



PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

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

Advanced Mobile Propulsion Test

1334 Airport Rd. Durango, CO 81303

Test Site-1125 County Road 309A, Durango, CO 81301

(Hereinafter called the Organization) and hereby declares that Organization is accredited in accordance with the recognized International Standard:

ISO/IEC 17025:2005

**& Meets the Requirements of ANSI/NCSI Z540-1-1994
& ANSI/NCSI Z540.3-2006 sub-clause 5.3**

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 January 2009):

Electrical, Mass, Mechanical, Thermodynamic, and Time & Frequency
(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:

DRAFT

Tracy Szerszen
President/Operations Manager

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

Initial Accreditation Date:

July 17, 2013

Issue Date:

October 22, 2015

Expiration Date:

October 22, 2017

Revision Date:

August 1, 2016

Accreditation No.:

76325

Certificate No.:

L15-345-R1

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.pjllabs.com



Certificate of Accreditation: Supplement

Advanced Mobile Propulsion Test

1334 Airport Rd. Durango, CO 81303

Contact Name: Skyler Hollinbeck Phone: 970-247-0840

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

1125 County Road 309A, Durango, CO 81301

Electrical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type K ^{FO}	-200 °C to -25 °C	0.53 °C	Omega CL 125 Thermocouple Calibrator
	-25 °C to 120 °C	0.44 °C	
	120 °C to 1 000 °C	0.47 °C	
	1 000 °C to 1 370 °C	0.56 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type J ^{FO}	-200 °C to -30 °C	0.62 °C	
	-30 °C to 150 °C	0.43 °C	
	150 °C to 760 °C	0.44 °C	
	760 °C to 1 050 °C	0.46 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type E ^{FO}	-150 °C to -25 °C	0.44 °C	
	-25 °C to 350 °C	0.43 °C	
	350 °C to 800 °C	0.43 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type T ^{FO}	-200 °C to 0 °C	0.38 °C	
	0 °C to 120 °C	0.47 °C	
	120 °C to 400 °C	0.43 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type R ^{FO}	0 °C to 250 °C	0.72 °C	
	250 °C to 400 °C	0.60 °C	
	400 °C to 1 760 °C	0.59 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type S ^{FO}	0 °C to 250 °C	0.60 °C	
	250 °C to 1 000 °C	0.60 °C	
	1 000 °C to 1 760 °C	0.66 °C	
Temperature Calibration, Indication, and Control Equipment used with Thermocouple Type N ^{FO}	-200 °C to 120 °C	0.48 °C	
	120 °C to 410 °C	0.44 °C	
	410 °C to 1 300 °C	0.44 °C	



