Blog #7,

Protecting Your Electricals

by Dudley Giberson

Years ago I was teaching a glass workshop at Penland School of Crafts in the scenic mountains of North Carolina. It's a beautiful place, and there are many stories from there..... here's a good one.

During this particular workshop we had a kiln that would mysteriously blow the breaker and shut the power off making it do a quick anneal if you know what I mean. When it was cold I did a look around and things looked pretty normal except there were some bare wires in the back joining the power lines to the element leads with split nuts. In those years various glass artists would come through the school and build or rebuild according to their preferences and it wasn't always to code. The element leads came out of the back and about an inch or so out, the power lines were connected using the split nuts, but nothing was tied down. These wires just stuck straight out. So when the element heated up the double twist part would move around just enough from the expansion to touch the other lead next to it, which caused a short that popped the breaker. A minute later the lead would cool off and move back to not touching anything so when you looked back there nothing was obviously the problem. The next time this happened, though, I saw a spark and had a "caught you" moment.

Usually when a breaker pops you think something is drawing too much juice and it needs a bigger breaker, etc. However, when I actually saw the bare wiring in the back of the kiln I was mortified. A person could so easily get Zapped to death with this set-up. So as a community glass class service project we built a connection board and a cover with ventilation.

This **Blog #7** is about how to build safe electrical connection boards for your kilns and ovens. This procedure is simple, inexpensive, and a totally easy project.

The Plan: Before picking up the hammer it is a great idea to make a sketch of what you are going to do, then make notations of the parts which will help you stay on course. Here we have a medium sized annealing kiln that has two elements of the E240-12-155 configuration. They are mounted in grooves in IFB brick walls. It is a Front Loader. A sketch of the kiln's electrical system is shown here in Fig. 1., to the right:

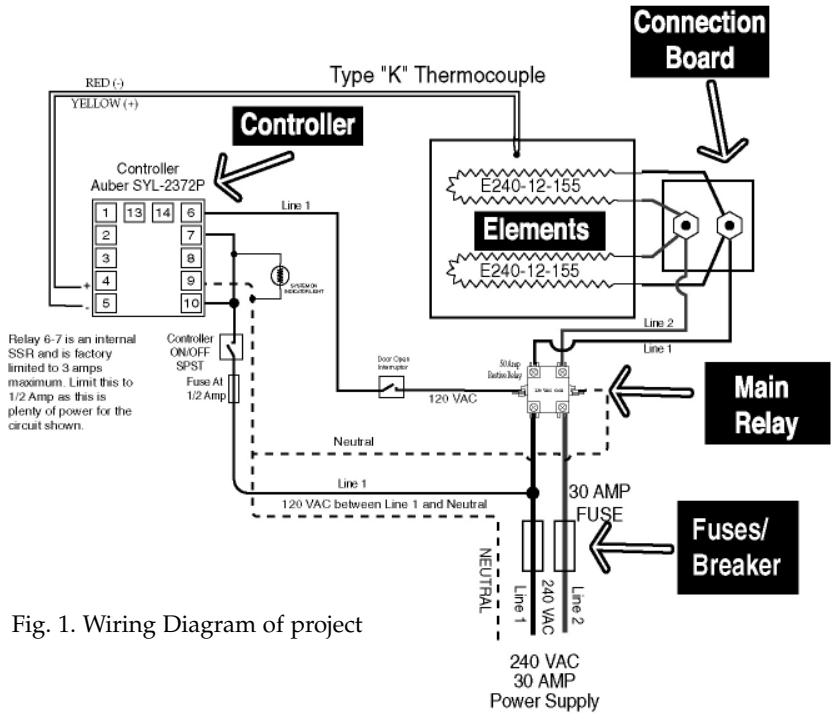

Fig. 1. Wiring Diagram of project

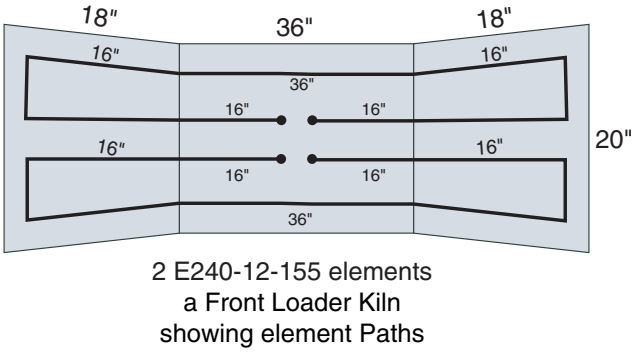

Fig. 2. Illustration of 2 element in Front Loader Kiln in what is termed a "butterfly installation"

