



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat – Cincinnati
11402 Reading Road
Cincinnati, OH 45241

Fulfills the requirements of

ISO/IEC 17025:2017

and national standards

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

In the field of

CALIBRATION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

A handwritten signature in black ink, appearing to be 'Jason Stine', is positioned above a horizontal line.

Jason Stine, Vice President
Expiry Date: 07 September 2025
Certificate Number: L2181-1



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

and

ANSI/NCSL Z540-1-1994 (R2002)

ANSI/NCSL Z540.3-2006 (R2013)

Transcat – Cincinnati

11402 Reading Road

Cincinnati, OH 45241

Jim Dull 513-832-6274

CALIBRATION

Valid to: **September 7, 2025**

Certificate Number: **L2181-1**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometer Sensitivity	(0 to 5 000) mV/g (10 to 99) Hz 100 Hz (101 to 920) Hz (921 to 5 000) Hz (5 001 to 10 000) Hz	1.7 % of reading 1.4 % of reading 1.6 % of reading 1.9 % of reading 2.3 % of reading	Comparison to Master Accelerometer per ISO 16063-21-2003

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ⁷	4 pH 7 pH 10 pH	0.023 pH 0.023 pH 0.025 pH	Compared to Accredited Solutions
Conductivity Meters ⁷	1 µS/cm 10 µS/cm 100 µS/cm 1 000 µS/cm 10 000 µS/cm	0.69 µS/cm 0.69 µS/cm 2.2 µS/cm 6.3 µS/cm 50.3 µS/cm	Compared to Accredited Solutions



