



# 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](http://www.anab.org).

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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 <sup>7</sup>	4 pH 7 pH 10 pH	0.022 pH 0.022 pH 0.13 pH	Compared to Accredited Solutions
Conductivity Meters <sup>7</sup>	1 µS/cm 10 µS/cm 100 µS/cm 1 000 µS/cm 10 000 µS/cm 100 000 µS/cm	0.69 µS/cm 0.77 µS/cm 3.1 µS/cm 23 µS/cm 226 µS/cm 2 140 µS/cm	Compared to Accredited Solutions

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Source <sup>1,3</sup>	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 + 0.003 1X) 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 (1.16 + 0.005 3X) μF (0.004 + 0.005 3X) mF (0.12 + 0.005 2X) mF (0.034 + 0.008 7X) mF (0.11 + 0.013X) mF	Fluke 5522A 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	0.7 % of reading + 23 pF 0.4 % of reading + 93 pF 0.9 % of reading + 34 pF 0.6 % of reading + 4 nF 0.9 % of reading + 0.6 nF 0.9 % of reading + 10 nF 1.3 % of reading + 10 nF 2.5 % of reading + 70 nF	Tenma 72-8150 Capacitance Meter
DC Current – Measure <sup>1,3</sup>	(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 (0.016 + 0.000 2X) mA (0.000 4 + 0.000 5X) A (0.005 + 0.000 6X) A	Transmille 8081 Digital Multimeter
DC Current – Measure <sup>1,3</sup>	(10 to 200) A (300 to 500) A	(0.34 + 0.018X) A (0.57 + 0.023X) A	Fluke 336 Clamp Meter

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source <sup>1,3</sup>	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 5522A Multiproduct Calibrator
DC Current – Source <sup>1,3</sup>	(20.5 to 400) A (400 to 500) A	(0.1 + 0.000 3X) A 0.12 % of reading	Fluke 5522A Multiproduct Calibrator w/ Coil
AC Current – Measure <sup>1,3</sup>	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 (1 to 10) 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 (0.002 + 0.000 6X) mA (0.001 4 + 0.000 4X) mA (0.003 4 + 0.0012X) mA (0.000 3 + 0.000 72X) A (0.000 2 + 0.000 5X) A (0.000 6 + 0.000 82X) A (0.005 + 0.001X) A (0.003 5 + 0.000 9X) A (0.014 + 0.001X) A (0.011 + 0.000 8X) A	Transmille 8081 Digital Multimeter
AC Current – Measure <sup>1,3</sup>	(30 to 600) A (45 to 65) Hz	(0.75 + 0.023) A	Fluke 336 Clamp Meter
AC Current – Source <sup>1,3</sup>	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 23 + 0.009 3X) 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 5522A 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 <sup>1,3</sup>	(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	(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	Fluke 5522A Multiproduct Calibrator
AC Current – Source <sup>1,3</sup>	(3 to 20.5) A (45 to 65) Hz 65 Hz to 1 kHz (1 to 5) kHz (20.5 to 500) A (45 to 100) Hz	(0.006 + 0.002X) A (0.006 + 0.002X) A (0.006 4 + 0.035X) A (0.002 + 0.000 08X) A	Fluke 5522A Multiproduct Calibrator w/ Coil
DC Power – Source <sup>1,3</sup>	Up to 336 W (336 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 5522A Multiproduct Calibrator
AC Power – Source <sup>1,3</sup> 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 + 0.9 μW 0.24 % of reading + 0.9 μW 0.25 % of reading + 28 μW 0.22 % of reading + 0.25 mW	Fluke 5522A Multiproduct Calibrator
AC Power – Source <sup>1,3</sup> 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 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure <sup>1,3</sup>	(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	0.005 % of reading + 8.5 μΩ 0.006 3 % of reading + 34 μΩ 0.002 % of reading + 23 μΩ 0.002 % of reading + 0.35 mΩ 0.001 % of reading + 2 mΩ 0.002 % of reading + 3 mΩ 0.002 % of reading + 90 mΩ 0.002 3 % of reading + 3 Ω 0.004 % of reading + 11 Ω	Transmille 8081 Digital Multimeter
Resistance – Measure <sup>1,3</sup>	(10 to 100) MΩ	1.2 % of reading	Agilent 34401A Digital Multimeter
Resistance – Source <sup>1,3</sup> (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 5522A Multiproduct Calibrator
Resistance – Source <sup>1,3</sup> (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 <sup>1</sup>	Pt 385, 100 Ω (-200 to 800) °C	0.06 °C	Fluke 5500A Multiproduct Calibrator
DC Voltage – Measure <sup>1,3</sup>	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 <sup>1,3</sup>	(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 <sup>1,3</sup>	(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 5522A Multiproduct Calibrator
AC Voltage – Measure <sup>1,3</sup>	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 (0.02 + 0.000 3X) mV (0.02 + 0.000 3X) mV (0.03 + 0.000 3X) 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 33X) V (0.000 6 + 0.000 85X) V (0.03 + 0.012X) V (0.002 + 0.000 5X) V (0.000 73 + 0.000 25X) V (0.000 8 + 0.000 2 X) V (0.000 8 + 0.000 2X) V (0.001 2 + 0.000 4X) V (0.006 + 0.000 9X) 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 (0.17 + 0.000 6X) V (0.1 + 0.000 3X) V (0.09 + 0.000 2X) V (0.12 + 0.000 4X) V	Transmille 8081 Digital Multimeter
AC High Voltage – Measure <sup>1,3</sup>	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 <sup>1,3</sup>	Up to 330 mV		Fluke 5522A 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 <sup>1</sup>	Type E		Fluke 5522A Multiproduct Calibrator
	(-250 to -100) °C	0.58 °C	
	(-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 <sup>1</sup>	(2 to 10) ns	0.000 3 % of reading + 3 fs	Fluke 5500A-SC600 Multiproduct Calibrator
	20 ns to 1 μs	0.02 % of reading	
	(2 to 50) μs	0.000 2 % of reading + 4 ps	
	(0.1 to 5 000) ms	0.2 % of reading + 0.23 ms	
Oscilloscopes – Bandwidth <sup>1</sup>	50 kHz to 100 MHz	4.3 % of reading	Fluke 5500A-SC600 Multiproduct Calibrator
	(100 to 300) MHz	4.8 % of reading	
	(300 to 600) MHz	7.2 % of reading	

