

## Tooltorial - What tools do I need for kiln repair?

### Multi-Purpose Screwdriver

10-in-1 Screwdriver or a standard #2 phillips, 1/4" flat head and a 1/4" Socket Nut driver.



A mutli-purpose screwdriver is the best choice for working on your kiln since you can buy one tool that has mutlipe bits for different types of screws. Most kilns use standard #2 phillips screws, but sometimes you may encounter sheet metal screws that require a 1/4" hex head bit. If you have a 10-in-1 driver you can simply remove the small phillips/flat bit and use the holder as a 1/4" hex head driver.

### 8" Diagonal Wire Cutters

A pair of long handled wire cutters will make it easy to cut element pigtails to length and cut electrical wires. Smaller sized wire cutters will not give you adequate leverage to cut through element pigtails, so expect to spend around \$20 on a quality set of cutters.



### Crimping Tool

Skutt and Olympic Kilns use crimp on element connectors, which require a special crimping tool. This is the most (specialized) tool you will need for a kiln repair, but they are available at almost any hardware store. The longer the handles the better, since long handles will allow you to get more leverage when crimping.

In the close up photo you will see a dimpled side and a recessed side to the tool. When you are crimping connectors, always put the dimple on the side of the connector without a seam otherwise you may split the connector.

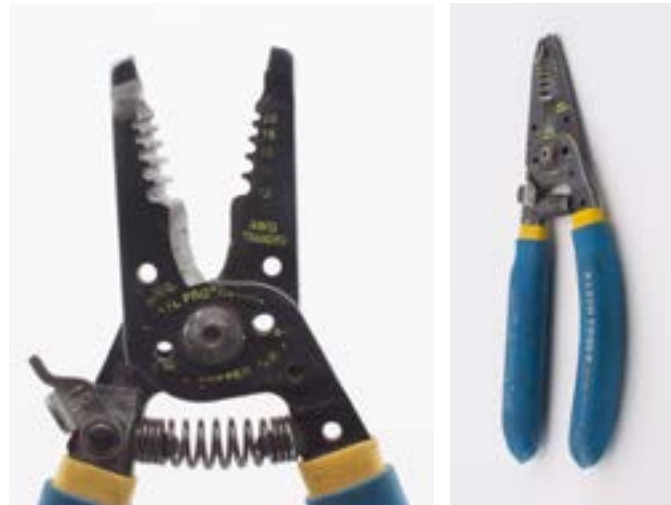
Most crimping tools will have a space on the jaws for an insulated connector and an uninsulated connector. The uninsulated crimp set is used for crimping connectors without plastic insulation such as an element connector. The insulated crimp set is for crimping connectors with a plastic cover such as feeder wire and harness wire connectors.

### Needle Nose Pliers

This one is pretty basic. A pair of needle nose pliers will help you remove and replace pins as well as help you pull female tabs off male tab holders without pulling the wires out of the connectors.



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### Wire Stripper Tool

A wire stripper is used to remove the insulation from around the metal wire.

A wire stripper has multiple teeth to remove insulation from different sizes of wire. Make sure to use the appropriate size for your wire, otherwise you may damage the wire.

When you are repairing electrical connections it's very important to remove enough insulation to expose untarnished wire. Any corrosion or oxidation on the wire will diminish its current-carrying capacity and result in burned connections.

### Long Nosed Multi-Purpose Tool

If you are on a budget or only plan to do repairs occasionally, you can save money by buying a multi-purpose tool. Home Depot sells a Klein Tools Long-Nose Multi-Purpose Tool that will cut wire, strip insulation and crimp element connectors. However, because this tool does three jobs it will never do them as well as a tool specifically designed to do one job. The multi tool will have a hard time cutting heavier wire and you will need to apply more force to adequately crimp element connectors.



### Electrical Meters

A cheap analog meter is around \$10. A cheap digital meter is around \$20 and an expensive digital meter can be \$120 - \$400. More expensive meters can have a clamp on amperage meter so you can test the amperage while the kiln is firing. An amperage meter is nice to have, but kiln problems can be diagnosed without one. Virtually any electrical meter can be used with electric kilns. It is not necessary to spend a fortune to be able to do basic repairs.