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source ^{1,3}	1 kHz (220 to 400) pF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (0.33 to 1.1) μF 100 Hz (0.33 to 1.1) μF (1.1 to 3.3) μF (3.3 to 11) μF (11 to 33) μF 50 Hz (33 to 110) μF (110 to 330) μF (330 to 1 100) μF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	(0.002 + 0.004X) pF (0.013 + 0.006X) nF (0.012 + 0.006X) nF (0.015 + 0.003X) nF (0.12 + 0.003X) nF (0.12 + 0.003X) nF (0.34 + 0.003X) nF (0.001 + 0.003X) μF (0.001 + 0.003X) μF (0.003 4 + 0.003X) μF (0.012 + 0.003X) μF (0.031 + 0.005X) μF (0.12 + 0.006X) μF (0.35 + 0.005 3X) μF (1.2 + 0.005 3X) μF (0.004 + 0.005 3X) mF (0.012 + 0.005 2X) mF (0.034 + 0.008 7X) mF (0.11 + 0.013X) mF	Fluke 5520A Multiproduct Calibrator
Capacitance – Measure	(0.2 to 2) nF (2 to 20) nF (20 to 200) nF (0.2 to 2) μF (2 to 20) μF (20 to 200) μF (Up to 10) mF (10 to 50) mF	0.9 % of reading + 23 pF 1.2 % of reading + 14 pF 0.9 % of reading + 27 pF 0.8 % of reading + 4 nF 0.9 % of reading + 0.6 nF 0.8 % of reading + 13 nF 1.3 % of reading + 10 nF 2.5 % of reading + 70 nF	Tenma 72-8150 Capacitance Meter
DC Current – Measure ^{1,3}	(0.1 to 1) mA (1 to 10) mA (10 to 100) mA (100 to 1 000) mA (1 to 10) A (10 to 30) A	(0.000 014 + 0.000 003X) mA (0.006 + 0.000 3X) mA (0.008 4 + 0.000 03X) mA (0.013 + 0.000 2X) mA (0.000 4 + 0.000 5X) A (0.005 + 0.000 6X) A	Transmille 8081 Digital Multimeter
DC Current – Measure ^{1,3}	(30 to 1 000) A	(0.77 + 0.024X) A	Fluke 378 FC Clamp Meter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source ^{1,3}	Up to 3.3 mA (3.3 to 33) mA (33 to 330) mA (0.33 to 3) A (3 to 20.5) A	(0.000 06 + 0.000 8X) mA (0.004 + 0.000 09X) mA (0.006 + 0.000 1X) mA (0.000 04 + 0.000 5X) A (0.001 + 0.001 2X) A	Fluke 5520A Multiproduct Calibrator
DC Current – Source ¹	(20.5 to 400) A (400 to 500) A	0.58 % of reading + 0.62 A 0.57 % of reading + 0.65 A	Fluke 5520A Multiproduct Calibrator, Fluke 5500A Coil
AC Current – Measure ^{1,3}	Up to 100 µA (1 to 10) kHz (0.1 to 1) mA (1 to 10) kHz (1 to 10) mA (10 to 40) Hz 40 Hz to 1 kHz (1 to 10) kHz (0.01 to 1) A (10 to 40) Hz 40 Hz to 1 kHz (1 to 10) kHz (1 to 10) A (10 to 40) Hz 40 Hz to 1 kHz (10 to 30) A (10 to 40) Hz 40 Hz to 1 kHz	(0.094 + 0.000 7X) µA (0.000 2 + 0.000 4X) mA (0.003 5 + 0.000 9X) mA (0.003 5 + 0.000 9X) mA (0.002 8 + 0.0013X) mA (0.000 3 + 0.000 72X) A (0.000 2 + 0.000 5X) A (0.000 6 + 0.000 82X) A (0.004 7 + 0.000 94X) A (0.004 7 + 0.000 94X) A (0.014 + 0.001X) A (0.014 + 0.001X) A	Transmille 8081 Digital Multimeter
AC Current – Measure ^{1,3}	(30 to 1 000) A (45 to 65) Hz	(0.77 + 0.024X) A	Fluke 336 Clamp Meter
AC Current – Source ^{1,3}	Up to 0.33 mA (1 to 10) kHz (0.33 to 3.3) mA (1 to 10) kHz (3.3 to 33) mA (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	(0.000 24 + 0.009 4X) mA (0.000 31 + 0.006X) mA (0.002 3 + 0.001 1X) mA (0.000 85 + 0.000 74X) mA (0.002 4 + 0.001X) mA (0.004 + 0.002 3X) mA (0.003 + 0.005X) mA	Fluke 5520A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ^{1,3}	(33 to 330) mA (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (0.33 to 3) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (3 to 20.5) A (45 to 65) Hz 65 Hz to 1 kHz (1 to 5) kHz	(0.024 + 0.001 1X) mA (0.022 + 0.000 5X) mA (0.063 + 0.001 2X) mA (0.12 + 0.002 3X) mA (0.22 + 0.005X) mA (0.000 14 + 0.002X) A (0.000 13 + 0.000 7X) A (0.001 2 + 0.007X) A (0.006 + 0.003 1X) A (0.006 + 0.002X) A (0.006 + 0.002X) A (0.006 4 + 0.035X) A	Fluke 5520A Multiproduct Calibrator
AC Current – Source ^{1,3}	(20.5 to 500) A (45 to 100) Hz	(0.002 + 0.000 08X) A	Fluke 5520A Multiproduct Calibrator, Fluke 5500A Coil
DC Power – Source ^{1,3}	Up to 336 W (360 to 3 059.9) W (3 059.9 to 20 910) W	(0.05 + 0.000 3X) W (0.001 5 + 0.000 4X) W (0.15 + 0.000 3X) W	Fluke 5520A Multiproduct Calibrator
AC Power – Source ^{1,3} PF = 1	(10 to 45) Hz 3.3 mA to 3 A 0.11 μW to 99 W (45 to 65) Hz 3.3 mA to 20.5 A 0.11 mW to 20.91 kW (65 to 500) Hz 33 mA to 3 A 0.11 μW to 99 W 33 mA to 20.5 A 0.11 mW to 20.91 kW	0.27 % of reading + 1 μW 0.24 % of reading + 0.9 μW 0.25 % of reading + 28 μW 0.22 % of reading + 0.25 mW	Fluke 5520A Multiproduct Calibrator
AC Power – Source ^{1,3} PF = 1	500 Hz to 1 kHz 33 mA to 20.5 A 0.11 μW to 20.91 kW	0.25 % of reading + 27 μW	Fluke 5520A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ^{1,3}	(0.000 5 to 5 000) mΩ Up to 1 Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ	0.06 % of reading + 1.8 μΩ 0.003 % of reading + 8 μΩ 0.002 % of reading + 4 μΩ 0.002 % of reading + 0.77 mΩ 0.001 % of reading + 5 mΩ 0.002 % of reading + 9 mΩ 0.002 % of reading + 93 mΩ 0.002 3 % of reading + 3 Ω 0.003 % of reading + 12 Ω	Transmille 8081 Digital Multimeter
Resistance – Measure ^{1,3}	(10 to 100) MΩ	1.2 % of reading + 1.5 kΩ	Agilent 34401A Digital Multimeter
Resistance – Source ^{1,3} (Simulation)	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ	(0.001 2 + 0.000 05X) Ω (0.002 + 0.000 04X) Ω (0.001 6 + 0.000 04X) Ω (0.002 4 + 0.000 04X) Ω (0.000 023 + 0.000 04X) kΩ (0.000 02 + 0.000 04X) kΩ (0.000 03 + 0.000 04X) kΩ (0.000 3 + 0.000 04X) kΩ (0.000 3 + 0.000 04X) kΩ (0.002 5 + 0.000 04X) kΩ (0.000 002 + 0.000 04X) MΩ (0.000 04 + 0.000 07X) MΩ (0.000 06 + 0.000 2X) MΩ (0.000 7 + 0.001 2X) MΩ (0.006 4 + 0.006X) MΩ (0.005 5 + 0.006X) MΩ	Fluke 5520A Multiproduct Calibrator
Resistance – Source ^{1,3} (Fixed Simulation)	500 μΩ 5 mΩ 50 mΩ 500 mΩ 5 Ω	(0.001 + 0.006X) mΩ (0.001 + 0.006X) mΩ (0.001 + 0.006X) mΩ (0.001 + 0.006X) mΩ (0.001 + 0.006X) mΩ	Fluke 5500A Multiproduct Calibrator, Agilent 34401A Digital Multimeter, Current Shunts
Electrical Simulation of RTD Indicators – Source ¹	Pt 385, 100 Ω (-200 to 800) °C	0.06 °C	Fluke 5500A Multiproduct Calibrator
DC Voltage – Measure ^{1,3}	Up to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	(0.000 001 + 0.000 01X) V (0.000 007 + 0.000 006X) V (0.000 07 + 0.000 01X) V (0.001 1 + 0.000 011X) V	Transmille 8081 Multimeter
DC High Voltage – Measure ^{1,3}	(1 to 80) kV	0.12 % of reading + 0.14 V	Ross Engineering HV Probe w/ Digital Multimeter



