

NATIONAL PHYSICAL LABORATORY

STANDARDS DIVISION

Ref: MOY/SCMI/78 SPECIFICATION OF ACCURACY
(Issue 2)

for

A SCREW PITCH MEASURING MACHINE

Type: A "Matrix" Plain Pitch Measuring Machine for determining the pitch of parallel screw threads.

The machine is primarily intended for measuring external threads and for this purpose it is provided with standard equipment.

Extra equipment can be supplied, if required, for measuring the pitch of internal screw threads.

Capacity: 4 in. (100 mm) diameter and 18 in. (460 mm) between centres.

Made by: The Coventry Gauge & Tool Co. Ltd.

- Notes: (i) All measurements refer to the basic temperature of 68° F (20° C).
- (2) Where reference is made to hardness a minimum of 800 HV is required, apart from the centres. (See Clauses 5.1 and 5.2).

LIMITING VALUE OR
MAXIMUM
PERMISSIBLE ERROR

1. GENERAL

1. The workmanship and finish throughout shall be in keeping with a precision instrument of this class.
2. Each machine shall be marked with the maker's name or trade mark and with an identification number.

2. BASE

- 2.1 The vee grooves and flat fixed to the base for supporting the micrometer carriage shall be hard.

3. FIXED CENTRE BRACKET

- 3.1 The seating in the bracket, for the rounded end of the thrust-rod shall be hard.

4. MICROMETER CARRIAGE

- 4.1 The balls on which the carriage is mounted shall be uniform and equal in diameter 0.0001 in (0.0025 mm).
- 4.2 Both the vee grooves on the underside of the carriage shall be hard.
- 4.3 The rounded roller on the carriage shall be hard.

		<u>LIMITING VALUE OR MAXIMUM PERMISSIBLE ERROR</u>
4.4	The roller shall be concentric with its spindle	0.0001 in. (0.0025 mm) i.e. 0.0002 in. (0.005 mm) FIM.
4.5	The edge of the corrector bar shall be hard.	
4.6	The adjustable shoe which operates on the corrector bar shall be hard.	
4.7	The movement of the fiducial dial as controlled by the corrector bar shall be free. The spring fitted shall be sufficiently strong to ensure continuous contact.	
4.8	The seating in the end of the micrometer screw for the rounded end of the thrust rod shall be hard.	
4.9	The ends of the thrust rod shall be hard.	
5.	<u>CENTRES</u>	
	(i) Fixed centre	
5.1	The fixed centre shall be hard	700 HV minimum.
	(ii) Adjustable centre	
5.2	The adjustable centre shall be hard, straight and uniform in diameter	700 HV minimum 0.0003 in. (0.008 mm).
5.3	The centre point shall be concentric with the cylindrical portion	0.0002 in. (0.005 mm) i.e. 0.0004 in. (0.01 mm) FIM.
5.4	If the centre is spring loaded the operating force shall be	6 lbf \pm 1 lbf (2.7 kgf \pm 1/2 kgf).
6.	<u>ALIGNMENT OF THE UNDER VEEES OF THE MICROMETER CARRIAGE WITH THEIR MATING VEEES ON THE BASE</u>	
6.1	The effective axis of each pair of opposing vees shall be parallel with the line of centres, i.e., the travel of a ball inserted in turn between each pair of opposing vees shall be parallel with the line of centres	0.001 in. in 10 1/2 in. (0.03 mm in 26 1/2 cm).
7.	<u>ALIGNMENT OF THE CENTRES WITH RESPECT TO THE MOTION OF THE MICROMETER CARRIAGE</u>	
7.1	The line of centres shall be parallel with the motion of the micrometer carriage in both the vertical and horizontal planes	0.0005 in. per in. (0.013 mm per 25 mm) Note: This tolerance is increased in the horizontal plane to 0.001 in. per in. (0.03 mm per 25 mm) when the centre points are separated by a distance not exceeding 1 in. (25 mm).

