Basic Troubleshooting

Fusing is far from an exact science and studying results is how we learn. If something has gone wrong, be sure to take the time to understand what happened. **Please note:** as your fusing projects become larger and more complex, you may want to move to a firing schedule that will allow for more fine tuning of the fusing process. Greater control can be achieved with the longer schedules available on the System96.com website and these can be further adjusted to suit your work if needed.

PROBLEM: Bubbles Between Glass Layers

Air always exists between the glass layers of an assembled project. If, during firing, the edges of the top piece "seal" to the glass beneath it before that air escapes, a bubble is created. In transparent glass, you'll see, and often feel, the trapped air bubble(s). In opal glass, it will look like bumps in the surface.

SOLUTION: This can be minimized or prevented by a "Bubble Squeeze" firing schedule that includes a lengthy hold at about 1050º F, and then a s-l-o-w ramp up to about 1250º F. This approach encourages a very slow relaxing of the top layer, "squeezing air outward toward the edges for release.


"Mumps:" Bubbles between layers

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.

PROBLEM: Bubbles from Beneath the Project

This problem is characterized by a "hump" in the project's top surface, and an associated cavity underneath. The hump can be small ("burp") or large ("eruption") or even a wide open hole ("blowout"), all caused by increasing degrees of the same problem: air gets trapped beneath the project, with no avenue of escape. When the glass softens, this air (ever expanding) pushes up from below, deforming the glass.
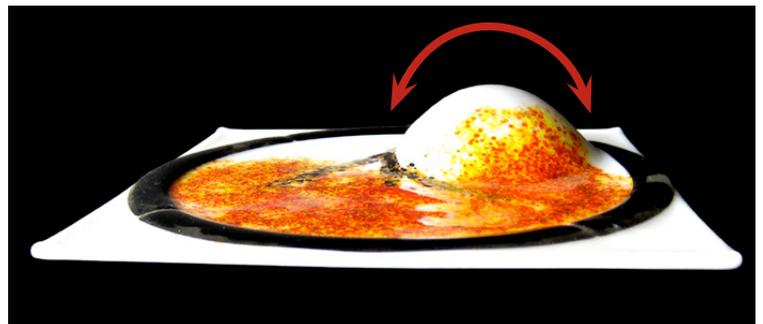
"Eruption:" Large bubble from beneath

SOLUTION: The problem is most likely to occur on a project with a single-layer Base that has been fired past tack fuse temperatures. After reaching temperatures above the mid 1300º (F) a single layer will become soft enough to expand and grow with the air that has been trapped underneath it (as in the picture above). We generally recommend using the equivalent of two even layers of glass when making projects, but if firing a single-layer project that has only scattered amount of decorative glass in the second layer, *don't fire beyond a tack fuse.* Additionally, always use a conservative firing schedule with sufficient holds to minimize bubble entrapment.

PROBLEM: Patchy, "Soap-scum" Areas on Glass Surface

Probably "de-vit" (short for "devitrification"). Glass is "vitreous" or non-crystalline in its molecular makeup. When crystallization occurs, it loses its glossy (glass-like) appearance. Devitrification can occur when glass has lingered too long at high temperatures. The effect of high temperature can be cumulative — that is, it may begin to show itself only after multiple firings. System 96 glasses are formulated to resist de-vit and are tested through four full firings. Surface haze can also result from firing dirty glass.

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Basic Troubleshooting *continued*

SOLUTION: Use System 96 glass; it is designed to be kiln fired. Otherwise, de-vit can be prevented or masked with an overglaze like "Super Spray" from FusionHeadquarters.com. Wipe glass pieces free of visible smudges/film during project assembly.

PROBLEM: "Charred" Areas, or Dense Patches of Small Bubbles
Sounds like glue – either too much or the wrong kind.

SOLUTION: Use as little glue as necessary to hold the pieces together during transfer to the kiln (this is often none, and never a lot). Use a glue that you know will burn away completely and cleanly during firing. (Elmer's white glue works well.) Toothpicks are a great tool to keep glue application to "pinpoint" size.

Black charring from too much glue, small cup with white glue & toothpick.

Other Interesting Glass Behavior Explained

"Outline" Appears Around Glass Pieces
This is the edges of the glass piece "folding up" as the glass melts and deforms. Find an unfired piece of the glass and compare its edges to its surface; you'll understand what happened. This is a nice effect and can be used to advantage in project design: it's especially noticeable with iridescents and some opalescent glasses.

Outline on Black Iridescent triangles

Glass Changes Color during Firing
Some glass colors are less stable than others and can shift (or "strike") when heated. The "hot" colors (reds and oranges) are particularly prone to this. System 96 glasses that are known to change are labeled with "Firing Advisories" indicating this. It's a good idea to know what to expect: include a small chip of a suspect glass on the shelf during another firing, so you'll know what to expect from that color.

Orange Pebble before and after firing

Troubleshooting Broken Projects

Sometimes a project will break; know this, and take time to understand what went wrong. Reassemble the pieces and examine the broken edges. Are they raw and sharp or have they been smoothed by the high heat of your forming stage? If sharp, you can deduce that the breakage occurred after forming was complete (because the broken edges were unaffected by the forming process). If they are smooth and rounded, then assume the opposite: the glass broke during heating, before the forming stage was reached.

Remember this: breakage is almost always caused by heating up or cooling down too fast for the project in question. Two notable exceptions: (1) shocking the hot glass by opening the kiln too soon, and (2) compatibility stress – somehow you've mixed together glasses of dissimilar expansion characteristics. Look, too, for wide thick-thin variation in the project. Areas where thin-meets-thick are very sensitive to cracking. More even-volume designs are less prone to problems.