National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES **NVLAP LAB CODE 200605-0**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

Mahr Inc.	**Fields of Calibration**
1139 Eddy Street Providence, RI 02905 Mr. Anthony Clang Phone: 401-784-3214 Fax: 401-784-3238 E-mail: anthony.clang@mahr.com URL: http://www.mahr.com	Dimensional This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (20/A01)

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
DIMENSIONAL			
ANGULAR (20/D01)			
Electronic Level System Angle Measure	≤ 1000”	0.40”	Sine Plate with Gage Blocks
Protractors and Digital Angle Gage	≤ 90°	75”	Angle Blocks
GAGE BLOCKS (20/D03)			
Steel & Ceramic (See Note 8 for other materials)	0.05 in 0.100 in to 0.19 in 0.200 in to 0.950 in 1 in to 2 in 3 in 4 in 1 mm 2.5 mm to 4.5 mm 5 mm to 24.5 mm 25 mm to 50 mm 75 mm 100 mm	2.5 µin 2.5 µin 2.5 µin 3.0 µin 3.5 µin 4.5 µin 62 nm 63 nm 65 nm 73 nm 88 nm 0.11 µm	Gage Blocks and 130B Comparator
Long Gage Blocks	5 in to 20 in 125 mm to 500 mm	5.0 µin + 1.3µin/in 0.13 µm + 0.0013 µm/mm	Gage Blocks and 130B Comparator

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
LENGTH and DIAMETER; STEP GAGES (20/D05)			
Dial and Digital Indicators	≤ 0.500 in (6.35 mm) > 0.500 in (6.35 mm) to 4.00 in (101.6 mm)	14 µin (0.4 µm) 31 µin (0.8 µm)	Indicator Calibrators
High Resolution Indicators	± 0.100 in (± 2.54 mm) ± 0.010 in (± 254 µm) ± 0.001 in (± 25.4 µm) ≤ 1.000 in (≤ 25.4 mm)	9 µin (0.22 µm) 7 µin (0.17 µm) 4 µin (0.10 µm) 5.6 µin (0.14 µm)	Microcalibrator Laser Interferometer
Marshaft Machines (Diameter and Length)			
MarShaft Scope Manual w/MC Field calibrations available Note 4,7	Length (< 2400 mm) Diameter (< 120 mm)	6 µm + 1.1*L* / 100 µm 2.2 µm + *L* / 100 µm	(*L*=mm) Helios Shaft Standard
MarShaft Scope Manual w/UNI Field calibrations available Note 4,7	Length (< 2400 mm) Diameter (< 220 mm)	9 µm + 1.2*L* / 100 µm 2 µm + *L* / 100 µm	(*L*=mm) Helios Shaft Standard
MarShaft Scope / Helios Scope Field calibrations available Note 4,7	Length (1000 mm) Diameter (< 80 mm)	5 µm + 1.2*L* / 100 µm 3 µm + *L* / 100 µm	(*L*=mm) Helios Shaft Standard
MarShaft Scope 250+ Field calibrations available Note 4,7	Length (< 250 mm) Diameter (< 40 mm)	4.3 µm + *L* / 100 µm 2.5 µm + *L* / 40 µm	(*L*=mm) Helios Shaft Standard
MarShaft Scope plus Field calibrations available Note 4,7	Length (< 1000 mm) Diameter (< 120 mm)	4 µm + 1.2*L* / 125 µm 3 µm + *L* / 125 µm	(*L*=mm) Helios Shaft Standard

