



# Firing

## Basics

► You can have as much control over the firing process as you want, if you apply a few simple rules and keep good records of your firings.

by Tom McInnerney, Process Engineering Manager, The Edward Orton Jr. Ceramic Foundation, Westerville, Ohio

**A**s a potter, you utilize your talent and skill to produce a ceramic piece that you see in your mind's eye from raw materials selected for their forming properties and their unique appearance. Once you have invested your time and ability into crafting your piece, you must complete the ceramic process by firing the piece in your kiln.

After the firing process is complete and you open your kiln, you experience the excitement that all ceramic artists feel. The mystery of what has taken place behind the closed kiln door has turned your clay object into a work of ceramic art. What takes place inside the kiln is a process you cannot see, and that can make you feel that you have little or no control over it. Not so! You can have as much control over the firing process as you want, if you apply a few simple rules and keep good records of your firings.

### In the Kiln

The first step in firing your ware is to place the ware into the kiln. Sounds simple enough, but proper ware placement is important. Large, tall items should be placed toward the center of the load and small, shorter objects to the outside. Think of the heating elements of your kiln as the sun. You want all of your ware to receive as much sun as possible.

Concern over the costs associated with firing your kiln would suggest that you want to load the kiln as full as possible. That's okay, as long as you remember this simple principle: The only way the kiln conveys heat to the ware before it reaches red heat is by convection (air movement), so you need to leave enough room between the pieces to allow for some air flow.

Now that you have loaded your kiln, you must decide if you have a heavy, intermediate or light load so you can utilize a suit-

able heating rate. If your kiln is loaded heavily, then you want to heat the kiln slowly to allow the ware inside to reach a uniform temperature from the outside to the inside of the load (or at least to minimize the difference). Figure 1 shows slow, medium and fast heating rates for a cone 6 firing.

Another technique for balancing the temperature inside the kiln is to add a soak or hold. Once your kiln has reached the maximum temperature, you will likely want to soak or hold the kiln at this temperature for a short period of time to allow the temperature inside the kiln to reach equilibrium.

If you have a light load, you can utilize a faster heating rate. How do you know if you've matched the load to the proper heating rate and soak period? The answer is to use pyrometric cones. Since ceramic materials reach fired maturity as a function of time and temperature, referred to by the term *heat work*, you need to be able to measure the heat work at various locations within your ware setting.

Ceramists have been using pyrometric cones to measure heat work for more than 100 years. Witness cones strategically placed within your kiln near the center and outside of your load and on each shelf will measure and record the heat work delivered to that location (see Figure 2). Once the firing is completed, visually inspect the cones and record the cone bending angle from each location in a firing logbook. Correlate the appearance of the cones to your ware to gain an understanding of what cones look like when the ware looks best.

### Other Firing Factors

Kiln manufacturers have made great strides in making their kilns "user friendly" by supplying them with electronic temperature

## FIRING BASICS

Firing Rate Comparison - Cone 6

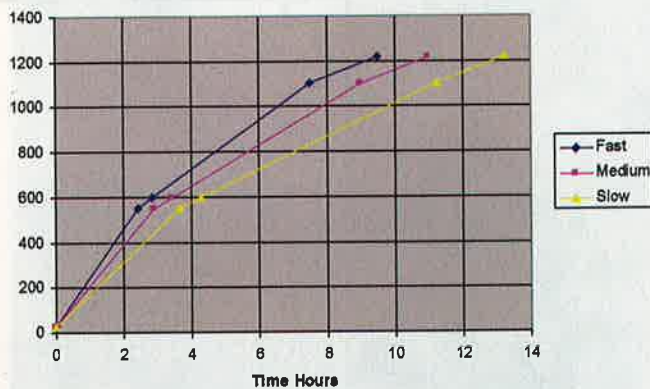


Figure 1. Comparison of a fast, medium and slow firing to cone 6.



Figure 2. Cones placed inside the ware setting allow you to verify that the desired heatwork has been achieved.

controllers, sizing the heating elements to provide a more uniform distribution of heat from top to bottom within the kiln, and adding more front-loading models to their product lines.

Some kiln manufacturers also provide a kiln venting option as part of their product line, and there are after-market venting options available as well. The fumes that evolve during the firing of ceramics result primarily from the organic materials in the raw materials, binders in the glazes, and suspension aids as they are burned off. The odors produced as these various materials burn off are usually unpleasant to anyone exposed to them.

Potters have two options to remove the fumes from the room where the kiln is located. The first option is to allow the fumes to exit the kiln into the room and then use a whole room vent to remove the tainted air from the room. The preferred, and most economical, method is to vent the fumes directly from the kiln (the fumes do not escape into the room), dilute them with fresh air and then exhaust them to the outside (see Figure 3, p. 24).

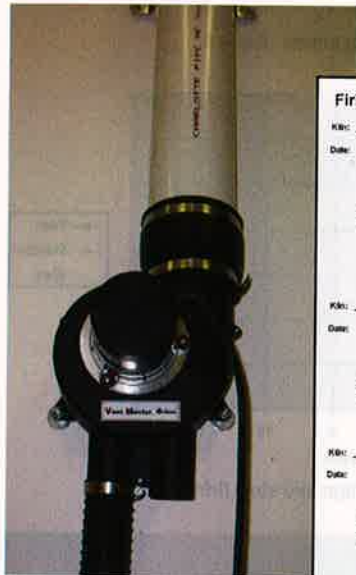


Figure 3. Vent blower mounted on the wall and exhausted outside using schedule 40 PVC pipe.

Figure 4. A firing log helps you spot trends and can be valuable when firing problems develop.

The addition of the electronic controller coupled with a kiln vent has given potters freedom and control. By using this equipment, along with cones, potters no longer need to babysit the kiln and wonder about what has taken place inside their mysterious hot box.

### Record Keeping

Good record keeping is important because it helps you build a database. Using a firing log to track the bending angle of your cones will enable you to see if your ware is experiencing changes in heat work over time (see Figure 4). Changes might be the result of diminished thermocouple accuracy due to age or heating elements that are not performing as well due to a change in resistance. If you have a kiln sitter, you might discover the need to make adjustments to the trip plate or replace worn parts.

If you are not satisfied with the uniformity of heat work within your kiln, record keeping arms you with the information you'll need to make the appropriate changes to either the heating rate and/or soak time for the next firing. Depending on your kiln's heating capabilities, you may have to consider limiting the load you place into the kiln. Each kiln is different, and there is no better way to get to know your kiln than by keeping proper records of how it performs at various firing schedules. ☉

For more information regarding kiln firing, contact The Edward Orton Jr. Ceramic Foundation at 6991 S. Old 3C Highway, Westerville, OH 43082-9026; (614) 895-2663; fax (614) 895-5610; e-mail [info@ortonceramic.com](mailto:info@ortonceramic.com); or visit [www.ortonceramic.com](http://www.ortonceramic.com).