PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

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

CTC, Inc.

12637 Hoover Street, Garden Grove, CA, 92841

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

ISO/IEC 17025:2017
& Meets the Requirements of ANSI/NCSL Z540.3-2006

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):

Chemical, Dimensional, Mechanical, Electrical, Mass, Force, Weighing, Thermodynamic, and Time & Frequency 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/Operations Manager

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

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
December 29, 2016	December 23, 2018	March 31, 2021
Revision Date:	*Accreditation No.:*	*Certificate No.:*
August 26, 2019	91218	L18-621-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.pjlabs.com

Certificate of Accreditation: Supplement

CTC, Inc.
12637 Hoover Street, Garden Grove, CA, 92841
Contact Name: Nonna Thomsen Phone: 562-989-2366

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

Chemical

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
pH Meters, Fixed points[FO]	4 pH	0.014 pH	pH Buffers
	7 pH		
	10 pH		
Conductivity Meters[FO]	10 µS/cm at 25 °C	0.68 µS/cm	Conductivity Solutions
	100 µS/cm at 25 °C	2.6 µS/cm	
	1 000 µS/cm at 25 °C	6.4 µS/cm	
	1 413 µS/cm at 25 °C	5.9 µS/cm	
	10 000 µS/cm at 25 °C	13 µS/cm	

Dimensional

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
Micrometers[FO]	Up to 36 in	(74.5 + 6.5L) µin	Gage Blocks
Calipers[FO]	Up to 11.9 in	(157 + 3.7L) µin	
	12 in to 36 in	(265 + 7.9L) µin	
Height Gages[FO]	Up to 40 in	(69.5 + 3.4L) µin	
Steel Ruler[FO]	0.05 in to 36 in	0.036 in	
Tape Measure[F]	Up to 360 in	0.073 in	
Indicators[FO]	0.05 in to 1in	(61.95 + 5.4L) µin	
Optical Comparator Angularity[FO]	0° to 90°	0.021°	
Optical Comparator X and Y Axis Travel[FO]	Up to 20 in	510 µin	
Optical Comparator X and Y Axis Squareness[FO]	Up to 20 in	510 µin	
Optical Comparator Magnification[FO]	10X	0.002 in	Gage Blocks, Glass Scale
	20X	0.001 in	
	50X	430 µin	
	100X	250 µin	
Pin Gages[F]	0.05 in to 1 in	43 µin	Pratt and Whitney LMU
Gage Blocks and Ring Gages[F]	0.05 in to 12 in	(5.2 + 0.74L) µin	
Bore Gages 2 Point[F]	Up to 4 in	93 µin	Gage Blocks, Ring Gages
End Measuring Rods[F]	1 in to 24 in	(43 + 0.52L) µin	Standard Measuring Machine

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Electrical

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Equipment to Measure DC Voltage[F]	31 µV to 329.999 mV	0.1 µV/mV + 4.5 µV	Fluke 5500A
	0.33 V to 3.299 V	59 µV/V + 6.7 µV	
	3.3 V to 32.999 V	59 µV/V + 67 µV	
	30 V to 329.999 V	660 µV/V + 65 µV	
	100 V to 1 000 V	65 µV/V + 1 778 µV	
Equipment to Output DC Voltage[F]	47 µV to 200 mV	0.01 µV/V + 47 µV	
	200 mV to 2 V	46 µV/V + 39 µV	
	2 V to 20 V	42 µV/V + 47 µV	
	20 V to 200 V	23 µV/V + 745 µV	
	200 V to 1 000 V	1.7 µV/V + 4 974 µV	
Equipment to Measure DC Current[F]	13 µA to 3.299 mA	0.61 µA/mA + 11 µA	
	3.3 mA to 32.999 mA	0.47 µA/mA + 9.5 µA	
	33 mA to 329.999 mA	0.08 µA/mA + 26 µA	
	0.33 A to 2.199 A	182 µA/A + 50 µA	
	2.2 A to 11 A	694 µA/A + 475 µA	
Equipment to Output DC Current[F]	0.5 µA to 200 µA	0.049 µA	
	200 µA to 2 mA	6.2 µA/mA + 0.7 µA	
	2 mA to 20 mA	0.67 µA/mA + 12 µA	
	20 mA to 200 mA	0.47 µA/mA + 16 µA	
	200 mA to 2 A	28 µA/mA + 1 045 µA	

