about ***FireRight***

THERMOCOUPLE TEMPERATURE SENSORS

ISA Type K (Nickel-Chromium vs' Nickel-Aluminum)

Thermocouples are made simply by connecting two dissimilar types of wire. The junction thus formed is temperature-sensitive, and produces a very small voltage which varies with its temperature. Since this physical phenomenon depends mostly on (1) the type of wire used and (2) the temperature of the junction, this very simple device is a very accurate and reliable temperature sensor.

When used at temperatures exceeding 1800°:F, type K thermocouple elements are subject to a corrosion process known as ***"green rot",*** which eventually consumes the wire. The higher the temperature and the longer the exposure, the shorter the life of the element. To inspect the condition of the element, use any sharp metal tool to scrape away the greenish, carbonaceous scale from the wire, until bright metal is exposed. If this corrosion process has reduced the wire to less than one-third of its original diameter, its accuracy and reliability are doubtful, and it should be replaced.

It is impossible to connect the thermocouple element to any temperature measuring device without forming a second junction, normally referred to as the *cold junction.* The free ends of the thermocouple element must inevitably be connected to brass screws on the back of a pyrometer or to a copper circuit board, forming temperature-sensitive second and third junctions. These become the algebraic equivalent of a single *cold junction* having the same temperature-sensitive characteristics as the *hot junction.* Because of this, it is important that this *cold junction* be formed at a known location, and properly compensated for. ***THE USE OF THERMOCOUPLE EXTENSION WIRE BETWEEN THE SENSOR AND THE MEASURING INSTRUMENT IS THEREFORE MANDATORY***. Thermocouple extension wire is made of the same type of wire as the sensor, in this case ***ISA type K***, also called *"Nickel-Chromium vs' Nickel-Aluminum"*.

The voltage produced by the sensor has a definite polarity, and ***POLARITY MUST THEREFORE BE CONSIDERED WHEN CONNECTING THE SENSOR AND EXTENSION WIRE TO THE MEASURING INSTRUMENT.*** To facilitate this, the positive wire is usually marked with a (+) symbol, or the pair may be or color-coded:

YELLOW: (+) (nonmagnetic wire)
RED: (-) (magnetic wire)

If the colors are missing or worn off, the magnetic property of the (-) wire is the key to determining the polarity, and can be checked using any small magnet (even the "bug" from the refrigerator door). *FireRight* replacement elements have one bright-colored wire (+), and one dark-colored wire (-).

TO REPLACE THE OLD THERMOCOUPLE ELEMENT, loosen the two screws which hold it, then pull it out of the sensor assembly. If you wish to re-use the existing mounting hardware, bend the ends of the new element to fit, then slip the base plate and insulator onto the element, insulator first. To complete the assembly, secure the two terminal ferrules to the ends of the element, being careful to observe polarity. Make sure that all screws are tightened securely.

Standard thermocouple replacement elements are 7-1/2" long, and are formed to fit the *FireRight* ceramic mounting block (p/n 179012). Bending the element to fit other mounting blocks will not affect the accuracy of the sensor in any way. The wire is pliable, and bends rather easily. The ceramic insulators are quite brittle, however, and will break under very little stress. Cracked or broken insulators will not affect the accuracy of the element as long as the wires do not touch at any point along its length.

TO TEST THE INSTALLATION, turn the controller on. Its temperature indicator should rise to 75°:F. Strike a match and hold it to the tip of the new sensor, and observe that the temperature indication

increases. (If the sensor is reversed, the indication will move downscale, below 0°:F ... a dangerous fault which can result in overfirings.) For non-indicating controllers, place the controller in the "soak" mode with a 200°:F set point, then permit the kiln to operate normally. If the kiln will not control at the 200°:F setting, assume that the sensor has been reversed. Correct the polarity and try again. ***THE TEMPERATURE SENSOR SHOULD BE PERMANENTLY FASTENED TO YOUR KILN, AND SHOULD PROTRUDE AT LEAST TWO INCHES INTO THE FIRING CHAMBER.*** The sensor mounting port (or peep-hole) should be sealed to prevent drafts from affecting the accuracy of the sensor, especially at high temperature. Pack the port with ceramic fiber insulation, if possible.

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