CERTIFICATE OF ACCREDITATION

ANSI-ASQ National Accreditation Board
500 Montgomery Street, Suite 625, Alexandria, VA 22314, 877-344-3044

This is to certify that

Productivity Quality, Inc./Advanced Inspection Services, LLC
15150 25th Ave N. Suite 200
Plymouth, MN 55447

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

ISO/IEC 17025:2005

while demonstrating technical competence in the fields of

CALIBRATION & TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of calibrations and/or tests to which this accreditation applies.

ACT-1608
Certificate Number

ANAB Approval

Certificate Valid: 01/11/2018-01/15/2020
Version No. 004 Issued: 01/11/2018

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).

ANSI-ASQ National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Productivity Quality, Inc. / Advanced Inspection Services, LLC

15150 25th Ave N. Suite 200
Plymouth, MN 55447
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CALIBRATION

Valid to: **January 15, 2020** Certificate Number: **ACT-1608**

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
DC Voltage - Source	Up to 330 mV 330 mV to 3 V (3 to 33) V (30 to 330) V (100 to 1 020) V	0.78 µV + 16 µV/V 1.7 µV + 8.6 µV/V 17 µV + 9.3 µV/V 0.13 mV + 14 µV/V 1.3 mV + 14 µV/V	Fluke 5522A
DC Voltage - Measure	Up to 200 mV 200 mV to 2 V (2 to 20) V (20 to 200) V 200 V to 1 kV	0.1 µV + 5 µV/V 0.4 µV + 3.5 µV/V 4 µV + 3.5 µV/V 40 µV + 5.5 µV/V 0.5 mV + 5.5 µV/V	Fluke 8508A
DC Current - Source	Up to 330 µA 330 µA to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 1.1 A (1.1 to 3) A (3 to 11) A (11 to 20.5) A	16 nA + 0.12 mA/A 40 nA + 78 µA/A 0.21 µV + 78 µA/A 2.1 µV + 78 µA/A 32 µV + 0.16 mA/A 32 µV + 0.3 mA/A 0.4 mA + 0.39 mA/A 0.59 mA + 0.78 mA/A	Fluke 5522A
	(20.5 to 150) A (150 to 550) A (550 to 1 000) A	0.14 A + 2.6 mA/A 0.5 A + 2.6 mA/A 0.5 A + 2.7 mA/A	Fluke 5522A and Fluke 50 Turn Current Coil
DC Current - Measure	Up to 200 µA 200 µA to 2 mA (2 mA to 20) mA (20 to 200) mA 200 mA to 2 A (2 to 20) A	0.4 nA + 12 µA/A 4 nA + 12 µA/A 40 nA + 14 µA/A 0.8 µV + 48 µA/A 16 µV + 0.19 mA/A 0.4 mA + 0.4 mA/A	Fluke 8508A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage - Source	(1 to 33) mV		Fluke 5522A
	(10 to 45) Hz	4.7 µV + 0.62 mV/V	
	45 Hz to 10 kHz	4.7 µV + 0.12 mV/V	
	(10 to 20) kHz	4.7 µV + 0.16 mV/V	
	(20 to 50) kHz	4.7 µV + 0.78 mV/V	
	(50 to 100) kHz	9.4 µV + 2.8 mV/V	
	(100 to 500) kHz	39 µV + 6.2 mV/V	
	(33 to 330) mV		
	(10 to 45) Hz	6.3 µV + 0.24 mV/V	
	45 Hz to 10 kHz	6.3 µV + 0.12 mV/V	
	(10 to 20) kHz	6.3 µV + 0.13 mV/V	
	(20 to 50) kHz	6.3 µV + 0.28 mV/V	
	(50 to 100) kHz	25 µV + 0.62 mV/V	
	(100 to 500) kHz	55 µV + 1.6 mV/V	
	330 mV to 3.3 V		
	(10 to 45) Hz	40 µV + 0.24 mV/V	
	45 Hz to 10 kHz	47 µV + 0.12 mV/V	
	(10 to 20) kHz	47 µV + 0.15 mV/V	
	(20 to 50) kHz	40 µV + 0.24 mV/V	
	(50 to 100) kHz	97 µV + 0.55 mV/V	
	(100 to 500) kHz	0.47 mV + 1.9 mV/V	
	(3.3 to 33) V		
	(10 to 45) Hz	0.51 mV + 0.24 mV/V	
	45 Hz to 10 kHz	0.47 mV + 0.12 mV/V	
	(10 to 20) kHz	0.47 mV + 0.19 mV/V	
	(20 to 50) kHz	0.47 mV + 0.28 mV/V	
	(50 to 100) kHz	1.3 mV + 0.7 mV/V	
	(33 to 330) V		
	45 Hz to 1 kHz	1.7 mV + 0.15 mV/V	
	(1 to 10) kHz	4.7 mV + 0.16 mV/V	
	(10 to 20) kHz	4.7 mV + 0.2 mV/V	
	(20 to 50) kHz	4.7 mV + 0.24 mV/V	
	(50 to 100) kHz	39 mV + 1.6 mV/V	
	(330 to 1 020) V		
	45 Hz to 1 kHz	9.7 mV + 0.24 mV/V	
	(1 to 5) kHz	9.7 mV + 0.2 mV/V	
	(5 to 10) kHz	9.7 mV + 0.24 mV/V	
AC Voltage - Measure	Up to 200 mV		Fluke 8508A
	(1 to 10) Hz	14 µV + 0.17 mV/V	
	(10 to 40) Hz	4 µV + 0.14 mV/V	
