PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

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

Magnet-Physics, Inc.

6330 East 75th Street, Ste. 224, Indianapolis, IN 46250

(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 and Mechanical 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

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

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
April 23, 2016	June 05, 2024	July 31, 2026

Accreditation No.:	*Certificate No.:*
80076	L24-417

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

Magnet-Physics, Inc.
6330 East 75th Street, Ste. 224, Indianapolis, IN 46250
Contact Name: Mr. Reinhold Strnat Phone: 317-577-8700

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

Electrical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE (AND SPECIFICATION WHERE APPROPRIATE)	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (±)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED	CALIBRATION MEASUREMENT METHOD OR PROCEDURES USED
Magnetic Flux Density *B* Reference Magnet Systems Reference Magnets [F]	2×10^{-4} T to 0.1 T	0.076 % + 6.3×10^{-6} T	Magnetometer with Hall probe	INS-05, Cullity[4] 43-44
	>0.1 T to 0.2 T	0.079 % + 3.1×10^{-5} T		
	>0.2 T to 0.5 T	0.086 % + 1.6×10^{-5} T		
	>0.5 T to 1 T	0.087 % + 7.1×10^{-6} T		
	>1 T to 2 T	0.14 % + 2.0×10^{-4} T		
	>2 T to 3 T	0.25 % + 5.6×10^{-7} T	Digital Fluxmeter Field Measuring Coil with Ceramic Former	INS-05, Cullity[4] 41-43
Magnetic Field Strength *H* Reference Magnet Systems Reference Magnets [F]	1.6×10^{2} A/m to 8×10^{4} A/m	0.076 % + 5.0 A/m	Magnetometer with Hall probe	INS-05, Cullity[4] 43-44
	>8×10^{4} A/m to 1.6×10^{5} A/m	0.079 % + 25 A/m		
	>1.6×10^{5} A/m to 4×10^{5} A/m	0.086 % + 13 A/m		
	>4×10^{5} A/m to 8×10^{5} A/m	0.087 % + 6 A/m		
	>8×10^{5} A/m to 1.6×10^{6} A/m	0.14 % + 1.6×10^{2} A/m		
	>1.6×10^{6} A/m to 2.4×10^{6} A/m	0.25 % + 0.45 A/m	Digital fluxmeter Field measuring coil with ceramic former	INS-05, Cullity[4] 41-43
Magnetic Flux Density *B* Hall effect and other Magnetometers together with Probes [F]	1×10^{-5} T to 9×10^{-5} T	0.065 % + 2.3×10^{-11} T	Magnetic moment measuring coil ("Helmholtz coil") Agilent 34401A DMM	INS-03, Cullity[4] 26
	>9×10^{-5} T to 9×10^{-4} T	0.065 % + 2.5×10^{-10} T		
	>9×10^{-4} T to 8×10^{-3} T	0.067 % + 2.0×10^{-9} T		
	>8×10^{-3} T to 0.1 T	0.12 % + 6.9×10^{-6} T	Magnetometer with Hall probe INS-03, Cullity[4] 43-44	
	>0.1 T to 0.2 T	0.11 % + 7.7×10^{-5} T		
	>0.2 T to 0.5 T	0.12 % + 4.3×10^{-5} T		
	>0.5 T to 1 T	0.13 % + 1.9×10^{-5} T		
	>1 T to 2 T	0.16 % + 6.1×10^{-4} T		
	0.10 T	0.21 %	Axial reference magnet	INS-02, Cullity[4] 44
	0.20 T	0.064 %	Transverse reference magnet	INS-03, Cullity[4] 44