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

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Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
MarShaft CNC Field calibrations available Note 4,7	Length (< 1600 mm) Diameter (< 220 mm)	4 µm + 1.1*L* / 100 µm 2 µm + *L* / 100 µm	(*L*=mm) Helios Shaft Standard
Length – Air Amplifiers Field calibrations available Note 4,7	0.00015 in to 0.005 in	11 µin (0.27 µm)	AMR – Air Restrictor
Diameter – Air restrictor kits	≤ 0.00030 in > 0.00030 in to 0.003 in > 0.003 in to 0.005 in	9 µin 18 µin 27 µin	Gage Blocks, Dimensionair
Length and Diameter – Outside Micrometers			
0.0001 in Resolution 0.001 in Resolution	< 6 in < 6 in	31 µin 300 µin	Gage Blocks
Universal Length Measuring Machines Field calibrations available Note 4,7	≤ 4.0 in > 4.0 in to 12.0 in ≤ 100 mm > 100 mm to 305 mm	3 µin + 0.4 µin/in 3.3 µin + 1.3 µin/in 0.076 µm + 0.0004 µm/mm 0.084 µm + 0.0013 µm/mm	Gage Blocks
	≤ 31 in (≤ 800 mm) ≤ 47.24 in (≤ 1200 mm) ≤ 78.8 in (≤ 2000 mm)	33 µin (0.84 µm) 45 µin (1.13 µm) 69 µin (1.75 µm)	Laser Interferometer
Length Amplifier Probe Systems	≤ 0.020 in 0.020 in to 0.160 in ≤ 0.10 in	3.5 µin 13 µin 5.6 µin	Gage Blocks
Heidenhain CT Probes	Up to 2.37” (60mm)	7 µin (0.18 µm)	Laser Gage Blocks
Heidenhain MT Series Probes	up to 1.00” (25.4mm)	10µ” (0.25µm)	Laser

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
Universal Height Measuring Machines			
Field calibrations available Note 4,7			
CX1	< 1000 mm	0.7 µm + (L/350) µm	Step Gage
CX2	< 1000 mm	2.3 µm + (L/350) µm	
817 CLM	< 1000 mm	1 µm + (L/500) µm	
816 CL	< 600 mm	2 µm + (L/350) µm	
814N & 814G	< 600 mm	6 µm + (L/2000) µm	
814SR	< 600 mm	12 µm + (L/2000) µm	(L=mm) in formulas
Indicating Height Stands	≤ 4 in (≤ 101.6 mm)	74 µin (1.8 µm)	Gage Blocks
Indicator (Universal) Calibrators	≤ 0.5 in (≤ 12.7 mm)	9.0 µin (0.23 µm)	Gage Blocks
Field calibrations available Note 4,7			
Optimar100	≤ 4.0 in (≤ 101.6 mm)	14 µin (0.36 µm)	Heidenhain Probe
Field calibrations available Note 4,7			
Optimar25	≤ 1.0 in (≤ 25.4 mm)	6.0 µin (0.15 µm)	Laser
Field calibrations	≤ 1.0 in (≤ 25.4 mm)	20 µin (0.50 µm)	Amplifier Probe System
available Note 4,7	≤ 1.0 in (≤ 25.4 mm)	18 µin (0.40 µm)	Gage Blocks
Gage Block and ID/OD Comparators	≤ 0.002 in	3.2 µin (0.08 µm)	Gage Blocks
Field calibrations	≤ 10 µin	0.5 µin (0.013 µm)	
available Note 4,7			

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** [Note 3]	**Remarks**
Dimentron plug and Bore gages	< 1 in ≥ 1 in to 2 in > 2 in to 3 in > 3 in to 4 in > 4 in to < 5 in > 0.125 in to 5 in	13 µin (0.33 µm) 17 µin (0.43 µm) 18 µin (0.46 µm) 18 µin (0.46 µm) 28 µin (0.71 µm) 18 µin (0.46 µm)	Master Ring / Gage Blocks Master Ring / T-50075
Thickness Gages Portable	≤ 0.00005 in > 0.00005 to ≤ 0.0001 in > 0.0001 in to ≤ 0.001in	33 µin (0.84 µm) 65 µin (1.6 µm) 720 µin (18 µm)	Gage Blocks
Bench	≤ 1 in (≤ 25.4 mm)	31 µin (0.77 µm)	Gage Blocks
Digital, Dial & Vernier Calipers	Up to 8 in > 8 in to 40 in	300 µin (15 µm) 600 µin (30 µm)	Gage Blocks / Master Ring
Inside Micrometers 0.0001 0.001	 > 0 in to 4 in	 32 µin 300 µin	 Master rings
36 ID/OD Comparators ≤0.0001 Res. ≤0.00005 Res.	 ±0.010 in (±.254 mm)	 250 µin 66 µin	 Master Ring / Gage Blocks
MEASURING WIRES (20/D07)			
Thread Measuring Wires Diameter	≤ 0.55 in	6.5 µin	ASME B89.1.17 using Master Thread Measuring Wires and Universal Length machine
ROUNDNESS (20/D09)			
Roundness Artifacts/ Standards Diameters 0.124 in to 14.5 in	< 100 µin ≤ 0.004 in > 0.004 in to 0.04 in	1 µin 3.5 µin (0.09 µm) 25 µin (0.64 µm)	MFU 100, or MMQ400 Form/Geometry Measuring Machines