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Equipment to Measure DC Voltage ^{FO}	10 mV to 100 mV	0.006 7 % reading + 4.1 μ V	Agilent 34401A 6.5 Digit DMM
	0.1 V to 1 V	0.004 2 % reading + 8.2 μ V	
	1 V to 10 V	0.003 5 % reading + 58 μ V	
	10 V to 100 V	0.004 7 % reading + 0.7 mV	
	100 V to 1 000 V	0.005 9 % reading + 7 mV	
Equipment to Measure DC Current ^{FO}	0.01 mA to 0.1 mA	0.063 % reading + 0.029 μ A	
	0.1 mA to 1 mA	0.058 % reading + 0.069 μ A	
	1 mA to 10 mA	0.061 % reading + 2.3 μ A	
	10 mA to 100 mA	0.058 % reading + 5.8 μ A	
	0.1 A to 1A	0.12 % reading + 0.12 mA	
	1 A to 3 A	0.12 % reading + 0.69 mA	
Equipment to Measure DC Resistance ^{FO}	10 Ω to 100 Ω	0.012 % reading + 4.6 m Ω	
	100 Ω to 1 000 Ω	0.012 % reading + 12 m Ω	
	1 k Ω to 10 k Ω	0.012 % reading + 0.12 Ω	
	10 k Ω to 100 k Ω	0.012 % reading + 1.2 Ω	
	0.1 M Ω to 1 M Ω	0.014 % reading + 12 Ω	
	1 M Ω to 10 M Ω	0.046 % reading + 0.12 k Ω	
	10 M Ω to 100 M Ω	0.93 % reading + 1.2 k Ω	
Equipment to Generate DC Voltage ^{FO}	10 mV to 100 mV	0.001 3 % reading + 2.4 μ V	Krohn-Hite 523 DC Calibrator
	100 mV to 1 V	0.001 3 % reading + 3.5 μ V	
	1 V to 10 V	0.001 2 % reading + 15 μ V	
	10 V to 100 V	0.001 7 % reading + 0.14 mV	
Equipment to Generate DC Current ^{FO}	0.1 mA to 11 mA	0.001 2 % reading + 0.046 μ A	
	11 mA to 110 mA	0.001 2 % reading + 0.47 μ A	
Amplitude Flatness Frequency Range: 100 kHz to 5 MHz ^{FO}	0.001 V to 10 V	2.3 % of reading + 0.001 3 V	Agilent 33522A
Amplitude Flatness Frequency Range: 5 MHz to 20 MHz ^{FO}	0.001 V to 10 V	4.2 % of reading + 0.001 3 V	
Amplitude Flatness Frequency Range: 20 MHz to 30 MHz ^{FO}	0.001 V to 10 V	5.6 % of reading + 0.001 3 V	
Amplitude Flatness Frequency Range: 100 kHz to 5 MHz ^{FO}	0.001 V to 10 V	2.3 % of reading + 0.001 3 V	



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Electrical

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Amplitude Flatness Frequency Range: 5 MHz to 20 MHz ^{FO}	0.001 V to 10 V	4.2 % of reading + 0.001 3 V	Agilent 33522A
Amplitude Flatness Frequency Range: 20 MHz to 30 MHz ^{FO}	0.001 V to 10 V	5.6 % of reading + 0.001 3 V	

Mass, Force and Weighing Devices

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE OR NOMINAL DEVICE SIZE AS APPROPRIATE	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
In House A&D FX 300i Digital Scale ^{FO}	2 g to 130 g	0.002 8 g	Class 1 Weight Set

Mechanical

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Pressure Transducer ^{FO}	300 psi to 3 000 psi	0.7 psi	Fluke 2700G-G20M 3000 psi Gauge
Vacuum Pressure Transducer ^{FO}	1.5 psi to -7.7 psi	0.047 psi	Setra 730
	-7.7 psi to -14.7 psi	0.085 psi	Digi-Vac 100LED760
Fluid Volume Measurement ^{FO}	574 cm ³ to 5 735 cm ³	0.002 cm ³	A&D FX 300i Digital Scale
Load Cell Compression ^{FO}	20 lbf to 1 000 lbf	0.093 % + 0.42 lbf	Morehouse Precision Load Cell
Load Cell Tension ^{FO}			

Thermodynamic

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Equipment to Generate and Measure Temperature ^{FO}	600 °C to 1 600 °C	0.64 % + 1.8 °C	M390 Blackbody Source via Mikron ML-GAPX- LO Photrix Optical Pyrometer



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Time and Frequency

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Data Acquisition Frequency ^{FO}	0.1 Hz to 225 MHz	0.000 021 % + 0.21 μ Hz	Agilent 53131A Frequency Counter
Frequency Source ^{FO}	0.001 mHz to 30 MHz	0.000 12 % + 5.8 x 10 ⁻⁷ Hz	Agilent 33522A

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.
3. 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. Example: Outside Micrometer ^{FO} would mean that the laboratory performs this calibration at its fixed location and onsite at customer locations.
4. 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
5. All calibrations performed for the fixed location are done at the test site location: 1125 County Road 309A, Durango, CO 81301.