**Electrical – DC/Low Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes – Amplitude <sup>1</sup>	Up to 5 V <sub>p-p</sub>	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 <sup>3</sup>	(0.005 to 4) in	(3.6 + 1.4L) μin	Gage Blocks, Gage Block Comparator
Long Gage Blocks <sup>3</sup>	(5 to 20) in	(3.3 + 1.6L) μin	Universal Length Measuring Machine, Gage Blocks
Plain Plug Gages <sup>3</sup>	(0.007 to 10) in	(7.9 + 4.2L) μin	Universal Length Measuring Machine, Gage Blocks
Height/Step Masters <sup>3</sup>	Up to 36 in	(17 + 3.3L) μin	Gage Blocks, Surface Plate, Indicator
Height Masters (Travel) <sup>3</sup>	Up to 1 in	(17.2 + 2.7L) μin	Gage Blocks, Surface Plate, Indicator
Micrometer Standards <sup>3</sup>	(0.5 to 26) in	(27 + 3.1L) μin	P&W Supermicrometer, Gage Blocks
Micrometer Standards <sup>3</sup>	(26 to 48) in	(93 + 1.2L) μin	Mu-Checker, Indicator, Gage Blocks, Surface Plate
Plain Ring Gages <sup>3</sup>	(0.15 to 10) in	(11.4 + 5.1L) μin	Mahr Precimar ULM
Thread Wires <sup>2</sup>	(0.007 to 0.2) in	11.4 μin	Universal Length Measuring Machine, XX Cylinder
Pin Gages <sup>3</sup>	(0.011 to 2) in	(32 + 0.3L) μin	P&W Super Micrometer
Thickness Gages (Leaf) <sup>3</sup>	Up to 1 in	(31 + 2.9L) μin	P&W Super Micrometer
Tape Measures	Up to 50 ft	(0.056 + 0.000 05L) in	Comparison to Master Tape
Steel Rules <sup>3</sup>	Up to 72 in	(0.01 + 0.000 1L) in	Comparison to Master Ruler
Thread Plug Gages <sup>3</sup> Major Diameter	(0.06 to 8) in	(28 + 12L) μin	P&W Super Micrometer, Thread Wires
Pitch Diameter (4 to 80) TPI	(0.06 to 8) in	(54 + 14L) μin	

