THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MASTER GAGE & TOOL CO.

Danville, VA

for technical competence in the field of **Calibration**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated January 2009*).

Presented this 7th day of April 2008.

President
For the Accreditation Council
Certificate Number: 2200.01
Valid to: June 30, 2010
Revised: March 13, 2009

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1994

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CALIBRATION

Valid To: June 30, 2010 Certificate Number: 2200.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1]:

I. Dimensional

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Calipers	Up to 60 in	$(15 + 2L + 0.6R)$ µin	Gage blocks and pins; IT/OIT 1002
Calipers[3]	Up to 60 in	$(66 + 0.1L + 0.6R)$ µin	Gage blocks and pins; IT/OIT 1002
Caliper and Depth Micrometer Masters	(0.001 to 6) in	$(84 + 6.4L)$ µin	Gage blocks and IT1035
Gage Blocks	(0.005 to 4) in (>4 to 13) in	$(3 + 1.5L)$ µin $(5 + 0.8L)$ µin	P&W UMM with laser; IT 1060

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Coordinate Measuring Machines[3] (CMM) –			Verification of CMMs gage blocks and granite squares; OIT 1049
Linearity	(1 to 48) in	$(61 + 0.2L + 0.6R)$ µin	
Squareness		$(69 + 0.6R)$ µin	
Cylindrical Gages –			Up to class XXX using gage blocks and comparator;
Outside Diameter	(0.001 to 13) in	$(8 + 0.6D)$ µin	IT/OIT 1003
Inside Diameter –			
Up to XX	(0.04 to 14) in	$(14 + 1.5D)$ µin	IT/OIT 1021
XXX	(0.04 to 14) in	$(8.5 + 0.6D)$ µin	IT 1021
Cylindrical Gages[3] –			Up to class XX using gage blocks and comparator;
Outside Diameter	(0.001 to 9) in	$(62 + 0.3D)$ µin	IT/OIT 1003
Inside Diameter –			
Up to XX	(0.04 to 9) in	$(63 + 0.3D)$ µin	IT/OIT 1021
Glass Scales, Precision	(0.001 to 12) in	$(72 + 0.02L)$ µin	Vision system; IT 1044
Height Gages	Up to 60 in	$(54 + 6.7L + 0.6R)$ µin	Gage blocks, IT/OIT 1010
Height Gages[3]	Up to 60 in	$(180 + 0.2L + 0.6R)$ µin	Gage blocks, IT/OIT 1010

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Indicators	(0.001 to 3) in	$(62 + 1.2L + 0.6R)$ μin	Gage blocks with super micrometer IT/OIT 1007
Indicators[3]	(0.001 to 3) in	$(94 + 0.6R)$ μin	Gage blocks with super micrometer IT/OIT 1007
Length Standards	(0.001 to 6) in (> 6 to 34) in	$(17 + 6L)$ μin $(42 + 7.5L)$ μin	Gage blocks with amp and probe; IT 1012
Levels – Level Vial Setting	(2 to 24) in	66 μin	Surface plate and gage blocks; IT 1013
Thread Micrometer Standards – Length Angle	 Up to 5 in Up to 60°	 62 μin 0.06° (3 minutes)	Vision System IT1039
Thread Micrometer Anvils – Cone & Vee Angles	 29°, 60°	 0.13°	Vision System IT1040
Microscopes/ Reticles – Length	(0.001 to 4) in	$(45 + 0.6R)$ μin	Glass standard; IT/OIT 1050
Microscopes/ Reticles[3] – Length	(0.001 to 4) in	$(120 + 0.6R)$ μin	Glass standard; IT/OIT 1050

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Micrometers –			Gage blocks and spheres;
Outside	Up to 24 in	$(16 + 0.8L + 0.6R)$ µin	IT/OIT 1017
Depth	(0 to 12) in	$(35 + 0.4L + 0.6R)$ µin	IT/OIT 1006
Inside	(0 to 12) in	$(34 + 1.1L + 0.6R)$ µin	IT/OIT 1011
Bore/Holematic	(0 to 9) in	$(32 + 0.2D + 0.6R)$ µin	IT/OIT 1011
Micrometers[3] –			Gage blocks and spheres;
Outside	Up to 24 in	$(63 + 0.3L + 0.6R)$ µin	IT/OIT 1017
Depth	(0 to 12) in	$(67 + 2.7L + 0.6R)$ µin	IT/OIT 1006
Inside	(0 to 12) in	$(69 + 0.6L + 0.6R)$ µin	IT/OIT 1011
Bore/Holematic	(0 to 9) in	$(66 + 2.1D + 0.6R)$ µin	IT/OIT 1011
Optical Comparators & Vision Systems[3] –			
Linearity (X, Y)	(0.001 to 12) in	$(56 + 0.6R)$ µin	Glass standard; OIT 1045
Pin Gages and Sets	(0.01 to 2) in	$(20 + 0.5D)$ µin	Laser micrometer and master plugs or gage blocks and comparator; IT/OIT 1020
Pin Gages and Sets[3]	(0.001 to 1) in	$(85 + 2.6D)$ µin	Laser micrometer and master plugs or gage blocks and comparator; IT/OIT 1020