	(40 to 100) Hz	4 µV + 0.12 mV/V	
	100 Hz to 2 kHz	2 µV + 0.11 mV/V	
	(2 to 10) kHz	4 µV + 0.14 mV/V	
	(10 to 30) kHz	8 µV + 0.64 mV/V	
	(30 to 100) kHz	20 µV + 0.77 mV/V	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Voltage - Measure	200 mV to 2 V (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (2 to 20) V (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (20 to 200) V (1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (200 V to 1 000) V (1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.12 mV + 0.15 mV/V 20 µV + 0.12 mV/V 20 µV + 90 µV/V 20 µV + 75 µV/V 20 µV + 0.11 mV/V 40 µV + 0.22 mV/V 0.2 mV + 0.57 mV/V 2 mV + 3 mV/V 20 mV + 10 mV/V 1.2 mV + 0.15 mV/V 0.2 mV + 0.12 mV/V 0.2 mV + 90 µV/V 0.2 mV + 75 µV/V 0.2 mV + 0.11 mV/V 0.4 mV + 0.22 mV/V 2 mV + 0.57 mV/V 20 mV + 3 mV/V 0.2 V + 10 mV/V 12 mV + 0.15 mV/V 2 mV + 0.12 mV/V 2 mV + 90 µV/V 2 mV + 75 µV/V 2 mV + 0.11 mV/V 4 mV + 0.22 mV/V 20 mV + 0.57 mV/V 0.2 V + 3 mV/V 2 V + 10 mV/V 70 mV + 0.15 mV/V 20 mV + 0.12 mV/V 20 mV + 0.12 mV/V 40 mV + 0.23 mV/V 0.2 V + 0.58 mV/V	Fluke 8508A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
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	 78 nA + 1.6 mA/A 78 nA + 1.2 mA/A 78 nA + 0.97 mA/A 0.12 µA + 2.4 mA/A 0.16 µA + 6.2 mA/A 0.31 µA + 13 mA/A	Fluke 5522A
AC Current - Source	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 (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 1.1) A (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (1.1 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 (1 to 5) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 0.12 µA + 1.6 mA/A 0.12 µA + 0.97 mA/A 0.12 µA + 0.78 mA/A 0.16 µA + 1.6 mA/A 0.24 µA + 3.9 mA/A 0.47 µA + 7.8 mA/A 1.6 µA + 1.4 mA/A 1.6 µA + 0.7 mA/A 1.6 µA + 0.31 mA/A 1.6 µA + 0.62 mA/A 1.6 µA + 1.6 mA/A 1.6 µA + 3.1 mA/A 16 µA + 1.4 mA/A 16 µA + 0.7 mA/A 16 µA + 0.31 mA/A 39 µA + 0.78 mA/A 78 µA + 1.6 mA/A 0.16 mA + 3.1 mA/A 78 µA + 1.4 mA/A 78 µA + 0.39 mA/A 0.78 mA + 4.7 mA/A 3.9 mA + 20 mA/A 78 µA + 1.4 mA/A 78 µA + 0.47 mA/A 78 µA + 4.7 mA/A 3.9 mA + 20 mA/A 1.6 mA + 0.47 mA/A 1.6 mA + 0.78 mA/A 1.6 mA + 24 mA/A 3.9 mA + 0.93 mA/A 3.9 mA + 1.2 mA/A 3.9 mA + 24 mA/A	Fluke 5522A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Current - Source	(20.5 to 55) A (45 to 65) Hz (65 to 440) Hz (55 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 550) A (45 to 65) Hz (65 to 440) Hz	 5.6 mA + 5.7 mA/A 10 mA + 11 mA/A 5.6 mA + 5.7 mA/A 10 mA + 11 mA/A 5.9 mA + 5.7 mA/A 11 mA + 11 mA/A	Fluke 5522A and Fluke 50 Turn Current Coil
AC Current - Source	(550 to 1 000) A (45 to 65) Hz (65 to 440) Hz	 6.9 mA + 5.7 mA/A 11 mA + 11 mA/A	Fluke 5522A and Fluke 50 Turn Current Coil
AC Current - Measure	Up to 200 µA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz 200 µA to 2 mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (2 to 20) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (20 to 200) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz 200 mA to 2 A 10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (2 to 20) A 10 Hz to 2 kHz (2 to 10) kHz	 20 nA + 0.5 mA/A 20 nA + 0.5 mA/A 20 nA + 0.71 mA/A 20 nA + 4 mA/A 0.2 µA + 0.31 mA/A 0.2 µA + 0.3 mA/A 0.2 µA + 0.71 mA/A 0.2 µA + 4 mA/A 2 µA + 0.31 mA/A 2 µA + 0.3 mA/A 2 µA + 0.71 mA/A 2 µA + 4 mA/A 20 µA + 0.31 mA/A 20 µA + 0.29 mA/A 20 µA + 0.63 mA/A 0.2 mA + 0.62 mA/A 0.2 mA + 0.74 mA/A 0.2 mA + 3 mA/A 2 mA + 0.82 mA/A 2 mA + 2.5 mA/A	Fluke 8508A
