



CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board
11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

Thermo-Temp, Inc.
813-A Woodcrest
Houston, TX 77018

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2017

and national standards

ANSI/NCSL Z540-1-1994 (R2002) and
ANSI/NCSL Z540.3-2006 (R2013)

while demonstrating technical competence in the field of

CALIBRATION

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

AC-2535

Certificate Number


ANAB Approval

Certificate Valid Through: 12/12/2021
Version No. 004 Issued: 12/09/2019



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017,
ANSI/NCSL Z540-1-1994 (R2002) AND ANSI/NCSL Z540.3-2006 (R2013)**

Thermo-Temp, Inc.

813-A Woodcrest
Houston, Texas 77018
Chuck Osterhaus
713-695-1939

CALIBRATION

Valid to: **December 12, 2021**

Certificate Number: **AC-2535**

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Voltage Generate ¹	(0 to 330) mV	18.5 μ V/mV + 1 μ V	Fluke 5520A
	(0 to 3.3) V	18.3 mV/V + 2 μ V	
	(0 to 33) V	18.3 mV/V + 20 μ V	
	(30 to 330) V	18.3 mV/V + 0.15 mV	
	(100 to 1 000) V	20 mV/V + 1.5 mV	
DC Voltage Measure ¹	100 mV	18.3 μ V/V + 1 μ V	HP 3458A
	1 V	19.2 μ V/V + 0.1 mV	
	10 V	59 μ V/V + 0.1 mV	
	100 V	1.01 mV/V + 0.4 mV	
	1 000 V	14.61 mV/V + 0.04 mV	
AC Voltage Generate ¹ 1 mV to 32.999 mV	up to 45 Hz	0.023 mV/V + 96 μ V	Fluke 5520A
	45 Hz to 10 kHz	0.02 mV/V + 96 μ V	
	10 kHz to 20 kHz	0.02 mV/V + 96 μ V	
	20 kHz to 50 kHz	0.02 mV/V + 96 μ V	
	50 kHz to 100 kHz	0.05 mV/V + 102 μ V	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage Generate ¹ 1 mV to 32.999 mV	100 kHz to 500 kHz	0.054 mV/V + 140 μV	Fluke 5520A
33 mV to 329.999 mV	10 Hz to 45 Hz	0.026 mV/V + 98 μV	
	45 Hz to 10 kHz	0.032 mV/V + 98 μV	
	10 kHz to 20 kHz	0.027 mV/V + 98 μV	
	20 kHz to 50 kHz	0.031 mV/V + 98 μV	
	50 kHz to 100 kHz	0.044 mV/V + 132 μV	
	100 kHz to 500 kHz	0.341 mV/V + 160 μV	
0.33 V to 3.299 99 V	10 Hz to 45 Hz	0.021 V/V + 250 μV	
	45 Hz to 10 kHz	0.021 V/V + 260 μV	
	10 kHz to 20 kHz	0.021 V/V + 260 μV	
	20 kHz to 50 kHz	0.021 V/V + 250 μV	
	50 kHz to 100 kHz	0.021 V/V + 325 μV	
	100 kHz to 500 kHz	0.021 V/V + 800 μV	
3.3 V to 32.999 9 V	10 Hz to 45 Hz	0.102 V/V + 2.65 mV	
	45 Hz to 10 kHz	0.102 V/V + 2.6 mV	
	10 kHz to 20 kHz	0.102 V/V + 2.6 mV	
	20 kHz to 50 kHz	0.102 V/V + 2.6 mV	
	50 kHz to 100 kHz	0.102 V/V + 3.6 mV	
33 V to 329.999 V	10 Hz to 45 Hz	0.027 V/V + 12 mV	
	45 Hz to 10 kHz	0.028 V/V + 16 mV	
	10 kHz to 20 kHz	0.029 V/V + 16 mV	
	20 kHz to 50 kHz	0.056 V/V + 16 mV	
	50 kHz to 100 kHz	0.151 V/V + 60 mV	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage Generate ¹ 330 V to 1 000 V	45 Hz to 1 kHz	0.074 V/V + 40 mV	Fluke 5520A
	1 kHz to 5 kHz	0.083 V/V + 40 mV	
	5 kHz to 10 kHz	0.079 V/V + 40 mV	
