Thermocouple Decalibration and Drift – Part 5

What can be done to prevent inhomogeneity and reduce "Drift"?

Last time we established that **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 inhomogeneity is there or not. If you just want to know whether the process is hot or not, this might not make a difference to you. But for most industrial applications **specifying the right temperature sensor for the job and taking care to install and maintain it correctly is very important.**

Here are several things that can be done to reduce the problems of inhomogeneity and improve thermocouple performance:

1. Pick **the right sensor for the job** – pay attention to sensor ranges and try not to push the recommended temperature range, there is often a tradeoff between sensitivity and useful range.
2. **Choose the sensor sheath** and construction that is best for the process environment and the sensor. Often the process environment dictates the sheath required, but where several sheath materials will withstand the process be aware that some combinations of sheath material and sensor type can reduce the amount of thermo-element decalibration. Closed end, un-grounded thermocouples are the best for protecting the thermoelements. Also, our new AccuTru MI-Dry™ mineral insulation material has been shown to slow down decalibration.
3. Don't skimp on size - **bigger is better when it comes to thermal stability** - especially if you are pushing the temperature limits of the thermoelements. Other factors, however, can dictate size and design such as speed of response which generally decreases with increasing size.
4. Use only **special limits** thermocouples – thermo-element materials have to be certified to meet tighter tolerances and are therefore more uniform along their length.
5. Use calibrations with caution – **calibrations are no guarantee** of tolerances when placed in service.
6. **Be careful of insertion depths** – insufficient insertion depth can cause errors in readings. The rule of thumb is insertion depth should be a minimum of 7 to 10 times the diameter of the probe. Also, changing insertion depth of a sensor moves the temperature profile and causes the emf to be generated by a different part of the thermo-elements. If inhomogeneity is present a different signal will result.
7. Consider **lead wire** quality, length and protection – thermal gradients occurring in lead wires contribute to the overall emf just like the thermo-elements in the sensor. Minimize lead wire lead wire length to obtain the strongest signals.
8. Keep **transitions** at or below recommended limits (normally 50 degrees C) – lead wires are not made to provide as high quality thermal response as thermo-elements.
9. Protect **wiring junctions** from corroding or loose connections and check them first if bad signals are suspected.

The informed customer will be familiar with many of these precautions and be able to specify the sensor needed. However in some cases he may have tradeoffs to make and will need assistance from an experienced sensor engineer.

Next time – Despite all these precautions, thermocouple drift will occur – it's just a matter of when, and how much. What other steps can be taken to deal with thermocouple drift.

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