



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Advanced Technical Services NW, Inc.
8612 South 228th Street
Kent, Washington 98031

Fulfills the requirements of

ISO/IEC 17025:2017

and national standard

ANSI/NCSL Z540-1-1994 (R2002)

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 read 'R. Douglas Leonard Jr.', is positioned above a horizontal line.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 10 June 2024

Certificate Number: AC-1458



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)**

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CALIBRATION

Valid to: **June 10, 2024**

Certificate Number: **AC-1458**

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 3.3 V (3.3 to 33) V (33 to 330) V 330 V to 1.02 kV | 60 μ V/V + 3 μ V 50 μ V/V + 5 μ V 50 μ V/V + 50 μ V 55 μ V/V + 0.50 mV 55 μ V/V + 1.5 mV | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |



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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 to 33) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz (33 to 330) mV (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz 330 mV to 3.3 V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz | 3.5 mV/V + 20 μV 1.5 mV/V + 20 μV 2 mV/V + 20 μV 2.5 mV/V + 20 μV 3.5 mV/V + 33 μV 10 mV/V + 60 μV 2.5 mV/V + 50 μV 0.50 mV/V + 20 μV 1 mV/V + 20 μV 1.6 mV/V + 40 μV 2.4 mV/V + 0.17 mV 7 mV/V + 0.33 mV 1.5 mV/V + 0.25 mV 0.30 mV/V + 60 μV 0.80 mV/V + 60 μV 1.4 mV/V + 0.30 mV 2.4 mV/V + 1.7 mV 5 mV/V + 3.3 mV | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |
| AC Voltage - Source | (3.3 to 33) V (10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (33 to 330) V 45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz 330 V to 1.02 kV 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz | 1.5 mV/V + 2.5 mV 0.40 mV/V + 0.60 mV 0.80 mV/V + 2.6 mV 1.9 mV/V + 5 mV 2.4 mV/V + 17 mV 0.50 mV/V + 6.6 mV 0.80 mV/V + 15 mV 0.90 mV/V + 33 mV 0.60 mV/V + 80 mV 2 mV/V + 0.10 V 2 mV/V + 0.50 V | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |
| DC Current - Source | Up to 3.3 mA (3.3 to 33) mA (33 to 330) mA 330 mA to 2 A (2 to 10) A | 0.13 mA/A + 50 nA 0.10 mA/A + 0.15 μA 0.10 mA/A + 3.3 μA 0.30 mA/A + 44 μA 0.60 mA/A + 0.33 mA | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |



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|---------------------|-------------------------|---|---|
| AC Current - Source | (33 to 330) μ A | | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |
| | (10 to 20) Hz | 2.5 mA/A + 0.15 μ A | |
| | (20 to 45) Hz | 1.3 mA/A + 0.15 μ A | |
| | 45 Hz to 1 kHz | 1.3 mA/A + 0.25 μ A | |
| | (1 to 5) kHz | 4 mA/A + 0.15 μ A | |
| | (5 to 10) kHz | 12.5 mA/A + 0.15 μ A | |
| | (330 μ A to 3.3 mA) | | |
| | (10 to 20) Hz | 2 mA/A + 0.30 μ A | |
| | (20 to 45) Hz | 1 mA/A + 0.30 μ A | |
| | 45 Hz to 1 kHz | 1 mA/A + 0.30 μ A | |
| | (1 to 5) kHz | 2 mA/A + 0.30 μ A | |
| | (5 to 10) kHz | 6 mA/A + 0.30 μ A | |
| | (3.3 to 33) mA | | |
| | (10 to 20) Hz | 2 mA/A + 3 μ A | |
| (20 to 45) Hz | 1 mA/A + 3 μ A | | |
| 45 Hz to 1 kHz | 0.90 mA/A + 3 μ A | | |
| (1 to 5) kHz | 2 mA/A + 3 μ A | | |
| (5 to 10) kHz | 6 mA/A + 3 μ A | | |
| AC Current – Source | (33 to 330) mA | | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |
| | (10 to 20) Hz | 2 mA/A + 30 μ A | |
| | (20 to 45) Hz | 1 mA/A + 30 μ A | |
| | 45 Hz to 1 kHz | 0.90 mA/A + 30 μ A | |
| | (1 to 5) kHz | 2 mA/A + 30 μ A | |
| | (5 to 10) kHz | 6 mA/A + 30 μ A | |
| | 330 mA to 2.2 A | | |
| | (10 to 45) Hz | 2 mA/A + 0.30 mA | |
| | 45 Hz to 1 kHz | 1 mA/A + 0.30 mA | |
| | (1 to 5) kHz | 7.5 mA/A + 0.30 mA | |
| | (2.2 to 11) A | | |
| | (45 to 65) Hz | 0.60 mA/A + 3 mA | |
| | (65 to 500) Hz | 1 mA/A + 3 mA | |
| | 500 Hz to 1 kHz | 3.3 mA/A + 3 mA | |