AC Voltage Measure ¹ 10 mV	1 Hz to 40 HZ	1.441 μ V/V + 0.5 μ V	HP 3458A
	40 Hz to 1 kHz	1.441 μ V/V + 0.31 μ V	
	1 kHz to 20 kHz	1.441 μ V/V + 0.31 μ V	
100 mV	1 Hz to 40 HZ	1.441 μ V/V + 4.1 μ V	
	40 Hz to 1 kHz	1.441 μ V/V + 2.1 μ V	
	1 kHz to 20 kHz	1.441 μ V/V + 2.1 μ V	
1 V	1 Hz to 40 Hz	5.801 μ V/V + 41 μ V	
	40 Hz to 1 kHz	5.801 μ V/V + 21 μ V	
	1 kHz to 20 kHz	5.801 μ V/V + 21 μ V	
10 V	1 Hz to 40 HZ	0.059 mV/V + 0.41 mV	
	40 Hz to 1 kHz	0.059 mV/V + 0.21 mV	
	1 kHz to 20 kHz	0.059 mV/V + 0.21 mV	
100 V	40 Hz to 1 kHz	1.001 mV/V + 2.1 mV	
	1 kHz to 20 kHz	1.001 mV/V + 2.1 mV	
1 000 V	40 Hz to 1 kHz	14.635 mV/V + 21 mV	
	1 kHz to 20 kHz	14.635 mV/V + 21 mV	
Resistance ¹ Measure	10 Ω	0.2 m Ω / Ω + 0.1 m Ω	HP 3458A - For 2 Wire ohms add 250 m Ω
	100 Ω	1.8 m Ω / Ω + 0.1 m Ω	
	1 k Ω	0.016 Ω / Ω + 0.1 m Ω	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance ¹ Measure	10 kΩ	0.151 Ω/Ω + 0.1 mΩ	HP 3458A - For 2 Wire ohms add 250 mΩ
	100 kΩ	1.501 Ω/Ω + 0.1 mΩ	
	1 MΩ	0.016 kΩ/Ω + 1 mΩ	
	10 MΩ	0.3 kΩ/Ω + 2 mΩ	
	100 MΩ	0.34 kΩ/Ω + 2 mΩ	
	1 GΩ	0.048 MΩ/Ω + 2 mΩ	
Resistance ¹ Generate	0 Ω to 10.999 9 Ω	0.5 mΩ/Ω + 0.001 Ω	Fluke 5520A
	11 Ω to 32.999 9 Ω	0.5 mΩ/Ω + 0.0015 Ω	
	33 Ω to 109.999 9 Ω	1.6 mΩ/Ω + 0.0014 Ω	
	110 Ω to 1.099 999 kΩ	9 mΩ/Ω + 0.002 Ω	
	1.1 kΩ to 10.999 99 kΩ	0.109 Ω/Ω + 0.002 Ω	
	11 kΩ to 109.999 9 kΩ	1 Ω/Ω + 0.2 Ω	
	110 kΩ to 1.099 99 MΩ	0.018 kΩ + 0.002 kΩ	
	1.1 MΩ to 3.299 99 MΩ	0.2 kΩ/Ω + 0.03 kΩ	
	3.3 MΩ to 10.999 99 MΩ	0.4 kΩ/Ω + 0.05 kΩ	
	11 MΩ to 32.999 99 MΩ	2.3 kΩ/Ω + 2.5 kΩ	
	33 MΩ to 109.999 9 MΩ	34.1 kΩ/Ω + 3 kΩ	
	110 MΩ to 329.999 9 MΩ	0.159 MΩ/Ω + 0.1 MΩ	
	330 MΩ to 1.1 GΩ	11 MΩ/Ω + 0.5 MΩ	
	0 μA to 329.999 μA	0.033 μA/A + 0.02 μA	Fluke 5520 A AUX 20 A
	0 μA to 3.299 99 mA	30.4 μA/A + 0.02 μA	
0 mA to 32.999 9 mA	30.4 μA/A + 0.25 μA		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance ¹ Generate	0 mA to 329.999 mA	35.4 μ A/A + 2.5 μ A	Fluke 5520 A AUX 20 A
	0 mA to 1.099 99 A	30.4 mA/A + 40 μ A	
	1.1 A to 2.999 99 A	30.5 mA/A + 40 μ A	
	0 A to 10.999 9 A	30.6 mA/A + 0.5 mA	
	11 A to 20.5 A	33.5 mA/A + 0.75 mA	
Resistance ¹ Measure	100 nA	0.046 nA/A + 0.2 nA	HP 3458 A
	1 μ A	0.031 μ A/A + 2 nA	
	10 μ A	0.031 μ A/A + 4 nA	
	100 μ A	0.031 μ A/A + 3 nA	
	1 mA	0.045 μ A/A + 20 nA	
	10 mA	0.322 μ A/A + 20 nA	
	100 mA	4.601 μ A/A + 20 nA	
	1.000 A	0.098 mA/A + 30 nA	
AC Current Generate ¹ 29 μ A to 329.99 μ A	10 Hz to 20 Hz	0.065 μ A/A + 0.6 μ A	Fluke 5520A AUX 20 A Port
	20 Hz to 45 Hz	0.061 μ A/A + 0.6 μ A	
	45 Hz to 1 kHz	0.061 μ A/A + 0.6 μ A	
	1 kHz to 5 kHz	0.073 μ A/A + 0.65 μ A	
	5 kHz to 10 kHz	0.128 μ A/A + 0.7 μ A	
	10 kHz to 30 kHz	0.681 μ A/A + 0.9 μ A	
0.33 mA to 3.2999 mA	10 Hz to 20 Hz	0.031 mA/A + 1.65 μ A	
	20 Hz to 45 Hz	0.031 mA/A + 0.3 μ A	
	45 Hz to 1 kHz	0.031 mA/A + 0.3 μ A	