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Ring Gages <sup>3</sup> Minor Diameter	(0.06 to 8) in (0.25 to 1) in	(170 + 6L) μin (52 + 70L) μin	Vision System, Intra-Micrometer
Thread Ring Gages <sup>3</sup> Pitch Diameter Solid (4 to 80) TPI Pitch Diameter Adjustable (4 to 80) TPI	(0.06 to 5) in  (0.06 to 6) in	(13 + 15L) μin  Tactical Fit	Mahr Precimar ULM, Plain Ring  Set Plugs
Thread Rings, Adjustable <sup>5</sup> Pitch Diameter Tactile Fit (Set to Plug)	(0.06 to 6) in	See footnote	Set Plugs
Radius Gage	(0.010 to 2) in	(100 + 9.8L) μin	Vision System
Spheres <sup>3</sup>	(0.013 2 to 2) in	(15 + 2.9L) μin	Universal Length Measuring Machine, Gage Blocks
Squares <sup>3</sup>	(2 to 24) in	(65 + 2.4L) μin	Grade 0 Square Gage Blocks
Surface Plates <sup>1,3</sup>  Overall Flatness  Local Area Flatness (Repeat Reading)	  (8 to 60) in diagonal (34 to 161) in diagonal  Up to 0.001 in	  (50 + 0.7L) μin (130 + 0.3L) μin  46 μin	  In accordance with ASME B89.3.7 using Planekator Level System  Repeat-o-Meter
Roughness Specimens	Up to 400 μin Ra	2.7 μin	Profilometers
Artifacts and Fixtures <sup>3</sup> Length  Diameter  Angle  Length  Touch Probe, X-Y Length  Touch Probe, Z Length	Up to 16 in  Up to 12 in  Up to 65° Up to 360°  Up to 9 in  Up to 10 in  Up to 8 in	(125 + 16L) μin  (84 + 6L) μin  0.001 3° 0.005°  (162 + 1.2L) μin  (96 + 7.3L) μin  (84 + 6L) μin	CMM  CMM  Sine Bar, Gage Blocks Vision System  Vision System  Vision System  Vision System
Height Gage <sup>1,3</sup>	Up to 36 in	(129 + 1.2L) μin	Gage Blocks, Surface Plate

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers <sup>1,3</sup>	Up to 60 in (60 to 120) in	(365 + 4.2L) μin (197 + 7.7L) μin	Gage Blocks
Outside Micrometers <sup>1,3</sup>	Up to 4 in (5 to 36) in	(29 + 2.9L) μin (52 + 3.3L) μin	Gage Blocks
Depth Micrometers <sup>1,3</sup>	Up to 12 in	(586 + 0.9L) μin	Gage Blocks, Surface Plate
Inside Micrometers <sup>1,3</sup>	(0.1 to 36) in	(574 + 0.6L) μin	Gage Blocks, Surface Plate
Bore Micrometers <sup>3</sup>	(0.15 to 10) in	(60 + 1.5L) μin	Ring Gages
Bench Micrometer <sup>1,3</sup> Travel Length Anvil Flatness Anvil Parallelism	Up to 1 in	(13 + 2.7L) μin 8.2 μin 17 μin	Gage Blocks Optical Flat Sphere
Indicator <sup>1,3</sup> 0.001 in resolution 0.0005 in resolution 0.00025 in resolution 0.0001 in resolution 0.000 05 in resolution 0.000 02 in resolution 0.000 01 in resolution	Up to 4 in Up to 2 in Up to 0.25 in Up to 2 in Up to 2 in Up to 2 in Up to 0.5 in	580 μin (290 + 0.7L) μin 145 μin (58 + 0.7L) μin (34 + 7.4L) μin (31 + 7.3L) μin (16 + 20.1L) μin	Indicator Tester, Gage Blocks
Indicator <sup>1,3</sup> 0.001 in resolution 0.0005 in resolution	(0 to 1) in (0 to 1) in	(615 + 6L) μin (317 + 1.2L) μin	Indicator Tester
Ultrasonic Thickness Gages	(0.005 to 2) in	578 μin	Gage Blocks
Magnetic Coating Thickness Gages <sup>3,4</sup>	(1 to 50) mils	(0.066 + 0.002 8L) mils	Precision Shims, Bench Micrometer
Profilometer (Ra) <sup>1</sup>	(0 to 200) μin	2.9 μin	Roughness Standard per ASME B46.1-2009
Protractor <sup>3</sup>	Up to 180°	(0.03 + 0.001 8X)°	Granite Squares, Sine Bar
Optical Comparators <sup>1,3</sup> Magnification X-Y Linearity Squareness	5x to 100x Up to 6 in Up to 6 in	(155 + 2.8L) μin (138 + 1.1L) μin 76 μin	Glass Scale, Length Standards, Spheres
Microscopes <sup>3</sup> Stage Travel	Up to 2 in	(158 + 10.6L) μin	Gage Blocks
Vision Systems <sup>1,3</sup> X-Y Linearity Angles	Up to 6 in Up to 360°	(162 + 1.2L) μin 0.005°	Glass Scale