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Magnetic Field Strength *H* Hall Effect and other Magnetometers together with Probes [F]	8 A/m to 72 A/m	0.065 % + 1.8 x 10^{-5} A/m	Magnetic moment measuring coil ("Helmholtz coil") Agilent 34401A DMM	INS-03, Cullity[4] 26
	>72 A/m to 7.2 x 10^{2} A/m	0.065 % + 2.0 x 10^{-4} A/m		
	>7.2 x 10^{2} A/m to 6.4 x 10^{3} A/m	0.067 % + 1.6 x 10^{-3} A/m		
	>6.4 x 10^{3} A/m to 8 x 10^{4} A/m	0.12 % + 5.5 A/m	Magnetometer with Hall probe	INS-03, Cullity[4] 43-44
	>8 x 10^{4} A/m to 1.6 x 10^{5} A/m	0.11 % + 61 A/m		
	>1.6 x 10^{5} A/m to 4 x 10^{5} A/m	0.12 % + 34 A/m		
	>4 x 10^{5} to 8 x 10^{5} A/m	0.13 % + 15 A/m		
	>8 x 10^{5} A/m to 1.6 x 10^{6} A/m	0.16 % + 4.9 x 10^{2} A/m		
	8.2 x 10^{4} A/m	0.21 %	Axial reference magnet	INS-02, Cullity[4] 44
	1.6 x 10^{5} A/m	0.064 %	Transverse reference magnet	INS-03, Cullity[4] 44
Magnetic Moment *m* Reference Magnet Systems Magnet Etalon [F]	2.4 x 10^{-4} Am² to 8 x 10^{4} Am²	0.19 % + 2.2 x 10^{-5} Am²	Digital fluxmeter Magnetic moment measuring coil ("Helmholtz coil")	INS-07, Cullity[4] 41-43, 26
Magnetic Dipole Moment *j* Reference Magnet Systems Magnet Etalon [F]	3 x 10^{-10} Vsm to 0.1 Vsm	0.19 % + 2.8 x 10^{-11} Vsm	Digital fluxmeter Magnetic moment measuring coil ("Helmholtz coil")	INS-07, Cullity[4] 41-43, 26
Magnetic Flux *Φ* Fluxmeters [F]	1 x 10^{-8} Vs to 9.1 x 10^{-7} Vs	0.19 % + 7.1 x 10^{-13} Vs	Field Measuring Coil with Ceramic Former Magnetic moment measuring coil ("Helmholtz coil") Agilent 34401A DMM	INS-01, Cullity[4] 33-34,43-44
	>9.1 x 10^{-7} Vs to 9.1 x 10^{-6} Vs	0.19 % + 8.7 x 10^{-13} Vs		
	>9.1 x 10^{-6} Vs to 8.1 x 10^{-5} Vs	0.19 % + 8.7 x 10^{-12} Vs		

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Magnetic Flux Φ Fluxmeters [F]	>8.1 x 10^{-5} Vs to 1 x 10^{-3} Vs	0.21 % + 3.8 x 10^{-8} Vs	Magnetometer with Hall probe Field Measuring Coil with Ceramic Former	INS-01, Cullity[4] 33-34,43-44
	>1 x 10^{-3} Vs to 2 x 10^{-3} Vs	0.21 % + 4.3 x 10^{-7} Vs		
	>2 x 10^{-3} Vs to 5.1 x 10^{-3} Vs	0.22 % + 2.1 x 10^{-7} Vs		
	>5.1 x 10^{-3} Vs to 1 x 10^{-2} Vs	0.22 % + 9.2 x 10^{-8} Vs		
	>1 x 10^{-2} Vs to 1.7 x 10^{-2} Vs	0.24 % + 4 x 10^{-6} Vs		
	>1.7 x 10^{-2} Vs to 3.4 x 10^{-2} Vs	0.22 % + 1.1 x 10^{-5} Vs	Magnetometer with Hall probe Field Measuring Coil with Ceramic Former (with coil flip)	
Magnetic Flux Φ Fluxmeters [F]	2 x 10^{-3} Vs	0.19 %	Transverse reference magnet Field measuring coil with ceramic former	INS-01, Cullity[4] 33-34,44
	4 x 10^{-3} Vs	0.19 %	Transverse reference magnet Field measuring coil with ceramic former (with coil flip)	

Mechanical

MEASURED INSTRUMENT, QUANTITY OR GAUGE	RANGE (AND SPECIFICATION WHERE APPROPRIATE)	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (±)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED	CALIBRATION MEASUREMENT METHOD OR PROCEDURES USED
Winding Area A Field Sensing Coils [F]	1 x 10^{-4} m² to 20 m²	0.18 % + 1.3 x 10^{-6} m²	Measure Φ in a Transverse Reference Magnet or in a Field generating coil	INS-06, Cullity[4] 33-34
Measuring Constant k_M Moment Detection Coils [F]	1 x 10^{-6} m to 0.01 m	0.067 %	Substitution method. Comparison with a Calibrated Moment Detection Coil by means of a Permanent Magnet.	INS-04, Cullity[4] 26

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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 F means that the laboratory performs calibration of the indicated parameter at its fixed location.

4. Procedures are based on the reference book: Introduction to Magnetic Materials by B.D Cullity