



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

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 17025:2005

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 calibrations to which this accreditation applies.

AC-2535

Certificate Number


ANAB Approval

Certificate Valid: 12/12/2017-12/12/2019

Version No. 001 Issued: 12/12/2017



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. 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 17025:2005,
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, 2019**

Certificate Number: **AC-2535**

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Voltage Generate	(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	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 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	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
	50 kHz to 100 kHz	0.05 mV/V + 102 μ V	
AC Voltage Generate 1 mV to 32.999 mV	100 kHz to 500 kHz	0.054 mV/V + 140 μ V	
33 mV to 329.999 mV	10 Hz to 45 Hz	0.026 mV/V + 98 μ V	Fluke 5520A
	45 Hz to 10 kHz	0.032 mV/V + 98 μ V	
	10 kHz to 20 kHz	0.027 mV/V + 98 μ V	
	20 kHz to 50 kHz	0.031 mV/V + 98 μ V	
	50 kHz to 100 kHz	0.044 mV/V + 132 μ V	
	100 kHz to 500 kHz	0.341 mV/V + 160 μ V	
0.33 V to 3.299 99 V	10 Hz to 45 Hz	0.021 V/V + 250 μ V	
	45 Hz to 10 kHz	0.021 V/V + 260 μ V	
	10 kHz to 20 kHz	0.021 V/V + 260 μ V	
	20 kHz to 50 kHz	0.021 V/V + 250 μ V	
	50 kHz to 100 kHz	0.021 V/V + 325 μ V	
	100 kHz to 500 kHz	0.021 V/V + 800 μ V	
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	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
	50 kHz to 100 kHz	0.151 V/V + 60 mV	
AC Voltage Generate 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 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 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	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
	1 k Ω	0.016 Ω/Ω + 0.1 m Ω	
Resistance Measure	10 k Ω	0.151 Ω/Ω + 0.1 m Ω	HP 3458A - For 2 Wire ohms add 250 m Ω
	100 k Ω	1.501 Ω/Ω + 0.1 m Ω	
	1 M Ω	0.016 k Ω/Ω + 1 m Ω	
	10 M Ω	0.3 k Ω/Ω + 2 m Ω	
	100 M Ω	0.34 k Ω/Ω + 2 m Ω	
	1 G Ω	0.048 M Ω/Ω + 2 m Ω	
Resistance Generate	0 Ω to 10.9999 Ω	0.5 m Ω/Ω + 0.001 Ω	Fluke 5520A
	11 Ω to 32.9999 Ω	0.5 m Ω/Ω + 0.0015 Ω	
	33 Ω to 109.9999 Ω	1.6 m Ω/Ω + 0.0014 Ω	
	110 Ω to 1.099999 k Ω	9 m Ω/Ω + 0.002 Ω	
	1.1 k Ω to 10.99999 k Ω	0.109 Ω/Ω + 0.002 Ω	
	11 k Ω to 109.9999 k Ω	1 Ω/Ω + 0.2 Ω	
	110 k Ω to 1.09999 M Ω	0.018 k Ω + 0.002 k Ω	
	1.1 M Ω to 3.29999 M Ω	0.2 k Ω/Ω + 0.03 k Ω	
	3.3 M Ω to 10.99999 M Ω	0.4 k Ω/Ω + 0.05 k Ω	
	11 M Ω to 32.99999 M Ω	2.30 k Ω/Ω + 2.5 k Ω	
	33 M Ω to 109.9999 M Ω	34.1 k Ω/Ω + 3 k Ω	
	110 M Ω to 329.9999 M Ω	0.159 M Ω/Ω + 0.10 M Ω	
	330 M Ω to 1.1 G Ω	11.0 M Ω/Ω + 0.5 M Ω	
0 μ A to 329.999 μ A	0.033 μ A/A + 0.02 μ A	Fluke 5520 A AUX 20 A	
0 μ A to 3.29999 mA	30.4 μ A/A + 0.02 μ A		