DC Power - Source	33mV to 1 020 V (0.33 to 330) mA 330 mA to 3 A (3 to 20.5) A	 0.18 mW/W 0.18 mW/W 0.55 mW/W	Fluke 5522A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
AC Power - Source	(33 to 330) mV (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 2.2 A (2.2 to 4.5) A (4.5 to 20.5) A	 1.1 mW/W 0.78 mW/W 1.1 mW/W 0.78 mW/W 1.1 mW/W 0.86 mW/W 1.1 mW/W 0.86 mW/W	Fluke 5522A
AC Power - Source	330mV to 1 020 V (3.3 to 9) mA (9 to 33) mA (33 to 90) mA (90 to 330) mA (330 to 900) mA 900 mA to 2.2 A (2.2 to 4.5) A (4.5 to 20.5) A	 0.93 mW/W 0.62 mW/W 0.93 mW/W 0.62 mW/W 0.86 mW/W 0.7 mW/W 0.93 mW/W 0.78 mW/W	Fluke 5522A
Resistance - Source	(0 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 to 1 100)MΩ	0.78 mΩ + 31 uΩ/Ω 1.2 mΩ + 24 uΩ/Ω 1.1 mΩ + 22 uΩ/Ω 1.6 mΩ + 22 uΩ/Ω 1.7 mΩ + 22 uΩ/Ω 16 mΩ + 22 uΩ/Ω 17 mΩ + 22 uΩ/Ω 0.16 Ω + 22 uΩ/Ω 0.17 Ω + 22 uΩ/Ω 1.6 Ω + 25 uΩ/Ω 1.7 Ω + 25 uΩ/Ω 24 Ω + 47 uΩ/Ω 40 Ω + 0.11 mΩ/Ω 2 kΩ + 0.2 mΩ/Ω 2.4 kΩ + 0.39 mΩ/Ω 78 kΩ + 2.4 mΩ/Ω 390 kΩ + 12 mΩ/Ω	Fluke 5522A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Resistance - Measure	Up to 2 Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2)GΩ	4 µΩ + 17 µΩ/Ω 14 µΩ + 9.5 µΩ/Ω 50 µΩ + 8 µΩ/Ω 0.5 mΩ + 8 µΩ/Ω 5 mΩ + 8 µΩ/Ω 50 mΩ + 8 µΩ/Ω 5.9 Ω + 9 µΩ/Ω 0.12 kΩ + 20 µΩ/Ω 10 kΩ + 0.12 mΩ/Ω 1 MΩ + 1.6 mΩ/Ω	Fluke 8508A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Capacitance - Source	(220 to 400) pF 10 Hz to 10kHz 400 pF to 1.1 nF 10 Hz to 10 kHz (1.1 to 3.3) nF 10 Hz to 3 kHz (3.3 to 11) nF 10 Hz to 1 kHz (11 to 33) nF 10 Hz to 1 kHz (33 to 110) nF 10 Hz to 1 kHz (110 to 330) nF 10 Hz to 1 kHz 330 nF to 1.1 µF (10 to 60)0 Hz (1.1 to 3.3) µF (10 to 300) Hz (3.3 to 11) µF (10 to 150) Hz (11 to 33) µF (10 to 120) Hz (33 to 110) µF (10 to 80) Hz (110 to 330) µF (0 to 50) Hz (330 to 1.1) mF (0 to 20) Hz (1.1 to 3.3) mF (0 to 6) Hz (3.3 to 11) mF (0 to 2) Hz (11 to 33) mF (0 to 0.6) Hz (33 to 110) mF (0 to 0.2)Hz	 7.8 pF + 3.9 mF/F 7.8 pF + 3.9 mF/F 7.8 pF + 3.9 mF/F 7.8 pF + 2 mF/F 7.8 pF + 2 mF/F 7.8 pF + 2 mF/F 24 pF + 2 mF/F 0.78 nF + 2 mF/F 2.4 nF + 2 mF/F 7.8 nF + 2 mF/F 24 nF + 3.1 mF/F 78 nF + 3.5 mF/F 0.24 µF + 3.5 mF/F 0.78 µF + 3.5 mF/F 2.4 µF + 3.5 mF/F 7.8 µF + 3.5 mF/F 24 µF + 5.9 mF/F 78 µF + 8.6 mF/F	Fluke 5522A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of Thermocouple – Source	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 316) °C Type E (-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1 000) °C Type J (-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1 200) °C Type K (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1 000) °C (1 000 to 1 372) °C Type L (-200 to -100) °C (-100 to 800) °C (800 to 900) °C Type N (-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1 300) °C	 0.35 °C 0.27 °C 0.24 °C 0.26 °C 0.24 °C 0.21 °C 0.24 °C 0.39 °C 0.66 °C 0.39 °C 0.13 °C 0.11 °C 0.13 °C 0.17 °C 0.21 °C 0.13 °C 0.11 °C 0.14 °C 0.18 °C 0.26 °C 0.14 °C 0.13 °C 0.21 °C 0.31 °C 0.29 °C 0.21 °C 0.14 °C 0.31 °C 0.18 °C 0.15 °C 0.14 °C 0.21 °C	Fluke 5522A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of Thermocouple – Source	Type R (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600)°C	0.45 °C 0.28 °C 0.26 °C 0.31 °C 0.37 °C 0.28 °C 0.29 °C 0.36 °C 0.49 °C 0.19 °C 0.13 °C 0.11 °C 0.44 °C 0.21 °C	Fluke 5522A
Electrical Simulation of RTDs – Source	Pt 385 100 Ω (-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C Pt 3926 100 Ω (-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.043 °C 0.057 °C 0.072 °C 0.08 °C 0.095 °C 0.18 °C 0.043 °C 0.057 °C 0.072 °C 0.08 °C 0.095 °C	Fluke 5522A

