

Calibration Procedure

DeFelsko Corporation

Testex Micrometer Calibration

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1 Introduction and UUC Performance Requirements

1.1 This procedure describes the calibration of Testex Micrometers with the following measurement range:

Table 1-1 Measurement Ranges

Version	Range	Resolution
Mils	0.0001 – 0.0500”	0.0001”
Microns	1 – 1000 μm	1 μm

1.2 The micrometer being calibrated will be referred to as the UUC (unit-under-calibration).

2 Measurement Standards and Support Equipment Performance Requirements

2.1 The UUC accuracy requirements are based upon the published UUC performance specifications.

2.2 The test uncertainty ratio applied in this calibration procedure is 4:1 unless otherwise stated.

2.3 Minimum-Use-Specifications are the minimum test equipment specifications required to meet all the UUC accuracy requirements and the test uncertainty ratio applied.

Table 2-1 UUC Accuracy Requirements and Description

Range	Accuracy	Test Method
0.0001 – 0.0500”	± 0.0002 ”	Gage Blocks
1 – 1000 μm	± 5 μm	Gage Blocks

Table 2-2 Minimum Use Specifications

Range	Accuracy
0.0001 – 0.0500”	50 μin
1 – 1000 μm	1.25 μm

Table 2-3 Actual Equipment Specifications

Range	Accuracy	Manufacturer/Model #'s Applicable
0.0050 – 0.0500”	± 2.4 μin	Mitutoyo 516-926-26
100 – 1000 μm	± 0.06 μm	Mitutoyo

Caution: The instructions in this Calibration Procedure relate specifically to the equipment and conditions listed in Section 2. If other equipment is substituted, the information and instructions must be interpreted accordingly.

Table 2-4 Calibration Environmental and Warm Up Requirements

Measurement Standards & Support Equipment Environmental Requirements:	Temperature: $23 \pm 5^{\circ}\text{C}$ Relative Humidity: Less Than 95%
Measurement Standards & Support Equipment Warm-up and Stabilization Requirements:	Not required

Measurement System Uncertainty Analysis

Gage block uncertainty = $2.4 \mu\text{in} @ 20 \pm 1^{\circ}\text{C}$

Laboratory Environment: $23 \pm 5^{\circ}\text{C}$ vs gage block calibration range of $20 \pm 1^{\circ}\text{C}$ results in -1°C (1.8°F) and $+7^{\circ}\text{C}$ (12.6°F) thermal expansion error. $+7^{\circ}\text{C}$ (12.6°F) is the larger error so it will be used as the basis for thermal expansion certainty.

Thermal expansion of block is given as $6e^{-6}\text{in}/^{\circ}\text{F}$

$$= 12.6^{\circ}\text{F} * 6e^{-6} \text{ in}/^{\circ}\text{F} = 75.6 \mu\text{in}$$

Performing a sum of squares on the uncertainties = $\sqrt{(75.6^2 + 2.4^2)} = 75.6 \mu\text{in}$

Applying a K=2 coverage factor = $75.6 * 2 = 151.2 \mu\text{in}$ ($3.8 \mu\text{m}$) uncertainty.

3 Preliminary Operations

Note: Review the entire document before starting the calibration process.

3.1 Visually inspect the UUC for:

- Damage
- Wear

3.2 Verify the reference standards are clean. If necessary place them on a clean paper towel and use a Q-tip with alcohol and light pressure to clean both sides.

3.3 Remove the micrometer from the packaging. Remove the corrosion paper from between the anvils and set it aside.

3.4 Actuate the micrometer several times and adjust the dial to zero if necessary.

4 Calibration Process

Note: Whenever the test requirement is not met, verify the results of each test and take corrective action before proceeding.

- 4.1 Review the Performance Requirements in Tables 5-1 and 5-2.
- 4.2 Measure the center of the thinnest gage block and enter the value in the calibration certificate to the nearest 0.0001” or 1 micron.
- 4.3 Check the zero of the micrometer. If the zero needs adjustment, clean the anvils before adjusting the zero.
- 4.4 Repeat steps 4.2 and 4.3 for all ten gage blocks.
- 4.5 Replace the corrosion paper between the anvils and return the gage to its case.

5 Performance Requirements

Note: The technician shall collect the data needed to complete the table below. Do not write in this procedure.

Table 5-1 Performance Requirements and Calibration Data (Mils)

Nominal Value (in)	Reference Value (in)	Gage Reading (in)	Min. Reading Allowed ^① (in)	Max. Reading Allowed ^② (in)
	A	B	C	D
0.005				
0.010				
0.015				
0.020				
0.025				
0.030				
0.035				
0.040				
0.045				
0.050				

① Calculation: $B - 0.0002$ ”

② Calculation: $B + 0.0002$ ”

Table 5-2 Performance Requirements and Calibration Data (Microns)

Nominal Value (μm)	Reference Value (μm)	Gage Reading (μm)	Min. Reading Allowed ^① (μm)	Max. Reading Allowed ^② (μm)
	A	B	C	D
100				
200				
300				
400				
500				
600				
700				
800				
900				
1000				

① Calculation: $B - 5 \mu\text{m}$

② Calculation: $B + 5 \mu\text{m}$