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source ^{1,3}	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1 020) V	(0.001 2 + 0.000 006X) mV (0.000 001 + 0.000 006X) V (0.000 02 + 0.000 003X) V (0.000 13 + 0.000 003X) V (0.0006 + 0.000 004X) V	Fluke 5520A Multiproduct Calibrator
AC Voltage – Measure ^{1,3}	Up to 100 mV (10 to 40) Hz (40 to 200) Hz 200 Hz to 2 kHz (2 to 20) kHz (20 to 100) kHz (0.1 to 1) V (10 to 40) Hz (40 to 200) Hz 200 Hz to 1 kHz (1 to 2) kHz (2 to 20) kHz (20 to 100) kHz 100 kHz to 1 MHz (1 to 10) V (10 to 40) Hz (40 to 200) Hz 200 Hz to 1 kHz (1 to 2) kHz (2 to 20) kHz (20 to 100) kHz (10 to 100) V (10 to 40) Hz (40 to 200) Hz 200 Hz to 1 kHz (1 to 2) kHz (2 to 20) kHz (20 to 50) kHz (100 to 1 000) V (10 to 40) Hz (40 to 200) Hz 200 Hz to 2 kHz (2 to 10) kHz	(0.02 + 0.000 6X) mV (0.015 + 0.000 3X) mV (0.014 + 0.000 3X) mV (0.015 + 0.000 4X) mV (0.13 + 0.000 4X) mV (0.000 2 + 0.000 5X) V (0.000 07 + 0.000 25X) V (0.000 07 + 0.000 2X) V (0.000 07 + 0.000 2X) V (0.000 12 + 0.000 25X) V (0.000 6 + 0.000 7X) V (0.03 + 0.012X) V (0.002 + 0.000 5X) V (0.000 9 + 0.000 2X) V (0.000 8 + 0.000 2 X) V (0.000 8 + 0.000 2X) V (0.001 2 + 0.000 3X) V (0.006 + 0.000 8X) V (0.02 + 0.000 6X) V (0.01 + 0.000 3X) V (0.009 + 0.000 3X) V (0.009 + 0.000 3X) V (0.01 + 0.000 5X) V (0.06 + 0.001X) V (0.18 + 0.000 6X) V (0.1 + 0.000 3X) V (0.09 + 0.000 23X) V (0.12 + 0.000 4X) V	Transmille 8081 Digital Multimeter
AC High Voltage – Measure ^{1,3}	60 Hz (1 to 80) kV	(0.01 + 0.012X) kV	Ross Engineering HV Probe w/ Digital Multimeter



