



CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board

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

This is to certify that

Accredited Calibration Services, Inc.

(Marsh Metrology)

2-1016C Sutton Drive

Burlington ON L7L 6B8

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

ISO/IEC 17025:2005

and national standard

ANSI/NCSL Z540-1-1994

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-1172

Certificate Number


ANAB Approval

Certificate Valid: 04/27/2016-05/27/2018
Version No. 003 Issued: 04/27/2016



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 January 2009).



ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005 & ANSI/NCSL Z540-1-1994 Accredited Calibration Services, Inc. (Marsh Metrology)

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CALIBRATION

Valid to: 05/27/2018

Certificate Number: AC – 1172

I. Dimensional

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Micrometers - Outside	Up to 4 in (4 to 20) in (20 to 36) in	(44 + 16L) μ in (32 + 22L) μ in (32 + 22L) μ in	Gage Blocks, Optical Flats
Calipers - Outside Jaws	Up to 6 in (6 to 40) in	(420 + 3.9L) μ in (350 + 17L) μ in	Gage Blocks
Calipers - Inside Jaws	Up to 24 in (24 to 40) in	(480 + 3.9L) μ in (340 + 19L) μ in	Reference Bar, Gage Blocks
Calipers - Depth	Up to 24 in	(530 + 1.7L) μ in	Gage Blocks, Surface Plate
Height Gages	Up to 24 in (24 to 40) in	(490 + 10L) μ in (260 + 19.2L) μ in	Reference Bar, Surface Plate, Test Indicator
Micrometers - Inside (Head Movement Only)	Up to 1 in	(81 + 24L) μ in	Gage Blocks, Gage Holder
Micrometers - Inside (Resolution 0.0001 in) (Resolution 0.001 in)	Up to 6 in (6 to 24) in (24 to 40) in	(100 + 12L) μ in (38 + 22L) μ in (460 + 16.7L) μ in	Reference Bar, Gage Blocks
Micrometers - Depth	Up to 12 in	(630 + 4.5L) μ in	Gage Blocks, Surface Plate
Bore Gages (Resolution 0.0001 in)	(0.1 to 0.5) in (0.5 to 3) in	(80 + 2L) μ in (150 + 19L) μ in	Master Ring Gages



PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Indicators Test, Dial, Digital (Resolution 0.0001 in)	Up to 2 in	(68 + 25L) μ in	Gage Blocks, Calibration Tester, Surface Plate
Flatness	Up to 4 in	5.5 μ in	Master Flat
Optical Comparator Horizontal Readout Vertical Readout	Up to 8 in Up to 8 in	(740 + 8.6L) μ in (760 + 8.7L) μ in	Reading Scale
Thickness (Feeler) Gages	(0 to 0.05) in	125 μ in	Digital Micrometer
Rulers	Up to 40 in	(3 200 + 112L) μ in	Caliper
Plain Plugs	Up to 90 mm	4.3 μ m + 0.0028 μ m/mm	IAC Master Scanner
Plain Ring	2.5 to 100 mm	4.3 μ m + 0.0047 μ m/mm	IAC Master Scanner
Thread Plug Gages Major / Minor Diameter	Up to 90 mm	4.2 μ m + 0.0157 μ m/mm	IAC Master Scanner
Effective Pitch Diameter	Up to 90 mm	4.3 μ m + 0.0155 μ m/mm	
Pitch	0.1 to 40 mm	1.4 μ m + 0.0037 μ m/mm	
Thread Ring Gages Major / Minor Diameter	2.5 to 100 mm	4.9 μ m + 0.0124 μ m/mm	IAC Master Scanner
Effective Pitch Diameter	2.5 to 100 mm	5.1 μ m + 0.0104 μ m/mm	
Pitch	0.1 to 40 mm	1.6 μ m + 0.0033 μ m/mm	
Thread Flank Angle Measurements	Up to 60 °	0.15 deg + 0.000073 deg/deg	IAC Master Scanner