For more information on meters please see the two PDF files available at:  
<http://kilnparts.com/index.php/learn/>

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### Digital Multimeter

This meter was purchased at Home Depot for \$19.99 in March of 2013.

**WARNING** - Some electrical measurements are done with energized circuits and if you do not feel comfortable testing energized circuits DO NOT attempt to test them. Getting electrocuted can seriously hurt or kill you.



### Face of Digital Meter

When you are working on kilns you will predominantly use two settings on this simple Digital Multimeter. The meter has to be set before testing. This is a multimeter, meaning it tests multiple things, but it is not smart enough to know what you want it to test without you setting it.

1. Voltage, AC (NOT DC) or V~ (White Numbers on this meter at the top right) 200 or 600
2. Resistance, Ohms,  $\Omega$  (White Numbers at the bottom left on this meter) 2M, 200k, 2k, 200

If you have questions about what Voltage and Resistance are you didn't read the first section, "What Is Electricity?" For shame.... Go read it! I will wait...



### Reading the Meter - Voltage, AC

Warning - Voltage is always tested with live circuits. SO BE CAREFUL! If you do not feel comfortable testing live circuits, don't! Get help from a qualified person.

1. On this meter the AC voltage can be set to 200 or 600 as the max.
2. Always set the meter to the highest setting available to start and then, if needed, lower the setting for a more accurate reading.
3. The number shown on the screen is your voltage (no multiplication needed).

### Reading the Meter - Ohms, $\Omega$

Testing resistance is always done with the power off, so it's not as dangerous as testing voltage.

1. On this meter the resistance range can be set to 2m, 2M, 200k, 20k, 2k, 200
2. Start at the 200 Ohm Setting when working on kilns. If you get an OL reading turn the meter up to the next setting and try again. You will rarely get a reading over 200 Ohms when working on a kiln.
3. The number you see on the screen is your resistance in Ohms. Watch the decimal.



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# Analog Multimeter

This meter was purchased at Home Depot for \$9.99 in March of 2013.

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### Face of Analog Meter

When you are working on kilns you will predominantly use two settings on this simple Analog multimeter. The meter has to be set before testing. This is a multimeter, meaning it tests multiple things, but it is not smart enough to know what you want it to test without you setting it.

1. Voltage, AC (NOT DC) or V~ (Yellow/Tan Numbers on this meter)
2. Resistance, Ohms,  $\Omega$  (White Numbers at the bottom left on this meter)  $\Omega \times 10$  or  $\Omega \times 1K$

If you have questions about what Voltage and Resistance are you didn't read the first section, "What Is Electricity?" For shame.... Go read it! I will wait..



### Reading the Meter - Voltage, AC

Warning - Voltage is always tested with live circuits. SO BE CAREFUL! If you do not feel comfortable testing live circuits, don't. Get help from a qualified person.

1. On this meter the AC voltage scale is shown in black and labeled as V.mA
2. Always set the meter to the highest setting available to start and then, if needed, lower the setting for a more accurate reading.
3. Make sure to look at the correct scale. If you set the meter to 250V~ use the scale with the 250 labeled in black. Below it you will see scales for 50 and 10 as well.



### Reading the Meter Ohms, $\Omega$

Testing resistance is always done with the power off, so it's not as dangerous as testing Voltage.

1. On this meter the resistance scale is shown in green and labeled as  $\Omega$ .
2. Always set the meter to the highest setting available to start and then, if needed, lower the setting for a more accurate reading.
3. When testing resistance, it is necessary to use the green scale and multiply the reading by the number your meter is set to. For example, if your meter is set to " $\Omega \times 10$ " and you get a reading of 2, your resistance is 20 Ohms not 2 Ohms. If your meter is set to " $\Omega \times 1k$ " and you get a reading of 2, your resistance is 2000 Ohms not 2 Ohms. On a kiln you will almost always read between 0 - 50 Ohms and rarely over.