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current Generate ¹ 0.33 mA to 3.299 9 mA	1 kHz to 5 kHz	0.031 mA/A + 1.7 μA	Fluke 5520A AUX 20 A Port
	5 kHz to 10 kHz	0.031 mA/A + 1.8 μA	
	10 kHz to 30 kHz	0.031 mA/A + 1.1 μA	
3.3 mA to 32.999 mA	10 Hz to 20 Hz	0.032 mA/A + 7 μA	
	20 Hz to 45 Hz	0.032 mA/A + 7 μA	
	45 Hz to 1 kHz	0.033 mA/A + 7 μA	
	1 kHz to 5 kHz	0.037 mA/A + 7 μA	
	5 kHz to 10 kHz	0.037 mA/A + 8 μA	
	10 kHz to 30 kHz	0.04 mA/A + 8 μA	
33 mA to 329.99 mA	10 Hz to 20 Hz	0.097 mA/A + 70 μA	
	20 Hz to 45 Hz	0.062 mA/A + 70 μA	
	45 Hz to 1 kHz	0.062 mA/A + 70 μA	
	1 kHz to 5 kHz	0.07 mA/A + 100 μA	
	5 kHz to 10 kHz	0.079 mA/A + 150 μA	
	10 kHz to 30 kHz	0.106 mA/A + 250 μA	
0.33 A to 1.099 99 A	10 Hz to 45 Hz	0.032 A/A + 600 μA	
	45 Hz to 1 kHz	0.032 A/A + 600 μA	
	1 kHz to 5 kHz	0.032 A/A + 1 500 μA	
	5 kHz to 10 kHz	0.032 A/A + 5500 μA	
1.1 A to 2.999 99 A	10 to 45 Hz	0.033 A/A + 600 μA	
	45 Hz to 1 kHz	0.033 A/A + 600 μA	