II. Electromagnetic – DC/Low Frequency

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
DC Voltage - Source	Up to 330 mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1 kV	14 $\mu\text{V/V} + 1.2 \mu\text{V}$ 6.3 $\mu\text{V/V} + 10 \mu\text{V}$ 7.7 $\mu\text{V/V} + 81 \mu\text{V}$ 12 $\mu\text{V/V} + 0.78 \text{ mV}$ 14 $\mu\text{V/V} + 1.4 \text{ mV}$	Multifunction Calibrator
DC Voltage - Measure	Up to 100 mV 100 mV to 1 V (1 to 10) V (10 to 100) V 100 V to 1 kV	9.6 $\mu\text{V/V} + 1.1 \mu\text{V}$ 3.8 $\mu\text{V/V} + 10 \mu\text{V}$ 8.4 $\mu\text{V/V} + 3.3 \mu\text{V}$ 10 $\mu\text{V/V} + 38 \mu\text{V}$ 10 $\mu\text{V/V} + 0.13 \text{ mV}$	High Resolution DMM
	Up to 6 kV (6 to 20) kV (20 to 35) kV Up to 150 kV	10 $\text{mV/V} + 0.6 \text{ V}$ 20 $\text{mV/V} + 2.4 \text{ V}$ 90 $\text{mV/V} + 51 \text{ V}$ 5.06 $\text{mV/V} + 6.9 \text{ V}$	DMM with High Voltage Probe
Thermocouple Simulation and Measure			
J-type thermocouple	(63 to 1 473) K (-210 to 1 200) °C	0.24 K (0.24 °C)	Multifunction Calibrator
K-type thermocouple	(73 to 1 645) K (-200 to 1 372) °C	0.25 K (0.25 °C)	
S-type thermocouple	(273 to 1 673) K (0 to 1 400) °C	0.52 K (0.52 °C)	
T-type thermocouple	(23 to 673) K (-250 to 400) °C	0.25 K (0.25 °C)	
E-type thermocouple	(23 to 1 273) K (-250 to 1 000) °C	0.43 K (0.43 °C)	
N-type thermocouple	(73 to 1 573) K (-200 to 1 300) °C	0.37 K (0.37 °C)	

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
AC Voltage - Source	(1 to 33) mV		
	(10 to 45) Hz	0.62 mV/V + 4.8 μ V	
	45 Hz to 10 kHz	0.12 mV/V + 4.7 μ V	
	(10 to 20) kHz	0.15 mV/V + 4.8 μ V	
	(20 to 50) kHz	0.78 mV/V + 4.7 μ V	
	(50 to 100) kHz	2.7 mV/V + 9.4 μ V	
	(100 to 500) kHz	6.2 mV/V + 39 μ V	
	(33 to 330) mV		
	(10 to 45) Hz	0.39 mV/V + 6.8 μ V	
	45 Hz to 10 kHz	0.11 mV/V + 7.1 μ V	
	(10 to 20) kHz	0.12 mV/V + 7.4 μ V	
	(20 to 50) kHz	0.27 mV/V + 6.7 μ V	
	(50 to 100) kHz	0.62 mV/V + 25 μ V	
	(100 to 500) kHz	1.6 mV/V + 54 μ V	
	330 mV to 3.3 V		
	(10 to 45) Hz	0.23 mV/V + 43 μ V	
	45 Hz to 10 kHz	0.11 mV/V + 66 μ V	
	(10 to 20) kHz	0.14 mV/V + 58 μ V	
	(20 to 50) kHz	0.23 mV/V + 42 μ V	
	(50 to 100) kHz	0.54 mV/V + 0.1 mV	
	(100 to 500) kHz	1.9 mV/V + 0.47 mV	
	(3.3 to 33) V		
	(10 to 45) Hz	0.23 mV/V + 0.53 mV	
	45 Hz to 10 kHz	0.11 mV/V + 0.53 mV	
(10 to 20) kHz	0.19 mV/V + 0.49 mV		
(20 to 50) kHz	0.27 mV/V + 0.5 mV		
(50 to 100) kHz	0.70 mV/V + 1.3 mV		
(33 to 330) V			
45 Hz to 1 kHz	0.11 mV/V + 2.4 mV		
(1 to 10) kHz	0.15 mV/V + 5.5 mV		
(10 to 20) kHz	0.19 mV/V + 5.4 mV		
(20 to 50) kHz	0.23 mV/V + 5.3 mV		
(50 to 100) kHz	1.6 mV/V + 39 mV		
330 V to 1 kV			
45 Hz to 1 kHz	0.23 mV/V + 8.1 mV		
(1 to 5) kHz	0.19 mV/V + 8 mV		
(5 to 10) kHz	0.23 mV/V + 8.2 mV		

