NATIONAL PHYSICAL LABORATORY

METROLOGY CENTRE

Ref: MOY/SCMI/19 (Issue 5)

SPECIFICATION OF ACCURACY

for

A SCREW PITCH MEASURING MACHINE

Type: A machine for measuring the pitch of screw threads based on NPL design (NPL Drawing No. 1547).

Capacity: 150 mm (6 in) diameter x 230 mm (9 in) length.

Notes:
(i) All measurements refer to the basic temperature of 20°C.
(ii) Where reference is made to hardness a minimum HV of 800 is required, apart from the centres, see clause 3.1.

		LIMITING VALUE OR MAXIMUM PERMISSIBLE ERROR
1.	**GENERAL**	
1.1	The workmanship and finish throughout shall be in keeping with a precision instrument of this class.	
1.2	The instrument shall be marked: -	
	(i) with an identification number	
	(ii) with the maker's name or trade mark	
	(iii) "Based on NPL Design".	
1.3	The vee grooves and bearing surfaces shall be smooth and free from blow holes.	
1.4	The balls shall be of uniform diameter.	0.0025 mm (0.0001 in)
1.5	The indicator carriage shall move smoothly.	
1.6	The machine shall measure plug screws up to 150 mm (6 in) in diameter and shall accommodate 230 mm (9 in) between the centres.	
2.	**SELF ALIGNMENT THRUST**	
2.1	The seating in the housing for the thrust rod shall be hard and well finished.	
2.2	The seating at the end of the micrometer spindle for the thrust rod shall be hard and well finished.	
2.3	The ends of the thrust rod shall be hard and well finished.	
2.4	Rotation of the thrust rod, when in position, shall not produce an axial movement of the indictor carriage.	0.0005 mm maximum (0.000 02 in)

		LIMITING VALUE OR MAXIMUM PERMISSIBLE ERROR
3.	**CENTRES**	
3.1	The fixed centre rod and the tip of the adjustable centre shall be hard and well finished.	700 HV minimum
3.2	Each centre shall be straight and of uniform diameter.	0.008 mm (0.0003 in)
3.3	Each centre point shall be concentric with its rod.	0.01 mm (0.0004 in) FIM
3.4	The force required to operate the springloaded centre point shall be	27N ± 5N (6 lbf ± 1 lbf)
3.5	The common axis of the centres shall be parallel with the motion of the indicator carriage in both the vertical and horizontal planes.	0.013 mm in 25 mm (0.0005 in per in) Note: This tolerance is increased in the horizontal plane to 0.025 mm in 25 mm (0.001 in per in) when the centre points are separated by a distance not exceeding 25 mm (1 in).
4.	**FIDUCIAL INDICATOR**	
4.1	The action of the indictor shall be free from “stickiness”.	
4.2	The magnification of the indicator shall be adequate.	400 times approximately.
4.3	Where the necessary adjustment is provided it shall be possible to set the base of the indicator such that the motion of the stylus is square to the common line of centres whilst the index remains on the mark.	0.0005 mm over 2.5 mm (0.000 02 in over 0.1 in)
4.4	The axis of the stylus shall pass through the common line of centres.	±0.25 mm (±0.01 in)
5.	**MICROMETER**	
5.1	It shall be possible to obtain repetition of reading to within	0.0005 mm (0.000 02 in)
5.2	The micrometer shall run smoothly and evenly throughout its range, and shall exceed its nominal travel by at least one revolution at each end.	
5.3	Any backlash present shall not exceed	0.0025 mm (0.0001 in)
5.4	Any progressive error present in the readings of the micrometer shall be of a reasonably uniform nature and shall not exceed	0.004 mm (0.000 15 in) overall
5.5	Any periodic error present in the readings of the micrometer shall not exceed	±0.0005 mm (±0.000 02 in)
5.6	Where a corrector bar is fitted its working edge shall be hard and well finished.	

		LIMITING VALUE OR MAXIMUM PERMISSIBLE ERROR
5.7	The roller that bears against the corrector bar shall be hardened, well finished and concentric.	0.025 mm (0.001 in)
	Note: Certification of the machine shall include a diagram of "errors in the machine reading".	

6. STYLUS POINTS

6.1	The stylus points shall be hard and well finished.	
6.2	The radii, diameter and lengths shall conform with the limits laid down in NPL Drawing No. 1547 Sheet No. 9.	
6.3	All stylus points shall be identified.	

7. GRADUATED DIALS

7.1	The dials shall be graduated and marked in conformity with NPL Sketch No. MC 170 (6.3.20) for micrometer screws of 0.5 mm pitch and NPL Drawing No. 1547 Sheet No. 10 for micrometer screws of 0.025 in pitch.	
7.2	The thickness of the graduation lines shall be	0.10 mm (0.004 in) minimum. 0.20 mm (0.008 in) maximum.
7.3	The graduation lines shall be clearly cut on a non-reflecting surface and shall be uniform in thickness.	0.05 mm (0.002 in)
7.4	The dials, including the fiducial dial, shall be accurately divided.	The equivalent of 0.0005 mm (0.000 02 in) on the scale of the dial.

8. REFERENCE SCREW

NPL Drawing No. 1547. Item No. 16 A (Metric)
" " 16 (English)

8.1	For Metric machines the reference screw shall be 1.85 mm pitch 60° included angle and for English machines 14 TPI Whitworth.	
8.2	The reference screw blank shall be subjected to a recognised heat treatment for securing dimensional stability.	
8.3	The reference screw shall be marked with the same identification number as the machine with which it is intended to be used.	
8.4	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.	
8.5	Any error in pitch shall be of a 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.	

9. **PERFORMANCE TEST**

9.1 It shall be possible to obtain satisfactory repetition of reading on both plug and ring screw gauges of sizes down to M3 x 0.5 (No. 6 BA) which is the minimum size the machine is designed to measure. 0.0005 mm (0.000 02 in)

(Signed) F.W. Nichols

for Director

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