Thermocouple Decalibration and Drift – Part 4

Why worry about Non-uniformity (also called inhomogeneity)?

Last time we posed the question: *If both ends of a thermocouple are at the same temperature will there be any emf produced?*

The answer is: *No, there shouldn't be, but there can be*.

Actually it's a little more complicated than that. Emf, or electromotive force, is another term for voltage. A thermocouple acts like a little battery producing a voltage across the leads if the remote end is at a different temperature than the measuring end. Emf is produced by a thermocouple anywhere a temperature gradient exists.

1. If the entire sensor is at the same temperature along it's length, there will be no emf produced anywhere and no net emf or voltage signal.

2. If both ends of the sensor are at the same temperature, but somewhere along it's length the temperature is higher or lower, emf will be produced, but it will cancel out and no net emf will be produced IF the wires in the sensor are uniform or homogeneous along their entire length.

3. If the wires are NOT homogeneous, temperature gradients can produce emf contributions that do not cancel out, and there can be a net emf or voltage signal produced. This is of course an erroneous signal in our example caused by what we call "inhomogeneity".

In practice, **inhomogeneity in thermocouple wires routinely causes erroneous signals**. Often they are small, however there are documented cases of huge errors of as much as 50% of the signal. The real problem is that in conventional thermocouples you don't know if it's there or not. If you just want to know if it's hot or not, this might not make a difference to you. But for most industrial applications **choosing the right temperature sensor for the job and taking care to install and maintain it correctly is very important.**

Next time we'll address the causes of inhomogeneity and what can be done about it.

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