Zone Control Advanced Uniformity

Modern Automatic Zone Control Technology Allows Dynamic Adjustment of Electric Kilns to Ensure Uniform Firings.

Zone control in ceramic electric kilns has been around for quite a few years. However, only since zone control became automated within the past few years has it become more popular.

The typical ceramic top-loading electric kiln, based on designs that are now almost a half-century old, has always had a problem with temperature uniformity, especially from top to bottom. Typically the center or the top of the kiln fires the hottest, while the bottom fires colder. This differential can be up to a whole cone or more.

There are a number of techniques that are used to counteract this effect. One of the oldest, used in batch kilns from time immemorial, is to learn the firing characteristics of a kiln and load the kiln accordingly. You can load certain pieces in the cold spots that won't be as affected by the temperature differences or perhaps load heavier pieces in the center that would absorb more heat. This has the obvious disadvantage of constraining the artist or productive output of the kiln. For instance, it would be difficult to uniformly fire 100 coffee mugs with the same glaze in a conventional polygonal electric kiln.

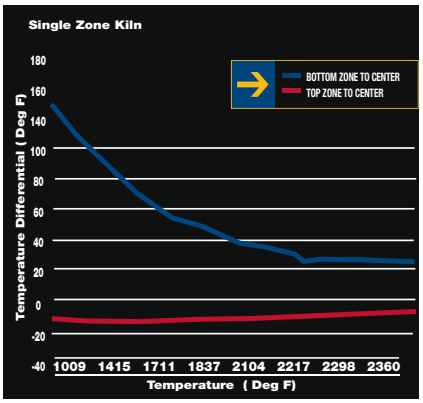
Another technique used in many electric kilns today is to grade the power output of the elements so more power goes towards the top and the bottom of the kiln. This can produce a very even kiln if done right. The problem with this method, however, is that the power output of the elements changes with age and so the heating characteristics of the kiln may become less uniform. It can become a big problem if one element gets ruined by glaze, for instance, and has to be changed. You may have to change all the elements in the kiln. Also this method may not accommodate changes in the loading patterns. (Interestingly when we designed the School-Master kilns, which have graded elements for uniformity, we only had to vary the ohms slightly and then only on the top to achieve perfect results - which indicates that the basic kiln design is extremely uniform.)

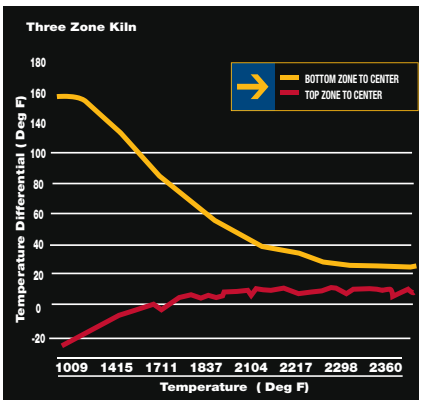
Another method of evening out temperatures in an electric top-loading kiln is to use a downdraft vent. This system pulls a small amount of air down from the top of the kiln and out the bottom. It counteracts the natural tendency of the heat to rise. Our tests have shown about a ½ cone uniformity improvement using this technology.

The other method of dealing with uniformity issues is by using zone control. This is a technology that L&L has used in its industrial division at great expense to achieve critical results for important processes like firing million-dollar loads of ceramic-based superconducting wire (We have built special kilns with up to 24 separate heating zones). In addition, L&L has had a long history of utilizing manual zone control on its top-loading electric pottery kilns. The use of manually controlled infinitely adjustable switches allows control of manual kilns zone by zone. This system, especially when used in conjunction with a multi-thermocouple pyro-meter system, allows potters to see which zone is getting hotter and make adjustments while firing. This, however, can be a tedious process.

In the past few years newer electronic controls designed just for electric kilns have begun to incorporate true automatic multi-zone operation. These controls typically use three separate thermocouple inputs and three relay outputs for the power control. Each zone of the kiln is independently controlled on a separate control loop – sophistication typically only available in controllers costing much more money.

The great advantage of automatic zone control technology is that it allows dynamic adjustment of the kiln to accommodate changing elements and different loads. Typical uniformity is within ½ a cone or better. Another nice feature of zone control is that you can bias zones. For instance, if the top of the kiln fires cooler, you can subtract a few degrees from the top zone thermocouple reading to make that zone fire to a higher temperature.





The downside of zone control is that it can slow down the kiln by turning off power to hotter zones. However, this technology has matured over the past few years. The new controls include the ability to turn zone control off during all but the last segment of the program to speed up firing. The key to good functioning now is to ensure that there is enough power in the kiln to compensate for the effects of the zone control.

Zone control is an excellent technical answer to the age-old difficulty of batch kiln uniformity problems.

L&L Kilns hotkilns.com

505 Sharptown Road • Swedesboro, NJ 08085
Phone: 856.294.0077 • Fax: 856.294.0070
sales@hotkilns.com • hotkilns.com

KILNS BUILT TO LAST

Bulletin No: ZC-3-15