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
	0 mA to 32.9999 mA	30.4 μ A/A + 0.25 μ A	
Resistance 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 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 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	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
	45 Hz to 1 kHz	0.031 mA/A + 0.3 μ A	
AC Current Generate 0.33 mA to 3.299 9 mA	1 kHz to 5 kHz	0.031 mA/A + 1.7 μ A	Fluke 5520A AUX 20 A Port
	5 kHz to 10 kHz	0.031 mA/A + 1.8 μ A	
	10 kHz to 30 kHz	0.031 mA/A + 1.1 μ A	
3.3 mA to 32.999 mA	10 Hz to 20 Hz	0.032 mA/A + 7 μ A	
	20 Hz to 45 Hz	0.032 mA/A + 7 μ A	
	45 Hz to 1 kHz	0.033 mA/A + 7 μ A	
	1 kHz to 5 kHz	0.037 mA/A + 7 μ A	
	5 kHz to 10 kHz	0.037 mA/A + 8 μ A	
	10 kHz to 30 kHz	0.04 mA/A + 8 μ A	
33 mA to 329.99 mA	10 Hz to 20 Hz	0.097 mA/A + 70 μ A	
	20 Hz to 45 Hz	0.062 mA/A + 70 μ A	
	45 Hz to 1 kHz	0.062 mA/A + 70 μ A	
	1 kHz to 5 kHz	0.070 mA/A + 100 μ A	
	5 kHz to 10 kHz	0.079 mA/A + 150 μ A	
	10 kHz to 30 kHz	0.106 mA/A + 250 μ A	
0.33 A to 1.099 99 A	10 Hz to 45 Hz	0.032 A/A + 600 μ A	
	45 Hz to 1 kHz	0.032 A/A + 600 μ A	
	1 kHz to 5 kHz	0.032 A/A + 1 500 μ A	
	5 kHz to 10 kHz	0.032 A/A + 5500 μ A	
1.1 A to 2.999 99 A	10 to 45 Hz	0.033 A/A + 600 μ A	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
	45 Hz to 1 kHz	0.033 A/A + 600 μ A	
AC Current Generate 3 A to 10.9999 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 100 μ A	20 Hz to 1 kHz	0.031 μ A/A + 0.03 μ A	HP 3458A
1 mA	20 Hz to 1 kHz	0.031 μ A/A + 0.2 μ A	
10 mA	20 Hz to 1 kHz	0.039 μ A/A + 2 μ A	
100 mA	20 Hz to 1 kHz	0.242 μ A/A + 20 μ A	
1 A	20 Hz to 1 kHz	3.001 μ A/A + 200 μ A	
Capacitance 0.19 nF to 1.099 9 nF	10 Hz to 10 kHz	0.013 nF/F + 10 pF	Fluke 5520A
1.1 nF to 3.299 9 nF	10 Hz to 3 kHz	0.013 nF/F + 0.01 nF	
3.3 nF to 10.999 9 nF	10 Hz to 1 kHz	0.019 nF/F + 0.01 nF	
11 nF to 109.999 nF	10 Hz to 1 kHz	0.16 nF/F + 0.1 nF	
110 nF to 329.999 nF	10 Hz to 1 kHz	0.303 nF/F + 0.3 nF	
0.33 μ F to 1.099 99 μ F	10 Hz to 600 Hz	0.016 μ F/F + 1 nF	
1.1 μ F to 3.299 99 μ F	10 Hz to 300 Hz	0.014 μ F/F + 3 nF	
3.3 μ F to 10.999 9 μ F	10 Hz to 150 Hz	0.019 μ F/F + 10 nF	
11 μ F to 32.999 9 μ F	10 Hz to 120 Hz	0.044 μ F/F + 30 nF	
33 μ F to 109.999 μ F	10 Hz to 80 Hz	0.317 μ F/F + 100 nF	
110 μ F to 329.999 μ F	0 Hz to 50 Hz	0.224 μ F/F + 300 nF	
330 μ F to 1.099 99 mF	0 Hz to 20 Hz	0.101 mF/F + 1 μ F	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
1.1 mF to 3.299 9 mF	0 Hz to 6 Hz	0.011 mF/F + 3 μF	
Capacitance 3.3 mF to 10.999 9 mF	0 Hz to 2 Hz	0.013 mF/F + 10 μF	Fluke 5520A
11 mF to 32.999 9 mF	0 Hz to 0.6 Hz	0.023 mF/F + 30 μF	
33 mF to 110 mF	0 Hz to 0.2 Hz	0.155 mF/F + 100 μF	
Electrical Temperature Simulation			
Type J	-210 °C to -100 °C	0.2 °C	Fluke 5520A
	-100 °C to -30 °C	0.17 °C	
	-30 °C to 150 °C	0.19 °C	
	150 °C to 760 °C	0.17 °C	
	760 °C to 1 200 °C	0.21 °C	
Type K	-200 °C to -100 °C	0.21 °C	
	-100 °C to -25 °C	0.16 °C	
	-25 °C to 120 °C	0.17 °C	
	120 °C to 1 000 °C	0.17 °C	
	1,000 °C to 1 372 °C	0.22 °C	
Type N	-200 °C to -100 °C	0.19 °C	
	-100 °C to -25 °C	0.16 °C	
	-25 °C to 120 °C	0.16 °C	
	120 °C to 410 °C	0.17 °C	
	410 °C to 1 300 °C	0.21 °C	
Type R	0 °C to 250 °C	0.2 °C	
	250 °C to 400 °C	0.22 °C	
	400 °C to 1 000 °C	0.23 °C	



Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
	1 000 °C to 1 767 °C	0.24 °C	
Electrical Temperature Simulation 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	

Mass

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Indirect Verification of Rockwell	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	HBW Low Middle High	2.59 HBW	Proving Ring, Hardness Test Blocks
		2.98 HBW	
		3.68 HBW	
	(0 to 30) psi - Vacuum	0.071 psi	Druck DPI150

Mass

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Pressure Gauge & Differential Pressure	(0 to 1 000) psi	0.121 psi	Budenberg CPB5800
Pressure Gauge & Differential Pressure	(200 to 20 000) psi	0.007 psi	Budenberg CPB5800
	(1 000 to 40 000) psi	0.822 psi	Fluke RPM4 A280MS-L
	(10 000 to 60 000) psi	5.323 psi	Budenberg 283

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature Measure	-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