Multifunction
Calibrator

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
AC Voltage - Measure	Up to 10 mV		
	(1 to 40) Hz	0.47 mV/V + 4 μV	
	40 Hz to 1 kHz	0.14 mV/V + 3 μV	
	(1 to 20) kHz	0.22 mV/V + 3 μV	
	(20 to 50) kHz	0.89 mV/V + 2.7 μV	
	(10 to 100) mV		
	(1 to 40) Hz	70 μV/V + 4.3 μV	
	40 Hz to 1 kHz	70 μV/V + 2.1 μV	
	(1 to 20) kHz	0.14 mV/V + 2.1 μV	
	(20 to 50) kHz	0.30 mV/V + 2.1 μV	
	100 mV to 1 V		
	(1 to 40) Hz	70 μV/V + 40 μV	
	40 Hz to 1 kHz	70 μV/V + 21 μV	
	(1 to 20) kHz	0.14 mV/V + 21 μV	
	(20 to 50) kHz	0.30 mV/V + 23 μV	
	(1 to 10) V		
	(1 to 40) Hz	70 μV/V + 0.4 mV	
	40 H to 1 kHz	70 μV/V + 0.22 mV	
	(1 to 20) kHz	0.14 mV/V + 0.21 mV	
	(20 to 50) kHz	0.30 mV/V + 0.21 mV	
(10 to 100) V			
(1 to 40) Hz	0.20 mV/V + 4 mV		
40 H to 1 kHz	0.20 mV/V + 2 mV		
(1 to 20) kHz	0.20 mV/V + 2.1 mV		
(20 to 50) kHz	0.35 mV/V + 2.1 mV		
100 V to 1 kV			
(1 to 40) Hz	0.40 mV/V + 40 mV		
40 Hz to 1 kHz	0.40 mV/V + 20 mV		
(1 to 20) kHz	0.60 mV/V + 20 mV		
(20 to 50) kHz	1.1 mV/V + 79 mV		
Up to 6 kV			
60 Hz	10 mV/V + 5 V		
(6 to 35) kV			
60 Hz	51 mV/V + 9 V		
Up to 150 kV			
1 kHz	8.45 mV/V + 38 V		

High Resolution
DMM,
Multifunction
Calibrator



PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
DC Current - Source	Up to 330 μ A 330 μ A to 3.3 mA (3.3 to 330) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A	59 μ A/A + 61 nA 73 μ A/A + 57 nA 77 μ A/A + 0.21 μ A 75 μ A/A + 2.8 μ A 0.16 mA/A + 31 μ A 0.29 mA/A + 31 μ A 0.42 mA/A + 31 μ A	Multifunction Calibrator
	(10 to 16.5) A (16.5 to 150) A (150 to 1 000) A	4.7 mA/A + 29 mA 4.7 mA/A + 0.21 A 4.7 mA/A + 0.99 A	Multifunction Calibrator with Current Coil
DC Current - Measure	Up to 100 nA 100 nA to 1 μ A (1 to 10) μ A (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	16 μ A/A + 45 pA 11 μ A/A + 54 pA 20 μ A/A + 0.1 nA 20 μ A/A + 0.81 nA 15 μ A/A + 14 nA 20 μ A/A + 51 nA 35 μ A/A + 0.51 μ A 35 μ A/A + 5.5 μ A/A	High Resolution DMM
AC Current - Source	(29 to 330) μA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz 330 μA to 3.3 mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (3.3 to 33) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	1.6 mA/A + 78 nA 1.2 mA/A + 78 nA 0.97 mA/A + 78 nA 2.3 mA/A + 0.12 μ A 6.2 mA/A + 0.16 μ A 12 mA/A + 0.31 μ A 1.6 mA/A + 0.13 μ A 0.97 mA/A + 0.12 μ A 0.78 mA/A + 0.12 μ A 1.6 mA/A + 0.16 μ A 3.9 mA/A + 0.23 μ A 7.8 mA/A + 0.47 μ A 1.4 mA/A + 1.6 μ A 0.70 mA/A + 1.6 μ A 0.31 mA/A + 1.6 μ A 0.62 mA/A + 1.6 μ A 1.6 mA/A + 2.3 μ A 3.1 mA/A + 3.1 μ A	Multifunction Calibrator