Image to the left shows the element layout pattern for the kiln. The power connection board is located in the middle of the back where the element leads pass through the kiln wall. It is there where the element leads attach to the power source.

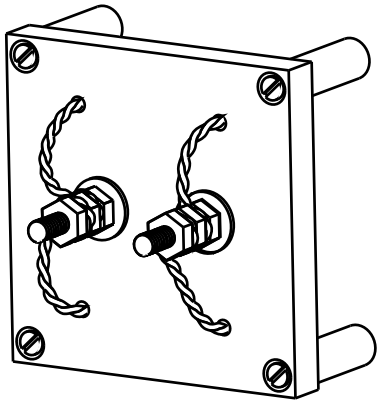

Fig. 3 Illustration of two elements attached to a pair of bolt stacks

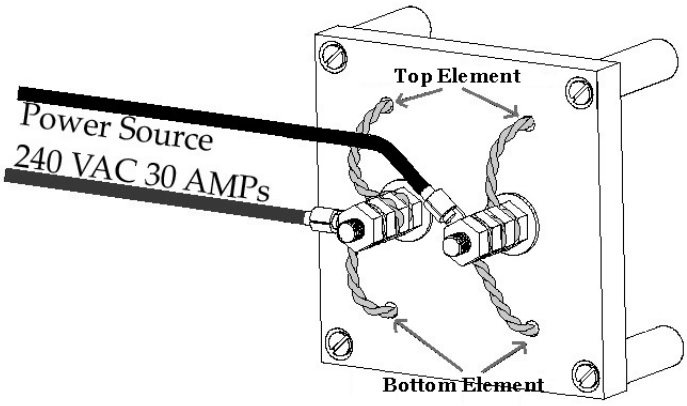

Fig. 4 Illustration of two elements attached to bolt stacks and also to the 240 VAC Power Source

Connection boards should be made of heat resistant and electrically inert material. My current preference is Hardy Backer Board which is cheap and available at every Home Depot. This material can be cut and drilled and shaped to fit your needs. Figs 3, 4, 5, and 6 show the general idea of the project. Basically it is to firmly attach bolts on the boards to create boltstacks to which we connect the element leads to the power source. This makes a connection scheme which will last your lifetime without needing adjustment. This will not be a future source of electrical failure. In the case of element replacement these nut/bolt connectors can be unscrewed and re-applied to new element leads if that is ever necessary.

There are several ways to attach the connection board to the kiln wall. You can either use sections of ceramic tubing or you can cut rectangular pieces of soft brick and drill a hole through them and use that for the stilt function. This costs next to nothing to install. This can be screwed directly into soft brick with sheet rock screws or into a metal shell with sheet metal screws. Another method for mounting the board is called the zig-zag frame shown here to the right., Fig. 5

For the bolt stacks I use brass bolts that are 1-1/4" long with a thread count of 1/4"-20. I prefer to use brass nuts and washers as these make the best electrical connections. **Do not use steel or iron** as they will rust. Stainless can be used but I think brass is better by reason of the fact that it is softer and will make a better connection when tightened. It is a better electrical conductor.

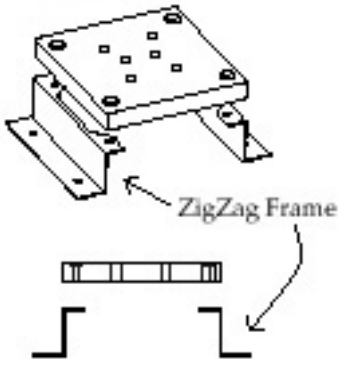

Fig. 5 Illustration of the zig-zag mounting system

Fig. 6. This illustration shows how to bend the double twist lead around the bolt post a total of 350 degrees to provide the best (flattest) contact area.

