Centre for Basic, Thermal and Length Metrology
National Physical Laboratory

MOY/SCMI/37

SPECIFICATION OF ACCURACY FOR A COMPOUND SINE TABLE

A "Composine" Compound Sine Table incorporating a 10 in. and a 5 in. sine table. Made by Messrs. Windley Bros. Ltd

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 (Metrology/Specification Certification Measuring Instruments) 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/37 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

A "Composine" Compound Sine Table incorporating a 10 in. and a 5 in. sine table. Made by Messrs. Windley Bros. Ltd

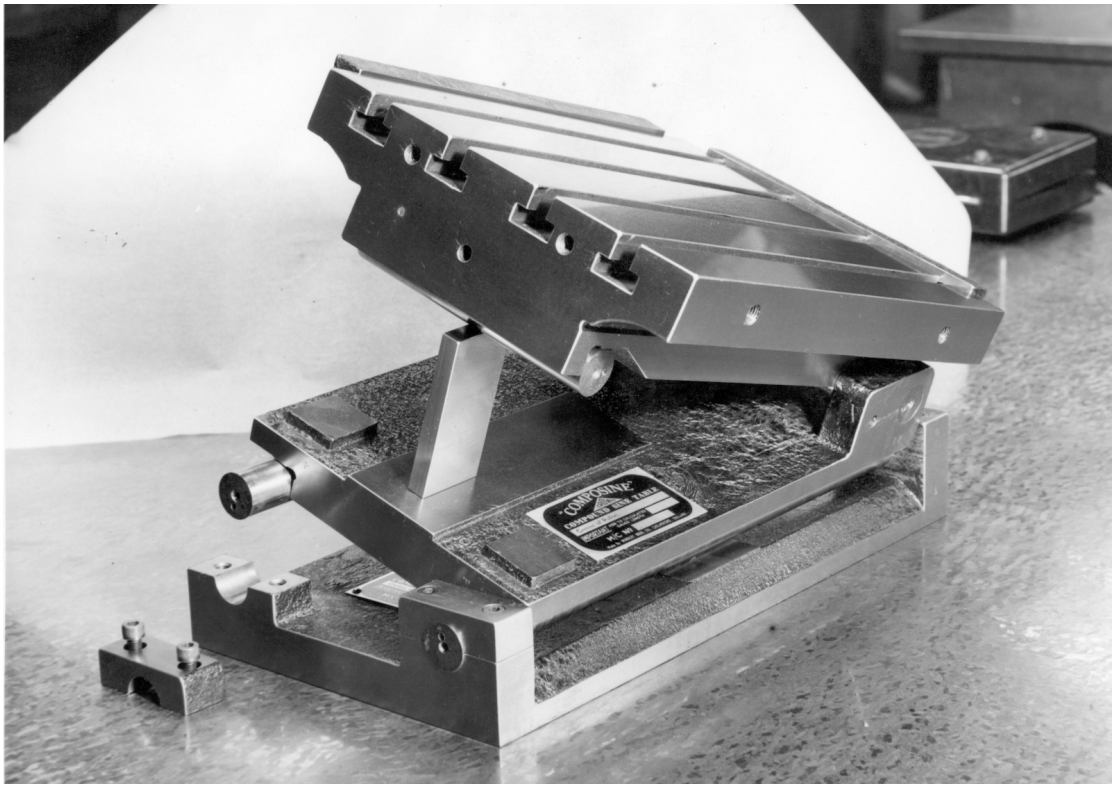

Figure 1 Compound Sine Table (Courtesy of Crown Windley)

CONTENTS

1 GENERAL

1.1 The workmanship and finish shall conform to that customary for precision instruments of this class (see BS3064 : 1976 Clauses 11 and 12 for general guidance on materials, manufacture and finish).

1.2 The sine table shall be marked with an identification number and with the maker's name or trademark.

1.3 All the working surfaces shall be finely ground or scraped; the hinge and setting rollers, after hardening, shall have a finely ground, or preferably lapped, finish. Non-working surfaces shall be clearly and permanently distinguishable by their finish.

1.4 The hinge and setting rollers shall be of high quality steel. They shall be hardened and, when finished, shall have a hardness of not less than **750 HV**, when tested in accordance with BS EN ISO 6507-1:1998.

2 ROBUSTNESS

2.1 When either table is set at an angle of 30 degrees, a downward thrust exerted at any position on the worktable shall produce a change in the position of any portion of the worktable surface of no more than **0.000 1 in per 20 lb**.

2.2 When both tables are set at an angle of 30 degrees, a downward thrust exerted at any position on the work table shall produce a change in the position of any portion of the work table surface of no more than **0.000 2 in per 20 lb**.