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Temperature Calibration, Indication and Control Equipment used with Thermocouple Type B[F]	600 °C to 800 °C	0.55 °C	Electrical Simulation of Thermocouple Output Fluke 7526A
	800 °C to 1 550 °C	0.36 °C	
	1 550 °C to 1 820 °C	0.31 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type C[F]	0 °C to 1 000 °C	0.22 °C	
	1 000 °C to 1 800 °C	0.31 °C	
	1 800 °C to 2 000 °C	0.34 °C	
	2 000 °C to 2 316 °C	0.45 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type E[F]	-200 °C to -100 °C	0.36 °C	
	-100 °C to 0 °C	0.24 °C	
	0 °C to 600 °C	0.12 °C	
	600 °C to 1 000 °C	0.13 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type J[F]	-210 °C to -100 °C	0.25 °C	Electrical Simulation of Thermocouple Output Fluke 7526A
	-100 °C to 800 °C	0.13 °C	
	800 °C to 1 200 °C	0.15 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type K[F]	-250 °C to -200 °C	0.57 °C	
	-200 °C to -100 °C	0.29 °C	
	-100 °C to 500 °C	0.15 °C	
	500 °C to 800 °C	0.15 °C	
	800 °C to 1 372 °C	0.18 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type N[F]	-250 °C to -200 °C	0.87 °C	
	-200 °C to -100 °C	0.34 °C	
	-100 °C to 0 °C	0.25 °C	
	0 °C to 100 °C	0.25 °C	
	100 °C to 800 °C	0.16 °C	
	800 °C to 1 300 °C	0.18 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type R[F]	0 °C to 100 °C	0.63 °C	
	100 °C to 400 °C	0.38 °C	
	400 °C to 1 000 °C	0.33 °C	
	1 000 °C to 1 767 °C	0.32 °C	
Temperature Calibration, Indication and Control Equipment used with Thermocouple Type S[F]	0 °C to 400 °C	0.70 °C	
	400 °C to 1 000 °C	0.39 °C	
	1 000 °C to 1 600 °C	0.32 °C	
	1 600 °C to 1 767 °C	0.59 °C	

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Temperature Calibration, Indication and Control Equipment used with Thermocouple Type T[F]	-250 °C to -200 °C	0.44 °C	Electrical Simulation of Thermocouple Output Fluke 7526A
	-200 °C to -100 °C	0.25 °C	
	-100 °C to 0 °C	0.21 °C	
	0 °C to 200 °C	0.29 °C	
	200 °C to 400 °C	0.29 °C	
Temperature Calibration, Indication, and Control Equipment used with RTD Indicators/Detectors Type Pt 385, 100 Ω[F]	-200 °C to -80 °C	0.061 °C	Electrical Simulation of RTD Output Fluke 7526A
	-80 °C to 100 °C	0.031 °C	
	100 °C to 300 °C	0.035 °C	
	300 °C to 400 °C	0.037 °C	
	400 °C to 630 °C	0.047 °C	
	630 °C to 800 °C	0.052 °C	
Temperature Calibration, Indication, and Control Equipment used with RTD Indicators/Detectors Type Pt 385, 200 Ω[F]	-200 °C to -80 °C	0.064 °C	
	-80 °C to 0 °C	0.067 °C	
	0 °C to 100 °C	0.071 °C	
	100 °C to 260 °C	0.071 °C	
	260 °C to 300 °C	0.083 °C	
	300 °C to 400 °C	0.085 °C	
	400 °C to 630 °C	0.11 °C	
Temperature Calibration, Indication, and Control Equipment used with RTD Indicators/Detectors Type Pt 385, 500 Ω[F]	-200 °C to 0°C	0.04 °C	
	0 °C to 100 °C	0.043 °C	
	100 °C to 300 °C	0.048 °C	
	300 °C to 400 °C	0.047 °C	
	400 °C to 630 °C	0.055 °C	
Temperature Calibration, Indication, and Control Equipment used with RTD Indicators/Detectors Type Pt 385, 1 kΩ[F]	-200 °C to 0°C	0.031 °C	
	0 °C to 100 °C	0.033 °C	
	100 °C to 300 °C	0.033 °C	
	300 °C to 400 °C	0.035 °C	
	400 °C to 630 °C	0.041 °C	