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ^{1,3}	Up to 330 mV		Fluke 5520A Multiproduct Calibrator
	(10 to 45) Hz	(0.007 + 0.001X) mV	
	45 Hz to 10 kHz	(0.01 + 0.000 2X) mV	
	(10 to 20) kHz	(0.008 + 0.000 3X) mV	
	(20 to 50) kHz	(0.01 + 0.001 2X) mV	
	(50 to 100) kHz	(0.001 + 0.005X) mV	
	(100 to 500) kHz	(0.07 + 0.009 5X) mV	
	(0.33 to 3.3) V		
	(10 to 45) Hz	(0.000 04 + 0.000 4X) V	
	45 Hz to 10 kHz	(0.000 07 + 0.000 2X) V	
	(10 to 20) kHz	(0.000 08 + 0.000 23X) V	
	(20 to 50) kHz	(0.000 04 + 0.000 4X) V	
	(50 to 100) kHz	(0.000 2 + 0.000 8X) V	
	(100 to 500) kHz	(0.001 2 + 0.003X) V	
	(3.3 to 33) V		
	(10 to 45) Hz	(0.000 6 + 0.000 4X) V	
	45 Hz to 10 kHz	(0.000 7 + 0.000 2X) V	
	(10 to 20) kHz	(0.000 7 + 0.000 3X) V	
	(20 to 50) kHz	(0.000 8 + 0.000 4X) V	
	(50 to 100) kHz	(0.002 + 0.001X) V	
	(33 to 330) V		
45 Hz to 1 kHz	(0.003 + 0.000 3X) V		
(1 to 10) kHz	(0.008 + 0.000 3X) V		
(10 to 20) kHz	(0.007 + 0.000 3X) V		
(20 to 50) kHz	(0.006 + 0.000 4X) V		
(50 to 100) kHz	(0.064 + 0.002 3X) V		
(330 to 1 000) V			
45 Hz to 1 kHz	(0.022 + 0.000 34X) V		
(1 to 5) kHz	(0.03 + 0.000 3X) V		
(5 to 10) kHz	(0.01 + 0.000 4X) V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure ¹	Type E (-250 to -100) °C	0.58 °C	Fluke 5520A Multiproduct Calibrator
	(-100 to -25) °C	0.19 °C	
	(-25 to 350) °C	0.17 °C	
	(350 to 650) °C	0.19 °C	
	(650 to 1 000) °C	0.25 °C	
	Type J (-210 to -30) °C	0.32 °C	
	(-30 to 150) °C	0.17 °C	
	(150 to 760) °C	0.2 °C	
	(760 to 1 200) °C	0.27 °C	
	Type K (-200 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.21 °C	
	(-25 to 120) °C	0.19 °C	
	(120 to 1 000) °C	0.22 °C	
	(1 000 to 1 372) °C	0.47 °C	
	Type N (-200 to -100) °C	0.47 °C	
	(-100 to -25) °C	0.26 °C	
	(-25 to 120) °C	0.22 °C	
	(120 to 410) °C	0.21 °C	
	(410 to 1 300) °C	0.32 °C	
	Type R (0 to 250) °C	0.67 °C	
(250 to 1 767) °C	0.47 °C		
Type S (0 to 250) °C	0.55 °C		
(250 to 1 400) °C	0.44 °C		
(1 400 to 1 767) °C	0.54 °C		
Type T (-250 to -150) °C	0.73 °C		
(-150 to 0) °C	0.28 °C		
(0 to 120) °C	0.19 °C		
(120 to 400) °C	0.17 °C		
Oscilloscopes – Time Base ¹	(2 to 10) ns 20 ns to 1 μs (2 to 50) μs (0.1 to 5 000) ms	0.000 3 % of reading + 3 fs 0.02 % of reading 0.000 2 % of reading + 4 ps 0.2 % of reading + 0.23 ms	Fluke 5500A-SC600 Multiproduct Calibrator
Oscilloscopes – Bandwidth ¹	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	4.3 % of reading 4.9 % of reading 7.2 % of reading	Fluke 5500A-SC600 Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes – Amplitude ¹	Up to 5 V _{p-p}	2.3 % of reading + 0.35 mV	Fluke 5500A-SC600 Multiproduct Calibrator