Radius Gages	Up to 1 in	210 μin	Vision system IT1023

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Plain Taper Gages –			Gage blocks, pins, master plugs and comparator;
Outside Diameter	(0.05 to 6) in	(26 + 0.2*D*) µin	IT 1031
Minimum Truncations			
B and BT Steps		(47 + 0.8*L*) µin	
Inside Diameter	(0.2 to 3) in	150 µin	IT 1032
Protractor –			Vision system or gage blocks and sine bar
Bevel	(0 to 90)°	0.05° + 0.6*R*	IT1022
Digital	(0 to 90)°	0.04° + 0.6*R*	
Rules	Up to 24 in > 24 in to 72 in	(62 + 0.4*L*) µin (150 + 8.8*L*) µin	CMM or vision system IT1024
Spheres	(0.04 to 2) in	(45 + 1.3*D*) µin	Gage blocks and super micrometer; IT 1036
Snap Gages – Plain Anvils Fixed or Adjustable Outside Diameter	(0.01 to 12) in	(12 + 0.7*L*) µin	Gage blocks and pins; IT/OIT 1057
Snap Gages[3] – Plain Anvils, Fixed or Adjustable Outside Diameter	(0.01 to 12) in	(60 + 2.1*L*) µin	Gage blocks and pins; IT/OIT 1057

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Straight Thread Gages –			Thread wires, comparator & Supermic;
Outside Diameter –			IT/OIT 1033
Pitch Diameter	(0.04 to 3) in (> 3 to 9) in	(44 + 2.8*D*) µin (42 + 3.5*D*) µin	
Major Diameter	(0.04 to 9) in	(44 + 0.3*D*) µin	
Pitch, Lead and Flank Angles		220 µin	
Inside Diameter –			IT 1034
Minor Diameter	(0.04 to 3) in	(240 + 1*D*) µin	
Straight Thread Gages[3] –			Thread wires, comparator & Supermic;
Outside Diameter			IT/OIT 1033
Pitch Diameter	(0.04 to 3) in (> 3 to 9) in	(73 + 4.6*D*) µin (83 + 1.2*D*) µin	
Major Diameter	(0.04 to 9) in	(71 + 2.5*D*) µin	
Surface Finish –			Master pad and comparator;
Gages	Ra/Ry	(3.1 + 0.6*R*) µin	IT 1028
Specimens	Ra/Ry	2.2 µin	IT 1059
Granite Surface Plates[3] – Flatness	Up to 26 ft	65 µin	Repeat-o-meter and autocollimator OIT 1048

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Taper Thread Gages –			
Outside Diameter			Super micrometer;
Length of Step and Size of Gage Plane	(0.05 to 3) in (3 to 10) in	(64 + 5*L*) µin (72 + 2.4*L*) µin	IT 1037
Inside Diameter			Master plugs;
Ring Thickness and Standoff to Master Plug	(0.065 to 3) in	(230 + 1.6*D*) µin	IT 1038

II. Dimensional Testing – Fixtures and Gauging

Parameter/Equipment	Range	Best Uncertainty[2, 4] (±)	Comments
Length –			Vision systems
Single X Axis	Up to 12 in	(60 + 6.8*L*) µin	IT 1042
Single Y Axis	Up to 8 in	(63 + 3.7*L*) µin	
Single Z Axis	Up to 6 in	(60 + 8.4*L*) µin	
Dual Axis (X and Y)	Up to 12 in	(98 + 6.2*L*) µin	
X Axis Dimension	Up to 24 in	(130 + 6.6*L*) µin	CMM
Y Axis Dimension	Up to 36 in	(130 + 7.7*L*) µin	
Z Axis Dimension	Up to 24 in	(130 + 6.6*L*) µin	

III. Mechanical

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Torque[3] –			
Wrenches	Up to 600 ft·lb Up to 3000 in·lb	0.35 % of reading 0.29 % of reading	Torque calibrator IT/OIT1063
Handles/Screwdrivers	Up to 120 in·lb	0.58 % of reading	
Indirect Verification of Rockwell and Rockwell Superficial Testers[3]	HRB: Low Middle High HRC: Low Middle High HR15N: Low Middle High HR30N: Low Middle High	 1.3 HRB 1.2 HRB 1.2 HRB 0.95 HRC 0.7 HRC 0.5 HRC 1.6 HR15N 1.3 HR15N 0.98 HR15N 1.3 HR30N 1.3 HR30N 0.96 HR30N	Indirect verification per ASTM E180; OIT 1047

Parameter/Equipment	Range	Best Uncertainty[2] (±)	Comments
Indirect Verification of Rockwell and Rockwell Superficial Testers[3] (cont)	HR15T: Low Middle High HR30T: Low Middle High	 2 HR15T 1.4 HR15T 1.4 HR15T 2 HR30T 1.4 HR30T 1.4 HR30T	Indirect verification per ASTM E180; OIT 1047
Indirect Verification of Vickers Hardness Testers[3] – @ 500 gf	Up to 700 HV	24 HV	ASTM E-384-07; OIT 1066
Indirect Verification of Knoop Hardness Testers[3] – @ 500 gf	Up to 700 HK	23 HK	ASTM E-384-07; OIT 1066

[1] This laboratory offers commercial and field calibration service.

[2] "Best Uncertainty" is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer's device, to the environment and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for this calibration and this laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the uncertainties achievable on a customer's site can normally be expected to be larger than the Best Measurement Capabilities (BMC) that the accredited laboratory has been assigned as Best Uncertainty on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the calibration uncertainty being larger than the BMC.

[4] In the statement of best uncertainty, L is the numerical value of the nominal length of the device measured in inches; R is the resolution of the device under test; D is the numerical value of the nominal diameter of the device measured in inches.