PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Emerald Mountain Properties LLC DBA Vantage Calibrations

2415 Skelly Drive, Tulsa, OK 74105

(Hereinafter called the Organization) and hereby declares that Organization 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
(as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017)

Electrical, Mechanical, and Thermodynamic Calibration

(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
May 07, 2019	January 03, 2024	January 03, 2026

Accreditation No.:	*Certificate No.:*
103883	L24-10

Perry Johnson Laboratory Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

Emerald Mountain Properties LLC
DBA Vantage Calibrations
2415 Skelly Drive, Tulsa, OK 74105
Contact Name: Patricia Henry Phone: 918-812-5875

Accreditation is granted to the facility to perform the following calibrations:

Electrical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (±)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Temperate Calibration, Indication, and Control Equipment Used with Thermocouple Type J FO	-210 ºC to -100 ºC	0.27 °C	Fluke 5500A Fluke 5500A Manual
	-100 ºC to -30 ºC	0.16 °C	
	-30 ºC to 150 ºC	0.14 °C	
	150 ºC to 760 ºC	0.17 °C	
	760 ºC to 1 200 ºC	0.17 °C	
Temperate Calibration, Indication, and Control Equipment Used with Thermocouple Type K FO	-200 ºC to -100 ºC	0.33 ºC	
	-100 ºC to -25 ºC	0.18 ºC	
	-25 ºC to 120 ºC	0.16 ºC	
	120 ºC to 1 000 ºC	0.26 ºC	
	1 000 ºC to 1 372 ºC	0.4 ºC	
Temperate Calibration, Indication, and Control Equipment Used with Thermocouple Type S FO	Up to 250 ºC	0.47 ºC	
	250 ºC to 1 000 ºC	0.36 ºC	
	1 000 ºC to 1 400 ºC	0.37 ºC	
	1 400 ºC to 1 767 ºC	0.46 ºC	
Temperate Calibration, Indication, and Control Equipment Used with Thermocouple Type T FO	-250 ºC to -150 ºC	0.63 ºC	
	-150 ºC to 0 ºC	0.24 ºC	
	Up to 120 ºC	0.16 ºC	
	120 ºC to 400 ºC	0.14 ºC	
Equipment to Measure Frequency FO	0.01 Hz to 10 kHz	25 µHz/Hz + 1 mHz	
	10 kHz to 2 MHz	25 µHz/Hz + 15 mHz	
Equipment to Measure AC Voltage (at the listed frequencies) FO			Fluke 5500A Fluke 5500A Manual
10 Hz to 45 Hz	1 mV to 32.999 mV	3.5 mV/V + 20µV	
45 Hz to 10 kHz	1 mV to 32.999 mV	1.5 mV/V + 20µV	
10 kHz to 20 kHz	1 mV to 32.999 mV	2 mV/V + 20 µV	
20 kHz to 50 kHz	1 mV to 32.999 mV	2.5 mV/V + 20 µV	
50 kHz to 100 kHz	1 mV to 32.999 mV	3.5 mV/V + 33 µV	
100 kHz to 500 kHz	1 mV to 32.999 mV	10 mV/V + 60 µV	