8. **INDICATOR UNIT**

- 8.1 The vee and flat on the base shall be hard.
- 8.2 The indicator shall function smoothly and shall be free from any stickiness.
- 8.3 The indicator pointer arm, in its extreme positions, shall be clear of the sides of the casing during normal manipulation of the machine.
- 8.4 The working force on the indicator shall be such that the indicator will operate satisfactorily for all the possible combinations of assembly of the various stylus-carrying rods. Under all conditions it shall be possible to obtain repetition of reading 0.000 02 in. (0.0005 mm).
- 8.5 The magnification of the indicator shall be adequate 400 times approximately.
- 8.6 When the stylus unit is mounted in its vertical position, the axis of the stylus shall pass through the line of centres ± 0.01 in. (± 0.25 mm).
- 8.7 When the stylus unit is mounted in its vertical position, the radial motion of the stylus shall be square to the line of centres 0.0005 in. over 0.1 in. (0.013 mm over 2.5 mm).

9. **STYLUS POINTS**

- 9.1 The stylus points shall be hard.
- 9.2 The radii shall conform with the limits laid down in NPL Sketch No. 361 (6th March, 1940).
- 9.3 All stylus points shall be identified.
- 9.4 The lengths of the plug stylus points shall be such that their measuring tips operate in the vertical plane passing through the intersection of the cross strips of the stylus unit.

10. **GRADUATED DIAL "C"**

- 10.1 The graduation lines shall be clearly cut on a matt surface and shall be uniform in thickness 0.002 in. (0.05 mm).
- 10.2 It is recommended that the thickness of the graduation lines shall be approximately 1/5 the distance between the centres of adjacent lines on the 250-division dial. 0.004 in. (0.1 mm) minimum thickness.
- 10.3 The dial (or dials) shall be accurately divided. The fiducial dial shall also be accurately divided The equivalent of 0.000 02 in. (0.0005 mm) on the dial.

11. **MICROMETER**

- 11.1 The micrometer shall run smoothly and evenly throughout its 2 in. (50.8 mm) range, and shall exceed its nominal travel by at least one revolution at each end.
- 11.2 Any backlash present shall not exceed 0.0001 in. (0.0025 mm).

- 11.3 Any progressive error present in the readings of the micrometer shall be of a reasonably uniform nature and shall not exceed 0.0001 in. over 2 in. (0.0025 mm over 50.8 mm).
- 11.4 Any periodic error present in the readings of the micrometer shall not exceed ± 0.0002 in. (± 0.0005 mm).

Note: Certification of the machine shall include a diagram of "errors in the machine reading."

12. **REFERENCE SCREW**

- 12.1 For inch machines the reference screw shall be 14 TPI Whitworth and for metric machines 1.85 mm pitch 60° included angle.
- 12.2 The reference screw blank shall be subjected to a recognised heat treatment for securing dimensional stability.
- 12.3 The reference screw shall be marked with the same identification number as the machine with which it is intended to be used.
- 12.4 The threads of the reference screw shall be hard. The flanks shall be highly finished and straight, and the length of the screw shall adequately cover the total range of the micrometer.
- 12.5 Any error in pitch shall be of a reasonably uniform nature and shall not exceed

0.0002 in (0.005 mm) overall.

Note: Certification of the machine shall include a table of pitch errors of the reference screw measured along an identified generator.

13. **PERFORMANCE TEST**

- 13.1 The machine shall be used for measuring a standard plug screw gauge of known pitch 0.0001 in (0.0025 mm) over the length of the screw.
- If the machine is supplied with extra equipment the additional tests shall be made using: -
- (i) A ring screw gauge
 - (ii) A No. 6 BA ring screw gauge (Minimum size of ring the machine is intended to accommodate).

14. CAPACITY

- 14.1 The machine shall have a capacity of 18 in. between centres and shall accommodate parallel screws up to 4 in. in diameter.

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