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ³	(0.005 to 4) in	(3.8 + 1L) μin	Gage Blocks, Gage Block Comparator
Long Gage Blocks ³	(5 to 20) in	(4.1 + 1.4L) μin	Universal Length Measuring Machine, Gage Blocks
Plain Plug Gages ³	(0.007 to 10) in	(8.2 + 3.3L) μin	Universal Length Measuring Machine, Gage Blocks
Height/Step Masters ³	Up to 36 in	(16 + 4.1L) μin	Gage Blocks, Surface Plate, Indicator
Height Masters (Travel) ³	Up to 1 in	(16 + 1.6L) μin	Gage Blocks, Surface Plate, Indicator
Micrometer Standards ³	(0.5 to 10) in	(26 + 3.8L) μin	P&W Supermicrometer [®] , Gage Blocks
Micrometer Standards ³	(26 to 48) in	(75 + 3.4L) μin	Mu-Checker, Indicator, Gage Blocks, Surface Plate
Plain Ring Gages ³	(0.15 to 10) in	(12 + 4.4L) μin	Mahr Precimar ULM
Thread Wires ²	(0.007 to 0.2) in	11.4 μin	Universal Length Measuring Machine, XX Cylinder
Pin Gages ³	(0.011 to 2) in	(32 + 0.3L) μin	P&W Supermicrometer [®]
Pin Gages ³	(0.011 to 2) in	(30 + 3.1L) μin	Zygo Lasermic
Thickness Gages (Leaf) ³	Up to 1 in	(31 + 3.1L) μin	P&W Supermicrometer [®]
Tape Measures	Up to 50 ft	(0.056 + 0.000 05L) in	Comparison to Master Tape
Steel Rules ³	Up to 72 in	(0.01 + 0.000 1L) in	Comparison to Master Ruler

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plug Gages ³ Major Diameter	(0.06 to 8) in	(28 + 2.4L) μin	P&W Supermicrometer®, Thread Wires
Pitch Diameter (4 to 80) TPI	(0.06 to 8) in	(56 + 8L) μin	
Thread Ring Gages ³ Minor Diameter	(0.06 to 6) in (0.25 to 1) in	(94 + 8.2L) μin (21 + 87L) μin	Vision System, Intra-Micrometer
Thread Ring Gages ³ Pitch Diameter Solid (4 to 80) TPI	(0.06 to 6) in	(11 + 3L) μin	Mahr Precimar ULM, Plain Ring
Pitch Diameter Adjustable (4 to 80) TPI	(0.06 to 6) in	Tactical Fit	Set Plugs
Thread Rings, Adjustable ⁵ Pitch Diameter Tactile Fit (Set to Plug)	(0.06 to 6) in	See footnote	Set Plugs
Radius Gage	(0.010 to 2) in	(98 + 16L) μin	Vision System
Spheres ³	(0.013 2 to 2) in	(15 + 3L) μin	Universal Length Measuring Machine, Gage Blocks
Squares ³	(2 to 24) in	(60 + 2.5L) μin	Grade 0 Square Gage Blocks
Surface Plates ^{1,3} Overall Flatness	(8 to 60) in diagonal (34 to 161) in diagonal	(31 + 2.5L) μin (43 + 4.3L) μin	In accordance with ASME B89.3.7 using Planekator Level System
Local Area Flatness (Repeat Reading)	Up to 0.001 in	40 μin	Repeat-o-Meter
Roughness Specimens	Up to 400 μin Ra	2.7 μin	Profilometers

