



Multi-level Kiln Firing

Many artisans ask if it is possible to load shelves in their kiln the ways potters do. It is possible but the results are rarely satisfactory. Pottery doesn't require the temperature accuracy needed for glass. Potters often fire using ceramic cones to control temperature. The cones they use have a temperature variance as much as 100°F (40°C). That's the difference between a tack fuse and a full fuse. So much temperature inaccuracy is completely unacceptable for glass work. Early glass artisans soon learned cones could not be trusted for firing glass. To be sure they got the results they wanted, they would peek in their kiln and, when the glass had fused to the amount they wanted, turn the kiln off. Allow it to cool and manually turn it on and off to control the rate temperature dropped.. Even that wasn't reliably accurate so they convinced kiln makers to install electronic controls to provide accurate temperature measure in their kiln. We now have electronic controllers for our kilns that can be programmed to reach heat to a specific temperature and remain at that temperature for a specific time.

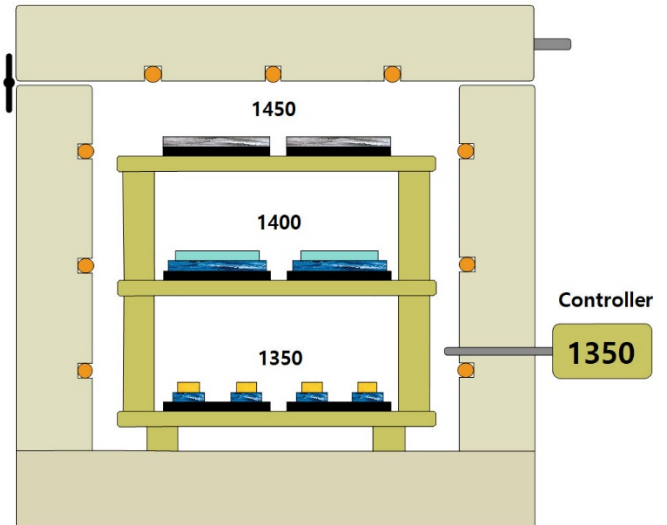
Glass artisans thought if potters could load multiple levels of shelves in their kilns, they should be able to do the same with glass. In theory, that should work. In practice it usually produced unacceptable results at all levels. Heat rises. The temperature in the upper part of a kiln will be higher than the temperature in the lower part. Glass on a higher level shelf will receive more heat than glass on a lower level shelf. Many artisans assume you can control that to produce different levels of fuses at different levels.

Top shelf - full fuse

Medium shelf - contour fuse

Bottom shelf - tack fuse

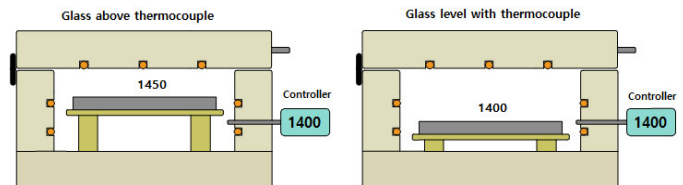
Multi-level Kiln Firing



That works in theory but not in practice. There are a few factors that prevent doing this from being predictable.

Thermocouple accuracy

The thermocouple reads the temperature in the kiln and displays a reading on the controller or pyrometer. It reads the temperature of the air at level with the thermocouple. If glass is placed at that level the thermocouple will be displaying the temperature in the glass. If the glass is placed higher, the glass will be a higher temperature than the thermocouple reads. If the glass is placed lower, it will be a lower temperature.





Multi-level Kiln Firing

Element relativity

If your kiln has **side elements**, heat will come from the sides of the kiln and rise in the kiln. If you have a shelf above the side elements, the heat is likely to be trapped under the shelf and fail to rise the way it would without a shelf obstructing heat rise.

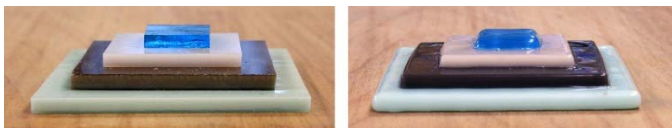
If your kiln has **lid elements**, a shelf between those elements and any glass on a lower shelf beneath that shelf will restrict heat reaching the glass at lower level. The thermocouple will instruct the kiln to continue applying heat until the heat is the requested temperature at the thermocouple level. The obstruction from the upper shelf will hold a much more heat at the upper level than you expect.

Heat distribution

One of the first things glass artisans learn when fusing glass is the importance of temperature accuracy and how important even heat distribution is to achieve that accuracy. Anything that impedes or obstructs heat distribution in your kiln will make it harder, perhaps impossible, to achieve that accuracy.

Heat retention

Whether you fire your kiln loaded with a single shelf or with tiers of shelves, how well the kiln holds heat after the elements are turned off will affect how much heat is applied to the glass. When you fire with lid elements the kiln lid stays hot and continues to apply heat even after the elements are turned off.



In the above photo, both tile stacks were fired with the identical firing schedule in the same kiln.

The one on the left was fired with only the side elements on. The one on the right was fired with only the lid elements on.

Annealing

Some artisans anneal batches of glass in kilns with multiple shelves. This works but it runs the risk of some of the glass being annealed at the wrong temperature.

Exception

It's a good practice to avoid firing multiple layers of shelves in your kiln but an exception is when you fire everything in the kiln to a full fuse with a long enough hold to be sure everything is fully fused. It doesn't matter if some of the projects are fired too high as long as all are fired high enough to achieve a full fuse. This can be done with full shelves the way potters do but works much better if you use part shelves offset at different levels to encourage air flow to allow relatively even heat distribution.

Suggestion

Other than the exception for loads of full fuse projects, firing kiln loads with shelves at multiple levels is a bad idea and should be avoided unless you have a VERY high tolerance for failure. Glass kilns are made shallow for a good reason.