Certificate of Accreditation: Supplement

Precision Calibration Services, Inc.
29912 Gratiot Ave, Roseville, MI 48066
Ron Warax Phone: 586-779-4516

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

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
Mechanical Tools (Linear Displacement Accuracy)[FO]	100 µin to 300 in	(31 + 0.1L) µin	Laser Measuring System Optodyne
Ring Gages[FO]	0.04 in to 14 in	(15 + 1.4L) µin	P&W LabMaster
Height Gages[FO]	500 µin to 48 in	(159.2 + 3.8L) µin	Master Gage Blocks
Calipers[FO]	2 000 µin to 60 in	(662 + 8.2L) µin	
Micrometer Standers[FO]		(12.6 + 7.8L) µin	
Radius Gages*[FO]	500 µin to 16 in	(154 + 0.09L) µin	Comparator J & L CLS14F
Indicator[FO]	500 µin to 12 in	(65 + 2.2L) µin	Master Gage Blocks
Height Master[FO]	200 µin to 48 in	(140 + 0.9L) µin	
Depth Micrometer[FO]	400 µin to 12 in	(22 + 21L) µin	
Micrometer[FO]	100 µin to 48 in	(30 + 3.7L) µin	
Steel Rule*[FO]	100 µin to 72 in	(418 + 2.5L) µin	Video Measuring System Micro View
Bore Gages[FO]	0.125 in to 18 in	(8.46 + 21.73L) µin	Master Gage Blocks
Magnification[FO]	5X to 250X	(116 + 0.7L) µin	Glass Scale
Optical Comparator Length[FO]	300 µin to 12 in	(108 + 2.4L) µin	Glass Scale
Angularity[FO]	6 min to 360°	2 min	Glass Scale
Squareness[FO]	300 µin to 4 in	(93 + 0.7L) µin	Glass Scale
Protractor[FO]	(0 to 360)°	(18 + 10.4L) min	Comparator J & L CLS14S
Tool Maker's Magnification[FO]			
Microscopesy[FO]	300 µin to 12 in	(108 + 2.4L) µin	Glass scale
Linearity[FO]	5X to 250X	(116 + 0.7L) µin	
Coordinate Measuring Machine (CMM)[FO]			Ball Bar Laser Measuring System (Optodyne) Master Sphere
Volumetric[FO]	300 µin to 36 in	(105 + 4.3 L) µin	
Linear Displacement[FO]	100 µin to 300 in	(31 + 0.1L) µin	
Repeatability[FO]	200 µin to 10 in	(60 + 16.5L) µin	Probe and CMM

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Surface Plate[FO]	4 µin to (144 x 180) in	(1.4D) µin	Electronic Level Repeat Gage
Flatness[FO]	80 µin to 60 in	25 µin	
Repeatability[FO]	60 µin to 180 in	40 µin	
Gage Blocks*[FO]	10 µin to 4 in	(2+2L) µin	Mechanical Comparison
	5 µin to 20 in	(12 + 1.9L) µin	
Gage Pins[FO]	50 µin to 2 in	(17 + 2L) µin	Laser Gage
Plain Plug Gages*[FO]	50 µin to 13 in	(15 + 1.3L) µin	P&W LabMaster
Thread Wires[FO]	4 TPI to 80 TPI	(27 + 4.5L) µin	Universal Measuring Machine P&W
Spheres/Precision Balls Diameter Only[FO]	50 µin to 12 in	(14 + 2.7L) µin	Master Blocks
Thread Plugs Pitch Diameter[FO]	300 µin to 12 in	(87 + 1.1L) µin	Thread Wires and Supermicrometer
Thread Rings* Pitch Diameter[FO]	0.04 to 14 in	(45 + 1.1L) µin	P&W LabMaster
Tapered Thread Plugs Pitch Diameter[FO]	250 µin to 12 in	(75 + 10.5L) µin	Thread Wires and Supermicrometer
Angle Blocks*[FO]	50 µin to 90°	13 min	Vision Measuring Systems Micro Square
Angle Plates & Squares[FO]	350 µin to 18 in	(112 + 0.47L) µin	Master Square
Bevel Protectors and Angle Gages[FO]	7 min to 180°	2° 25’	Comparator J & L CLS14F
Brinell Scopes[FO]	1750 µin to 0.4 in	(580 + 11L) µin	Glass Reticle Comparator
Differential Probes[FO]	11 µin to 5 µin	(3 +1.9L) µin	Master Gage Blocks
Feeler Gages[FO]	101 µin to 0.2 in	(32+ 4.8L) µin	Super Micrometer
Glass Graduated* Rules and Reticles[FO]	250 µin to 12 in	(76 + 2.3L) µin	Vision Measuring System
Indicator Calibrator[FO]	100 µin to 2 in	(31.6 + 0.105L) µin	Amplifier, Gage Probe
Inch Bars, Reference Bars, Step Masters[FO]	21 µin to 40 in	(5.3 + 5L) µin	Master Gage Blocks

