NATIONAL PHYSICAL LABORATORY

METROLOGY CENTRE

Ref: MOY/SCMI/16 (Issue 5) **SPECIFICATION OF ACCURACY**

for

A SCREW PITCH MEASURING MACHINE

Type: Matrix T. S. Pitch Measuring Machine.

Capacity: 200 mm (8 in) in diameter and 450 mm (18 in) between centres.

Made by: Coventry Gauge & Tool Co. Ltd.

Notes: (1) All measurements refer to the basic temperature of 20º 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**	
1.1	The workmanship and finish throughout shall be of the highest order and in keeping with an instrument of this class.	
1.2	Each machine shall be marked with the maker's name or trade mark and with an identification number.	
2.	**BASE**	
2.1	The attached vee grooves and flat for the micrometer carriage shall be well finished and hardened.	
3.	**FIXED CENTRE BRACKET**	
3.1	The seating in the bracket for the rounded end of the thrust-rod shall be well finished and hardened.	
4.	**MICROMETER CARRIAGE**	
4.1	The balls on which the carriage is mounted shall be of uniform diameter	0.0025 mm (0.0001 in)
4.2	Both the vee grooves on the underside of the carriage shall be well finished and hardened.	
4.3	The rounded roller on the carriage shall be well finished and hardened.	
4.4	The roller shall be concentric with its spindle	0.0025 mm (0.0001 in)
4.5	The edge of the corrector bar shall be well finished and hardened.	

		LIMITING VALUE OR MAXIMUM PERMISSIBLE ERROR
4.6	The adjustable shoe which operates on the corrector bar shall be well finished and hardened.	
4.7	The movement of the fiducial dial as controlled by the corrector bar shall be free. The spring which maintains contact between the adjustable shoe and the edge of the corrector bar shall be adequate 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 well finished and hardened.	
4.9	The ends of the thrust-rod shall be well finished and hardened.	

5. **CENTRES**

I. Fixed centre

5.1	The fixed centre shall be well finished and hardened	Minimum 700 HV

II. Adjustable centres

5.2	The adjustable centres shall be well finished, hardened, straight and uniform in diameter	Minimum 700 HV 0.008 mm (0.0003 in)
5.3	The centre points shall be concentric with their rods	0.005 mm (0.0002 in)
5.4	The force required to operate the spring loaded centre point shall be .	27 N ± 5 N (6 lbf ± 1 lbf)

6. **ALIGNMENT OF THE UNDER VEES OF THE MICROMETER CARRIAGE WITH THEIR MATING VEES ON THE BASE**

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	0.03 mm (0.001 in) over length of vee

7. **INTERMEDIATE CARRIAGE**

7.1	The upper grooves, the lower vee and the bearing flat shall be well finished and hardened.	

8. **ALIGNMENT OF THE CENTRES WITH RESPECT TO THE MOTION OF THE MICROMETER CARRIAGE**

8.1	The front and the back line of centres shall be parallel with the motion of the micrometer carriage in both the vertical and horizontal planes	0.01 mm per 25 mm (0.0004 in per in) in the vertical plane. 0.02 mm per 25 mm (0.0008 in per in) in the horizontal plane.

9. **INDICATOR UNIT**

9.1	The vee and flat on the base shall be hardened.	
9.2	The roller for contacting the taper guide bar shall be hardened.	
9.3	The roller shall be circular and concentric with its spindle	0.015 mm (0.0006 in)

		LIMITING VALUE OR MAXIMUM PERMISSIBLE ERROR
9.4	The balls on which the indicator unit is mounted shall be of uniform diameter	0.0025 mm (0.0001 in)
9.5	The strength of the spring attached to the roller pillar shall be sufficient to maintain contact between the roller and the taper guide bar at any position of the indicator along the guide bar at any angular setting.	
9.6	The indicator shall function smoothly and shall be free from any stickiness.	
9.7	The indicator pointer arm, in its extreme positions, shall be clear of the sides of the casing during the normal manipulation of the machine.	
9.8	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	0.0005 mm (0.000 02 in)
9.9	The magnification of the indicator shall be adequate	Approximately 400 times.
9.10	When the stylus unit is mounted in its vertical position the axis of the stylus shall pass through the line of centres	±0.25 mm (±0.01 in)
9.11	When the stylus unit is mounted in its vertical position, the diametral motion of the stylus shall be square to the line of centres	0.01 mm over 2.5 mm (0.0004 in over 0.1 in)
9.12	The motion of the indicator carriage shall be square to the motion of the micrometer carriage	0.005 mm per 25 mm (0.0002 in per in)

10. TAPER GUIDE BAR

10.1	The taper guide bar shall be hardened. Its working edge shall be straight	0.015 mm (0.0006 in)
10.2	When the bar is set to the zero position, the bearing edge shall be parallel with the line of centres	0.05 mm over 50 mm (0.002 in over 2 in)
10.3	The graduations for setting the bar shall be accurate	1 in 1000

11. STYLUS POINTS

11.1	The stylus points shall be well finished and hardened.
11.2	The radii shall conform with the limits laid down in NPL Sketch No. 361.
11.3	All stylus points shall be identified.
11.4	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.

12. **GRADUATED DIALS**

12.1	The graduations shall be clearly cut on a non-reflecting surface and shall be uniform in thickness	0.05 mm (0.002 in)
12.2	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.	
	Minimum thickness	0.1 mm (0.004 in)
12.3	The dials, including the fiducial dial, shall be accurately divided	The equivalent of 0.0005 mm (0.000 02 in) on the dial.

13. **MICROMETER**

13.1	The micrometer shall run smoothly and evenly throughout its 50 mm (2 in) range, and shall exceed its nominal travel by at least one revolution at each end.	
13.2	The backlash shall not exceed	0.0025 mm (0.0001 in)
13.3	Any progressive error present in the readings of the micrometer shall be of a reasonably uniform nature and shall not exceed	0.0025 mm over 50 mm (0.0001 in over 2 in)
13.4	Any periodic error present in the readings of the micrometer shall not exceed	±0.0005 mm (±0.000 02 in)
	Note: Certification of the machine shall include a diagram of "errors in the machine reading".	

14. **REFERENCE SCREW**

14.1	For metric machines the reference screw shall be 1.85 mm pitch 60º included angle and for English machines 14 TP1 Whitworth.	
14.2	The reference screw blank shall be subjected to a recognized heat treatment for securing dimensional stability.	
14.3	The reference screw shall be marked with the same identification number as the machine with which it is intended to be used.	
14.4	The threads of the reference screw shall be hardened. The flanks shall be highly finished and straight, and the length of the screw shall adequately cover the total range of the micrometer.	
14.5	Any error in pitch shall be of uniform nature and shall not exceed	0.005 mm (0.0002 in) overall
	Note: Certification of the machine shall include a diagram of pitch errors of the reference screw measured along an identified generator.	

15. **PERFORMANCE TEST**

15.1 The machine shall be used for measuring the pitches of the following types of gauges, the values of which have been accurately determined by other means: -

(i) A ring screw gauge (parallel).
(ii) A plug or ring screw gauge (taper).
(iii) A No. 6 BA ring screw gauge (Minimum sized ring the machine will accommodate). 0.0025 mm (0.000 1 in) over the length of the screw.

16. **CAPACITY**

16.1 The machine shall measure screws up to 200 mm (8 in) in diameter, and shall accommodate 450 mm (18 in) between the centres.

(Signed)

for Director

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