

Firing Tips

SOLVING GLAZE DEFECTS BLISTERS, CRATERS and PINHOLES

Blisters, craters and pinholes are related glaze surface defects. They show up as a rough, grainy or bubbled surface on the ware and appear after the glaze firing or decorating firing.

What Causes These Defects?

This family of problems can be caused by many different factors including:

- *dust and contamination in the glaze*
- *air bubbles in the glaze*
- *air trapped in the slip*
- *improperly mixed slip*
- *a dirty kiln*

Most commonly, however, the problems are related to gases coming from the body, glaze or kiln atmosphere.

What Happens During Firing?

Clays and glazes contain organic materials. When heated, these burn out of the body, forming gases such as carbon, sulfur and water.

If the carbon in materials is not fully removed from the body, then gas will form during the glaze or decorating firing, forming bubbles or blisters. These may pop to become craters or pinholes.

These defects can occur because:

1. There was not enough air in the

kiln during firing for the carbon to properly burn out. Any combustion process requires air. Without air, oxidation cannot occur.

2. Carbon monoxide formed by oxidation of carbon has not been adequately removed from kiln. If the gases produced during firing are not removed from the kiln, they may deposit onto the glaze surface or affect the glaze color.
3. The kiln was heated so quickly that there was not enough time for the carbon to burn out. Carbon, which is only partially burned, will continue to oxidize during the glaze or decorating firing causing defects.
4. The ware was underfired. That is, there was not enough heat-work. When the body is underfired, it is weaker and its expansion may no longer fit the glaze.

How Do I Solve Glaze Defects?

To make sure that glaze defects do not occur, it is important to properly mix glazes and slips and to use good pouring (slip) and application (glaze) techniques. Proper housekeeping for the kiln and workplace should be observed. Straining glaze through nylon often helps remove any lumps.

Most critical for good results are proper firing practices. We recommend the following:

1. Bring air into the kiln and make sure it circulates around the ware especially during bisque firings:

- use setters and stilts to improve air flow around the ware
- use half shelves to improve air flow through the kiln
- adequately vent the kiln
- position ware to take best advantage of air flow in the kiln

Use a downdraft vent like the Orton KilnVent to bring a controlled amount of air into the kiln and circulate it throughout the kiln. This helps remove fumes and even out the temperatures in the kiln.

2. Control the firing

Fire slower, especially below 1200°F (650°C). Slow down the firing by adjusting switches to lower settings or soak/hold at a temperature to allow carbon to burn out.

Use an automatic controller to set heating rates and hold times.

3. Use witness cones to verify heatwork

Under firing can occur due to burned out heating elements, an improperly adjusted Kiln-Sitter, a controller thermocouple which has changed or differences in heating within the kiln. Witness cones give a true reading of the heatwork the ware received. Witness cones placed throughout the kiln show differences in

heat distribution.

4. Vent the kiln to remove gases and prevent them from redepositing on ware

Only downdraft venting removes the gases from the kiln.

If good firing and venting practices are observed during firing, problems with glaze surface defects can be controlled.

Want to learn more?

Read more about glaze surface defects in the Orton Firing Line and Technical Tips publications. Members of the Orton Center for Firing 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.

For information on the Center For Firing or publications, contact Orton Center For Firing, P.O. Box 2760, Westerville, OH 43086, 614-895-2663.