

Centre for Basic, Thermal and Length Metrology
National Physical Laboratory

MOY/SCMI/22

**SPECIFICATION OF ACCURACY FOR A
BENCH MICROMETER**

Type: A bench micrometer based on NPL design, fitted with a fiducial indicator and a micrometer graduated to read direct to 0.002 mm (0.000 1 in.).

Capacity: 0 to 50 mm (0 to 2 in.)
0 to 100 mm (0 to 4 in.)

FOREWORD

In the 1940s and 1950s, NPL was involved in drafting a special series of Specifications of Accuracy that covered a wide range of precision measuring apparatus. This series has been built on first hand experience gained in the design and construction of prototype measuring equipment at NPL and in the design and calibration of measuring equipment of British and foreign manufacture. Each specification in the series originally conformed to a general pattern and was allocated a permanent serial number which, in addition to its title, serves as its identity.

The MOY/SCMI standards are complementary to the Standards issued by the British Standards Institute (BSI). The majority relate to measurement equipment of a proprietary kind designed either at NPL or by British manufacturers which, in the ordinary way, would not fall within BSI's terms of reference. In some cases, in which the equipment is of a more general nature, the Specification has provided a useful basis for formulating a British Standard. The specifications are to enable manufacturers to base their inspection on mutually agreed specifications of accuracy both in workmanship and performance.

MOY/SCMI/22 has been updated as part of a project financed by the DTI (MPU 8/61.3) concerned with Good Practice Guides and Equipment Specifications.

SCOPE

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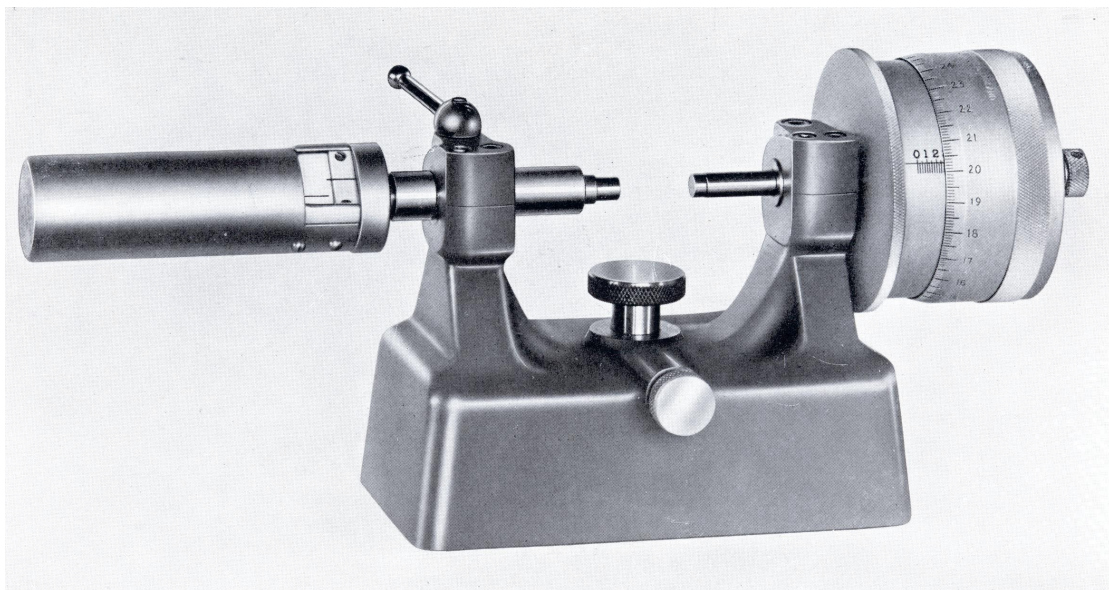


Figure 1 NPL-designed Bench Micrometer

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1 GENERAL

- 1.1 The workmanship and finish shall be in keeping with a precision instrument of this class.
- 1.2 The instrument shall be marked:
- (i) With an identification number. (The casting, micrometer and indicator should all be identified).
 - (ii) With the maker's name or trade mark.
 - (iii) "Based on NPL Design"
- 1.3 The actual capacity of the instrument shall cover its nominal range of measurement.

