



# **PORCELAIN FIRING GUIDE**



A HELPFUL RESOURCE BOOKLET  
FOR THE BEST FIRING OF PORCELAIN PRODUCTS

Porcelain products have become increasingly popular, yet many porcelains can be very difficult to fire properly, especially when they have a firing range of less than a cone number. Other products we fire do not have this restriction.

Literature for some porcelains shows a firing range of only a couple of clock positions or a quarter of a cone and less than a properly deformed witness cone. A properly deformed witness cone is bent to the 6 o'clock position.

To maintain today's kilns within even half a cone number is very difficult. Consequently, underfiring or overfiring of porcelain is common. To complicate this further, the porcelain you purchase will also vary from batch to batch. By itself, these variations may be okay, but when combined with variations in the Kiln-Sitter® adjustment and condition, heat distribution within the kiln and different heating rates, problems can occur.

Also, some variation occurs in each cone batch. Orton minimizes this variation better than any other cone supplier in the world, but it is within acceptable standards for individual cones batches to vary by a quarter cone or so.

If a porcelain must be fired to less than one full cone, the differences between cones batches and normal kiln variations can readily lead to an underfiring or overfiring of the porcelain.

We are dealing with a lot of variables: changes in the porcelain composition, changes in the kiln and Kiln-Sitter and changes in the cones. For porcelains with less than a full cone firing range, these can add up to a firing problem.

### **How to Know if Porcelain is Properly Fired**

The best way to know if your porcelain is being fired properly is to place witness cones near your ware. It is not a good practice to simply rely on the Kiln-Sitter® cone/bar to shut off the kiln at the proper cone number.

Because the kiln is hotter near the side walls, the Kiln-Sitter® cone receives more heat than cones set on the shelf. The cone/bar in the Kiln-Sitter® is also smaller, so it heats up faster than a witness cone. This may seem insignificant, however at high temperatures, these changes can make a difference in your firing. Often, it is necessary to use one cone number hotter in the Kiln-Sitter to get proper bending of witness cones on the shelf located by your ware.

## Procedures to Minimize Firing Conditions

To reduce the impact of variations in firing conditions on porcelain, testing is recommended. This testing is to determine what the correct firing conditions are for the porcelain you chose to use.

1. What cone number does the porcelain manufacturer recommend for their product? Can the product be fired to a full cone number (6 o'clock position)?
2. Obtain a supply of Self-Supporting witness cones and either Orton small cones or bars. Use Self-Supporting cone numbers above and below the recommended firing cone number. Have Kiln-Sitter® cones/bars that are one and two cone numbers hotter than the recommended cone number.
3. Prepare test pieces of your ware for firing. Place these on a shelf(s) in your kiln. Locate a series of 3 Self-Supporting cones near each piece of test ware. Use the firing cone and a cooler and a hotter cone. Place cones near the middle of your kiln so they can be observed by looking in a peephole.
4. Place a cone number in the Kiln-Sitter that is two cones higher than your fired cone. Fire your kiln in a normal way and when the kiln approaches high temperatures, regularly remove the peephole plug and observe the witness cones. Use proper glasses for looking in your kiln!

The cooler (lower numbered) cone will bend first, typically taking about 20 minutes. Then the firing cone will bend. If the Kiln-Sitter® has not shut off the kiln when the firing cone bends either to the 6 o'clock position or the position recommended by your porcelain manufacturer, then manually shut off the kiln.

Orton recommends that all porcelain firings be done by observing a witness cone and manually shutting off the kiln when the proper cone has bent.

5. After cooling, examine your test ware and the bending of all cones in the kiln, including the cone/bar in the Kiln-Sitter®.

If the ware is fired satisfactorily, then you have completed your testing. If the ware is underfired or overfired, then an adjustment in firing is needed. If you placed cones on other shelves in the kiln, they will allow you to determine how much variation can occur.

If the kiln is more than a half cone cooler on the top shelf, it may mean you will have to be very careful about the product to be fired on this shelf. If you need to change or adjust the cone/bar in the Kiln-Sitter, remember that

- a bar will fire the kiln a little hotter than a cone centered in the Kiln-Sitter
- the thinner portion of the cone will fire the kiln a little cooler
- using the next lower cone number will produce a cooler firing

If you want to fire the kiln cooler, than the kiln will have to be shut off before the witness cones (firing cone) bend(s) as much as they did in your initial firing. Likewise, firing the kiln hotter will require more bending of the witness cones (firing cone).

6. As needed, repeat the test firing to determine the proper position of the witness cones for ware that is properly fired.

Following the above procedure and using the instructions supplied by your porcelain manufacturer will allow you to determine the correct position of a witness cone to obtain correctly fired ware. Remember that a quarter of a cone variation is normal, so we should not have to be exactly at the same position on each firing.

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Orton has manufactured quality pyrometric products since 1896. Orton also makes the Orton KilnVent fume removal system for electric kilns, the Orton AutoFire and Cone-troller controllers and offers kiln and firing supplies.

Orton administers the Firing Institute which makes information available on the firing through our Firing Line and Technical Tips publications, Key Principles of Successful Firing video and through regional firing seminars.

For information, contact:



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