STRAIGHT FROM THE LAB

System calibration gives far higher precision

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Pentronic's laboratory is accredited since 1988

"By system calibrating temperature sensors plus good-quality instruments, you can improve your measurement precision by at least five times," says Lars Grönlund, manager of Pentronic's accredited calibration laboratory.

The reason for this greatly improved precision is found in how the standards for temperature sensors operate.

During their manufacturing process, Pt100 detectors and thermocouple wires are selected into various precision classes. The standards permit a certain amount of variation between individual sensors. The class specifications make no mention of the properties of an individual sensor, but only state that the sensor must stay within the permitted tolerances.

"Pt100 in accordance with IEC60751, class A" is a common sensor specification when more precise measurements are required. At 0 °C the standard requires maximum tolerance less than ±0.15 °C. The more the temperature deviates from 0, the more this tolerance value increases: at 150 °C it becomes ±0.45 °C.

"At 400 °C the standard states that sensors can vary by as much as ± 0.95°C," Lars Grönlund explains.

In addition to this comes the error contribution from the instrument. The final measurement uncertainty is over 1 °C. This is too much when a company has to save energy and have more efficient processes.

The properties of an individual sensor plus its associated measurement chain are established during the calibration process. If the calibrations are done separately, the error contributions are added together. In contrast, system calibration establishes the properties of the entire system, and thereby further reduces total measurement uncertainty.

"In Pentronic's laboratory we can system calibrate the Pt100 sensor and good-quality instruments with a measurement uncertainty down to ±0.02 °C at 400°C," Lars says.

This example shows that a fivefold improvement is a conservative estimate of the effects of system calibration.

In addition to the total measurement uncertainty that is established during calibration in a laboratory, various error contributions also occur at the site where the sensor is installed. These can also be reduced by calibrating within the actual production process. For certain critical processes, the US Food and Drug Administration (FDA) is beginning to require that an external party inspects and calibrates measurement equipment in situ.