Once the leads are wrapped around the bolts, use washers and nuts to snug this to the bolt. Refer to Fig. 4. above as this shows how to add the power to the bolt stack. I use the yellow crimp fittings designed for 12-10 wiring and I solder with electrical solder to make a secure lifetime attachment.

Once everything is snug on the board, use sheet metal to construct a simple "U" shaped cover over the board as shown in Figs. 7a, 7b, & 7c. For this I use 18 gauge aluminum with covers of screening hardware cloth over the top and bottom for full chimney effect ventilation.

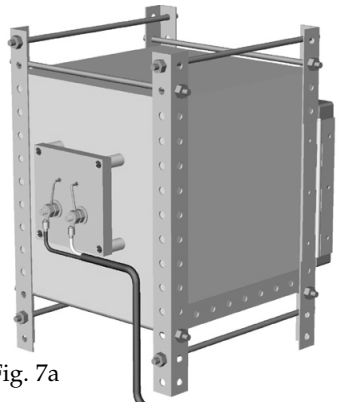

Fig. 7a

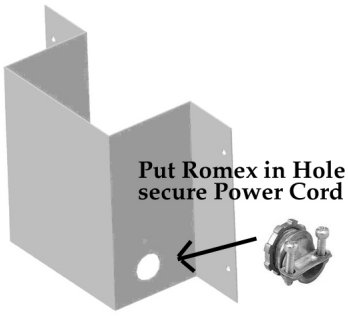

Fig. 7b

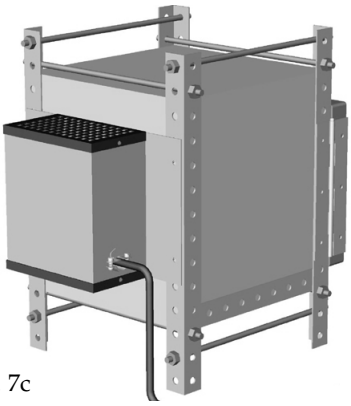

Fig. 7c

Fig. 7a, b, &c. The point here is to show the parts fitting together: the 4 x 4 connection board is secure on the back of the kiln. The final steps are to cut a piece of sheet metal and bend it to the approximate design shown in Fig 7b.And finally it is totally recommended to cover the box, top and bottom, to make a highly effective safe electrical connection board box and cover (Fig. 7c).

A word on Construction Technique and the tools needed to do this job:

1. Metal hand sheers.
2. 7/8" hole saw
3. A couple of 2 x 4 wood pieces x 10" long
4. A couple of "C" clamps
5. A hammer

If you don't have access to a regular sheet metal break you can use a pair of 2 x 4 boards with "C" clamps to hold the metal while you bend it as shown in Fig. 8 . You will need to hammer the seam to make it nice and square. Relocate the boards for each bend.

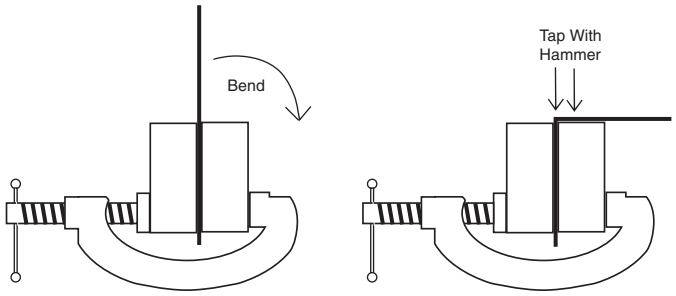

Fig. 8

Fig. 9 This is a metal hole saw size 7/8". Use with electric drill to make the hole shown in Fig. 7b. Then place a 7/8" Romex connector in this hole to securely hold your power cord in the side of your electric cover. That's it! You have built a safe and secure power connection box.

Fig. 10 This is a Romex Connector. It is used in Figure 7b.