

**Certificate Of Calibration
 Fluke Calibration, American Fork
 Temperature Laboratory**

Certificate Number: 4500019334	Date of Calibration: 29 Sep 2022
Status: Found-Left: Pass	Date Due:
Model: 5609	Temperature: 21 to 25 °C
Serial Number: 08690	Relative Humidity: 20 to 55 %rh
Options:	Pressure: 83.5 to 88.5 kPa
Description: Platinum Resistance Thermometer	Issue Date: 29 Sep 2022
Procedure: AFC1006: Rev 001	

Customer: NEW PRODUCT
Location:
RMA/SO Number: 9757779
PO Number: B32201054

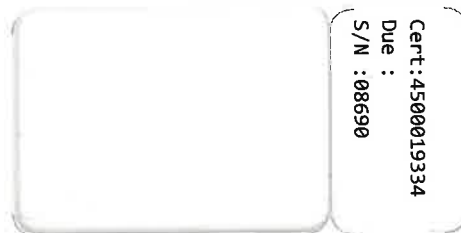
This calibration is traceable to the International System of Units (SI) through recognized national metrology institutes (NIST, NRC, PTB, NPL, etc.), radiometric techniques, or natural physical constants and is in compliance with ISO/IEC 17025:2017. Calibration certificates without identification of the authorizing person are not valid. This certificate applies to only the item identified and shall not be reproduced except in full, without the specific written approval by Fluke Corporation. This certificate shall not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Measurement uncertainties at the time of calibration are given where applicable. They are calculated in accordance with the method described in the ISO Guide to the Expression of Uncertainty in Measurement (GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95 %.

Calibration status should be interpreted as follows:

- As-Found: Data collected before the unit was adjusted and / or repaired.
- Found/Left: Data collected without any adjustment and / or repair performed.
- As-Left: Data collected after the unit has been adjusted and/or repaired.

Comments: This calibration certificate was reviewed and approved electronically.



**Authorized By
 Michael Coleman**

Quality Manuals

This calibration has been completed in accordance with:

- Fluke Corporate Quality Manual, QSD 111.0
- Fluke 17025 Quality Manual, QSD 111.41

Fluke values feedback. Please contact us at <http://us.flukecal.com/about/contact>.

Method Used

This platinum resistance thermometer (PRT) was calibrated on the International Temperature Scale of 1990 (ITS-90) by comparison with a standard platinum resistance thermometer (SPRT). The calibration was performed as follows. PRT output resistance was measured at several temperatures using the SPRT as the temperature reference. The PRT resistance values were characterized using the ITS-90 system of equations for platinum thermometers to obtain calibration coefficients that align the PRT with the ITS-90 temperature scale. The calibration coefficients are required for the PRT to measure temperature correctly. When available, extra calibration points are included in the characterization to verify quality of the characterization. A calibration status of Pass indicates that the PRT characterization meets the requirements of the curve-fit analysis. If the PRT fails curve-fit analysis the calibration status is Fail and a detailed description is provided in the calibration data section.

A calibration status of Pass indicates the PRT passes curve-fit analysis and meets the required short-term repeatability limit. A status of Fail is accompanied by additional information describing the failure. Curve-fit analysis is done using Chi-Squared analysis which compares residual size with expanded uncertainty. Short-term repeatability is evaluated by measuring the PRT resistance at the triple-point of water temperature (0.010 °C) multiple times as the calibration progresses. As Found RTPW is measured first and then, if required, the PRT is thermally stabilized. After thermal stabilization, Begin RTPW is measured. After this, temperatures above 0 °C are measured and, as applicable, Middle RTPW is measured. Then temperatures below 0 °C and Final RTPW are measured. Change in RTPW is the difference between the maximum and minimum of the RTPW values measured after As Found RTPW. The average of these RTPW values is reported with the calibration coefficients.

Pass/Fail conditions reported herein pertain only to results observed during calibration and do not describe the long-term (calibration-to-calibration) status of the PRT. Long-term drift of the PRT is evaluated by comparing the results from this calibration with the results from the previous calibration. To aid in this evaluation, a temperature vs. resistance table is provided in the Calibration Results section. Change in resistance is converted to change in temperature by dividing the change-in-resistance value by dR/dT which is also listed in the table.

Uncertainty is reported for each calibration point. The uncertainty evaluation accounts for all known uncertainties present at the time of calibration including uncertainties of the calibration system, measurement noise, and short-term non-repeatability of the PRT as defined in manufacturer specifications. To determine total long-term uncertainty of the PRT, Fluke recommends combining measurement uncertainty reported herein with the other sources of uncertainty that exist in the measurement process where the PRT is used, including, at a minimum, allowed long-term drift of the PRT.