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Electrical Simulation of RTDs – Source	Pt 3916 100 Ω		Fluke 5522A
	(-200 to -190) °C	0.2 °C	
	(-190 to -80) °C	0.036 °C	
	(-80 to 0) °C	0.043 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.057 °C	
	(260 to 300) °C	0.065 °C	
	(300 to 400) °C	0.072 °C	
	(400 to 600) °C	0.08 °C	
	(600 to 630) °C	0.18 °C	
	Pt 385 200 Ω		
	(-200 to -80) °C	0.31 °C	
	(-80 to 100) °C	0.036 °C	
	(100 to 260) °C	0.043 °C	
	(260 to 300) °C	0.095 °C	
	(300 to 600) °C	0.11 °C	
	(600 to 630) °C	0.13 °C	
	Pt 385 500 Ω		
	(-200 to -80) °C	0.036 °C	
	(-80 to 100) °C	0.043 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.065 °C	
	(300 to 400) °C	0.065 °C	
	(400 to 600) °C	0.072 °C	
	(600 to 630) °C	0.087 °C	
	Pt 385 1000 Ω		
	(-200 to 0) °C	0.029 °C	
	(0 to 100) °C	0.036 °C	
	(100 to 260) °C	0.043 °C	
	(260 to 300) °C	0.05 °C	
	(300 to 600) °C	0.057 °C	
	(600 to 630) °C	0.18 °C	
	PtNi 385 120 Ω		
	(-80 to 0) °C	0.065 °C	
	(0 to 100) °C	0.065 °C	
	(100 to 260) °C	0.11 °C	
	Cu 427 10 Ω		
	(-100 to 260) °C	0.24 °C	