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current Generate ¹ 3 A to 10.999 9 A	45 Hz to 500 Hz	0.039 A/A + 3 mA	Fluke 5520A AUX 20 A Port
	500 Hz to 1 kHz	0.042 A/A + 3 mA	
11 A to 20.5 A	45 Hz to 100 Hz	0.033 A/A + 3 mA	
	100 Hz to 1 kHz	0.042 A/A + 3 mA	
AC Current Measure ¹ 100 μA 1 mA 10 mA 100 mA 1 A	20 Hz to 1 kHz	0.031 μA/A + 0.03 μA	HP 3458A
	20 Hz to 1 kHz	0.031 μA/A + 0.2 μA	
	20 Hz to 1 kHz	0.039 μA/A + 2 μA	
	20 Hz to 1 kHz	0.242 μA/A + 20 μA	
	20 Hz to 1 kHz	3.001 μA/A + 200 μA	
Capacitance ¹ 0.19 nF to 1.099 9 nF 1.1 nF to 3.299 9 nF 3.3 nF to 10.999 9 nF 11 nF to 109.999 nF 110 nF to 329.999 nF 0.33 μF to 1.099 99 μF 1.1 μF to 3.299 99 μF 3.3 μF to 10.999 9 μF 11 μF to 32.999 9 μF 33 μF to 109.999 μF 110 μF to 329.999 μF 330 μF to 1.099 99 mF 1.1 mF to 3.299 9 mF	10 Hz to 10 kHz	0.013 nF/F + 10 pF	Fluke 5520A
	10 Hz to 3 kHz	0.013 nF/F + 0.01 nF	
	10 Hz to 1 kHz	0.019 nF/F + 0.01 nF	
	10 Hz to 1 kHz	0.16 nF/F + 0.1 nF	
	10 Hz to 1 kHz	0.303 nF/F + 0.3 nF	
	10 Hz to 600 Hz	0.016 μF/F + 1 nF	
	10 Hz to 300 Hz	0.014 μF/F + 3 nF	
	10 Hz to 150 Hz	0.019 μF/F + 10 nF	
	10 Hz to 120 Hz	0.044 μF/F + 30 nF	
	10 Hz to 80 Hz	0.317 μF/F + 100 nF	
	0 Hz to 50 Hz	0.224 μF/F + 300 nF	
	0 Hz to 20 Hz	0.101 mF/F + 1 μF	
0 Hz to 6 Hz	0.011 mF/F + 3 μF		

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Capacitance ¹ 3.3 mF to 10.999 9 mF 11 mF to 32.999 9 mF 33 mF to 110 mF	0 Hz to 2 Hz 0 Hz to 0.6 Hz 0 Hz to 0.2 Hz	0.013 mF/F + 10 μF 0.023 mF/F + 30 μF 0.155 mF/F + 100 μF	Fluke 5520A
Electrical Temperature Simulation ¹ Type J	-210 °C to -100 °C -100 °C to -30 °C -30 °C to 150 °C 150 °C to 760 °C 760 °C to 1 200 °C	0.2 °C 0.17 °C 0.19 °C 0.17 °C 0.21 °C	Fluke 5520A
Type K	-200 °C to -100 °C -100 °C to -25 °C -25 °C to 120 °C 120 °C to 1 000 °C 1 000 °C to 1 372 °C	0.21 °C 0.16 °C 0.17 °C 0.17 °C 0.22 °C	
Type N	-200 °C to -100 °C -100 °C to -25 °C -25 °C to 120 °C 120 °C to 410 °C 410 °C to 1 300 °C	0.19 °C 0.16 °C 0.16 °C 0.17 °C 0.21 °C	
Type R	0 °C to 250 °C 250 °C to 400 °C 400 °C to 1 000 °C 1 000 °C to 1 767 °C	0.2 °C 0.22 °C 0.23 °C 0.24 °C	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Temperature Simulation ¹ Type S	0 °C to 250 °C	0.19 °C	Fluke 5520A
	250 °C to 1 000 °C	0.22 °C	
	1 000 °C to 1 400 °C	0.25 °C	
	1 400 °C to 1 767 °C	0.25 °C	
Type T	-250 °C to -150 °C	0.23 °C	
	-150 °C to 0 °C	0.22 °C	
	0 °C to 120 °C	0.19 °C	
	120 °C to 400 °C	0.19 °C	
Electrical Temperature Simulation ¹ RTD Pt 385, 200Ω ¹	-200°C to -80°C	0.044 °C	Fluke 5522A
	-80°C to 0°C	0.044 °C	
	0°C to 100°C	0.054 °C	
	100°C to 260°C	0.064 °C	
	260°C to 300°C	0.074 °C	
	300°C to 400°C	0.084 °C	
	400°C to 600°C	0.084 °C	
	600°C to 630°C	0.244 °C	
Pt 385, 500Ω ¹	-200°C to -80°C	0.042 °C	
	-80°C to 0°C	0.042 °C	
	0°C to 100°C	0.052 °C	
	100°C to 260°C	0.062 °C	
	260°C to 300°C	0.072 °C	