**Length – Dimensional Metrology**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
CMM <sup>1,3</sup> Length Measurement Errors	Up to 48 in	(34 + 3.5L) μin	ISO 10360-2, ASME B89.4.10360.2 using Step Gauge or Gage Blocks

**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gas Flow Speed (Anemometers)	(490 to 3 300) ft/min	4 % of reading + 1.6 ft/min	TSI 9535 VelociCalc Air Velocity Meter
Gas Flow Meter	(200 to 1 000) sccm (10 to 50) slpm (50 to 250) slpm	0.7 % of reading + 0.97 sccm 0.8 % of reading + 0.09 slpm 1 % of reading + 1.1 slpm	Alicat Flow Standard
Bench Micrometer Measuring Force	(4 to 40) ozf	0.22 ozf	Force Gage
Force Gages <sup>3</sup>	(0.5 to 50) lbf (50 to 250) lbf	(0.003 9 + 0.000 33 <i>W</i> ) lbf (0.014 + 0.000 18 <i>W</i> ) lbf	NIST Class F Weights
Force Gages, Force Testing Machines <sup>3</sup> (Tension)	(6 to 300) lbf (40 to 2 000) lbf	(0.085 + 0.000 2 <i>F</i> ) lbf (0.26 + 0.000 1 <i>F</i> ) lbf	Load Cell within ASTM E74 Class A Ranges
Force Gages, Force Testing Machines <sup>3</sup> (Compression)	(6 to 300) lbf (40 to 2 000) lbf	(0.08 + 0.000 3 <i>F</i> ) lbf (0.017 + 0.000 7 <i>F</i> ) lbf	Load Cell within ASTM E74 Class A Ranges
Force Testing Machine – Load Cells	(1 001 to 5 000) lbf (5 001 to 20 000) lbf	(6 + 0.000 3 <i>F</i> ) lbf (59 + 0.000 01 <i>F</i> ) lbf	Comparison to Master Load Cells
Rockwell and Rockwell Superficial Hardness Testers <sup>1</sup>	HRBW Low Middle High HRC Low Middle High HRFW Low Middle High	0.82 HRBW 0.87 HRBW 0.78 HRBW 0.49 HRC 0.45 HRC 0.37 HRC 0.76 HRFW 0.65 HRFW 0.93 HRFW	Indirect Verification per ASTM E18 using test blocks.



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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
Rockwell and Rockwell Superficial Hardness Testers <sup>1</sup>	HR15N Low Middle High	0.72 HR15N 0.69 HR15N 0.59 HR15N	Indirect Verification per ASTM E18 using test blocks.		
	HR30N Low Middle High	0.67 HR30N 0.77 HR30N 0.6 HR30N			
	HR45N Low Middle High	0.63 HR45N 0.61 HR45N 0.56 HR45N			
	HR15TW Low Middle High	0.86 HR15TW 0.78 HR15TW 0.51 HR15TW			
	HR30TW Low Middle High	0.77 HR30TW 0.93 HR30TW 0.59 HR30TW			
	HR45TW Low Middle High	0.63 HR45TW 0.59 HR45TW 0.72 HR45TW			
	Mass Determination	1 g		0.14 mg	ASTM Class 1 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	
		200 g		1.2 mg	
Low Pressure Gages <sup>1</sup> (Magnehelic/Photohelic)	Up to 30 inH <sub>2</sub> O	0.006 5 % of reading + 0.021 inH <sub>2</sub> O	ABB 364DS Differential Pressure Transmitter		
Low Pressure Gages <sup>1</sup> (Magnehelic/Photohelic)	(30 to 200) inH <sub>2</sub> O	0.006 % of reading + 0.058 inH <sub>2</sub> O	ABB DDN0200 Differential Pressure Transmitter		
Pneumatic Pressure Gage <sup>1</sup>	Up to 30 psig	0.002 % of reading + 0.019 psi 0.074 % of reading + 0.024 psi	Druck DPI 802 Pressure Calibrator		
Hydraulic Pressure Gage <sup>1</sup>	(10 001 to 15 000) psig	0.12 % of reading + 1.7 psi	Keller Gage		



