

# Firing Tips

## FIRING HANDBUILT OR THICK CAST WARE

Most pinch pots, coiled or slab built ware generally have thicker walls than their slip cast cousins, although molded pieces may be cast heavily as well. With these types of pieces, the thicker walls create some unique challenges for firing.

Basic problems that can occur when firing handbuilt or thick cast ware include cracking (or exploding) and carbon burnout. Because of the thicker walls it is important to fire slower and control heating and cooling during firing. Preparation of the piece is important as well.

During forming, stresses within the piece may result in hairline cracks that appear during firing. It takes longer to fully dry a thick piece. Uneven drying can result in warping or cracking.

For pieces properly prepared, handled and dried, the next critical step is firing.

### Firing issues

- Is the ware fully dry?

Ware that is not adequately dried will crack or explode during the early stages of firing. Water inside the pores of the ware turns to steam, exerting pressure inside the ware. To fully dry a thick walled piece, the ware needs to be warm for more than 12 hours.

- Am I firing too fast?

All bodies expand when heated and shrink when cooled. If the outside wall expands more than the inner wall, stresses occur. If these stresses are large enough, they pull the body apart and cause cracking. A 1" thick wall can have more than a 10°F difference in temperature between the hotter and cooler surfaces. Firings need to be slowed down for thicker wall pieces. Likewise, it is important not to cool too fast.

- Have I allowed enough time for carbon burnout?

It is important to burn out all carbon from the ware before higher temperatures are reached (1200°F or 650°C). It takes time for oxygen to move into the porous body, react with the carbon and then leave. If carbon remains, many problems can occur. These include problems with color, glaze fit, strength, blistering and discoloration. Use of a downdraft vent system, combined with slower heating, virtually eliminates carbon-related problems.

### Heating & cooling control

The best way to control cracking problems during firing is by controlling the rate of heating and cooling for the kiln.

 **Orton**

® The Edward Orton Jr. Ceramic Foundation  
6991 Old 3C Highway  
Westerville, OH 43082

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During firing, materials that make up the body undergo many changes. Special care must be taken at temperatures below 1500°F (815°C) to heat the body uniformly.

Remember, the thicker the wall, the slower the heating should be done. Above 1500°F, temperatures can be increased more rapidly because the changes are less likely to cause stress cracks within the ware.

- What kind of changes occur?

All clays and many minerals contain water which does not leave the body until above 700°F. Organic (carbon) materials need to be oxidized (burned out). Other minerals, such as calcite, break down and give off a carbon dioxide gas. Minerals such as flint (silica) undergo a sudden expansion on heating to 1060°F and contraction during cooling.

- How can I control my heating?

This depends on the controls for the kiln. With switches, leave them on medium settings longer. It should take more than 3 hours to reach red heat and even longer for thick pieces or a heavily loaded kiln.

Make sure the kiln is well vented below red heat and closed up completely above red heat. Keep the kiln closed during cooling for 8 hours or until well below red heat.

- When did cracking occur?

Often the crack itself can be examined to determine when it occurred. If the edges are sharp, then it probably occurred during cooling. If the edges are rounded or if glaze has flowed into the crack, then it occurred during heating.

- What else can cause cracking?

1. Uneven heating is a primary culprit that causes cracking during firing.

Hot and cold spots in the kiln can cause uneven heating of pieces.

Use witness cones to diagnose hot and cold spots and then adjust the switching or use a downdraft vent to help even out the heating.

Careful loading of the ware in setters and on stilts can also help heat circulate around the piece.

2. Underfired bisque is not as strong and may crack more easily during the glaze firing.

Use witness cone to assure a proper firing and prevent underfired bisque.

3. Gas expanding in air pockets which developed in the ware during forming can cause large cracks during firing.

## Want to learn more?

Read more about firing handbuilt and thickcast ware in the Orton Firing Line and Technical Tips publications. Published 8 times a year, 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.

For information on Orton products, see your Orton dealer or distributor.

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Orton Firing Institute, 6991 Old 3C Hwy., Westerville OH 43082, 614-895-2663