



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



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



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Parallels ^{FO}	300 μ in to 36 in	(7.5 + 5L) μ in	Amplifier, Gage Probe, Surface Plate
Pitch Gages ^{FO}	500 μ in to 0.25 in	(150.4 + 1.47L) μ in	Optical Comparator
Sine Plates and Sine Bars ^{FO}	1000 μ in to 10 in	(30.5 + 3.3L) μ in	Amplifier, Gage Probe, Sine Plate, Gage Blocks, Comparator
Surface Roughness Specimen ^{FO}	12.6 μ in to 500 μ in	4.2 μ in	Surface Finish Mahr Federal Model PMD-90101
V-Blocks Parallelism ^{FO}	50 μ in to 10 in	(15 + 4.12L) μ in	Surface Plate, Gage Pin, Master Square, Amp, Gage Head
Squareness ^{FO}	40 μ in to 10 in	(8.3 + 14.4L) μ in	
Precision Levels Bubble Levels High Accuracy Electronic ^{FO}	900 μ in to 0.000 5 in	300 μ in	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 (\pm)	CALIBRATION EQUIPMENT AND REFERENCE STANDARDS USED
Torque Wrenches ^{FO}	0.5 μ in to 400 lbf-in	2.4 % of reading	Torque Testing System (CDI) Model 2000-0-0
	5 μ in to 50 lbf-in	1.5 % of reading	
	50 μ in to 100 lbf-in	0.6 % of reading	
	100 μ in to 200 lbf-in	0.3 % of reading	
	32.5 μ in to 750 lbf-in	0.2 % of reading	
	12.5 μ in to 2 000 lbf-in	0.2 % of reading	
Torque Transducers ^{FO}	125 μ in to 2 000 lbf-in	0.06 % of reading	Deadweight and Torque Arms
	5 μ in to 750 lbf-in		
	0.5 μ in to 400 lbf-oz		
Force Gages ^{FO}	5 μ in to 125 lbf	0.08 % of reading	Torque Testing System (CDI) Model 2000-0-0
	125 μ in 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	4.3 BHN	Hardness Blocks Stage Micrometer
	200 BHN to 300 BHN	2.1 BHN	
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	0.53 HRA	Hardness Blocks
	HRA Med	0.44 HRA	
	HRA High	0.36 HRA	
	HRB Low	1.9 HRB	
	HRB Med	1.4 HRB	
	HRB High	1.1 HRB	
	HRC Low	0.76 HRC	
	HRC Med	0.88 HRC	
	HRC High	0.54 HRC	
	HR15N Low	0.94 HR15N	
	HR15N Med	0.96 HR15N	
	HR15N High	0.82 HR15	



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

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
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 °C or °F 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" preceded 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.