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Oscilloscope Voltage – Source			Fluke 5522A SC1100
DC Signal 50 Ω	(1 to 25) mV	31 µV + 2 mV/V
	(25 to 110) mV	32 µV + 2 mV/V
	110 mV to 2.2 V	66 µV + 2 mV/V
	(2.2 to 6.6) V	0.58 mV + 2 mV/V
DC Signal 1 MΩ	(1 to 25) mV	31 µV + 0.39 mV/V
	(25 to 110) mV	32 µV + 0.39 mV/V
	110 mV to 2.2 V	66 µV + 0.39 mV/V
	(2.2 to 11) V	0.58 mV + 0.39 mV/V
	(11 to 130) V	5.8 mV + 0.39 mV/V
Square Wave 50 Ω	(1 to 25) mV	31 µV + 2 mV/V
	(25 to 110) mV	32µV + 2 mV/V
	110 mV to 2.2 V	66 µV + 2 mV/V
	(2.2 to 6.6) V	0.58 mV + 2 mV/V
Square Wave 1 MΩ	(1 to 25) mV	31 µV + 0.78 mV/V
	(25 to 110) mV	32 µV + 0.78 mV/V
	110 mV to 2.2 V	66 µV + 0.78 mV/V
	(2.2 to 11) V	0.58 mV + 0.78 mV/V
	(11 to 130) V	5.8 mV + 0.78 mV/V
Square Wave Frequency	(10 to 100) Hz	5.8 mHz + 2 µHz/Hz
	100 Hz to 1 kHz	58 mHz + 2 µHz/Hz
	(1 to 10) kHz	0.58 Hz + 2 µHz/Hz
Oscilloscope Leveled Sine Wave – Source			Fluke 5522A SC1100
Amplitude	**5 mV to 5.5 V**	
	50 kHz (Reference)	0.24 mV + 16 mV/V
	50 kHz to 100 MHz	0.24 mV + 28 mV/V
	(100 to 300) MHz	0.24 mV + 31 mV/V
	(300 to 600) MHz	0.24 mV + 47 mV/V
Frequency	**5 mV to 3.5 V**	
	(600 to 1 100) MHz	0.24 mV + 55 mV/V
	50 kHz to 600) MHz	5.8 kHz + 2 µHz/Hz
	(600 to 1 100) MHz	58 kHz + 2 µHz/Hz