Standards Used:

Asset	Description	Cal-Date	Due-Date
5699-1410	Fluke Calibration 5699 Standard Platinum Resistance Thermometer	22-Mar-2022	22-Mar-2025
1595A-B43151	Fluke Calibration 1595A Precision Digital Thermometer	17-Dec-2021	17-Dec-2022
5917A-17103	Fluke Calibration 5917A Thermometric Fixed-Point Cell	22-Jul-2022	22-Jul-2023

Calibration Results:

Calibration Data

	Reference Value	Measurement Result	Expanded Uncertainty
Description	(°C)	(ohms)	(mK)
Comparison	-196.960	18.3221	10.0
Comparison	-80.008	67.6805	10.0
Comparison	-38.826	84.4119	9.0
Comparison	0.010	99.9829	9.0
Comparison	156.611	160.9249	14.0
Comparison	231.933	189.2006	16.0
Comparison	419.549	256.7681	25.0
Fixed Point	660.323	337.4014	30.0

Short-Term Repeatability Results

	Reference Value	Measurement Result
Description	(°C)	(ohms)
As Found RTPW	0.010	99.9825
Begin RTPW	0.010	99.9828
Middle RTPW	0.010	99.9835
Final RTPW	0.010	99.9824

Change in RTPW

	Observed	Limit
Temperature	3 mK	10 mk

Excitation Current: 1.000 mA

Calibration Coefficients

RTPW = 99.9829
 a4 = -5.251872 E-04
 b4 = -2.434117 E-05

a7 = -5.411682 E-04

b7 = 1.382959 E-05

c7 = -1.570663 E-05

Test ID: C2269094534734

Cal Model: 1922-4-7

Temperature vs. Resistance Table

Temp (°C)	Res (ohms)	dR/dT (ohms/K)
-200	17.0123	0.429822
-190	21.3360	0.433844
-180	25.6743	0.433346
-170	29.9966	0.430925
-160	34.2908	0.427861
-150	38.5537	0.424746
-140	42.7863	0.421825
-130	46.9911	0.419176
-120	51.1708	0.416798
-110	55.3279	0.414662
-100	59.4647	0.412726
-90	63.5829	0.410951
-80	67.6841	0.409303
-70	71.7693	0.407756
-60	75.8395	0.406291
-50	79.8954	0.404894
-40	83.9376	0.403555
-30	87.9667	0.402266
-20	91.9830	0.401016
-10	95.9871	0.399792
0	99.9789	0.398570
10	103.9585	0.397354
20	107.9260	0.396141
30	111.8814	0.394932
40	115.8247	0.393727
50	119.7559	0.392524
60	123.6751	0.391323
70	127.5824	0.390125
80	131.4776	0.388929
90	135.3610	0.387734
100	139.2323	0.386542
110	143.0918	0.385352
120	146.9394	0.384163
130	150.7751	0.382977
140	154.5989	0.381793
150	158.4109	0.380611
160	162.2112	0.379430
170	165.9996	0.378252
180	169.7762	0.377076
190	173.5411	0.375903

Temp (°C)	Res (ohms)	dR/dT (ohms/K)
200	177.2943	0.374731
210	181.0357	0.373561
220	184.7655	0.372393
230	188.4836	0.371228
240	192.1901	0.370064
250	195.8849	0.368901
260	199.5681	0.367741
270	203.2397	0.366581
280	206.8997	0.365423
290	210.5482	0.364266
300	214.1850	0.363110
310	217.8104	0.361954
320	221.4241	0.360799
330	225.0264	0.359644
340	228.6170	0.358489
350	232.1961	0.357333
360	235.7637	0.356176
370	239.3196	0.355019
380	242.8640	0.353860
390	246.3968	0.352700
400	249.9180	0.351538
410	253.4276	0.350374
420	256.9255	0.349207
430	260.4117	0.348039
440	263.8863	0.346867
450	267.3491	0.345693
460	270.8001	0.344515
470	274.2393	0.343334
480	277.6668	0.342150
490	281.0823	0.340963
500	284.4860	0.339771
510	287.8778	0.338577
520	291.2575	0.337378
530	294.6253	0.336176
540	297.9810	0.334969
550	301.3247	0.333760
560	304.6562	0.332546
570	307.9756	0.331329
580	311.2828	0.330109
590	314.5778	0.328885
600	317.8605	0.327659
610	321.1309	0.326429
620	324.3891	0.325196
630	327.6348	0.323962
640	330.8683	0.322725
650	334.0893	0.321486
660	337.2980	0.320245

Temp (°C)	Res (ohms)	dR/dT (ohms/K)
670	340.4942	0.319003

