



Thermocouple

Thermocouples

How To Evaluate Thermocouples

The 5 most important things to consider when evaluating a thermocouple are:

- Accuracy
- Responsiveness
- Life
- Durability
- Cost
- Flaking

Accuracy

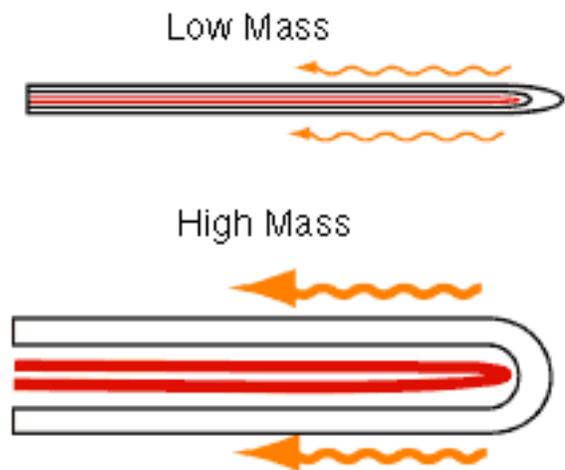
The Accuracy of a thermocouple is measured by the difference between what a thermocouple is reading and the actual temperature of the chamber. This is measured when the kiln is at a steady state (not ramping up or down).

A Type S thermocouple is considered to be the most accurate thermocouple and is therefore used as the standard to measure against. The material used to construct a Type S thermocouple will not degrade in most atmospheres and therefore the thermocouple will not drift with age.

Type K thermocouple wire is also very accurate however as the wire degrades the thermocouple will begin to drift towards an overfire. This is a gradual process and is not something to be concerned about. Use self supporting Pyrometric cones to monitor your firings and indicate when it is time to change the thermocouple.

High mass protection tubes can also affect the accuracy of a thermocouple even during a long soak. This is because the end of the tube that is not exposed to the kiln chamber wicks heat through conduction causing a falsely low reading (see Illustration). This will cause the kiln to fire too high. The higher the temperature the more dramatic the effect.

You can compensate for this affect by entering Cone offsets (altering cone correlation temperatures in Cone Fire Mode) however this must be done for every cone value and does not compensate for temperature ranges prior to cone correlation.



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Responsiveness

The Responsiveness of a thermocouple is determined by the accuracy of the thermocouple while the kiln is increasing or decreasing in temperature. This is determined primarily by the type and mass of the protection tube used if any. The greater the mass of the protection tube the less responsive the thermocouple becomes.

Thermocouples that are not responsive will lag behind the actual temperature of the kiln when it is ramping up. Since the controller thinks the kiln is cooler than it actually is, this will cause the kiln to overshoot the desired temperature. Generally, the faster the rate the more dramatic the overshoot.

This can be compensated for by entering thermocouple offsets (tricking the controller to read a higher temperature than the thermocouple is indicating), however once the kiln enters a soaking temperature the temperature balances out and the actual temperature of the kiln will be too low. For obvious reasons this is not recommended.

Life

The life of a thermocouple, how long it lasts, can be affected by a multitude of factors. The most influential factors are Wire Type (see Wire Type section) and temperature. The temperature range in which it is used can have a huge impact on the life of the thermocouple. For example, a thermocouple used at glass temperatures may last for over 1000 firings where the same thermocouple used at cone 10 may only last for 20 firings.

The life of the thermocouple will also be affected by the gauge of thermocouple, and gases it is exposed to from clay and glazes.

Durability

Durability is determined mostly by the thermocouples impact resistance. In certain applications, especially when inexperienced people are loading the kilns, it is possible to bump the thermocouple with a piece of ware or a shelf. The stronger the thermocouple the more it will hold up to this abuse.

Flaking

Type K thermocouples will oxidize as they age. If a protection tube is not used they will drop small black particles below the thermocouple. This is generally not a problem since the thermocouples do not protrude too far into the kiln chamber and the particles drop straight down. It will be necessary to vacuum the kiln chamber occasionally.

Type S thermocouples will not flake however a protection tube is needed for dimensional stability.

Cost

Type S thermocouples are approximately 20 times more expensive than Type K thermocouples due to the materials used to make them. At Skutt we give you a spare type K thermocouple with every purchase of a new Skutt Kiln therefore your initial cost per firing is cut in half. Since a Type S thermocouple will virtually last forever, unless you break it, your cost per firing decreases with every firing.