

Fusing Glass in Your Ceramic Kiln

Unless you have been living under a rock for the past several years you more than likely have noticed that fusing and slumping glass has become, excuse the pun, Very Hot!. Art Teachers everywhere are beginning to introduce glass fusing and slumping into their curriculum.

Fused Glass is fascinating to work with and brings a unique perspective to 3 dimensional art.

The biggest stumbling block to getting started with any Fired Art has always been the kiln. Well most Art teachers already have a kiln so what is the problem!

I ALREADY HAVE A KILN, WHAT'S THE PROBLEM?

There is no problem. A common misconception is that you cannot fuse or slump glass in a ceramic kiln. The fact is people fuse successfully in "ceramic" kilns everyday. If you have a programmable controller on your kiln you can begin fusing glass right now.

WHAT IS THE DIFFERENCE BETWEEN A GLASS KILN AND A CERAMIC KILN?

The main difference between a glass kiln and a ceramic kiln is that glass kilns generally heat a single layer from the top and ceramic kilns heat multiple layers from the side.

The reason glass kilns were designed to heat the kiln from the top is because the majority of glass projects tend to be relatively flat. With the heat being radiated from the top, the entire face of the glass "sees" the heat at the same time. This keeps temperature differences within a glass project uniform and prevents cracking.

The same uniform heating results can easily be attained by simply slowing down the firing.

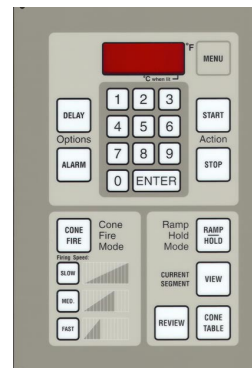
Most Ceramic and Glass Kilns sold today come with Automatic controllers. Both types of controllers almost always have a programming mode called Ramp and Hold Mode which is perfect for writing glass programs. If your ceramic kiln has a KilnSitter instead of an automatic controller fusing glass will be very difficult and is not recommended.



PROGRAMMING FOR SUCCESS

One of the keys to successful fusing in any kiln is to slow down the heating or cooling rate during critical points in the firing schedule. Temperature variations within the glass can become exaggerated when you try to fire too fast. This is true for ceramic and glass kilns. Ceramic kilns are just a little more sensitive because heat must soak into the center of the kiln from the side.

Below is a list of sample programs for fusing, slumping and tac fusing that you can enter into almost any controller. These are extremely conservative programs so they should be very safe for pieces up to 1/2" Thick and 8" in diameter. They were developed to work for most fusible glass however for best results use process rates temperatures and hold times recommended by the manufacturer of the glass you are using. The process segments are highlighted in gray.



Full Fuse	Segments							
	1	2	3	4	5	6	7	8
Rate - °F/hr.	300	300	300	600	600	9999	30	60
Temp. - °F	250	500	750	1250	1480	1000	970	750
Hold - hrs.min	00.25	00.25	00.25	00.20	00.15	02.00	02.00	0000

Tack Fuse	Segments							
	1	2	3	4	5	6	7	8
Rate - °F/hr.	300	300	300	600	600	9999	30	60
Temp. - °F	250	500	750	1250	1350	1000	970	750
Hold - hrs.min	00.25	00.25	00.25	00.20	00.15	02.00	02.00	0000

Slump	Segments							
	1	2	3	4	5	6	7	8
Rate - °F/hr.	300	300	300	600	600	9999	30	60
Temp. - °F	250	500	750	1150	1220	1000	970	750
Hold - hrs.min	00.25	00.25	00.25	00.05	00.05	02.00	02.00	0000

Below is a chart which illustrates the critical temperature ranges for fusing glass and the problems that can result from going too fast. If you experience a problem consult this chart and slow down the rate in that temperature range on your next firing.

Description	Temperature Range *	Potential Problems	How to Identify
Initial Heating	Room Temp. - 1000 °F	Thermal Shock	Crack with rounded edge.
Pre-Process	1000 °F - 1225	Bubbles	Bubbles trapped between layers of glass.
Process	1225 °F - 1480°F	Uneven Heatwork	Parts of piece will be under or over fired.
Annealing	1000 °F - 750 °F	Stress in glass	Cracks with S shaped hooks where it exits the piece.
Cooling	750 °F - Room Temp.	Thermal Shock	Crack with sharp edges

* Temperature ranges vary slightly between glass manufacturers.

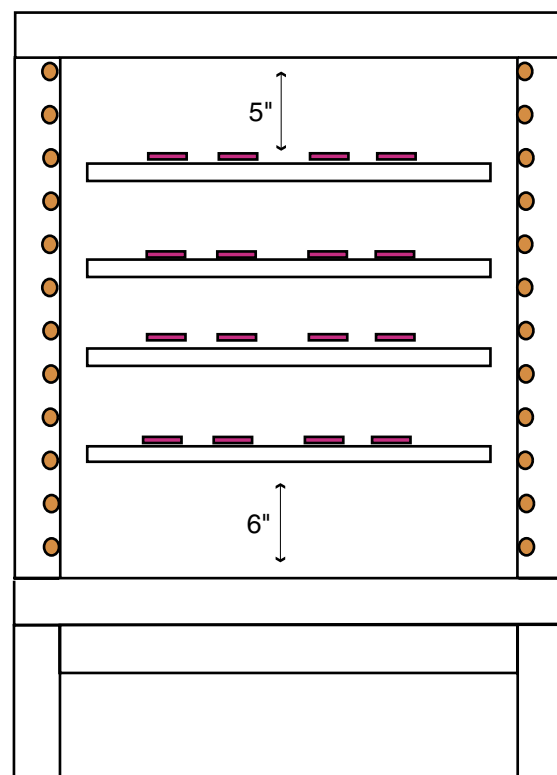
LOADING THE KILN

How you load the kiln is also very important when firing glass in a side fired kiln. At glass fusing temperatures many ceramic kilns have a tendency to fire a little cool near the bottom and top of the kiln's chamber. To address this it is recommended that you post up your first shelf higher than usual and your top shelf lower than usual.

A good rule of thumb on a kiln with a 27" deep chamber is to post the first shelf up 6" and keep the top shelf at least 5" from the lid. With smaller projects (less than 8" in diameter) more space may be used in the top and bottom of the kiln.

Always make sure you have at least 1 element freely radiating between each shelf layer.

Always load the glass at least 2" from the kiln wall. Remember that projects thicker than 1/4" will spread as the glass melts. Pieces too close to the elements may heat unevenly. Also, make sure all shelves and ware is at least 2" from the thermocouple. Shelves place too close to the thermocouple can bias the reading.



SOME FINAL THOUGHTS

Fusing glass can be a fun addition to your classroom curriculum. Take the time to do a little research before jumping in head first and start with some simple projects. There is a ton of helpful information available. A lot of it can be found for free right on the internet. There are also some excellent books out there that walk you through the many techniques that are available.