Electrical – DC/Low Frequency

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Oscilloscope Pulse Generator – Source Pulse Width Pulse Period	(4 to 10) nS (10 to 500) nS 200 nS to 1 µS (1 to 10) µS (10 to 100) µS 100 µS to 1 mS (1 to 10) mS (10 to 20) mS	1.6 nS + 39 mS/S 1.7 nS + 39 mS/S 58 pS + 2 µS/S 0.58 nS + 2 µS/S 5.8 nS + 2 µS/S 58 nS + 2 µS/S 0.58 µS + 2 µS/S 5.8 µS + 2 µS/S	Fluke 5522A SC1100
Oscilloscope Wave Generator – Source Amplitude p-p Frequency	(1.8 to 100) mV (0.1 to 1) V (1 to 8) V (8 to 55) V 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz	97 µV + 24 mV/V 0.59 mV + 24 mV/V 5.8 mV + 24 mV/V 58 mV + 24 mV/V 13 mHz + 20 µHz/Hz 59 mHz + 20 µHz/Hz 5.8 Hz + 20 µHz/Hz	Fluke 5522A SC1100

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Micrometers- O.D., Blade, Point, Spline, Tube, Disc, Depth, Indicating, Interchangeable, Bench and Pitch [1]	Up to 48 in Flatness Parallelism	(42 + 1.1*L*) µin 11 µin 16 µin	Gage Blocks w/ Optical Flats, and Parallels
Calipers [1]	Up to 72 in	(408 + 0.1*L*) µin	Gage Blocks
Indicator Gages [1]	Up to 6 in	(13 + 0.4*L*) µin	Gage Blocks
Electronic Indicator Gages/ LVDT [1]	Up to 4 in	(8.9 + 0.4*L*) µin	Gage Blocks
Height Gages [1]	Up to 48 in	(30 + 0.8*L*) µin	Gage Blocks
Height Masters [1]	Up to 1.5 in (1.5 to 24) in	40 µin (28 + 0.5*L*) µin	Gage Blocks

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Step Gages	Up to 48 in	(28 + 0.8*L*) µin	Gage Blocks
Micrometer Length Standards[1]	Up to 40 in	(6 + 1.5*L*) µin	Universal Measuring Machine
Length – 1D[1]	Up to 40 in	(7 + 1.6*L*) µin	Universal Measuring Machine
Long Gage Blocks	(5 to 20) in	(11 + 1.2*L*) µin	Universal Measuring Machine
Steel Rule	Up to 72 in	2 880 µin (66 + 0.5*L*) µin	Gage Block Video Measuring Machine
Tapes[1]	Up to 25 ft	(3 600 + 0.1*L*) µin (133 + 0.6*L*) µin	Master Tape Video Measuring Machine
Plug Gages[1]	Up to 4 in (4 to 40) in	(6.3 + 1.1*D*) µin (6.6 + 1.5*D*) µin	Universal Measuring Machine
Spherical Diameters[1]	Up to 8 in	(6.6 + 1.2*D*) µin	Universal Measuring Machine
Thread Wires	Up to .6 in	(7.6 + 0.3*D*) µin	Universal Measuring Machine
Thread Plug / Set Plugs[1] Major Diameter Pitch Diameter	 Up to 12 in Up to 12 in	 (11 + 1.2*D*) µin (70 + 0.3*D*) µin	Universal Measuring Machine w/ Thread Wires
Thread Rings Pitch Diameter	Up to 4 in	(70 + 0.3*D*) µin	Thread Setting Plug
Ring Gages / Internal Diameter[1]	(0.012 to 20) in	(5 + 1.1*D*) µin	Universal Measuring Machine and Ring Gage Comparator
Feeler (Thickness) Gages	Up to 0.25 in	(7.6+0.6*L*) µin	Universal Measuring Machine
Gage Blocks	(0.01 to 4) inch	(1.4 + 0.9*L*) µin	Gage Block Comparator w/ Master Gage Blocks
Optical Comparators[1]	Up to 12 in	(70+ 3.3*L*) µin	Glass scales
Machine Tools[1] Linearity Volume	 Up to 3 200 in Up to 24 in	 (2.4 + 1.3*L*) µin 50 µin	Laser Interferometer Ball Bar System
Video Measuring Systems[1] X/Y Axes Z Axis	 Up to 30 in Up to 4 in	 (53 + 0.3*L*) µin (24 +0.8*L*) µin	 Glass grid Z step gage
Horizontal Measuring Machine[1]	(0 to 8) in	(3 + 1*L*) µin	Gage Blocks