3 BASE

3.1 The under surface of the base shall have not less than **20% bearing area**, evenly distributed, as shown by a rubbing test. This rubbing test should be performed using a Grade A (BS817 : 1972) or Grade 0 (BS817 : 1988) surface plate.

3.2 The under surface shall be flat and free from any rock when placed on a Grade A (BS817 : 1972) or Grade 0 (BS817 : 1988) surface plate.

3.3 The flatness of the gauge block platform and its parallelism to the under surface of the base shall lie within two parallel planes **0.000 1 in** apart.

3.4 The working surfaces of the two zero setting pads shall be:

(i) Flat to within **0.000 1 in**
(ii) Parallel with, and equidistant from, the gauge block platform to within **0.000 1 in**
(iii) **0.1 in ± 0.000 1 in** above the surface of the gauge block platform

3.5 The hinge axis shall be parallel to the under surface of the base to within **0.000 1 in** over the length of the hinge roller.

Some of the following clauses are difficult to check without disassembly of the table. Refer to Section 8 before proceeding.

4 INTERMEDIATE TABLE

4.1 The working surface of the setting roller shall be cylindrical to within **0.000 1 in**

4.2 The axes of the setting roller and the lower hinge roller shall be:

(i) In a common plane to within **0.000 2 in** over the length of the setting roller
(ii) Parallel in their common plane to within **0.000 4 in** over the length of the setting roller
(iii) Parallel with, and equidistant from, the upper gauge block platform to within **0.000 1 in** over the length of the setting roller

4.3 The distance between the roller axes shall be **10.000 0 in ± 0.000 2 in**.

4.4 The gauge block platform shall be flat to within **0.000 1 in**.

4.5 The working surfaces of the two zero setting pads shall be:

(i) Flat to within **0.000 1 in**
(ii) Parallel and equidistant from the gauge block platform to within **0.000 1 in**
(iii) **0.1000 in. ± 0.000 1 in** above the surface of the gauge block platform

4.6 When the intermediate table is at its zero angle position, i.e. when the setting roller rests on the two pads, the upper gauge block platform

shall be parallel with the under surface of the base to within **0.000 1 in** over the surface of the platform.

4.7 With the table in this position the axis of the upper hinge shall be parallel with the under surface of the base to within **0.000 1 in** over the length of the roller**.**

5 UPPER TABLE

5.1 The upper surface shall be:

(i) Flat to within **0.000 2 in**.
(ii) Parallel with the underside of the base, when both tables are in their zero angle position, to within **0.000 2 in**.

Note: This parallelism shall apply when the roller, in each case, rests on its two zero setting pads and also when the roller rests on a 0.1 in. gauge block placed on the gauge block platform.

5.2 The side faces shall be:

(i) Flat to within **0.000 2 in**.
(ii) Square to the upper surface of the table to within **0.000 2 in** over their depth.
(iii) Parallel with the axis of the associated hinge roller to within **0.000 5 in.** in 10 in.

5.3 When each stop plate is mounted on either of its associated table faces the abutment surface of the stop plate shall be:

(i) Flat to within **0.000 2 in**.
(ii) Parallel with the axis of its associated hinge roller to within **0.000 5 in.** in 10 in.
(iii) Square to the upper surface of the table to within **0.000 1 in** over depth of abutment face.

5.4 The working surface of the setting roller shall be cylindrical to within **0.000 1 in**

5.5 The axes of the setting roller and the hinge roller shall be:

(i) In a common plane to within **0.000 2 in** over the length of the setting roller
(ii) Parallel in their common plane to within **0.000 2 in** over the length of the setting roller
(iii) Parallel with, and equidistant from, the surface of the work table to within **0.000 1 in** over the length of the setting roller.

5.6 The distance between the roller axes shall be **5.000 0 in ± 0.000 1 in.**

5.7 The axes of the two hinge rollers shall be square to within **0.000 5 in.** in 10 in.

6 PERFORMANCE

When either sine table is set with a light contact thrust between the roller and the gauge block stack, the angle between the base and the surface of the work table shall be that deduced from the value of the slip gauge stack by means of a sine formula, using the nominal roller centre distance. This shall hold good for any position of the supporting gauge block stack on the working surface of the gauge block platform to within **± 0.2 minute of arc** for all table settings up to 50°**.**

7 UNCERTAINTIES

7.1 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.

8 REPORTING OF COMPLIANCE

8.1 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.

8.2 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

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More information on angle measurement in general can be found in *'Measurement of Angle in Engineering'* by J C Evans and C O Taylerson (Third Edition Revised by E W Palmer and S P Poole).

Other types of sine table are covered by BS 3064:1978 *Metric sine bars and sine tables (excluding compound tables).*

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

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