible materials in kiln.
13. Read the control instructions as well as these and other general instructions that come with your kiln - **BEFORE OPERATING THE KILN!**
14. Use dark glasses to view inside the kiln through the peephole when firing.
15. Do not apply kiln wash to the brick sides, element holders or undersides of kiln shelves.
16. Do not operate kiln with deteriorated wiring. Be sure to check this periodically.
17. 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.

18. 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

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 that has splattered on the firebrick or shelves. (use safety glasses when doing this because glaze can be like broken glass). 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).
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 termi-



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nals connections get loose heat can be generated and cause a fire.

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.

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 kiln can be 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.**

SAFETY FEATURES OF R SERIES

SAFETY AUTOMATIC DOOR SHUT-OFF LIMIT SWITCH (on units with built in automatic controls only)

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.

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. 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 surface. 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.

120 VOLT POWER SUPPLY

From the wiring diagram, have your electrician install the proper receptacle and safety switch at your kiln location. Have receptacle placed in such a manner that



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plug-in cord can in no way touch the body of the kiln. The R523 needs a 20 amp 120 volt circuit (with a special plug). The R490 and R500 can be plugged into a standard 15 amp 120 volt plug. **BE SURE NOT TO USE THAT SAME ELECTRICAL CIRCUIT FOR ANY OTHER USE WHILE FIRING THE KILN (YOU COULD OVERLOAD THE CIRCUIT).** Be sure to use a grounded outlet. If this is being used in an industrial application or environment be sure to follow lock out/tag out requirements and procedures.

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. If there is ever a short circuit (where the electricity flows through to the case or control panel and where you 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!**

INFINITE SWITCH

The kiln includes an input control switch. 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 also maintain a desired temperature manually. (This requires a pyrometer system, as you must be able to know what degree or temperature the kiln is set for). 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. The R Series kiln uses a 120 volt INF switch (L&L Part No L-J-INF0/10). The voltage rating of the switch is marked on the switch itself.

REPLACING INFINITE SWITCHES

Often when an INFINITE 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 as 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 LIGHT

There is a pilot light. This red light will flicker on and off at all switch settings except HIGH. This is a normal operating characteristic of the switch and 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 light" can help 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. L&L Part No is L-G-PILO/00.

PYROMETER

The standard R 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. Both standard 14 gauge thermocouples and heavier duty 8 gauge thermocouples are available from L&L. L&L recommends the 8 gauge thermocouples when you are firing frequently to higher temperatures. (8 gauge is a thicker wire size and will last longer than the 14 gauge). Current models of the R Series have Red as the negative lead and Yellow as the positive



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lead. Some earlier models had black on the thermocouple for positive and yellow for negative with a separate lead wire on some that changed to red for negative and yellow for positive. Note that the negative wire on the thermocouple is magnetic Alumel wire while the positive wire in non-magnetic Chromel wire.

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.

OPTIONAL AUTOMATIC CONTROLS

A variety of automatic temperature controls are available for the R Series. Please request separate bulletin for these controls. They must be installed in the factory.

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 temperature. Fire it to cone 5 (2150°F). 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."

SPEED OF FIRING

Although the kiln may be capable of firing relatively fast this does not mean you should fire it as fast as it is capable of firing. The speed of firing will depend on what you are trying to accomplish. If you are firing ceramics, check with the glaze or clay manufacturer or supplier as to a recommended firing cycle.

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
- Zone Switch
- Door switch (if used)

- Spare control (if used)
- Spare thermocouple
- Several element holders
- 1/2 pint firebrick cement
- 1/2 pint grout
- 1/2 pint facing

BRICK REPLACEMENT

1. Remove back cover.
2. If elements are involved, remove ends from connection posts and remove element(s).
3. Loosen furnace sheath by unscrewing adjustable clamps (under furnace) enough to allow brick to move forward.
4. Remove brick section.
5. Replace with new firebrick section.
6. Align brick with front surface of other bricks.
7. Tighten clamps.
8. Replace element if appropriate.
9. Replace back cover.
10. Touch up brick interior with cement, facing or grout if necessary.