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Artifacts and Fixtures ³			
Length	Up to 16 in	(126 + 16L) μin	CMM
Diameter	Up to 12 in	(204 + 17L) μin	CMM
Angle	Up to 65° Up to 360°	0.001 7° 0.006°	Sine Bar, Gage Blocks Vision System
Length	Up to 9 in	(162 + 1.4L) μin	Vision System
Touch Probe, X-Y Length	Up to 10 in	(95 + 7.2L) μin	Vision System
Touch Probe, Z Length	Up to 8 in	(83 + 6L) μin	Vision System
Height Gage ^{1,3}	Up to 36 in	(125 + 2L) μin	Gage Blocks, Surface Plate
Calipers ^{1,3}	Up to 60 in (60 to 120) in	(357 + 4.6L) μin (216 + 7.5L) μin	Gage Blocks
Outside Micrometers ^{1,3}	Up to 4 in (5 to 36) in	(29 + 3.3L) μin (49 + 4L) μin	Gage Blocks
Depth Micrometers ^{1,3}	Up to 12 in	(584 + 0.3L) μin	Gage Blocks, Surface Plate
Inside Micrometers ^{1,3}	(0.1 to 36) in	(574 + 0.6L) μin	Gage Blocks, Surface Plate
Bore Micrometers ³	(0.15 to 10) in	(28 + 6.5L) μin	Ring Gages
Bench Micrometer ^{1,3}			
Travel Length	Up to 1 in	(16 + 2.5L) μin	Gage Blocks
Anvil Flatness		9 μin	Optical Flat
Anvil Parallelism		18 μin	Sphere
Universal Length Measuring Machine ^{1,3}	Up to 4 in	(3.9 + 4.2L) μin	Gage Blocks
Indicator ^{1,3}			
0.001 in resolution	Up to 4 in	580 μin	Indicator Tester, Gage Blocks
0.0005 in resolution	Up to 2 in	(290 + 0.7L) μin	
0.00025 in resolution	Up to 0.25 in	145 μin	
0.0001 in resolution	Up to 2 in	(58 + 0.8L) μin	
0.000 05 in resolution	Up to 2 in	(34 + 8L) μin	
0.000 02 in resolution	Up to 2 in	(31 + 7.4L) μin	
0.000 01 in resolution	Up to 0.5 in	(16 + 20.L) μin	
Indicator ^{1,3}			
0.001 in resolution	(0 to 1) in	(615 + 6L) μin	Indicator Tester
0.0005 in resolution	(0 to 1) in	(317 + 1.2L) μin	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Ultrasonic Thickness Gages	(0.005 to 2) in	580 μ in	Gage Blocks
Magnetic Coating Thickness Gages ^{3,4}	(1 to 50) mils	(0.063 + 0.003L) mils	Precision Shims, Bench Micrometer
Profilometer (Ra) ¹	(0 to 200) μ in	3.5 μ in	Roughness Standard per ASME B46.1-2009
Protractor ³	Up to 180°	(0.03 + 0.001 8X)°	Granite Squares, Sine Bar
Optical Comparators ^{1,3} Magnification X-Y Linearity Squareness	5x to 100x Up to 6 in Up to 6 in	(137 + 3.5L) μ in (137 + 1L) μ in 76 μ in	Glass Scale, Length Standards, Spheres
Microscopes ³ Stage Travel	Up to 2 in	(160 + 11L) μ in	Gage Blocks
Vision Systems ^{1,3} X-Y Linearity Angles	Up to 6 in Up to 360°	(162 + 1.2L) μ in 0.005°	Glass Scale
CMM ^{1,3} Length Measurement Errors	Up to 48 in	(82 + 3.1L) μ in	ISO 10360-2, ASME B89.4.10360.2 using Step Gage or Gage Blocks