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Equipment to Measure AC Voltage (at the listed frequencies) [FO]			Fluke 5500A Fluke 5500A Manual
10 Hz to 45 Hz	33 mV to 329.999 mV	2.5 mV/V + 50 µV	
45 Hz to 10 kHz	33 mV to 329.999 mV	0.5 mV/V + 20 µV	
10 kHz to 20 kHz	33 mV to 329.999 mV	1 mV/V + 20 µV	
20 kHz to 50 kHz	33 mV to 329.999 mV	1.6 mV/V + 40 µV	
50 kHz to 100 kHz	33 mV to 329.999 mV	2.4 mV/V + 170 µV	
100 kHz to 500 kHz	33 mV to 329.999 mV	7 mV/V + 330 µV	
Equipment to Measure AC Voltage (at the listed frequencies) [FO]			
10 Hz to 45 Hz	0.33 V to 3.299 99 V	1.5 mV/V + 250 µV	
45 Hz to 10 kHz	0.33 V to 3.299 99 V	0.3 mV/V + 60 µV	
10 kHz to 20 kHz	0.33 V to 3.299 99 V	0.8 mV/V + 60 µV	
20 kHz to 50 kHz	0.33 V to 3.299 99 V	1.4 mV/V + 300 µV	
50 kHz to 100 kHz	0.33 V to 3.299 99 V	2.4 mV/V + 1.7 mV	
100 kHz to 500 kHz	0.33 V to 3.299 99 V	5 mV/V + 3.3 mV	
Equipment to Measure AC Voltage (at the listed frequencies) [FO]			
10 Hz to 45 Hz	3.3 V to 32.999 9 V	1.5 mV/V + 2.5mV	
45 Hz to 10 kHz	3.3 V to 32.999 9 V	0.4 mV/V + 600 µV	
10 kHz to 20 kHz	3.3 V to 32.999 9 V	0.8 mV/V + 2.6mV	
20 kHz to 50 kHz	3.3 V to 32.999 9 V	1.9 mV/V + 5 mV	
50 kHz to 100 kHz	3.3 V to 32.999 9 V	2.4 mV/V + 17 mV	
Equipment to Measure AC Voltage (at the listed frequencies) [FO]			
45 Hz to 1 kHz	33 V to 329.999 V	0.5 mV/V + 6.6mV	
1 kHz to 10 kHz	33 V to 329.999 V	0.8 mV/V + 15 µV	
10 kHz to 20 kHz	33 V to 329.999 V	0.9 mV/V + 33 µV	
Equipment to Measure AC Voltage (at the listed frequencies) [FO]			
45 Hz to 1 kHz	330 V to 1 020 V	0.5 mV/V + 80mV	
1 kHz to 5 kHz	330 V to 1 020 V	2 mV/V + 100 µV	
5 kHz to 10 kHz	330 V to 1 020 V	2 mV/V + 500 µV	

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Equipment to Measure AC Current (at the listed frequencies) [FO]			Fluke 5500A Fluke 5500A Manual
10 Hz to 20 Hz	0.029 mA to 0.329 99 mA	2.5 mA/A + 0.15 µA	
20 Hz to 45 Hz	0.029 mA to 0.329 99 mA	1.25 mA/A + 0.15 µA	
45 Hz to 1 kHz	0.029 mA to 0.329 99 mA	1.25 mA/A + 0.25 µA	
1 kHz to 5 kHz	0.029 mA to 0.329 99 mA	4 mA/A + 0.15 µA	
5 kHz to 10 kHz	0.029 mA to 0.329 99 mA	12.5 mA/A + 0.15 µA	
Equipment to Measure AC Current (at the listed frequencies) [FO]			
10 Hz to 20 Hz	0.33 mA to 3.299 9 mA	2 mA/A + 0.3 µA	
20 Hz to 45 Hz	0.33 mA to 3.299 9 mA	1 mA/A + 0.3 µA	
45 Hz to 1 kHz	0.33 mA to 3.299 9 mA	1 mA/A + 0.3 µA	
1 kHz to 5 kHz	0.33 mA to 3.299 9 mA	2 mA/A + 0.3 µA	
5 kHz to 10 kHz	0.33 mA to 3.299 9 mA	6 mA/A + 0.3 µA	
Equipment to Measure AC Current (at the listed frequencies) [FO]			
10 Hz to 20 Hz	3.3 mA to 32.999 mA	2 mA/A + 3 µA	
20 Hz to 45 Hz	3.3 mA to 32.999 mA	1 mA/A + 3 µA	
45 Hz to 1 kHz	3.3 mA to 32.999 mA	0.9 mA/A + 3 µA	
1 kHz to 5 kHz	3.3 mA to 32.999 mA	2 mA/A + 3 µA	
5 kHz to 10 kHz	3.3 mA to 32.999 mA	6 mA/A + 3 µA	
Equipment to Measure AC Current (at the listed frequencies) [FO]			
10 Hz to 45 Hz	0.33 A to 2.199 99 A	2 mA/A + 300 µA	
45 Hz to 1 kHz	0.33 A to 2.199 99 A	1 mA/A + 300 µA	
1 kHz to 5 kHz	0.33 A to 2.199 99 A	7.5 mA/A + 300 µA	
Equipment to Measure AC Current (at the listed frequencies) [FO]			
45 Hz to 65 Hz	2.2 A to 11 A	0.6 mA/A + 300 µA	
65 Hz to 500 Hz	2.2 A to 11 A	1 mA/A + 300 µA	
500 Hz to 1 kHz	2.2 A to 11 A	3.3 mA/A + 300 µA	
Equipment to Measure AC Current (at the listed frequencies) [FO]			Fluke 5500A w/ Turned Coil
45 Hz to 65 Hz	11 A to 110 A	0.76 % of Output	
65 Hz to 400 Hz	11 A to 110 A	1.1 % of Output	