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Parallels[FO]	300 µin to 36 in	(7.5 + 5L) µin	Amplifier, Gage Probe, Surface Plate
Pitch Gages[FO]	500 µin to 0.25 in	(150.4 + 1.47L) µin	Optical Comparator
Sine Plates and Sine Bars[FO]	1000 µin to 10 in	(30.5 + 3.3L) µin	Amplifier, Gage Probe, Sine Plate, Gage Blocks, Comparator
Surface Roughness Specimen[FO]	12.6 µin to 500 µin	4.2 µin	Surface Finish Mahr Federal Model PMD-90101
V-Blocks Parallelism[FO]	50 µin to 10 in	(15 + 4.12L) µin	Surface Plate, Gage Pin, Master Square, Amp, Gage Head
Squareness[FO]	40 µin to 10 in	(8.3 + 14.4L) µin	
Precision Levels Bubble Levels High Accuracy Electronic[FO]	900 µin to 0.000 5 in	300 µin	Amplifier with Gage, Probe, Sine Plate, Gage Blocks

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
Torque Wrenches[FO]	0.5 µin to 400 lbf·in	2.4 % of reading	Torque Testing System (CDI) Model 2000-0-0
	5 µin to 50 lbf·in	1.5 % of reading	
	50 µin to 100 lbf·in	0.6 % of reading	
	100 µin to 200 lbf·in	0.3 % of reading	
	32.5 µin to 750 lbf·in	0.2 % of reading	
	12.5 µin to 2 000 lbf·in	0.2 % of reading	
Torque Transducers[FO]	125 µin to 2 000 lbf·in	0.06 % of reading	Deadweight and Torque Arms
	5 µin to 750 lbf·in		
	0.5 µin to 400 lbf·oz		
Force Gages[FO]	5 µin to 125 lbf	0.08 % of reading	Torque Testing System (CDI) Model 2000-0-0
	125 µin to 2 000 lbf	0.3 % of reading	

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Rockwell Hardness Testers Indirect Verification[FO]	HR30T Low	0.88 HR30T	Hardness Blocks
	HR30T Med	0.62 HR30T	
	HR30T High	0.44 HR30T	
	HR45T Low	0.86 HR45T	
	HR45T Med	1.2 HR45T	
	HR5T High	0.85 HR45T	
Microhardness Hardness Tester Indirect Verification Knoop Vickers[FO]	458 HK	9.15 HK	
	463 HK	12 HK	
	464 HK	14 HK	
	441 HV	12 HV	
	440 HV	15 HV	
	441 HV	22 HV	
Brinell Hardness Tester Indirect Verification[FO]	100 BHN to 200 BHN 200 BHN to 300 BHN	4.3 BHN 2.1 BHN	Hardness Blocks Stage Micrometer
Durometers[FO]	Type A, BO, CD, DO	0.59 N	Durometer Calibrator Rex RDC-1
Pressure[FO]	100 psi to 10 000 psi	0.34 psi	Deadweight Tester
Rockwell Hardness Testers Indirect Verification[FO]	HRA Low HRA Med HRA High HRB Low HRB Med HRB High HRC Low HRC Med HRC High HR15N Low HR15N Med HR15N High	0.53 HRA 0.44 HRA 0.36 HRA 1.9 HRB 1.4 HRB 1.1 HRB 0.76 HRC 0.88 HRC 0.54 HRC 0.94 HR15N 0.96 HR15N 0.82 HR15	Hardness Blocks

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Rockwell Hardness Testers Indirect Verification[FO]	HR30N Low HR30N Med HR30N High HR45N Low HR45N Med HR45N High HR15T Low HR45T Med HR45T High	0.75 HR30N 0.88 HR30N 0.65 HR30N 0.82 HR45N 0.75 HR45N 0.71 HR45N 0.49 HR15T 1.4 HR15T 0.72 HR15T	Hardness Blocks

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
Bench Scales, Platform Scales, Weighing Scales[FO]	5 lb to 10 000 lb (Res. = 0.5 lb)	1.4 lb	Class F Weights
	10 000 lb to 20 000 lb (Res. = 0.5 lb)	1.4 lb	

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.

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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.

   The term D represents diameter in inches or millimeters as appropriate to the uncertainty statement.

Note that Diameter and Diagonal both use the same designation "D". This is not a problem unless a laboratory is accredited for both however the usage is common and should be retained when possible and modified in the few cases where a laboratory is accredited for both. In those cases continue to use D for diameter and use DL for Diagonal Length. This note is intended for internal office use only and is to be removed during preparation of draft documents.

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

6. The term T represents temperature in ºC or ºF as appropriate to the uncertainty statement.

7. The term T represents torque in N•m (including SI multiple and submultiple units) for the international system of units (the SI) or ozf•in, lbf•in and lbf•ft for the USC system of units.

Note that temperature and torque both use the same designation "T". This is not a problem unless a laboratory is accredited for both however the usage is common and should be retained when possible and modified in the few cases where a laboratory is accredited for both. In those cases continue to use T for temperature and use Tr for torque. This note is intended for internal office use only and is to be removed during preparation of draft documents.

8. The term Wt represents weight in pounds or grams (including SI multiple and submultiple units) appropriate to the uncertainty statement.

9. 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.