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Temperature Calibration, Indication, and Control Equipment used with RTD Indicators/Detectors Type Pt 3916, 100 Ω[F]	-200 °C to -190 °C	0.02 °C	Electrical Simulation of RTD Output Fluke 7526A
	-190°C to -80 °C	0.023 °C	
	-80 °C to 0 °C	0.024 °C	
	0 °C to 100 °C	0.026 °C	
	100 °C to 300 °C	0.032 °C	
	300 °C to 400 °C	0.036 °C	
	400 °C to 600 °C	0.041 °C	
	600 °C to 630 °C	0.043 °C	
Temperature Calibration, Indication, and Control Equipment used with RTD Indicators/Detectors Type Pt 3926, 100 Ω[F]	-200 °C to -80 °C	0.021 °C	
	-80 °C to 0 °C	0.023 °C	
	0 °C to 100 °C	0.025 °C	
	100 °C to 300 °C	0.031 °C	
	300 °C to 400 °C	0.035 °C	
	400 °C to 630 °C	0.043 °C	
Equipment to Measure Eddy Current Conductivity[F]	16 % IACS to 25 % IACS	0.38 % IACS	Sigmascope SMP10 & EC Conductivity Reference Blocks
	25.1 % IACS to 63 % IACS	0.5 % IACS	
	63.1 % IACS to 101 % IACS	1.4 % IACS	
Eddy Current Conductivity Standard Blocks[F]	16 % IACS to 25 % IACS	0.38 % IACS	
	25.1 % IACS to 63 % IACS	0.5 % IACS	
	63.1 % IACS to 101 % IACS	1.4 % IACS	

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 (±)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Force, Tension, and Compression[FO]	0 lbf to 15 000 lbf	0.5 % of reading	Calibrated Load Cell
Balances[FO]	Up to 5 g	0.038 mg	Class 1 Weights
	5 g to 205 g	0.34 mg	
	200 g to 500 g	3.3 mg	
	500 g to 4 000 g	33 mg	
	4 kg to 10 kg	330 mg	
Platform Scales[FO]	1 lb to 1 500 lb	0.52 lb	Class F Weights

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

Mechanical

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
Pressure Gages[FO]	5 psig to 1 000 psig	3.1 psig	DWT/PSI Gage Comparator Test Gages
	950 psig to 10 000 psig	28 psig	
Vacuum Gauges[FO]	-0.1 in Hg to -30 in Hg	0.02 in Hg	Reference Grade Digital
Torque[F]	4 lbf•in to 50 lbf•in	0.21 lbf•in	AKO Torque Calibration System
	51 lbf•in to 1 000 lbf•in	2.7 lbf•in	
	1 001 lbf•in to 2 400 lbf•in	3.5 lbf•in	
	30 lbf•ft to 250 lbf•ft	1.3 lbf•ft	
	100 lbf•ft to 1 000 lbf•ft	8.9 lbf•ft	
Indirect Verification Rockwell Hardness[FO]	20 HRA to 65 HRA	0.54 HRA	Rockwell Test Blocks ASTM E18
	70 HRA to 78 HRA	0.68 HRA	
	79 HRA to 84 HRA	0.57 HRA	
	40 HRBW to 59 HRBW	0.54 HRBW	
	60 HRBW to 79 HRBW	0.58 HRBW	
	80 HRBW to 100 HRBW	0.64 HRBW	
	20 HRC to 30 HRC	0.58 HRC	
	35 HRC to 55 HRC	0.59 HRC	
	60 HRC to 65 HRC	0.54 HRC	
	70 HREW to 79 HREW	0.61 HREW	
	83 HREW to 90 HREW	0.58 HREW	
	93 HREW to 100 HREW	0.58 HREW	
	70 HR15 to 77 HR15	0.57 HR15	
	78 HR15 to 88 HR15	0.66 HR15	
	90 HR15 to 92 HR15	0.55 HR15	
	42 HR30N to 50 HR30N	0.68 HR30N	
	55 HR30N to 73 HR30N	0.66 HR30N	
	77 HR30N to 82 HR30N	0.60 HR30N	
	20 HR45N to 31 HR45N	0.55 HR45N	
	37 HR45N to 61 HR45N	0.54 HR45N	
	66 HR45N to 72 HR45N	0.54 HR45N	
	74 HR15TW to 80 HR15TW	0.54 HR15TW	

