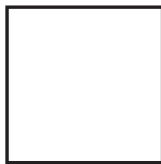
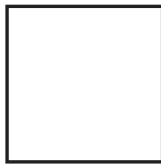
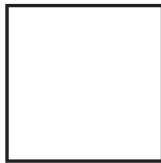


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Sample Procedure - CP02E Outside Micrometer and Micrometer Head

Revision Date: 10/01/2009

Calibration Interval: 12 months (can be modified according to stability, purpose and usage)

1.0 Scope:

This method describes the calibration of outside micrometer and micrometer head (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. Gageblocks, 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.

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

| 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) | No visible flat | Magnifying glass or microscope |
| 4 | Constant-force mechanism (if applicable) | Uniform pressure | Visual |
| 5 | Anvil and spindle flatness (for flat anvil only) TIs used in precision work or with relapped anvil or spindle. Not required on general purpose tools. | see Table1 | Optical parallel flat and monochromatic light, apply sufficient force to obtain 3 to 5 fringes across the TI anvil face |

| | | | |
|----------|---|---------------------------|---|
| 6 | Anvil and spindle parallelism (for flat anvil only) | see Table 1 see Note 2 | Optical parallel flat and monochromatic light or gauge blocks at four positions or spherical standard or inside micrometer at four positions or ball and gauge blocks at five positions |
| | For blade type TI, verify at both sides of the blades | | |
| 7 | Scale linearity | | |
| | Verify at: | | Gage Blocks |
| | DOD: in.: 0.210, 0.420, 0.605, 0.815, and 1.000 | see Table 1 | or appropriate steps of the Mike Master for a resolution less than 0.001 in (0.01mm) |
| | NAVY: in.: 0.195, 0.390, 0.585, 0.780 and 1.000 mm: 5.10, 10.20, 15.30, 20.40 and 25.00 | see Table 1 | |

For micrometer head calibration, apply gage block stacks equivalent to 25, 50, 75 and 95% of the TI range. (see Figure 1.).

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.
5. For TIs with interchangeable anvils, spindles or rods, calibrate zero value for each anvil, spindle or rod.

TABLE 1 - Tolerances

| Micrometer | | Contact Faces | | Scale | | |
|-------------------|--------------|-----------------------------------|-------------------------------------|-----------------------------------|-------------|---------|
| Resolution | Range | Flatness max. Navy | Parallelism max. DOD | Linearity max. +/- | | |
| Inches | | | Fixed | | Interchang. | |
| 0.00005 | 0 to 3 | 0.00004 | 0.00005 | 0.00005 | 0.0004 | 0.00005 |
| 0.0001 | 0 to 3 | 0.00004 | 0.00005 | 0.0001 | 0.0004 | 0.0002 |
| 0.0001 | 4 to 9 | 0.00004 | 0.00008 | 0.0002 | 0.0004 | 0.0003 |
| 0.0001 | 10 to 18 | 0.00004 | 0.00010 | 0.0003 | 0.0006 | 0.0004 |
| 0.0001 | 19 to 24 | 0.00004 | 0.00010 | 0.0004 | 0.0008 | 0.0005 |
| 0.0001 | 25 to 30 | 0.00004 | 0.00010 | 0.0005 | 0.0010 | 0.0006 |
| 0.0001 | 31 to 48 | 0.00010 | 0.00010 | 0.0007 | 0.0010 | 0.0007 |
| 0.0001 | 49 to 54 | 0.00010 | 0.00010 | 0.0008 | 0.0010 | 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 | 0.001 | | 0.003 | 0.010 | 0.004 |
| 0.001 or 0.002 | 75 to 150 | 0.001 | | 0.005 | 0.010 | 0.005 |
| 0.001 or 0.002 | 175 to 225 | 0.001 | | 0.006 | 0.015 | 0.006 |
| 0.001 or 0.002 | 250 to 300 | 0.001 | | 0.008 | 0.015 | 0.015 |
| 0.001 or 0.002 | 325 to 1000 | 0.0025 | | 0.009 | 0.030 | 0.020 |
| 0.01 | 0 to 275 | not required | | 0.01 | 0.02 | 0.01 |
| 0.01 | 300 to 1000 | not required | | 0.01 | 0.02 | 0.02 |

8.0 Figure 1:

Procedure attachment, image001.gif:

