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 2.0 µin 2.0 µin 2.6 µin 3.1 µin 4.0 µin 63 nm 51 nm 51 nm 65 nm 78 nm 0.10 µm	Gage Blocks and 130B Comparator
Long Gage Blocks	5 in to 20 in 125 mm to 500 mm	3.0 µin + 1.3µin/in 0.08 µm + 0.0013 µm/mm	Gage Blocks and 130B Comparator

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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	≤ 0.100 in > 0.100 in to 0.500 in	16 µin 61 µin	Indicator Calibrators
	≤ 0.250 in > 0.250 in to 4 in	21 µin 60 µin	Indicator Calibrators
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 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
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

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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
Length – Air Amplifiers	0.00030 in to 0.0030 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
Micrometer Standards	Up to 4 in > 4in. to 14 in	7.0 µin 6.0 µin + 1 µin/in	ULM & Gage Blocks
	< 5 in ≥ 5 in to 36 in	8.4 µin 6.4 µin + 1 µin/in	PLM1000-E Comparator
Universal Length Measuring Machines Field calibrations available Note 4,7	≤ 4.0 in > 4.0 in up to 12.0 in ≤ 100 mm > 100 mm up to 305 mm ≤ 31 in (≤ 800 mm) ≤ 47.24 in (≤ 1200 mm) ≤ 78.8 in (≤ 2000 mm)	3 µin + 0.4 µin/in 3.3 µin + 1.3 µin/in 0.07 µm + 0.0041 µm/mm 0.081 µm + 0.013 µm/mm 33 µin (0.84 µm) 45 µin (1.13 µm) 69 µin (1.75 µm)	Gage Blocks Laser Interferometer

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Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
Length Amplifier Probe Systems	≤ 0.020 in 0.020 in to 0.160 in	3.5 µin 13 µin	Gage Blocks
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 Field calibrations available Note 4,7	≤ 0.5 in (≤ 12.7 mm)	9.0 µin (0.23 µm)	Gage Blocks
Optimar100 Field calibrations available Note 4,7	≤ 4.0 in (≤ 101.6 mm)	71 µin (1.8 µm)	Heidenhain Probe
Optimar25 Field calibrations available Note 4,7	≤ 1.0 in (≤ 25.4 mm)	44 µin (1.1 µm)	
Gage Block and ID/OD Comparators Field calibrations available Note 4,7	≤ 0.002 in ≤ 10 µin	3.2 µin (0.08 µm) 0.5 µin (0.013 µm)	Gage Blocks
Dimentron plug	< 1 in ≥ 1 in to 2 in > 2 in to 3 in	13 µin (0.33 µm) 17 µin (0.43 µm) 18 µin (0.46 µm)	Master Ring / Gage Blocks

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Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
	> 3 in to 4 in > 4 in to < 5 in > 0.125 in to 5 in	18 µin (0.46 µm) 28 µin (0.71 µm) 18 µin (0.46 µm)	Master Ring / T-50075
Thickness Gages Portable	≤ 0.00005 in > 0.00005 in 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
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	roundness < 100 µin roundness ≤ 0.004 in roundness > 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
SPHERICAL DIAMETER; PLUG / RING GAGES (20/D11)			

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
Plug Gages, Master Balls, Pins, Wires (OD and Length)	≤ 4 in	7 µin	Gage Blocks & Mahr 828 CiM , ULM100
	≥ 4 in	10 µin + 1 µin/in	Gage Blocks & Mahr 828 CiM , ULM100
Ring Gages (ID and Length)	< 5 in	8.4 µin	Gage Blocks & PLM1000-E
	≥ 5 in to 36 in	6.4 µin + 1 µin/in	
	Up to 2 in	6 µin	Gage Blocks & 136B-3 Comparator
	> 2 in to 4 in	7 µin	
	> 4 in to 14 in	7 µin + 1 µin/in	
	0.030 in to 5.0 in	8 µin	Master Rings & Mahr 828 CiM, ULM
	> 5.0 in to 14 in	10 µin + 1 µin/in	Master Rings/Gage Blocks & Mahr 828 CiM
	≤ 1 in	6 µin	Gage Blocks & 136B-3 Comparator
	> 1 in to 2 in	7 µin	
	> 2 in to 4 in	8 µin	
	> 4 in to 14 in	8 µin + 1 µin/in	
	< 5 in	8.4 µin	Master Rings/Gage Blocks & PLM1000-e Comparator
	> 5 in up to 33 in	6.4 µin + 1 µin/in	
Air Rings	≤ 4 in	17 µin	Master Disc/Plug, Mahr Air Amplifier Calibrator, Electronic Amplifier
	> 4 in to 14 in	17 µin + 3.5 µin/in	
Air Plugs	≤ 4 in	17 µin	Master Rings, Mahr air Amplifier, Electronic Amplifier
	> 5 in to 10 in	17 µin + 3.5 µin/in	
Tapered Plug and Rings - Diameter	≤ 4 in	30 µin	Gage Blocks/ 136B-3 Comparator
SURFACE TEXTURE (20/D12)			

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
Surface Roughness:			
Ra (Roughness Average)	1 µin to 250 µin	1 µin	
Rz	1 µin to 500 µin	2.5 µin	Mahr Surface and Contour 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			832 Amplifier, Sine Plate & Gage blocks
Flatness	< 0.08 in	17 µin	
Parallelism	< 0.08 in	17 µin	
Runout (Total Runout)	< 0.08 in	17 µin	
Surface Contour			
Angle	≤ 90º	36”	LD-120, Contour 1 Master
Distance X	≤ 83 mm	D/100 µm + 1.5 µm	(D = Distance in mm)
Distance Z	≤ 6.3 mm	D/100 µm + 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	1.2 µin (0.030 µm)	Contour-2 ball master, Displacement standard, Surface Finish Standard
Wt	< 60 µin/in.	2.0 µin (0.05 µm)	Optical Flat
Displacement	180 µin to 240 µin	3.0 µin (0.076 µm)	Step Height Standard
Length	1 mm to 70 mm	16 µin (0.41 µm)	Gage Blocks
Gage Pin Radius	2 mm to 4 mm	6.3 µin (0.16 µm)	Gage Pin

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Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
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 Form and Geometry Measuring Machines
Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	≤ 0.004 in	5.0 µin (0.12 µm)	
	> 0.004 in to 0.040 in	25 µin (0.64 µm)	
Cylindricity			MFU100 / MMQ400-2 Form and Geometry Measuring Machines
Height: ≤ 1.5 in and Diameter: ≤ 14.5 in	≤ 0.0001 in	2.0 µin (0.05 µm)	
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)	
Flatness			MFU100 / MMQ400-2 Form and Geometry Measuring Machines
Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	≤ 0.004 in	3.5 µin (0.089 µm)	
	> 0.004 in to 0.040 in	25 µin (0.64 µm)	
Parallelism			MFU100 / MMQ400-2 Form and Geometry Measuring Machines
Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	≤ 0.004 in	4.5 µin (0.11 µm)	
	> 0.004 in to 0.040 in	34 µin (0.87 µm)	
Perpendicularity			MFU100 / MMQ400-2 Form and Geometry Measuring Machines
Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	≤ 0.004 in	4.0 µin (0.10 µm)	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2			
Measured Parameter or Device Calibrated	**Range**	**Expanded Uncertainty** Note 3	**Remarks**
Runout Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	> 0.004 in to 0.040 in ≤ 0.004 in	25 µin (0.64 µm) 5.0 µin (0.13 µm)	MFU100 / MMQ400-2 Form and Geometry Measuring Machines
Total Runout Diameter: ≤ 14.5 in and Height: ≤ 13.75 in	> 0.004 in to 0.040 in ≤ 0.004 in	25 µin (0.64 µm) 6.0 µin (0.15 µm)	MFU100 / MMQ400-2 Form and Geometry Measuring Machines
Geometry / Form Measuring Machines Field calibrations available Note 4,7	> 0.004 in to 0.040 in	25 µin (0.64 µm)	
Radial Departure	< 50 µin	1.2 µin (0.030 µm)	Precision Sphere
Axial Deviation	< 50 µin	1.0 µin (0.025 µm)	Optical Flat
Coning Error	< 10 µin / in	1.2 µin (0.030 µm)	Precision Sphere
Probe Calibration	< 0.040 in	40 µin (1.0 µm)	Gage Blocks
Straightness	< 2 µm / 100 mm	3.0 µin (0.08 µm)	Optical Straight Edge
Z Axis Parallelism	< 10 µm / m	16 µin (0.41 µm)	Cylindrical Square
X Axis Perpendicular	< 10 µm / m	12 µin (0.30 µm)	Straight Edge
END			

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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.

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