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

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Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
SPHERICAL DIAMETER; PLUG / RING GAGES (20/D11)			
Master Plugs, Pins, Wires, Master Balls and Micrometer standards (OD and Length)	> 4.000 in ≥ 4.000 in > (4.000 to 12.000) in < 5.000 in > (5.000 to 36.000) in ≤ 1.000 in > (1.000 to 2.000) in > (2.000 to 4.5000) in	7.5 µin 8.0 µin 10 µin+ 1 µin/in 6.0 µin 4.5+(0.25L) µin 7.0 µin 7.5 µin 8.0 µin	Gage Blocks & ULM300 Gage Blocks & 828 CiM Gage Blocks & PLM1000-E Gage Blocks & 136B-3 Comparator
Master Ring Gages and inside diameters (ID and Length)	(0.030 to 5.000) in >5.000 ≤ 5.000 in > (5.000 to 33.0) in ≤ 1.000 in > (1.000 to 2.000) in > (2 to 4.500) in	8 µin 10 µin + 1 µin/in 6.0 µin 4.5+(0.25L) µin 7.0 µin 7.5 µin 8.0 µin	Master rings and 828 CiM/ULM300 Master ring & PLM1000-E Gage Blocks & 136B-3 Comparator
Air Rings	≤ 4 in > 4 in to 14 in	17 µin 17 µin + 3.5 µin/in	Master Disc/Plug, Mahr Air Amplifier Calibrator, Electronic Amplifier
Air Plugs	≤ 4 in > 5 in to 10 in	17 µin 17 µin + 3.5 µin/in	Master Rings, Mahr Air Amplifier, Electronic Amplifier
Tapered Plug and Rings - Diameter	≤ 4 in	30 µin	Gage Blocks/ 136B-3 Comparator

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
SURFACE TEXTURE (20/D12)			
Surface Roughness			
Ra (Roughness Average)	1 µin to 250 µin	1 µin	Mahr Surface and Contour
Rz	1 µin to 500 µin	2.5 µin	Measuring Machines
Flatness	Up to 14.5 in	4.5 µin	Optical Flat
Optical Flats	< 14.5 in (round) or < 13 in (rectangular)	4.5 µin (0.11 µm)	Optical Flat
General Surface Variance Measurements			
Flatness	< 0.08 in	17 µin	832 Amplifier, Sine Plate &
Parallelism	< 0.08 in	17 µin	Gage blocks, Granite surface
Runout (Total Runout)	< 0.08 in	17 µin	plate
Length / Height	Up to 24" (610mm)	17µin	832 Amplifier probe system with Gage blocks
Surface Contour			
Angle	≤ 90º	36"	LD-120, Contour 1 Master
Distance X	≤ 83 mm	(D/100) + 1.5 µm	(D = Distance in mm)
Distance Z	≤ 6.3 mm	(D/100) + 1.5 µm	
Radius	< 22.5 mm	0.12R µm	(R= Radius in mm)
Surface Finish & Contour Measuring Machines			
Field calibrations available Note 4,7			
Ra (Roughness Average)	1 µin to 250 µin	1.0 µin (0.025 µm)	Contour-2 ball master,
Rz	1 µin to 500 µin	2.5 µin	Displacement standard, Surface Finish Standard or Mahr Surface and Contour Measuring Machine
Wt	< 60 µin/in	6.0 µin (0.15 µm)	Optical Flat
Displacement	180 µin to 240 µin	3.0 µin (0.076 µm)	Step Height Standard