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gas Flow Speed (Anemometers)	Hotwire (490 to 3 300) ft/min Vane (490 to 3 300) ft/min	4.7 % of reading + 3.1 ft/min 3.4 % of reading + 5.2 ft/min	TSI 9535 VelociCalc Air Velocity Meter
Gas Flow Meter	(50 to 1 000) sccm (1 to 50) slpm (50 to 250) slpm	0.8 % of reading + 0.18 sccm 1 % of reading + 0.11 slpm 1 % of reading + 1 slpm	Alicat Flow Standard
Bench Micrometer Measuring Force	(4 to 40) ozf	0.26 ozf	Force Gage
Force Gages ³	(0.5 to 50) lbf (50 to 250) lbf	(0.002 + 0.000 4W) lbf (0.014 + 0.000 2W) lbf	NIST Class F Weights
Force Gages, Force Testing Machines ³ (Tension)	(10 to 300) lbf (40 to 2 000) lbf	(0.09 + 0.000 1F) lbf (0.28 + 0.000 1F) lbf	Load Cell within ASTM E74 Class A Ranges



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Gages, Force Testing Machines ³ (Compression)	(10 to 300) lbf (40 to 2 000) lbf	(0.09 + 0.000 2F) lbf (0.04 + 0.000 3F) lbf	Load Cell within ASTM E74 Class A Ranges
Force Testing Machine – Load Cells	(2 000 to 20 000) lbf	(59 + 0.000 01F) lbf	Comparison to Master Load Cells
Rockwell and Rockwell Superficial Hardness Testers ¹	HRBW Low Middle High HRC Low Middle High HRFW Low Middle High HR15N Low Middle High HR30N Low Middle High HR45N Low Middle High HR15TW Low Middle High HR30TW Low Middle High HR45TW Low Middle High	0.82 HRBW 0.87 HRBW 0.78 HRBW 0.49 HRC 0.46 HRC 0.38 HRC 0.77 HRFW 0.65 HRFW 0.93 HRFW 0.72 HR15N 0.7 HR15N 0.6 HR15N 0.67 HR30N 0.78 HR30N 0.6 HR30N 0.63 HR45N 0.61 HR45N 0.57 HR45N 0.86 HR15TW 0.79 HR15TW 0.51 HR15TW 0.77 HR30TW 0.93 HR30TW 0.6 HR30TW 0.64 HR45TW 0.59 HR45TW 0.72 HR45TW	Indirect Verification per ASTM E18 using test blocks.

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Determination (SI)	1 g	0.14 mg	OIML Class E2 Weights, Electronic Balance
	2 g	0.22 mg	
	5 g	0.2 mg	
	10 g	0.22 mg	
	20 g	0.25 mg	
	50 g	0.5 mg	
	100 g	0.73 mg	
Mass Determination (Avoirdupois)	200 g	1.2 mg	ASTM E617 Class 2 Weights, Electronic Balance
	10 lb	0.000 26 lb	
	20 lb	0.000 44 lb	
Low Pressure Gages ¹ (Magnehelic/Photohelic)	50 lb	0.000 92 lb	Druck DPI 802 Pressure Calibrator
	(-27.73 to 27.73) inH ₂ O	0.005 % of reading + 0.034 inH ₂ O	
	(0 to 15) psig	0.001 8 % of reading + 0.01 psi	
	(0 to 30) psig	0.001 % of reading + 0.02 psi	
Low Pressure Gages ¹ (Magnehelic/Photohelic)	(0 to 50) psig	0.001 7 % of reading + 0.03 psi	Hart ABB Differential Pressure Transmitter
	(30 to 200) inH ₂ O	0.001 4 % of reading + 0.063 inH ₂ O	
Pneumatic Pressure Gage ¹	Up to 3 000 psig	0.03 % of reading + 0.32 psi	Comparison to Pace 1000 Pressure Indicator
Hydraulic Pressure Gage ¹	Up to 15 000 psig	0.12 % of reading + 1.7 psi	Keller Gage
Pneumatic Vacuum Gage ¹	(-15 to 0) psiv	0.009 psi	Druck DPI 802 Pressure Calibrator
Precision Balances ^{1,6}	Up to 120 g	(0.000 04 + 0.000 002 <i>M</i>) g	OIML Class E2 Mass and NIST Handbook 44 utilized for the calibration of the weighing system.
	(121 to 260) g	(0.000 16 + 0.000 000 5 <i>M</i>) g	
	(261 to 1 100) g	(0.000 41 + 0.000 0007 <i>M</i>) g	
Scales / Balances ^{1,6} (SI)	(1 101 to 5 000) g	(0.001 + 0.000 1 <i>M</i>) lb	NIST Class F Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
	(5 001 to 17 000) g	(0.001 + 0.000 01 <i>M</i>) lb	
Scales / Balances ^{1,6} (Avoirdupois)	(37 to 110) lb	(0.003 + 0.000 11 <i>M</i>) lb	ASTM Class 7 Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
	(111 to 500) lb	(0.008 + 0.000 2 <i>M</i>) lb	
Torque Tools	0.5 ozf·in to 1 000 lbf·ft	0.35 % of reading	CDI Torque Tester
	(1 000 to 2 000) lbf·ft	0.13 % of reading + 19 lbf·ft	
Torque Transducers	Up to 1 000 lbf·ft	0.09 % of reading	Torque Arms, NIST Class F Weights

