

Properties of Glass – Temperature and Stress

PART 3: Temperature and Stress

In Properties of Glass Part 2, we discussed how malleable hot glass can be and how quickly it cools when it's removed from the furnace.

Glass is kept in furnaces at 2100°F. In order to keep the hot glass malleable (or capable of being shaped), it needs to be constantly reheated so it remains within a working temperature. Meet PGC's Roary the Reheating Chamber!



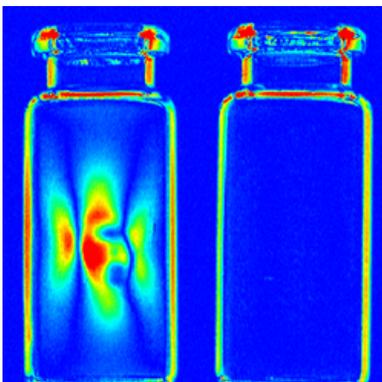
Roary is one of our many reheating chambers, also known as a "glory hole." The glory hole is a metal drum turned on its side, lined with a high-temperature refractory brick and material. It is powered by natural gas and resides at around 2150°F at working temperature. Glory holes are only turned on as needed, but need about half an hour to warm up before working.

The longer glass is out of the furnace, the longer it takes to reheat. If it gets too "cold," the glass becomes stressed and it could crack and break like in this video: <https://www.youtube.com/watch?v=oUtEFcABsJU>

So how do we keep cooled glass from breaking?

Glass must be properly annealed, or cooled slowly, to remove any stress in the glass. As glass pieces are finished, they are loaded into an oven called an "annealer." Our annealers sit at 930° F and are cooled slowly on a computerized program. Inadequately annealed glass is likely to crack or shatter spontaneously.

A polariscope is a special tool that can be used to see whether glass has been properly annealed or still contains stress. Look at this image of two cooled glass objects under a polariscope:



Notice how colorful the image on the left is? This glass has not been properly annealed. The colorful area is showing the internal stress of the glass. The glass on the right has been properly annealed and is not showing any signs of stress.



This image is looking at a stressed glass work under PGC's polariscope. Although the stressed glass looks beautiful and colorful under the polariscope the object is likely to break.

For more stressed glass fun check out this example of a Prince Rupert's Drop: <https://www.youtube.com/watch?v=x-e-f4gokRBs>

Activity: Stressed Glass Artwork

Here is what you will need:

- Looking Eyes
- Paper
- Pencil or other drawing tool
- Color! Crayons, colored pencils, markers, tissue paper, construction paper; whatever you have

What to do:

- Find one of your favorite glass items in your house to sketch. You may also want to come up with your own imaginary glass object!
- Sketch your object.
- Pretend your glass has not been properly annealed. Color in what it might look like under a polariscope. You can use colored pencils, crayons, markers, or even collage materials!

Additional Challenge: Try creating a stressed glass matching game! Choose as many glass objects as you can find. Sketch each object on a small square of paper. Then sketch and color the same objects again – pretending they are stressed on more pieces of paper. Flip them over and try to find all the matches!

Share Your Artwork

Post a photo of your stressed glass artwork! Tag us on Instagram, Facebook, or Twitter @pghglasscenter and we might share your creation.