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
AC Current - Source	(33 to 330) mA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz 330 mA to 3 A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (3 to 11) A (45 to 100) Hz 100 Hz to 1 kHz (5 to 10) kHz	1.4 mA/A + 16 μ A 0.70 mA/A + 16 μ A 0.31 mA/A + 16 μ A 0.78 mA/A + 39 μ A 1.6 mA/A + 78 μ A 3.1 mA/A + 0.16 mA 1.4 mA/A + 78 μ A 0.47 mA/A + 78 μ A 4.7 mA/A + 0.78 mA 19 mA/A + 3.9 mA 0.45 A/A + 1.9 mA 0.77 A/A + 1.6 mA 23 mA/A + 1.6 mA	Multifunction Calibrator
AC Current - Source	(10 to 16.5) A (45 to 65) Hz (65 to 440) Hz (16.5 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	5.5 mA/A + 33 mA 10 mA/A + 35 mA 5.6 mA/A + 0.27 A 10 mA/A + 0.27 A 5.1 mA/A + 1.7 A 12 mA/A + 1.1 A	Multifunction Calibrator with Current Coil
AC Current - Measure	100 μA to 1 mA (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (10 to 100) mA (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	1.5 mA/A + 0.2 μ A 0.60 mA/A + 0.2 μ A 0.30 mA/A + 0.2 μ A 4 mA/A + 2 μ A 1.5 mA/A + 2 μ A 0.60 mA/A + 2 μ A 0.30 mA/A + 2 μ A 4 mA/A + 20 μ A 1.5 mA/A + 20 μ A 0.60 mA/A + 20 μ A 0.30 mA/A + 20 μ A	High Resolution DMM

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
AC Current - Measure	100 mA to 1 A (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz	4 mA/A + 0.2 mA 1.6 mA/A + 0.2 mA 0.60 mA/A + 0.2 mA 1 mA/A + 0.2 mA	High Resolution DMM
Resistors - Source Fixed Values (at 1 kΩ)	24.9 Ω 375.6 Ω 5.97 kΩ 95.3 kΩ	6.9 mΩ 51 mΩ 0.79 Ω 12 Ω	Standard Resistors Kit
Resistance - Source	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω 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 330 kΩ 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 330 MΩ to 1.1 GΩ	27 μΩ/Ω + 1.2 mΩ 19 μΩ/Ω + 1.7 mΩ 20 μΩ/Ω + 1.4 mΩ 21 μΩ/Ω + 2 mΩ 22 μΩ/Ω + 1.8 mΩ 20 μΩ/Ω + 22 mΩ 22 μΩ/Ω + 17 mΩ 19 μΩ/Ω + 0.3 Ω 19 μΩ/Ω + 0.52 Ω 24 μΩ/Ω + 2.7 Ω 24 μΩ/Ω + 3.8 Ω 24 μΩ/Ω + 0.1 kΩ 95 μΩ/Ω + 0.12 kΩ 0.17 mΩ/Ω + 3.1 kΩ 0.38 mΩ/Ω + 3.7 kΩ 2.3 mΩ/Ω + 81 kΩ 12 mΩ/Ω + 0.4 MΩ	Multifunction Calibrator
Resistance - Measure	Up to 10 Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kΩ to 1 MΩ (1 to 10) MΩ (10 to 100) MΩ 100 MΩ to 1 GΩ	14 μΩ/Ω + 75 μΩ 12 μΩ/Ω + 0.52 mΩ 10 μΩ/Ω + 0.57 mΩ 9.7 μΩ/Ω + 13 mΩ 10 μΩ/Ω + 57 mΩ 15 μΩ/Ω + 2.1 Ω 49 μΩ/Ω + 0.12 kΩ 0.16 mΩ/Ω + 79 kΩ 4.5 mΩ/Ω + 0.56 MΩ	High Resolution DMM

