

Please place your responses in
the green boxes.

Name of laboratory
Date survey was filled out
Name of technical contact filling
out survey
Phone number of technical
contact

Fax number of technical contact
E-mail of technical contact

Sandia National Laboratories
9/19/2019
Lisa Bunting Baca
505-844-2180
505-844-0562
labunti@sandia.gov

1. Basic Methods

Do you perform calibrations by a
comparison method?

If yes, please fill in the following information

1a. Type of reference
thermometer (e.g., type S TC)

Yes
(y/n)

SPRT & Type S TC

1b. Type of furnace or bath, and
temperature range of each

	temperature range	thermocouple immersion in furnace/bath (cm)
Fluke 9173	50°C-700°C	20.3 cm
Fluke 9118A	300°C-1200°C	36.5 cm

1c. Is an isothermal block used?

Yes
(y/n)

1d. Are the test thermocouples
thermally anchored to the
reference thermometer?

No
(y/n)

Do you perform calibrations at fixed points?

No (y/n)

Reference Junctions

1f. Type of reference junction
bath (ice/water in Dewar,
electronic compensation,

Ice/water in Dewar

1g. Thermocouple immersion
into bath (cm)

7.5 in. or 19.1 cm.

2. Uncertainty Budget

Below are possible uncertainty components. Please fill in the relevant values for your calibration service, either at the temperatures listed or at temperatures relevant to your service. Enter component uncertainties in units of equivalent temperature, at a confidence level of $k=1$.

**2a. Uncertainty components:
comparison methods, in units of
°C**

Reference thermometer calibration
Reference thermometer drift
Reference thermometer
repeatability
Reference thermometer readout
Test thermocouple repeatability
Test thermocouple readout
Test thermocouple inhomogeneity
Test thermocouple stability
Reference junction temperature
uncertainty
Bath or furnace temperature
stability
Bath or furnace temperature non-
uniformity
Extraneous emf of wiring, scanners,
etc.

	t=100 °C	200 °C	300 °C	400 °C	500 °C	600°C	700°C
Reference thermometer calibration	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.125
Reference thermometer drift	0.001	0.001	0.001	0.001	0.001	0.001	0.124
Reference thermometer repeatability	0.005	0.002	0.002	0.002	0.003	0.002	0.008
Reference thermometer readout	0.0035	0.0035	0.0035	0.0035	0.0035	0.0035	0.02
Test thermocouple repeatability	0.007	0.007	0.007	0.023	0.008	0.008	0.033
Test thermocouple readout	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Test thermocouple inhomogeneity	0.029	0.052	0.081	0.104	0.133	0.162	0.185
Test thermocouple stability	0.002	0.002	0.002	0.007	0.002	0.002	0.008
Reference junction temperature uncertainty	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Bath or furnace temperature stability	0.006	0.006	0.006	0.006	0.017	0.017	0.058
Bath or furnace temperature non- uniformity	0.065	0.065	0.065	0.065	0.101	0.101	0.116
Extraneous emf of wiring, scanners, etc.	0.006	0.006	0.006	0.006	0.006	0.006	0.006

**2b. Additional components not in
above list, if any
(description of extra component)**

**2c. Total expanded uncertainty
(k=2), comparison methods, in
units of °C**

	0.21	0.23	0.26	0.29	0.37	0.41	0.60
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3. Thermal history



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3a. Please describe, approximately, the duration and temperature for each exposure of the test thermocouple to temperatures above 100 °C

(An alternative description in words is acceptable.)

temperature of exposure / °C	duration / minutes
100	20 min.
200	20 min.
300	20 min.
400	20 min.
500	30 min.
600	30 min.
700	60 min.

4. Immersion history

4a. Please describe, in words, whether the test thermocouple is kept at a single, fixed immersion through the test, or whether the immersion of the thermocouple varies throughout the test.

The test thermocouple was immersed 8" for the test ranges 100°C to 600°C. It was immersed 14.5" at 700°C.

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Thermocouple emf at the time of first heating

Cut number

C

D

temperature / °C

temperature / °C	emf/mV	U(k=2)/mV
100	5.269395943	0.011
200	10.80885675	0.013
300	16.37046432	0.014
400	21.8891463	0.016
500	27.44343887	0.021
600	33.14454203	0.024
700	39.12395399	0.037

temperature / °C	emf/mV	U(k=2)/mV
100	5.264754725	0.011
200	10.79137026	0.013
300	16.35491921	0.014
400	21.89270889	0.016
500	27.44845131	0.021
600	33.14558268	0.024
700	39.10081303	0.037