



## Volume and Shape Control

Distortion of a project's shape during firing can lead to some unpleasant surprises, or it can contribute to a well-executed design. This information should help you understand why it happens and how to avoid it, or use it to your advantage.

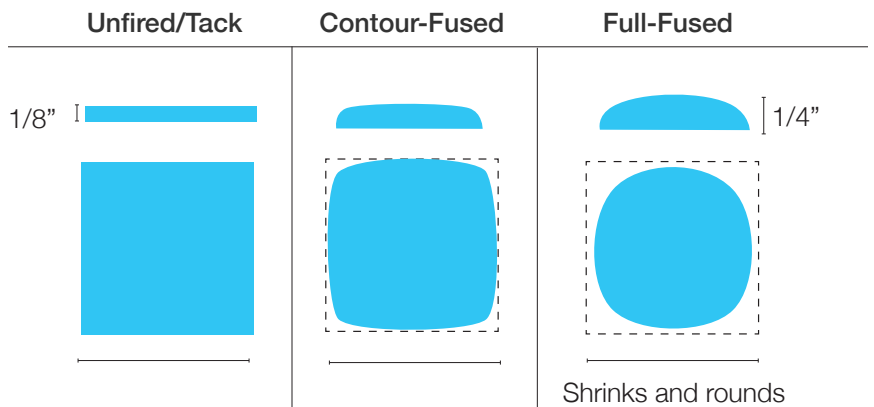
Glass, as it gets hotter and hotter, becoming less like a solid and more like a liquid, will either draw-in or spread-out toward a circular "puddle" about 1/4-inch (6mm) thick. If it's thicker than that to begin with (more than 2-layers of glass), it will spread out. If it's thinner, it will draw-in, ever seeking that quarter-inch thickness equilibrium.

In fusing, we stop the process before it reaches full fruition, but understanding the inclination of hot glass to seek the circular-shape-quarter-inch-thick state is important to thoughtful design and predicting fired results.

### Consider these examples:

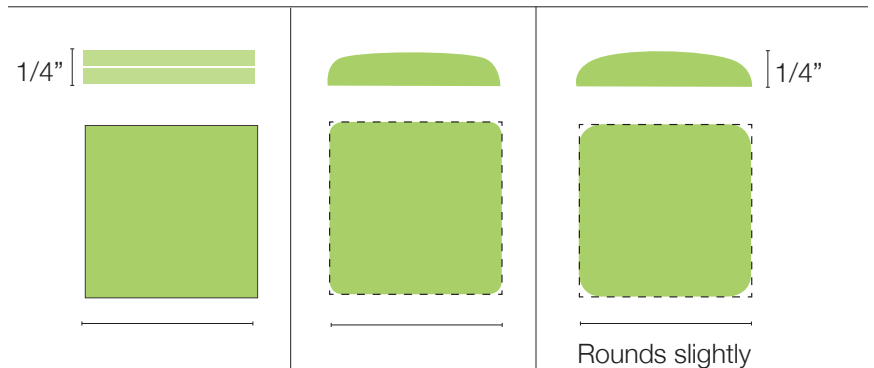
#### One Layer Thick ▷

Most Oceanside Compatible™ sheet glass is about 1/8-inch thick. So, a single square of this glass, given enough heat and time, will draw in toward a circular-shaped, rounded-top, flat bottom 1/4-inch thick "glob." The original perimeter will contract. Degree of change depends on type of fuse (amount of heat).



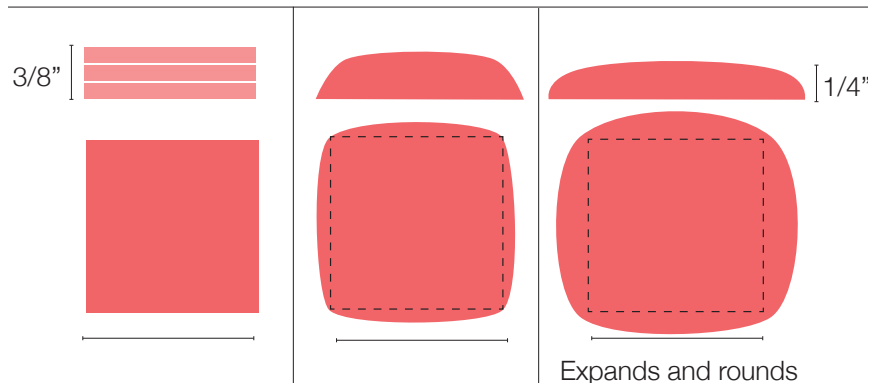
#### Two Layers Thick (Ideal for Full Fuse) ▷

Two stacked squares are about 1/4-inch (6mm) thick. Already at its thickness equilibrium, this arrangement will change less under high heat. The corners will round, but the thickness (and original perimeter) will remain largely unchanged.



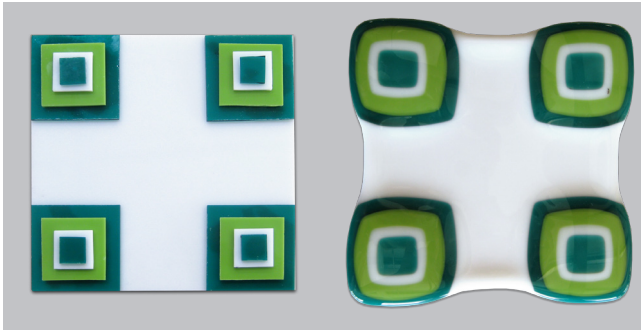
#### Three Layers Thick ▷

Three squares stacked is about 3/8-inch thick. Under sufficiently high heat and time, the stack will spread-out, seeking to reach the 1/4-inch equilibrium. The original perimeter will expand and round. Degree of change depends on type of fuse (amount of heat).