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Indirect Verification Rockwell Hardness[FO]	81 HR15TW to 86 HR15TW	0.60 HR15TW	Rockwell Test Blocks ASTM E18
	87 HR15TW to 93 HR15TW	0.76 HR15TW	
	43 HR30TW to 56 HR30TW	0.59 HR30TW	
	57 HR30TW to 69 HR30TW	0.66 HR30TW	
	70 HR30TW to 83 HR30TW	0.65 HR30TW	
Brinell Hardness 10 mm Ball[FO]	HBW 500 kg	1.5 HBW	Brinell Test Blocks ASTM E10
	HBW 1 000 kg	1.2 HBW	
	HBW 3 000 kg (0 to 173)	1.5 HBW	
	HBW 3 000 kg (174 to 395)	4.9 HBW	
	HBW 3 000 kg (396 to 561)	7.4 HBW	

Thermodynamic

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
Temperature Infrared Thermometerl[FO]	38 °C to 600 °C	2.8 °C	IR-564 Black Body Source IR-300 Control
	601 °C to 1 100 °C	4.9 °C	
	1 101 °C to 1 200 °C	5.9 °C	
Temperature Measure[F]	0 °C to 419 °C	0.035 °C	Fluke 5624 PRT Fluke 1586A and Dry Block
	420 °C to 660 °C	0.049 °C	
	661 °C to 962 °C	0.077 °C	
	-200 °C to -37 °C	0.066 °C	Fluke 5615 PRT Fluke 1586A and Dry Block
	-36 °C to 0 °C	0.048 °C	
	0.01 °C to 200 °C	0.047 °C	
	201 °C to 420 °C	0.081 °C	
	-200 °C to 0 °C	0.046 °C	Fluke 5609 PRT Fluke 1586A and Dry Block
	0.01 °C to 419 °C	0.045 °C	
	420 °C to 660 °C	0.067 °C	
	50 °C to 749 °C	0.3 °C	Fluke 5605 S Thermocouple Fluke 7526A and Dry Block
	750 °C to 999 °C	1.0 °C	
	1 000 °C to 1 450 °C	0.7 °C	

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Thermodynamic

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Relative Humidity Instruments[F]	0.5 % RH	2.4 % RH	Calibration Salts
	20 % RH	2.5 % RH	
	50 % RH	2.6 % RH	
	80 % RH	2.8 % RH	
	95 % RH	2.6 % RH	

Time & Frequency

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
Digital Stop Watches and Timers[FO]	1 s to 24 hr	0.24 s / 24 hr	NIST 960-12 Land Line
Analog Stop Watches and Timers[FO]	5 s to 24 hr	1.3 s / 24 hr	

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. Example: Outside Micrometer[F] would mean that the laboratory performs this calibration at its fixed location.

4. 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.

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5. 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.

6. The term L represents length in inches or millimeters as appropriate to the uncertainty statement.

7. The term "X" proceeded by a number represents the number of times a lense system magnifies an image relative to its actual size. CMC stated as "% of magnification" represents the CMC of magnification expressed as a percentage of the total magnification.

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Certificate of Accreditation

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CTC, Inc.

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(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):

Thermodynamic Testing

(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/Operations Manager

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

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
December 23, 2018	December 23, 2018	March 31, 2021
Revision Date:	*Accreditation No.:*	*Certificate No.:*
August 26, 2019	91218	L18-622-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.pjlabs.com

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

FIELD OF TEST	ITEMS, MATERIALS OR PRODUCTS TESTED	SPECIFIC TESTS OR PROPERTIES MEASURED	SPECIFICATION, STANDARD METHOD OR TECHNIQUE USED	RANGE (WHERE APPROPRIATE) AND DETECTION LIMIT
Thermodynamic[O]	Ovens, Autoclaves, Freezers, Refrigerators, Environmental Chambers, Liquid Baths	Temperature Uniformity Survey	AMS 2750	-87.2 °C to 1204.4 °C
			Customer Specific Specifications	0.07 °C + 0.15 % of Reading
		System Accuracy Test	AMS 2750	-87.2 °C to 1 204.4 °C
			Customer Specific Specifications	0.07 °C + 0.15 % of Reading
		Instrumentation	AMS 2750	-87.2 °C to 1204.4 °C
			Customer Specific Specifications	0.07 °C + 0.15 % of Reading

1. The presence of a superscript O means that the laboratory performs testing of the indicated parameter onsite at customer locations. Example: Outside Micrometer[O] would mean that the laboratory performs this testing onsite at the customer's location.