Length – Dimensional Metrology

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Coordinate Measuring Machines (CMM) [1]			
Linear Displacement Accuracy	Up to 26 in Up to 24.41 in Up to 3 200 in	(41 + 0.8*L*) µin (13 + 1.2*L*) µin (2.4 + 1.3*L*) µin	Step Gage Step Gage (Koba) Laser Interferometer Ball
Volumetric Performance	Up to 36 in	(32 + 0.8*L*) µin	Bar Sphere
Sphere Repeatability Probing and Scanning Form	(0.75 to 1) in (1 to 1.18) in	6.7 µin (12 + 0.3*L*) µin	Sphere
Surface Finish Analyzers [1]	120 µin at 0.03 in cut-off	3.8 µin	Master Specimens
Surface Finish Specimen	(2 to 300) µin	3.7 µin	Surface Finish Analyzer
Surface Finish (RA)	Up to 120 µin	3.7 µin	Mitutoyo Surface Roughness Tester
Surface Plates [1,3]			
Overall Flatness Repeat Reading	(0 to 140) in (0 to 140) in	(0.27 + 0.3*d*) µin 19 µin	Renishaw Laser Repeat-O-Meter
Vision (Z)	Up to 10 in	(76 + 0.8*L*) µin	OGP Quest 450
Two Dimensions (Vision) (X & Y) TouchProbe	Up to 25 in Up to 1 in Up to 8 in	(51 + 2*L*) µin 116 µin (110 + 1.4*L*) µin	OGP Quest 450 Gage Pins OGP Flash
Three Dimensions Single Point	Up to 67 in Up to 99 in Up to 67 in Up to 99 in	(28 + 3.5*L*) µin (48 + 6.3*L*) µin (51 + 2.9*L*) µin (120 + 5.2 *L*) µin	PMM-C 12107 B&S Xcel 122010 PMM-C 12107 B&S Xcel 122010
Scanning Form	Up to 100 µin (100 to 500) µin	6.4 µin 53.2 µin	Mitutoyo RA2200 AH Roundness Tester

Mass

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Rockwell Hardness Testers[1]	HRBW Low Middle High HRC: Low Middle High	 0.71 HRBW 0.71 HRBW 0.71 HRBW 0.71 HRC 0.71 HRC 0.71 HRC	Indirect Verification per ASTM E18 using Hardness Test Blocks
Torque – Wrenches	(5 to 50) in ozf (4 to 50) in lbf (30 to 400) in lbf (80 to 1 000) in lbf (20 to 250) ft lbf (60-600) ft lbf	0.45% of reading 0.37% of reading 0.29% of reading 0.35% of reading 0.44% of reading 0.50% of reading	Torque Tester
Pressure Gages Pressure Transducers[1]	(0 to 1) inH_2O (0 to 10) inH_2O (0 to 10) PSI (0 to 100) PSI (-14.7 to 200) PSI	0.005 3 inH_2O 0.011 inH_2O 0.023 PSI 0.033 PSI 0.16 PSI	Ashcroft ATE-2 / AM2-1
	(0 to 1 000) PSI (0 to 3 000) PSI (0 to 10 000) PSI	0.54 PSI 2.5 PSI 8.8 PSI	Fluke 525A / 700 Series

