

Establishment of a secondary temperature calibration laboratory

Application Note

Introduction

A wide range of temperature sensors is used in science and industry. These sensors need to be calibrated for a variety of technical and regulatory reasons. If you want to calibrate these temperature sensors in house, what will you need to get started?

Assuming that your accuracy requirements are not as tight as few thousandths of a degree Celsius, take a look at establishing a secondary calibration lab. You may find that you can reduce costs and maximize other benefits to your organization.

A secondary laboratory can be tailored to your specific workload, accuracy and throughput requirements. The most common kinds of workload are RTDs, PRTs, thermocouples, and liquid-in-glass thermometers.

Secondary temperature laboratory comparison calibration from -196 °C to 1100 °C

The backbone of the secondary temperature laboratory is a series of highly stable and uniform fluid baths and/or Metrology Wells with a stable standard platinum resistance thermometer (SPRT) as the traceable standard. For thermocouple calibrations, a horizontal furnace is used as the stable heat source and a noble-metal thermocouple as the reference standard. Temperature setpoints are often used which correlate to ITS-90 fixed points. For increased productivity, automated calibration software is preferred.

The equipment listed here is intended to provide a range of uncertainty adequate for a secondary comparison laboratory. This will, of course, be finally dependent on the establishment of good laboratory practices and procedures. Fluke Calibration can advise on this process. Table 1 details a secondary lab's capability.

In addition, industrial thermocouple type B, E, J, K, N, R, S, T, and less common versions, such as type C, can be calibrated. Internal or external cold junction compensation is selectable. See Table 2 for a list of recommended equipment.

Table 1. Secondary laboratory capabilities

Unit Under Test	Temperature	Uncertainty	Technique
SPRT	-200 °C to 660 °C	6 to 16 mK	Comparison calibration on the ITS-90 to SPRT.
RTD	-200 °C to 660 °C	10 to 50 mK	Comparison calibration on the ITS-90 to SPRT.
Thermistor	Various spans	2 to 10 mK	Comparison calibration on the ITS-90 to SPRT.
Thermocouple	-200 °C to 1100 °C	1.0 °C to 2.0 °C	Comparison calibration to noble metal thermocouple.

Notes: The values listed above in the "Uncertainty" column are the expanded uncertainty of the calibration process at a coverage factor of k=2. The method used will be stated on the Report of Calibration. Not all instruments submitted will be capable of being calibrated over the temperature ranges shown or to the above levels of uncertainty.

We strongly recommend that you visit our working primary and secondary laboratories, to discuss with our metrologists all aspects of building and commissioning a temperature facility. Topics to include ITS-90, uncertainties, laboratory management (ISO-17025), all elements of construction, HVAC, fume extraction, and health and safety issues.

Table 2. Equipment needed

Item No.	Qty.	Description	Model No.	Remarks
1	1	LN2 Comparison Calibrator	7196-13	-196 °C
2	1	Ultra Low Temperature Deep-Well Bath Spare access cover LiG calibration kit, level adaptor Magnifier Halocarbon 0.8 Fluid (-100 °C to 70 °C)	7381 2012-DCB 2019-DCB 2069 5019-18.9L	-80 °C to 110 °C
3	1	Ultra Stable Bath Spare access cover Carousel Distilled Water (27 L)	7012 2010 2017 n/a	-10 °C to 110 °C
4	1	Low Temperature Deep-Well Bath Spare access cover LiG Calibration Kit, Level Adaptor Magnifier Silicone Oil 200.05, 18.9 L (-40 °C to 130 °C)	7341 2012-DCB 2019-DCB 2069 5010-18.9L	-40 °C to 150 °C
5	1	Mid Range Deep-Well Bat Spare Access Cover LiG Calibration Kit, Level Adaptor Silicone Oil Type 710 (80 °C to 300 °C)	6331 2012-DCB 2019-DCB 5017-18.9L	40 °C to 300 °C
6	1	High Temperature Deep-Well Salt Bath Carousel Salt Automation Package	6055 2018 5001 2001-6055	200 °C to 550 °C
7	6	Probe Stand	2050	One for each heat source
8	1	Thermocouple Furnace	9118A	300 °C to 1200 °C
9	1	High Accuracy Metrology Well	9170	-45 °C to 140 °C
10	1	High Accuracy Metrology Well	9173	50 °C to 700 °C
11	1	Thermometer Readout SPRT Reference Module PRT Scanner Module Thermocouple Reference Module Thermocouple Scanner Module	1560 2560 2562 2565 2566	
12	1	Constant Temperature Ice Bath	7911A2	
13	1	Working Standard SPRT	5698	-200 °C to 661 °C
14	1	Secondary Standard PRT	5628	-200 °C to 661 °C (for use in Metrology Wells)
15	2	Type S Thermocouple Standard or Type R Thermocouple Standard	5650-20 5649-20	For use in 9118A
17	1	Thermo-Hygrometer	1621-S	
18	1	Triple Point of Water (TPW) Cell	5901A-G	Calibration and check standard
19	1	TPW Maintenance Bath	7312	Maintains two TPW cells
20	1	MET/TEMP II, Automated Calibration Software	9938	
		Training and Commissioning		

Notes:

1. All items supplied with accredited/traceable certificates to national standards where appropriate.

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Electrical	RF	Temperature	Pressure	Flow	Software
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