

Firing Tips

CONES AND CONTROLLERS

Automatic controllers and shut-off devices are a convenient way to heat and turn off a kiln. But for consistent results it is still important to know how much heat the ware received. Only cones provide this information.

Witness cones set near the ware tell if the firing reached the cone value necessary to properly mature the ware. Cones also help in diagnosing firing problems.

Advantages of Controllers

Electronic controllers have many advantages. They:

- allow heating rate control - heat up/cool down of the kiln
- permit slow down of the firing below red heat to burn out carbon and organic materials
- permit elimination of a kiln shut-off device, although some use this as a safety backup
- allow soaking of kiln at the firing temperature to get more uniformity of fired pieces or for special results
- provide more consistency from firing to firing

So with all of these advantages, why

are cones still needed?

Firing Ceramics

Firing ceramics is much like baking food, except ceramics go to higher temperatures. When we bake, we leave food in the oven at a temperature for a certain time. A thermometer may help measure the temperature of our food or we may stick a fork in to test whether it seems right.

It is the same with firing - a combination of temperature and time "cooks" the ware. However, unlike baking we can't put our ware into a preheated kiln and poke a fork in our pot to test doneness. The next best thing is to place Pyrometric Cones near the ware to measure whether it has received enough heat.

Firing With Cones

The bodies, glazes and decoration products we use are all formulated to be correctly fired when they have received enough heat to properly bend a cone. The companies and individuals who make and test these supplies use Orton Cones. Cones deform when they have received the


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right amount of heat, not just when the kiln reaches a certain temperature. In other words, cones behave just like your ware. This is why they are such good indicators of whether the ware was properly fired.

How Controllers Work

Electronic controllers regulate power to the heating elements. They do this by comparing the temperature measured by a thermocouple with the expected temperature programmed into the controller. If the temperature is low, heat is added.

Controllers fire a kiln to a temperature. If this temperature is not measured accurately, the controller will fire the kiln improperly. Most controllers use a Type K thermocouple, which is less expensive, or a platinum thermocouple (Type S), which costs more but is more accurate and has a longer life.

Measuring Temperature

Even brand new, a Type K thermocouple can vary from a true reading, as shown below. On the other hand, a Self-Supporting witness Cone will vary no more than 4°F.

| | |
|-----------------------------------|------------------------|
| Variation in New Thermocouples | Max. Cone Variation |
|-----------------------------------|------------------------|

| Cone | Type K | Type S | Cones |
|------|--------|--------|-------|
| 020 | 8.5°F | 2.9°F | 4°F |
| 06 | 13.5°F | 4.5°F | 4°F |
| 6 | 16.6°F | 5.6°F | 4°F |

This variation in the temperature measured by a thermocouple becomes even larger after the thermocouple has been used for awhile. It is not unusual for a Type K thermocouple to have an error of more than 25°F when fired to Cone 6 repeatedly. This means that more than a full cone error can be introduced.

Using Controllers and Cones

Controllers do a good job at what they do - controlling the heating and cooling rate and providing consistency from firing to firing. However, if witness cones are not used with the controller, there is no way of determining what the actual firing conditions were, except by how the ware looks. By then, it may be too late.

Want to learn more?

Read more about using cones and controlling a kiln in the Orton Firing Line and Technical Tips publications. Each issue is packed full of articles to help you learn more about firing. Members of the Orton Firing Institute receive these publications at no charge. Single copies are available to non-members at a per issue rate. Orton's 80 minute video, *Key Principles of Successful Firing*, is also an excellent resource on firing.

For information on Orton products, see your Orton dealer or distributor. For information on the Firing Institute, video or publications, contact

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