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
RTD Simulation			
Pt 385 (100 Ω)	(73 to 1 073) K (-200 to 800) °C	0.09 K (0.09 °C)	High Resolution DMM
Pt 385 (1 000 Ω)	(73 to 903) K (-200 to 630) °C	0.1 K (0.1 °C)	
Pt 3916 (100 Ω)	(73 to 903) K (-200 to 630) °C	0.09 K (0.09 °C)	
Pt 3926 (100 Ω)	(73 to 903) K (-200 to 903) °C	0.09 K (0.09 °C)	
Ni 120 (120 Ω)	(193 to 533) K (-80 to 260) °C	0.13 K (0.13 °C)	
Pt 385 (200 Ω)	(73 to 903) K (-200 to 630) °C	0.1 K (0.1 °C)	
Pt 385 (500 Ω)	(73 to 903) K (-200 to 630) °C	0.1 K (0.1 °C)	

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Capacitance – Source			
10 Hz to 1 kHz	(3.3 to 11) nF	1.8 mF/F + 11 pF	Multifunction Calibrator
Charge/Discharge Rate	(11 to 33) nF	1.7 mF/F + 95 pF	
	(33 to 110) nF	1.7 mF/F + 0.13 nF	
	(110 to 330) nF	1.4 mF/F + 0.57 nF	
10 Hz to 600 Hz			
Charge/Discharge rate	(0.33 to 1.1) μF	1.9 mF/F + 0.91 mF	
10 Hz to 300 Hz			
Charge/Discharge rate	(1.1 to 3.3) μF	1.4 mF/F + 5.7 nF	
10 Hz to 150 Hz			
Charge/Discharge rate	(3.3 to 11) μF	1.8 mF/F + 10 nF	
10 Hz to 120 Hz			
Charge/Discharge rate	(11 to 33) μF	2.6 mF/F + 52 nF	
10 Hz to 80 Hz			
Charge/Discharge rate	(33 to 110) μF	3.4 mF/F + 88 nF	
Up to 50 Hz			
Charge/Discharge rate	(110 to 330) μF	3 mF/F + 0.51 μF	
Up to 50 Hz			
Charge/Discharge rate	330 μF to 1 mF	3.4 mF/F + 0.99 μF	

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Capacitance - Source Fixed Values	1 nF		
	1 kHz	0.28 nF	
	1 μF		
	100 Hz	1.5 nF	
	120 Hz	1.5 nF	
	1 kHz	1.5 nF	
	10 μF		
	100 Hz	15 nF	
	120 Hz	15 nF	
	1 kHz	15 nF	
	100 μF		
	100 Hz	0.15 μF	
	120 Hz	0.15 μF	
	1 kHz	0.15 μF	
	1 mF		
100 Hz	1.9 μF		
120 Hz	2.1 μF		
1 kHz	2.1 μF		
10 mF			
100 Hz	0.11 mF		
120 Hz	0.11 mF		
1 kHz	0.15 mF		
Inductance - Source Fixed Values	10 mH		
	100 Hz	6.5 μH	
	1 kHz	6.5 μH	



PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Oscilloscopes Bandwidth (Leveled Sine Wave)	50 kHz to 600 MHz	$(4.8 + 0.0068 X^1) \%$	Multifunction Calibrator
DC Voltage 50 Ω load 1 M Ω load	0 V to 6.6 V 0 V to 130 V	1.9 mV/V + 0.37 mV 0.46 mV/V + 0.5 mV	
Square Wave - Amplitude 50 Ω load 1 M Ω load	0 V to 6.6 V 0 V to 130 V	0.19 mV/V + 0.46 mV 0.77 mV/V + 0.64 mV	
Rise Time	3.5 ns Pulse Edge	41 ps	
Time Marker	(2 to 10) ns	2.9 ns/s + 7.8 ps	
	(20 to 100) ns	27 ns/s + 7.7 ps	
	(100 to 500) ns	0.15 μ s/s + 7.7 ps	
	(1 to 20) ms	4.6 ns/s + 8.6 ns	
	(50 to 500) ms	1.4 ns/s + 44 ns	
	(1 to 5) s	2.8 ms/s + 9 ms	