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.**

ELECTRICAL SPECIFICATIONS

MODEL NO	WATTS	AMPS	NO ELEM	OHMS PER ELEM
R490	1150	10.0	3	3.83
R500	1750	15.0	4	7.56
R523	2300	20.0	4	5.80

All R Kilns operate on 120 volts single phase (standard household current). Be sure to use the proper amperage circuit on the R523.

FOR MORE INFORMATION ABOUT FIRING CERAMICS

L&L Kiln Mfg. Inc. has available a book called Electric Kiln Ceramics written by Richard Zakin and published by Chilton. This is an excellent in depth review of clays, glazes and techniques developed exclusively for use in an electric kiln. Electric Kiln Ceramics begins with an introduction to the electric kiln and the various clays and glazes best suited to its use. Both commercial and homemade clays and glazes are discussed, and recipes are provided for slips and glazes for different firing temperatures. Special glazes (wood ash, majolica, tzu



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chou, and crystal glazes), the application of oxidation surfaces (intaglio glazing, painting, wax resist, and sgraffito methods), and loading and firing are also explored in depth. Health and safety information and advice on routine maintenance are included. More than 200 color and black and white photographs illustrate contemporary electric kiln ceramic work.

PYROMETRIC CONES

Pyrometric cones are made of clay and other minerals and are precisely formulated to soften when fired in a kiln. They will bend over when they have absorbed a certain amount of heat. The amount of heat is related to both time and temperature. They mirror fairly accurately what goes on in ceramic body and so can be a more reliable guide to firing than a thermocouple instrument. Differing materials in the cones result in different firing temperatures. The cones you are likely to use in an L&L kiln are numbered from Cone 022 to Cone 10 (coldest to hottest). The number is imprinted on the cone. Usually clay and glaze comes with a recommended cone to fire to. Be careful not to drop or expose to moisture your cones. There are two sizes, large and small. The small cones (1-1/8" tall) are used in the Dawson Kiln Sitter. The large cones (2-5/8" tall) are generally used in the kiln as a visual check of what is going on. When locating the large cones be sure they are placed so that their normal 8° angle is maintained. Typically you will place another cone of the next higher number next to the main cone. This cone should not quite bend over while the main cone should be bent totally over. Keep the cones a few inches away from the peephole site so it is not affected by cold drafts. Wear protective glasses when viewing inside the kiln.

TEMPERATURE EQUIVALENTS OF ORTON PYROMETRIC CONES

NOTE: the rate of temperature rise is during the last several hundred degrees of firing. Table is courtesy of The Edward Orton, Jr. Ceramic Foundation. Note that the kilns tend to slow down considerably in the higher temperature ranges to perhaps 50°F to 100°F per hour.

Cone Number	Large Cone	Large Cone	Type of Ware
	Deg F Equival at 108°F per hour temp rise	Deg F Equival at 270°F per hour temp rise	
022	1069°F	1086°F	
021	1116°F	1137°F	
020	1157°F	1175°F	
019	1234°F	1261°F	Overglaze Colors,
018	1285°F	1323°F	Enamels and Gold
017	1341°F	1377°F	
016	1407°F	1458°F	
015	1454°F	1479°F	
014	1533°F	1540°F	
013	1596°F	1566°F	
012	1591°F	1623°F	
011	1627°F	1641°F	
010	1629°F	1641°F	
09	1679°F	1693°F	
08	1733°F	1751°F	
07	1783°F	1803°F	Low Fire Fritted Glazes
06	1816°F	1830°F	Lead Glazes and
05	1888°F	1915°F	Low Fire Earthenware
04	1922°F	1940°F	
03	1987°F	2014°F	
02	2014°F	2048°F	
01	2043°F	2079°F	
1	2077°F	2109°F	
2	2088°F	2124°F	Semi-Vitreous Ware
3	2106°F	2134°F	
4	2134°F	2167°F	
5	2151°F	2185°F	
6	2194°F	2232°F	
7	2219°F	2264°F	China Bodies, Stoneware
8	2257°F	2305°F	and Porcelain
9	2300°F	2336°F	
10	2345°F	2381°F	