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Temperature Simulation ¹ RTD Pt 385, 500Ω ¹	300°C to 400°C	0.082 °C	Fluke 5522A
	400°C to 600°C	0.082 °C	
	600°C to 630°C	0.242 °C	
Pt 385, 1 kΩ ¹	-200°C to -80°C	0.053 °C	
	-80°C to 0°C	0.053 °C	
	0°C to 100°C	0.063 °C	
	100°C to 260°C	0.073 °C	
	260°C to 300°C	0.083 °C	
	300°C to 400°C	0.093 °C	
	400°C to 600°C	0.093 °C	
Pt Ni 385, 120Ω ¹	-80°C to 0°C	0.093 °C	
	0°C to 100°C	0.093 °C	
	100°C to 260°C	0.153 °C	
Pt 3916, 100Ω ¹	-200°C to -190°C	0.026 °C	
	-190°C to -80°C	0.050 °C	
	-80°C to 0°C	0.060 °C	
	0°C to 100°C	0.007 °C	
	100°C to 260°C	0.080 °C	
	260°C to 300°C	0.090 °C	
	300°C to 400°C	0.100 °C	
	400°C to 600°C	0.110 °C	
600°C to 630°C	0.240 °C		



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Temperature Simulation ¹ RTD Pt 3926, 100Ω ¹	-200°C to -80°C	0.060 °C	Fluke 5522A
	-80°C to 0°C	0.060 °C	
	0°C to 100°C	0.080 °C	
	100°C to 300°C	0.090 °C	
	300°C to 400°C	0.100 °C	
	400°C to 630°C	0.110 °C	
Cu 427, 10Ω ¹	-100°C to 260°C	0.305 °C	

Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Indirect Verification of Rockwell ¹	HRA Low Middle High	0.89 HRA	Test Blocks
		0.89 HRA	
		0.53 HRA	
	HRBw Low Middle High	1.43 HRBw	
		1.37 HRBw	
		1.17 HRBw	
	HRC Low Middle High	0.81 HRC	
		0.79 HRC	
		0.71 HRC	
Brinell Hardness Testers ¹	HBW Low Middle High	2.59 HBW	Proving Ring, Hardness Test Blocks
		2.98 HBW	
		3.68 HBW	
Pressure Gauge & Differential Pressure ¹	(-14 to 15) psi	0.025 psi	Druck DPI150
	(0 to 1 000) psi	0.166 psi	Budenberg CPB5800



Mass and Mass Related

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Pressure Gauge & Differential Pressure ¹	(200 to 20 000) psi	0.484 psi	Budenberg CPB5800
	(10 000 to 72 500) psi	0.405 psi	Fluke PG7302

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature Measure ¹	-197 °C to -80 °C	0.013 °C	Fluke 1502A/5623
	-80 °C to -38.84 °C	0.013 °C	
	-38.84 °C to 0 °C	0.009 °C	
	0 °C to 156.6 °C	0.013 °C	
	156.6 °C to 231.9 °C	0.015 °C	
	231.9 °C to 419.5 °C	0.019 °C	
	419.5 °C to 660 °C	0.029 °C	

Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ($k=2$), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2535.


 Vice President