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Standard Specification for Microscope Objective Thread¹

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GENERAL AND HISTORICAL

1. Scope

1.1 This standard covers the screw thread used for mounting the objective assembly to the body or lens turret of microscopes. It is based on, and intended to be interchangeable with, the screw thread introduced and adopted many years ago by the Royal Microscopical Society of Great Britain, generally known as the “RMS thread” and now almost universally accepted as the basic standard for microscope objective mountings. Formal recognition, however, has been extremely limited.

1.2 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASA Standard:*²

ASA B1.6–1944 Truncated Whitworth Threads

2.2 *ANSI Standard:*³

B1.7–1949 Nomenclature, Definitions, and Letter Symbols for Screw Threads

3. Terminology

3.1 The nomenclature, definitions, and letter symbols used in this standard are in conformance with ANSI B1.7–1949.

4. Truncated Whitworth Thread

4.1 Because of its British origin, the basic thread possesses the British Standard Whitworth form, having an included angle

of 55° and rounded crests and roots. This same full Whitworth form is also employed as the design, or maximum material, form by the British. The presence (American National) standard, however, the design thread form established in American War Standard ASA B1.6–1944, has been adopted.

5. Pitch Diameter Allowance and Tolerances

5.1 The pitch diameter allowance and tolerances promulgated in June 1924 for the RMS thread were subsequently applied by most American manufacturers to their truncated versions and found to be acceptable. Uniformity of practice with regard to the allowances and tolerances for the other diameters never materialized.

6. Attributes of Good Fit

6.1 Experience has established that the principal attributes of a good fit for microscope objective threads are:

6.1.1 Adequate clearance to afford protection against binding due to the presence of foreign particles or minor thread crest damage.

6.1.2 Sufficient depth of thread engagement to assure security in the short lengths of engagement commonly encountered.

6.1.3 Allowances for limited eccentricities so that centralization and squareness of the objective are not influenced by such errors in manufacture.

7. Need for Good Fit

7.1 The need for the above characteristics stems principally from the inherent longevity of optical equipment and the repeated use to which objective threads are subjected. The measures necessary to provide these properties precluded adoption of the allowances and tolerances recommended for threads of this pitch in the American War Standard ASA B1.6–1944. The more significant departures from the standard are:

7.1.1 A larger allowance on the pitch diameter of the external thread.

7.1.2 Smaller tolerances on the major diameter of the external thread and the minor diameter of the internal thread.

¹ This specification is under the jurisdiction of ASTM Committee E41 on Laboratory Apparatus and is the direct responsibility of Subcommittee E41.06 on Weighing Devices.

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² Discontinued 1951, Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, <http://www.nist.gov>.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.



7.1.3 The provision of allowances on the major and minor diameters of the external thread.

7.2 The values established and further details regarding them are given under Specifications.

8. Other Applications

8.1 Though utilized principally for microscope objective mountings, this screw thread is recommended also for other optical assemblies of microscopes and associated apparatus, such as photomicrographic equipment.

SPECIFICATIONS

9. Basic Form of Thread

9.1 The basic form of the thread for this standard is the British Standard Whitworth form. Basic dimensions are given in Table 1.

10. Design Form of Thread

10.1 The design, or maximum material, forms of both the external and internal threads conform to the ASA B1.6–1944. The design dimensions are given in Table 1.

11. Lead of Thread

11.1 The thread is of the single (single-start) type.

12. Classification

12.1 There is established herein only one class of thread which experience has proved to be adequate to meet the demands of the applications.

13. Nominal Sizes

13.1 There is only one nominal size having a basic major diameter of 0.800 in. and a pitch of 0.027778 in. (36 threads per in.).

14. Allowances

14.1 Positive allowances (minimum clearances) are provided on the pitch, major, and minor diameters of the external thread. The allowance on the pitch diameter is 0.0018 in., the value established by the British Royal Microscopical Society in 1924 and now widely regarded as a basic requirement. The same allowance is also applied on both the major and minor diameters.

14.2 Where interchangeability with product having full-form Whitworth threads is not required, the allowances on the major and minor diameters of the external thread are not necessary, since the forms at the root and crest of the truncated internal thread provide the desired clearances. In such cases, either both limits or only the maximum limit of the major and minor diameters may be increased by the amount of the allowance. Benefits are derived principally from changes in the major diameter where increasing both limits improves the depth of thread engagement, and increasing only the maximum limit grants a larger manufacturing tolerance. However, unless such deviations are specifically covered in purchase negotiations, it is to be assumed that the threads will be supplied in accordance with the tables in this standard.

15. Tolerances

15.1 In accordance with standard practice, tolerances on the internal thread are applied in a plus direction from the basic

TABLE 1 Definitions, Formulas, Basic and Design Dimensions

Property	Symbol	Formula	Dimension
Basic Thread Form			
Half angle of thread ^A	α	...	27° 30 min
Included angle of thread ^A	2α	...	55° 00 min
Number of threads per inch ^A	n	...	36°
Pitch	p	$1/n$	0.027778
Height of fundamental triangle	H	$0.960491p$	0.026680
Height of basic thread	h_b	$0.640327p$	0.0178
Radius at crest and root of British Standard Whitworth basic thread (not used)	r	$0.137329p$	0.0038
Design Thread Form			
Height of truncated Whitworth thread	k	$h_b - U = 0.566410p$	0.0157
Width of flat at crest	F_c	$0.243624p$	0.0068
Width of flat at root	F_r	$0.166667p$	0.0046
Basic truncation of crest from basic Whitworth form	U	$0.073917p$	0.00205
Basic and Design Sizes			
Major diameter, nominal and basic	D	...	0.800
Major diameter of internal thread	D_n	D	0.800
Major diameter of external thread ^B	D_s	$D - 2 U - G$	0.7941
Pitch (effective) diameter, basic	E	$D - h_b$	0.7822
Pitch (effective) diameter of internal thread	E_n	$D - h_b$	0.7822
Pitch (effective) diameter of external thread ^C	E_s	$D - h_b - G$	0.7804
Minor diameter, basic	K	$D - 2 h_b$	0.7644
Minor diameter of internal thread	K_n	$D - 2 h_b$	0.7685
Minor diameter of external thread ^B	K_s	$D - 2 h_b - G$	0.7626
Allowance at pitch (effective) diameter ^{B,C}	G	...	0.0018

^A All other dimensions are given in inches.

^B An allowance equal to that on the pitch diameter is also provided on the major and minor diameters of the external thread for additional clearance and centralizing.

^C Allowance (minimum clearance) on pitch (effective) diameter is the same as on British RMS thread.