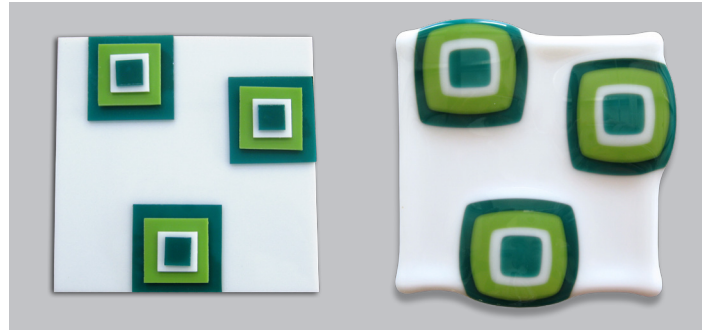


## Volume and Shape Control *continued*

What if we combine thick and thin areas in our design arrangement?



Above: a single-thick square of glass with smaller square stacks in each corner. After Full Fusing, the thin areas draw in; the thicker areas push out as the uneven layers seek equilibrium.



Above: a single-thick square of glass with smaller square stacks placed *unevenly*, then Full Fused. The perimeter of the piece becomes distorted because of the uneven distribution of glass. (Note that both of these tiles were created for demonstration purposes only. Incorporating wide variations of thin and thick areas in a Full Fused design can often result in breakage!)



We can take advantage of uneven thickness to create a fluted edge on a project. Round glass globes (approximately 1/2-inch in diameter) were placed around the edge of a single-thickness square, creating more volume at those spots. The project was given enough heat/time to allow the thinner areas to draw in while the thicker ones remained stable. (A contour fuse was enough for this to take place.)

Here are some “rules of thumb” that we can absorb from our understanding of volume control.

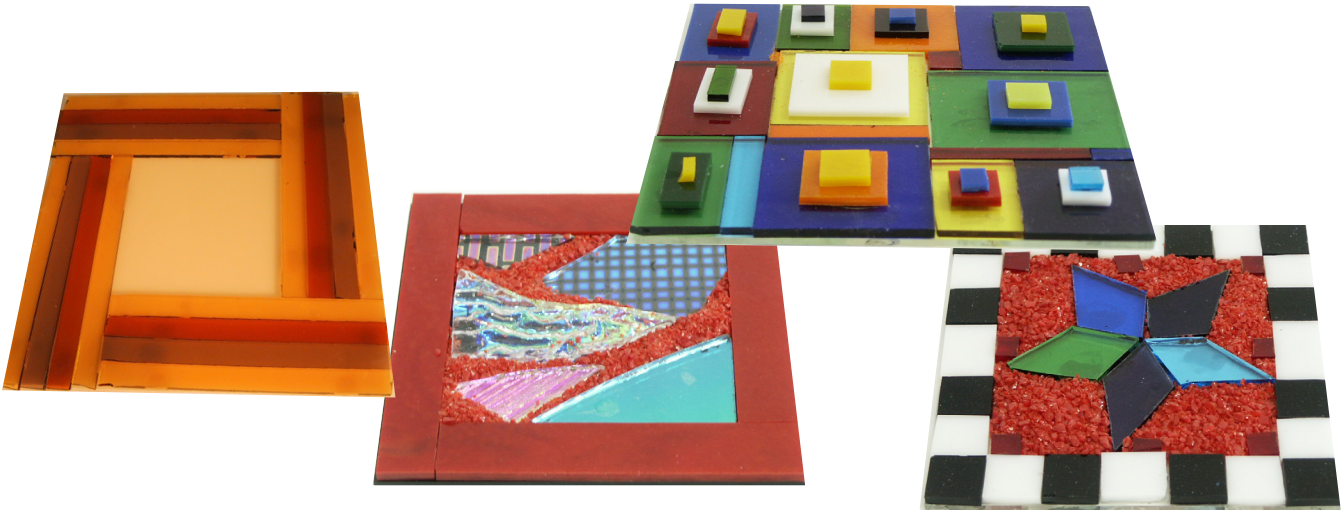
1. Projects assembled to a volume of about two-glass layers (1/4-inch) thick, or with uniform 1/4-inch thick perimeters, will more predictably retain their original shape in the firing process.
2. We can control shape-changes during firing by thoughtful use of thick-thin variation in design, and by stopping the forming process when our desired effect has been achieved (see Firing Cycles).
3. We can predict shape-changes during firing by examining thick-thin variation in the assembled, pre-fired project.
4. Projects assembled to a uniform thickness will tend to reconfigure uniformly in the firing process.

**Remember:** Glass wants to be 1/4-inch thick — and given sufficient heat and time, it will get there. But also understand that results can be controlled by using a variety of firing schedules to your advantage.

## Volume and Shape Control *continued*

### Good Candidates for Full Fuse

Uniform 2-layer perimeters, relatively even volume of glass in design.



### Poor Candidates for Full Fuse

Single layer perimeters, delicate details, uneven glass distribution. These are best Tack or Contour Fused.