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Equipment to Measure AC Current (at the listed frequencies) [FO]			Fluke 5500A w/ Turned Coil
45 Hz to 65 Hz	110 A to 550 A	0.95 % of Output	
65 Hz to 440 Hz	110 A to 550 A	1.1 % of Output	
Equipment to Output AC Voltage (at the listed frequencies)[FO]			
3 Hz to 5 Hz	0 4 mV to 100 mV	1.2 mV	Agilent 34401A WI-004
5 Hz to 10 Hz	0 2 mV to 100 mV	0.41 mV	
10 Hz to 20 kHz	0 1 mV to 100 mV	0.074 mV	
20 kHz to 50 kHz	0 1 mV to 100 mV	0.15 mV	
50 kHz to 100 kHz	0 3 mV to 100 mV	0.7 mV	
100 kHz to 300 kHz	0 15 mV to 100 mV	4.7 mV	
Equipment to Output AC Voltage (at the listed frequencies)[FO]			
3 Hz to 5 Hz	0.1 V to 1 V	0.012 V	Agilent 34401A WI-004
5 Hz to 10 Hz	0.1 V to 1 V	0.004 6 V	
10 Hz to 20 kHz	0.1 V to 1 V	0.001 1 V	
20 kHz to 50 kHz	0.1 V to 1 V	0.002 4 V	
50 kHz to 100 kHz	0.1 V to 1 V	0.008 3 V	
Equipment to Measure DC Voltage [FO]	0 mV to 329.999 9 mV	60 µV/V + 3 µV	Fluke 5500A Fluke 5500A Manual
	0.33 mV to 3.299 999 V	50 µV/V + 5 µV	
	3.3 V to 32.999 99 V	50 µV/V + 50 µV	
	33 V to 329.999 V	55 µV/V + 500 µV	
	330 V to 1 020 V	55 µV/V + 1.5 mV	
Equipment to Output DC Voltage [FO]	10mV to 100 mV	0.001 7 mV	Agilent 34401A WI-004
	0.1001V to 1 V	0.000 056 V	
	1.0001V to 10 V	0.000 43V	
	10.0001 V to 100 V	0.005 4 V	
	100.001 V to 1 000 V	0.065 V	
Equipment to Measure DC Voltage [F]	0.1 mv to 329 mv	1.2 µV	Fluke 5700A Fluke 5700A Operation Manual supported by manufacturer methods
	330 mv to 3.299 99 V	40 µV	
	3.3 V to 32.999 99V	0.42 mV	
	33 V to 329.999 9V	14 mV	
	330 V to 1 000V	23 mV	