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Electrical – DC/Low Frequency

| Parameter/Equipment | Range | Expanded Uncertainty of Measurement (+/-) | Reference Standard, Method, and/or Equipment |
|---|--|--|---|
| Resistance - Source | Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω 330 k Ω to 1.1 M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω | 0.12 m Ω/Ω + 6 m Ω 0.12 m Ω/Ω + 10 m Ω 90 $\mu\Omega/\Omega$ + 10 m Ω 90 $\mu\Omega/\Omega$ + 10 m Ω 90 $\mu\Omega/\Omega$ + 60 m Ω 90 $\mu\Omega/\Omega$ + 60 m Ω 90 $\mu\Omega/\Omega$ + 0.60 Ω 90 $\mu\Omega/\Omega$ + 0.60 Ω 0.11 m Ω/Ω + 6 Ω 0.12 m Ω/Ω + 6 Ω 0.15 m Ω/Ω + 55 Ω 0.15 m Ω/Ω + 55 Ω 0.60 m Ω/Ω + 0.55 k Ω 1 m Ω/Ω + 0.55 k Ω 5 m Ω/Ω + 5.5 k Ω | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |
| Resistance Simulation of RTD Indicators | PT 100 Ω , 385 (-180 to 0) $^{\circ}\text{C}$ (0 to 360) $^{\circ}\text{C}$ (360 to 750) $^{\circ}\text{C}$ | 0.05 $^{\circ}\text{C}$ 0.01 $^{\circ}\text{C}$ 0.23 $^{\circ}\text{C}$ | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |
| Millivolt Simulation of Thermocouple Indicators | Type K (-200 to -100) $^{\circ}\text{C}$ (-100 to -25) $^{\circ}\text{C}$ (-25 to 120) $^{\circ}\text{C}$ (120 to 1 000) $^{\circ}\text{C}$ (1 000 to 1 372) $^{\circ}\text{C}$ | 0.33 $^{\circ}\text{C}$ 0.18 $^{\circ}\text{C}$ 0.16 $^{\circ}\text{C}$ 0.26 $^{\circ}\text{C}$ 0.4 $^{\circ}\text{C}$ | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |
| Millivolt Simulation of Thermocouple Indicators | Type J (-210 to -100) $^{\circ}\text{C}$ (-30 to 150) $^{\circ}\text{C}$ (150 to 760) $^{\circ}\text{C}$ (760 to 1 200) $^{\circ}\text{C}$ Type T (-250 to -150) $^{\circ}\text{C}$ (-150 to 0) $^{\circ}\text{C}$ (0 to 120) $^{\circ}\text{C}$ (120 to 400) $^{\circ}\text{C}$ | 0.27 $^{\circ}\text{C}$ 0.14 $^{\circ}\text{C}$ 0.17 $^{\circ}\text{C}$ 0.23 $^{\circ}\text{C}$ 0.63 $^{\circ}\text{C}$ 0.24 $^{\circ}\text{C}$ 0.16 $^{\circ}\text{C}$ 0.14 $^{\circ}\text{C}$ | Fluke 5500A Multi Product Calibrator SOP-LABE-03, Fluke 5500A Manual |

Length – Dimensional Metrology

| Parameter/Equipment | Range | Expanded Uncertainty of Measurement (+/-) | Reference Standard, Method, and/or Equipment |
|---|----------------|---|---|
| Gage Blocks ² | (0.01 to 4) in | (2.1 + 4.5L) μin | Mahr UMM, Gage Blocks SOP-LABM-04 Rev B |
| Calipers ² | Up to 60 in | (4 + 4.9L) μin | Gage Blocks SOP-LABM-17 |
| Micrometers ² | Up to 20 in | 60 μin | Gage Blocks SOP-LABM-08 |
| Indicators ² Dial and Digital | Up to 2 in | 13 μin | Mahr UMM, Gage Blocks SOP-LABM-10 SOP-LABM-11 |
| Height Gage ² | Up to 60 in | (22 + 4.8L) μin | Gage Blocks SOP-LABM-09 |

Mass and Mass Related

| Parameter/Equipment | Range | Expanded Uncertainty of Measurement (+/-) | Reference Standard, Method, and/or Equipment |
|--|--|--|--|
| Force (Tension) Load Cells ¹ | Up to 750 lbf | 0.017 lbf | Class F Weights SOP-FIELD-12 Rev New ASTM E4 |
| Force (Tension) Load Cells ¹ | (58 to 1 010) lbf (288 to 10 100) lbf (1 146 to 51 000) lbf (5 504 to 101 000) lbf | 0.15 lbf 0.58 lbf 2 lbf 18 lbf | Load Cells SOP-FIELD-12 Rev New ASTM E4 |
| Force (Compression) Load Cells ¹ | Up to 190 lbf | 0.008 9 lbf | Class F Weights SOP-FIELD-12 Rev New ASTM E4 |
| Force (Compression) Load Cells ¹ | (29 to 505) lbf (200 to 10 100) lbf (2 543 to 61 000) lbf (23 652 to 400 000) lbf | 0.057 lbf 0.55 lbf 3.5 lbf 35 lbf | Load Cells SOP-FIELD-12 Rev New ASTM E4 |
| Vacuum | (-29 to 0) inHg | 0.14 inHg | Pressure Calibrator SOP-FIELD-05 |
| Pressure | Up to 95 psi (95 to 237.5) psi (237.5 to 475) psi (475 to 3 000) psi (3 000 to 10 000) psi | 0.13 psi 0.14 psi 0.24 psi 1.6 psi 5.4 psi | |

Mass and Mass Related

| Parameter/Equipment | Range | Expanded Uncertainty of Measurement (+/-) | Reference Standard, Method, and/or Equipment |
|---------------------|---|---|--|
| Scales | (1 to 20) g (20 to 210) g (0.46 to 21) lb (21 to 190) lb (190 to 750) lb (751 to 1 770) lb | 0.000 36 g 0.001 2 g 0.001 4 lb 0.005 1 lb 0.02 lb 0.04 lb | Class F Weights SOP-FIELD-24 |

Time and Frequency

| Parameter/Equipment | Range | Expanded Uncertainty of Measurement (+/-) | Reference Standard, Method, and/or Equipment |
|---------------------|--------------------------------------|---|--|
| Frequency - Source | 0.01 Hz to 10 kHz (10 to 100) kHz | 25 μ Hz/Hz + 1 mHz 25 μ Hz/Hz + 15 mHz | Fluke 5500A Multi Product Calibrator |

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. L = length in inches.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-1458.



R. Douglas Leonard Jr., VP, PILR SBU