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Piston Operated Pipettes ³	(10 to 1 000) µL	(0.21 + 0.000 64X) µl	Gravimetric Method using Precision Balance

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared Thermometers ¹	35 °C (35 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 500) °C	0.5 °C 0.7 °C 1 °C 1.6 °C 2.1 °C 2.2 °C	Fluke 4181 Black Body Source (flat plate) ε = (0.9 to 1), λ = (8 to 14) µm
Relative Humidity – Measure ¹ (Thermohygrometer)	(-20 to 15) °C (0 to 80) % RH (15 to 25) °C (0 to 80) % RH (25 to 40) °C (0 to 80) % RH	1.1 % of reading + 1.25 % RH 0.4 % of reading + 1.3 %RH 1.1 % of reading + 1.25 % RH	Comparison to Vaisala MI70/HMP77 Temperature/Humidity Indicator/Probe
Temperature – Measure ¹ (Thermohygrometer)	(-70 to 180) °C	0.3 °C	Comparison to Vaisala MI70/HMP77 Temperature/Humidity Indicator/Probe
Temperature Probes and Systems ^{1,3}	(-200 to 670) °C	(0.003 + 0.000 2T) °C	Hart Scientific Baths, Drywells, Fluke 5609 PRT
Liquid-in-Glass Thermometers ³ (Partial and Total Immersion)	(-20 to 600) °C	(0.08 + 0.000 9T) °C	Hart Scientific Bath, Fluke 5609 PRT
Temperature Sources ³ (Drywells, Liquids Baths, Water Baths, etc.)	(-15 to 110) °C (-30 to 125) °C (50 to 350) °C	(0.3 + 0.000 3T) °C (0.3 + 0.000 02T) °C (0.7 + 0.000 004T) °C	Fluke 5609 PRT w/ Display

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source ¹	1 Hz to 50 MHz (50 to 600) MHz	0.003 % of reading + 1.1 mHz 0.003 % of reading	Fluke 5500A Multiproduct Calibrator, Fluke PM 5193 Function Generator
Frequency – Measure ¹	1 Hz to 225 MHz	0.37 Hz	HP 53131A Universal Frequency Counter
Timers and Stopwatches ¹	(0.1 to 60) min	0.006 % of reading + 35 ms	HP 53131A Universal Frequency Counter
Rotational Speed – Optical Tachometers ^{1,3}	Up to 60 000 rpm	0.001 % of reading + 0.015 rpm	Fluke 5500A Multiproduct Calibrator, LED
Rotational Speed – Contact Tachometers and Testing Equipment ^{1,3}	Up to 1 800 rpm	0.3 % of reading + 0.002 rpm	Comparison to Ametek 1726 Digital Tachometer

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. Uncertainty shown is per wire for thread wire sets.
 3. L = length in inches; D = diameter in inches; T = temperature applied; X = flow / frequency / volts / ohms / amps / capacitance applied; M = mass applied; F = force in kg; V = volume; W = weight in lb; A = angle in degrees; rpm = revolutions per minute.
 4. 1 mil = 0.001 in.
 5. The setting of an adjustable thread ring is not a measurement for which an uncertainty can be estimated. The method for this activity is an accredited activity.
 6. The uncertainties for scales and balances are highly dependent upon the resolution of the unit under test. The uncertainties presented here do not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
 7. The values presented here are nominal. The actual certified values will be used at the time of calibration along with the associated uncertainties.
 8. The legal entity for this client is Transcat, Inc.
 9. This scope is formatted as part of a single document including Certificate of Accreditation No. L2181-1.



Jason Stine, Vice President