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Equipment to Measure DC Current [FO]	Up to 3.299 99 mA	0.16 µA	Fluke 5500A w/ Turn Coil
	3.3 mA to 32.999 9 mA	100 µA/A + 0.25 µA	
	33 mA to 329.999 mA	100 µA/A + 3.3 µA	
	0.33 mA to 2.2 A	300 µA/A + 44 µA	
	2.2 A to 11 A	600 µA/A + 330 µA	
	11 A to 110 A	0.65 % of Output	
	110 A to 150 A	0.82 % of Output	
	150 A to 550 A	0.62 % of Output	
Equipment to Output DC Current [FO]	1 mA to 10 mA	0.006 1 mA	Agilent 34401A WI-004
	10 mA to 100 mA	0.058 mA	
	0.100 1 A to 1 A	0.001 3 A	
	1.00 A to 3 A	0.004 4 A	
Equipment to Measure Capacitance [FO]	0.33 nF to 11 nF	0.5 % of Output + 10 pF	Fluke 5500A Fluke 5500A Manual
	11 nF to 110 nF	0.25 % of Output + 100 pF	
	110 nF to 329.999 nF	0.25 % of Output + 300 pF	
	0.33µF to 1.1 µF	0.25 % of Output + 1 nF	
	1.1µF to 3.3 µF	0.35 % of Output + 3 nF	
	3.3 µF to 11 µF	0.35 % of Output + 10 nF	
	11 µF to 33 µF	0.4 % of Output + 30 nF	
	33 µF to 110 µF	0.5 % of Output t + 100 nF	
	110 µF to 329.99 µF	0.7 % of Output + 300 nF	
	0.33 mF to 1.1 mF	1 % o of Output + 300 nF	
Equipment to Measure Resistance [FO]	Up to 10.99 Ω	120 µΩ/Ω + 8mΩ	Fluke 5500A Fluke 5500A Manual
	11 Ω to 32.999 Ω	120 µΩ/Ω + 15 mΩ	
	33 Ω to 109.999 Ω	90 µΩ/Ω + 15 mΩ	
	110 Ω to 329.999 Ω	90 µΩ/Ω + 15 mΩ	
	0.33 kΩ to 3.299 99 kΩ	90 µΩ/Ω + 60 mΩ	
	3.3 kΩ to 32.999 9 kΩ	90 µΩ/Ω + 600 mΩ	
Equipment to Measure Resistance [FO]	33 kΩ to 109.999 kΩ	110 µΩ/Ω + 6 Ω	Fluke 5500A Fluke 5500A Manual
	110 kΩ to 329.999 kΩ	120 µΩ/Ω + 6 Ω	
	0.33 kΩ to 3.299 99 MΩ	150 µΩ/Ω + 55 Ω	
	3.3 MΩ to 10.999 9 MΩ	600 µΩ/Ω + 550 Ω	
	11 MΩ to 32.999 9 MΩ	1 mΩ/Ω + 550 Ω	
	33 MΩ to 109.999 MΩ	5 mΩ/Ω + 5.5 kΩ	

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Equipment to Measure Resistance [FO]	110 MΩ to 330 MΩ	5 mΩ/Ω + 16.5 kΩ	Fluke 5500A Fluke 5500A Manual
Equipment to Measure Resistance [F]	Up to 10.999 Ω	0.021 mΩ	Fluke 5700A Operation Manual supported by manufacturer methods
	11 Ω to 32.999 Ω	1.5 mΩ	
	33 Ω to 329.999 Ω	2.1 mΩ	
	330 Ω to 1.099 9 kΩ	12 mΩ	
	1.1 kΩ to 10.999 9 kΩ	0.38Ω	
	11 kΩ to 109.999 kΩ	1.5 Ω	
	110 kΩ to 1.099 9 MΩ	0.005 5 kΩ	
	1.1 MΩ to 10 MΩ	0.007 6 kΩ	
Equipment to Measure DC Current [FO]	Up to 3.299 99 mA	0.16 µA	Fluke 5500A w/ Turn Coil
	3.3 mA to 32.999 9 mA	100 µA/A + 0.25 µA	
	33 mA to 329.999 mA	100 µA/A + 3.3 µA	
	0.33 mA to 2.2 A	300 µA/A + 44 µA	
	2.2 A to 11 A	600 µA/A + 330 µA	
	11 A to 110 A	0.65 % of Output	
	110 A to 150 A	0.82 % of Output	
	150 A to 550 A	0.62 % of Output	
Equipment to Measure DC Current [F]	0.1 µA to 329.999 µA	0.002 2 µA	Fluke 5700A Operation Manual supported by manufacturer methods
	330 µA to 3.299 9 mA	0.019 µA	
	3.3 mA to 32.999 mA	0.37 µA	
	33 mA to 329.999 mA	4.8 µA	
	330 mA to 2 A	0.49 mA	
Equipment to Output AC Current (at the listed frequencies) [FO]			
3 Hz to 5 Hz	0.1 A to 1 A	0.013 A	Agilent 34401A DMM WI-004
5 Hz to 10 Hz	0.1 A to 1 A	0.006 6 A	
10 Hz to 5 kHz	0.1 A to 1 A	0.004 A	

