NATIONAL PHYSICAL LABORATORY

METROLOGY DIVISION

Ref: MOY/SCMI/66 (Issue 1) **SPECIFICATION OF ACCURACY**

for

A UNIVERSAL OPTICAL PROJECTOR

Type: A Hilger Universal Optical Projector, Type T660, intended for engineering precision inspection. The projector is designed for magnifications of 10, 15, 20, 25, 30, 40, 50 and 100 times, and it has a capacity up to 8 inches in diameter and 9 inches between centres. The 6 in. x 2 in. motions of the work-holder cross slide are controlled by two glass scales observed through a single microscope which reads direct to 0.0001 in.

Surface illuminators can be supplied when required.

Designed and made by: Messrs. Hilger & Watts Ltd. (Hilger Division).

		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 instrument shall be marked with the maker's name or trade mark and with an identification number.	
2. **MECHANICAL AND OPTICAL ALIGNMENTS**		
2.1	The slide which controls the focusing motion of the work-holder shall be straight, in both the horizontal and vertical planes, over its 3 inch length. (This slide shall be the datum against which all alignments are checked).	0.0002 inch per inch.
2.2	The horizontal and vertical faces of the work-holder cross slide shall be flat and mutually square.	0.0005 inch (squareness measured over 3 inch depth)
2.3	The work-holder cross slide centre rods shall be straight and both shall be of equal diameter.	0.0003 inch.
2.4	The centre points of the rods shall be hardened and concentric with the cylindrical portion.	Minimum hardness 600 D.P.N. Concentricity 0.0005 inch
2.5	The horizontal motion of the work-holder cross slide shall be straight over its 6 inch travel.	0.0002 inch measured in the vertical plane 0.001 inch measured in the horizontal plane.

		MAXIMUM PERMISSIBLE ERROR
2.6	The vertical motion of the work-holder cross slide shall be straight over its 2 inch travel.	0.0002 inch measured in the vertical plane normal to the optical axis. 0.001 inch measured in the vertical plane parallel with the optical axis.
2.7	The vertical motion of the work-holder cross slide shall be square with the datum	0.001 inch over its 2 inch travel.
2.8	The horizontal and vertical motions of the work-holder cross slide shall be mutually square.	0.0002 inch measured over a 2 inch travel.
2.9	The accuracy of the glass scales which control the motions of the work-holder slide shall be such as to guarantee the overall performance of the projector as required under para. 4.1.	
2.10	The horizontal surface of the work-holder cross-slide shall be parallel with the datum, as measured in the vertical plane.	0.0001 inch per inch.
2.11	When the work-holder cross slide is set square with the datum, in the horizontal plane, there shall be no observable error in the zero of the rake scale.	
2.12	The line of the centres shall be parallel with the vertical face of the work-holder cross slide.	0.001 inch in 9 inches.
2.13	The rake scales shall be accurate	±¼ degree relative to zero graduation.
2.14	When the projector lamp is set according to the instructions given in the handbook supplied by the makers and the work-holder cross slide is set to zero, the out of focus pattern of a projected annular vee groove held between centres, shall be symmetrical.	
2.15	The projector scale, the thimble scale of the fine adjustment micrometer and the protractor zero setting shall be accurate.	±1 minute of arc.
2.16	The cross lines on the protractor screen shall intersect at 90º to each other.	±1 minute of arc.
2.17	The intersection of the 90º cross lines on the protractor screen shall lie on the axis of rotation of the protractor scale, after the latter has been centred.	0.0025 inch on the screen at 25 magnification.
2.18	The magnification given by each lens shall be correct.	0.005 inch as measured over a central 12 inch span on the plain screen.
2.19	The lenses shall not give rise to any appreciable distortion in the field of view.	The error in the separation between any two points in the field of view shall not exceed 0.01 inch as measured at the screen.

3. SURFACE ILLUMINATORS

3.1 When surface illuminators are fitted, they shall be capable of producing a satisfactory projected image of an appropriate surface.

		MAXIMUM PERMISSIBLE ERROR
4.	**PERFORMANCE TEST**	
4.1	A performance test on the overall accuracy of the motions of the work-holder cross slide as controlled by the glass scales and micrometer microscope shall be made when the slide is both loaded and unloaded.	Error of total traverse: - 0.0003 inch up to 10 lb load 0.0004 inch between 10 and 20 lb load. 0.0005 inch between 20 and 30 lb load.
	NOTES (1) When testing the horizontal motion, the vertical slide shall be at its maximum height.	
5.	**THREAD FORM DIAGRAMS**	
5.1	When thread form diagrams are supplied with the projector their outlines shall be accurate.	The edges of the outline shall be very clearly defined and be free from any noticeable defects. The whole outline shall not depart from the nominal outline by more than ± 0.005 inch at any point. In addition, the error in inclination of the sloping flanks shall not exceed 0.005 in over the length of flank.

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