2 FIDUCIAL INDICATOR

- 2.1 When the indicator is clamped in position, its action shall be free from "stickiness".
- 2.2 The pointer shall be clear of the casing when the face of the measuring plunger is depressed to its limit.
- 2.3 The pointer shall have a free movement of at least **5 mm (0.1875 in.)** on either side of the fiducial mark.
- 2.4 The force required to operate the indicator shall lie between the limits **2 and 5 N**.
- 2.5 The magnification shall be at least **150 times**.
- 2.6 The indicator bearing shank shall be straight and uniform in diameter to within **0.005 mm**.
- 2.7 The measuring face shall be lapped, well finished and flat to within **0.000 5 mm**.
- 2.8 The face shall have a hardness of not less than **800 HV**, when tested in accordance with BS EN ISO 6507-1:1998.
- 2.9 The face shall be square to the bearing shank to **0.000 8 mm** over the diameter of the face).

3 MICROMETER

NOTE: The micrometer spindle should preferably be of the non-rotating type.

- 3.1 The measuring face shall be lapped, well finished and flat to within **0.000 5 mm**.
- 3.2 The face shall have a hardness of not less than **800 HV**, when tested in accordance with BS EN ISO 6507-1:1998.
- 3.3 If the micrometer has a rotating spindle, the measuring face and spindle axis shall be square to within **0.000 8 mm** over the diameter of the face. The measuring face and micrometer bearing axis shall also be square to the same accuracy; alternatively, if not square, the angular position of the sleeve shall be located against the machine casting to ensure the required parallelism between the measuring faces (see para 4.2).
- 3.4 The graduation lines on the thimble and barrel shall be clearly cut and uniform in thickness to within **0.05 mm**.
- 3.5 It is recommended that the thickness of the graduation lines shall be approximately $1/5^{\text{th}}$ of the distance between the centres of adjacent lines. The minimum thickness shall be **0.10 mm**.
- 3.6 The graduation lines shall preferably be blacked in.
- 3.7 The feel of the micrometer shall be smooth and even throughout its range. The micrometer spindle shall exceed its nominal travel by at least one revolution at each end.

4 ALIGNMENT OF MEASURING FACES

- 4.1 The axes of the micrometer and indicator shall be co-axial to within **0.5 mm**.
- 4.2 The measuring faces of the micrometer and indicator shall be parallel, for all relative positions, to within **0.002 5 mm**.

5 CALIBRATION OF MICROMETER SCREW

- 5.1 Progressive error, if present, shall be of a uniform nature and shall not exceed **0.003 mm over 25 mm**.
- 5.2 Periodic error shall not exceed **$\pm 0.000 5$ mm**.
- 5.3 When making a series of repeated settings, the readings shall fall within the range **0.000 5 mm**.
- 5.4 Any backlash in the micrometer screw shall not exceed **0.001 mm**.

Note: The adjustable rest of this bench micrometer is for supporting cylindrical work and the surface is intended to be only approximately parallel with the measuring axis of the micrometer.

6 UNCERTAINTIES

- 6.1 It will normally be necessary to consider the uncertainty of measurement when ascertaining compliance (or non-compliance) with this specification. UKAS document M3003 '*Uncertainty and confidence in measurement*' gives guidance in Appendix J.

7 REPORTING OF COMPLIANCE

- 7.1 Certain clauses in any specifications are necessary to support manufacture and assembly but may be difficult or unnecessary to check in subsequent checks for compliance with this specification. In certain cases checking a feature may require disassembly of the item, which may be undesirable. Although it is not essential that all clauses be checked on subsequent verification, it is important that those clauses omitted do not detract from the metrological value of the test. Where applicable, a performance check should always be carried out as this may allow indirect verification of those parameters that are not easily measured individually without disassembly.
- 7.2 When making statements of compliance or non-compliance, it is recommended that this specification and the relevant clauses within it be unambiguously identified in the calibration certificate or test report.

Example wording for a set of angle gauges follows.

This set of angle gauges has been examined for compliance with the accuracy requirements of clauses 2 and 3 of NPL Specification of Accuracy MOY/SCMI/18 (Issue 5), a copy of which is attached to this certificate.

For free measurement advice and information on other specifications in this series call the NPL Help line on 020 8943 6880

E-mail: enquiry@npl.co.uk

Internet: www.npl.co.uk

National Physical Laboratory
Queens Road
Teddington
Middlesex
TW11 0LW

The standard reference temperature for industrial length measurements is defined in ISO 1:1975 *Standard reference temperature for industrial length measurements*.

Micrometer heads are covered by British Standard 1734:1951.

United Kingdom Accreditation Service (UKAS) can be contacted at

21-47 High Street
Feltham
Middlesex
TW13 4UN

Tel 020 8917 8400

Internet: www.ukas.com