**Mass and Mass Related**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pneumatic Vacuum Gage <sup>1</sup>	(-14.5 to 0) psiv	0.018 psi	Druck DPI 802 Pressure Calibrator
Hydraulic Pressure Devices <sup>1</sup>	(2 to 500) psig (500 to 10 000) psig	0.04 % of reading + 0.003 psi 0.033 % of reading + 0.72 psi	Deadweight Tester
Precision Balances <sup>1,6</sup>	Up to 120 g (121 to 260) g (261 to 1 100) g	(0.000 07 + 0.000 002M) g (0.000 13 + 0.000 0012M) g (0.000 44 + 0.000 0014M) g	OIML Class E2 Mass and NIST Handbook 44 utilized for the calibration of the weighing system.
Scales / Balances <sup>1,6</sup> (SI)	(1 101 to 5 000) g (5 001 to 17 000) g	(0.038 + 0.000 11M) g (0.6 + 0.000 035M) g	NIST Class F Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Scales / Balances <sup>1,6</sup> (Avoirdupois)	(37 to 110) lb (111 to 500) lb	(0.003 + 0.000 11M) lb (0.008 + 0.000 2M) lb	ASTM Class 7 Weights and NIST Handbook 44 utilized for the calibration of the weighing system.
Torque Tools	0.5 ozf·in to 1 000 lbf·ft (1 000 to 2 000) lbf·ft	0.35 % of reading 0.2 % of reading + 17 lbf·ft	CDI Torque Tester
Torque Transducers	(5 to 1 000) lbf·ft	0.08 % of reading	Torque Arms, NIST Class F Weights
Piston Operated Pipettes <sup>3</sup>	(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 <sup>1</sup>	35 °C 100 °C 200 °C 300 °C 400 °C 500 °C	0.5 °C 0.7 °C 1.1 °C 2.1 °C 2.5 °C 2.5 °C	Fluke 4181 Black Body Source (flat plate) $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$
Relative Humidity – Measure <sup>1</sup> (Thermohygrometer)	(0 to 80) % RH	0.6 % of reading + 1.2 %RH	Comparison to Vaisala MI70/HMP77 Temperature/Humidity Indicator/Probe

**Thermodynamic**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure <sup>1</sup> (Thermohygrometer)	(-70 to 180) °C	0.25 °C	Comparison to Vaisala MI70/HMP77 Temperature/Humidity Indicator/Probe
Temperature Probes and Systems <sup>1,3</sup>	(-20 to 600) °C	(0.004 + 0.000 7T) °C	Hart Scientific Baths and Drywells w/ Fluke 5609 PRT
Liquid-in-Glass Thermometers <sup>3</sup> (Partial and Total Immersion)	(-20 to 600) °C	(0.08 + 0.000 6T) °C	Hart Scientific Bath w/ Fluke 5609 PRT
Temperature Sources <sup>3</sup> (Drywells, Liquids Baths, Water Baths, etc.)	(-195 to 420) °C (420 to 600) °C	(0.012 + 0.000 04T) °C (0.008 + 0.000 12T) °C	Fluke 5609 PRT w/ Display

**Time and Frequency**

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source <sup>1</sup>	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 <sup>1</sup>	1 Hz to 225 MHz 225 MHz to 3 GHz	0.47 Hz 0.16 Hz	HP 53131A Universal Frequency Counter
Timers and Stopwatches <sup>1</sup>	(0.1 to 60) min	0.006 % of reading + 35 ms	HP 53131A Universal Frequency Counter
Rotational Speed – Optical Tachometers <sup>1,3</sup>	Up to 60 000 rpm	0.003 % of reading + 0.001 1 rpm	Fluke 5500A Multiproduct Calibrator, LED
Rotational Speed – Contact Tachometers and Testing Equipment <sup>1,3</sup>	Up to 1 800 rpm	0.3 % of reading + 0.05 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.



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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