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature - Measure	(-197 to -38) °C (-38 to 0) °C (0 to 157) °C (157 to 232) °C (232 to 420) °C (420 to 660) °C	0.23 °C 0.24 °C 0.035 °C 0.037 °C 0.046 °C 0.061 °C	Fluke 5609 with Fluke 914X-P
	(-197 to -38) °C (-38 to 0) °C (0 to 157) °C (157 to 232) °C (232 to 420) °C (420 to 660) °C	0.023 °C 0.023 °C 0.032 °C 0.032 °C 0.036 °C 0.045 °C	Fluke 5609 with Fluke 8508A

Thermodynamic

Parameter / Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Temperature - Source	(-25 to -12) °C (-12 to 75) °C (75 to 150) °C	0.069 °C 0.069 °C 0.084 °C	Fluke 9142
	(50 to 200) °C (200 to 330) °C (330 to 540) °C (540 to 660) °C	0.092 °C 0.22 °C 0.3 °C 0.42 °C	Fluke 9144

TESTING

Dimensional Measurement

Specific Tests and / or Properties Measured[2]	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Length- One Dimension	Up to 24 in Up to 12 in Up to 3.2 in Up to 0.008 in Up to 0.03 in Up to 2 in Up to 1 in	(590 + 0.2*L*) µin (512 + 0.2*L*) µin 124 µin 120 µin 310 µin 120 µin 116 µin	Dial Height Gage Calipers Micrometers Dial Indicator Dial Indicator Drop Indicator Gage Pins
Vision (Z) Two Dimensions (Vision) (X & Y) TouchProbe Three Dimensions Single Point Scanning	Up to 2 in Up to 10 in Up to 25 in Up to 1 in Up to 8 in Up to 67 in Up to 99 in Up to 67 in Up to 99 in	(188 + 1.0*L*) µin (76+ 0.8*L*) µin (51 + 2*L*) µin 116 µin (110 +1.4*L*) µin (28 + 3.5*L*) µin (48 + 6.3*L*) µin (51 + 2.9*L*) µin (120 +5.2*L*) µin	Tool makers Microscope OGP Quest 450 OGP Quest 450 Gage Pins OGP Flash PMM-C 12107 B&S Xcel 122010 PMM-C 12107 B&S Xcel 122010
Three Dimensional Length[1]	8 ft spherical volume Up to 708 in	(678 + 0.9*L*) µin (1 100 + 3.2*L*) µin	Romer Absolute CMM Leica Laser Tracker (MR) w/ T-probe
Depth	Up to 6 in	590 µin	Depth Micrometer

Specific Tests and / or Properties Measured[2]	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Form Roundness	Up to 100 µin (100 to 500) µin	4.8 µin 53 µin	Mitutoyo RA2200 AH Roundness Tester
Cylindricity	Up to 100 µin (100 to 500) µin	39 µin 66 µin	Mitutoyo RA2200 AH Roundness Tester
Surface Finish (RA)	Up to 120 µin	3.7 µin	Mitutoyo Surface Roughness Tester
Contour	Up to 4 in	(162 + 11*L*) µin	Mitutoyo Contracer

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. The use of (L) represents length in inches, the use of (D) represents diameter in inches, the use of (d) represents diagonal in inches
3. The expanded uncertainty for Surface Plate Overall Flatness represents the maximum closure error acceptable for Surface Plate Calibrations.
4. The expanded uncertainties for electrical parameters do not contain a contributor for a “best existing device. Reported uncertainties will reflect the resolution of the device under test.
5. This scope is formatted as part of a single document including Certificate of Accreditation No. ACT-1608.

Vice President