



CalPro v6.5/v6

Step-by-Step Calibration Procedures

CalPro is a database of complete step-by-step calibration procedures covering more than 60 kinds of measuring devices— everything from gage blocks to micrometers and calipers.

Procedures are provided as hard copy and in Microsoft Word files so that they can be edited to meet your particular requirements. CalPro's procedures can be imported directly into your company's quality control manual; they can also be used in conjunction with the GAGetrak Calibration System.

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CalPro v6.5/v6 Sample Procedure

OUTSIDE MICROMETER AND MICROMETER HEADS

Calibration Method-CP02E

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Calibration Frequency: 12 months Revision date: 10/01/2009

(can be modified according to stability, purpose and usage)

1.0 Scope:

This method describes the calibration of outside micrometer calipers (English/metric) including such types as solid anvil, interchangeable anvil, ball anvil, tubing-upright anvil, blade, hub, point and flange.

Instrument resolution: English 0.001 or 0.0001 inch and metric (0.01 and 0.001 mm).

Measuring range: 0 to 54 in. (0 to 1000 mm).

2.0 References: This document is based on the NAVAIR and DOD procedures.

3.0 Definitions: TI : Test Instrument
DOD : Department of Defense
NAVAIR : Navy Air Force

4.0 General Requirements:

Environment:

- Temperature : Change should not exceed 2 deg. F/h (1 deg. C/h).
- Humidity : No excessive humidity.
- Air quality : N/A.

Stabilization:

- Stabilize equipment and standards at ambient temperature.
NAVY: a minimum of eight hours is recommended for TI exceeding a length of 10 in.
DOD: two hours on 0.001 inch (0.01mm) micrometers
four hours on 0.0001 inch (0.001 mm) micrometers

Preliminary Operations:

- Clean TI.
- Verify TI for damage such as nicks or burrs.
- Slowly rotate the TI micrometer thimble, and ensure that it operates smoothly through its entire range (clean and lubricate if required).
- Zero TI.

Standards and Calibrating Equipment:

- The standards and equipment used must have a valid calibration certificate.

5.0 Equipment: The following equipment is considered a minimal requirement and any equivalent equipment may be used.

1. Gage blocks, DOD = grade 2, NAVY= grade 0.
2. Magnifying glass or microscope may be required to inspect spherical components.
3. Optical parallel flat, uncertainty, DOD = 6 microinches, NAVY = 4 microinches and monochromatic light. A ball could replace optical parallel flat if the micrometer resolution is 0.001 inch (0.01 mm).
4. Vise (optional).
5. Lapping kit.



CalPro Sample Procedure

(continued)

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6.0 Calibration Use only the portion of the calibration method applicable to the TI and use manufacturer specifications and limits when available.

Process:

Item	Test Characteristics	Acceptance Limits	Test Method
1.	Graduations	Good contrast	Visual
2.	Thread free play	No perceptible free play (adjust threads if required)	Visual
3.	Flat on round anvil (for tube or ball micrometers)	Magnifying glass or microscope	No visible flat
4.	Constant-force mechanism (if applicable)	Uniform pressure	Visual
5.	Anvil and spindle flatness (for flat anvil only)	See Table 1	Optical parallel flat and monochromatic light, apply sufficient force to obtain 3 to 5 across the TI anvil face.
6.	Anvil and spindle parallelism (for flat anvil only) For blade type TI, verify at both sides of the blades	See Table 1 See Note 2	Optical parallel flat and monochromatic light Or Gage blocks at four positions Or Spherical Standard Or Inside micrometer at four positions Or Ball and gage blocks at five position
7.	Scale linearity Verify at: DOD: in.: 0.210, 0.420, 0.605, 0.815 and 1.000 or appropriate steps of the Mike Master for a resolution less than 0.111 in (0.01 mm) NAVY: in.: 0.195, 0.390, .585, 0.780 and 1.00 mm: 5.10, 10.20, 15.30, 20.40 and 25.00 For micrometer head calibration, apply gage block stacks equivalent to 20, 50, 75 and 95% of the TI range.	See Table 1 See Table 1	Gage Blocks
8	If end standard(s) are supplied with the micrometer, calibrate standard following CP06E.		

7.0 Notes:

1. For digital micrometer with both English and metric units, one Gage Block should be checked within the calibration range to ensure the metric conversion is working correctly.
2. Verification of parallelism with optical parallel is recommended at two dimensions, 0.500 and 0.5125 or with balls at diameters 0.1875 and 0.250.
3. For precise calibration, it is recommended to wear cotton gloves when handling gage blocks to prevent transfer of body heat.
4. Record readings, maintenance such as servicing, adjustment, repairs or modifications.



CalPro Sample Procedure

(continued)

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TABLE 1—Tolerances

Discrimination	Micrometer Range	Contact Faces		Scale Linearity Max. +/-
		Flatness Max. NAVY	Parallelism Max. NAVY	
Inches				
0.0001	0 to 2	0.00005	0.0001	0.0002
0.0001	3 to 12	0.00008	0.0002	0.0003
0.0001	13 to 18	0.00010	0.0003	0.0004
0.0001	19 to 24	0.00010	0.0004	0.0005
0.0001	25 to 30	0.00010	0.0005	0.0006
0.0001	31 to 48	0.00010	0.0007	0.0007
0.0001	49 to 54	0.00010	0.0008	0.0008
0.001	0 to 30	not required	0.001	0.001
0.001	31 to 54	not required	0.001	0.002
Millimeters				
0.001 or 0.002	0 to 50	0.0012	0.003	0.004
0.001 or 0.002	75 to 150	0.0012	0.003	0.005
0.001 or 0.002	175 to 225	0.0020	0.005	0.006
0.001 or 0.002	250 to 750	0.0025	0.013	0.015
0.001 or 0.002	775 to 0000.0025		0.018	0.020
0.01	0 to 275	not required	0.01	0.01
0.01	300 to 1000	not required	0.01	0.02

