



## Firing Guide

These are some guidelines for kiln-forming projects of common thicknesses. These are not strict rules, of course. Times and temperatures may vary with equipment.

<b>BASIC Firing Chart</b> (For projects up to 9mm thick)			
<b>Segment</b>	<b>Rate</b>	<b>Temp</b>	<b>Hold</b>
	(°C per Hour)	°C	(minutes)
<b>1. Heating I:</b>	139	566	30
Moderate ramp up then hold to allow soft glass to settle. Soak even longer to reduce bubbles			
<b>2. Heating II:</b>	139	677	20
Continue heating, with another hold here to equalize temperatures.			
<b>3. Heat to Forming Stage:</b>	167	See Forming Chart Below	Desired Effect
Heat glass to forming temperature. Consult Forming Chart.			
<b>4. Anneal I:</b>	as fast as possible	510	60
Fast ramp down then hold to thoroughly equalize temperatures.			
<b>5. Anneal II:</b>	111	427	10
Slow cool through sensitive zone, then hold to equalize.			
<b>6. Cool Down:</b>	167	38	0
Moderate ramp down to minimize thermal shock.			

## Slumping Chart (For projects up to 9mm thick)

Segment	Rate (°C per Hour)	Temp °C	Hold (minutes)
<b>1. Heating I:</b>			
Slow ramp up to 121° then hold to equalize temperature of everything in kiln (minimizes thermal shock).	139	121	15
<b>2. Heating II:</b>			
Moderate ramp to 566° and hold.	139	566	30
<b>3. Heat to Forming Stage:</b>			
Heat glass to forming temperature. Consult Forming Chart.	83	See Forming Chart Below	Desired Effect
<b>4. Anneal I:</b>			
Moderate ramp down then hold to thoroughly equalize temperatures.	222	510	60
<b>5. Anneal II:</b>			
Slow cool through sensitive zone, then hold to equalize.	111	427	10
<b>6. Cool Down:</b>			
Moderate ramp down to minimize thermal shock.	167	38	0

Forming Chart	Definition	Forming Temp
<b>Slump</b>	Glass softens and slumps to take the shape of a selected form or mold. Note: small molds may need higher temperatures and/or hold times.	657°- 677° C
<b>Tack Fuse</b>	Separate glass layers are fused together with little deformation beyond softening of edges.	732°- 743° C
<b>Contour Fuse</b>	Separate glass layers are fused together, edges are soft and rounded, project surface retains the degree of dimension desired by the artist (any degree beyond Tack but not yet Full fused).	760°-788° C
<b>Full Fuse</b>	Separate glass layers are completely fused into a single uniform layer, top surface is smooth and void of dimension or relief.	793°-804° C

## Bubble Squeeze

### To Reduce Bubbles Between Glass Layers

To reduce bubbles between glass layers, fire to encourage a very slow relaxing of the layers, “squeezing” air outward to the edges for release. As the fusing chart indicates, we recommend a lengthy hold at about 566° C, then a slow ramp up to 677° C. Increase the effectiveness of your “squeeze” by lengthening your Hold in Segment I and slowing your Rate in Segment 2.

Bubbles are best avoided in the design stage. Large areas of uninterrupted layering invite them. For example, a 10 x 10-inch sheet atop another 10 x 10-inch sheet leaves no easy avenue of escape for the air between glass layers. Alternately, a 10 x 10-inch sheet topped with four 5 x 5-inch pieces provides seams to vent trapped air. Design to avoid bubbles for the best prevention.

Below is our Advanced Full Fuse Firing Schedule with ranges included for a Bubble Squeeze. As with any firing schedule, you will need to adjust the schedule based on your kiln, and the requirements of your particular project.

### Advanced 8-Segment FULL FUSE Schedule (For projects up to 9mm thick)

Segment	Rate	Temp	Hold
	(°F per Hour)	°F	(minutes)
<b>1. Heating I:</b>			
Initial heat from room temperature. Holding here allows the glass to fully accept a moderate amount of heat before ramping up.	139	121	30
<b>2. Heating II:</b>			
Moderate ramp past thermal shock danger, then hold to allow softened glass time to relax before edges seal together. (Add more time here if necessary.)	139	1050	30-60
<b>3. Heating III:</b>			
Slowing the ramp speed here + lengthening the hold provides more time for bubbles to find an avenue out. Modify this segment even further if necessary.	100-250	1250	10-30
<b>4. Heating IV:</b>			
The hold here gives the glass layers time to settle together before rising to the forming temperature.	250	1370	20
<b>5. Heat to Forming Stage:</b>			
Moderate ramp to forming temperature.	300	1465	10
<b>6. Anneal I:</b>			
Fast ramp down then hold to thoroughly equalize temperatures.	9999	950	60
<b>7. Anneal II:</b>			
Slow cool through sensitive zone, then hold to equalize.	200	800	10
<b>8. Cool Down:</b>			
Moderate ramp down to minimize thermal shock.	300	100	0