III. Electromagnetic – RF/Microwave

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
RF Absolute Power - Generate			
Sine Wave into 50 Ω 200 Hz to 81 MHz	(13.01 to -86.98) dBm	0.015 dBm	HP 3335A Synthesized Function Generator
Sine Wave into 75 Ω 200 Hz to 81 MHz	(11.25 to -88.74) dBm	0.015 dBm	
RF Absolute Power - Generate			
<1.0 Hz to 100 KHz (0.10 to 20) MHz	(23.00 to -56) dBm	0.33 dBm	HP 3325B Function Generator

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
RF Absolute Power - Generate 100 KHz to 2.060 GHz	(+13 to - 140.0) dBm	0.099 dBm	HP 8657B Signal Generator
RF Absolute Power - Generate 10 MHz to 2 GHz (≥2 to ≤20) GHz (>20 to 26.5) GHz	(-9.95 to 10) dBm	0.025 dBm 0.061 dB dBm 0.074 dBm	HP 8340B Signal Generator.
RF Absolute Power - Generate 10 MHz to 2 GHz (≥2 to ≤20) GHz (>20 to 26.5) GHz	(-80 to -100) dBm	0. dBm 0.13 dBm 0.15 dBm	HP 8340B Signal Generator
RF Absolute Power - Generate ≥10MHz to ≤40GHz	(+20 to -120) dBm	0.125 dB	Anritsu 69367B Signal Generator
RF Absolute Power Measure 10 MHz to 18 GHz 10 MHz to 18 GHz 0.1 MHz to 4.2 GHz 0.1 MHz to 4.2 GHz 10 MHz to 18 GHz 10 MHz to 18 GHz 10 MHz to 18 GHz 10 MHz to 18 GHz 30 MHz to 26.5 GHz 30 MHz to 26.5 GHz	(0 to 35) dBm (35 to 44) dBm (-30 to 10) dBm (10 to 20) dBm (-70 to -30) dBm (-30 to - 20) dBm (-30 to 10) dBm (10 to 20) dBm (-20 to -10) dBm (-10 to 30) dBm	0.12 dBm 0.23 dBm 0.08 dBm 0.09 dBm 0.10 dBm 0.11 dB 0.08 dBm 0.17 dBm 0.15 dBm 0.15 dBm	RF Power Meter and Power Sensor

IV. Time and Frequency

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Frequency - Source Using Calibrator's Normal Output	(0.01 to 120) Hz 120 Hz to 1.2 kHz (1.2 to 12) kHz (12 to 120) kHz 120 kHz to 1.2 MHz (1.2 to 2) MHz	1.2 μ Hz/Hz + 0.11 mHz 1.6 μ Hz/Hz + 0.48 mHz 1.9 μ Hz/Hz + 0.4 mHz 1.9 μ Hz/Hz + 1.2 mHz 1.9 μ Hz/Hz + 1.2 mHz 1.9 μ Hz/Hz + 14 mHz	Multifunction Calibrator
Using Calibrator's Oscilloscope Output	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	1.9 μ Hz/Hz + 5.1 Hz 1.9 μ Hz/Hz + 0.3 Hz 1.9 μ Hz/Hz + 70 mHz	
Frequency - Measure	1 Hz to 10 MHz	0.50 mHz/Hz + 0.1 μ Hz	High Resolution DMM
Stopwatches	Up to 24 hours	0.19 s	NIST UTC Phone Time Signal
Frequency – Source and Measure	0.1 μ Hz to 3 GHz 10 Hz to 26.5 GHz	0.012 Hz + 0.385 Hz/MHz 0.17 Hz	Frequency Counter

V. Thermodynamic

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Temperature at Ice Point	273.15 K (0 °C)	0.033 K 0.033 °C	Standard Multimeter and Platinum Resistance Thermometer
Temperature - Measure	(73 to 933) K (-200 to 660) °C	0.000004 K/K + 0.032 K 0.000004 °C/°C + 0.032 °C	Standard Multimeter and Platinum Resistance Thermometer
	(0 to 1 750) °C	0.00434 °C/°C + 0.57 °C	Type R Thermocouple and Multifunction Calibrator

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT
Humidity - Source	(10 to 95) %RH	0.81 %RH + 0.014 %RH/%RH	Humidity Chamber and Humidity Meter
Humidity - Measure	(10 to 95) %RH	0.7 %RH + 0.015 %RH/%RH	

