



Kiln Temperature Variance

Is it Magic?

Many glass artisans claim different kilns fire differently. How could that be? The electronic controllers used to control kiln firings are assured to be accurate to 1°F and 1 minute. How could it be different in different kilns? How would 1350°F produce one result in one kiln but a different result in a different kiln? Is there some voodoo magic happening to cause different results? Perhaps little gremlin fairies that sneak around to reset our kiln controllers while the glass is firing?

Is it a Misconception?

I suggest the difference is a misconception. A misconception that causes a lot of confusion. It isn't that different kilns produce different results. It's that different kilns read temperature to different degrees of accuracy.

All kilns work the same. They generate heat and keep increasing heat until they reach the temperature requested. They are then turned off, either manually or electronically, to stop increasing heat. The misconception comes when artisans reporting different kilns firing to the same desired temperature not always produce the same results in the glass wrongly assume each kiln is reading the temperature accurately. The different results are not a result of different kilns behaving differently but in how accurately each kiln pyrometer or thermocouple reads the temperature. Some are accurate – some are not.

It's like the speedometer on your car. 60 mph in one car is 60 mph in ever other car but just because your speedometer says 60 mph does not mean you are traveling 60 mph. You might be going a little faster or might going a little slower. It depends on how accurately your speedometer reads speed.

What Causes Wrong Readings

Thermocouple malfunction – Thermocouples can fail and produce the wrong temperature reading. Sometimes even brand new ones are inaccurate. You need to test each kiln to see if the thermocouple is reading temperature accurately. If it isn't, you should either adjust all kiln firings to compensate for any error factor or adjust your controller to read more accurately.

Thermocouple mispositioned – Not far enough into the kiln. It's not uncommon for a thermocouple to get pushed slightly out. If it doesn't reach as far into the kiln as it was designed to be placed, it won't read the temperature accurately.

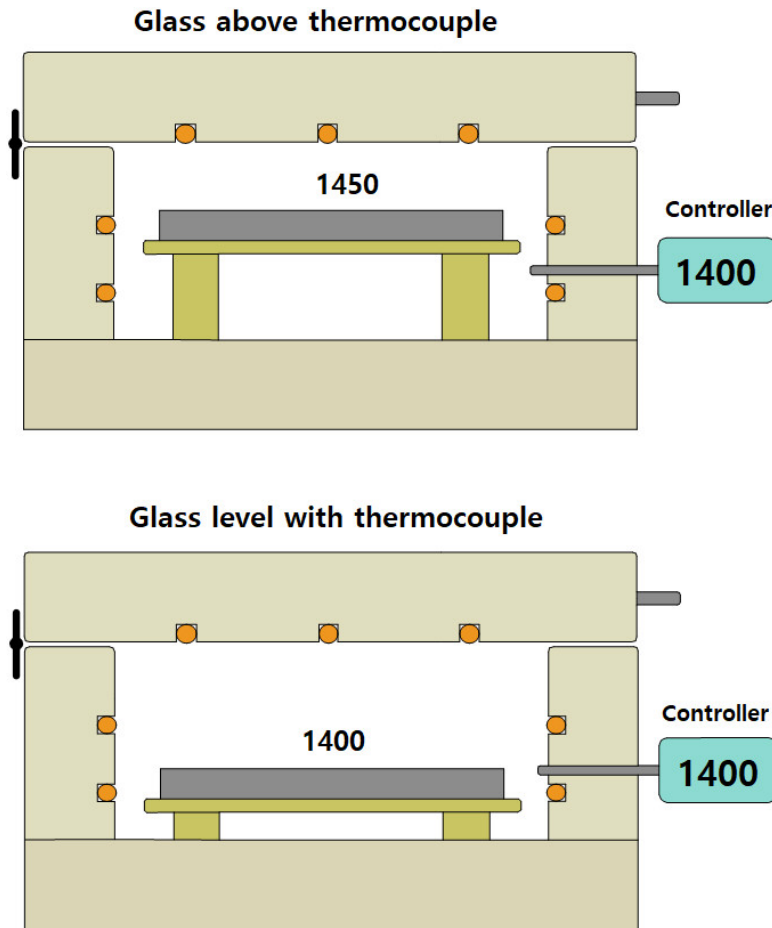
Glass Not Level with Thermocouple – The thermocouple reads the air temperature where is it positioned. Heat rises. Air in your kiln lower than the thermocouple will be cooler than at the level of the thermocouple. Air above that level will be warmer. If your glass is fired at a level



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other than level with the thermocouple it will not be fired at the temperature the thermocouple reads.

Venting – any opening in the kiln from a partially open lid or open plug holes can allow cool air to enter your kiln and affect the kiln firing.



This diagram shows how if the glass is positioned level with the thermocouple it will heat to the temperature the thermocouple reads but if the glass is positioned above the thermocouple it could be hotter than the thermocouple reads. This would cause your project to be fired to a higher temperature than you programmed.

Adjusting for Error

If you think your kiln is not delivering the correct results for the temperature you programmed it to fire to, you should adjust for the error. Two ways to do that:



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Compensate for it. If the kiln is firing too high or too low, change your program to compensate for the error. Just as if you believe the speedometer in your car is inaccurate, it's a good idea to compensate for the error when you're driving. The same with your kiln. If you think your kiln is firing too high or too low, you can compensate for it by firing to a lower or higher temperature.

Correct it. Digital controllers have a setting called "thermocouple offset" that allows you to adjust the temperature reading. Each controller is different. It's usually in a special place kiln makers refer to as the "secret menu". Contact your kiln maker to learn how to access it to make any needed adjustment.

It's Your Responsibility

If you get a speeding ticket, a judge is unlikely to let you off because your speedometer reads wrong. It's your responsibility to allow for any inaccuracy. If your glass project is ruined because your kiln fired too high, don't blame the kiln and don't excuse it with "all kilns fire differently". Blame yourself for not compensating for it. There are tests you can do to measure how accurately your kiln is reading temperature. It is your responsibility to do those tests so you will know how to compensate for any inaccuracy.

Testing for Accuracy

Some artisans suggest using ceramic test cones to measure the accuracy of your kiln. The problem with using test cones is they can have a variance as much as 100°F. That amount of error makes them useless for testing kiln accuracy for firing glass. A test that does produce an accurate measure is a tack fuse test.

- Stack layers of glass in descending size.
- Fire to tack fuse (1350°F for COE 96, 1370°F for COE 90 and 1425°F for float glass) with a 15 minute hold.

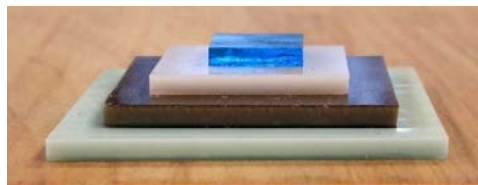
If your kiln is reading temperature accurately, the pieces should have formed a reliably firm fuse and retained a straight square sides with just enough edge rounding to remove the razor sharp edges on the glass. If the test results are any different, visit the "thermocouple offset" to have your kiln produce the desired effect.



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Test stacks at each corner of the kiln ready to fire to test for temperature variance.



Before firing.



After firing to 1350°F (732°C)



Test stacks after firing to 1350°F (732°C)



Identical tiles fired in the same kiln at the same firing schedule at different times. The tile on the left was fired with lid elements only. On the right with only side elements