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Equipment to Output AC Current (at the listed frequencies) FO			
3 Hz to 5 kHz	1 A to 3 A	0.04 A	Agilent 34401A DMM WI-004
5 Hz to 10 Hz	1 A to 3 A	0.013 A	
10 Hz to 5 kHz	1 A to 3 A	0.008 2 A	
Equipment to Output Resistance: Two Wire FO	0.1 Ω to 100 Ω	0.013 Ω	Agilent 34401A WI-004
	0.1 kΩ to 1 kΩ	0.000 028 kΩ	
	1 kΩ to 10 kΩ	0.001 5 kΩ	
	10 kΩ to 100 kΩ	0.013 kΩ	
	0.1 MΩ to 1 MΩ	0.000 2 MΩ	
	1 MΩ to 10 MΩ	0.006 5 MΩ	
	10 MΩ to 100 MΩ	1.1 MΩ	
Equipment to Output Resistance: Four Wire FO	0.1 Ω to 10 Ω	0.002 8 Ω	Agilent 34401A WI-004
	10 Ω to 100 Ω	0.013 Ω	
	0.1 kΩ to 1 kΩ	0.000 13 kΩ	
	1 kΩ to 10 kΩ	0.001 2 kΩ	
	10 kΩ to 100 kΩ	0.014 kΩ	
Equipment to Output Frequency FO	3 Hz to 10 Hz	0.005 8 Hz	Agilent 34401A WI-004
	10 Hz to 40 Hz	0.014 Hz	
	40 Hz to 300 kHz	0.12 Hz	

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Mechanical

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Pressure Gauges [FO]	Up to 300 psi	0.019 psi	Fluke 700G27 w/ Pump ASME B40.1
	Up to 10 000 psi	14 psi	Fluke 700G31 w/ Pump ASME B40.1
	10 000 psi to 40 000 psi	23 psi	Additel 681 w/ Pump ASME B40.1
Torque Wrenches [FO]	5 in·lb to 50 in·lb	0.9 % of Reading	CDI 2000-400-02 Transducer w/ Loader CDI Manufacturer Method
	30 in·lb to 400 in·lb	1 % of Reading	
	80 in·lb to 1 000 in·lb	1 % of Reading	
	20 ft·lb to 250 ft·lb	1.1 % of Reading	
Vacuum Gauges[FO]	-0.05 psi to -13 psi	0.01 psi	Druck 620 WI-002

Thermodynamic

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Dial & Digital Thermometers [FO]	-30.01 °C to 0 °C	0.005 °C	Fluke 1524 w/ 5609 PRT 9105S Temperature Well or Fluke 9100 Temperature Well Fluke 1524/ 5609 Manuals
	0.01 °C to 660 °C	0.007 °C	

1. The CMC (Calibration and Measurement Capability) stated for calibrations included on this scope of accreditation represents the smallest measurement uncertainty attainable by the laboratory when performing a more or less routine calibration of a nearly ideal device under nearly ideal conditions. It is typically expressed at a confidence level of 95 % using a coverage factor *k* (usually equal to 2). The actual measurement uncertainty associated with a specific calibration performed by the laboratory will typically be larger than the CMC for the same calibration since capability and performance of the device being calibrated and the conditions related to the calibration may reasonably be expected to deviate from ideal to some degree.

2. The laboratories range of calibration capability for all disciplines for which they are accredited is the interval from the smallest calibrated standard to the largest calibrated standard used in performing the calibration. The low end of this range must be an attainable value for which the laboratory has or has access to the standard referenced. Verification of an indicated value of zero in the absence of a standard is common practice in the procedure for many calibrations but by its definition it does not constitute calibration of zero capacity.

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4. The laboratories range of calibration capability for all disciplines for which they are accredited is the interval from the smallest calibrated standard to the largest calibrated standard used in performing the calibration. The low end of this range must be an attainable value for which the laboratory has or has access to the standard referenced. Verification of an indicated value of zero in the absence of a standard is common practice in the procedure for many calibrations but by its definition it does not constitute calibration of zero capacity.

5. The presence of a superscript FO means that the laboratory performs calibration of the indicated parameter both at its fixed location and onsite at customer locations.

6. Measurement uncertainties obtained for calibrations performed at customer sites can be expected to be larger than the measurement uncertainties obtained at the laboratories fixed location for similar calibrations. This is due to the effects of transportation of the standards and equipment and upon environmental conditions at the customer site which are typically not controlled as closely as at the laboratories fixed location.