VI. Mechanical

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(±)]	REFERENCE STANDARD OR EQUIPMENT
Balances	Up to 410 g	0.016 mg/g + 1.6 mg	Class 3 Weights
	Up to 9 kg (20 lb)	0.092 mg/g + 0.1 g 0.000092 lb/lb + 0.00022 lb	Class 6 Weights
Scales	Up to 400 lb	0.24 lb + 0.00021 lb/lb	Class 6 Weights
Torque Tools	(0.4 to 2) Nm (4 to 18) lbf in	0.00056 Nm/Nm + 0.000034 Nm 0.00056 lbf in/lbf in + 0.003 lbf in	Torque Tester
Torque Tools	(2.26 to 11.29) Nm (20 to 100) lbf in (67 to 338.9) Nm (50 to 250) lbf ft (271.1 to 1 356) Nm (200 to 1 000) lbf ft	0.034 Nm + 0.0026 Nm/Nm 0.3 lbf in + 0.0023 lbf in / lbf in 0.22 Nm + 0.0073 Nm/Nm 0.16 lbf ft + 0.00536 lbf ft / lbf ft 0.46 Nm + 0.0781 Nm/Nm 0.34 lbf ft + 0.00576 lbf ft/lbf ft	Torque Transducer, Torque Display
Tensiometers	(5 to 600) lbf	(1.6 + 0.034 X ²) lbf	Class 6 Weights
Force Gage	Up to 1 000 lbf	2 lb + 0.00046 lb/lb	Load cell with indicator

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
Pressure - Pneumatic	(-10 to 30) psi (30 to 50) psi (50 to 100) psi (100 to 300) psi (300 to 600) psi (600 to 1 000) psi	0.007 psi + 0.43 µpsi/psi 0.009 psi + 0.59 µpsi/psi 0.02 psi + 0.83 µpsi/psi 0.04 psi + 2.4 µpsi/psi 0.08 psi + 2.5 µpsi/psi 0.18 psi + 1.7 µpsi/psi	Precision Pressure Controller used as Standard; Calibration Media - Nitrogen
Pressure * - Hydraulic, Cross Floating	41.4 kPa to 16.5 MPa (6 to 2 400) psi	0.22 kPa + 0.19 Pa/Pa 0.032 psi to 0.000028 psi/psi	Comparison to Ruska 2400 Standard Dead Weight Tester
	207 kPa to 82.7 MPa (30 to 12 000) psi	0.35 kPa + 0.25 Pa/Pa 0.05 psi + 0.000037 psi/psi	
	Up to 499.86 MPa (Up to 72 500) psi	4.8 MPa + 0.000072 MPa/MPa 700 psi + 0.000005 psi/psi	Pressure Transducer
Pressure - Hydraulic	34.48 to 137.92 MPa (5 000 to 20 000) psi	77 kPa + 0.00055 Pa/kPa 11.2 psi + 0.00008 psi/psi	Precision Pressure Monitor
Hardness (Rockwell scale) B Scale	Low Mid High	2 HRBW 1.6 HRBW 1.8 HRBW	Indirect Comparison to Hardness Test Blocks
C Scale	Low Mid High	1.3 HRC 1.3 HRC 1.1 HRC	
Superficial 30T Scale	Low Mid High	1.6 HR30TW 1.3 HR30TW 1.4 HR30TW	

VII. Chemical Quantities

PARAMETER/ EQUIPMENT	RANGE	CALIBRATION & MEASUREMENT CAPABILITY [EXPRESSED AS UNCERTAINTY(+)]	REFERENCE STANDARD OR EQUIPMENT
pH Meters	(4, 7 and 10) pH	0.012 pH	Standard Buffer Solutions

Notes:

1. Calibration and Measurement Capabilities (CMC) (Expanded Uncertainties) are based on approximately a 95% confidence interval, using a coverage of $k=2$.
2. This laboratory offers calibration services in its laboratory and on-site at customer-designated locations. Satellite sites may also be established in the future at key customer locations. Since on-site and/or satellite 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. .
3. X^1 = measured value, X^2 = measured value in lbf, L = Length in inches.
4. Items marked with an asterisk (*) cannot be performed on-site.
5. This scope is formatted as part of a single document including the Certificate of Accreditation No. AC-1172.



Vice President