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

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Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
Length	1 mm to 70 mm	16 µin (0.41 µm)	Gage Blocks
Gage Pin Radius	2 mm to 4 mm	7.0 µin (0.18 µm)	Gage Pin
Sphere Radius	> 4 mm to 25 mm	20 µin (0.51 µm)	Precision Sphere (2 ball master)
TWO DIMENSIONAL GAGES (20/D15)			
Concentricity			MFU100 / MMQ400-2
Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	≤ 0.004 in	5.0 µin (0.12 µm)	Form and Geometry Measuring Machines
	> 0.004 in to 0.040 in	25 µin (0.64 µm)	
Cylindricity			
Height: ≤ 1.5 in and Diameter: ≤ 14.5 in	≤ 0.0001 in	2.0 µin (0.05 µm)	MFU100 / MMQ400-2 Form and Geometry Measuring Machines
Height: ≤ 4.0 in and Diameter: ≤ 14.5 in	≤ 0.004 in	6.0 µin (0.15 µm)	
Height: > 4.0 in to 13.75 in and Diameter: ≤ 14.5 in	≤ 0.004 in	16 µin (0.41 µm)	
Height: ≤ 4.0 in and Diameter: ≤ 14.5 in	> 0.004 in to 0.040 in	26 µin (0.66 µm)	
Height: > 4.0 in to 13.75 in and Diameter: ≤ 14.5 in	> 0.004 in to 0.040 in	30 µin (0.76 µm)	
Straightness			
(Z)	14.5 in	0.03 + (L/1000) µm	L = Length in mm
(X)	4 in	0.05 + (L/1000) µm	
Flatness			MFU100 / MMQ400-2
Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	≤ 0.004 in	3.5 µin (0.089 µm)	Form and Geometry Measuring Machines
	> 0.004 in to 0.040 in	25 µin (0.64 µm)	

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

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Parallelism			MFU100 / MMQ400-2
Diameter: ≤ 14.5 in and	≤ 0.004 in	4.5 µin (0.11 µm)	Form and Geometry
Height: ≤ 13.75 in	> 0.004 in to 0.040 in	34 µin (0.87 µm)	Measuring Machines
Perpendicularity			MFU100 / MMQ400-2
Diameter: ≤ 14.5 in and	≤ 0.004 in	4.0 µin (0.10 µm)	Form and Geometry
Height: ≤ 13.75 in	> 0.004 in to 0.040 in	25 µin (0.64 µm)	Measuring Machines
Runout			
Diameter: ≤ 14.5 in and	≤ 0.004 in	5.0 µin (0.13 µm)	MFU100 / MMQ400-2
Height: ≤ 13.75 in	> 0.004 in to 0.040 in	25 µin (0.64 µm)	Form and Geometry Measuring Machines
Total Runout			
Diameter: ≤ 14.5 in and	≤ 0.004 in	6.0 µin (0.15 µm)	MFU100 / MMQ400-2
Height: ≤ 13.75 in	> 0.004 in to 0.040 in	25 µin (0.64 µm)	Form and Geometry Measuring Machines
Geometry / Form Measuring Machines			
Field calibrations available Note 4,7			
Radial Departure	< 50 µin	1.2 µin (0.030 µm)	Precision Sphere
Axial Deviation	< 50 µin	1.0 µin (0.025 µm)	Optical Flat
Probe Calibration	< 0.040 in	40 µin (1.0 µm)	Gage Blocks
Z Axis Straightness	< 2 µm / 100 mm	3.0 µin (0.08 µm)	Cylindrical Square
Z Axis Parallelism	< 10 µm / m	16 µin (0.41 µm)	Cylindrical Square
X Axis Perpendicular	< 10 µm / m	12 µin (0.30 µm)	Optical flat
X Axis Straightness	< 7.0 in / 180 mm	8 µin (0.20 µm)	Optical flat
END			

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program

Notes

Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

Note 2: Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

Note 3: The uncertainty associated with a measurement in a CMC is an expanded uncertainty with a level of confidence of approximately 95 %, typically using a coverage factor of $k = 2$. However, laboratories may report a coverage factor different than $k = 2$ to achieve the 95 % level of confidence. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

Note 3a: The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

Note 3b: As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

Note 3c: As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions.* However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.5 of NIST Handbook 150, Procedures and General Requirements.

Note 4: Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)

Note 5: Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

Note 6: NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

Note 7: This laboratory has field service technicians located across the U.S., Mexico, Brazil and South America. Field calibrations may be provided by these technicians at the customer facility.

Note 8: Uncertainties listed are for steel blocks. Add 1.5 µin / 38.1 nm for chrome carbide, 2.3 µin / 58.4 nm for tungsten carbide to the uncertainty listed.

2025-04-24 through 2026-03-31
Effective dates

For the National Voluntary Laboratory Accreditation Program